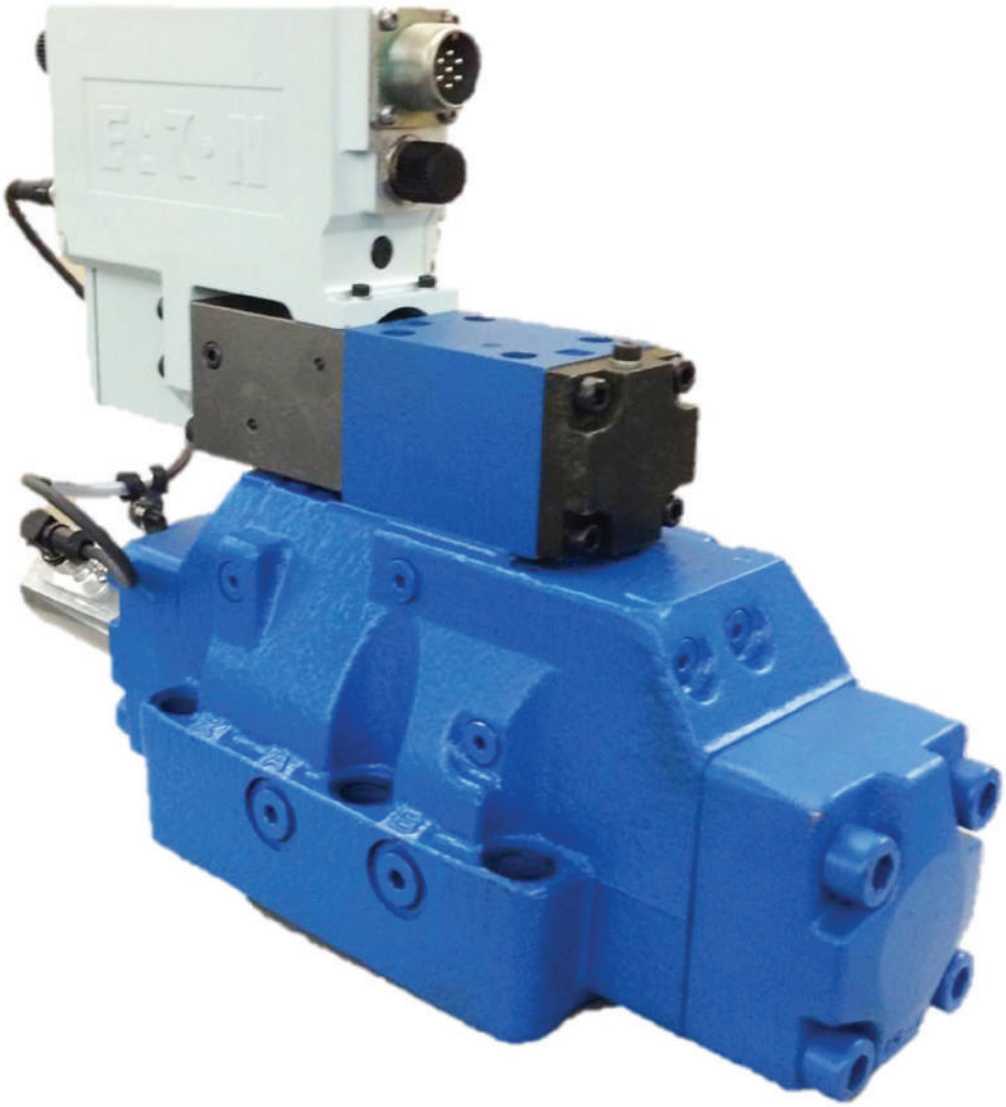
Eaton Servo-Performance Proportional Directional Valve

AxisPro™

KBH*-8
10 Series



Powering Business Worldwide

Contents

Introduction

General Description 3

Typical Section View 3

Model Code 4

Spool Data 6

Operating Data ..... 7 - 9

Installation Dimensions 10

Electrical Information 12

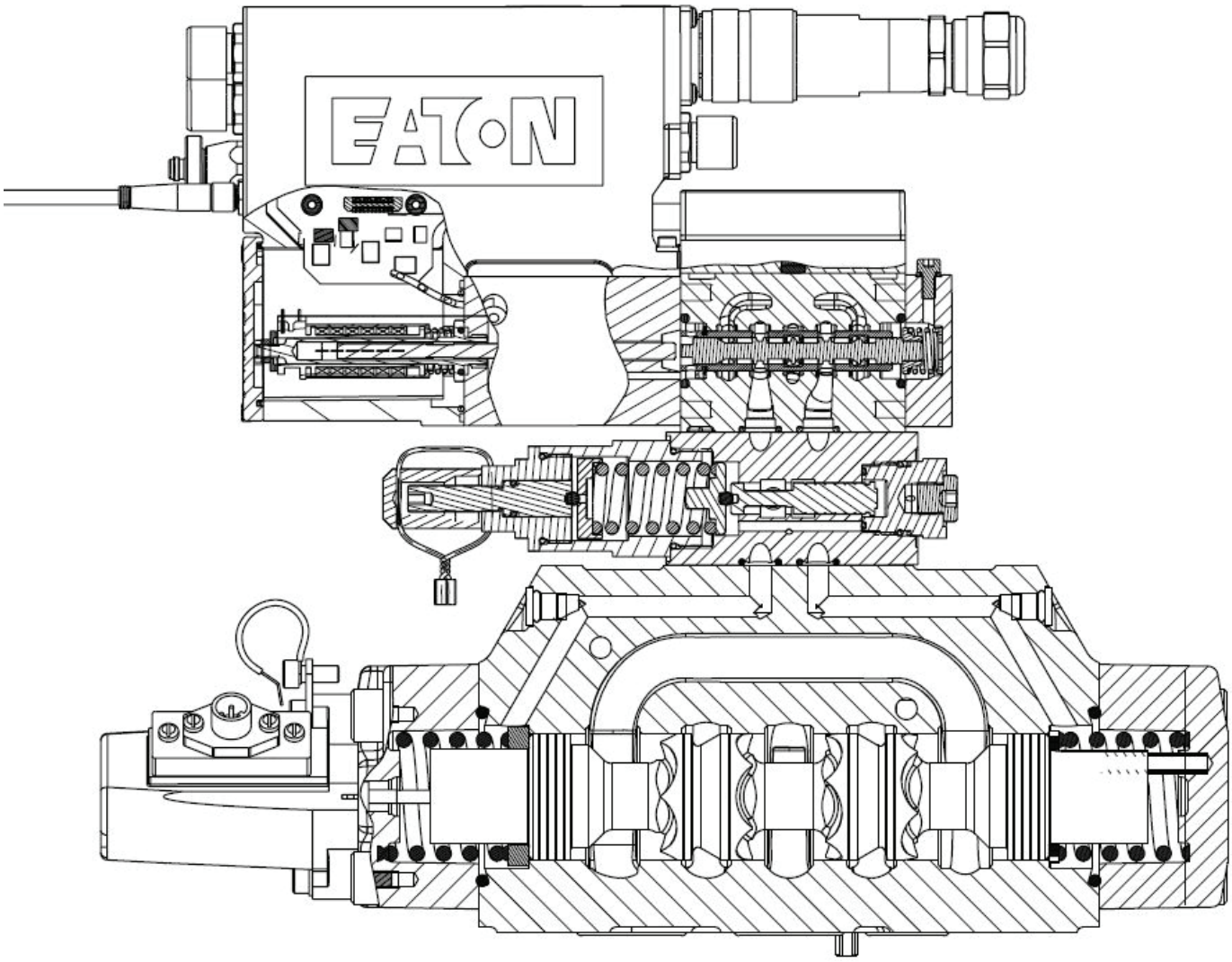
Software Information 16

Application Data 17

Introduction

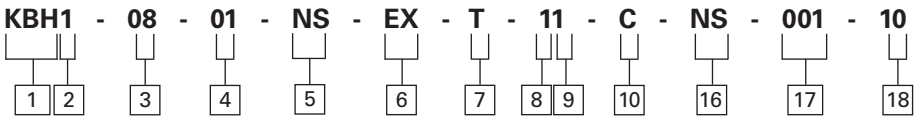
General Description

Built on the proven KB Servo Proportional Valve technology, Eaton's next generation proportional valve provides two levels of performance in a two stage modular design. These four-way solenoid operated proportional valves offer high dynamic performance which enables them to be used in closed loop applications previously only possible using conventional servo valves.



KBH*-08

Model Code



1 Valve Type

KBH – Two stage servo performance proportional valve with integral amplifier and electronic feedback

2 **1** – Level 1

3 Interface

08 – ISO 4401, Size 8

4 Spool

01 – 2C375N - overlapped, P,A,B,T blocked

02 – 5C375N - zero lapped; P,A,B,T blocked

03 – 33C375N - P blocked, A & B to tank

04 – 2C375N250 - overlapped, P,A,B,T blocked, asymmetric

06 – 33C375N250 - P blocked, A & B to tank, asymmetric

07 – PQ375F - pressure flow control spool

5 Valve Special Feature

NS – Not Selected

6 Pilot Supply,

TS – Internal supply without pressure reducer

ES – External supply without pressure reducer

TX – Internal supply with pressure reducer

EX – External supply with pressure reducer

7 Pilot Drain

T – Internal Drain

D – External Drain

8 Command Signal

1 – +/- 10V voltage command signal

Note: Command signal is shipped with 1 configuration. You may reconfigure to other command signal options using Pro-FX: Configure software.

2 – 4-20mA current command signal

3 – +/- 10mA current command signal

4 – +/- 15mA current command signal

9 Monitor Output

1 – ±10V voltage feedback signal

Note: Monitor signal is shipped with 1 configuration. You may reconfigure to other monitor signal options using Pro-FX: Configure software.

2 – 4-20mA current feedback signal

10 Electrical Connection

C – 7 pin connector without plug

E – 7 pin connector with plug

H – As E but with pin "C" used for enable signal

R – As C but with pin "C" used for enable signal

16 Electronics Special Feature

NS – Not selected

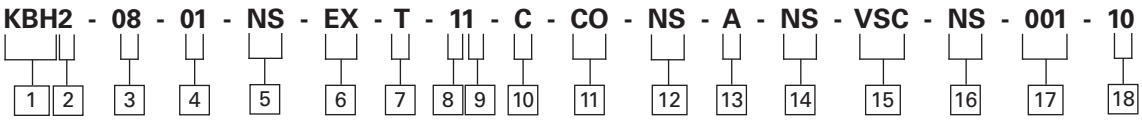
17 Software Revision

XXX – Software revision

18 Design Number

10 series.

Model Code



2 **2** – Level 1 plus Network enabled and DS408 control modes

11 **Digital Communication Interface**

CO – CANOpen

12 **Pilot Valve Sensors**

NS – Not Selected

PS – Pilot Pressure and Temperature Sensors

13 **External Sensor**

A – 4 4-20mA external sensor analog inputs and 2 discrete inputs

D – 1 SSI external digital sensor input

14 **Custom Application Programming Space**

NS – Not Selected

CW – Codesys White Space

15 **Control Mode**

VSC - Valve spool position control

Note: Control Mode is shipped in valve spool closed loop position control (VSC) configuration. You may reconfigure to other command signal options using Pro-FX: Configure software.

DPC - DS408 Drive Position Control Mode Enabled

DSC - DS408 Drive Speed Control Mode Enabled

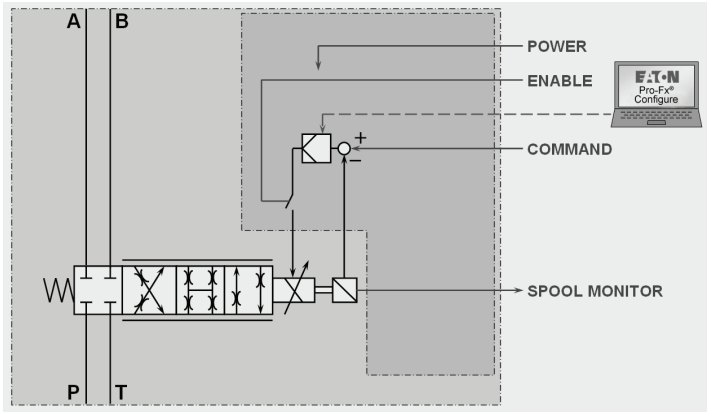
DFP - DS408 Drive Force/ Pressure Control Mode Enabled

DPQ - Eaton Custom Drive Pressure / Flow Control Mode Enabled

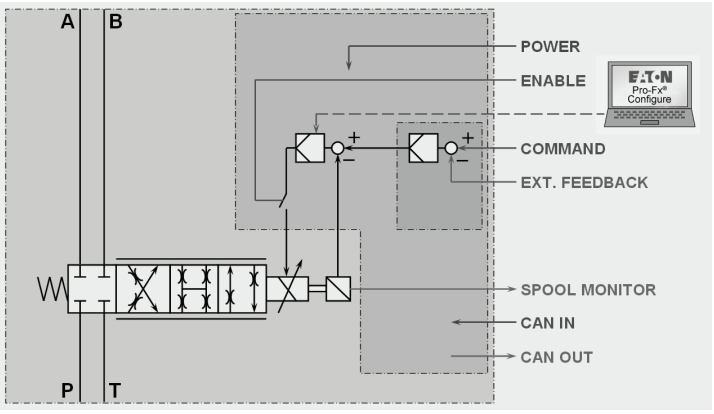
Refer to previous model code on page 4 for descriptions of other model code options

Spool Data
Spool Symbols

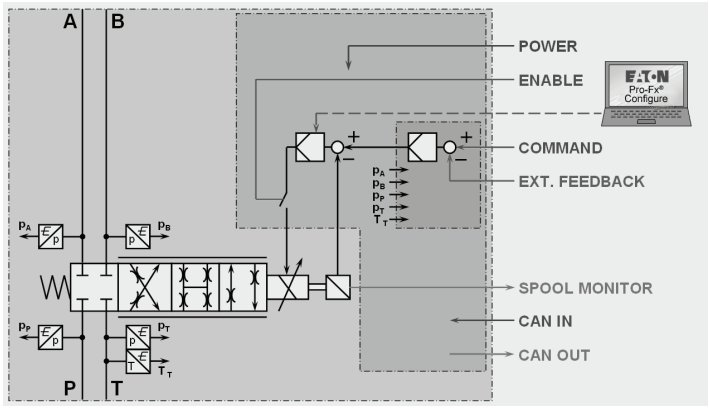
Model Type KBH1



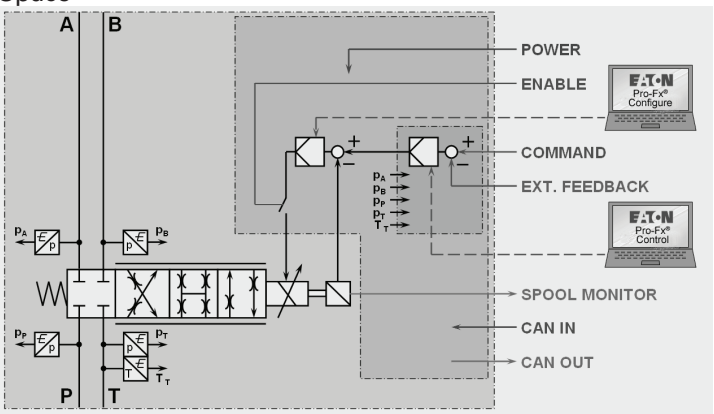
Model Type KBH2



Model Type KBH2 with Pilot Valve Sensor Option



Model Type KBH2 with Pilot Sensor Option and White Space



Application Notes

1. Main-Spool Options

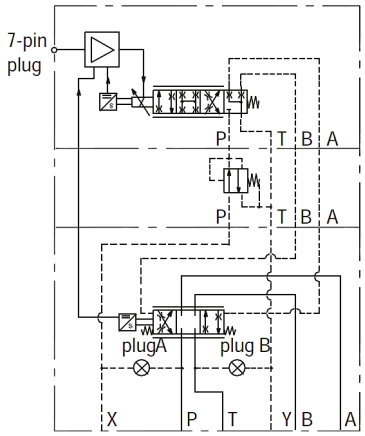
Spools shown are meter-in/meter-out types. Center-condition options are type 5C.

2. Internally Piloted Models

Differ from detailed symbols above by omission of plug A and the blocking of port X by the mating surface.

3. Internally Pilot Drain Models

Differ from detailed symbols above by omission of plug B and blocking of port Y by the mating surface.



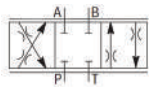
Spool Types and Flow Ratings

Symmetric Spools

Base line pressure drop Δp 5 bar (72 psi) per metering flow path, e.g. B to T. For actual maximum flow refer to power capacity envelope curves.

Note: Valves with 5C spools are designed so that with the valve disabled the pressure in port B is at least twice that in port A (blocked ports).

Spool code	Spool symbol	Flow rating
For KBH*-8 valves:		
5C375N	5C	375 L/min (99 USgpm) "A" port flow 375 L/min (99 USgpm) "B" port flow



Spool Type 5C (zero-lapped)

Pressure and Minimum Flow Rates

Maximum Pressures, Bar (PSI) Valves With Pressure Reducer

Model	Pilot pressure source †	Pilot drain connection	P Port	A&B Ports	T Port	X Port ♦	Y Port
KBH*-08	External	External	350 (5000)	50 (5000)	350 (5000)	350 (5000)	50 (700)
		Internal*	350 (5000)	350 (5000)	50 (700)	350 (5000)	50 (700)
	Internal	External	350 (5000)	350 (5000)	350 (5000)	350 (5000)	50 (700)
		Internal*	350 (5000)	350 (5000)	50 (700)	350 (5000)	50 (700)

† Minimum recommended pilot operating pressure = 50 bar (700 psi)

* Internal drain is a non-preferred option

♦ For pilot pressures ≤ 210 bar (3000 psi) a pilot pressure reducer is optional
For pilot pressures > 210 bar (3000 psi) a pilot pressure reducer must be used

Unused pilot port: Maximum pressure as shown

Maximum Pressures, Bar (PSI) Valves Without Pressure Reducer

Model	Pilot pressure source †	Pilot drain connection	P Port	A&B Ports	T Port	X Port ♦	Y Port
KBH*-08	External	External	350 (5000)	350 (5000)	350 (5000)	210 (3000)	50 (700
		Internal*	350 (5000)	350 (5000)	50 (700)	210 (3000)	50 (700)
	Internal	External	210 (3000)	350 (5000)	350 (5000)	210 (3000)	50 (700)
		Internal*	210 (3000)	350 (5000)	50 (700)	210 (3000)	50 (700)

† Minimum recommended pilot operating pressure = 50 bar (700 psi)

* Internal drain is a non-preferred option

♦ For pilot pressures ≤ 210 bar (3000 psi) a pilot pressure reducer is optional
For pilot pressures > 210 bar (3000 psi) a pilot pressure reducer must be used

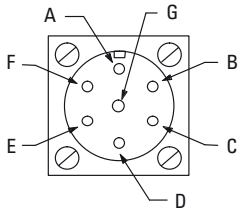
Unused pilot port: Maximum pressure as shown

Minimum Recommended Flow Rates

Valve Size/Spool Code	Min. Flow Rate L/min	in^3/min
KBH*-08	1,5	91

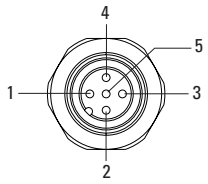
Connector Details

7-pin plug connector



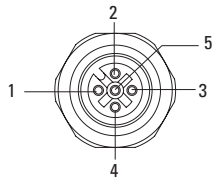
Pin	Description	Note:
A	Power supply positive (+)	Present at location 1 of the electronics enclosure (see figure 1 below).
B	Power supply 0V and current command return	
C	Not connected (PE7 & PC7)	To ensure EMI protection use only metal shielded mating connectors. Mating 7-pin (connector) is Eaton part number 934939
C	Valve enable (PH7 & PR7)	
D	Command signal (+V or current in)	
E	Command signal (-V or current GND)	
F	Output monitor	
G	Protective earth	

M12 5-pin CAN Connector (Male)



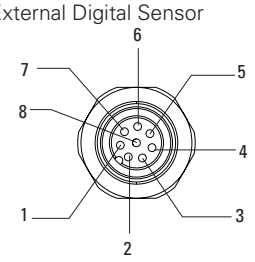
Pin	Description	Note:
1	GND	Present at location 2 and 4 of the electronics enclosure (see figure 1 below). Selection based on model code field number 11, present when CO option enabled.
2	Not Connected	
3	GND	To ensure EMI protection use only metal shielded mating connectors
4	CAN High	Use only shielded twisted pair (STP) cables for mating connection.
5	CAN Low	

M12 5-pin CAN Connector (Female)



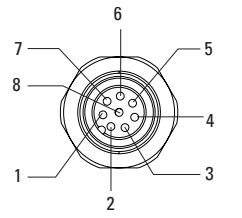
Pin	Description	Note:
1	GND	Present at location 5 of the electronics enclosure (see figure 1 below).
2	Not Connected	
3	GND	To ensure EMI protection use only metal shielded mating connectors
4	CAN High	Use only shielded twisted pair (STP) cables formating connection.
5	CAN Low	

M12 8-pin External Digital Sensor



Pin	Description	Note:
1	Power supply 0V	Present at location 3 of the electronics enclosure (see figure 1 below). Selection based on model code field number 13, present when D option enabled.
2	+24V Supply	
3	CLK-	To ensure EMI protection use only metal shielded mating connectors
4	DATA-	24V to Power supply 0V (pin 2, 1) short circuit protected (max current 1.5 A).
5	DATA+	Use only shielded twisted pair (STP) cables for mating connection.
6	Not Connected	
7	CLK+	
8	Not Connected	

M12 8-pin External Analog Sensor Port



Pin	Description	Note:
1	Speed Sensor Input1	Present at location 3 of the electronics enclosure (see figure 1 below). Selection based on model code field number 13, present when A option enabled.
2	Speed Sensor Input2	
3	4-20mA External Sensor Signal1	To ensure EMI protection use only metal shielded mating connectors
4	+15V Supply	15V to Power supply 0V (pin 4, 6) short circuit protected (max current 500 mA).
5	4-20mA External Sensor Signal2	
6	Power supply 0V	
7	4-20mA External Sensor Signal3	
8	4-20mA External Sensor Signal4	

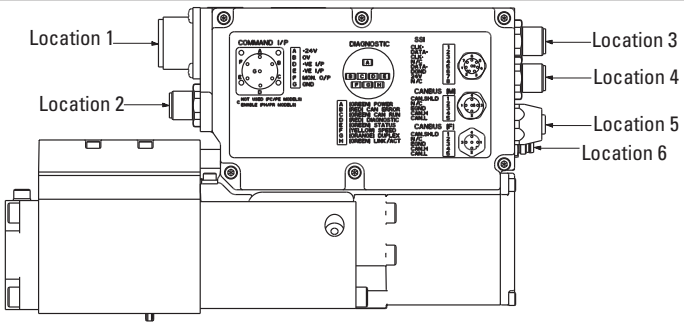
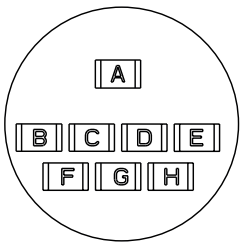


Figure1: Pilot Stage

Operating Data

Data is typical, with fluid at 32 cST (150 SUS) and 40°C (104°F)

Diagnostic		Color / Description A [Green] Power B [Red] CAN Error C [Green] CAN Run D [Red] Diagnostic E [Green] Status Note: 1. Figure to the left references the clear plastic window on the top of the valve. 2. LED F (amber) will glow as a part of normal operation.
Electromagnetic compatibility (EMC):		IEC61326-2-1
Monitor Points Signal: Voltage mode Current mode Output impedance		 ±10V DC 4 to 20 mA 10 kΩ
Power stage PWM frequency		20 kHz nominal
Reproducibility, valve-to-valve (at factory settings): Flow gain at 100% command signal		 ≤5%
Protection: Electrical		 Reverse polarity protected between pin A and B of the 7 pin plug connector
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)
Power supply		24V DC (18V to 36V including 10% peak-to-peak max ripple) max current 3,7A
Command Signal: Voltage mode Input impedance Voltage between Pin D and B Voltage between Pin E and B Current mode Max differential voltage to pin E to pin B		 –10V to +10V DC 13 bit resolution, ± 1% M1: 47 kΩ - M2, M3, M4: 100Ω M1: 18V (max) M1: 18V (max) M2: 4-20 mA , M3: ±10mA, M4: ±15mA (± 20 mA, 13 bit resolution, ± 1%) M2, M3, M4: 100 mV
Valve enable signal for model code H & R Enable Disable Input impedance		 Disable <6.5V; Enable Signal >8.5V (max 36V) 10 kΩ
Sensor Resolution: Ext. Sensor Port		 4-20 mA: 0-20mA 12 bit resolution ± 1%, 3mA cable break detect, 22mA overcurrent detect. Speed, independent frequency mode: 10Hz to 100 kHz. Speed, incremental count and direction + frequency mode: signed 32bit count, 0 to 100 kHz. Speed, quadrature phase A&B + frequency mode: signed 32 bit count, 0 to 100 kHz. SSI: binary or gray code, 32bits max, adjustable resolution and zero offset.
Integrated Pilot Pressure and Temperature Sensors		Integrated PCB temperature sensor accuracy: ± 2 C For valves with "PS" Pressure Sensor option" Integrated pressure sensors on all ports Pressure sensor rated to 400bar Integrated pressure sensor accuracy: ± 0.5% of full scale Bandwidth: >100 Hz Integrated temperature sensor on tank port Accuracy: ± 5C Bandwidth: ~1 Hz
Amplifier Temperature Sensing		1° C (1.8° F) resolution, -25°C (-13° F) undertemp detect, 125° C (257° F) overtemp detect
Power Supply Detect		18-36Vdc, 0.01 V resolution ± 1%, 19V under voltage detect, 36V overvoltage

Operating Data

KBH*-8 Valves (all valves)	
Relative duty factor	Continuous rating (ED = 100%)
Hysteresis	<0.4%
Step response:	
	5C
Step, % Flow	ms
0% to 100%, 100% to 0%	33
10% to 90%, 90% to 10%	25
-10% to 10%, 10% to -10%	16
25% to 75%, 75% to 25%	18
Mass: KBH*-08 with reducer KBH*-08 without reducer	 17.1 kg (37.5 lb) approx. 15.9 kg (34.8 lb) approx.
Environmental	IP65 and IP67 rated when using a similarly rated connector Location 2, 3, 4 and 5 connectors have IP65 and IP67 rated shipping covers
Interface Seal Kits	02-350686
Mating Electrical 7-pin Connector	934939

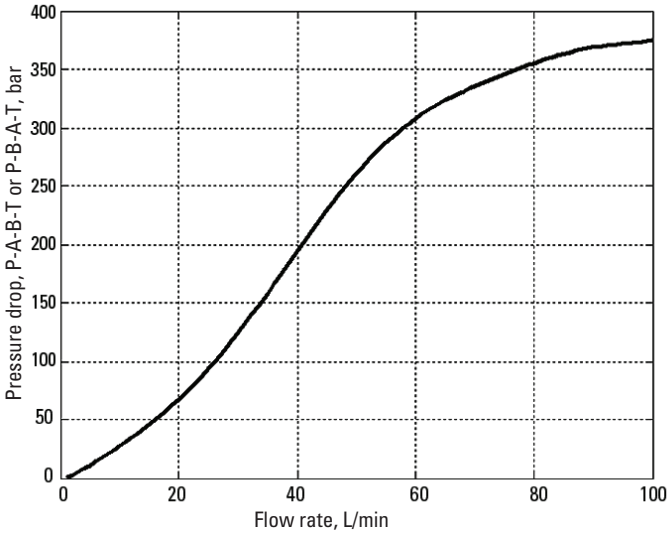
Performance Curves

Flow Gain

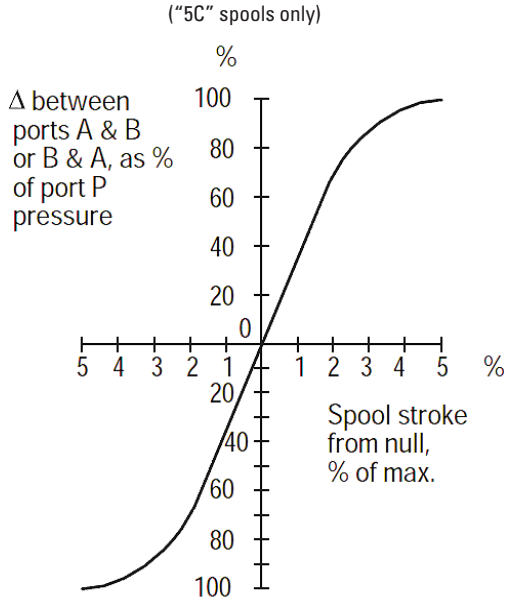
At Øp = 5 bar (72 psi) per metering path (e.g. P-A), with flow through P-A-B-T or P-B-A-T. Percentage command signals applicable for positive and negative values of command signal.

At other Øp values, flow rates approximate to: $Q_X = Q_D \sqrt{\frac{Øp_X}{Øp_D}}$

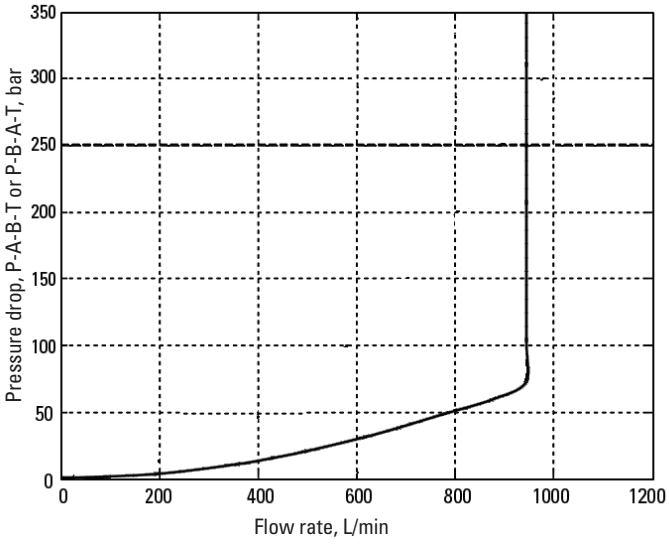
where QD= Datum flow rate
ØpD= Pressure drop at datum flow rate
ØpX= Required p
Limited by valve power capacity.
Refer to curves on page 8.



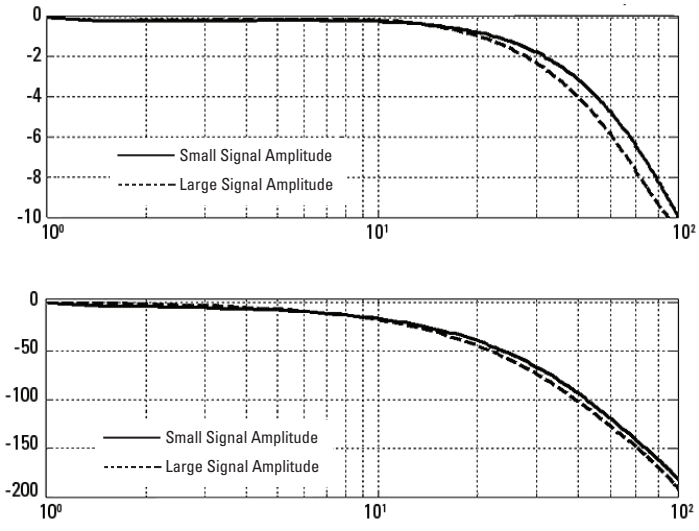
Pressure Gain



Power Capacity Envelopes



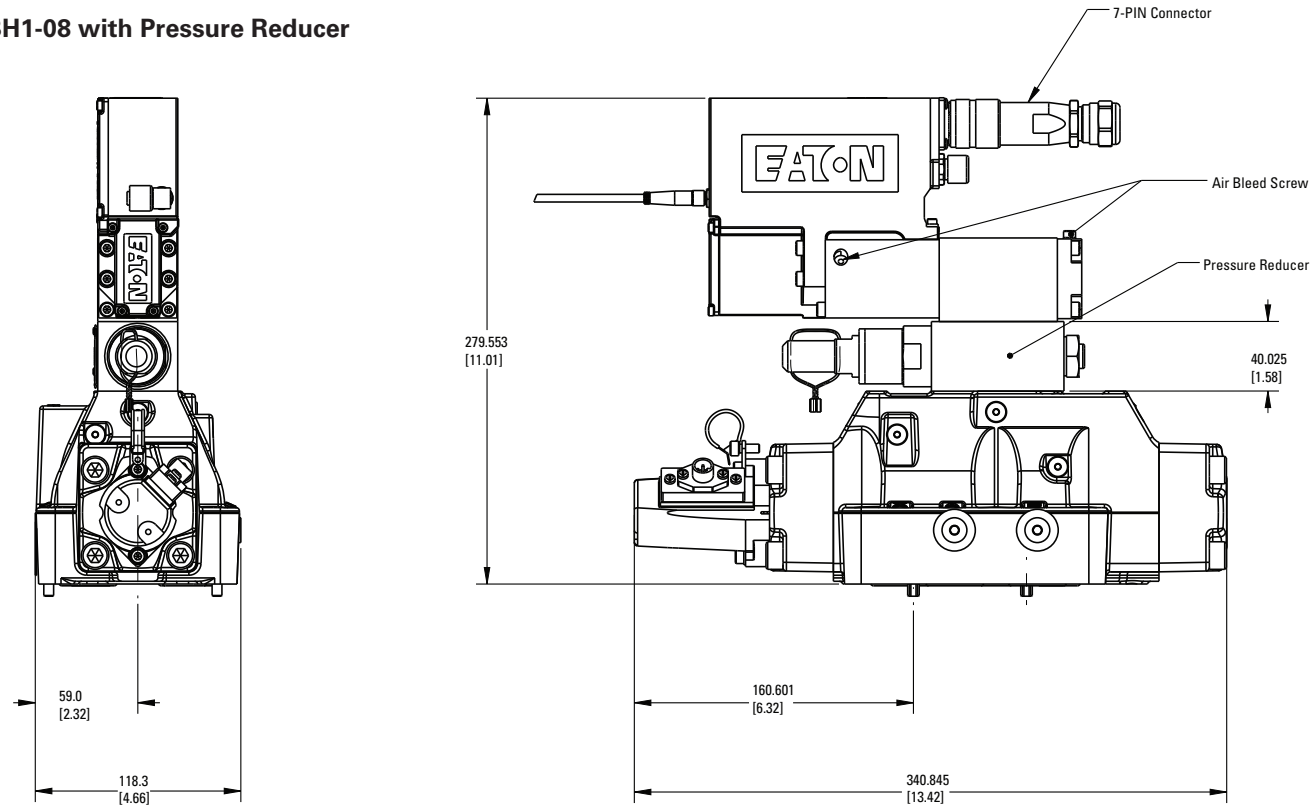
Frequency Response, typical



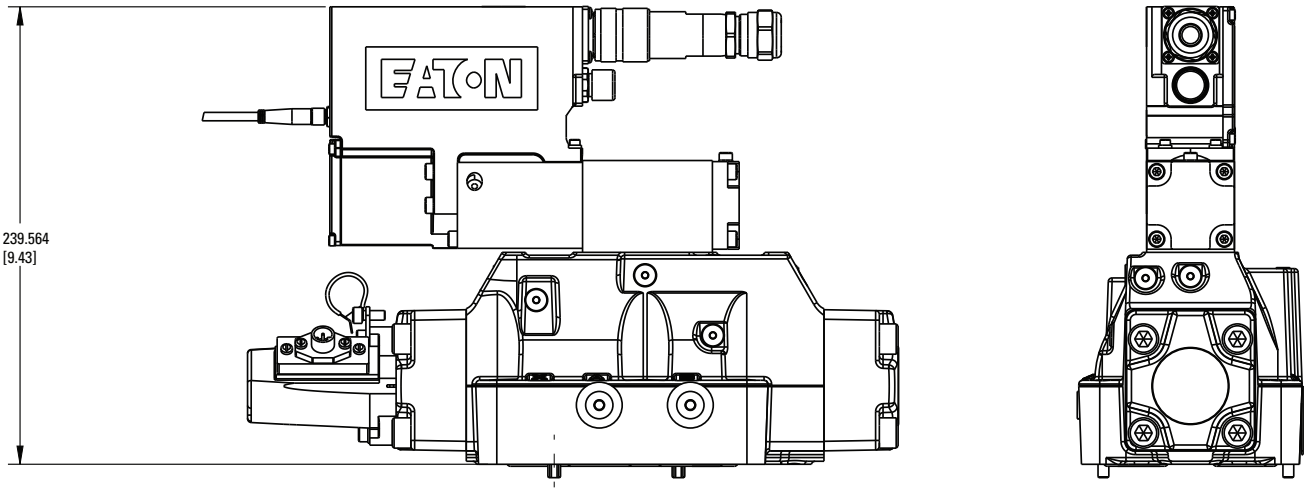
Installation Dimensions

mm (inch)

KBH1-08 with Pressure Reducer

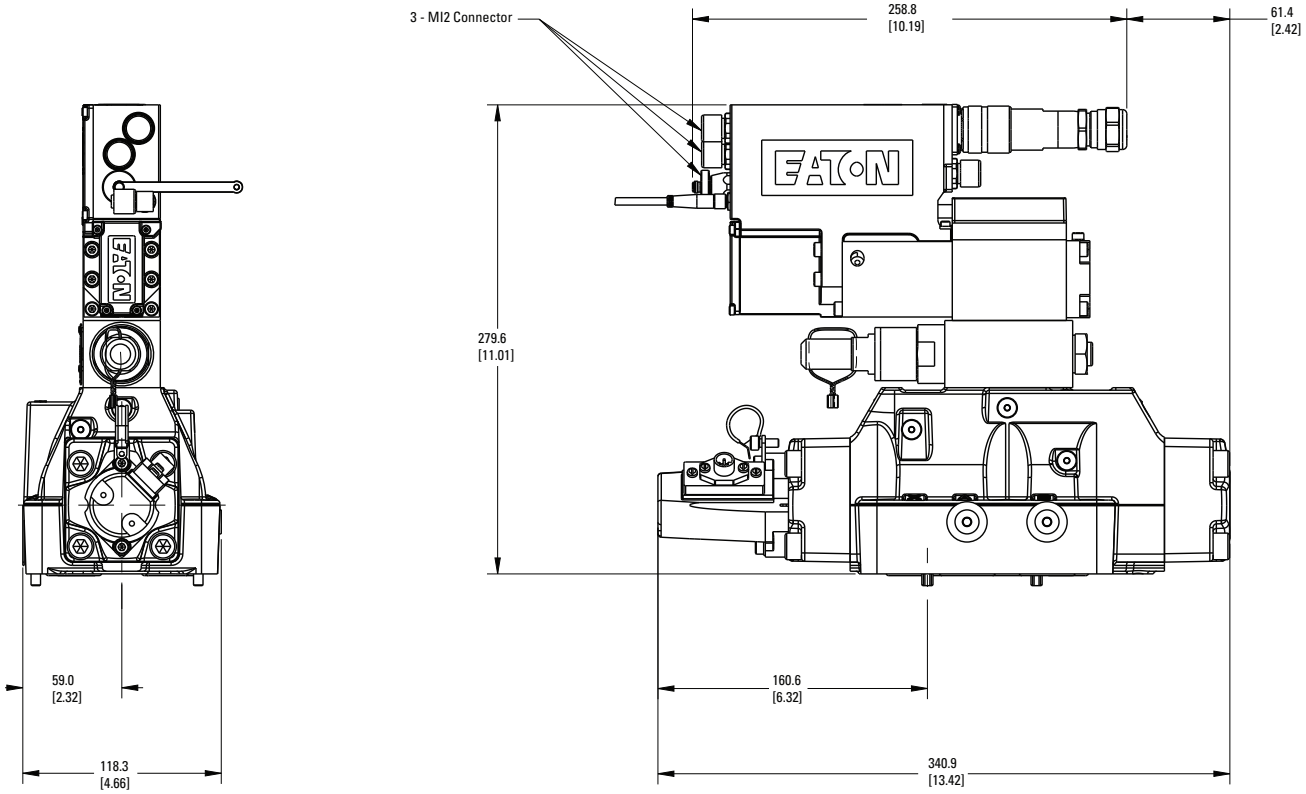


KBH1-08 without Pressure Reducer



Installation Dimensions
mm (inch)

KBH2-08 with Reducer and Pilot Sensors



Block Diagram Voltage Input (Command Signal 1) KBH-08

KBH*-08 Wiring

Connections must be made via the 7-pin plug mounted on the amplifier. See page 15 of this leaflet and Eaton's Installation Wiring Practices for Vickers™ Electronic Products, leaflet 2468. Recommended cable sizes are:

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:

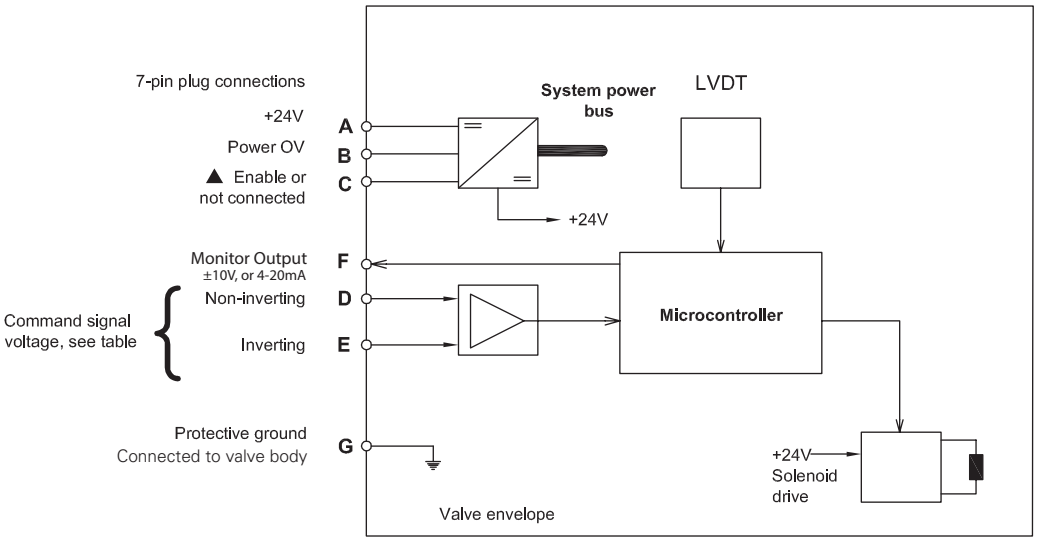
0.50 mm² (20 AWG)

Screen (shield):

A suitable cable would have 7 cores, a separate screen for the signal wires and an overall screen.

Cable outside diameter 8.0 - 10.5 mm (0.31 - 0.41inches)

See connection diagram on next page.



▲ Pin C is used for a valve enable signal with electrical connections H and R.

Command Signals and Outputs, Command Signal 1

7-pin plug		Flow direction
Pin D	**Pin E**	
Positive OV $U_D - U_E$ = Positive	OV Negative	P to A
Negative OV $U_D - U_E$ = Negative	OV Positive	P to B

WARNING

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

Electrical Information

Block Diagram Current Input (Command Signal 2, 3 and 4) KBH*-08

KBH*-08 Wiring

Connections must be made via the 7-pin plug mounted on the amplifier. See page 15 of this leaflet and Eaton's Installation Wiring Practices for Vickers™ Electronic Products, leaflet 2468. Recommended cable sizes are:

Power cables:

For 24V supply

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1.00 mm² (16 AWG) up to 40m (130 ft)

Signal cables:

0.50 mm² (20 AWG)

Screen (shield):

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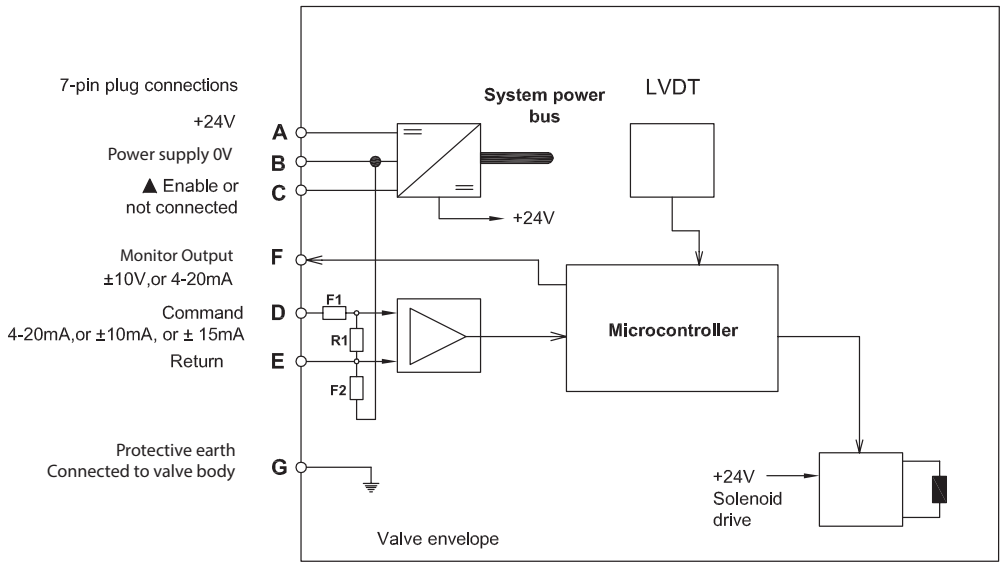
Cable outside diameter 8.0 - 10.5 mm (0.31 - 0.41 inches)

See connection diagram on next page.



▲ Pin C is used for a valve enable signal with electrical connections H and R.

R1 shunt resistor 100R
F1, F2 resettable fuse

Command Signals and Outputs, Command Signal 2

7-pin plug			
Pin D	**Pin E**	**Pin B**	**Flow direction**
More than 12 mA	Current return	Power ground	P to A
Less than 12 mA	Current return	Power ground	P to B

Command Signals and Outputs, Command Signal 3

7-pin plug			
Pin D	**Pin E**	**Pin B**	**Flow direction**
More than 0 mA	Current return	Power ground	P to A
Less than 0 mA	Current return	Power ground	P to B

Command Signals and Outputs, Command Signal 4

7-pin plug			
Pin D	**Pin E**	**Pin B**	**Flow direction**
More than 0 mA	Current return	Power ground	P to A
Less than 0 mA	Current return	Power ground	P to B

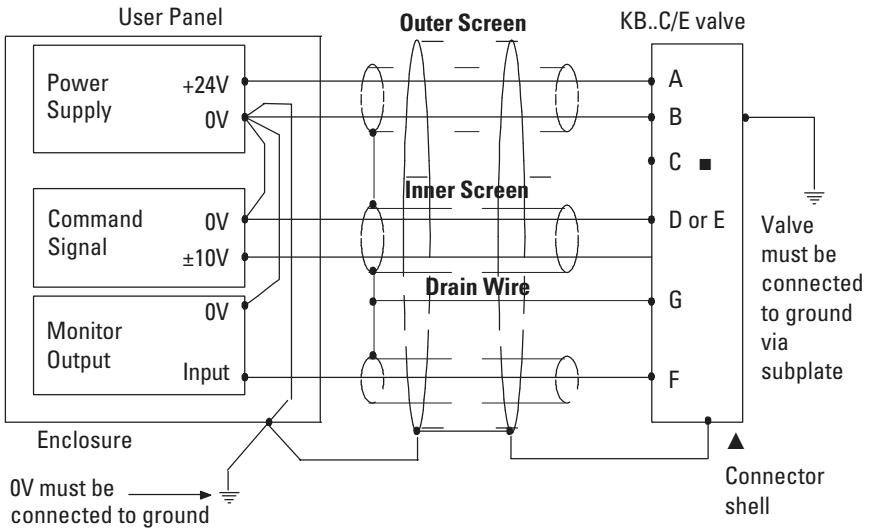
Note: Flow direction listings only applicable to valve closed-loop spool position mode. Refer to field number 18 of model code.

WARNING

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

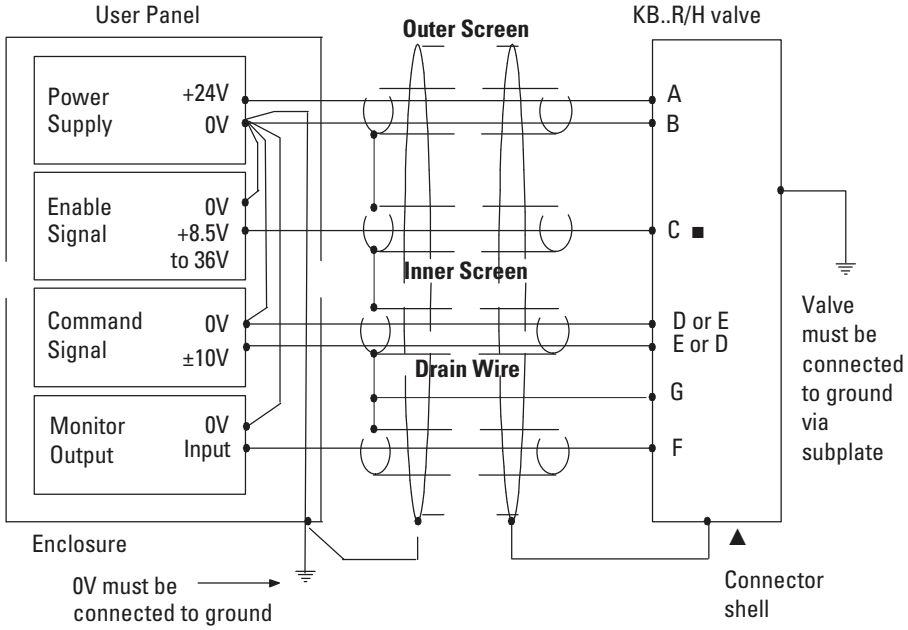
Wiring Connections Voltage Input (Command Signal 1)

■ Spool position monitor voltage (pin F) will be referenced to the KB valve local ground (pin B).



Wiring Connections for Command Signal 1 Valves with Enable Feature

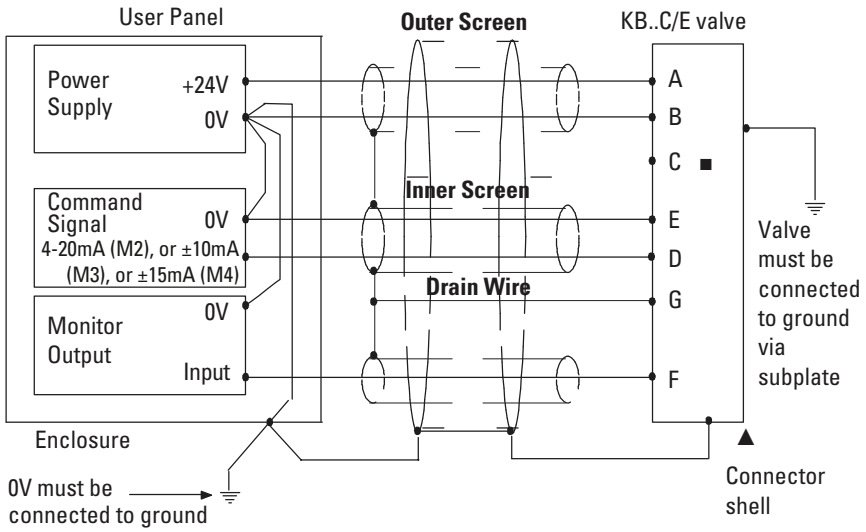
▲ Note: In applications where the valve must conform to European RFI/EMC regulations, the outer screen (shield) must be connected to the outer shell of the 7 pin connector, and the valve body must be fastened to the earth ground. Proper earth grounding practices must be observed in this case, as any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



Electrical Information

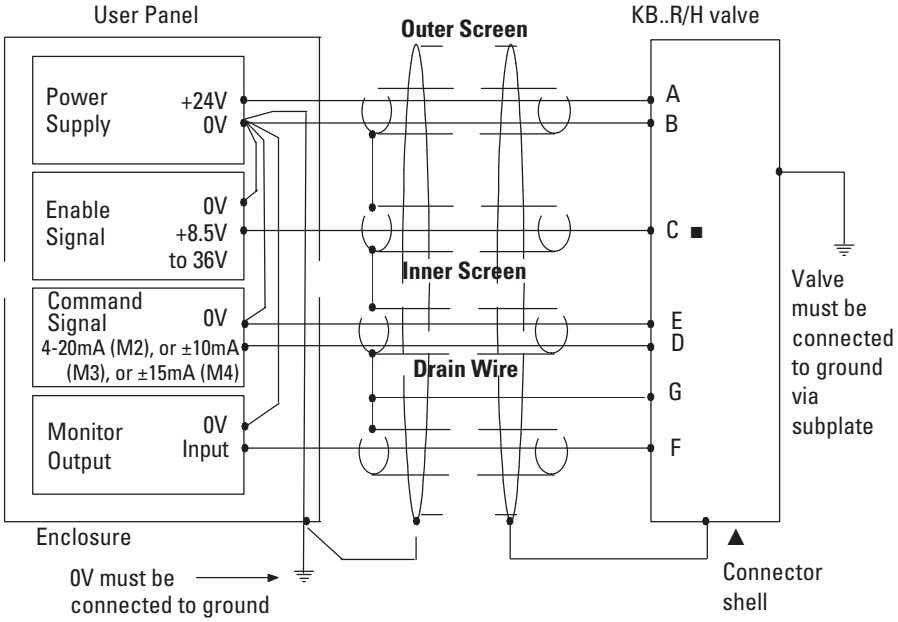
Wiring Connections Current Input (Command Signal 2, 3 and 4)

■ Spool position monitor voltage (pin F) will be referenced to the KB valve local ground (pin B).



Wiring Connections for Command Signal 2, 3 and 4 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 of 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.

To ensure EMI protection use only metal shielded mating connectors.

Software Information

KBH1

- Analog commanded spool control.
- Analog command source configuration options.
- Monitor output signal configuration options.
- Enable input signal enable/disable option.

KBH2

- KBH1 capability.
- Sensor port configuration options. Configurable position, Speed, Pressure, Force and SSI Sensors.
- CANopen DS408 compliant control modes (device options vary per available hardware options).
  - valve spool position control (VPOC/VSC).
  - drive speed control (DSC).
  - drive force/pressure control (DFPC/DFP).
  - drive position control (DPC).
  - drive pressure/flow control (Eaton DPQ).
- CANopen DSP306 compliant electronic data sheet (EDS).
- Diagnostic configuration options.
- Optional White Space
- Optional Pilot Pressure Sensors

All levels and models are compatible with the Eaton Pro-FX: Configure application and service tool software, version 2.2 or higher.

Download Pro-Fx™, Technical Information and Support Materials from Eaton's Website:

http://www.eaton.com/AxisPro

Install the Eaton Pro-Fx™ Configure PC application tool. Installation is supported on a wide range of Windows based operating systems including Windows 7 32 bit and 64 bit.

The Pro-Fx™ configure installation provides several options for PC USB peripheral CANbus adapters supported by the software. During installation the user can choose to install drivers for an available CANbus adapter.

The adapters supported by Pro-Fx™: Configure are:

- PCAN-USB* PEAK-System Technik GmbH (http://www.peak-system.com)
- ValueCAN Intrepid Control Systems, Inc. (http://www.intrepidcs.com)
- Leaf-Light Kvaser AB (http://www.kvaser.com)

* The PCAN-USB adapter is recommended for compatibility with Eaton Pro-Fx: Control development environment used with KBS4DGV-xxx and other Eaton Pro-Fx products.

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.

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:

17/15/12

Eaton 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 aryl 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.

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 Eaton 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.

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Powering Business Worldwide

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Valvistor® Proportional Flow Control
Cartridge Valves

CVCS-**-HFV, 10 Series, Covers
CVI-**-HFV-A/B, 10 Series, Inserts

350 bar
Up to 2160 L/min

Powering Business Worldwide

Table of Contents

General Description 2
Valvistor Technology 2
Basic characteristics 2
Features and Benefits 3
Functional Symbols 4
Model Codes 5
Operating Data 6
Pivot Valve Electrical Data 6
Flow Pressure Drop Charts 7
Pressure Drop 9
Hydraulic Fluids 10
Filtration Requirements 10
Temperature Limits 10
Mounting Bolts and Assembly Torques 11
Seal Kits 11
Ordering Procedure 11
Installation Dimensions 12
Valvistor Line Extension (High performance and OBE options) 13
Released Part Numbers 14

General Description

Eaton's Vickers® HFV (Hydraulic Feedback Valvistor®) range of slip-in cartridge valves uses a self-regulating hydraulic design for the control of flow rate by a current-controlled PWM signal. The design achieves servo-type control of the main poppet without using an electrical feedback transducer.

The construction and features of these valves open up a wide range of applications with hydraulic cylinders and motors. Such applications include ie casting, deep drawn presses, injection molding, container handling, shovel loaders, forestry and dump trucks. With the addition of HFV valves to the established ISO 7368 (DIN 24342) cartridge valves, Eaton has further enhanced an already comprehensive range.

Valvistor Technology

In "Valvistor" designs a main poppet amplifies a small flow through the pilot circuit, comparable to a transistor. Thus the name "Valvistor", derived from "valve" and "transistor". Figures 1 and 2 show the construction of proportional throttles to ISO 7368. In both cases a Vickers type KTG4V-3S proportional valve is used as the pilot control valve. Hydraulic position feedback is obtained by providing the main poppet with a longitudinal slot (5) in its cylindrical surface. This slot, together with a metering edge inside the sleeve, forms a variable orifice between the inlet of the valve and the volume above the main poppet (3). When the valve is closed and the main poppet is seated, the variable orifice area is almost closed.

Figure 1
Construction for flow direction A to B; poppet in the closed (no flow) condition. (Note: For flow A-B, poppet drilled from A.)

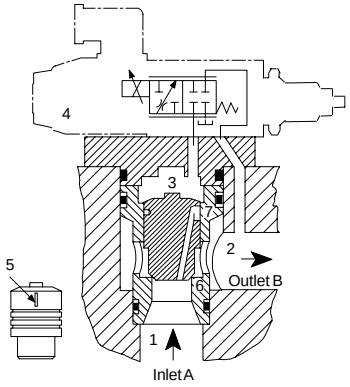
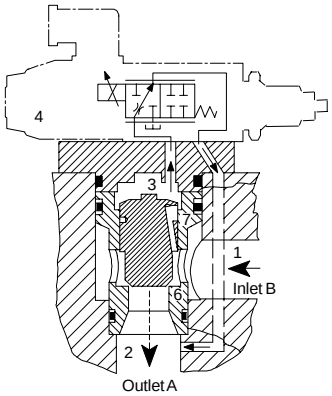


Figure 2
Construction for flow direction B to A; poppet partially open. (Note: For flow B-A, poppet drilled from B.)



Basic Characteristics

Nominal Sizes:

ISO 7368	DIN 24342
06	NG16
08	NG25
09	NG32
10	NG40
11	NG50
12	NG63

Maximum operating pressure .....350 bar (5000 psi)
Flow ratings ..... up to 2160 L/min (571 USgpm)

Catalog data based on pilot valve KTG4V-3S-EN427.

As the main poppet opens, the variable orifice area increases. The slot is a part of one leg of a hydraulic bridge circuit and provides an internal position feedback. With the pilot throttle valve closed (figure 1), there is no pilot flow through the closed-off slot in the seated poppet. The pressure above the main poppet (3) is equal to the pressure at the valve inlet (1), due to the controlled small opening at the variable orifice. As the upper area of the poppet is greater than the area facing the inlet (1), the poppet is held against its seat (6) by a force proportional to the difference between valve inlet and outlet pressures.

Opening the pilot throttle valve (figure 2) lowers the pressure in volume (3) allowing the main poppet to move off its seat. As this occurs the slot passes the metering edge (7), opening the variable orifice and allowing flow through the pilot circuit. Initially the flow through the pilot valve equals the flow through the slot plus the volume displaced by the opening movement of the main poppet. The main poppet moves upwards until the pressure drops across the slot and the pilot effects a force balance on the poppet. The poppet is then held in a steady-state condition with equal flow across the slot and the pilot.

If the flow through the pilot valve is reduced (by reducing the command current to the solenoid), the force balance of the main poppet is again disturbed and the main poppet moves downwards reducing the slot area and decreasing flow to the upper chamber until the force balance is restored. Thus by controlling flow through the pilot valve, the main poppet can be controlled in any position from fully closed to fully open. In this manner a very simple, effective servo-control of the main poppet is obtained. If the outlet pressure exceeds inlet pressure when the pilot valve is closed, the main poppet allows reverse flow (see CVCS model code). The main valve function is determined by the type of pilot fitted.

If pressure compensation is added to the pilot stage, the complete valve is pressure compensated. If a pilot relief valve is fitted, the main stage operates as a relief valve. As the pilot flow is returned to the valve outlet (i.e. no "drain" connection) the valve is energy efficient. Therefore the position of the main poppet is controlled by a closed-loop system with a variable orifice in the poppet acting as the internal position feedback element. The command signal in this feedback system is pilot flow, as set at the proportional pilot throttle valve (4).

Features and Benefits

The HFV range with its simplicity, cost effectiveness and performance level can be applied in almost all applications from high performance industrial areas such as injection molding to those applications just requiring proportional functionality.

The data in this catalog is based on the specially developed proportional pilot KTG4V-3S-60-EN427. The functional flexibility of the Valvistor may be extended by the use of different pilots. Contact Eaton for application assistance.

In addition, the HFV range offers:

Unequalled simplicity	No inner electrical feedback loop and associated electronics
Two models: for flow direction A to B or B to A	Provides system design options and flexibility
Free flow in reverse direction	Provides system design options and flexibility
Poppet valve construction	Provides tight shut-off and load holding
Internal pilot flow	Simple installation and energy efficient
Very fast response	Provides the system designer with high dynamic acceleration/velocity/deceleration profiles for demanding performance requirements such as: • Cylinder position control including lift/lower • Rotary actuator dynamic control • Velocity profile control
Smooth closing and opening	Shock-free start-up and shut-off allow high velocities to be maintained for longer periods, thus reducing cycle times
Low hysteresis	8% to 1% depending on pilot valve used
Integral feedback	Internal hydraulic feedback provides effective, low-cost position control of main poppet
Repeatability	Provides repeatable and accurate actuator velocity to a given operator command input
Electrical operation	Current-controlled PWM signal
Pressure compensation	Can be achieved by pressure compensating pilot stage only
Cost-effective design	Provides multiple functions such as pressure compensation, flow control and reverse free flow check valve
Optional manual override	Pin design
Compatible with antiwear hydraulic oils and phosphate esters (non alkyl)	Flexible application for broad range of installations
Electrical connections DIN or conduit box	Provides design flexibility to meet OEM or user preference

Inherent benefits of Eaton cartridge valve technology are applicable to the Valvistor range.

Functional Symbols Valvistor® Proportional Throttle Valves

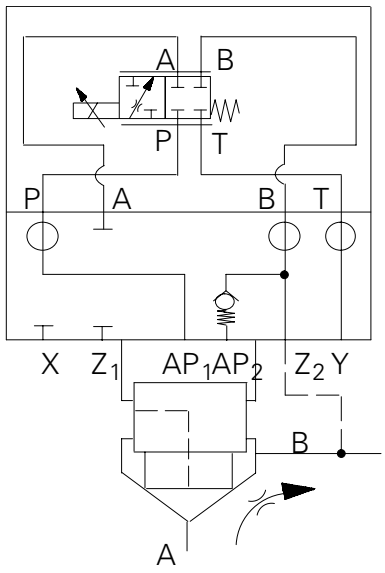
Complete valve assembly comprises insert, cover and proportional solenoid operated pilot valve (pilot valve to be specified and ordered separately).

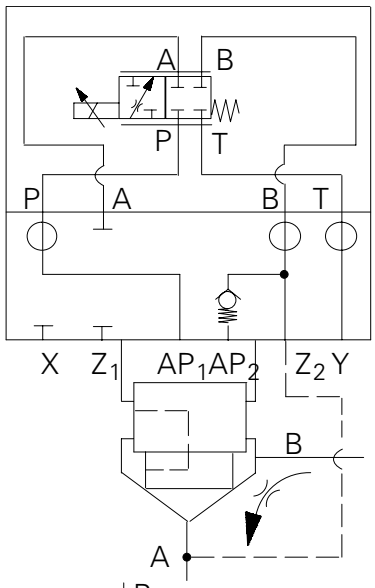
Direction of controlled flow

A to B
Use insert type CVI-**-HFV-20-**A**-***-1*

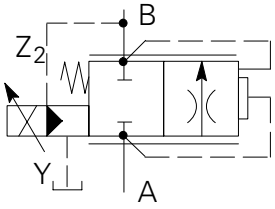
B to A
Use insert type CVI-**-HFV-20-**B**-***-1*

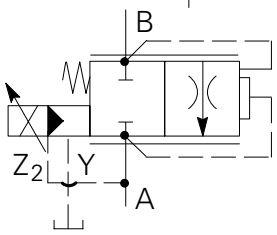
Models without free reverse flow capability
Use cover type CVCS-**-HFV*-**W**-*2(9)-1*



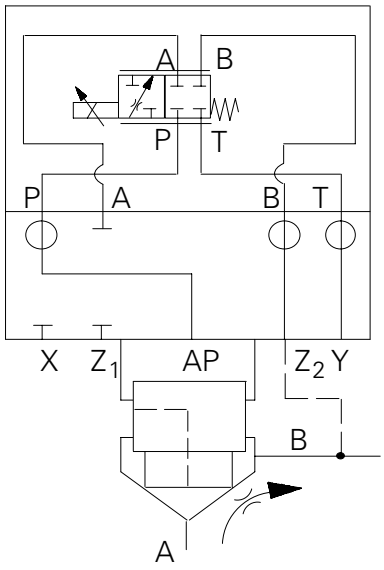


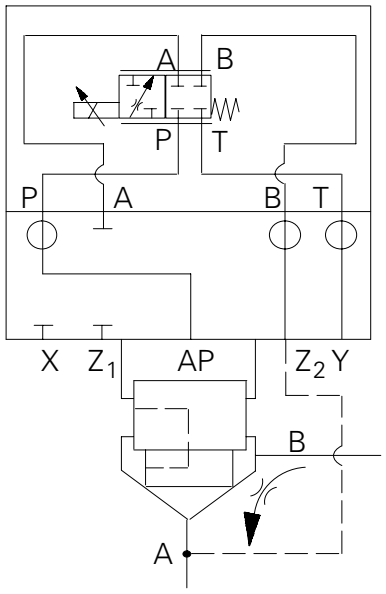
Simplified symbol



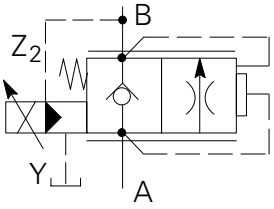


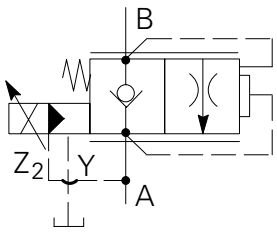
Models with free reverse flow capability
Use cover type CVCS-**-HFV*-*2(9)-1*
Note: Omit W from model code position 6





Simplified symbol





Model Codes Valvistor® Proportional Throttle Valves

(F3-) CVI - ** - HFV - 20 - * - * - 1***

1 2 3 4 5 6 7 8

1 Seal Material
F3 - Seals for phosphate esters or chlorinated hydrocarbons. Omit for all other fluid types.

2 Model
CVI - Cartridge valve insert

3 Nominal size to ISO 7368 (DIN 24342)
16 - 06 (NG16)
25 - 08 (NG25)
32 - 09 (NG32)
40 - 10 (NG40)
50 - 11 (NG50)
63 - 12 (NG63)

4 Flow direction
HFV - Hydraulic feedback, Valvistor

5 Area ratio
20 - 1:2 area ratio

6 Flow direction
A - For flow A to B
B - For flow B to A

7 Flow capacity at Δp = 10 bar (145 psi)

Size/Flow Direction	Code	L/min	USgpm
16A	21	210	55
16B	21	210	55
25A	40	405	107
25B	32	320	107
32A	63	630	166
32B	63	630	166
40A	90	900	238
40B	81	900	238
50A	130	1305	345
50B	130	1305	345
63A	216	2160	571
63B	216	2160	571

Valvistor Throttle Covers (Suitable for flows A to B and B to A)

(F3-) CVCS - ** - HFV - * - * - * 2 (9) - 1*

1 2 3 4 5 6 7 8 9 10

1 Fluid compatibility
F3 - Seals for phosphate esters or chlorinated hydrocarbons. Omit for all other fluid types.

2 Model
CVI - Cartridge valve cover to ISO 7368

3 Nominal size to ISO 7368 (DIN 24342)
16 - 06 (NG16)
25 - 08 (NG25)
32 - 09 (NG32)
40 - 10 (NG40)
50 - 11 (NG50)
63 - 12 (NG63)

4 Type
HFV - Hydraulic feedback, Valvistor

5 Size 3 pilot valve mounting bolts
1 - Imperial threads
3 - Metric threads

6 Control option
W - Mainstage Valvistor without free reverse flow.
Omit for standard mainstage Valvistor with free reverse flow capability

7 Thread/seal combination
B - G (BSPF) threads for gage ports; metric threads for orifices (only available when "3" specified at position 5)
S - SAE O-ring gage; inch threads for orifices (only available when "1" specified at position 5)

8 Seals
2 - Inch O-ring seals to ISO 3601

9 Mounting bolts
Sizes 16-40 only
9 - Metric mounting bolts supplied as standard when "B" (BSPF threads) specified at position 7 Omit for sizes 50 and 63

10 Design number, 1* series
Subject to change. Installation dimensions unaltered for design numbers 10 to 19.

Pilot Valve
For operation with 12V control system:
KTG4V-3S2B 08N-(V)M-*** ***
*(1)**G5**-60-**EN427**

For operation with 24V control system:
KTG4V-3S2B 08N-(V)M-*** ***
*(1)**H5**-60-**EN427**

For full technical details of this valve including types of electrical connections, see Eaton's Vickers Slip-in Cartridge Valve Catalog.

Operating Data

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

Maximum pressure	350 bar (5000 psi)					
Flow ratings	See model code (CVI)					
Controlled flow characteristics	See graphs on pages 7 and 8					
Pressure drop, free return flow	See graphs on page 9					
Dynamic performance:	06	08	09	10	11	12
Step input ▲ response at Δp = 10 bar (145 psi)	(NG16)	(NG25)	(NG32)	(NG40)	(NG50)	(NG63)
Opening time (ms)	50	85	130	240	280	340
Closing time (ms)	40	60	85	130	200	300
Hysteresis ▲	<8%	<8%	<8%	<8%	<8%	<8%
Repeatability ▲	<3%	<3%	<3%	<3%	<3%	<3%
Area ratio (all sizes)	2:1					
Hydraulic fluids	See page 11					
Temperature limits	See page 11					
Filtration requirements	See page 11					
Mounting bolts and assembly torques	See page 12					
Seal kits	See page 12					
Mass	See page 12					

▲ *Data quoted with KTG4V-3S---60-EN427 as pilot valve, driven by EEA-PAM-523-A-32 (Economic Performance)*

▲ ***For standard & high performance and On-Board-Electronics (OBE) options, see "Valvistor line extension" on page 13.***

Pilot Valve Electrical Data

Full performance data and model code breakdown can be found in Eaton's Vickers Slip-in Cartridge Valve Catalog.

Type	KTG4V-3S---60-EN427 (denotes special spool)	
Max. current at 50°C (122F)	Coil type	
	G	H
	3.2A	1.6A
Coil resistance at 20°C (68F)	1.8 ohms	7.3 ohms
Coil inductance at 1000 Hz	7.5 mH	29 mH
Relative duty factor	Continuous rating (ED = 100%)	
Electrical protection with plugs fitted correctly	IEC 947 class IP65	
Recommended amplifier	EEA-PAM-523-A-32	

▲ ***For standard & high performance and On-Board-Electronics (OBE) options, see "Valvistor line extension" on page 13.***

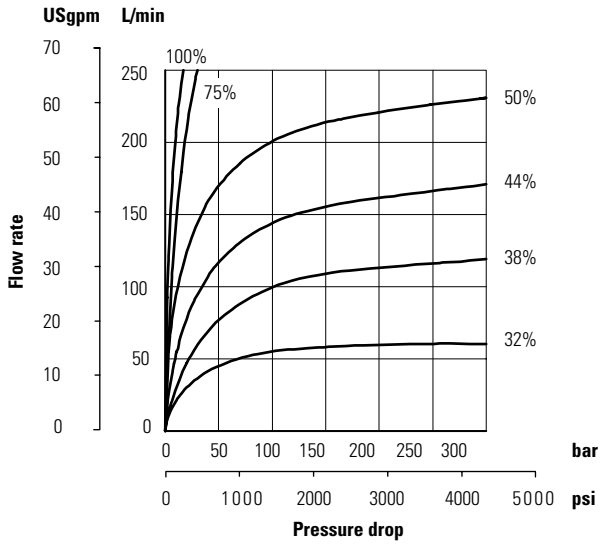
Performance Characteristics

The graphs on the following two pages show typical flow characteristics for different values of input current to pilot valve plotted against flow rate and valve pressure drop. They are based on a standard HFV insert and cover with a KTG4V-3S---EN427 pilot valve. A minimum pressure drop of 5 bar (72 psi) is recommended. Higher pressure drops result in improved control.

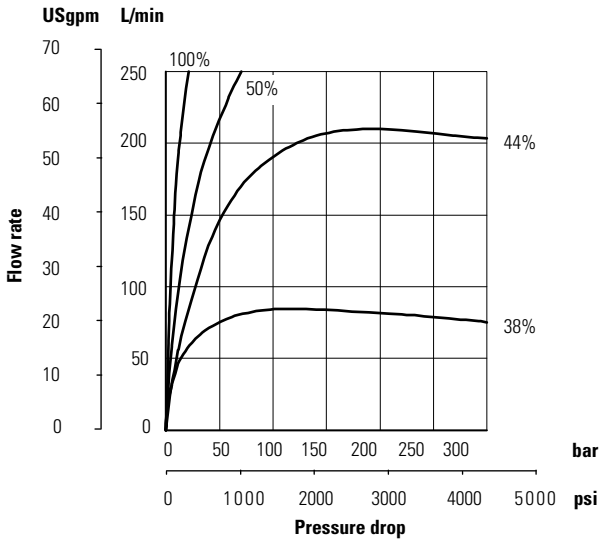
Flow/Pressure Drop vs Solenoid Current (% of max.)

Size 16

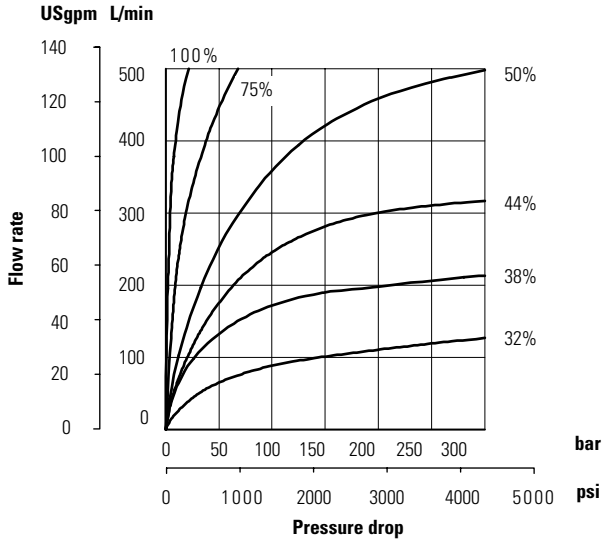
Flow A → B

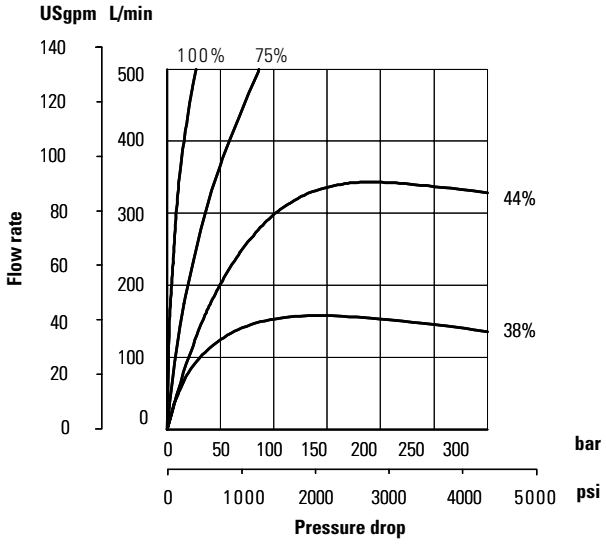


Flow B → A

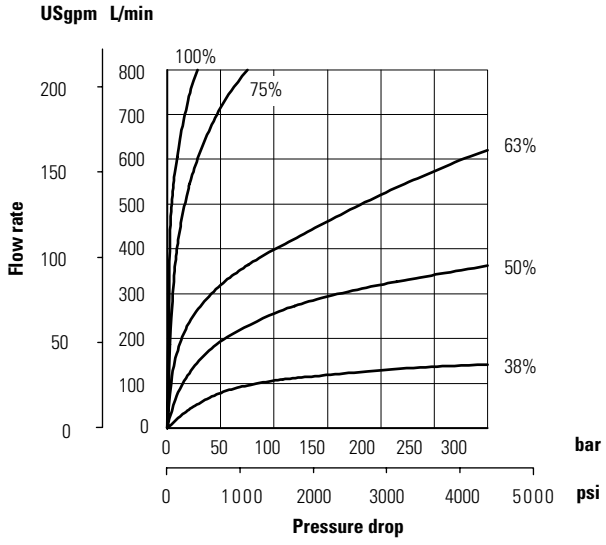


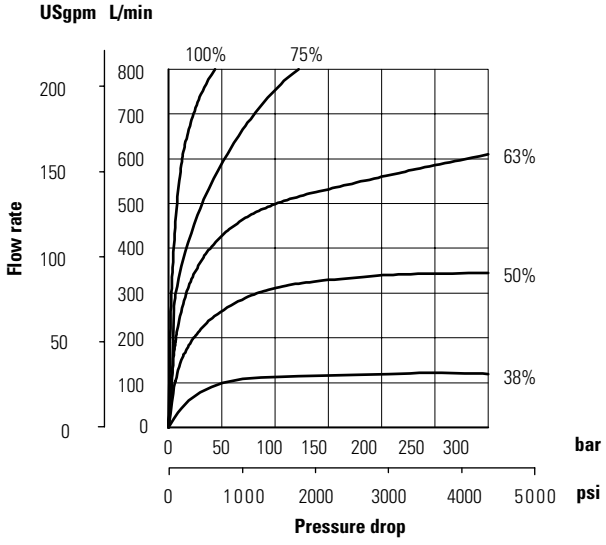
Size 25





Size 32

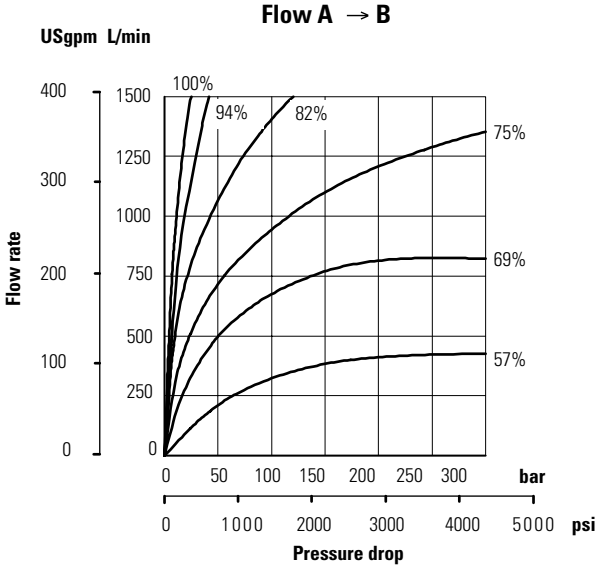




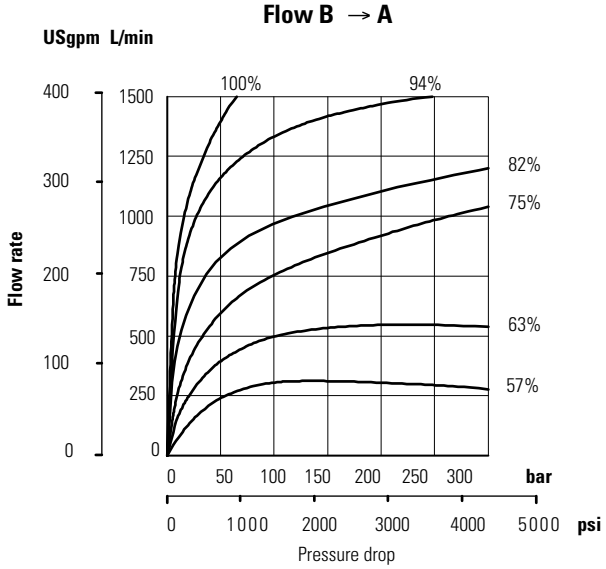
Flow/Pressure Drop vs Solenoid Current (% of max.)

Size 40

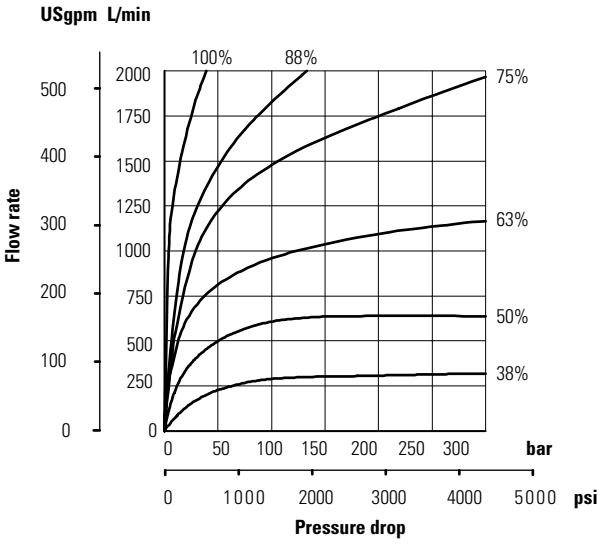
Flow A → B

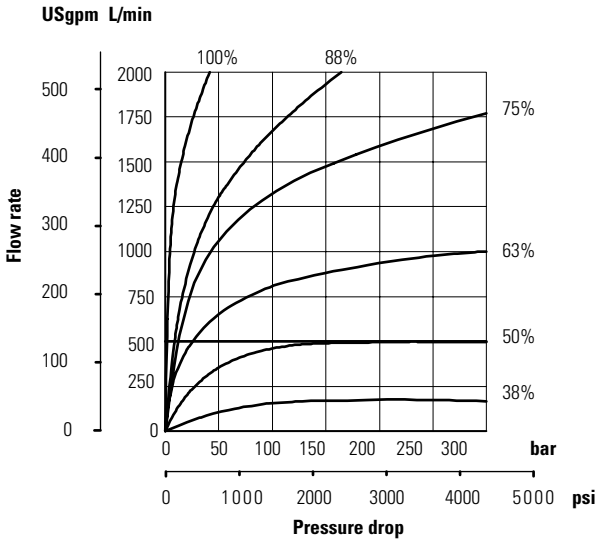


Flow B → A



Size 50





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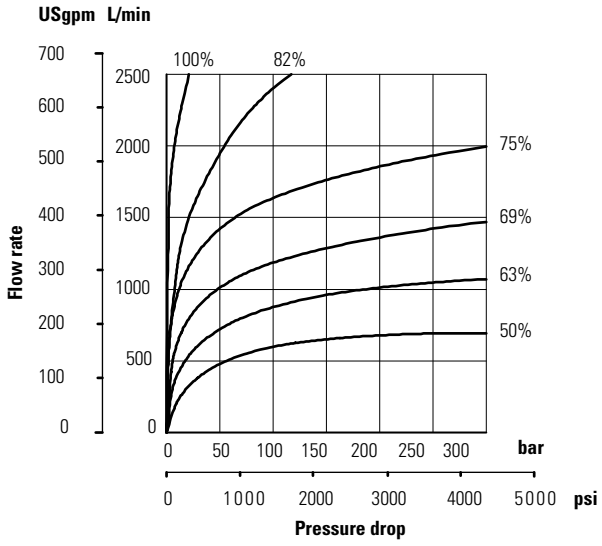
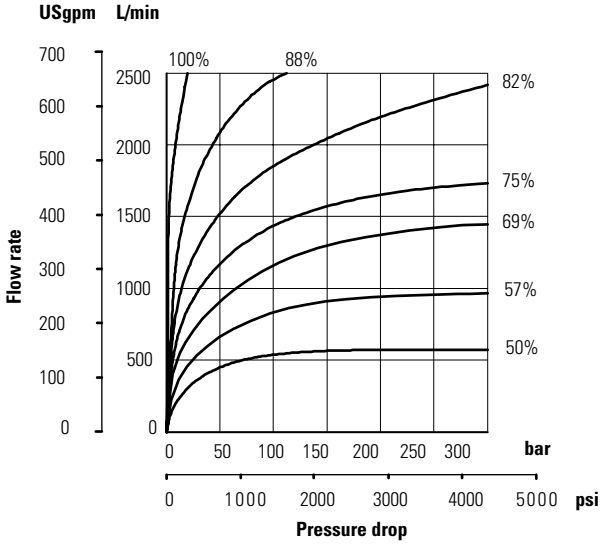
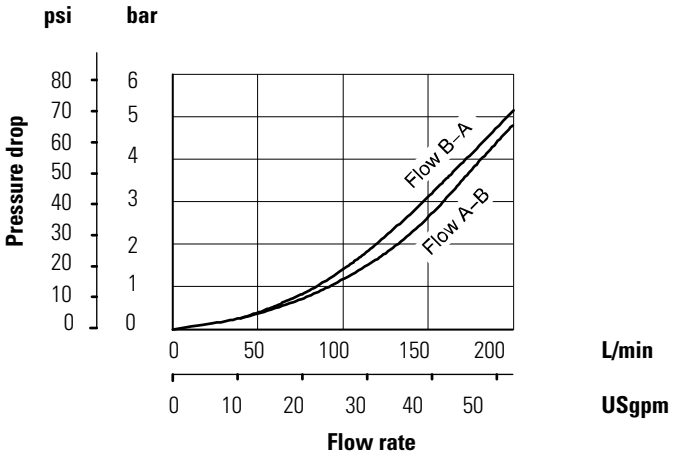




Pressure Drops - Free Return Flow

Size 16



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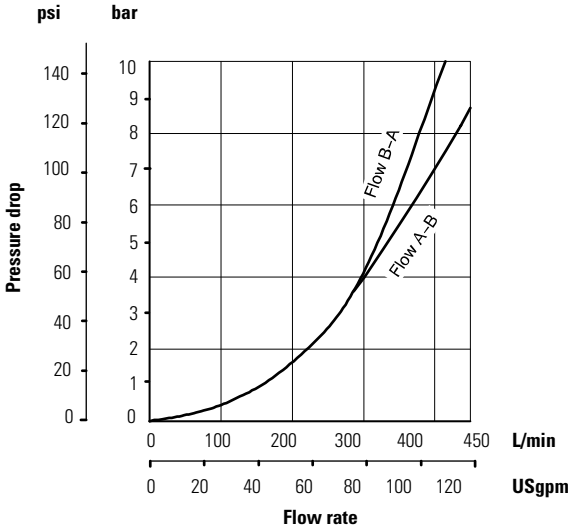

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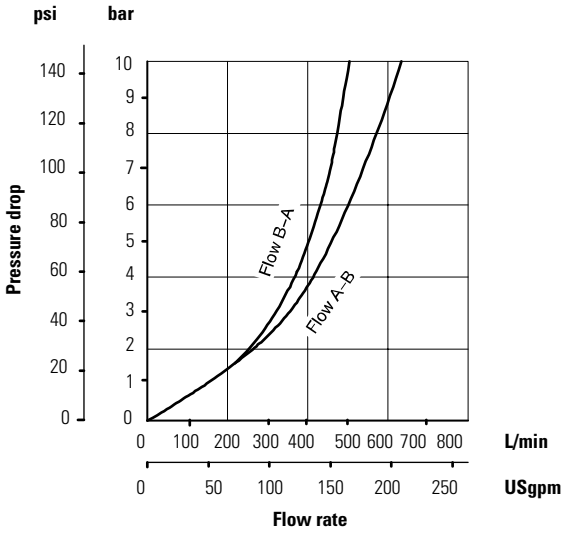

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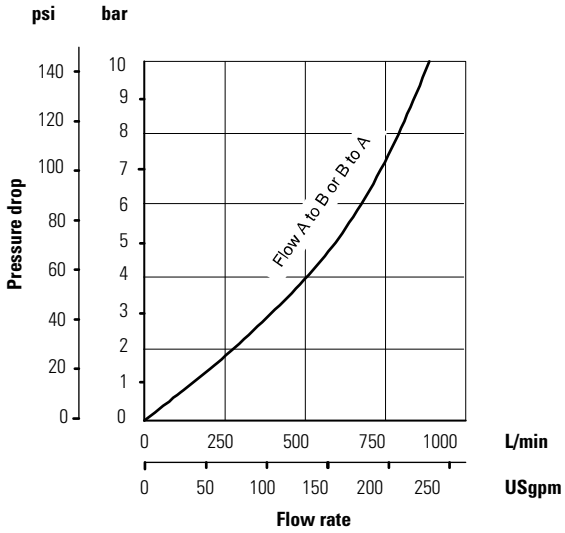

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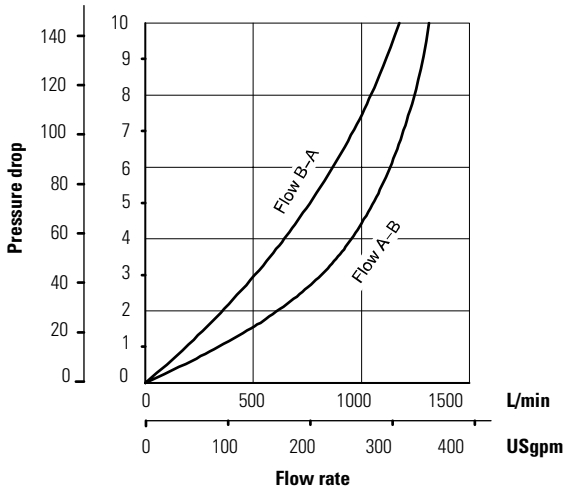

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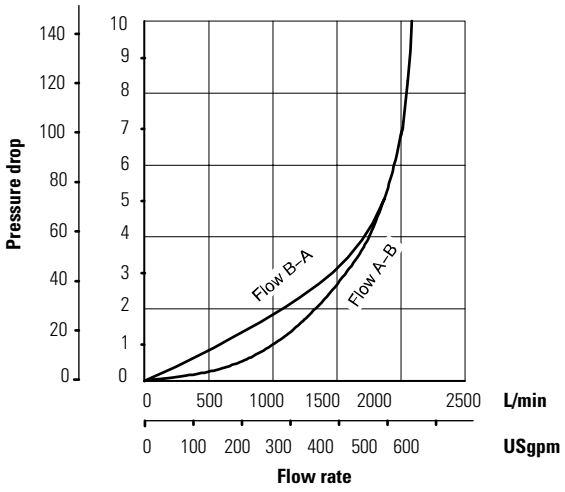


Hydraulic Fluids

All cartridge valves can be used with antiwear hydraulic oils, and certain low viscosity fluids. Add prefix "F3" to model designations when phosphate esters (not alkyl-based) or chlorinated hydrocarbons are to be used. The extreme viscosity range is from 500 to 5 cSt (2270 to 42 SUS) but the recommended running range is from 54 to 13 cSt (245 to 70 SUS).

Filtration Requirements

Essential information on the correct methods for treating hydraulic fluid is included in the Eaton's Vickers publication 561 "Vickers Guide to Systemic Contamination Control", available from your local Eaton distributor.

Recommendations on filtration and the selection of products to control fluid condition are also included in Eaton's Vickers publication 561.

Temperature Limits

Ambient min.....– 20C (–4F)
Ambient max.....+70C (+158F)

Fluid temperatures

	Petroleum oil	Wateroil containing
Min.	–20C (–4F)	+10C (+50F)
Max.	+80C (+176F)	+54C (+130F)

Recommended cleanliness levels using petroleum oil under common conditions is based on the highest fluid pressure levels in the system. In referencing the table below, the bolded numbers highlight the recommended cleanliness level for Valvistor proportional throttles.

Fluids other than petroleum, severe service cycles or temperature extremes are cause for adjustment of these cleanliness codes. See Eaton's Vickers publication 561 for exact details.

Recommended Fluid Cleanliness Level (ISO Code)

Product	System Pressure Level 69 bar (1000 psi)	System Pressure Level 138 bar (2000 psi)	System Pressure Level 210+ bar (3000 psi)
Vane Pumps – Fixed	20/18/15	19/17/14	18/16/13
Vane Pumps – Variable	18/16/14	17/15/13	
Piston Pumps – Fixed	19/17/15	18/16/14	17/15/13
Piston Pumps – Variable	18/16/14	17/15/13	16/14/12
Directional Valves	20/18/15	20/18/15	19/17/14
Pressure/Flow Control Valves	19/17/14	19/17/14	19/17/14
Servo Valves	16/14/11	16/14/11	16/13/10
Proportional Valves	**17/15/12**	**17/15/12**	**15/13/11**
Cylinders	20/18/15	20/18/15	20/18/15
Vane Motors	20/18/15	19/17/14	18/16/13
Axial Piston Pumps	19/17/14	18/16/13	17/15/12
Radial Piston Pumps	20/18/14	19/17/13	18/16/13

Mounting Bolts and Assembly Torques

As noted in CVCS model code position , cover types CVCS-**-HFV1-(W)-B29-1*, sizes 16 to 40 inclusive, are supplied complete with metric mounting bolts. For correct installation of all other CVCS-**-HFV* cover types, the following Eaton bolt kits are recommended.

Inch threads

Nominal Size	Bolt Size	Bolt Kit Model Code	Recommended Assembly Torque, lbf ft■
16	5/16"-18 x 1.50	BKDNG16-700	26
25	1/2"-13 x 1.50	BKDPNG25-704	81
32	5/8"-11 x 2.00	BKDNG32-713	210
40	3/4"-10 x 2.25	BKDPNG40-706	370
50	3/4"-10 x 3.00	BKDNG50-708	429
63	1 1/4"-7 x 3.50	BKDNG63-710	888

Metric threads

Nominal Size	Bolt Size	Bolt Kit Model Code	Recommended Assembly Torque, Nms
16	♦	–	35
25	♦	–	110
32	♦	–	285
40	♦	–	500
50	M20 x 80	BKDNG50-709M	580
63	M30 x 90	BKDNG63-711M	1200

■ *With threads lubricated.* ♦ *See installation drawing, next page.*

For Pilot Valve
See Slip-in Cartridge Valve Catalog.

Seal Kits

For CVI--HFV inserts**

Nominal Size	Seal Kit Type, See Model Code Standard	F3-
16	456173	02-157617
25	456926	02-157618
32	479449	02-157619
40	478732	514808
50	478733	02-157620
63	456798	02-157621

For CVCS--HFV covers**

Nominal Size	Seal Kit Type, See Model Code Standard	F3-
16	02-157672	02-157671
25	02-157674	02-157673
32	02-157905	02-157906
40	02-157712	02-157713
50	02-310971	02-310973
63	02-310975	02-310976

Weights

Nominal Size	CVI-**-HFV Insert	CVCS-**-HFV Cover
16	0,13 kg (0.29lb) 1,2 kg (2.6 lb)	1,2 (2.6)
25	0,33 (0.73)	1,9 (4.2)
32	0,9 (1.98)	3,3 (7.3)
40	1,35 (3.0)	6,3 (13.9)
50	2,2 (4.8)	9,6 (21.0)
63	5,4 (11.9)	19,4 (42.7)

Ordering Procedure

The component parts of the Valvistor proportional throttle assembly, including the pilot control valve, must be ordered individually. In addition there is a choice of electronics: typically a Vickers Eurocard drive amplifier, alternatively a Vickers 12V DC or 24V DC proportional power plug. The full model code must be specified in all cases.

Typical Valvistor Component Selection
1 x CVI-**-HFV-20-*-**-10 insert, see this catalog
1 x CVCS-**-HFV**-*2*-10 cover, see this catalog
1 x cover mounting bolt kit u, see this catalog
1 x KTG4V-3S- - - 60-EN427, see product catalog Slip-in Cartridge.
1 x pilot valve mounting bolt kit, product catalog Valve Catalog.

Plus:

Drive Electronics for 24V DC System
1 x EEA-PAM-523-A-32 Eurocard amplifier, see catalog 2464

or

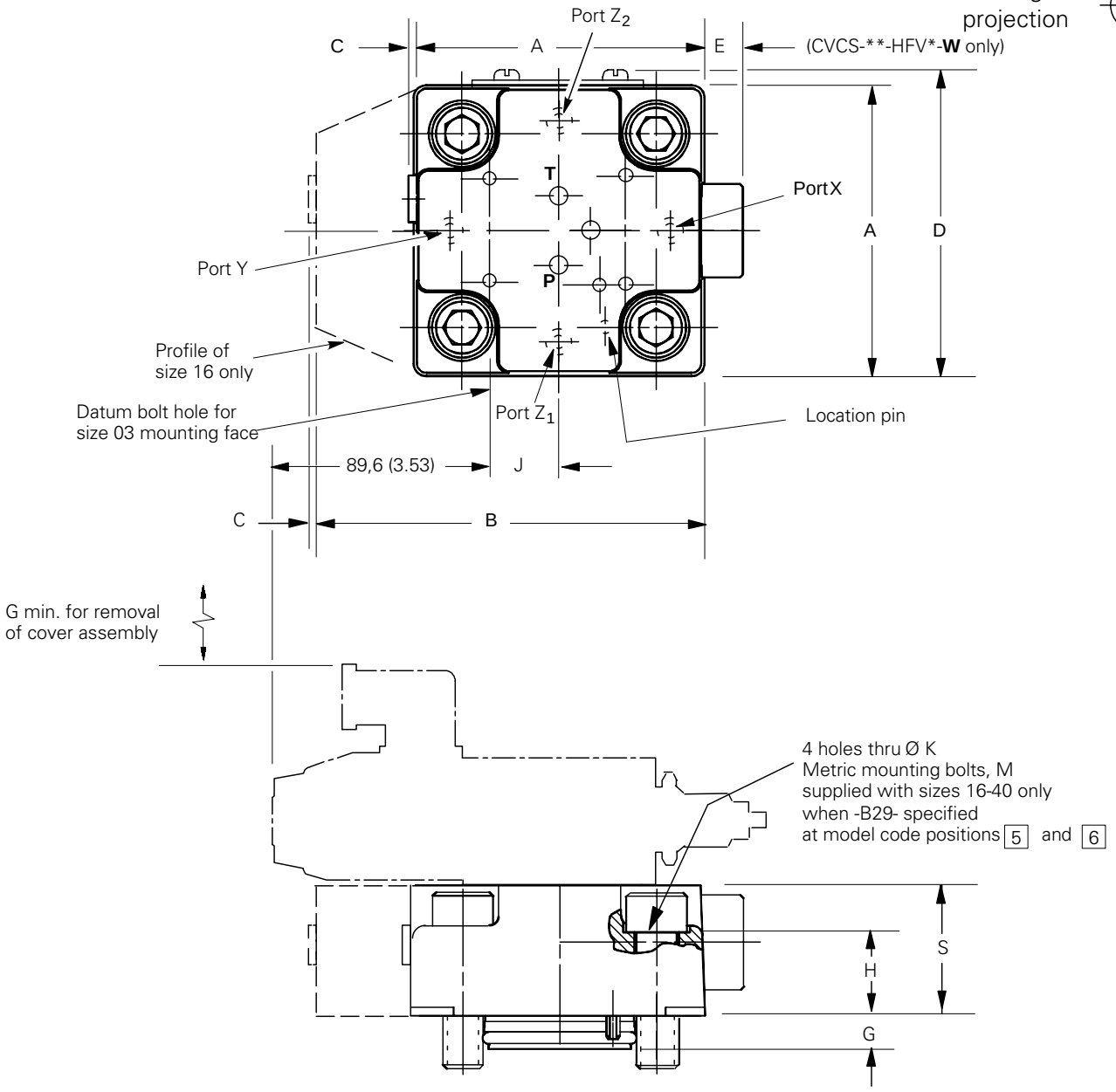
1 x EHH-AMP-702-*-10 proportional power plug, see catalog 2115

Drive Electronics for 12V DC System
1 x EHH-AMP-712-*-10 proportional power plug, catalog 2282

Installation Dimensions in mm (inches)

CVCS--HFV***

3rd angle projection



Valve Size	A sq.	B	C max.	D	E max.	G	H	J	Ø K (K dia.)	M Mounting Bolts (supplied)	S
16	66,0 (2.6)	85,5 (3.36)	4,5 (0.18)	68,5 (2.7)	14,5 (0.57)	8,0 (0.32)	36,0 (1.42)	32,50 (1.28)	8,75/9,25 (0.344/0.364)	M8 x 50 cap hd. screw	48,0 (1.89)
25	86,0 (3.38)	– (0.14)	3,5 (3.5)	88,5 (0.53)	13,5 (0.42)	10,5 (0.98)	25,0 (0.82)	20,75	13,75/14,25 (0.541/0.561)	M12 x 40 cap hd. screw	39,0 (1.54)
32	102,5 (4.0)	–	3,5 (0.14)	104,5 (4.2)	13,5 (0.53)	13,0 (0.52)	30,0 (1.18)	21,50 (0.85)	17,75/18,25 (0.699/0.718)	M16 x 55 cap hd. screw	48,0 (1.89)
40	126,0 (5.0)	–	2,0 (0.08)	128,5 (5.1)	11,0 (0.43)	15,0 (0.59)	35,0 (1.38)	21,50 (0.85)	21,75/22,25 (0.856/0.875)	M20 x 60 cap hd. screw	58,0 (2.28)
50	142,5 (5.6)	–	4,5 (0.18)	145,0 (5.7)	0 (0)	18,0 (0.71)	42,0 (1.66)	21,50 (0.85)	21,75/22,25 (0.856/0.875)	–	68,0 (2.68)
63	183,0 (7.2)	–	4,5 (0.18)	185,5 (7.3)	0 (0)	20,0 (0.79)	48,0 (1.89)	21,50 (0.85)	32,75/33,25 (1.289/1.309)	–	83,0 (3.27)

Valvistor® Line Extension

Proportional Slip-in Cartridge Valve, Flow Control

K(B)TG4V-3 Pilot Stage K(B)FTG4V-3 Pilot Stage

Eaton's Vickers® line is now extended with the addition of K(B) TG4V-3 and K(B)FTG4V-3 pilot stage proportional valves. The new features and benefits of the higher performance and on-board electronics (OBE) open up new applications and markets. The valves piloted with K(B)FTG4V-3 offer performance that is close to conventional feedback valves. As its name implies, the Valvistor design has a main poppet valve that amplifies a low flow rate through the pilot circuit, similar to a transistor. This innovative design achieves servo-type control of the main poppet, without using an electrical main poppet position feedback transducer on the Slip-in cartridge valve.

Features and benefits of the new valves include:

- Integral hydraulic feedback on main stage — Closed loop, main-stage performance is achieved without using a main-stage LVDT.
- Pilot stage selected to meet specific requirements — Cost-effective design results in design flexibility.
- Pilot flow is directed to the load — Higher flow efficiency is achieved since the flow is not wasted to the tank.
- IP65 and IP67 environmental protection rated best in class — More reliable performance in harsh environments.
- On board ramp adjustment on KBTG pilot.

Applications include injection and blow molding, rubber molding, press, die-casting, offshore, civil engineering, marine, primary metal, and mobile applications. The tables below show existing Valvistor configurations and the new extended configurations with K(B) TG4V-3 and K(B)FTG4V-3 as pilot valves.

High Performance

	Extended Configuration		Extended Configurations	
Pilot Valve Model Code & Part Number	**Non-OBE Valve KFTG4V-3-2B13N-Z-M-U-H7-10, 506834**		**OBE Valve KBFTG4V-3-2B13N-Z-M1-PE7-H7-11, 5996165-001 KBFTG4V-3-2B13N-Z-M2-PE7-H7-11, 5996350-001**	
Step Response (ms)	**Open**	**Close**	**Open**	**Close**
Delta P Tested	**10 bar**	**10bar**	**10bar**	**10bar**
NG16	51	33	35	25
NG25	88	50	50	30
NG32	135	71	70	45
NG40	249	108	130	65
NG50	290	167	170	100
NG63	352	250	200	150
Hysteresis	1%	1%	1%	1%

Notes Valvistor full flow reached at around 70% command input of K(B)F with 13N spool. For M2 version, the command input range is 4-12ma, valve is fully open at 4ma, and fully closed at 12ma.

Standard Performance

	Extended Configuration		Extended Configurations	
Pilot Valve	**Non-OBE Valve**		**OBE Valve**	
Model Code & Part Number	**KTG4V-3-2B08N-M-U-H7-60-EN427, 02-398752** **Other configurations available.** **Contact Eaton**		**KBTG4V-3-2B08N-M1-PE7-H7-10-EN427, 02-398750** **KBTG4V-3-2B08N-M2-PE7-H7-10-EN427, 02-398751**	
Step Response (ms)	**Open**	**Close**	**Open**	**Close**
Delta P Tested	**10 bar**	**10 bar**	**10 bar**	**10 bar**
NG16	50	40	38	24
NG25	85	60	66	36
NG32	130	85	101	51
NG40	240	130	186	78
NG50	280	200	217	120
NG63	340	300	264	180
Hysteresis	<5	<5	<5	<5

Notes: For M2 version, the command input range is 4-12ma, valve is fully open at 4ma, and fully closed at 12ma.

Economical Solution

	Extended Configuration		Extended Configurations	
Pilot Valve	**Non-OBE Valve**		**OBE Valve**	
Model Code & Part Number	**KTG4V-3S-2B08N-M-U-H5-60-EN427, 02-154581** **Other configurations available.** **Contact Eaton**		**KBTG4V-3S-2B08N-M1-PE7-H5-10-EN427, 02-397168** **KBTG4V-3S-2B08N-M2-PE7-H5-10-EN427, 02-398753**	
Step Response (ms)	**Open**	**Close**	**Open**	**Close**
Delta P Tested	**10 bar**	**10 bar**	**10 bar**	**10 bar**
NG16	50	40	38	24
NG25	85	60	66	36
NG32	130	85	101	51
NG40	240	130	186	78
NG50	280	200	217	120
NG63	340	300	264	180
Hysteresis	<8%	<8%	<8%	<8%

Notes: For M2 version, the command input range is 4-12ma, valve is fully open at 4ma, and fully closed at 12ma.

Released Part Numbers

Model Code	Assembly Number
CVCS-16-HFV1-S2-10	02-311552
CVCS-16-HFV1-W-S2-10	02-312313
CVCS-16-HFV3-B29-10	02-310565
CVCS-16-HFV3-W-B29-10	02-312336
CVCS-25-HFV1-S2-10	02-311553
CVCS-25-HFV1-W-S2-10	02-312312
CVCS-25-HFV3-B29-10	02-157809
CVCS-25-HFV3-W-B29-10	02-157811
CVCS-32-HFV1-S2-10	02-311554
CVCS-32-HFV1-W-S2-10	02-312310
CVCS-32-HFV3-B29-10	02-310641
CVCS-32-HFV3-W-B29-10	02-312335
CVCS-40-HFV1-S2-10	02-312311
CVCS-40-HFV1-W-S2-10	02-312314
CVCS-40-HFV3-B29-10	02-157212
CVCS-40-HFV3-W-B29-10	02-312121
CVCS-50-HFV1-S2-10	02-312103
CVCS-50-HFV1-W-S2-10	02-312104
CVCS-50-HFV3-B2-10	02-311957
CVCS-50-HFV3-W-B2-10	02-311959
CVCS-63-HFV1-S2-10	02-312106
CVCS-63-HFV1-W-S2-10	02-312107
CVCS-63-HFV3-B2-10	02-311958
CVCS-63-HFV3-W-B2-10	02-311960

Model Code	Assembly Number
F3-CVCS-16-HFV3-W-B29-10	02-358045
F3-CVCS-25-HFV1-W-S2-10	02-333781
F3-CVCS-25-HFV3-W-B29-10	02-319363
F3-CVCS-32-HFV1-W-S2-10	02-312315
F3-CVCS-40-HFV1-W-S2-10	02-353592
F3-CVCS-50-HFV1-S2-10	02-325658
F3-CVCS-50-HFV1-W-S2-10	02-395045
CVI-16-HFV-20-A-21-10	02-310564
CVI-16-HFV-20-B-21-10	02-310563
CVI-25-HFV-20-A-43-10	02-157670
CVI-25-HFV-20-B-32-10	02-157741
CVI-32-HFV-20-A-63-10	02-310643
CVI-32-HFV-20-B-63-10	02-310642
CVI-40-HFV-20-A-90-10	02-157234
CVI-40-HFV-20-B-81-10	02-157233
CVI-50-HFV-20-A-130-10	02-312101
CVI-50-HFV-20-B-130-10	02-312102
CVI-63-HFV-20-A-216-10	02-311063
CVI-63-HFV-20-B-216-10	02-311062

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Powering Business Worldwide

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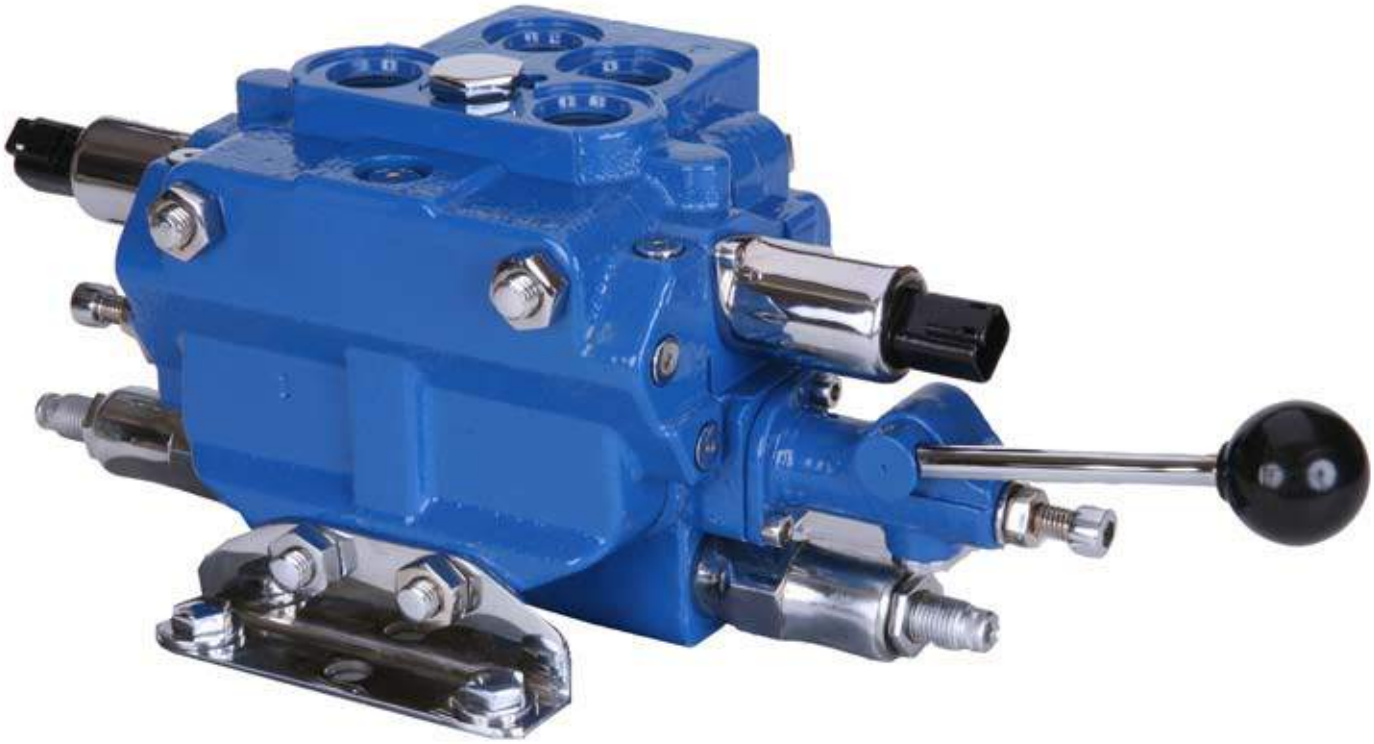
Mobile Valves
Proportional - Load Sensing

Model CML60

325 bar
60 L/min

Up to 8 sections
Eaton F(x)® Compliant



Powering Business Worldwide

Table of Contents

General Information 3
Model Code
- Valve Section 4
- Valve Assembly 5

Specifications and Performance 6
Standard Section Electrohydraulic Schematics 7
Standard Section Hydraulic Schematics 8
Performance Data 9
Inlet and End Cover Schematics 10
Valve Bank Installation Dimensions 11
Valve Bank Schematic Examples 12
Section Installation 13-14

General Information

Product Overview

The Eaton CML60 mobile valve is a load sensing, sectional proportional valve with a highly versatile design that offers extensive relief options through the use of standard C-10-2 relief cavities. The CML60 valve can be utilized across the breadth of pump types ranging from fixed displacement pumps to pressure compensated, load sensing variable displacement pumps.

Increased productivity is the key user benefit of the CML60 load sensing proportional valve. This operator efficiency is achieved because each valve function is proportional to the spool position under all load conditions and independent of the number of valve functions in operation providing the total demand flow is less than pump flow. Additional benefits of the CML60 load sensing proportional valve include energy savings due to less fuel consumption and heat dissipotion.

Rated Flow:

Inlet: to 100 l/min (26.3 USgpm)
Section: to 60 l/min (15.8 USgpm)

Rated Fatigue Pressure per NFPA T2.6.1:

280 bar (4050 psi) Inlet
- Qualified at 1 million cycles at 325 bar [4700 psi] test pressure 300 bar (4350 psi)

Work Ports
- Qualified for 1 million cycles at 350 bar [5075 psi] test pressure

Standard Circuit Design

Parallel circuit, closed center load sensing, inlet pressure compensated

Actuation Options

- Hydraulic
- Electrohydraulic Proportional

Features and Benefits

Precise Control

- EH proportional
  - With or without manual handle back-up
  - Can be used on/off
- Hydraulic pilot

Energy Efficiency

- Load sensing circuit design

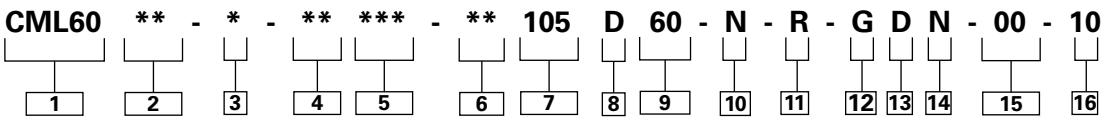
Versatile Design

- Sectional design
  - 1-8 sections
  - Spool type, flow and actuation options
- Work ports accept Eaton's Vickers® SiCV cartridges
  - C-10-2 cavities
  - Section pressure limitation available
- Inlet Options
  - Unload/relief for fixed displacement pump systems
  - Load sensing for variable-displacement flow compensated pumps
- Integral pressure reducing valve for EH pilot supply

Eaton F(x)® Compliant

- Control F(x)™ Software
- EFX, and SFX Controllers

Model Code –
Valve Section



1 Load Sensing Proportional Valve CML60 –

2 Actuation

E0 – Electrohydraulic
H0 – Hydraulic
EM – Electrohydraulic w/ manual override
HM – Hydraulic w/ manual override

3 Ports

B – 1/2 BSP
D – Direct port STC, -8
M – ISO 6149 metric, M18
S – SAE, -8
T – SAE, -10

4 Port A Relief Valve

00 – No cavities
P1 – Plugged
C1 – Check Valve

L1 – LS Relief Valve (opposite port coding must be the same)

F1 – Relief Valve, Direct Acting, Poppet Type, Fixed Relief (RV1-10-F-0-30/*-00) (standard for 3000 psi and below)

S1 – Relief Valve, Direct Acting, Poppet Type, Screw Adjust Relief (RV1-10-S-0-30/*-00)

A1 – Relief Valve, Direct Acting, Poppet Type, Fixed Relief (RV1-10-F-0-30 Internal Adjust Relief (RV1-10-I-0-30/*-00)

F2 – Relief Valve, Pilot Operated, Fixed Relief (RV5-10-F-0 -50/*-00) (standard for 3000-4000 psi)

S2 – Relief Valve, Pilot Operated, Screw Adjust Relief (RV5-10-S-0-50/*-00)

A2 – Relief Valve, Pilot Operated, Internal Adjust Relief (RV5-10-I-0-50/*-00)

5 Pressure setting for Port A

Check valve crack pressure in psi (OR) relief valve nominal setting pressure in psi; available in 50 psi increments from 500 to 4350 psi depending on type.

Coded as in the following examples:

005 – 5 psi Anti-Cav Check

050 – Relief pressure, 500 psi (72.4 BAR) MIN etc. increments of 50 psi (3.45 BAR)

435 – Relief pressure, 4350 psi (300 BAR) MAX

6 Port B Relief Valve

00 – No cavities
P1 – Plugged
C1 – Check Valve

L1 – LS Relief Valve (opposite port coding must be the same)

F1 – Relief Valve, Direct Acting, Poppet Type, Fixed Relief (RV1-10-F-0-30/*-00) (standard for 3000 psi and below)

S1 – Relief Valve, Direct Acting, Poppet Type, Screw Adjust Relief (RV1-10-S-0-30/*-00)

A1 – Relief Valve, Direct Acting, Poppet Type, Internal Adjust Relief (RV1-10-I-0-30/*-00)

F2 – Relief Valve, Pilot Operated, Fixed Relief (RV5-10-F-0 -50/*-00) (standard for 3000-4000 psi)

S2 – Relief Valve, Pilot Operated, Screw Adjust Relief (RV5-10-S-0-50/*-00)

A2 – Relief Valve, Pilot Operated, Internal Adjust Relief (RV5-10-I-0-50/*-00)

7 Port B Pressure Setting

Check valve crack pressure in psi (OR) relief valve nominal setting pressure in psi; available in 50 psi increments from 500 to 4350 psi depending on type.

Coded as in the following examples:

005 – 5 psi Anti-Cav Check

050 – Relief pressure, 500 psi (72.4 BAR)

435 – Relief pressure, 4350 psi (300 BAR)

8 Spool Type

D – 4 way cylinder
H – 4 way motor

9 Spool Flow Rating

05 – 5 lpm
10 – 10 lpm
15 – 15 lpm
30 – 30 lpm
45 – 45 lpm
60 – 60 lpm

10 Compensator

N – Noncompensated

C – Inlet pressure compensated

11 Build Type (Determined by viewing the valve stack from the end cover)

R – RH Build. Port A is on the right. Manual override handle, if present, is on the right.

L – LH Build (non-standard). Port A is on the left. Manual override handle, if present, is on the left.

12 Coil Voltage

G – 12 Vdc
H – 24 Vdc
0 – No Coil

13 Coil Connector

D – Deutsch
Y – Amp Jr
L – Lead Wires
0 – No Coil

14 Wire Lead Length

0 – No Lead Wire

N - Integrated Connector (Deutsch and Amp Jr.

B - Wire Lead length 24 inch (Standard)

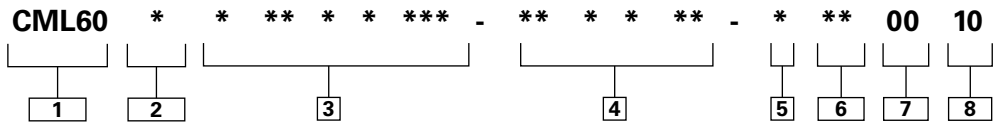
15 Special Features

00 – None

16 Design Level

10 – Design Level

Model Code –
Valve Assembly



1 CML60 Assembly

2 Number of Sections

1 – 1 Section
2 – 2 Sections
3 – 3 Sections
4 – 4 Sections
5 – 5 Sections
6 – 6 Sections
7 – 7 Sections
8 – 8 Sections

3 Inlet Module Options

Port Location

C – Open Center Unload Top Ported
S – Load Sensing Side Ported
T – Load Sensing Top Ported
R – Load Sensing Top Ports w/ Relief

Port Options

S1 – P port SAE-8, T port SAE-10 (with OC or LS top and side ported)
S2 – P port SAE-10, T port SAE-12 (LS side ported or LS top ported with full system relief)
M1 – P port M18, T port M22
B1 – P Port 1/2 BSP, T port 3/4 BSP
B2 – P port 3/4 BSP, T port 3/4 BSP
D1 – P port STC-8, T port STC-10

Relief Type

0 – No relief
L – Load sense relief
S – System direct acting relief, screw adjustable, (RV8-10 -S) (standard)
A – System direct acting relief, internal adjustable (RV8-10-I)
F – System direct acting relief, fixed (RV8-10-F)

Pressure Setting Range

0 – No relief
L – Pressure range 17-175 bar (250-2500 psi)
H – Pressure range 38-350 bar (550-5000 psi)

Relief Pressure Setting
Nominal relief valve setting, available in increments of 50 psi (3,5 bar) and coded as in the following examples:

000 – no relief setting
100 – Relief pressure, 1000 psi (68.9 BAR)
405 – Relief pressure, 4050 psi (280 BAR)

4 Valve Sections Abbreviated Code

Section 1
(First and Second Digit)

E0 – Electrohydraulic
H0 – Hydraulic
EM – Electrohydraulic w/ manual override
HM – Hydraulic w/ manual override

Port Type (Third Digit)

B – 1/2 BSP
D – Direct port STC, -8
M – ISO 6149 metric, M18
S – SAE, -8
T – SAE, -10

Spool Type (Fourth Digit)

D – 4 way, Cylinder spool
H – 4 way, Motor spool

Spool Flow
(Fifth and Sixth Digit)

05 – 5 lpm
10 – 10 lpm
15 – 15 lpm
30 – 30 lpm
45 – 45 lpm
60 – 60 lpm

Repeat for Section 2, 3, etc. as applicable. Section 1 is nearest the inlet.

5 End Cover

E – Electrohydraulic
H – Hydraulic
P – Electrohydraulic, external pilot supply port

6 Paint/Coating

00 – no paint
0A – Red oxide primer
CD – Eaton blue
AU – Std. flat black
0K – Green
BN – Tan
CC – Yellow

Other colors available upon request

7 Special Features

00 – None

8 Design Level

10 – Design Level

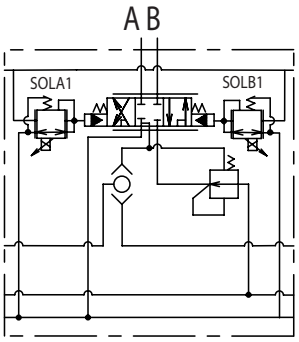
Specifications and Performance

CML60 Proportional Load Sensing Valve		
Rated Fatigue Pressure	**Inlet** **Work Ports**	280 bar [4050 psi] 300 bar [4350 psi]
Maximum Pressure	**Inlet** **Work Ports**	325 bar [4700 psi] 350 bar [5075 psi]
Rated Inlet Flow		100 lpm [26.3 gpm]
Fluid Cleanliness and Viscosity		See Hydraulic Fluid Recommendations bulletin 03-401
Maximum Fluid Temperature		107°C (225°F)
Construction		Sectional
Work Sections		1-8
Maximum Leakage, Cylinder Workport to Tank		20 cc/min @ 69 bar [1000 psi]
Port Types		SAE o-ring ISO 6149 Metric BSP Direct port STC
Inlet Section Options		Unload/relief for fixed displacement pump systems Load sensing inlet
Work Section Options	**General**	Accept Eaton SiCV cartridges C-10-2 cavities - work port on port 1, tank on port 2
	Spools	4 way cylinder (work ports closed in neutral) 4 way motor (work ports closed in neutral) Maximum flows, 5 to 60 lpm Adjustable Travel Stops
	Actuation	Electrohydraulic Hydraulic Electrohydraulic w/ manual override Hydraulic w/ manual override
Outlet Section Options		EH with external pilot supply port and integral pressure reducing valve Plain (for hydraulic pilot) Integral pressure reducing valve for EH pilot supply
EH Pilot Coil Voltages		12 Volt DC, 1500 mA current max 24 Volt DC, 750 mA current max
EH Pilot Coil Terminations		Integral Deutsch DT04-2P Integral Amp Jr. Dual Leadwires
Mounting Options		Stamped mounting plate Mounting attitude unrestricted
Electrohydraulic interface		Eaton F(x) compliant, EFX, and SFX Controllers

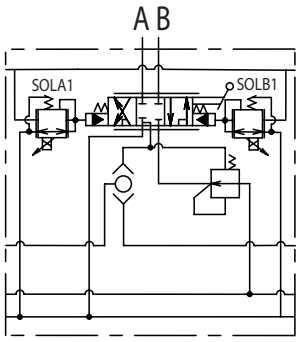
Standard Section Electrohydraulic Schematics

Cylinder Spools

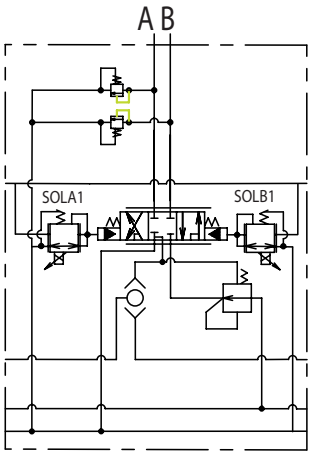
The same configurations are also available with motor spools (work ports open to tank in neutral).



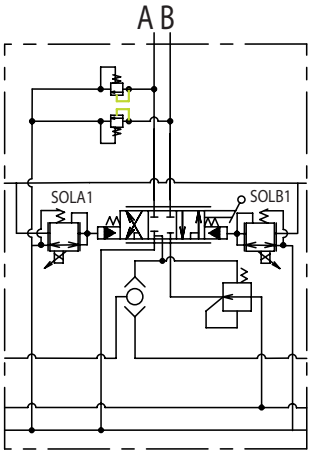
w/o reliefs



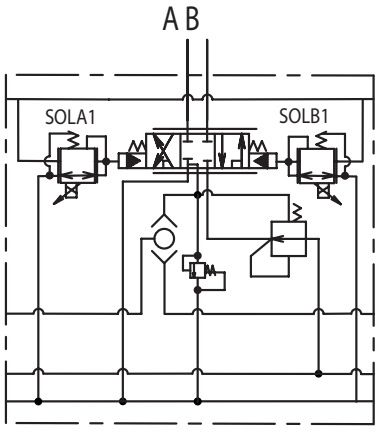
w/o reliefs
w/ manual override



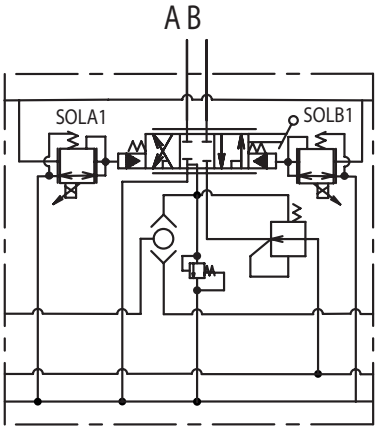
w/ work port reliefs



w/ work port reliefs
w/ manual override



w/ load sense relief

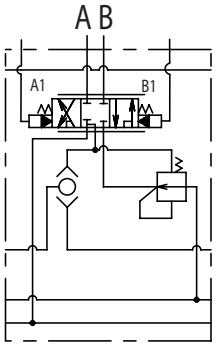


w/ load sense relief
w/ manual override

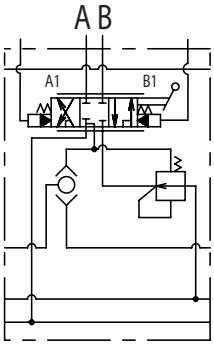
Standard Section Hydraulic Schematics

Cylinder Spools

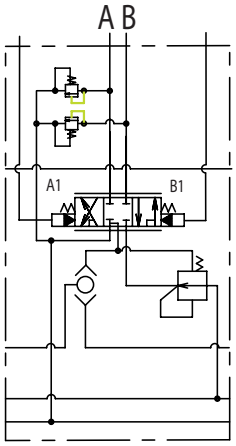
The same configurations are also available with motor spools (work ports open to tank in neutral).



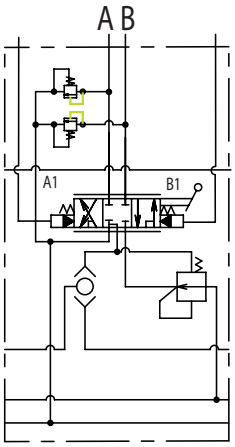
w/o reliefs



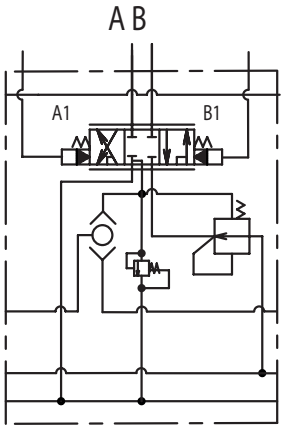
w/o reliefs
w/ manual override



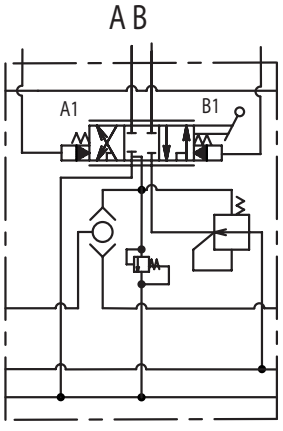
w/ work port reliefs



w/ work port reliefs
w/ manual override



w/ load sense relief

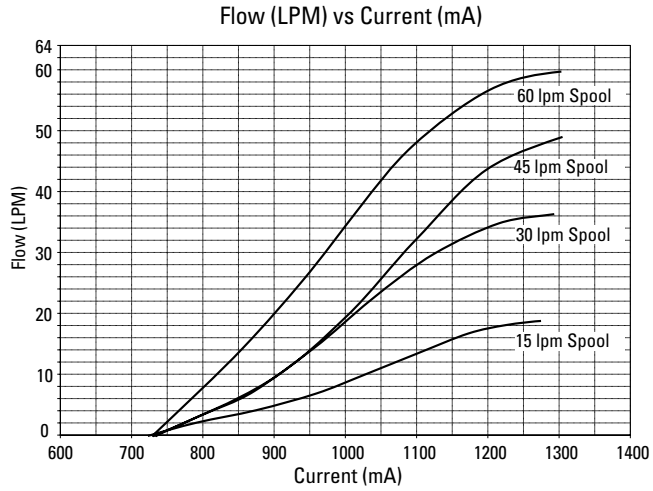


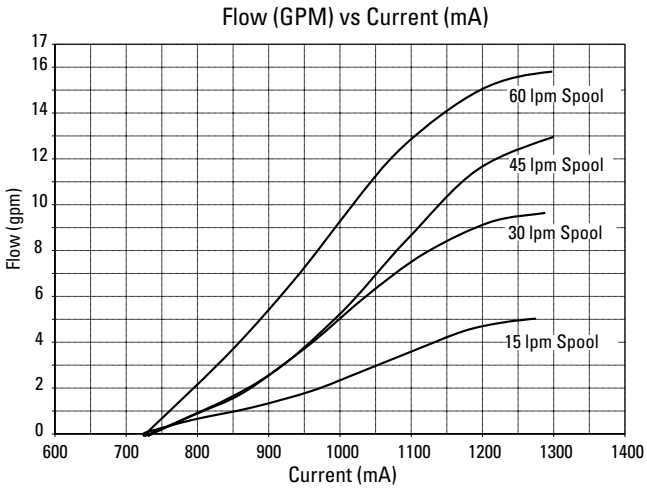
w/ load sense relief
w/ manual override

Performance Data

CML60 Flow vs Current

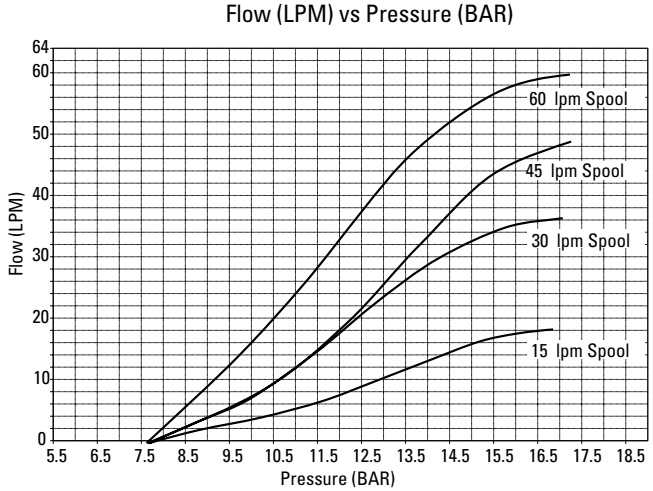
Maximum flow ± 5% of rated flow.
Cracking current ± 0.25 mA.
Hysteresis <20%

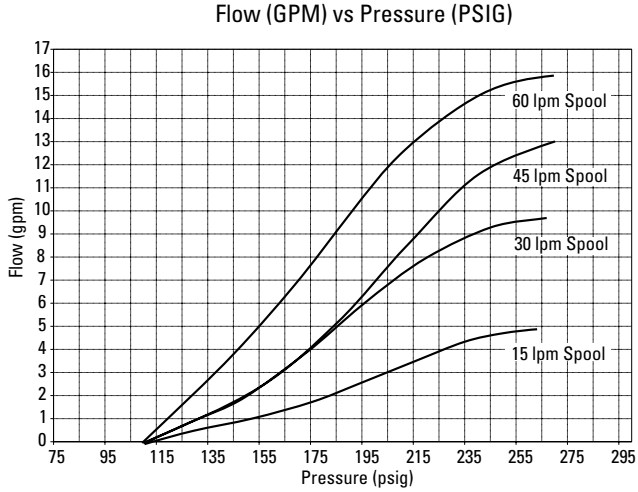




CML60 Flow vs Pressure

Maximum flow ±5% of rated flow.
Cracking pressure ±0.5 bar (±7 psig)
Hysteresis <20%

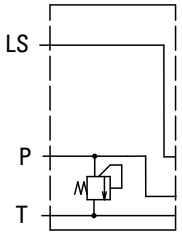




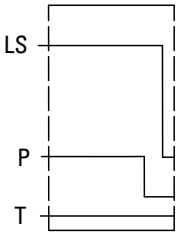
Inlet and End Cover Schematics

Hydraulic and Electrohydraulic

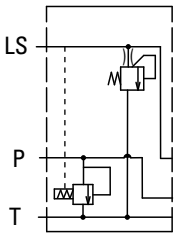
Load Sensing Inlet w/ Full Relief



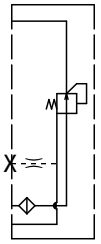
Load Sensing Inlet



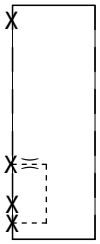
Open Center Inlet w/ LS Relief

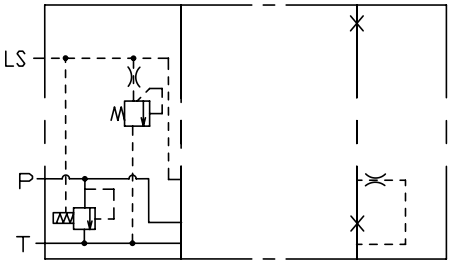


Electrohydraulic Endcover

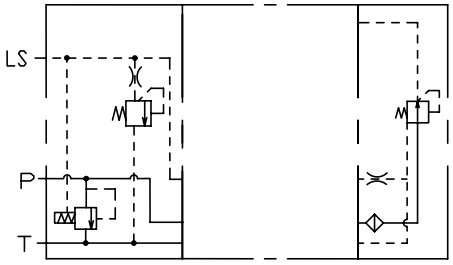


Hydraulic Endcover

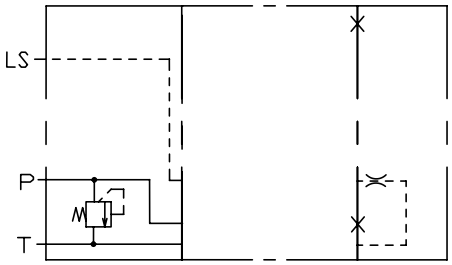




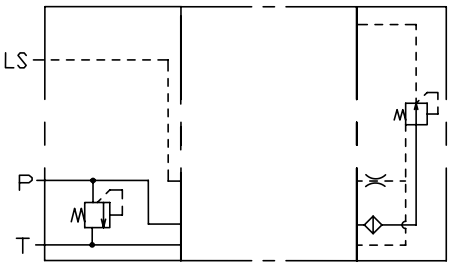
Open Center Inlet & Hydraulic Endcover



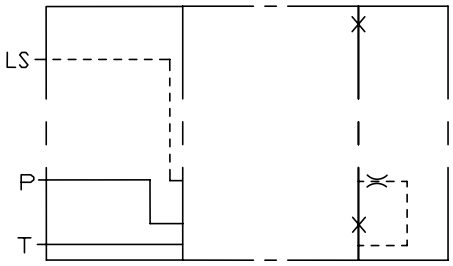
Open Center Inlet & Eltrohydraulic Endcover



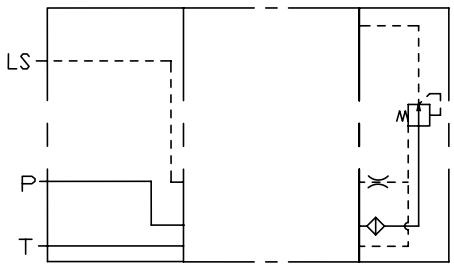
Load Sense Inlet w/Full Relief & Hydraulic Endcover



Load Sense Inlet w/Full Relief & Eletrohydraulic Endcover



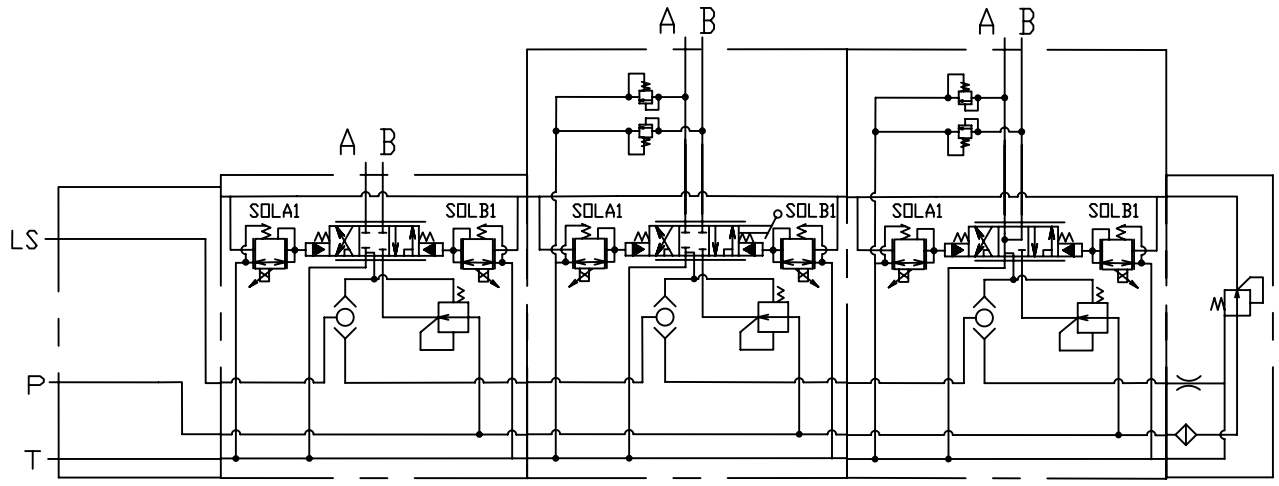
Load Sense Inlet & Hydraulic Endcover



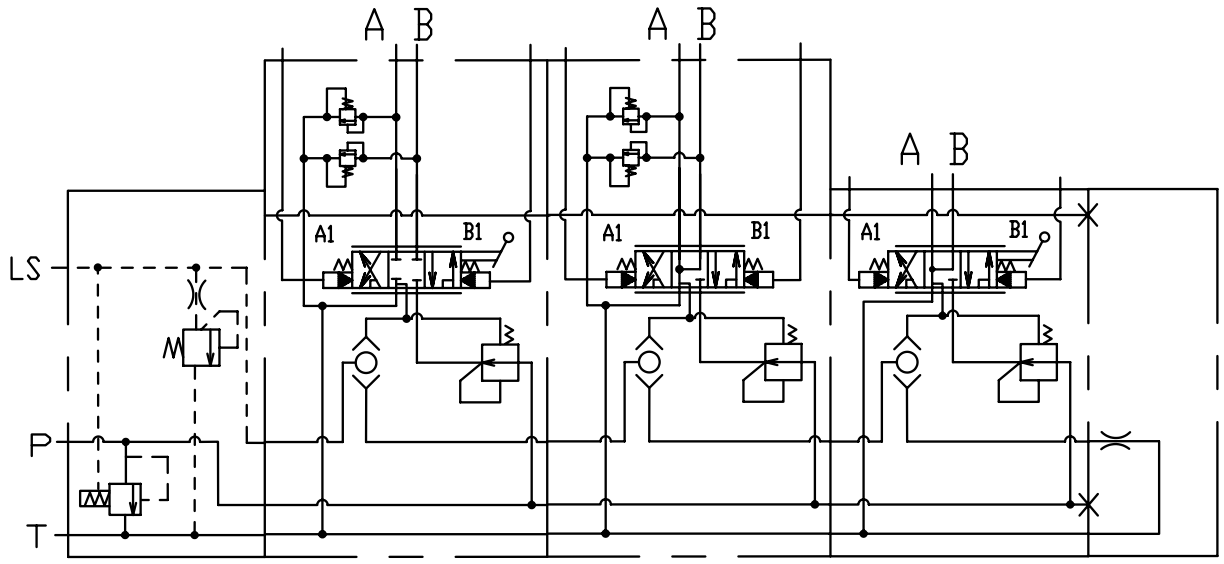
Load Sense Inlet & Eletrohydraulic Endcover

Valve Bank
Schematic Examples

Electrohydraulic Load Sense Valve Bank Example



Hydraulic Open Center Valve Bank Example

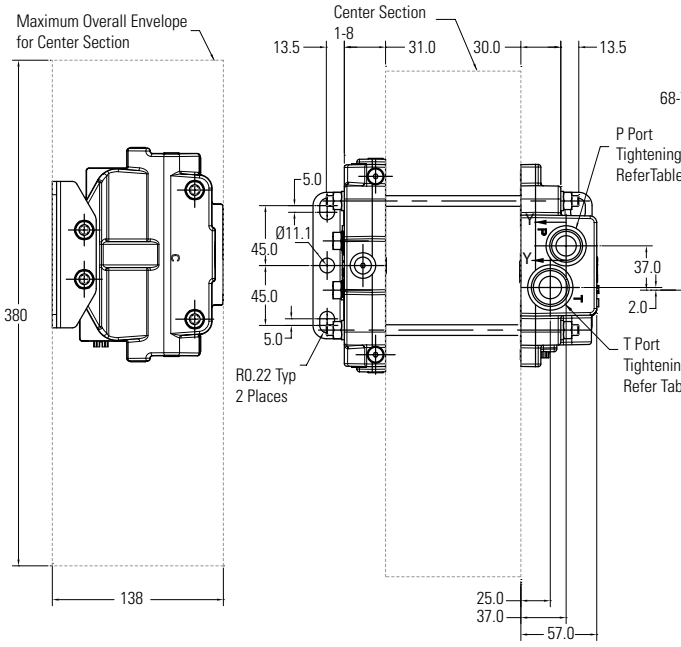


Valve Bank
Installation Dimensions

Load Sensing with Full System Relief and Open Center Inlet Port Configuration

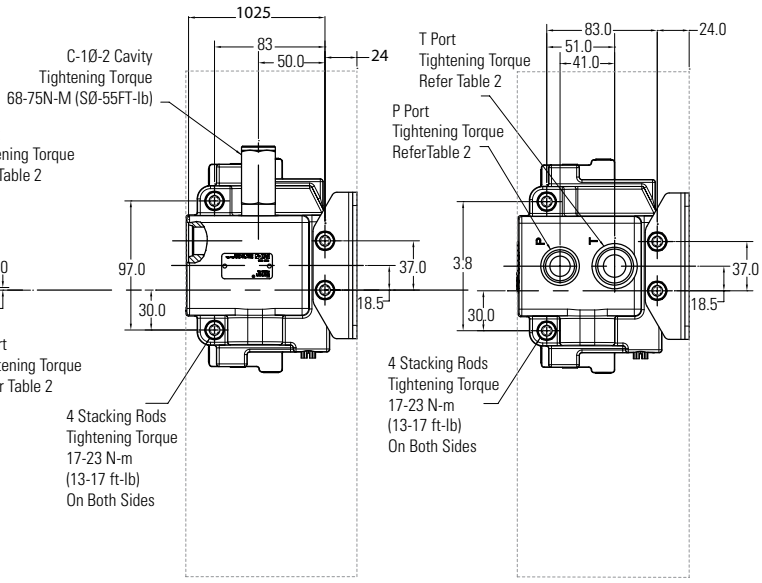
Note: Dimensions are in mm

Hydraulic and Electrohydraulic
Endcover Configuration



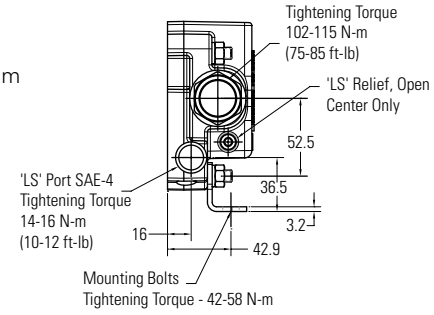
Load Sensing Inlet with Full System Relief Configuration

Note: Dimensions are in mm



Open Center Inlet Configuration

Note: Dimensions are in mm



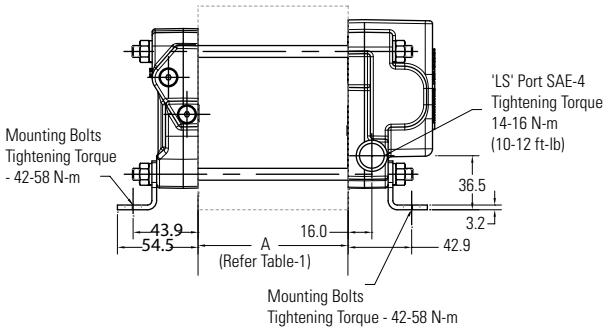


Table 1

No. of Center Sections	1	2	3	4	5	6	7	8
Dimension "A" (mm)	38	76	114	152	190	228	266	304
Dimension "A" (in)	1.5	3.0	4.5	6.0	7.5	9.0	10.5	12.0

Table 2

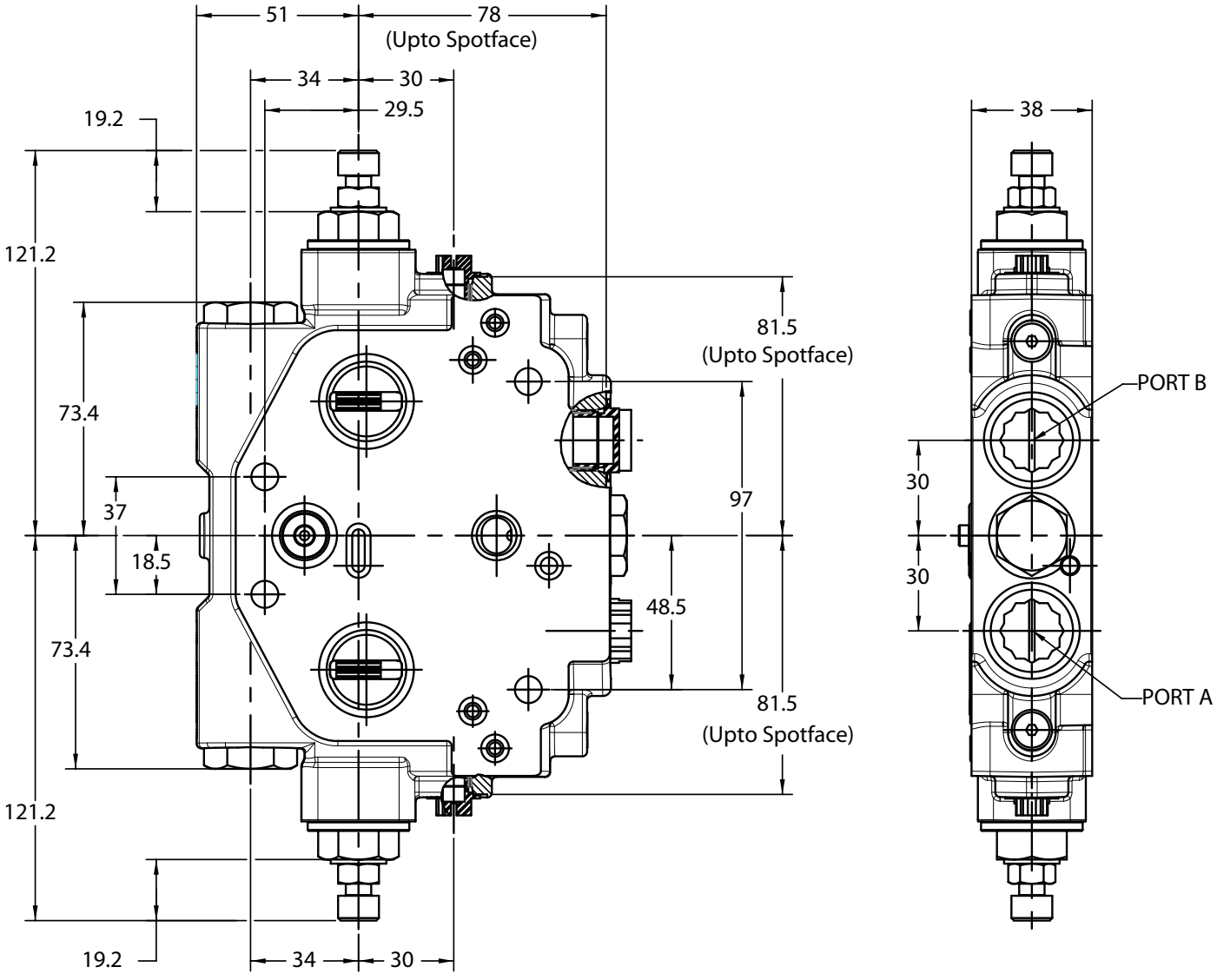
For Open Center Inlet Only

P-Port	Tightening Torque	T-Port	Tightening Torque
SAE-10	42-46 N-m (30-35 ft-lb)	SAE-12	88-100 N-m (65-75 ft-lb)
SAE-8	34-41 N-m (25-30 ft-lb)	SAE-10	68-75 N-m (50-55 ft-lb)
M18	42-46 N-m (30-35 ft-lb)	M22	68-75 N-m (50-55 ft-lb)

Section Installation Dimensions

Hydraulic Section Installation Dimensions Minimum Envelope

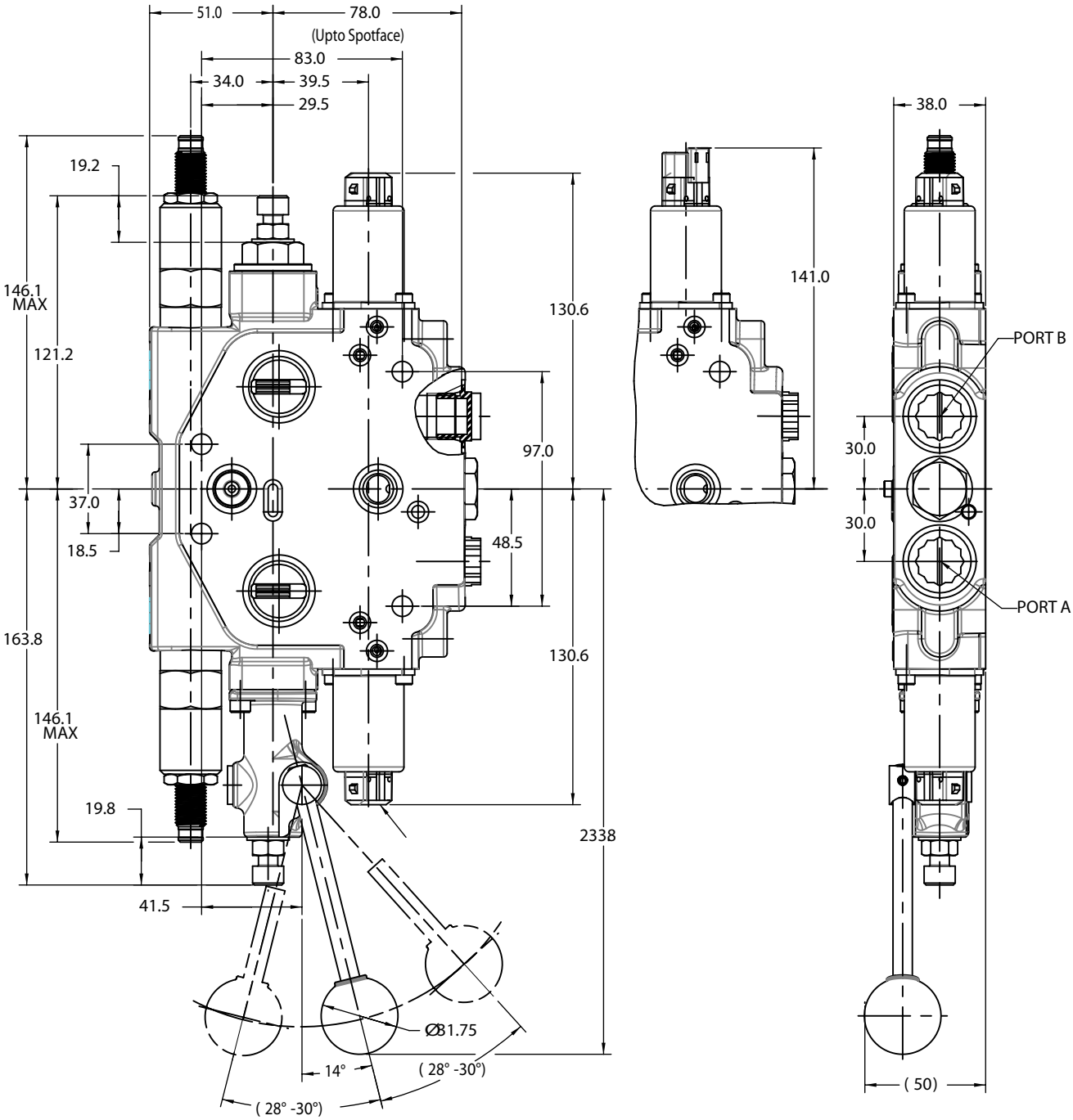
Note:
Dimensions are in mm



Section Installation Dimensions

Electrohydraulic Section Installation Dimensions Maximum Envelope

Note:
Dimensions are in mm



Application Notes

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Powering Business Worldwide

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July 2010

Flow Dividers

Priority, Proportional, Variable
Priority and Load Sensing
Priority Flow Dividers

Powering Business Worldwide

Flow Dividers

Priority, Proportional, Variable Priority, and Load Sensing Priority Flow Dividers

Eaton® Flow Dividers are available in priority, proportional, variable and load sensing versions with a wide range of standard flow ratings and relief settings. Many are also available in either adjustable or non-adjustable versions, thus providing multiple configurations allowing the use of these products in virtually any mobile application.

Eaton load sensing priority valves provide dependable flow on demand for load sensing steering, braking or other priority functions while allowing excess flow to be used for auxiliary functions. Used with fixed or variable displacement pumps, a dynamic signal system increases machine performance and stability. Static signal systems are also available. Applications include ag tractors, motor graders, lift trucks, and backhoe/loaders.

Model 32306 Priority Flow Divider 3

Model 32501 Proportional Flow Divider 4

Model 32700 Variable Priority Flow Control 5

Model VFA Priority Flow Dividers 6
– Non-adjustable Divider

Model VFA Priority Flow Dividers (continued) 7
– Screwdriver adjustable
– 350° Dial Adjustable

Model F1217 Priority Flow Dividers 8
90° Lever Adjustable

VL Load Sensing Priority Valves 9

Sample Circuits 10

Model VLC
– Load Sensing Priority Valve 11
– Model VLC Bolt-on Load Sensing Priority Valve

VLC Ordering Information/Order Numbers 12
Model VLC – Model Code

Model VLE Load Sensing Priority Valve 13

VLE Order Information/Order Numbers 14

Model VLE – Model Code 15

Model VLH Load Sensing Priority Valve 16

Model VLH – Order Information/ 16
Order Numbers

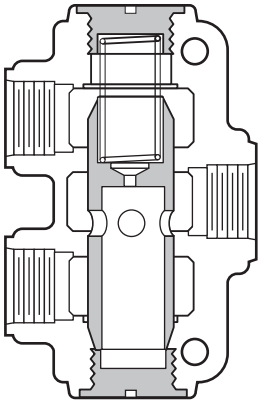
Model VLH – Model Code 17

Relief Valve Setting Code 17

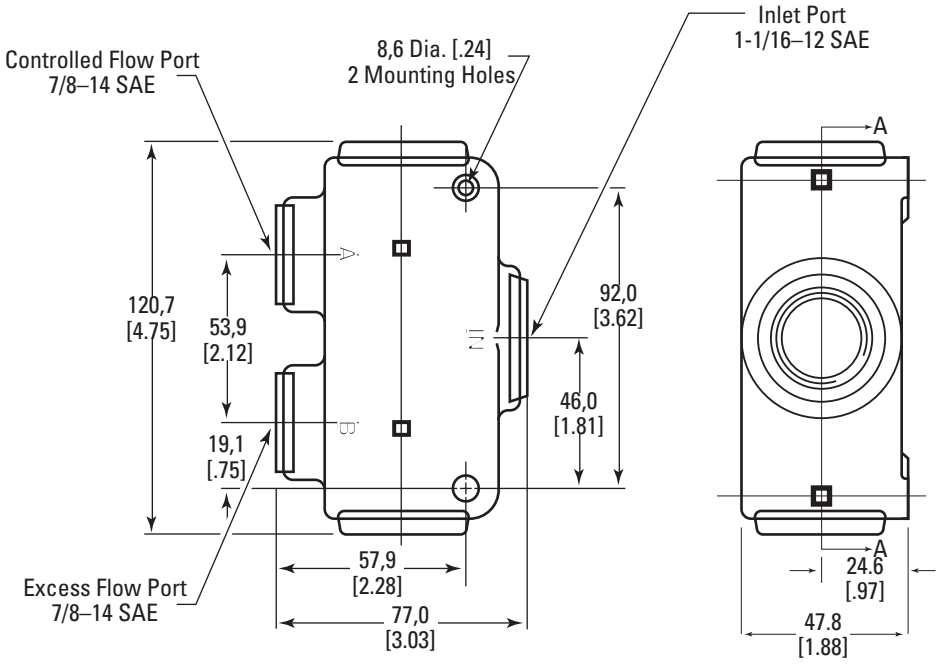
CF Relief Valve Pressure & CF Setting Code 18
for VFA and F1217 Flow Dividers

Model 32306
Priority Flow Divider

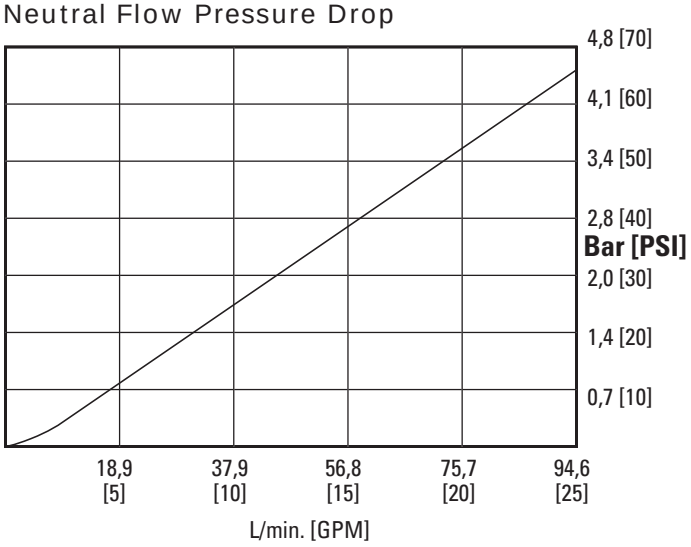
Dimensions



SECTION A-A

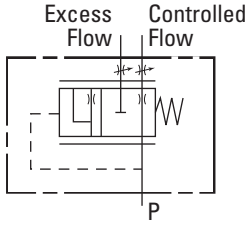


Neutral Flow Pressure Drop



Note: All tests performed with oil viscosity 150 SUS @ 37,7C [100F] with oil temp @ 54,4C [130F].

Schematic



SPECIFICATIONS

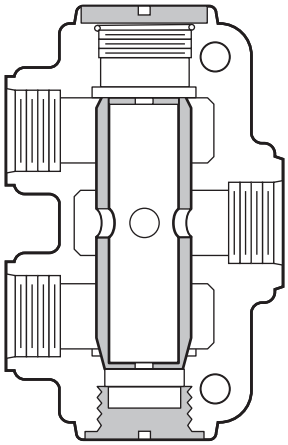
Rated Input Flow	96.6 L/min. [25 G.P.M.]
Rated Pressure	172.4 bar [2500 PSI]
Maximum Pressure Drop Through Valve at Rated Input Flow	4.5 bar [65 PSI]
Weight	1.6 kg. [3.5 lbs.]
Paint	Primer

ORDERING INFORMATION

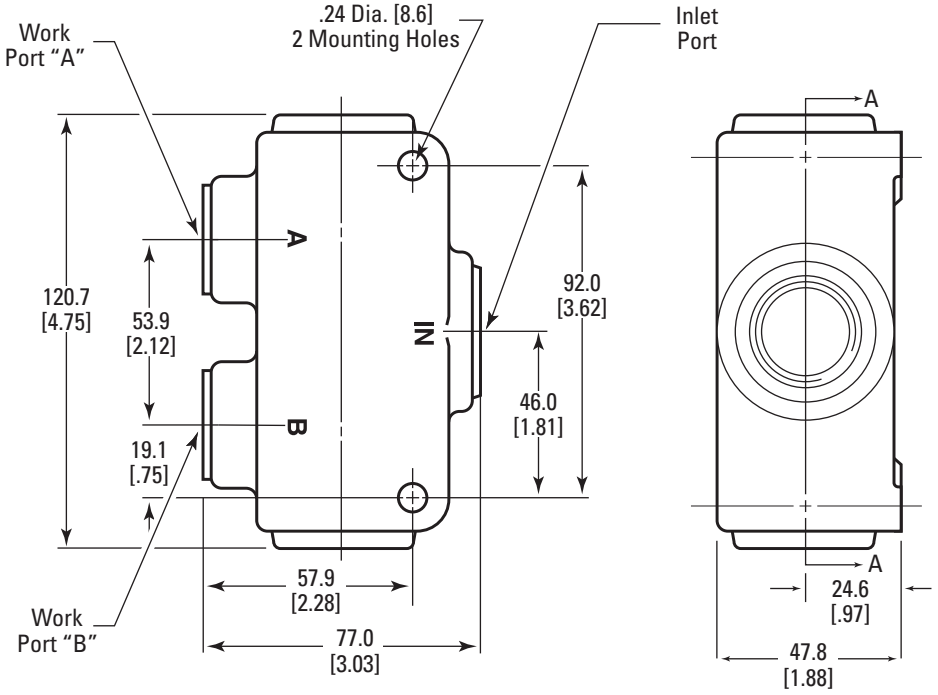
Order No.	**32306-DAB**	**32306-DAC**	**32306-DAD**
Controlled Flow Setting L/min. [G.P.M.]	11.4 [3]	18.9 [5]	26.5 [7]

Model 32501
Proportional Flow Divider

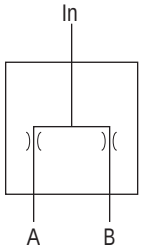
Dimensions



Section A–A



Schematic



SPECIFICATIONS

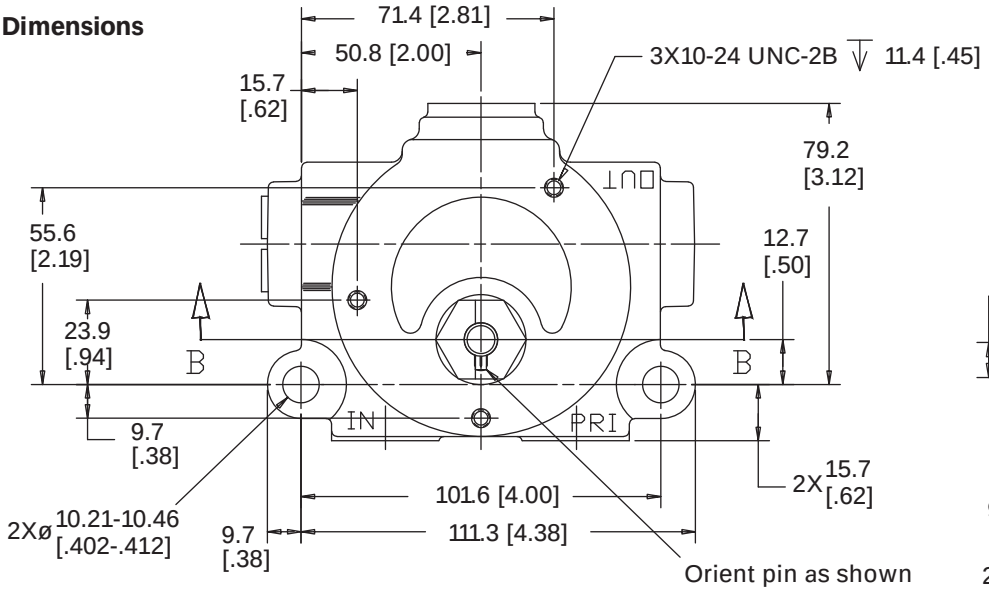
Rated Input Flow	113.6 L/min. [30 G.P.M.]
Rated Pressure	172.4 bar [2500 PSI]
Maximum Pressure Drop Through Valve at Rated Input Flow	8.6 bar [125 PSI]
Weight	1.6 kg. [3.5 lbs.]
Paint	Primer

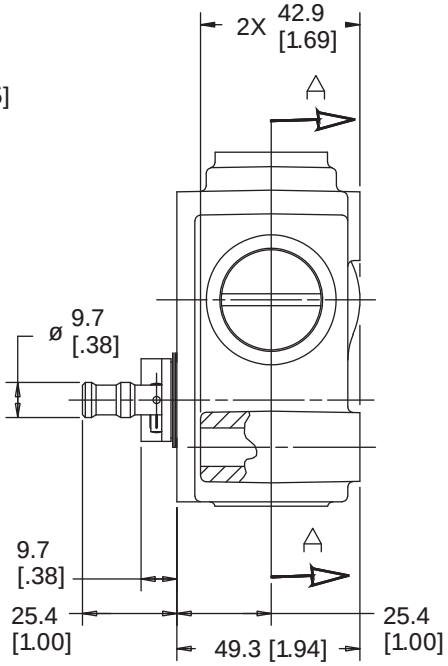
ORDERING INFORMATION

Maximum Input Flow L/min [G.P.M.]	Order Number	Flow Division Ratio Port "A"	Flow Division Ratio Port "B"	Inlet Port Size S.A.E.	Work Port "A" & "B" SizeS.A.E.
37.9 [10]	32501-DAA 32501-DAB	50% 33%	50% 67%	3/4–16	3/4–16
75.7 [20]	32501-DAC 32501-DAD	50% 33%	50% 67%	7/8–14	3/4–16
113.6 [30]	32501-DAE 32501-DAF	50% 33%	50% 67%	1-1/16–12	7/8–14

Model 32700
Variable Priority Flow Control

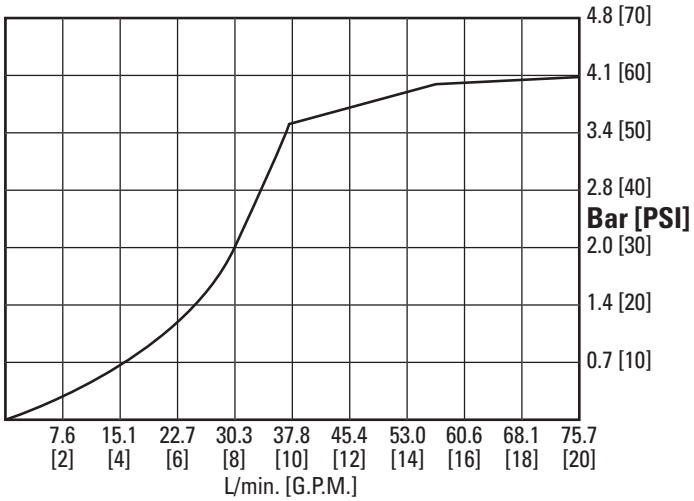
Dimensions





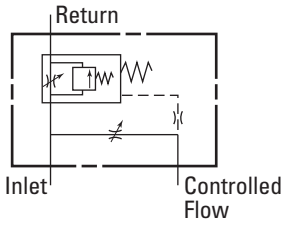
Note: Return port flow cannot be pressurized.

Neutral Flow Pressure Drop
with Adjustable Orifice Open



Note: All tests performed with oil viscosity 150 SUS @ 37.7C [100F] with oil temp @ 54.4C [130F].

Schematic



ORDERING INFORMATION

Order No.	32700-DAA

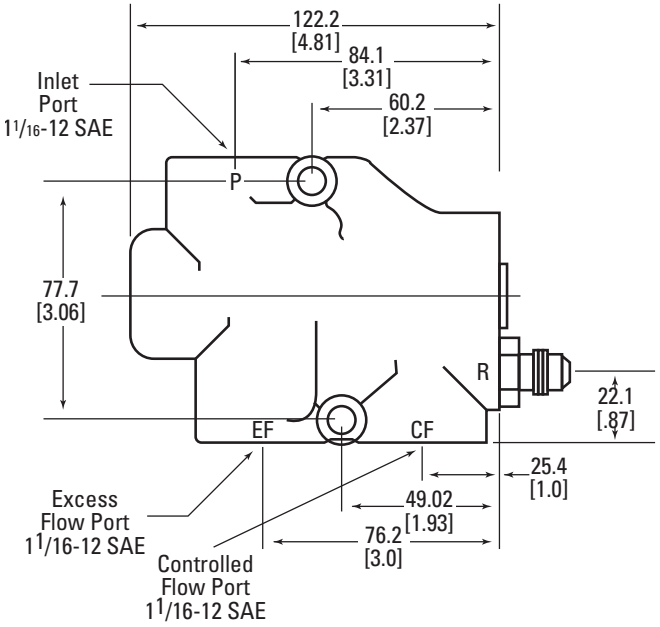
SPECIFICATIONS

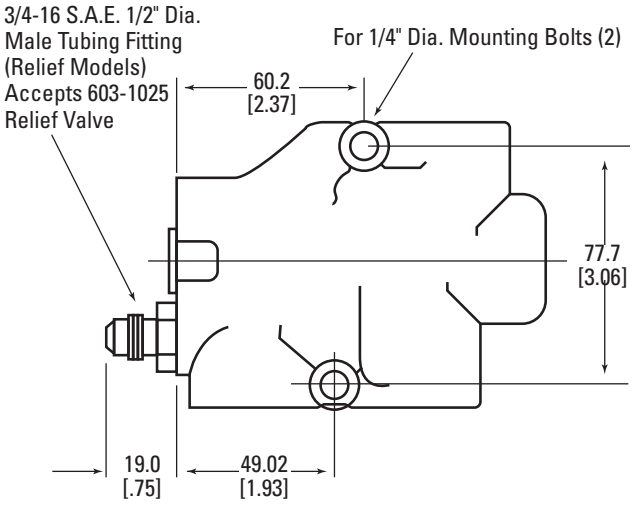
Rated Input Flow	75.7 L/min. [20 G.P.M.]
Rated Pressure	172.4 bar [2500 PSI]
Maximum Pressure Drop Through Valve at 56.8 L/min. [15 G.P.M.] Input	4.0 bar [48 PSI]
Maximum Controlled Flow	36.0 L/min. [9.5 G.P.M.]
Controlled Flow Adjustment Range	5.7 L/min. [1.5 G.P.M.] to 36.0 L/min. [9 .5 G.P.M.]
Relief Valve Factory Setting	151.7 bar [2200 PSI] @ 36.0 L/min. [9.5 G.P.M.]
Weight	2.04 kg. [4.5 lbs.]
Paint	Primer

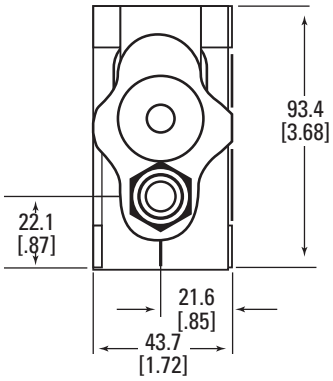
Model VFA
Priority Flow Dividers

Non-Adjustable Divider

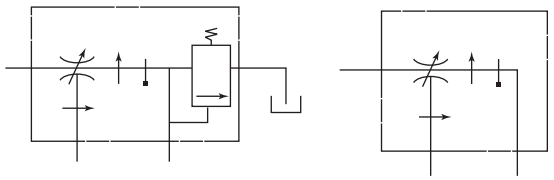
Dimensions



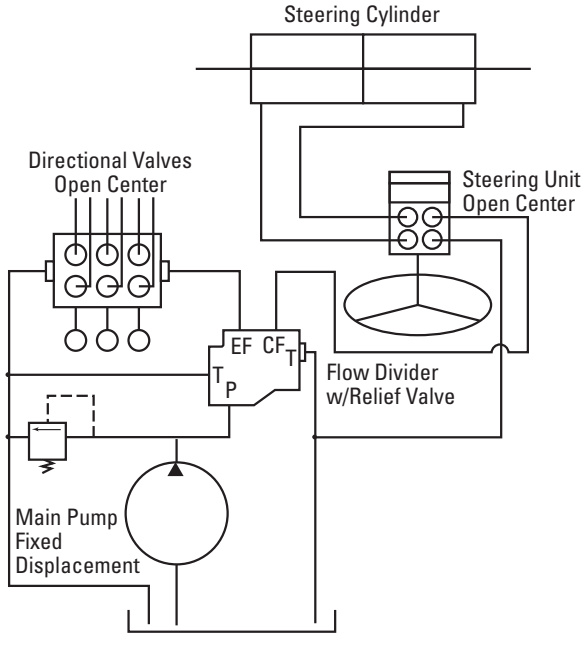




Schematics



Typical Open Center
System with Flow Divider
for Power Steering



SPECIFICATIONS

Rated Input Flow	115 L/min. [30 G.P.M.]
Maximum Controlled Flow	75 L/min. [20 G.P.M.]
Rated Pressure	170 bar [2500 PSI]
Weight	3.2 kg. [7 lbs.]

Optional CF Relief Valve to 170 bar [2500 PSI]

ORDERING INFORMATION

Fixed CF Setting with Relief Valve	604-1106-001-XX*
Fixed CF Setting w/o Relief Valve	604-1102-001-XX*

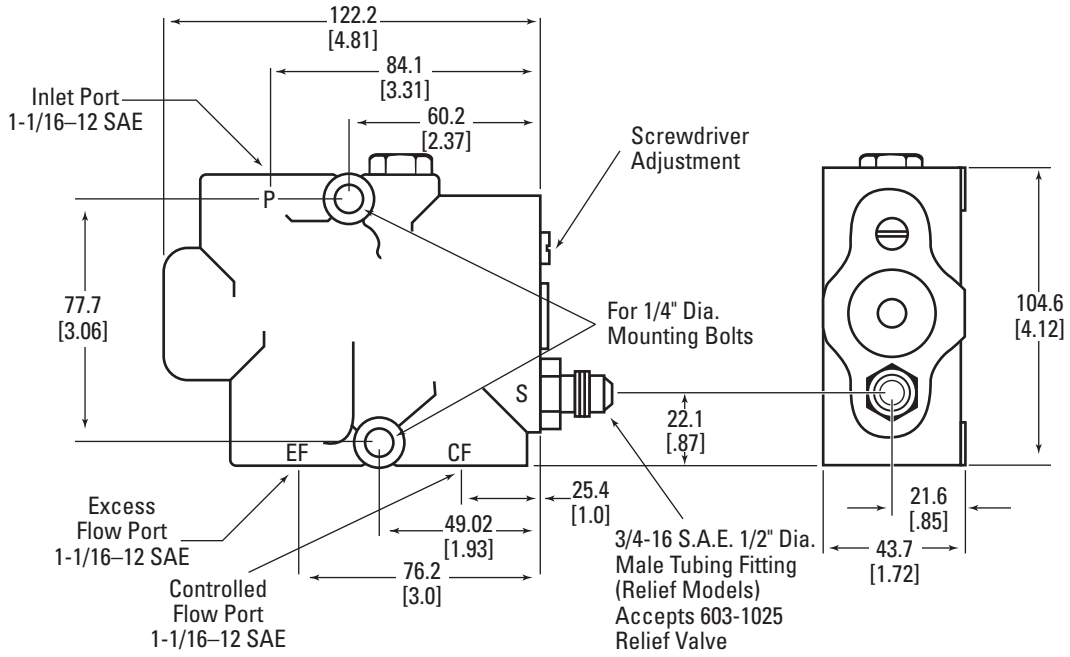
* CF setting and CF relief valve pressure (if used) must be specified to determine two digit suffix code.

See page 17 for choosing the two digit relief valve pressure setting code.

Model VFA
Priority Flow Dividers

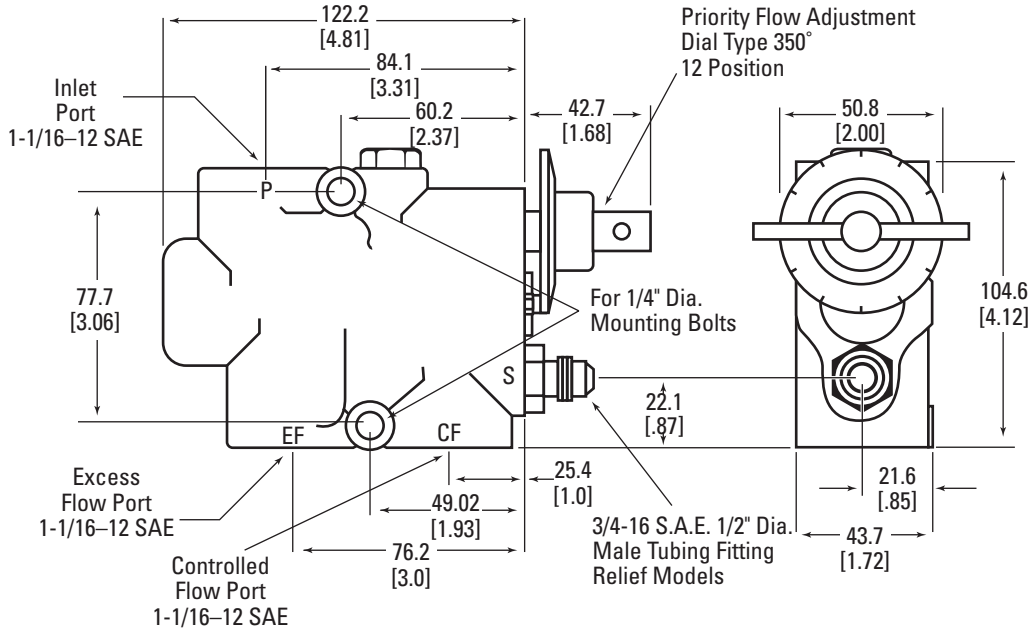
Screwdriver Adjustable
Controlled Flow to 12 G.P.M.

Dimensions



350° Dial Adjustable
Controlled Flow to 12 G.P.M.

Dimensions



ORDERING INFORMATION

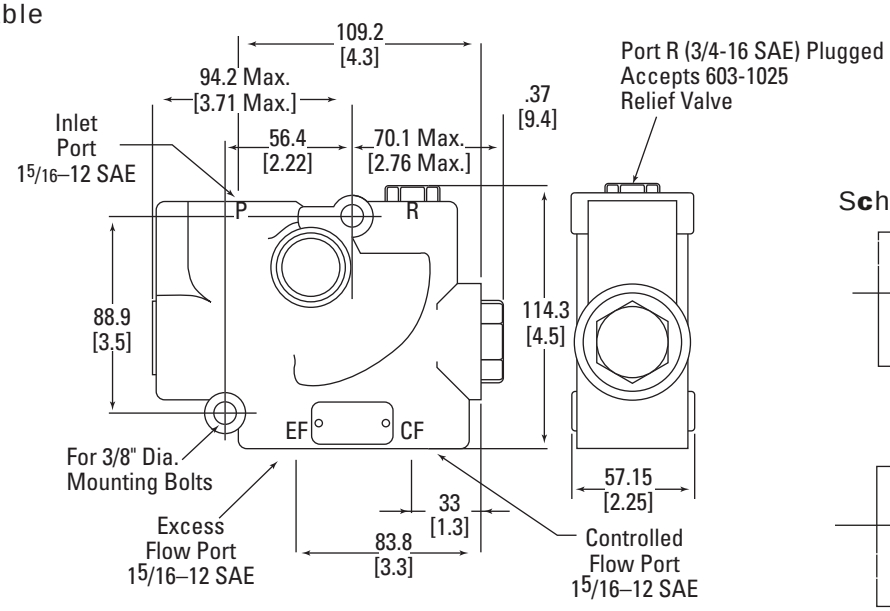
Screwdriver Adjust CF Setting w/o Relief Valve	604-1141-001-XA
Screwdriver Adjust CF Setting with Relief Valve	604-1142-001-XX*
350° Dial Adjust CF Setting w/o Relief Valve	604-1120-001-XA
350° Dial Adjust CF Setting with Relief Valve	604-1122-001-XX*

*CF setting and CF relief valve pressure (if used) must be specified to determine two digit suffix code.
See page 17 for choosing the two digit relief valve pressure setting code.

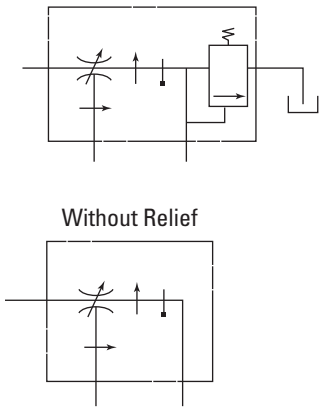
Model F1217
Priority Flow Dividers

Non-Adjustable

Dimensions

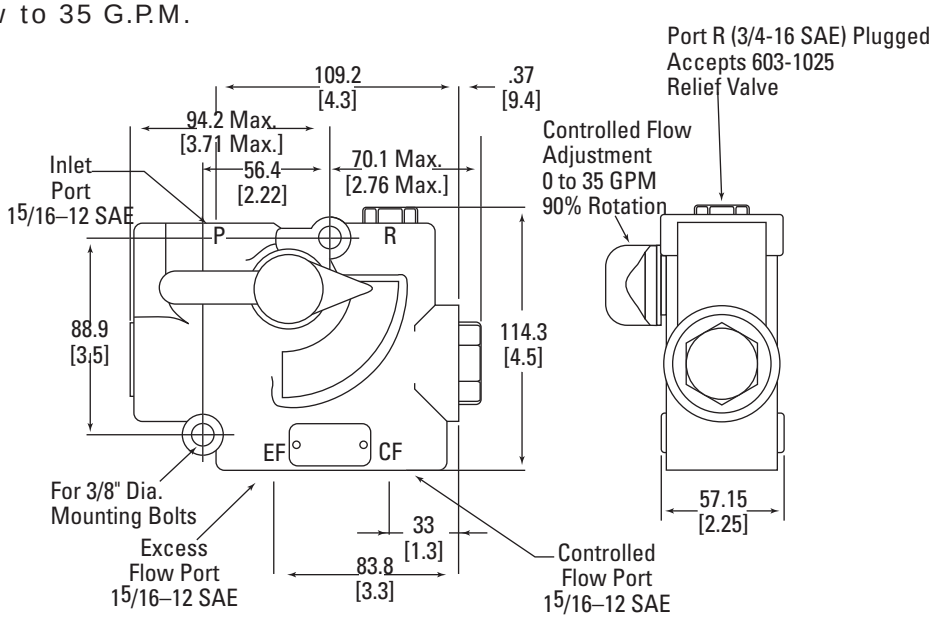


Schematics



90° Lever Adjustable
Controlled Flow to 35 G.P.M.

Dimensions



SPECIFICATIONS

Specifications	
Rated Input Flow	175 L/min. [45 G.P.M.]
Maximum Controlled Flow	135 L/min. [35 G.P.M.]
Rated Pressure	195 bar [2800 PSI]
Weight	4.1 kg. [9 lbs.]

Optional CF Relief Valve to 170 bar [2500 PSI]

ORDERING INFORMATION

Non-Adjustable Setting w/o Relief Valve	604-1037-002-XX*
90° Lever Adjust CF Setting w/o Relief Valve	604-1091-002-XA
90° Lever Adjust CF Setting with Relief Valve	604-1039-002-XX*

* CF setting and CF relief valve pressure (if used) must be specified to determine two digit suffix code.

See page 17 for choosing the two digit relief valve pressure setting code.

VL Load Sensing Priority Valves

Eaton® load sensing priority valves can be used with open center, closed center, or load sensing systems. Use in an open center system with a fixed displacement pump, or a closed center system with a pressure compensated pump, offers many of the features of a load sensing system. Excess flow is available for auxiliary circuits.

Priority valves are sized for design pressure drop at maximum pump output flow rate and priority flow requirements. The minimum control pressure must ensure adequate steering flow rate and must be matched with the steering control unit. The dynamic signal priority valve must be used with a dynamic signal steering control unit.

A pilot line is required to sense pressure downstream from the variable control orifice in the steering control unit. This is balanced by an internal passage to the opposite side of the priority control spool. If there is an appreciable pressure drop (at the maximum steering rate) in the line between the CF port of the priority valve and the P port of the steering unit due to remote location of the priority valve, a higher control pressure or a dynamic signal steering unit and priority valve must be used. Another alternative is the use of the external PP pilot option, with the pilot line connected as close as possible to the steering unit. The total system performance depends on careful consideration of the control pressure chosen and pressure drop in the CF line.

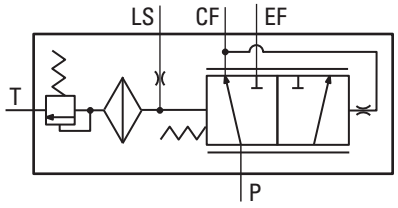
Eaton offers two types of load sensing signal systems: static and dynamic.

Static: Used for conventional applications in which response or circuit stability is not a problem. The load sensing pilot line should not exceed 2 meters [6 feet].

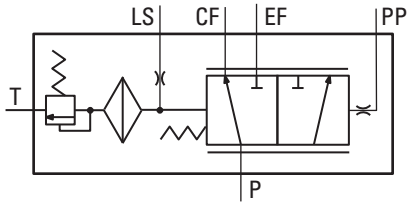
Dynamic: The dynamic signal system offers several advantages, including faster steering response, improved cold weather startup performance, and increased flexibility to optimize system performance and stability. Furthermore, it reduces the reverse flow through the steering unit (wheel kick), which can eliminate the need for an inlet check valve. This design increases the CF spring differential by a “boost ratio” that is determined by the sizing of the orifices.

The priority (CF) circuit pilot relief valve must be factory set at least 20 bar [290 PSI] above the maximum steering pressure requirement. All of the flow other than the small pilot flow of the relief valve will be directed to the excess flow (EF) circuit when the CF relief setting is reached. A pump pressure compensator or master relief valve is required upstream of the priority valve. The compensator or relief must be set at least 10 bar [145 PSI] above the CF relief setting.

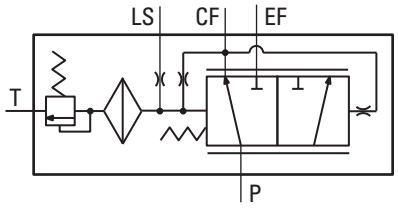
Schematics



Static Signal



Static Signal w/External Pilot

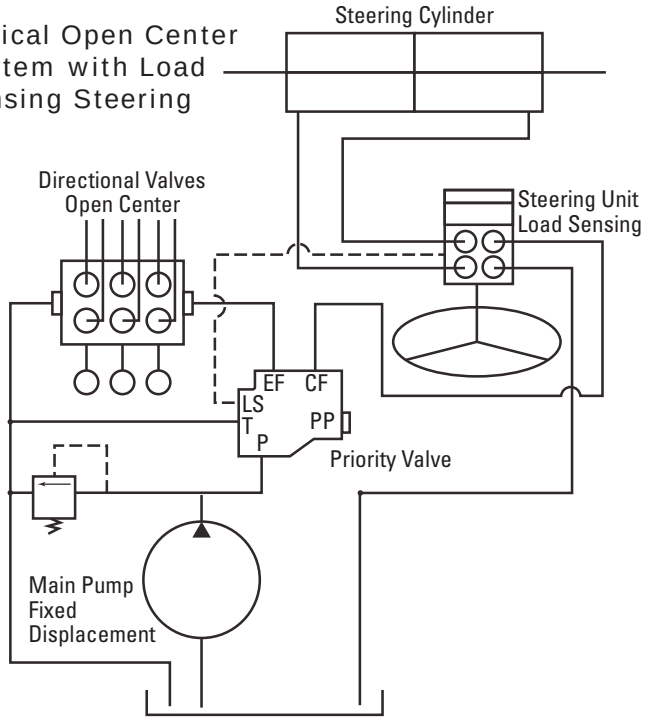


Dynamic Signal

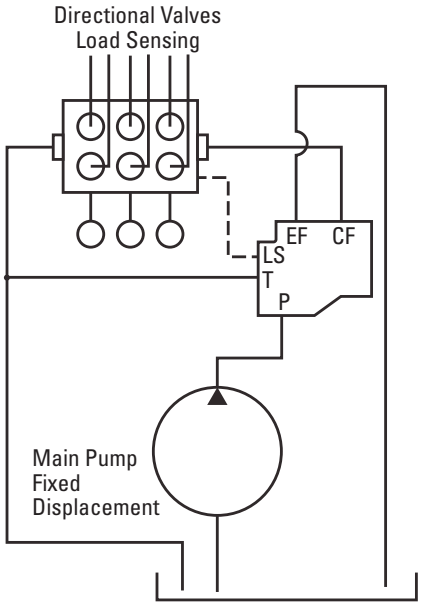
Sample Circuits

These sample circuit configurations show only a few applications possible with the VLC, VLE, and VLH priority valves. Your Eaton distributor can assist with your choice in valves for optimum performance.

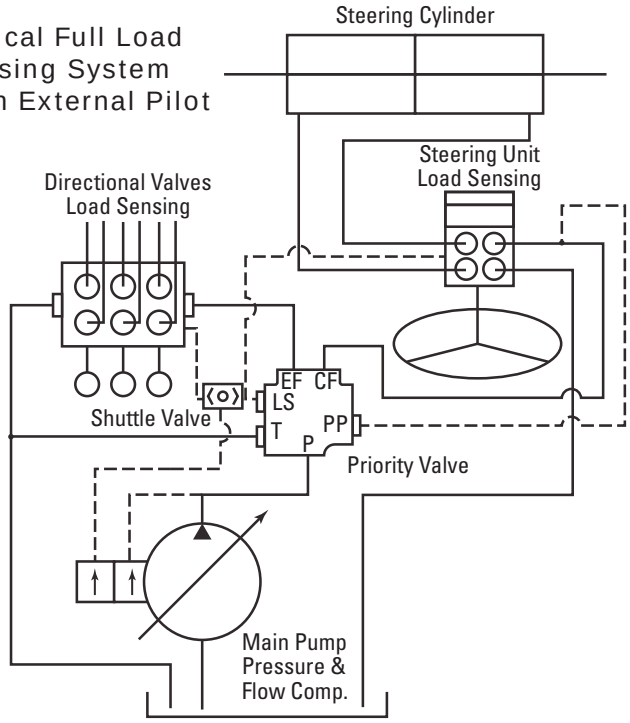
Typical Open Center System with Load Sensing Steering



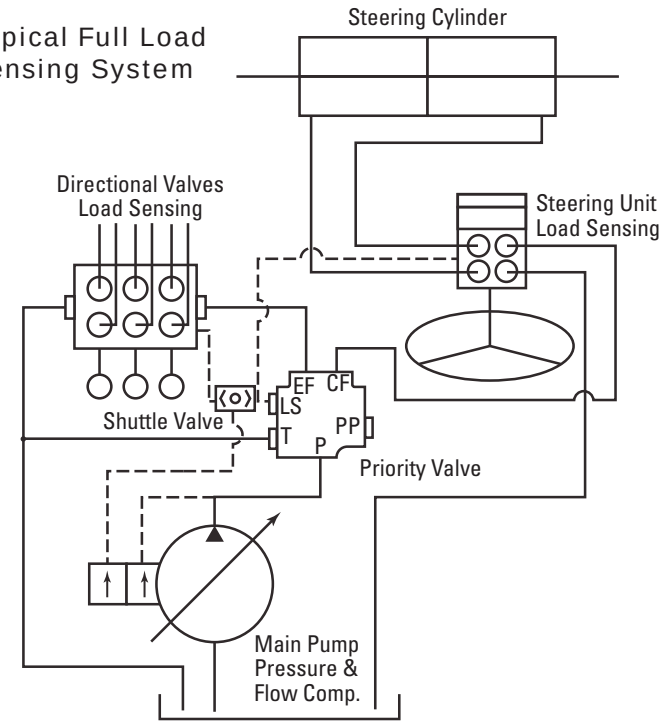
Typical Use of Priority Valve as Unloading Device



Typical Full Load Sensing System with External Pilot

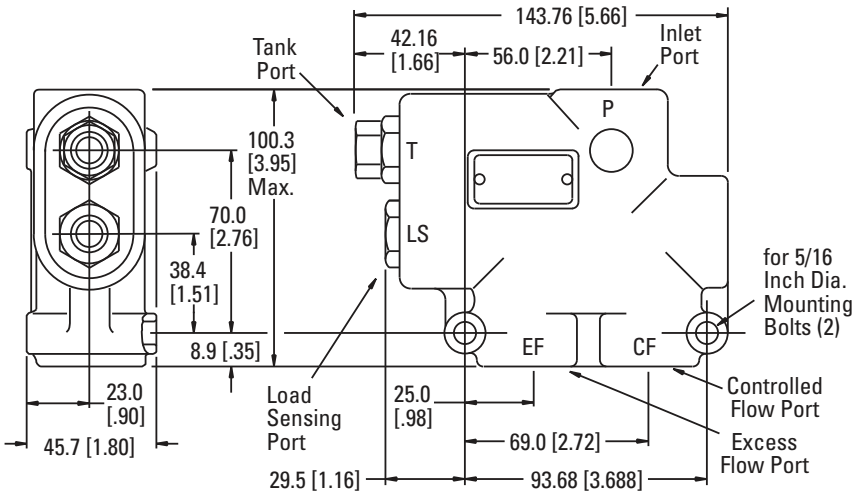


Typical Full Load Sensing System

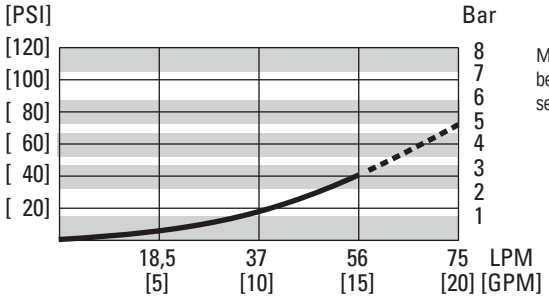


Model VLC
Load Sensing Priority Valves

Dimensions



VLC P-EF Pressure Drop



Minimum Pressure Drop P - EF
Oil Viscosity 25 cSt [120 SUS]

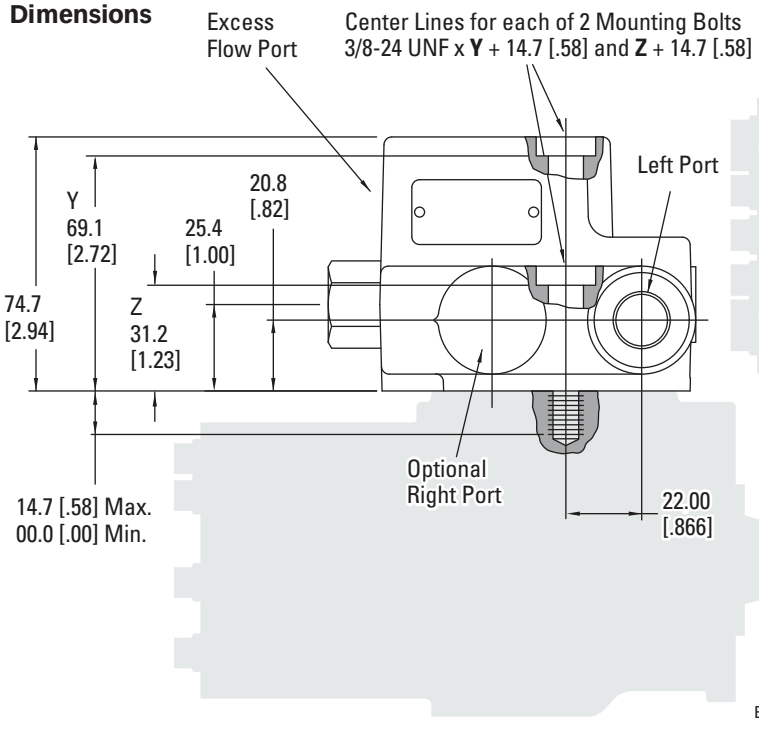
Minimum P port pressure will be equal to control pressure setting.

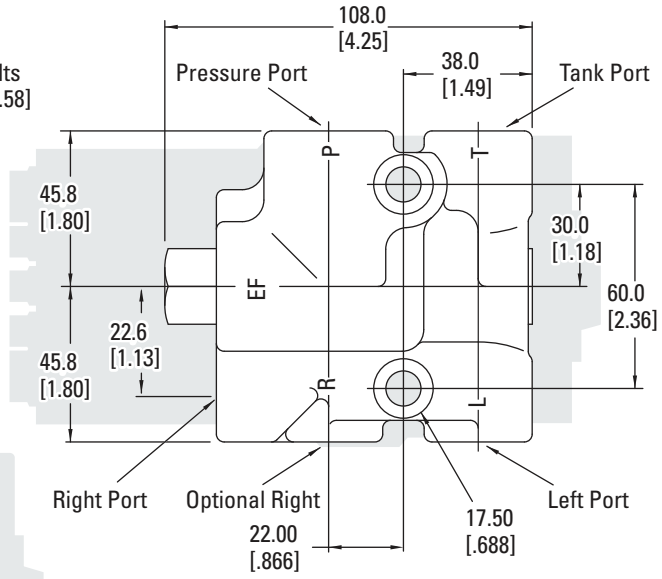
SPECIFICATIONS:
NFPA Fatigue Rated P and EF Pressure
NFPA Fatigue Rated CF Pressure

Rated Input Flow	60 L/min. [16 G.P.M.]
Rated Inlet and EF Pressure	276 bar [4000 PSI]
Rated CF Pressure	276 bar [4000 PSI]
Maximum CF Relief Setting	276 bar [4000 PSI]

Bolt-on (Manifold Mount) Load Sensing Priority Valve

Dimensions





Model VLC

Ordering Information/ Order Numbers

			Signal Type & Control Pressure Bar [PSI]					
			Static	Dynamic	Static	Dynamic	Static	Dynamic
Configuration	Ports (5)	Port Size	3,5 [50]	5,2 [75]	5,2 [75]	7,6 [110]	6,9 [100]	10,0 [145]
Line	P & EF CF LS & T	7/8 - 14 3/4 - 16 7/16 - 20	606-1217	606-1232	606-1218	606-1314	606-1219	606-1315
Line	P & EF CF LS & T	3/4 - 16 9/16 - 18 7/16 - 20	606-1214	606-1327	606-1215	606-1278	606-1216	606-1328
Line	P & EF CF LS & T	M22 X 1,5 M18 X 1,5 M12 X 1,5	606-1329	606-1330	606-1331	606-1332	606-1333	606-1334
Line	P & EF CF LS & T	G1/2 - 14 G1/2 - 14 G1/4 - 19	606-1335	606-1336	606-1337	606-1338	606-1339	606-1340
Manifold (Metric)	P & EF T & L R (end)	G1/2 G3/8 G3/8				612-0001		
Manifold (Metric)	P & EF T, L & R (side)	G1/2 G3/8				612-0005		
Manifold (Series 10)	P & EF T, L & R (side)	G1/2 G3/8				612-1005		

Example: 606-1218-004-QA

Product Number | **Design Level** | **Pressure Code See Page 17**

The example product number describes a VLC with 5,2 bar [75 PSI] control pressure, static signal, 7/8 – 14 P and EF ports, 3/4 – 16 CF port, 7/16 – 20 LS and T ports, 172 bar [2500 PSI] relief valve setting.

Model VLC - Model Code

V	L	C	L	3	3	A	9	Q	A	0	0	C
1	2	3	4	5	6	7	8	9	10	11	12	13

1 Product
V – Valve

2 Type
L – External pilot operated flow control (priority) valve

3 Inlet Flow Rating
C – 60.6 L/min. [16 G.P.M.]

4 Configuration
L – Line mount
M – Manifold mount (bolt-on to metric SCU)
S – Manifold mount to series 10 SCU

5 Ports
2 – CF 9/16, P & EF 3/4 –16, LS & T, 7/16 – 20
3 – CF 3/4 - 16, P & EF 7/8 – 14, LS & T, 7/16 – 20
4 – CF M18 x 1.5, P & EF M22 x 1.5, LS & T, M12 x 1.5
5 – CF G1/2, P & EF G1/2, LS & T, G1/4
A – P & EF G1/2, T, L & R G3/8
B – P & EF M22 x 1.5, T, L & R M18 x 1.5
C – P & EF G1/2, L & R G3/8
D – P & EF 7/8 – 14, T, L & R 3/4 – 16
E – P & EF 7/8 – 14, T & L 3/4 – 16, R 3/4 – 16 (End)
F – P & EF G1/2, T & L G3/8, R G3/8 (End)

6 Pilot Signal
1 – LS pilot only – static
2 – PP and LS pilots – static
3 – LS pilot only – dynamic

7 Control Spring
6 – PP and LS pilots – dynamic
Z – 3.4 bar [50 lbf/in²]
A – 5.2 bar [75 lbf/in²]
B – 6.9 bar [100 lbf/in²]
C – 10.3 bar [150 lbf/in²]

8 Relief Valve
0 – None (solid plug)
4 – None (shipping plug)
9 – Inverted style cartridge

9, 10 Relief Setting
00 – None
XX – Setting per code on page 17

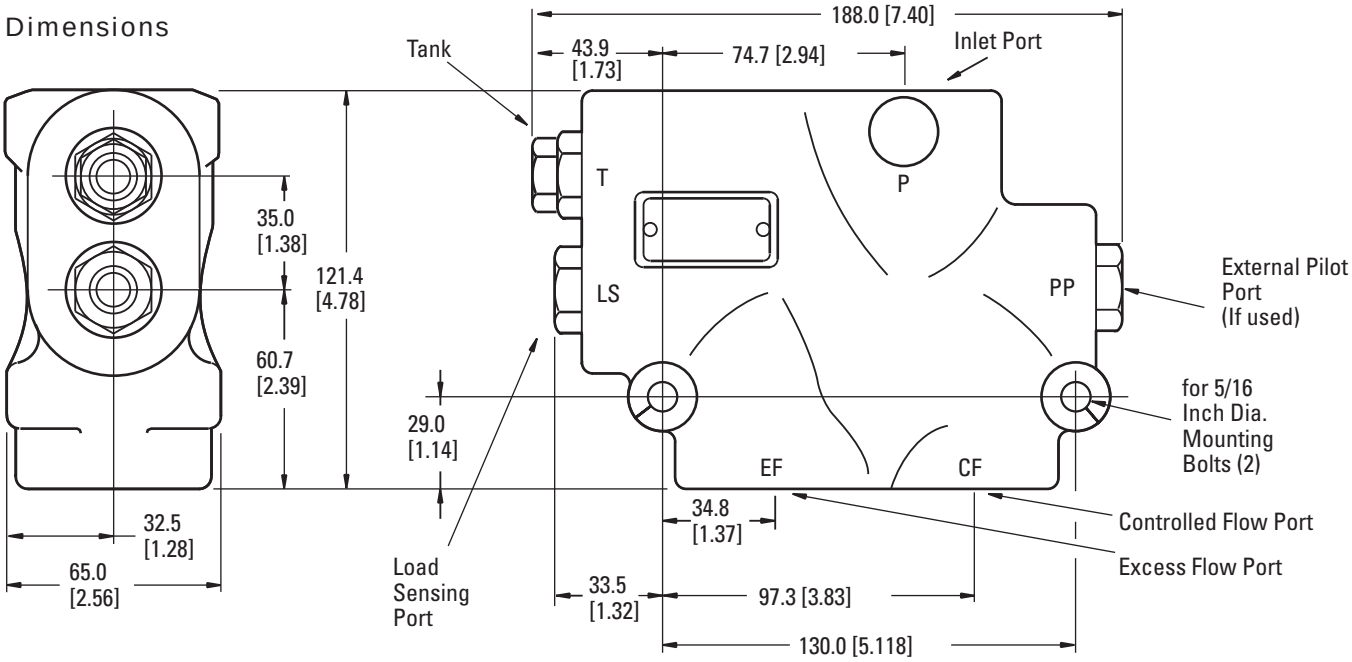
11 Special Features
0 – Static or Std. Dynamic with 1.45 Boost
A – Dynamic with 2.0 Boost
C – Dynamic with 1.64 Boost
D – Dynamic with 1.67 Boost

12 Paint
0 – Standard - painted black
G – Painted red oxide primer

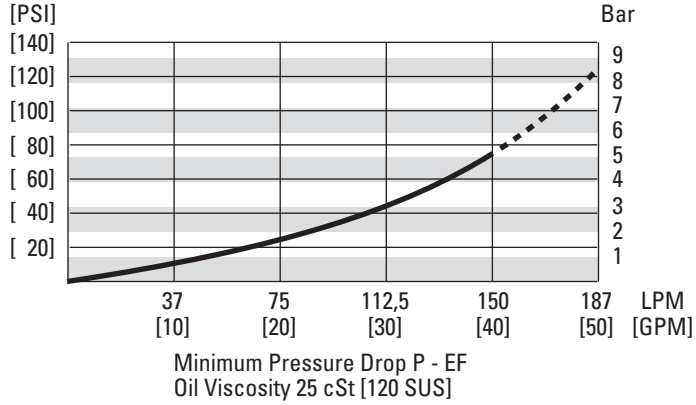
13 Design Code
D – Fourth Design

Model VLE
Load Sensing
Priority Valve

Dimensions



VLE P-EF Pressure Drop



Minimum Pressure Drop P - EF
Oil Viscosity 25 cSt [120 SUS]

Minimum P port pressure will be equal to control pressure setting.

SPECIFICATIONS:
NFPA Fatigue Rated P and EF Pressure
NFPA Fatigue Rated CF Pressure

Rated Input Flow	150 L/min. [40 G.P. M.]
Rated Inlet and EF Pressure	310 bar [4500PSI]
Rated CF Pressure	276 bar [4000 PSI]
Maximum CF Relief Valve Setting	276 bar [4000 PSI]

Model VLE

Ordering Information/ Order Numbers

		Signal Type & Control Pressure Bar [PSI]					
		Static	Dynamic	Static	Dynamic	Static	Dynamic
Ports (5)	Port Size	4,5 [65]	5,5 [80]	6,9 [100]	8,6 [125]	10,3 [150]	12,8 [185]
P & EF CF LS & T	1-1/16 - 12 3/4 - 16 7/16 - 20	606-1093	606-1294	606-1094	606-1295	606-1095	606-1296
P & EF CF LS & T	1-1/16 - 12 7/8 - 14 7/16 - 20	606-1046	606-1341	606-1047	606-1342	606-1048	606-1343
P & EF CF LS & T	1-5/16 - 12 7/8 - 14 7/16 -20	606-1058	606-1344	606-1059	606-1345	606-1060	606-1346
P & EF CF LS & T	1-5/16 - 12 1-5/16 - 12 7/16 - 20	606-1141	606-1347	606-1142	606-1348	606-1143	606-1349
P & EF CF LS & T	1-5/16 - 12 1-1/16 - 12 7/16 - 20	606-1350	606-1282	606-1351	606-1281	606-1454	606-1323
P & EF CF LS & T	M27 X 2 M18 X 1,5 M12 X 1,5	606-1353	606-1354	606-1355	606-1356	606-1357	606-1358
P & EF CF LS & T	G3/4 - 14 G1/2 - 14 G1/4 - 19	606-1359	606-1360	606-1361	606-1362	606-1363	606-1364

Example

Example: 606-1094-003-QA

Product Number | **Design Level** | **Pressure Code See Page 17**

The example product number describes a VLE with 6,9 bar [100 PSI] control pressure, static signal, 1-1/16 – 12 P and EF ports, 3/4 – 16 CF port, 7/16 – 20 LS and T ports, 172 bar [2500 PSI] relief valve setting.

Model VLE - Model Code

V	L	E	7	B	4	A	4	4	Q	A	0	0	B
1	2	3	4	5	6	7	8	9	10	11	12	13	14

1 Product
V – Valve

2 Type
L – External pilot operated flow control (priority) valve

3 Inlet Flow Rating
E – 151 L/min. [40 G.P.M.]

4 Ports
1 CF 1-1/16 - 12, P & EF 1-5/16 - 12, LS & T 7/16 - 20
3 CF 3/4 - 16, P & EF 7/8 - 14, LS & T 7/16 - 20
4 CF 7/8 - 14, P & EF 1-1/16 - 12, LS & T 7/16 - 20
5 CF 7/8 - 14, P & EF 1-5/16 - 12, LS & T 7/16 - 20
6 CF 3/4 - 16, P & EF 1-1/16 - 12, LS & T 7/16 - 20
7 CF, P & EF 1-5/16 - 12, LS & T 7/16 - 20
9 CF 3/4 - 16, P & EF 1-5/16 - 12, LS & T 7/16 – 20
A CF M18 x 1.5, P & EF M27 x 2, LS & T M12 x 1.5
B CF G1/2, P & EF G3/4, LS & T G1/4
C CF M22x1.5, P & EF M27x2, LS & T M14x1.5

5 Metering Type
0 Standard
A High flow CF
B Double EF land, tapered
C Double EF land, notched
D High gain, straight land
E EF slots don't close completely

6 Pilot Signal
1 LS pilot only – static
2 PP & LS pilots – static
3 LS pilot only – dynamic
4 PP & LS pilots – dynamic

7 Control Spring
A 4.5 bar [65 lbf/in²]
B 6.9 bar [100 lbf/in²]
C 10.3 bar [150 lbf/in²]

8 Relief Valve
0 None (solid plug)
4 Inverted style cartridge

9 Relief Dashpot
0 None (Std. with relief valve) or none (Std. with no relief valve)
4 0.67 [.0265] Dia. (Standard with inverted relief valve)

10 11 Relief Setting
00 None
XX Setting per code on page 17

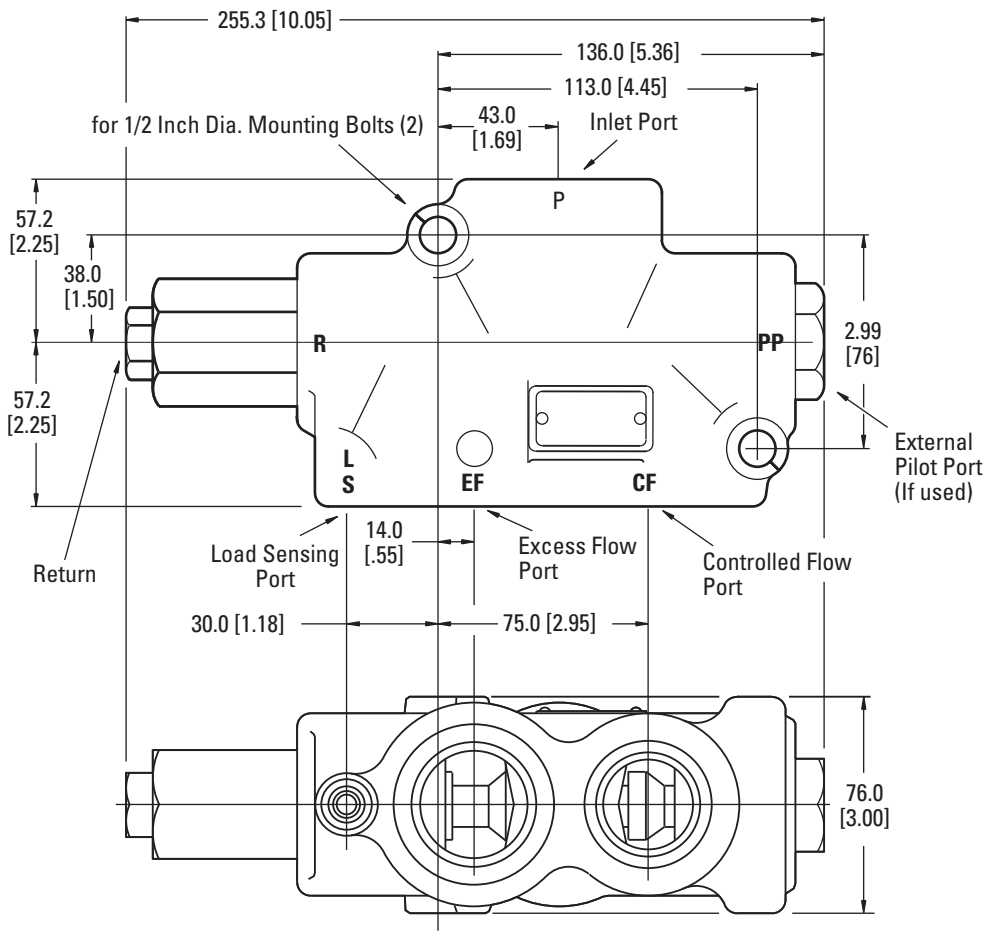
12 Special Features
0 LS & PP - .91 [.036] Dia.
D LS & PP - .79 [.031] Dia.
E Dynamic with 1.19 Boost
F PP- .79 (.031) Dia. Dynamic with 1.08 boost
G Dynamic with 1.37 Boost
H PP- .91 (.036) Dia. Dynamic with 1.08 Boost
N Dynamic with 1.42 Boost
P Dynamic with 1.23 Boost (Standard)
R PP- .91 (.036) Dia. Dynamic with 2.00 Boost
S Dynamic with 1.67 Boost
T PP- .64 (.025) Dia. Dynamic with 2.00 Boost

13 Paint
0 Standard - painted black
7 Painted red oxide primer

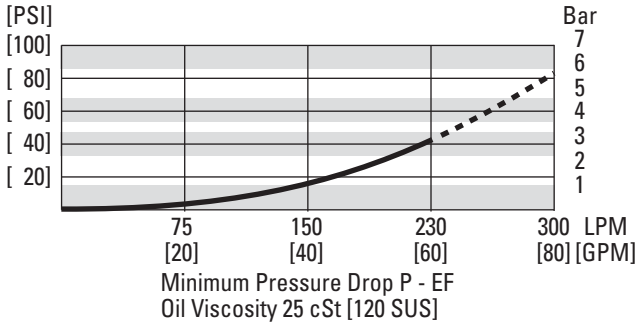
14 Design code
B – Second design

Model VLH
Load Sensing
Priority Valve

Dimensions



VLH P-EF Pressure Drop



Minimum P port pressure will be equal to control pressure setting.

SPECIFICATIONS:
NFPA Fatigue Rated P and EF Pressure
NFPA Fatigue Rated CF Pressure

Rated Input Flow	240 L/min. [63 G.P.M.]
Rated Inlet and EF Pressure	297 bar [4300 PSI]
Rated CF Pressure	276 bar [4000 PSI]
Maximum CF Relief Setting	276 bar [4000 PSI]

Model VLH
Order Information/ Order Numbers

		Signal Type & Control Pressure Bar [PSI]					
		Static	Dynamic	Static	Dynamic	Static	Dynamic
Ports (5)	Port Size	4,5 [65]	5,5 [80]	6,9 [100]	8,6 [125]	10,3 [150]	12,8 [185]
P & EF CF LS & R	1-5/8 - 12 1-5/16 - 12 7/16 - 20	606-1201	606-1288	606-1202	606-1289	606-1203	606-1290
P & EF CF LS & R	1-5/8 - 12 1-1/16 - 12 7/16 - 20	606-1368	606-1316	606-1369	606-1285	606-1376	606-1286
P & EF CF LS & R	1-5/8 - 12 3/4 - 16 7/16 - 20	606-1189	606-1371	606-1190	606-1372	606-1191	606-1373

Example

Example: 606-1202-003-QA

Product Number | **Design Level** | **Pressure Code See Page 17**

The example product number describes a VLHwith 6,9 bar [100 PSI] control pressure, static signal, 1-5/8 – 12 P and EF ports, 1-5/16 – 20 CF port, 7/16 – 20 LS and T ports, 172 bar [2500 PSI] relief valve setting.

Model VLH - Model Code

V	L	H	8	0	2	B	4	4	F	Q	A	0	B
1	2	3	4	5	6	7	8	9	10	11	12	13	14

1 Product
V – Valve

2 Type
L – External pilot operated flow control (priority) valve

3 Inlet Flow Rating
H – 240 L/min. [63 G.P.M.]

4 Ports
7 CF 1-1/16 – 12, P & EF 1–5/8 – 12, LS & T 7/16 – 20
8 CF 3/4 – 16, P & EF 1-5/8 – 12, LS & T 7/16 – 20
9 CF 15/16 – 12, P & EF 1-5/8 – 12, LS & T 7/16 – 20
D CF 7/8-14, P&EF 1-5/8 – 12, LS&T 7/16 – 20
F CF M27 x 2, P&EF M33x2, LS & T M14x1.5
L CF M22 x 1.5, P&EF M42x2, LS & T M14x1.5

5 Adjustments
0 Non-adjustable

6 Pilot Signal
1 LS pilot only – static
2 PP & LS pilots – static
3 LS pilot only – dynamic
4 PP & LS pilots – dynamic

7 Control Spring
A 5.2 bar [75 lbf/in²]
B 6.9 bar [100 lbf/in²]
C 10.3 bar [150 lbf/in²]
D 14.5 bar [210 lbf/in²]

8 Relief Valve
0 None (solid plug)
4 Inverted style cartridge

9 Relief Dashpot
0 None (Std. with no relief valve)
4 0.67 [.0265] DIA. (Standard with inverted relief valve)

10-11 Relief Setting
00 None
XX Setting per code on page 17

12 Special Features
0 LS & PP - 1.19 [.047] Dia.
A LS & PP - 0.58 [.023] Dia.
B LS & PP - 0.71 [.028] Dia.
C Dynamic with 1.37 Boost
D Dynamic with 1.23 Boost (Standard)
H Dynamic with 1.64 Boost
J Dynamic with 1.42 Boost

13 Paint
0 – Standard - painted black

14 Design Code
B – Second design

Relief Valve Setting Code

Use this chart to find the two digit suffix that corresponds to the nominal pressure setting. The factory pressure setting tolerance is -0 psi, +100 psi (-0 bar, +7bar).

Settings in bold print are preferred standard settings.

SUFFIX	BAR	PSI
AA	**17**	**250**
AB	19	275
AC	21	300
AD	23	325
AE	24	350
AF	**26**	**375**
AG	28	400
AH	29	425
AJ	31	450
AK	33	475
AL	**35**	**500**
AM	36	525
AN	38	550
AP	40	575
AQ	42	600
AR	**43**	**625**
AS	45	650
AT	47	675
AU	48	700
AV	50	725
BA	**52**	**750**
BB	54	775
BC	55	800
BD	57	825
BE	59	850
BF	**60**	**875**
BG	62	900
BH	64	925
BJ	66	950
BK	67	975
CA	**69**	**1000**
CB	71	1025
CC	72	1050
CD	74	1075
CE	76	1100
DA	**78**	**1125**
DB	79	1150
DC	81	1175
DD	83	1200
DE	85	1225
EA	**86**	**1250**
EB	88	1275
EC	90	1300
ED	91	1325
EE	93	1350
FA	**95**	**1375**
FB	97	1400
FC	98	1425
FD	100	1450
FE	102	1475

SUFFIX	BAR	PSI
GA	**104**	**1500**
GB	105	1525
GC	107	1550
GD	109	1575
GE	111	1600
HA	**112**	**1625**
HB	114	1650
HC	116	1675
HD	117	1700
HE	119	1725
JA	**121**	**1750**
JB	123	1775
JC	124	1800
JD	126	1825
JE	128	1850
KA	**129**	**1875**
KB	131	1900
KC	133	1925
KD	135	1950
KE	136	1975
LA	**138**	**2000**
LB	140	2025
LC	142	2050
LD	143	2075
LE	145	2100
MA	**147**	**2125**
MB	148	2150
MC	150	2175
MD	152	2200
ME	154	2225
NA	**155**	**2250**
NB	157	2275
NC	159	2300
ND	160	2325
NE	162	2350
PA	**164**	**2375**
PB	166	2400
PC	167	2425
PD	169	2450
PE	171	2475
QA	**172**	**2500**
QB	174	2525
QC	176	2550
QD	178	2575
QE	179	2600
RA	**181**	**2625**
RB	183	2650
RC	185	2675
RD	186	2700
RE	188	2725

SUFFIX	BAR	PSI
SA	**190**	**2750**
SB	191	2775
SC	193	2800
SD	195	2825
SE	197	2850
TA	**198**	**2875**
TB	200	2900
TC	202	2925
TD	204	2950
TE	205	2975
UA	**207**	**3000**
UB	209	3025
UC	211	3050
UD	212	3075
UE	214	3100
UF	**216**	**3125**
UG	217	3150
UH	219	3175
UJ	221	3200
UK	223	3225
VA	**224**	**3250**
VB	226	3275
VC	228	3300
VD	229	3325
VE	231	3350
VF	**233**	**3375**
VG	235	3400
VH	236	3425
VJ	238	3450
VK	240	3475
WA	**242**	**3500**
WB	243	3525
WC	245	3550
WD	247	3575
WE	248	3600
WF	**250**	**3625**
WG	252	3650
WH	254	3675
WJ	255	3700
WK	257	3725
YA	**259**	**3750**
YB	260	3775
YC	262	3800
YD	264	3825
YE	266	3850
YF	**267**	**3875**
YG	269	3900
YH	271	3925
YJ	272	3950
YK	274	3975

SUFFIX	BAR	PSI
ZA	**276**	**4000**
ZB	279	4050
ZC	283	4100
ZD	286	4150
ZE	290	4200
ZF	**293**	**4250**
ZG	297	4300
ZH	300	4350
ZJ	304	4400
ZK	307	4450
ZL	**311**	**4500**
ZM	314	4550
ZN	317	4600
ZP	321	4650
ZQ	324	4700
ZR	**328**	**4750**
ZS	331	4800
ZT	335	4850
ZU	338	4900
ZV	342	4950
IA	**345**	**5000**
IB	348	5050
IC	352	5100
ID	355	5150
IE	359	5200
IF	**362**	**5250**
IG	366	5300
IH	369	5350
IJ	372	5400
IK	376	5450
IL	**379**	**5500**
IM	383	5550
IN	386	5600
IP	390	5650
IQ	393	5700
IR	**397**	**5750**
IS	400	5800
IT	403	5850
IU	407	5900
IV	410	5950
IW	**414**	**6000**

XA through XZ—Special

CF Relief Valve Pressure and CF Setting Code

For VFA and F1217 Flow Dividers

Use this chart to find the two-digit suffix code; the first digit corresponds to the nominal CF relief valve pressure setting, and the second digit corresponds to the nominal CF flow setting. Use Table 1 to find the first digit in the suffix code for both the VFA and F1217 valves. Use Table 2A to find the second digit in the suffix code of **VFA valves only**; use Table 2B to find the second digit in the suffix code of **F1217 valves only.**

Table 1: CF RV Setting

SUFFIX	BAR	PSI
A	35	500
B	43	625
C	52	750
D	60	875
E	69	1000
F	78	1125
G	86	1250
H	95	1375
J	104	1500
K	112	1625
L	121	1750
M	129	1875
N	138	2000
O	147	2125
P	155	2250
Q	164	2375
R	172	2500
X	—	no relief valve
2	—	2 relief valves

Table 2A: CF Flow (VFA)

SUFFIX	L/MIN	GPM
A	Adjustable	Adjustable
B	13.2, 14.0	3.5, 3.7
C	15.1	4
D	60.6	16
E	20.8	5.5
F	17	4.5
G	7.6	2
H	37.9	10
J	22.7	6
K	11.4	3
L	30.3	8
M	34.1	9
N	45.4	12
Q	18.9	5

Table 2B: CF Flow (F1217)

SUFFIX	L/MIN	GPM
A	Adjustable	Adjustable
B	15.1	4
C	18.9	5
D	22.7	6
E	75.7	20
F	11.4	3
G	13.2	3.5
H	113.6	30
J	132.5	35
K	53	14
R	56.8	15

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Powering Business Worldwide

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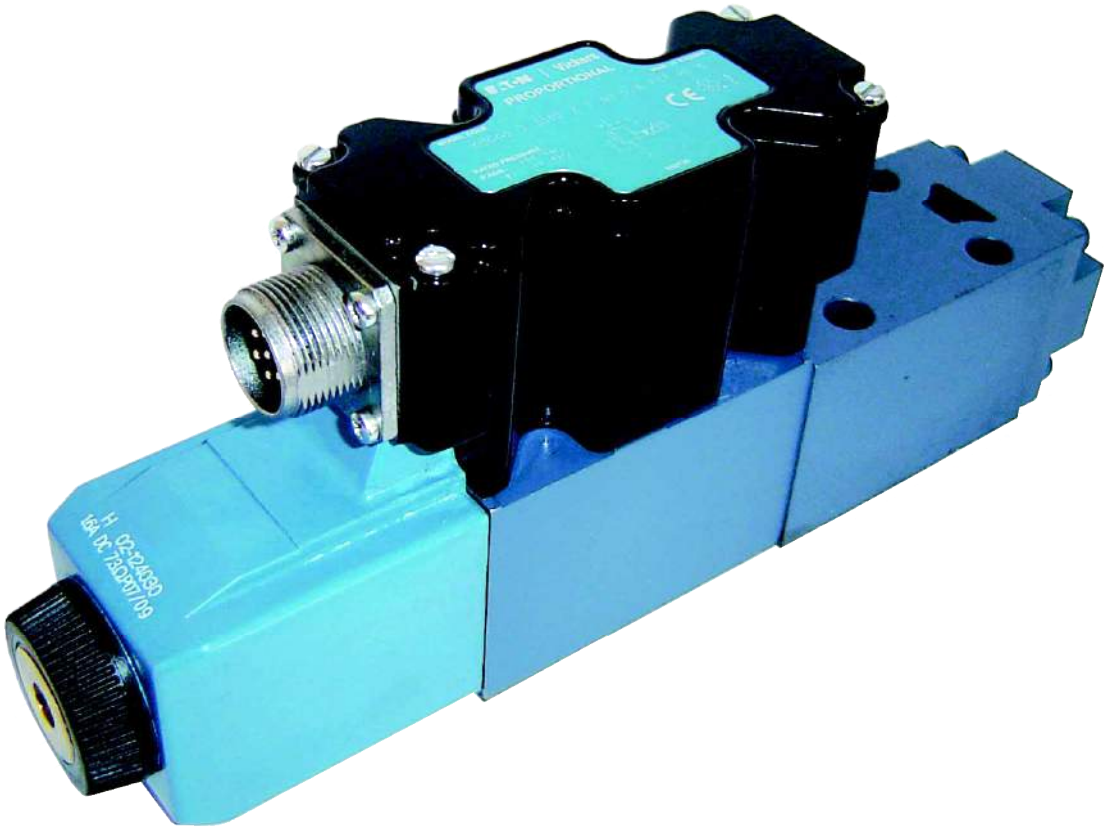
September 2008

Vickers®

Proportional Pressure Relief Valve Technical Catalog

KBCG5-3
10 Design



Powering Business Worldwide

Contents

Introduction
- General Description 3
- Basic Characteristics 3
- Features and Benefits 3
- Typical Section 3
- Functional Symbols 3

Model Code 4
Operating Data 5
Performance Data 6
Installation Dimensions 9
Elettrical Information 10
Application Data 12

CE *This product has been designed and tested to meet specific standards outlined in the European Electromagnetic Compatibility Directive (EMC).*
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).*

General Description

These compact two-stage pressure relief valves offer extensive application possibilities through their ability to control the pressure setting in proportion to an applied electrical input.

The integral amplifier allows the pressure to be controlled from a low power command signal: either a voltage or current command.

The amplifier is mounted in a robust metal housing and electrical connections are via an industry standard 7-pin plug. Factory-set adjustments ensure high reproducibility valve-to-valve.

Basic Characteristics

Max. pressure
350 bar (5000 psi)

Max. flow rate
40 L/min (10.6 USgpm)

Mounting face to
ISO 6264-03-04

Note: Port B must be blocked by the mounting interface - see installation diagram for port postions.

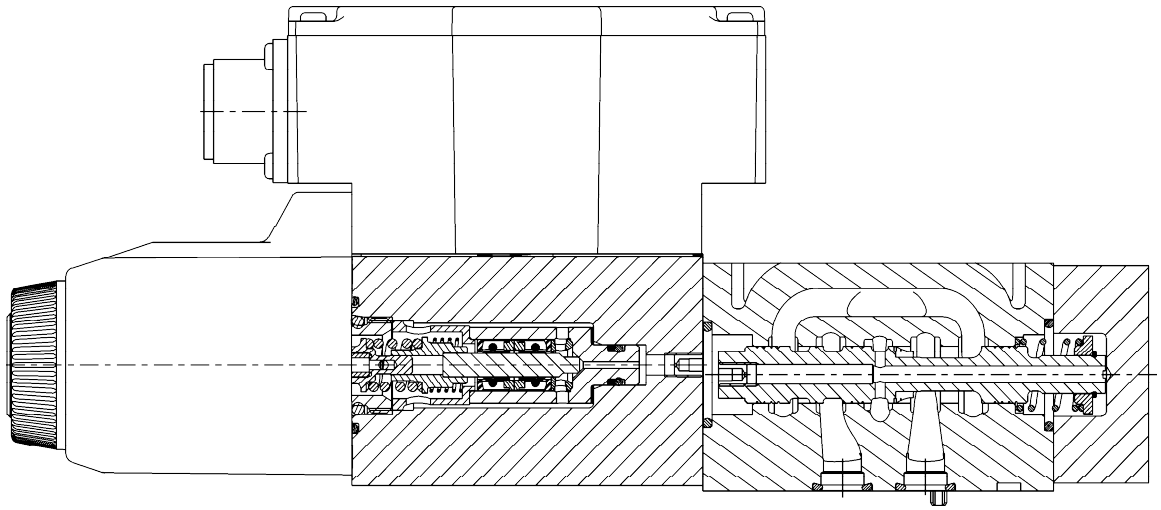
Port A is used for pilot drain flow on external drain models.

External drain models should be selected for applications where a high T port pressure is required (up to 210 bar) or where T port pressure disturbances are present..

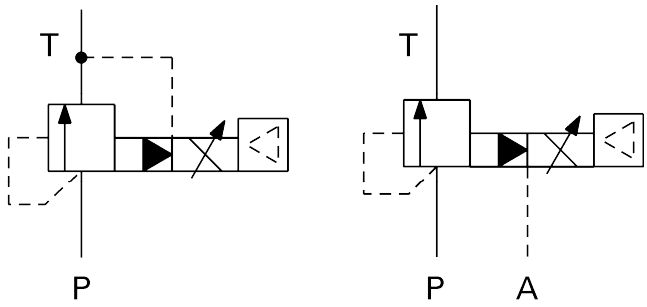
Features and Benefits

- Remote electrical proportional control of pressure from a choice of five pressure ranges.
- Excellent repeatability and stable performance.
- Low installed cost and space requirement from high power/size ratios.
- On-board ramp adjustment.
- Model code selectable ramp times.

Typical Section



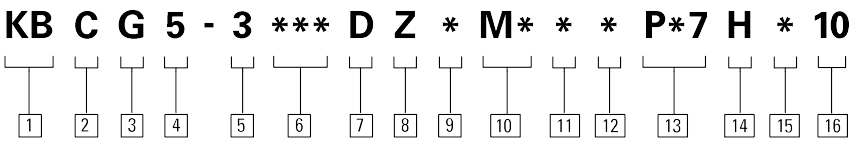
Functional Symbols



Internal Drain

External Drain

Model Code



1 **Valve Type**
KB – Proportional valve with integral amplifier, B series

2 **Control Type**
C – Pressure Relief Valve

3 **Mounting**
G – Subplate mounted

4 **Operation**
5 – Pilot operated

5 **Mounting Interface**
3 – ISO 6264-03-04

6 **Pressure Rating**
40 – 40 bar

100 – 100 bar

160 – 160 bar

250 – 250 bar

350 – 350 bar

7 **Damper**
D – Standard Damper

8 **Manual Override**
Z – No manual override

9 **Drain Option**
T – Internal drain

Blank – External drain

10 **Amplifier Control Signal**
M1 – ±10 V control signal

M2 – 4 to 20 mA control signal

11 **Ramp Option**
4 – Fast ▼

5 – Damped ▲

12 **Amplifier Type**
A – Standard

13 **Electrical Connection**

PC7 – 7 pin connector, without plug supplied

PE7 – 7 pin connector, with plug supplied

PH7 – As PE7 but with pin 'C' used for enable signal

PR7 – As PC7 but with pin 'C' used for enable signal

14 **Coil Identification**
H – 24VDC

15 **T port pressure**
1 – 10 bar. Internal drain (T models)

7 – 210 bar. External drain (non-T models)

16 **Design Number**
1* series. Subject to change

▼ Typically 160 ms for 0-100%/100-0% signal (system dependent)

▲ Typically 420 ms for 0-100%/100-0% signal (system dependent)

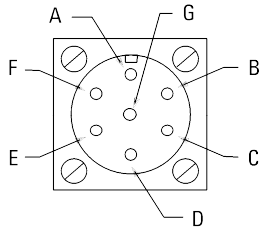
WARNING
Valves with integral amplifiers are supplied with or without the metal 7-pin plug.
The Vickers TM plug, part no. 934939, must be correctly fitted to ensure that EMC and IP67 ratings are achieved.
The plug retaining nut must be tightened with a torque of 2-2,5 Nm (1.5-2.0 lbf ft) to effect a proper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

Operating Data

Standard test conditions are with antiwear hydraulic oil at 36 cSt (168 SUS) and 50°C (122°F)

Maximum pressures:	Internal drain Model code [9] = T	External drain Model code [9] = blank
Port P	350 bar (5000 psi)	350 bar (5000 psi)
Port T	10 bar (145 psi)	210 bar (3000 psi)
Port A*	—	10 bar (145 psi)
*External drain port		
Rated flow at Δp = 5 bar (73 psi): KBCG5V-3	40 L/min (10.6 USgpm)	
Pilot flow	0,4 - 1,0 L/min (0.1 - 0.26 USgpm)	
Coil or amplifier rating	24V x 36W max. (22 to 34V including 10% peak-to-peak max. ripple)	
Command signal:		
Volts (see model code - [10] M1)	0 to +10V or 0 to -10V	
Input impedance	47 kΩ	
Common mode voltage to pin B	4V	
Current (see model code - [10] M2)	4 to 20 mA	
Input impedance	100Ω	
Valve enable signal:		
Enable	>9.0V (36V max)	
Disable	<2.0V	
Input impedance	36 kΩ	

7-pin plug connector



View of pins of fixed half

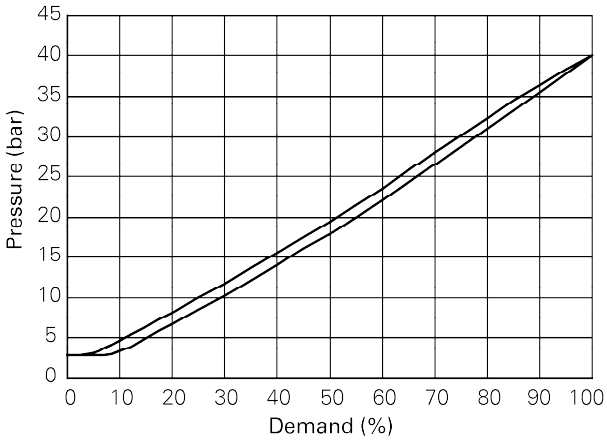
Pin	Description
A	Power supply positive (+)
B	Power supply 0V and current command return
C	Valve enable (PH7 & PR7)
D	Command signal (+V or current in)
E	Command signal (-V or current GND)
F	Output monitor
G	Protective ground

Electromagnetic compatibility (EMC):	
Emission	EN 50081-2
Immunity (10 V/m)	EN 50082-2
Monitor signal (pin F)	1.52 V/amp solenoid current
Output impedance	10 kΩ
Pressure gain Factory setting: maximum with 100% command signal	See graphs
Pressure override when relieving and when off-load	See graphs
Linearity, between 10% and 100% of rated pressure	<5%
Hysteresis	<5% (with factory-set dither)
Repeatability	+/-2% of rated pressure
Reproducibility, valve-to-valve (at factory settings): Pressure at 100% command signal	+/-3% of rated pressure
Protection:	
Electrical	Reverse polarity protected
Environmental	IE C60529, Class IP67
Mass (weight)	3,45 kg (7.61lb)
Mounting attitude	No restriction, provided that the valve is kept full of fluid through port T.

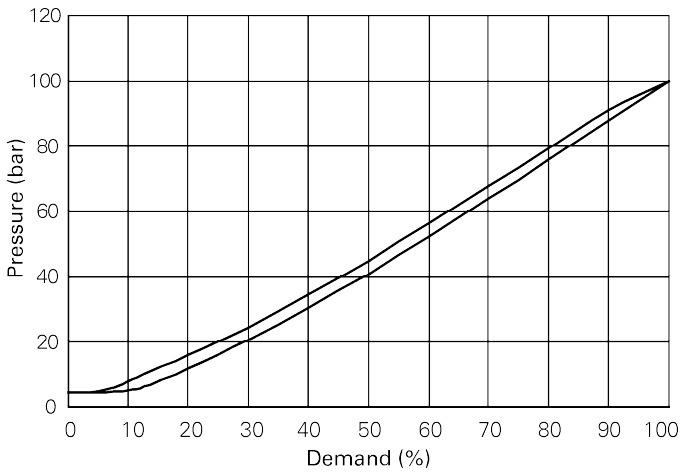
Performance Data

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

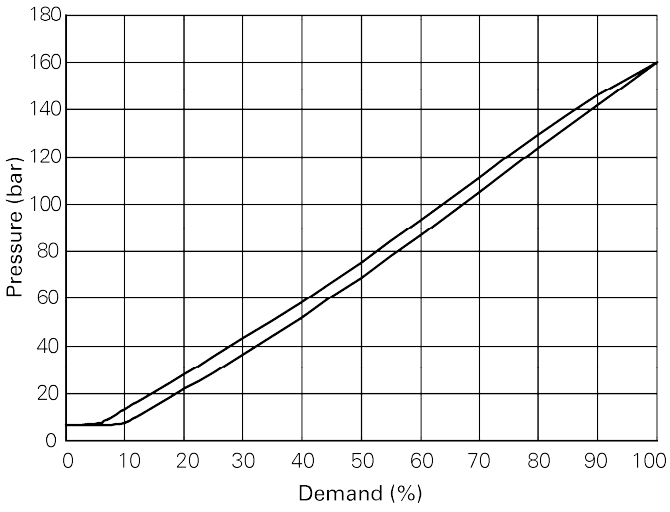
Pressure/Demand characteristic at 4 l/min
40 bar version



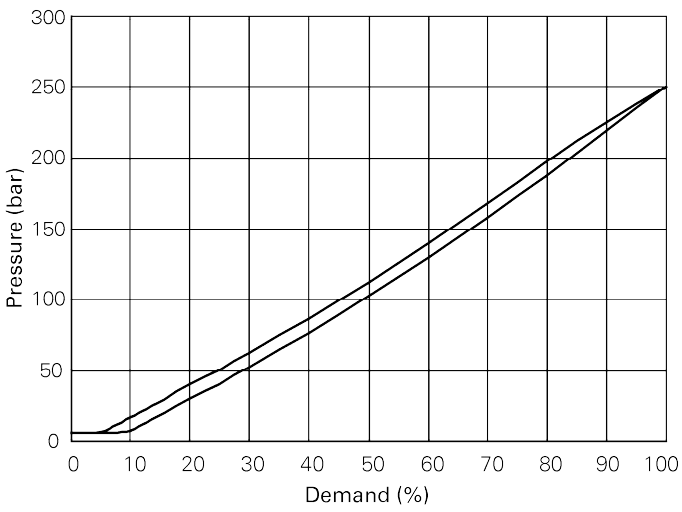
Pressure/Demand characteristic at 4 l/min
100 bar version



Pressure/Demand characteristic at 4 l/min
160 bar version

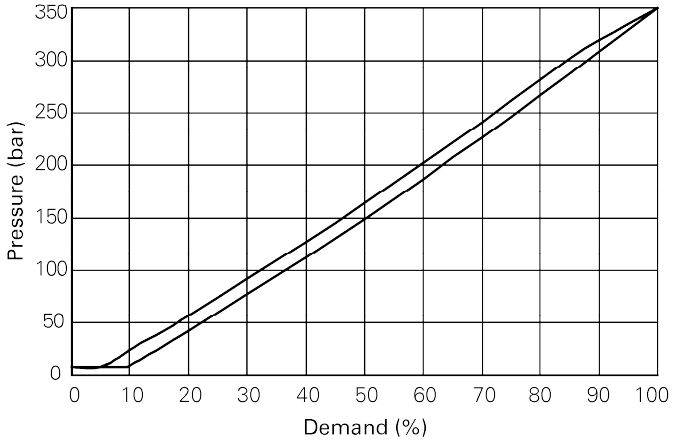


Pressure/Demand characteristic at 4 l/min
250 bar version

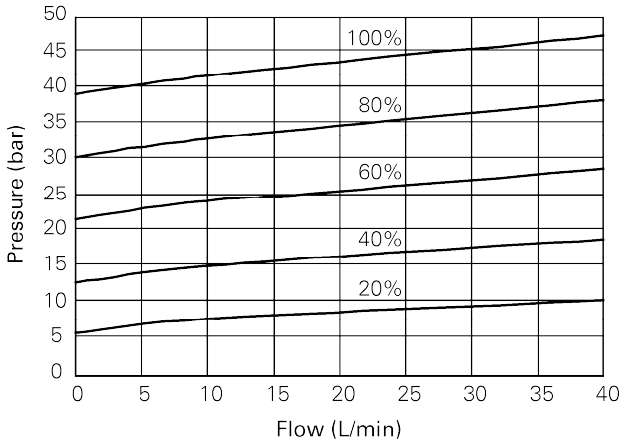


Performance Data

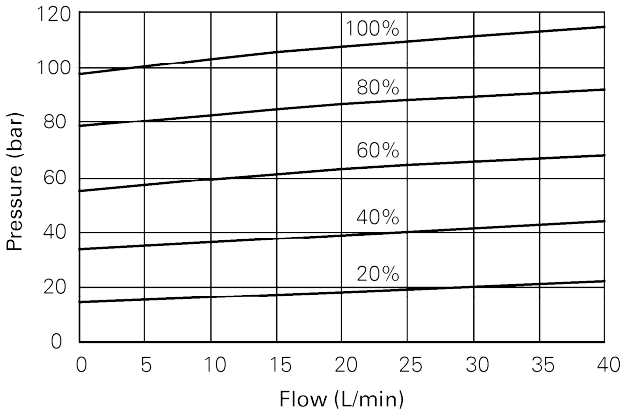
Pressure/Demand characteristic at 4 l/min
350 bar version



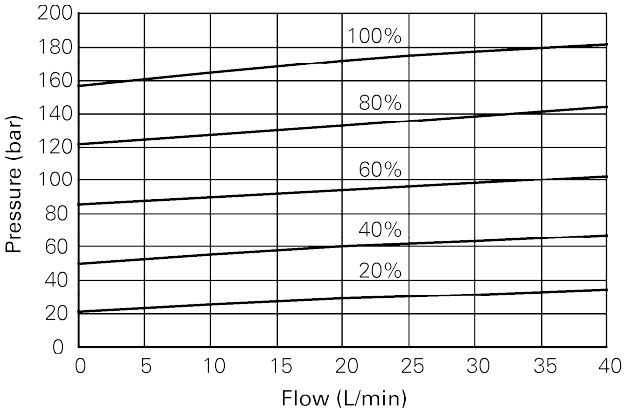
Pressure/Flow characteristic
40 bar version



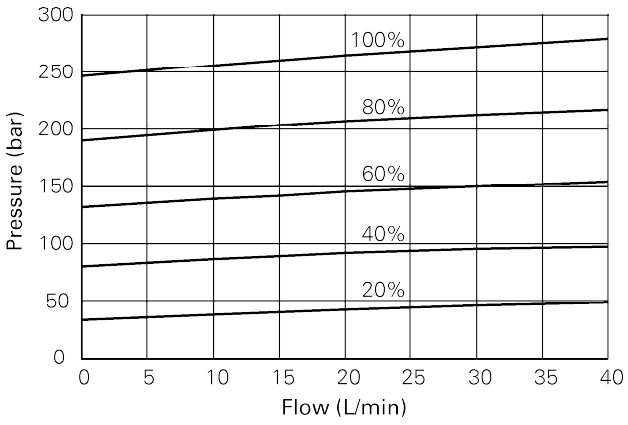
Pressure/Flow characteristic
100 bar version



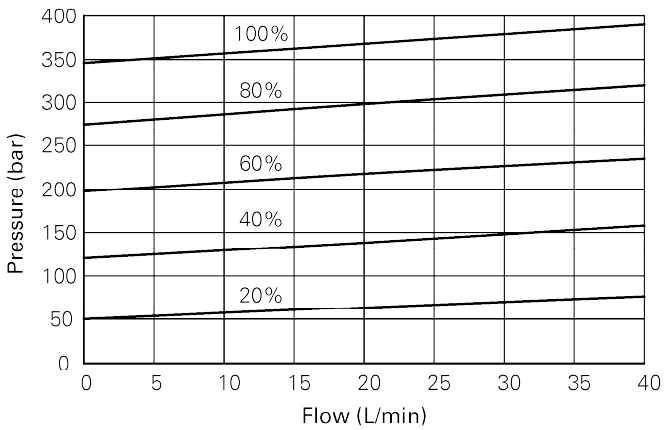
Pressure/Flow characteristic
160 bar version



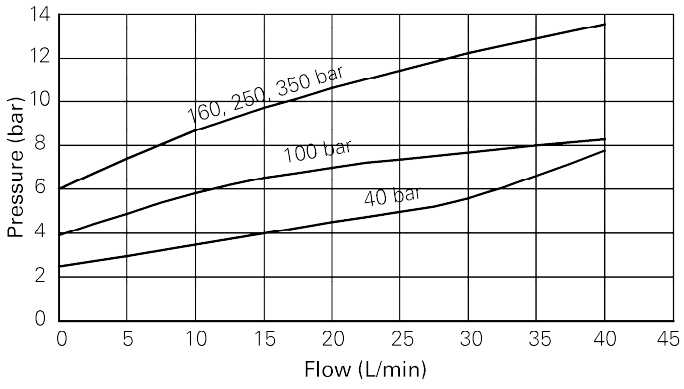
Pressure/Flow characteristic
250 bar version



Pressure/Flow characteristic
350 bar version



Headloss

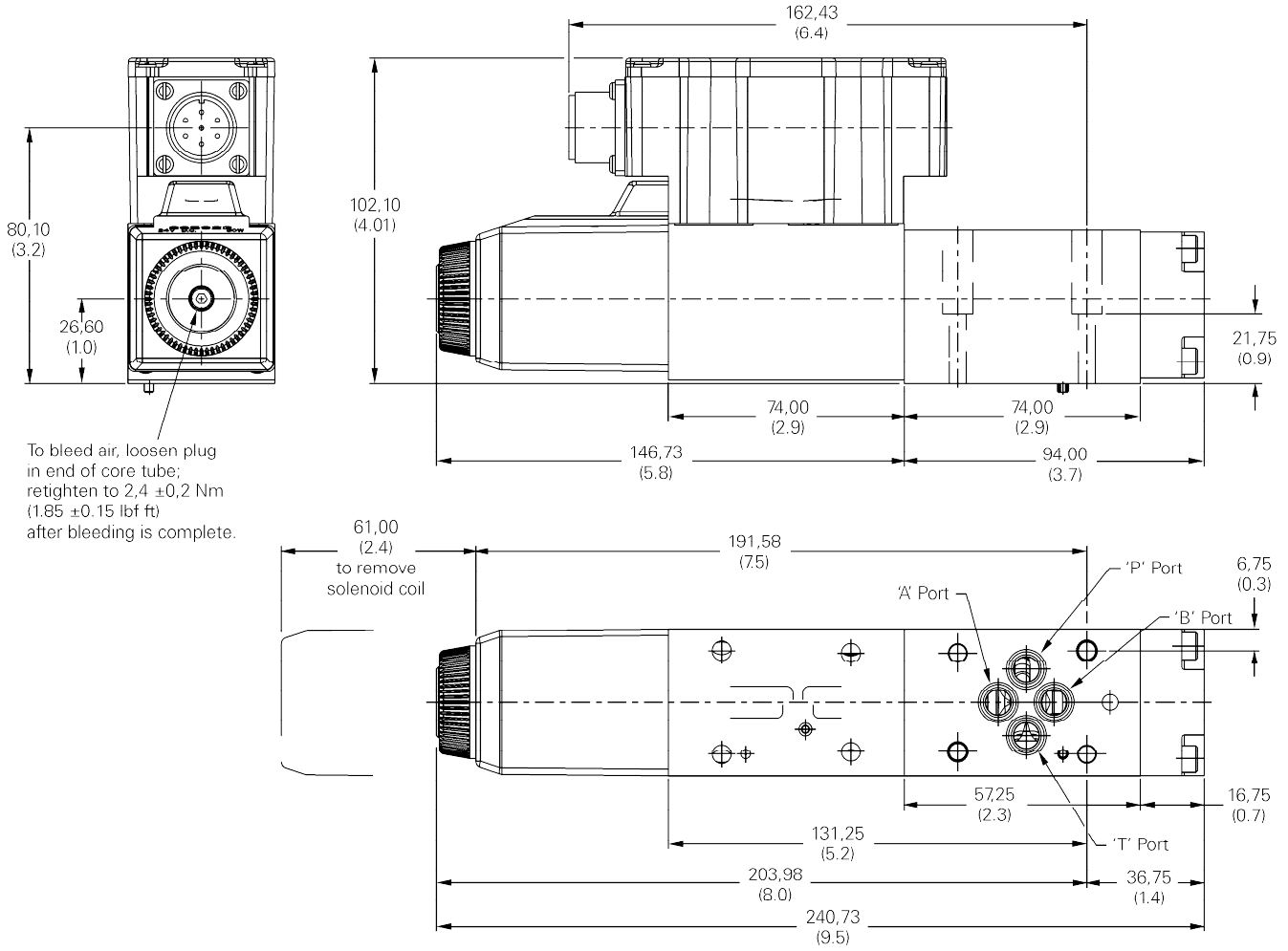


Step Response

The step response data in the attached table should be used as a guideline only as response time in any application will be system dependant.

The response will be significantly influenced by the valve operating flow rate as well as the volume of oil being controlled.

MODEL CODE	STEP SIZE: PRESSURE DEMAND	RESPONSE TIME (ms)
M*-4	0-100%/100-0%	160
	25 - 75%/75-25%	100
	10-90%/90-10%	140
M*-5	0-100%/100-0%	420
	25-75%/75-25%	260
	10-90%/90-10%	360



WARNING

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

Block Diagram

Wiring

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

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:

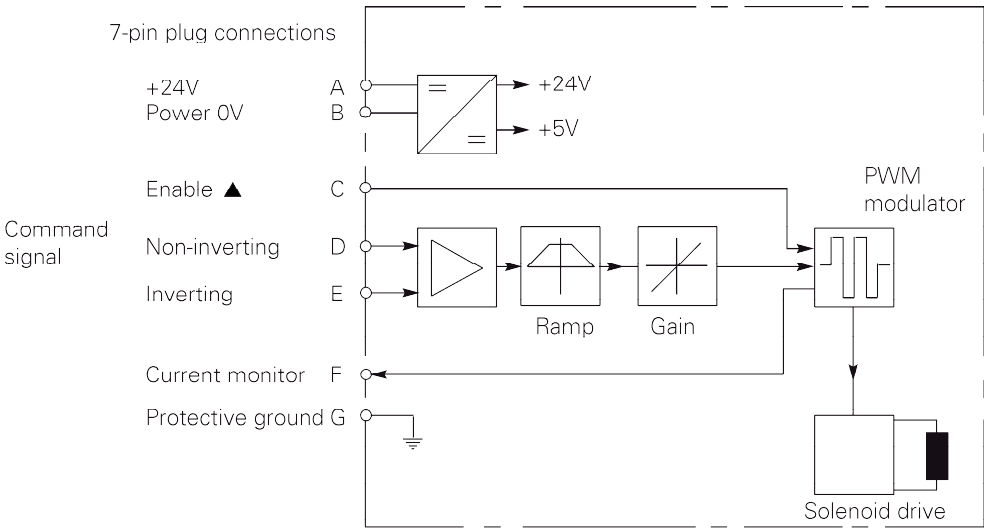
0,50 mm² (20 AWG)

Screen (Shield):

A suitable cable should have at least 6 cores with pairs of conductors individually screened and an overall screen.

Cable outside diameter 8,0-10,5 mm (0.31- 0.41 inches).

See connection diagrams on next page.



▲ In valves with PH7 or PR7 type electrical connection.

WARNING

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

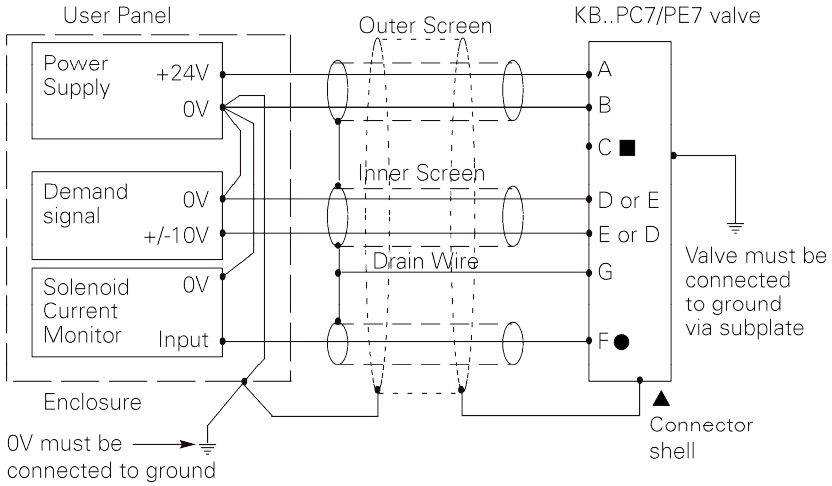
Typical Connection Arrangements

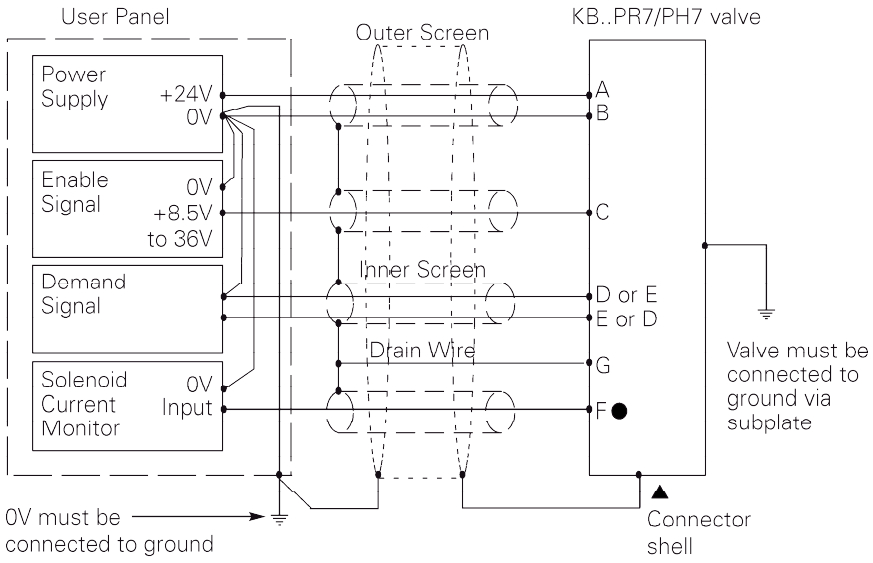
■ Pin C may be connected to ground or left unconnected.

● Output monitor voltage pin F) will be referenced to the power 0 volts (pin B).

▲ 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.

Hydraulic Fluids

Materials and seals used in these valves are compatible with:

Anti-wear petroleum oils .....L-HM

Non-alkyl based phosphate esters .....L-HFD

The extreme operating range is 500 to 13 cSt (270 to 70 SUS) but the recommended running range is 54 to 13 cSt (245 to 70 SUS). For further technical information about fluids see 694.

Contamination Control

Requirements 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:

Up to 210 bar (3000 psi) 18/**16/13**

Above 210 bar (3000 psi) 17/**15/12**

Installation and Start-up Guidelines

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.

If this proves to be the case any accumulated air can be bled from the solenoid bleed screw. This task is easier if the valve has been mounted base downwards. Good installation practice dictates that the tank port, and any drain port, are piped so as to keep the valve full of fluid once the system start-up has been completed.

Temperatures

For petroleum oil:
Min.....-20°C (-4°F)
Max .....+70°C (158°F)

For fluids where limits are outside those of petroleum oil, consult fluid manufacturer or Eaton representative. Whatever the actual temperature range, ensure that viscosities stay within those specified under "Hydraulic Fluids".

Ambient for:
Valves at full performance specification:
-20 to +70°C (-4 to +158°F).

Valves, as above, will operate at temperatures of 0 to -20°C (32 to -4°F) but with a reduced dynamic response.

Storage:
-25 to +85°C (-13 to +185°F)

Seal Kits

6022633-001

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EATON | Vickers

Proportional Pressure Relief Valves

Technical Catalog

KBCG-6-1*
KBCG-8-1*

Contents

General Description	Page 3
Typical Section	Page 3
Functional Symbol	Page 4
Model Codes	Page 5
Operating Data	Page 6
Performance Data	
Pressure Override, Off-Load	Page 8
Pressure Override when Relieving	Page 9
Pressure Gain	Page 9
Step Response	Page 9
Installation Dimensions	
KBCG-6/8 Models	Page 10
Mounting Surfaces	Page 11
CGVM-6-10-R Subplate	Page 11
Electrical Information	
Block Diagram	Page 12
Typical Connection Arrangements	Page 13
Further Information	Page 14

CE *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).*

General Description

These two-stage pressure relief valves offer extensive application possibilities through their ability to control the pressure setting in proportion to an applied electrical input (up to a pressure limit which is manually adjustable and lockable).

The integral amplifier allows the pressure to be controlled from a low power command signal: either a voltage or current command. The amplifier is mounted in a robust metal housing and electrical connections are via an industry standard 7-pin plug. Factory-set adjustments ensure high reproducibility valve-to-valve.

Basic Characteristics

Max. pressure.....350 bar (5000 psi)

Max. flow rate.....400 L/min (106 USgpm)

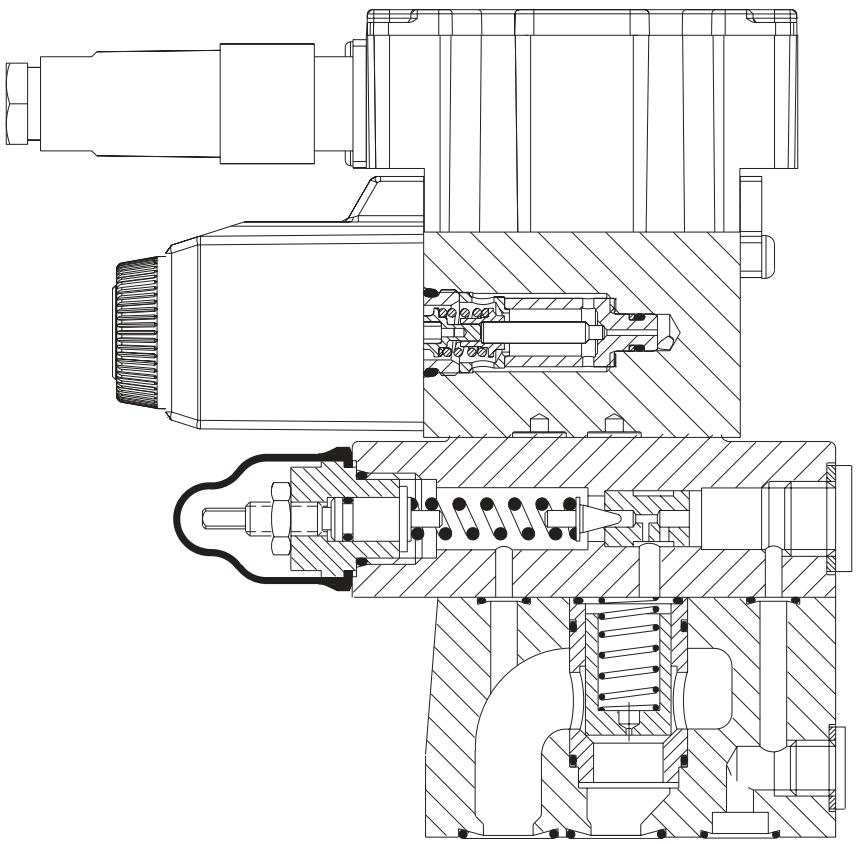
Mounting face to ISO 6264:

For KBCG-6..... AR-06-2-A
For KBCG-8..... AS-08-2-A

Features and Benefits

- Remote electrical proportional control of pressure from a choice of five pressure ranges per valve size.
- Excellent repeatability and stable performance results from cartridge design of mainstage elements.
- Low installed cost and space requirement from high power/size ratios (more than double that of many conventional designs).
- On-board ramp adjustment.

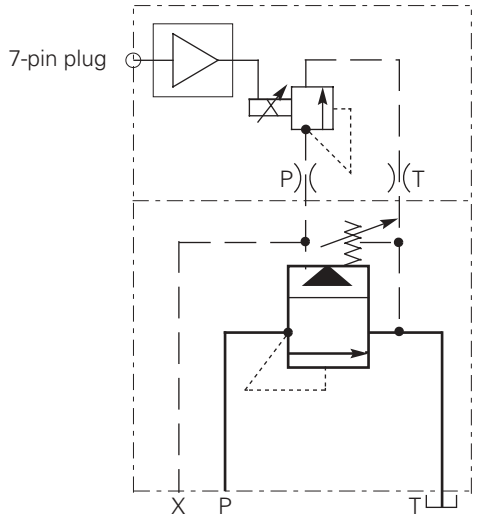
Typical Section



Functional Symbols

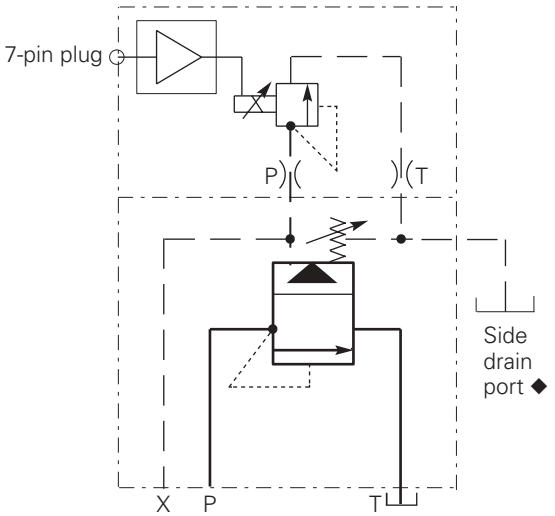
Manual and electrical pilots internally drained to port T.

Model code 7 = Blank



Manual and electrical pilots drained to side drain port ◆.

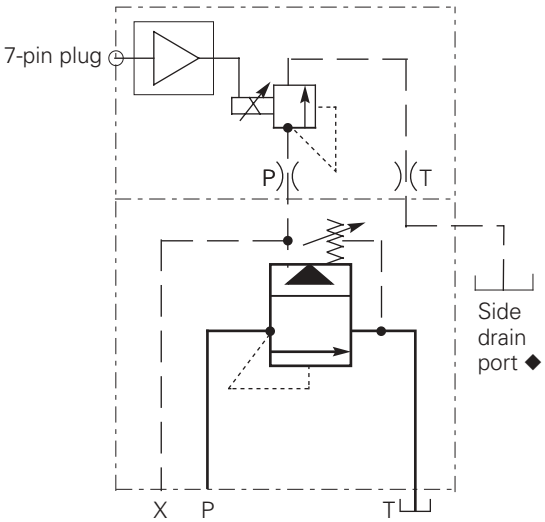
Model code 7 = 1



◆ Tapped port on side of pilot head.

Manual pilot internally drained to port T; electrical pilot drained to side drain port ◆.

Model code 7 = 3



◆ Tapped port on side of pilot head.

Model Codes

KB	*	G	*	*	***	*	ZM	*	3	A	P*7	*	10
1	2	3	4	5	6	7	8	9	10	11	12	13	14

1 Valve Type

KB - Proportional valve with integral amplifier, B series

2 Type

C - Pressure relief

3 Mounting

G - Subplate mounted

4 Interface - ISO 6264

With B port high pressure inlet, A port reduced pressure outlet

6 - AR-06-2-A

8 - AS-08-2-A

5 Manual Adjustment

K - Micrometer with keylock

M - Micrometer without keylock

W - Screw/locknut

6 Controlled Pressure Range

Based on inlet pressure of 350 bar (5000 psi).

Note, with 100 bar (1450 psi) inlet the lower limits will be 2-3 bar (30-43 psi) lower

40 - 6-40 bar (87-580 psi)

100 - 7,75-100 bar (112-1450 psi)

160 - 8,5-160 bar (125-2300 psi)

250 - 8,5-250 bar (125-3625 psi)

350 - 9-350 bar (139-5000 psi)

7 Drain

Blank - Manual and electrical pilots drain internally to T port

1 - Manual and electrical pilots drained to side port drain

3 - Manual pilot internally drained to T port, electrical pilot drained to side port drain

8 Standard Features

ZM - for KBC

9 Electrical Command Options

1 - +/- 10 volts control signal

2 - 4-20 mA control signal

10 Ramps

3 - Standard ramp for KBCG-6/8 valve types

11 Command/Pressure Characteristic

A - Standard

12 Electrical Connection

PC7 - 7 pin connector, without plug supplied

PE7 - 7 pin connector, with plug supplied

PH7 - As PE7 but with pin 'C' used for enable signal

PR7 - as PC7 but with pin 'C' used for enable signal

13 Coil Rating

H1 - 24V DC amplifier supply

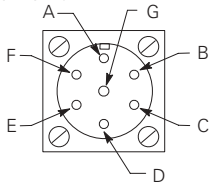
14 Design Number, 1* Series

Subject to change. Installation dimensions unaltered for design numbers 10 to 19 inclusive.

Warning

To conform to the EC Electromagnetic Compatibility directive (EMC) this KBCG valve must be fitted with a metal 7-pin plug. The screen of the cable must be securely connected to the shell of the metal connector. A suitable IP67 rated connector is available from Eaton, part no. 934939. Alternatively a non IP67 rated connector is available from ITT-Cannon, part no. CA 02 COM-E 14S A7 P.

Operating Data

Standard test conditions are with antiwear hydraulic oil at 36 cSt (168 SUS) and 50°C (122°F)	
Maximum pressures:	
Ports P and X▲	350 bar (5000 psi)
Port T▲ in KBCG-*-****-Z valves	2 bar (30 psi)
Port T▲ in KBCG-*-****-1/3-Z valves	350 bar (5000 psi)
Side drain port▲	2 bar (30 psi)
▲ Back pressure at these ports additive to the pressure setting of the valve.	
Rated flow at Δp = 6 bar (87 psi):	
KBCG-6	200 L/min (52.8 USgpm)
KBCG-8	400 L/min (105.7 USgpm)
Vent ◆ flow with valve at rated flow ◆ See "Venting", page 8.	1 L/min (0.26 USgpm)
Pilot control drain flow, when valve is limiting system pressure, i.e. flow P to T occurring:	
KBCG-6	1,3 L/min (0.34 USgpm)
KBCG-8	2,0 L/min (0.53 USgpm)
Coil or amplifier rating	24V x 40W max. (22 to 36V including 10% pk.-to-pk. max. ripple)
Command signal:	
Volts (see model code 9 - 1)	0 to +10V or 0 to -10V
Input impedance	47 kΩ
Common mode voltage to pin B	4V
Current (see model code 9 - 2)	4 to 20 mA
Input impedance	100Ω
Valve enable signal:	
Enable	>9.0V (36V max)
Disable	<2.0V
Input impedance	36 kΩ
7-pin plug connector  View of pins of fixed half	Pin Description A Power supply positive (+) B Power supply 0V and current command return C Valve enable (PH7 & PR7) D Command signal (+V or current in) E Command signal (-V or current GND) F Output monitor G Protective ground
Electromagnetic compatibility (EMC):	
Emission (10 V/m)	EN 50081-2
Immunity (10 V/m)	EN 50082-2
Monitor signal (pin F)	1.7 V/amp solenoid current
Output impedance	10 kΩ
Pressure gain Factory setting - Maximum with 100% command signal.	See graph
Pressure override when relieving and when off-load	See graphs
Linearity, between 10% and 100% of rated pressure:	
KBCG-6 models at 100 L/min (26 USgpm)	<6%
KBCG-8 models at 200 L/min (52 USgpm)	<6%
Hysteresis	<6% (with factory-set dither)
Repeatability	<1.3% of rated pressure

Operating Data (continued)

Reproducibility, valve-to-valve (at factory settings):	
Pressure at 100% command signal	≤5%
Protection:	
Electrical	Reverse polarity protected
Environmental	IEC 529, Class IP67
Mass (weight):	
KBCG-6	5,36 kg (11.8 lb)
KBCG-8	6,26 kg (13.8 lb)
Supporting products:	
Auxiliary electronic modules (DIN-rail mounting):	
EHA-CON-201-A-2* Signal converter	See catalog 2410B
EHD-DSG-201-A-1* Command signal generator	See catalog 2470
EHA-RMP-201-A-2* Ramp generator	See catalog 2410B
EHA-PID-201-A-2* PID controller	See catalog 2427
EHA-PSU-201-A-10 Power supply	See catalog 2410B
Subplates, size 03	See catalog 2425
Mounting bolts ■	See catalog 2314A
■ Note: If not using Vickers™ recommended bolt kits, bolts must be to ISO 898 grade 12.9 or stronger.	
Mounting attitude	No restriction, provided that the valve is kept full of fluid through port T.

Performance Data

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

Pressure Override, Off-Load

Graphs show the minimum pressures obtainable:

a) With 0 mA current to the solenoid coil

b) When the valve is vented (see following explanation).

Venting

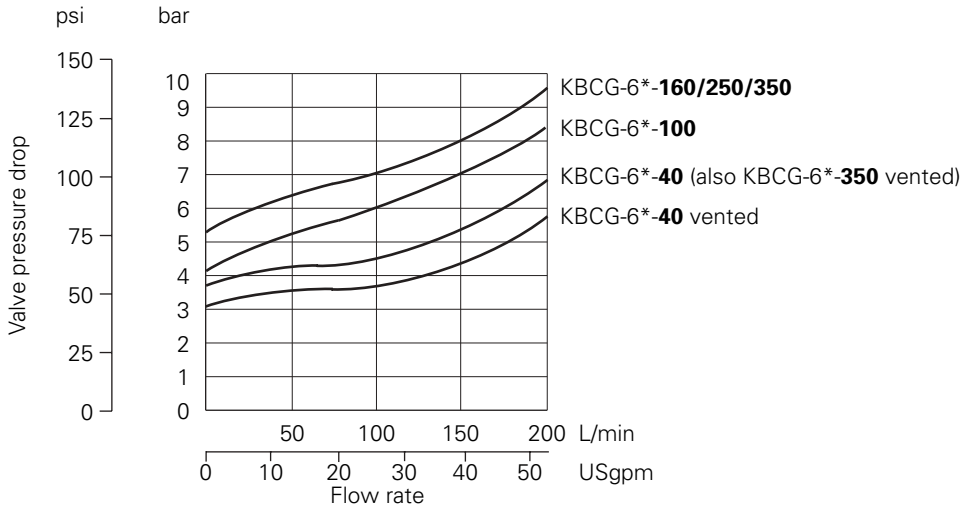
When the vent port X (or alternative vent port in the valve body) is connected to the reservoir via a suitable 2-way pilot valve, the mainstage of the relief valve opens to allow full flow from P to T at low pressure drop. The minimum pressure drop is obtained when the pilot valve is also de-energized. The total pressure drop through the venting 2-way valve and pipework is additive to the pressure at P.

While the valve is vented the system pressure cannot be controlled via the proportional solenoid.

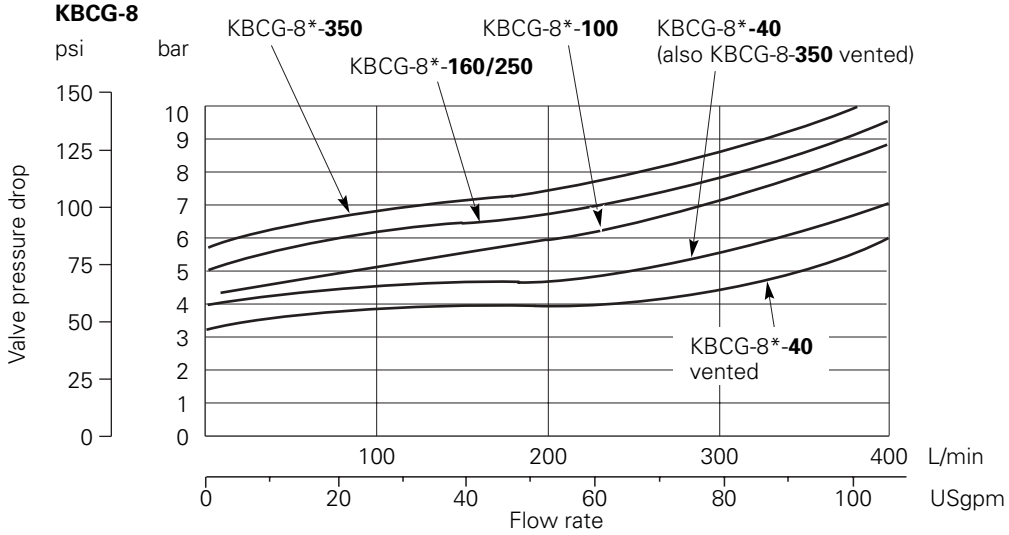
This control feature is frequently used during off-load periods in machine cycle times. If lower off-load system pressures are required then additional full flow unloading valves are recommended, e.g. Vickers™ CV series cartridge valves.

Note: All valves are with pilot valve de-energized.

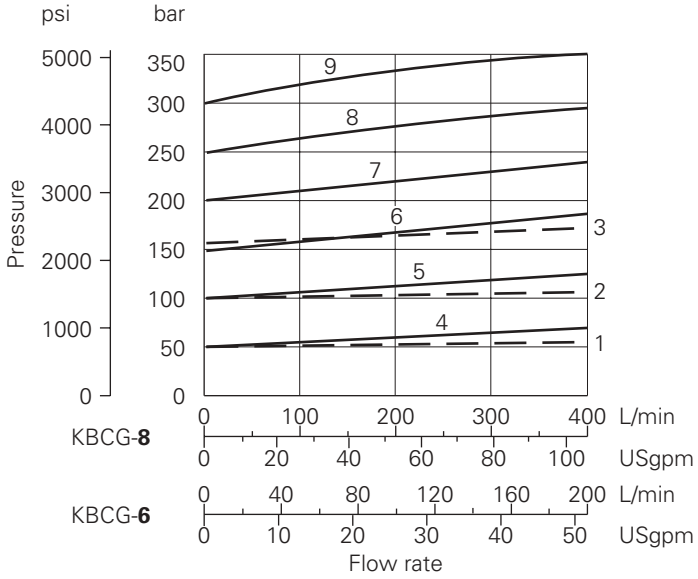
KBCG-6



KBCG-8



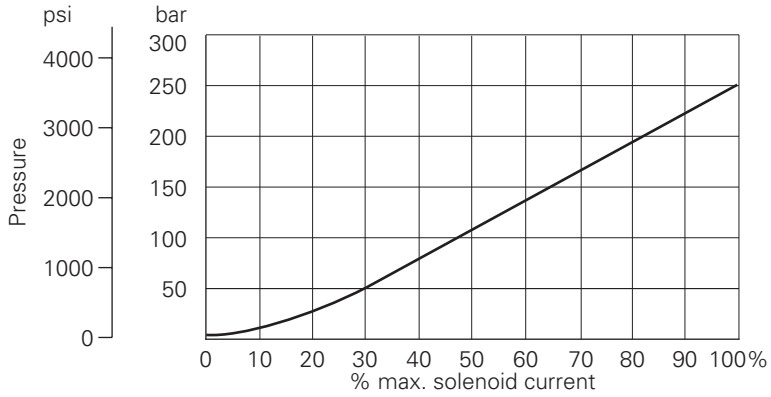
Pressure Override when Relieving



MODEL	CURVE NUMBER								
	1	2	3	4	5	6	7	8	9
KBCG-**-40	•								
KBCG-**-100	•	•							
KBCG-**-160	•	•	•						
KBCG-**-250				•	•	•	•	•	•
KBCG-**-350				•	•	•	•	•	•

Pressure Gain

Typical pressure versus command signal response of KBCG-6-250 model.



Step Response

KBCG models with factory-set gain.

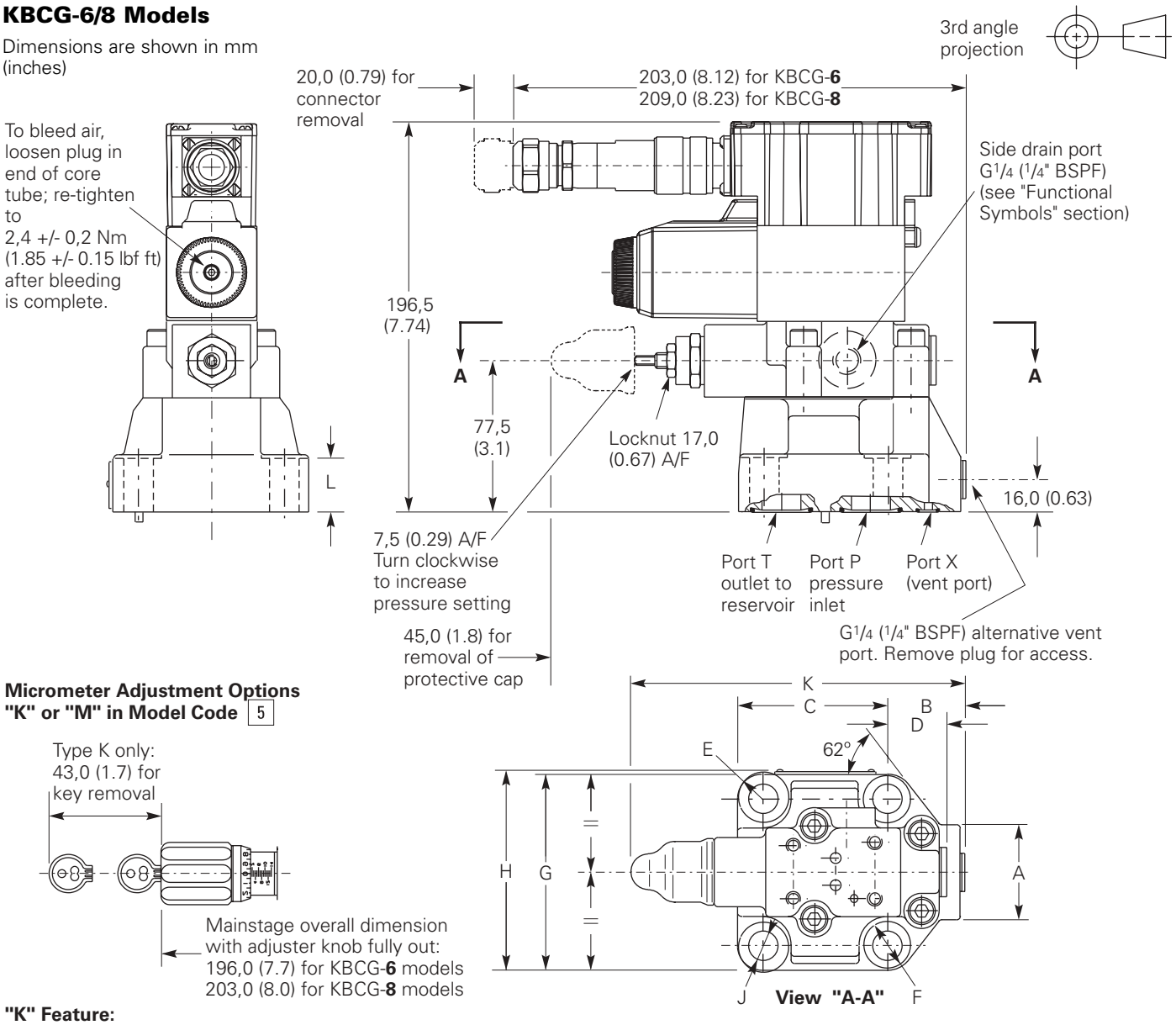
Test method

1. Trapped volume between pump and test valve, as in table.
2. Flow rate set at pump, as in table.
3. Response = time from step input signal until pressure reaches 90% of step change, as measured by transducer.

VALVE SIZE	TEST CONDITIONS: TRAPPED VOLUME	FLOW RATE	STEP SIZE: PRESSURE DEMAND	RESPONSE TIME (ms)
6	2,0 liters	100 L/min	0 to 100%	100
	(0.53 USg)	(26 USgpm)	100% to 0	70
			25 to 100%	40
			100 to 25%	50
8	4,0 liters	200 L/min	0 to 100%	110
	(1.06 USg)	(52 USgpm)	100% to 0	70
			25 to 100%	50
			100 to 25%	65

KBCG-6/8 Models

Dimensions are shown in mm (inches)



Micrometer Adjustment Options "K" or "M" in Model Code 5

"K" Feature:
To adjust pressure setting, insert key and turn clockwise. Turn micrometer knob clockwise to increase pressure setting; counter-clockwise to decrease setting. When the key is removed the knob can spin freely without affecting the pressure setting.

Warning

To conform to the EC Electromagnetic Compatibility directive (EMC) this KBCG valve must be fitted with a metal 7-pin plug. The screen of the cable must be securely connected to the shell of the metal connector. A suitable IP67 rated connector is available from Eaton, part no. 934939. Alternatively a non IP67 rated connector is available from ITT-Cannon, part no. CA 02 COM-E 14S A7 P.

MODEL	A	B	C	D	E RAD	ØF (DIA)
KBCG-6	58,0 (2.3)	35,0 (1.4)	68,0 (2.7)	35,0 (1.4)	12,0 (0.5)	20,0 (0.78)
KBCG-8	42,0 (1.7)	39,0 (1.54)	83,0 (3.3)	30,0 (1.2)	16,0 (0.63)	26,0 (1.02)

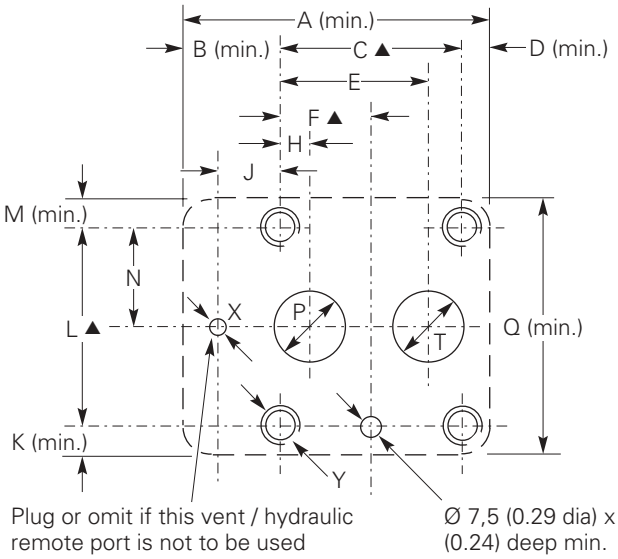
MODEL	G	H	ØJ (DIA)	K	L
KBCG-6	79,0 (3.1)	82,0 (3.23)	13,5 (0.53)	176,0 (7.0)	20,0 (0.78)
KBCG-8	103,0 (4.1)	106,0 (4.2)	17,0 (0.7)	183,0 (7.2)	25,0 (1.0)

Mounting Surfaces, ISO 6264

AR-06-2-A
AS-08-2-A

When a subplate is not used, a raised pad must be provided for mounting. The pad must be flat within 0,001 mm/100 mm (0.0001"/10") and smooth within 0,8 µm (32 µin). Dimensional tolerances are ±0,2 mm (±0.008") except where indicated.

Port functions:
P = Pressure inlet
T = Outlet to reservoir
X = Vent, or remote control port



SIZE	A	B	C	D	E	F	H	J	K	L
AR-06	80 (3.2)	13,1 (0.5)	53,8 (2.12)	13,1 (0.5)	47,5◆ (1.87)	22,1 (0.87)	22,1◆ (0.87)	0	13,1 (0.5)	53,8 (2.12)
AS-08	118 (4.7)	35,0 (1.4)	66,7 (2.63)	16,3 (0.7)	55,6 (2.19)	33,4 (1.35)	11,1 (0.44)	23,8 (0.94)	16,0 (0.63)	70,0 (2.76)

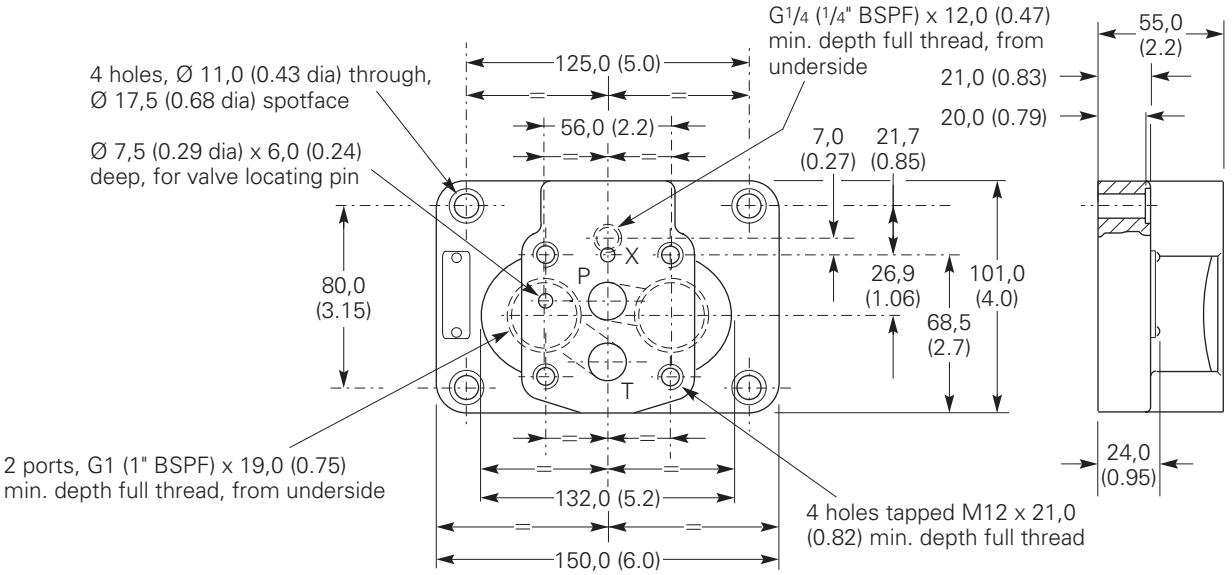
SIZE	M	N	ØP (DIA)	Q	ØT (DIA)	ØX (DIA)	Y THREAD x MIN. FULL THREAD DEPTH
AR-06	13,1 (0.5)	26,9 (1.06)	14,7 (0.58)	80 (3.2)	14,7 (0.58	4,8 (0.19)	M12 x 21 (7/16" UNF x 0.83) ●
AS-08	16,0 (0.63)	35,0 (1.38)	23,4 (0.92)	102 (4.0)	23,4 (0.92)	6,3 (0.25)	M16 x 30 (5/8" UNF x 1.2) ●

▲ Tolerance on bolt and pin locations ±0,1 mm (±0.004").

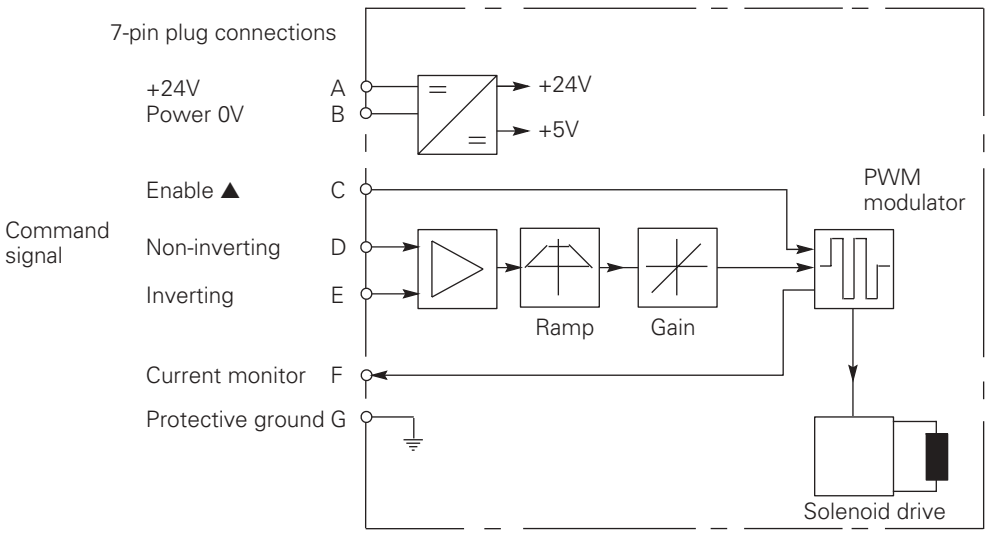
◆ These ISO standard dimensions can be used, but improved flow paths to and from valve are obtained by using 48,0 (1.89) instead of 47,5 (1.87), and 22,6 (0.89) instead of 22,1 (0.87).

● ISO standard does not give UNC bolt sizes. These are recommended equivalents to metric sizes specified in the standard.

CGVM-6-10-R Subplate



Block Diagram



▲ In valves with PH7 or PR7 type electrical connection.

Wiring

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

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)

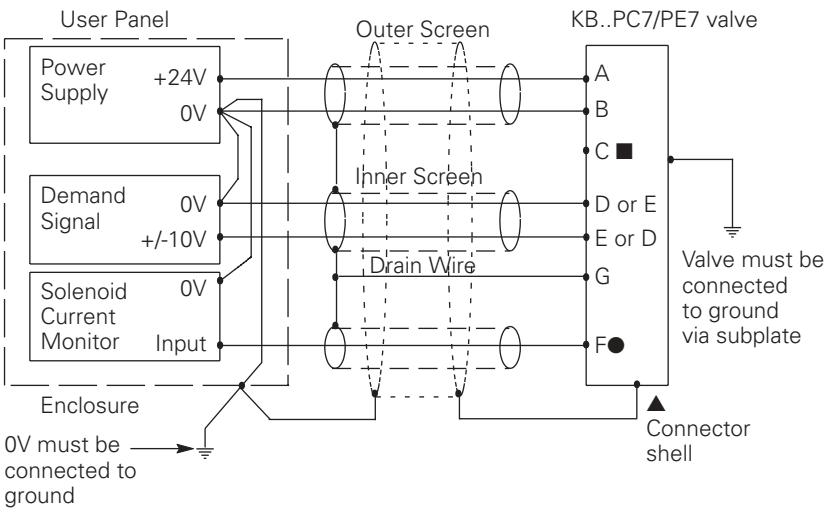
Screen (Shield)

A suitable cable should have at least 6 cores with pairs of conductors individually screened and an overall screen. Cable outside diameter 8,0-10,5 mm (0.31- 0.41 inches). See connection diagrams on next page.

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

Typical Connection Arrangements

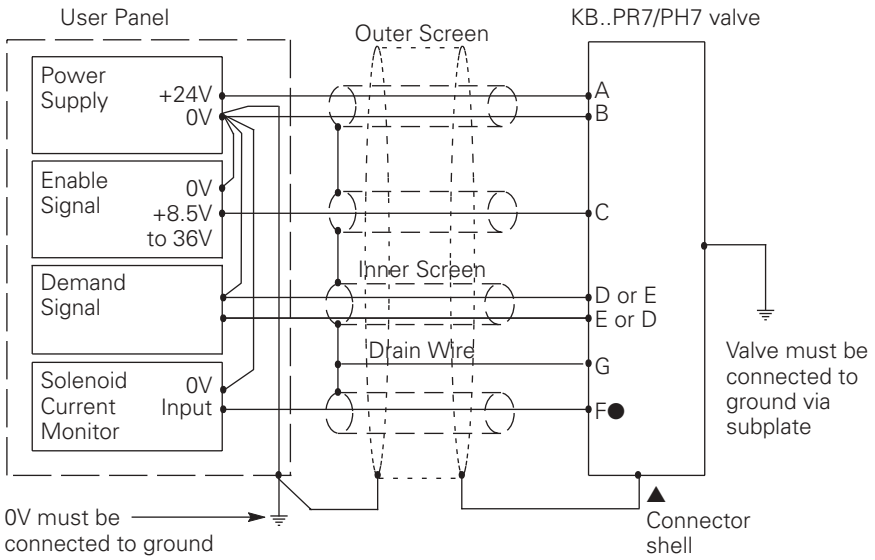
Wiring Connections



■ Pin C may be connected to ground or left unconnected.

● Output monitor voltage (pin F) will be referenced to the power 0 volts (pin B).

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.

Further Information

Hydraulic Fluids

Materials and seals used in these valves are compatible with:
Anti-wear petroleum oils...L-HM
Non-alkyl based phosphate esters.....L-HFD

The extreme operating range is 500 to 13 cSt (270 to 70 SUS) but the recommended running range is 54 to 13 cSt (245 to 70 SUS). For further technical information about fluids see 694.

Contamination Control Requirements

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:
Up to 210 bar (3000 psi).....18/**16/13**
Above 210 bar (3000 psi).....17/**15/12**

Installation and Start-up Guidelines

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.

If this proves to be the case any accumulated air can be bled from the solenoid bleed screw. This task is easier if the valve has been mounted base downwards. Good installation practice dictates that the tank port, and any drain port, are piped so as to keep the valve full of fluid once the system start-up has been completed.

Temperatures

For petroleum oil:
Min.....-20°C (-45°F)
Max.....+70°C (158°F)

For fluids where limits are outside those of petroleum oil, consult fluid manufacturer or Eaton representative. Whatever the actual temperature range, ensure that viscosities stay within those specified under "Hydraulic Fluids".

Ambient for:
Valves at full performance specification: -20 to +70°C (-4 to +158°F).

Valves, as above, will operate at temperatures of 0 to -20°C (32 to -4°F) but with a reduced dynamic response.

Storage:
-25 to +85°C (-13 to +185°F)

Seal Kits

Pilot valve:
KBCG-3.....02-352521
Mainstage valves:
KBCG-6.....614824
KBCG-8.....614931

Eaton
14615 Lone Oak Road
Eden Prairie, MN 55344-2287
USA
Tel: (+1) 952 937-9800
Fax: (+1) 952 974-7722
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Proportional Pressure Reducing Valves

Technical Catalog

KBX(C)G-6-1*
KBX(C)G-8-1*

Contents

General Description Page 3
Typical Section Page 3
Functional Symbols Page 4
Model Codes Page 5
Operating Data Page 6
Performance Data
Pressure Underride Page 8
Pressure Drop Page 8
Pressure Gain Page 9
Step Response Page 9
Installation Dimensions
KBX(C)G-6/8 Models Page 10
Mounting Surfaces Page 11
XCGVM-6-10R Subplate Page 11
Electrical Information
Block Diagram Page 12
Typical Connection Arrangements Page 13
Further Information Page 14

CE *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).*

General Description

These two-stage pressure reducing valves incorporate an electro-hydraulic proportional pressure pilot stage by which the reduced pressure setting is adjustable in response to an electrical input. Each model is available in two sizes, with optional free reverse flow check valve.

Basic Characteristics

Max.
inlet pressure.....350 bar
(5000 psi)
Max.
reduced pressure.....330 bar
(4750 psi)
Max. flow rate.....300 L/min
(80 USgpm)
Mounting face to ISO 5781
(B port high pressure inlet):
For KBX(C)G-6.....AG-06-2-A
For KBX(C)G-8.....AH-08-2-A

Design Features

A maximum outlet pressure to suit the application requirements is preset by the manual adjustment. Below this maximum setting, the outlet pressure is controlled by the solenoid operated proportional pilot valve, according to the electrical command signal applied to the amplifier.

The "normally open" condition of the mainstage allows full flow from inlet to outlet port until the required reduced pressure is reached, whereupon the mainstage closes, or reduces the flow sufficient only to maintain the required outlet pressure.

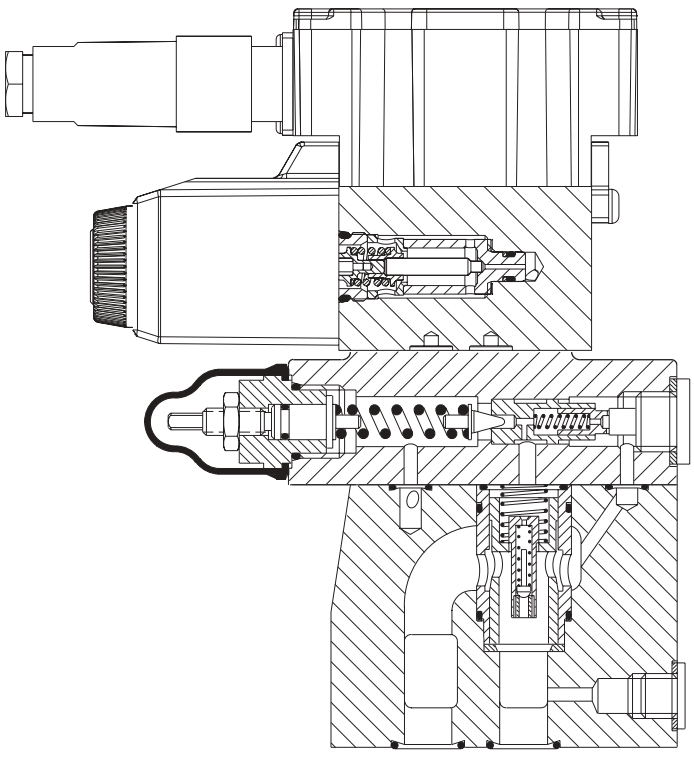
High valve response ensures that the reduced outlet pressure is unaffected by inlet pressure peaks. Excess build-up of outlet pressure (during long holding periods, or flow back from an actuator reacting to an overload) is prevented by the small check valve in the mainstage spool, allowing fluid to bleed-off across the pilot stage.

The integral amplifier allows the pressure to be controlled from a voltage or current signal range. The amplifier is mounted in a robust metal housing and electrical connections are via an industry standard 7-pin plug. Factory-set adjustments ensure high reproducibility valve -to-valve.

Features and Benefits

- Remote electrical proportional control of reduced pressure from a choice of five pressure ranges per valve size.
- Excellent repeatability and stable performance results from cartridge design of mainstage parts.
- Low installed cost and space requirement from high power/size ratios.
- On-board ramp.

Typical Section



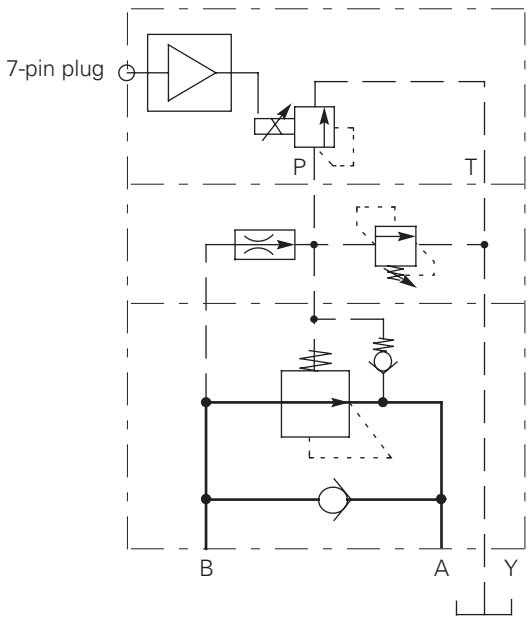
Functional Symbols

Manual and Electrical Pilots Drained to Port Y:

Model code 8 = Blank

Symbol for KBXCG.

For KBXG models omit check and internal connection A-B.

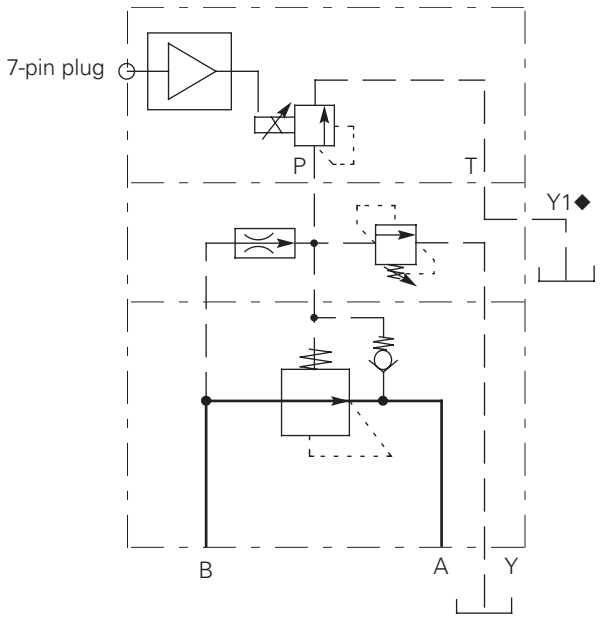


Manual Pilot Drained to Port Y; Electrical Pilot Drained to Port Y1◆:

Model code 8 = 3

Symbol for KBXG.

For KBXCG models add check valve symbol and internal connection A-B.



Model Codes

KB	*	*	G	*	*	***	*	ZM	*	3	A	P*7	*	10
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

1 Valve Type

KB - Proportional valve with integral amplifier, B series

2 Type

X - Pressure reducer

3 Reverse Flow Check Option

Blank - Omit

C - Reverse flow check

4 Mounting

G - Subplate mounted

5 Interface - ISO 5781

With B port high pressure inlet, A port reduced pressure outlet

6 - AG-06-2-A

8 - AH-08-2-A

6 Manual Adjustment

K - Micrometer with keylock

M - Micrometer without keylock

W - Screw/locknut

7 Reduced Pressure Adjustment

Based on inlet pressure of 350 bar (5000 psi).

Note, with 100 bar (1450 psi) inlet the lower limits will be 2-3 bar (30-43 psi) lower

40 - 10-40 bar (145-580 psi)

100 - 12-100 bar (175-1450 psi)

160 - 14-160 bar (200-2300 psi)

250 - 15-250 bar (220-3625 psi)

330 - 15-330 bar (220-4750 psi)

8 Drain

Blank - Manual and electrical pilots drain to Y port

3 - Manual pilot drained to Y port, electrical pilot drained to Y1 port

9 Standard Features

ZM - for KBX

10 Electrical Command Options

1 - +/- 10 volts control signal

2 - 4-20 mA control signal

11 Ramp

3 - Standard ramp for KBX(C)G 6/8 valve types

12 Command/Pressure Characteristic

A - Standard

13 Electrical Connection

PC7 - 7 pin connector, without plug supplied

PE7 - 7 pin connector, with plug supplied

PH7 - As PE7 but with pin 'C' used for enable signal

PR7 - as PC7 but with pin 'C' used for enable signal

14 Coil Rating

H1 - 24V DC amplifier supply

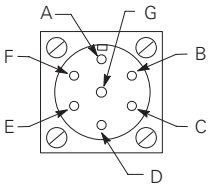
15 Design Number, 1* Series

Subject to change. Installation dimensions unaltered for design numbers 10 to 19 inclusive.

Warning

To conform to the EC Electromagnetic Compatibility directive (EMC) this KBCG valve must be fitted with a metal 7-pin plug. The screen of the cable must be securely connected to the shell of the metal connector. A suitable IP67 rated connector is available from Eaton, part no. 934939. Alternatively a non IP67 rated connector is available from ITT-Cannon, part no. CA 02 COM-E 14S A7 P.

Operating Data

Standard test conditions are with antiwear hydraulic oil at 36 cSt (168 SUS) and 50°C (122°F)	
Maximum pressures:	
Port B (pressure inlet)	350 bar (5000 psi)
Port A (reduced pressure outlet)	See [7] in "Model Code"
Port Y▲ and side drain port Y1▲	2 bar (30 psi)
▲ Back pressure at these ports is additive to the reduced pressure setting of the valve.	
Rated flow at Δp = 12 bar (175 psi) and 0 mA to coil:	
KBX(C)G-6	200 L/min (53 USgpm)
KBX(C)G-8	300 L/min (80 USgpm)
Pressure adjustment ranges	See [7] in "Model Code"
Minimum pressure differential (P_B-P_A) for effective reduced pressure control, all models	20 bar (300 psi)
Pilot control drain flow, all models	1,5 L/min (0.4 USgpm) max.
Coil or amplifier rating	24V x 40W max. (22 to 36V including 10% pk.-to-pk. max. ripple)
Command signal:	
Volts (see model code [10] - 1)	0 to +10V or 0 to -10V
Input impedance	47 kΩ
Common mode voltage to pin B	4V
Current (see model code [10] - 2)	4 to 20 mA
Input impedance	100Ω
7-pin plug connector  View of pins of fixed half	Pin Description A Power supply positive (+) B Power supply 0V and current command return C Valve enable (PH7 & PR7) D Command signal (+V or current in) E Command signal (-V or current GND) F Output monitor G Protective ground
Electromagnetic compatibility (EMC):	
Emission (10 V/m)	EN 50081-2
Immunity (10 V/m)	EN 50082-2
Monitor signal (pin F)	1.7 V/amp solenoid current
Output impedance	10 kΩ
Pressure gain Factory setting - Maximum with 100% command signal.	See graph
Pressure underride	See graph
Hysteresis, using Vickers™ drive amplifier	<7%
Linearity at conditions: 1. "Dead-head" (no flow from reduced pressure outlet port) 2. Between 10% and 100% rated pressure	<6% of rated pressure
Repeatability	<±1.3% of rated pressure
Protection:	
Electrical	Reverse polarity protected
Environmental	IEC 529, Class IP67

Operating Data (continued)

Mass (weight):	
KBXG-6	5,36 kg (11.8 lb)
KBXCG-6	5,36 kg (11.8 lb)
KBXG-8	6,26 kg (13.8 lb)
KBXCG-8	6,26 kg (13.8 lb)
Supporting products:	
Auxiliary electronic modules (DIN-rail mounting):	
EHA-CON-201-A-2* Signal converter	See catalog 2410B
EHD-DSG-201-A-1* Command signal generator	See catalog 2470
EHA-RMP-201-A-2* Ramp generator	See catalog 2410B
EHA-PID-201-A-2* PID controller	See catalog 2427
EHA-PSU-201-A-10 Power supply	See catalog 2410B
Subplates, size 03	See catalog 2425
Mounting bolts ■	See catalog 2314A
■ Note: If not using Vickers™ recommended bolt kits, bolts must be to ISO 898 grade 12.9 or stronger.	
Mounting attitude	No restriction, provided that the valve is kept full of fluid through port T.

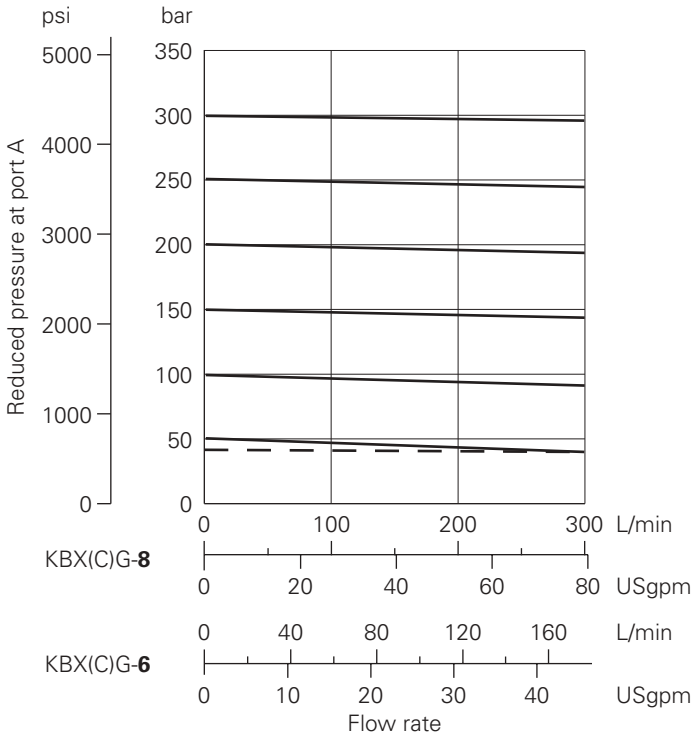
Performance Data

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

Pressure Underride

——— KBX(C)G-6/8-*-330--- models, at inlet pressure 350 bar (5000 psi)

– – – KBX(C)G-6/8-*-100--- models, at inlet pressure 100 bar (1450 psi)



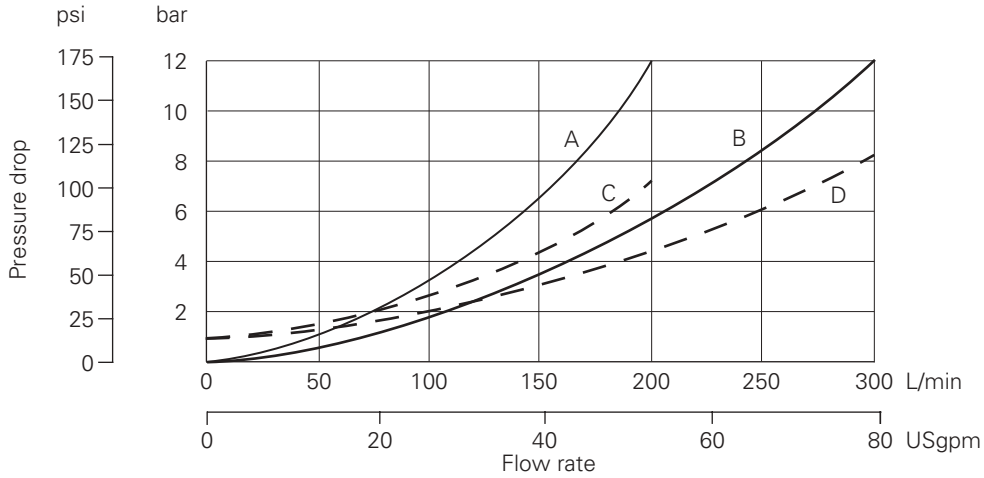
Pressure Drop

From port B to A at pressures below reduced pressure setting:

KBX(C)G-**6** valves.....Curve A
KBX(C)G-**8** valves.....Curve B

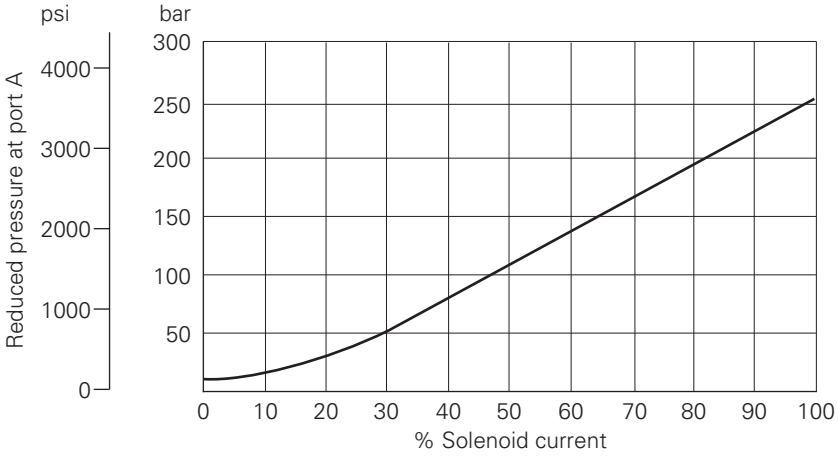
From port A to B through check valve (mainstage assumed closed).

Types KBXCG only:
KBXCG-**6** valves.....Curve C
KBXCG-**8** valves.....Curve D



Pressure Gain

Typical example KBX(C)G-6/8-*-250, at inlet pressure 350 bar (5000 psi).



Step Response

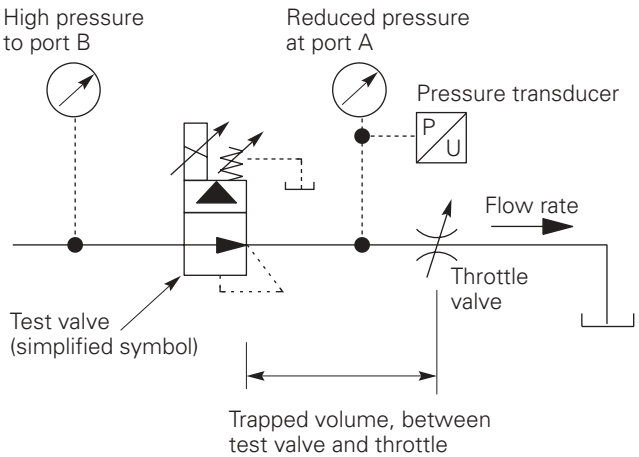
Typical data for KBX(C)G-*-*-250 model.

VALVE SIZE	TEST CONDITIONS: TRAPPED VOLUME	FLOW RATE	STEP SIZE: PRESSURE DEMAND	RESPONSE TIME (ms)
6	1,5 liters	75 L/min	0 to 100%	75
	(0.4 USg)	(20 USgpm)	100% to 0	60
			25 to 100%	60
			100 to 25%	50
8	3,0 liters	150 L/min	0 to 100%	70
	(0.8 USg)	(40 USgpm)	100% to 0	70
			25 to 100%	45
			100 to 25%	70

Test Method

1. Inlet pressure set 300 bar (4350 psi)
2. Trapped volume as in table
3. Steady state flow rate adjusted by downstream throttle valve with Δp = 250 bar (3600 psi)
4. Response = time from step input signal until reduced output pressure reaches 90% of step change, as measured by transducer

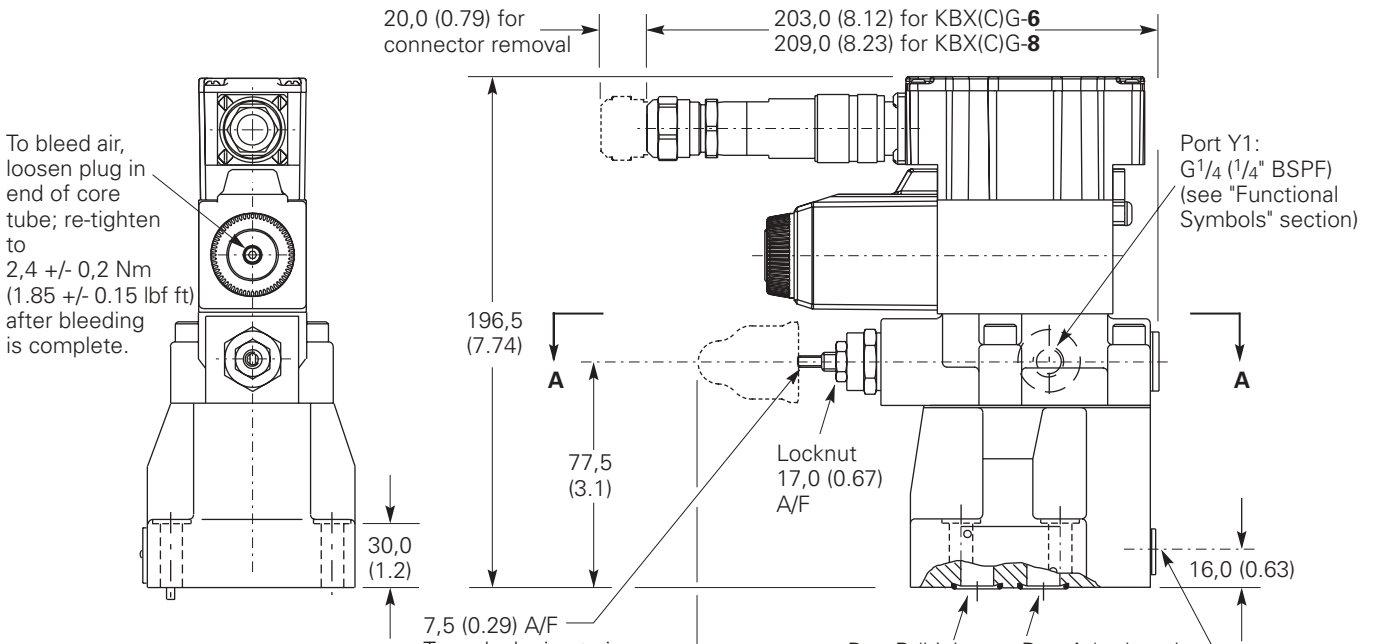
Test Circuit



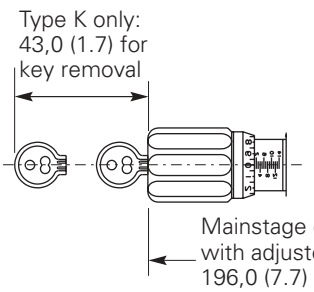
KBX(C)G-6/8 Models

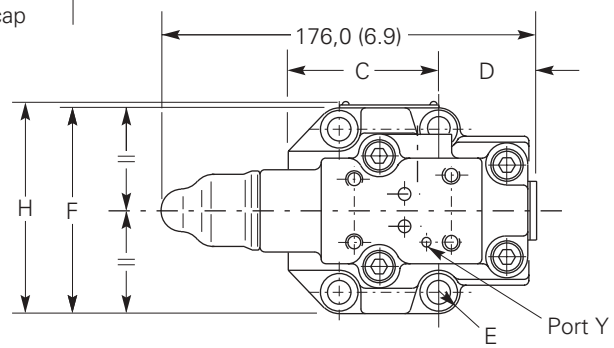
Dimensions are shown in mm (inches)

3rd angle projection



Micrometer Adjustment Options "K" or "M" in Model Code 6





View "A-A"

"K" Feature:
To adjust pressure setting, insert key and turn clockwise. Turn micrometer knob clockwise to increase pressure setting; counter-clockwise to decrease setting. When the key is removed the knob can spin freely without affecting the pressure setting.

Warning

To conform to the EC Electromagnetic Compatibility directive (EMC) this KBCG valve must be fitted with a metal 7-pin plug. The screen of the cable must be securely connected to the shell of the metal connector. A suitable IP67 rated connector is available from Eaton, part no. 934939. Alternatively a non IP67 rated connector is available from ITT-Cannon, part no. CA 02 COM-E 14S A7 P.

MODEL	C	D	E RAD	F	H
KBX(C)G-6	42,0	66,0	10,0	89,0	92,0
	(1.7)	(2.6)	(0.4)	(3.5)	(3.65)
KBX(C)G-8	40,0	77,0	11,0	104,0	107,0
	(1.6)	(3.1)	(0.43)	(4.1)	(4.25)

Mounting Surfaces, ISO 5781 (B Port High Pressure Inlet) AG-06-2-A AH-08-2-A

When a subplate is not used, a raised pad must be provided for mounting. The pad must be flat within 0,001 mm/100 mm (0.0001"/10") and smooth within 0,8 µm (32 µin). Dimensional tolerances are ±0,2 mm (±0.008") except where indicated.

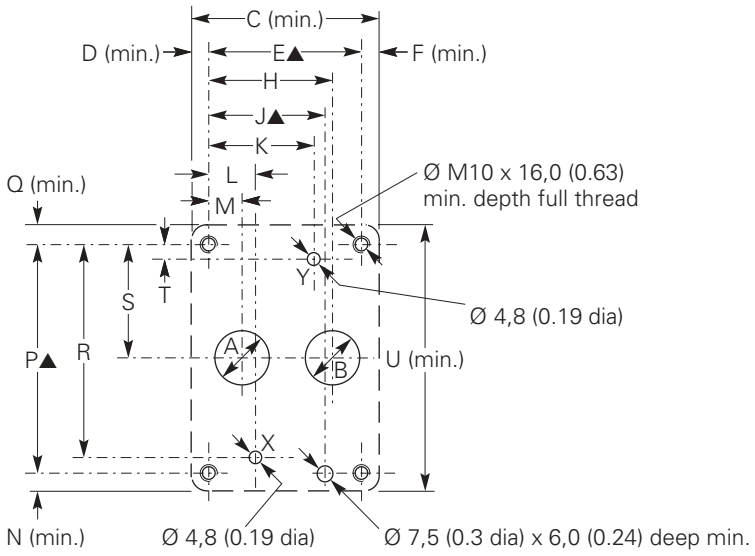
Port functions

A = Reduced pressure outlet (Also free reverse flow inlet for KBXCG valves)

B = High pressure inlet (Also free reverse flow outlet for KBXCG valves)

X = Not used for KBX(C)G valves; can be omitted or plugged

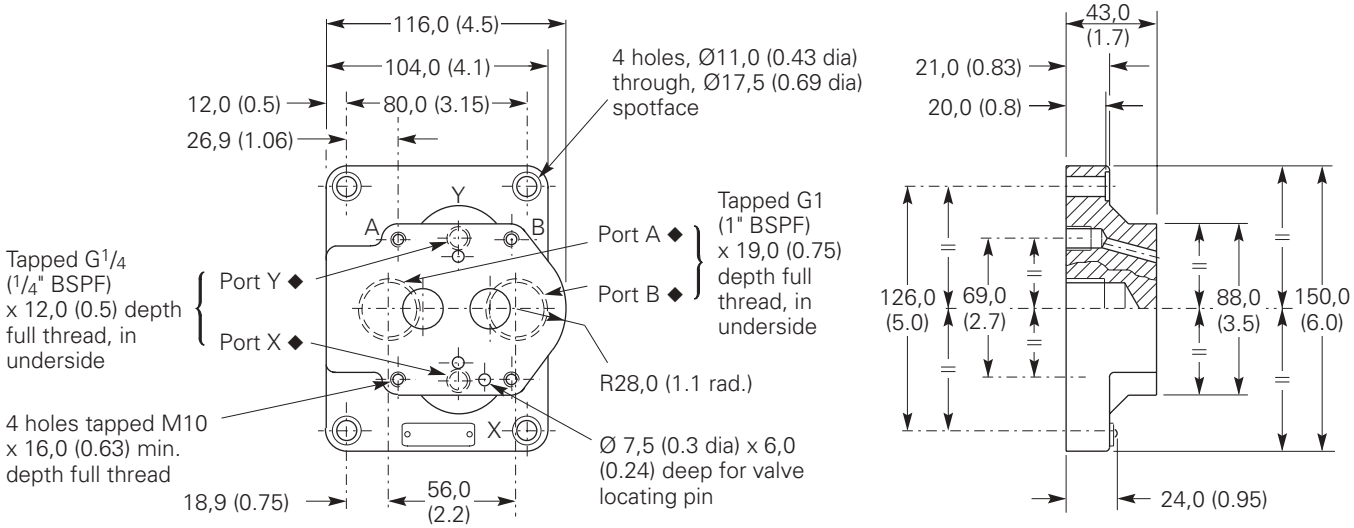
Y = Drain port



SIZE	ØA (DIA)	ØB (DIA)	C	D	E	F	H	J	K
06	14,7 (0.58)	14,7 (0.58)	61,0 (2.4)	9,0 (0.4)	42,9 (1.69)	9,0 (0.4)	35,7 (1.4)	31,8 (1.25)	21,4 (0.84)
08	23,4 (0.92)	23,4 (0.92)	78,0 (3.1)	8,8 (0.35)	60,3 (2.37)	8,8 (0.35)	49,2 (1.94)	44,5 (1.75)	39,7 (1.56)
SIZE	**L**	**M**	**N**	**P**	**Q**	**R**	**S**	**T**	**U**
06	21,4 (0.84)	7,1 (0.28)	10,0 (0.4)	66,7 (2.62)	10,0 (0.4)	58,7 (2.3)	33,3 (1.3)	7,9 (0.31)	87,0 (3.4)
08	20,6 (0.81)	11,1 (0.44)	10,8 (0.43)	79,4 (3.125)	10,8 (0.43)	73,0 (2.87)	39,7 (1.56)	6,4 (0.25)	101,0 (4.0)

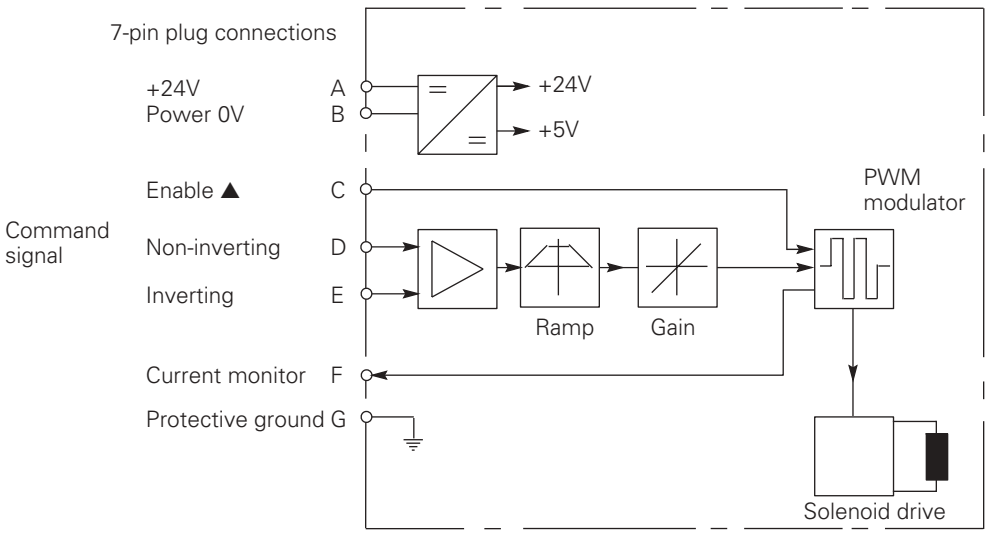
▲ Tolerance on bolt and pin locations ±0,1 mm (±0.004").

XCGVM-6-10R Subplate



◆ See "Mounting Surfaces" section above for port usage.

Block Diagram



▲ In valves with PH7 or PR7 type electrical connection.

Wiring

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

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)

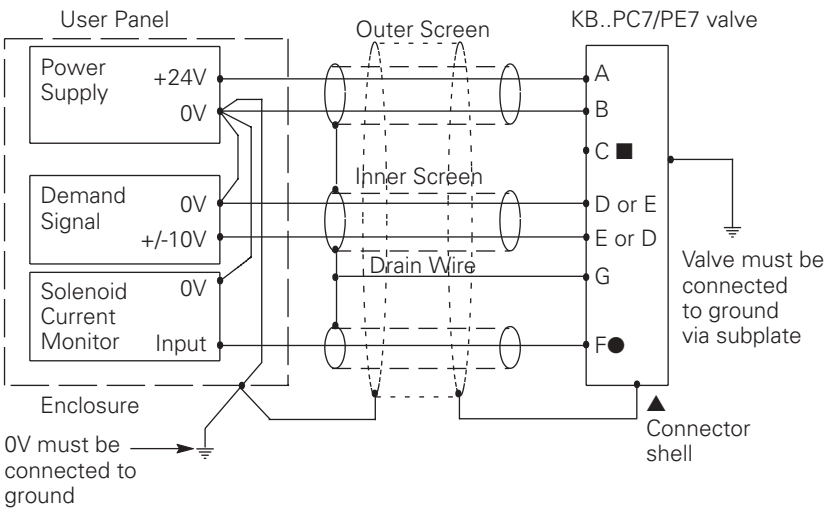
Screen (Shield)

A suitable cable should have at least 6 cores with pairs of conductors individually screened and an overall screen. Cable outside diameter 8,0-10,5 mm (0.31- 0.41 inches). See connection diagrams on next page.

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

Typical Connection Arrangements

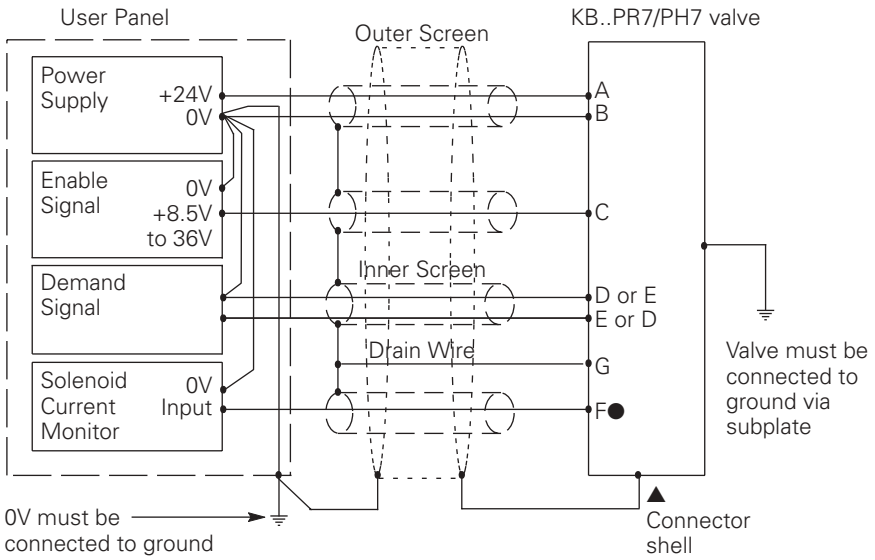
Wiring Connections



■ Pin C may be connected to ground or left unconnected.

● Output monitor voltage (pin F) will be referenced to the power 0 volts (pin B).

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.

Further Information

Hydraulic Fluids

Materials and seals used in these valves are compatible with:
Anti-wear petroleum oils...L-HM
Non-alkyl based phosphate esters.....L-HFD

The extreme operating range is 500 to 13 cSt (270 to 70 SUS) but the recommended running range is 54 to 13 cSt (245 to 70 SUS). For further technical information about fluids see 694.

Contamination Control Requirements

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:
Up to 210 bar (3000 psi).....18/**16/13**
Above 210 bar (3000 psi).....17/**15/12**

Installation and Start-up Guidelines

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.

If this proves to be the case any accumulated air can be bled from the solenoid bleed screw. This task is easier if the valve has been mounted base downwards. Good installation practice dictates that the tank port, and any drain port, are piped so as to keep the valve full of fluid once the system start-up has been completed.

Temperatures

For petroleum oil:
Min.....-20°C (-45°F)
Max.....+70°C (158°F)

For fluids where limits are outside those of petroleum oil, consult fluid manufacturer or Eaton representative. Whatever the actual temperature range, ensure that viscosities stay within those specified under "Hydraulic Fluids".

Ambient for:
Valves at full performance specification: -20 to +70°C (-4 to +158°F).

Valves, as above, will operate at temperatures of 0 to -20°C (32 to -4°F) but with a reduced dynamic response.

Storage:
-25 to +85°C (-13 to +185°F)

Seal Kits

Pilot valve:
KBCG-3.....02-352521
Mainstage valves:
KBX(C)G-6.....614824
KBX(C)G-8.....614826

Eaton
14615 Lone Oak Road
Eden Prairie, MN 55344-2287
USA
Tel: (+1) 952 937-9800
Fax: (+1) 952 974-7722
www.hydraulics.eaton.com

Eaton
20 Rosamond Road
Footscray
Victoria 3011
Australia
Tel: (+61) 3 9319 8222
Fax: (+61) 3 9318 5714

Eaton
Dr.-Reckeweg-Str. 1
D-76532 Baden-Baden
Germany
Tel: +49 (0) 7221 682-0
Fax: +49 (0) 7221 682-788

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May 2003

Proportional Pressure Relief Valves

K(A)CG-6/8, 1* Series

Basic Characteristics

Max. pressure . . . . . 350 bar (5000 psi)
Max. flow rate . 400 L/min (106 USgpm)
Mounting face to ISO 6264:
For K(A)CG-6 . . . . . AR-06-2-A
For K(A)CG-8 . . . . . AS-08-2-A

General Description

These two-stage pressure relief valves (based on Vickers type CG2V valves featured in catalog 2323) offer extensive application possibilities through their ability to control the pressure setting in proportion to an applied electrical input (up to a pressure limit which is manually adjustable and lockable).

Two model types are available

KCG-6/8
The valve responds to variations of current input to its solenoid, for which separate Vickers drive amplifiers, with PWM output stage and output current control, are available.

The proportional pilot control stage is a Vickers type KCG-3 valve, described in catalog 2162.

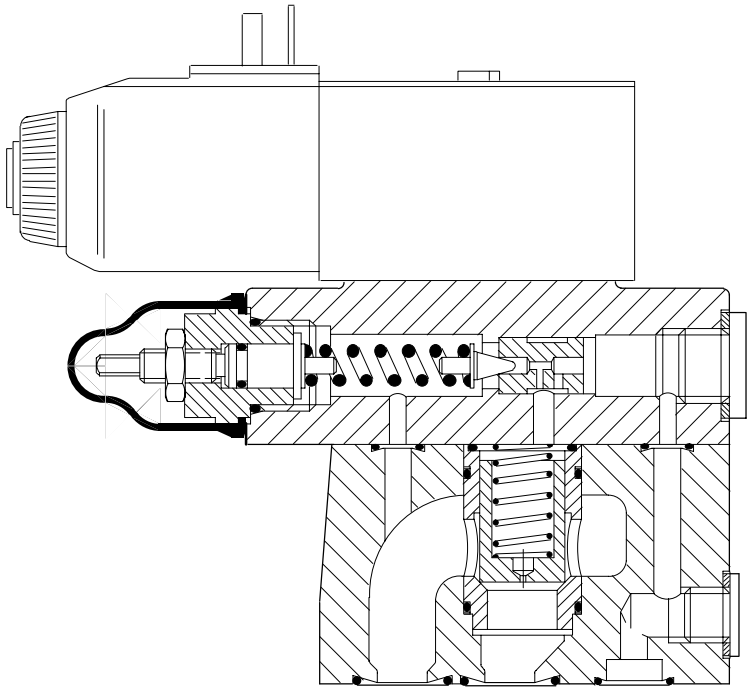
KACG-3

The addition of an integral amplifier allows the pressure to be controlled from a 0 to +10V, or 0 to –10V command signal range. The amplifier is mounted in a robust metal housing and electrical connections are via an industry standard 7-pin plug. Factory-set adjustments ensure high reproducibility valve -to-valve.

Features and Benefits

- With or without integrated electronics.
- Remote electrical proportional control of pressure from a choice of five pressure ranges per valve size.
- Excellent repeatability and stable performance results from cartridge design of mainstage elements.
- Low installed cost and space requirement from high power/size ratios (more than double that of many conventional designs).

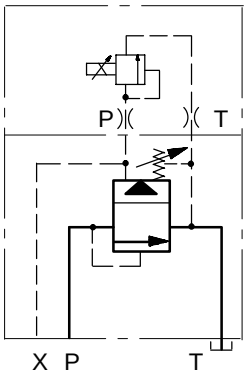
KCG-6 Valve with Type “U” Coil Connection



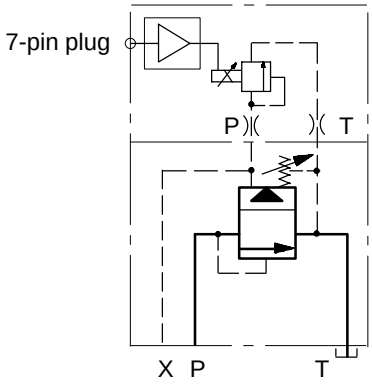
This product has been designed and tested to meet specific standards outlined in the European Electromagnetic Compatibility Directive (EMC) 89/336/EEC, amended by 91/263/EEC, 92/31/EEC and 93/68/EEC, article 5. For instructions on installation requirements to achieve effective protection levels, see this leaflet, the Installation Wiring Practices for Vickers Electronic Products leaflet 2468 and leaflet 02-123931A which is packed with every KA valve. Wiring practices relevant to this Directive are indicated by ⚠ Electromagnetic Compatibility (EMC).

Functional Symbols

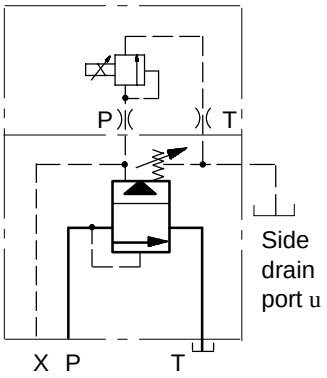
KCG-6/8 with manual and electrical pilots internally drained to port T:
Model code 5 = Blank



KACG-6/8 with manual and electrical pilots internally drained to port T:
Model code 5 = Blank

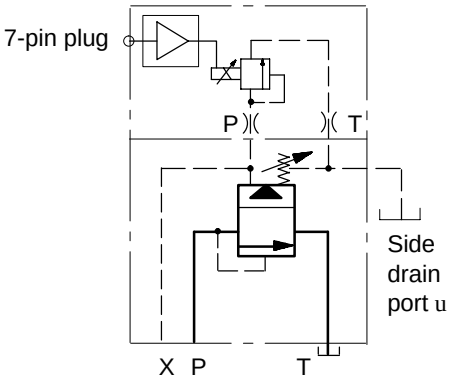


KCG-6/8 with manual and electrical pilots drained to side drain port ◆:
Model code 5 = 1



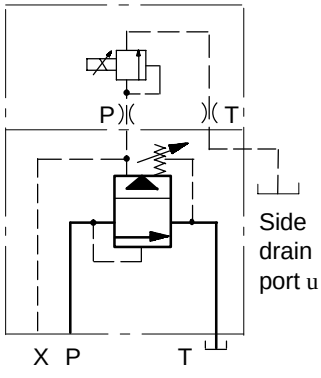
◆ *Tapped port on side of pilot head.*

KACG-6/8 with manual and electrical pilots drained to side drain port ◆:
Model code 5 = 1



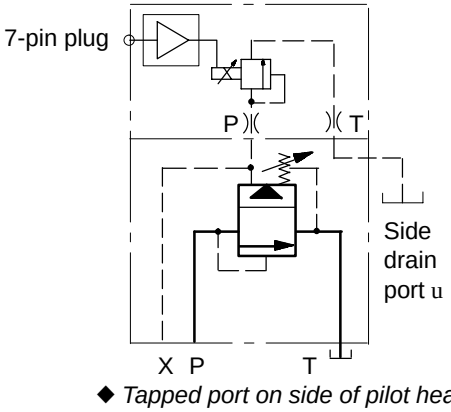
◆ *Tapped port on side of pilot head.*

KCG-6/8 with manual pilot internally drained to port T; electrical pilot drained to side drain port ◆:
Model code 5 = 3



◆ *Tapped port on side of pilot head.*

KACG-6/8 with manual pilot internally drained to port T; electrical pilot drained to side drain port ◆:
Model code 5 = 3



◆ *Tapped port on side of pilot head.*

Model Code

Features in brackets () may be omitted. All other features must be specified.

Models requiring separate amplifiers

(F3-)KCG-* - * * -*- Z-M- *** - *** -1* (-EN46)**

1 2 3 4 5 6 7 8 9 11 12 13

Models with integral amplifier

(F3-)KACG-* - * * -*- Z-M- PD7- H1 -1***

1 2 3 4 5 6 7 8 10 11 12

1 Fluid compatibility

Blank = Antiwear hydraulic oil (class L-HM)
F3 = As above or phosphate ester (class L-HFD)

2 Valve type

KC = Proportional pressure relief
KAC = Proportional pressure relief with integral amplifier

3 Mounting type

G = Subplate mounted

4 Mounting surface, ISO 6264

6 = AR-06-2-A
8 = AS-08-2-A

5 Type of manual adjustment

K = Micrometer with keylock
M = Micrometer without keylock
W = Screw/locknut

6 Pressure adjustment control range

(All coils except type HJ, see position 11, footnote ■)
40 = 6 - 40 bar (87 - 580 psi)
100 = 7,75 - 100 bar (112 - 1450 psi)
160 = 8,5 - 160 bar (125 - 2300 psi)
250 = 8,5 - 250 bar (125 - 3600 psi)
350 = 9,0 - 350 bar (130 - 5000 psi)

7 Pilot drain options

See also “Functional Symbols”

Code	Drain routing: Manual pilot stage	Electrical pilot stage
Blank	Port T	Port T
1	Side port	Side port
3	Port T	Side port

8 Standard features

Z-M = For KCG-6/8 and KACG-6/8

9 Coil connection type (KCG only)

U = ISO 4400 (DIN43650) interface▼
FW = Flying-leads in wiring box tapped $^1/_2$″ NPT
FTW = As “FW” plus terminal strip
FJ = Flying-leads in wiring box tapped M20
FTJ = As “FJ” plus terminal strip
P = Plug-in coil (type “H” only) Use with “EN46”

▼ *Female connector to be supplied by user.*

10 Connections (KACG only)

PD7 = 7 pin connector with plastic plug.
See **Warning** note regarding CE compliance on pageNO TAG

11 Coil rating

Code = amps x ohms◆
G1 = 3,5 x 1,65
GP1 = 3,0 x 2,0
H1 = 1,6 x 7,3▼
HA1 = 0,94 x 22
HJ1 = 1,0 x 14,25■
HL1 = 0,80 x 29●
◆ *Resistance at 20°C (68°F).*
▼ *KACG valves must have H1 coils*
l *For valves replacing CGEV models.*
■ *This lower power coil is limited to the following maximum controlled pressures. Valves supplied with type HJ coils will be stamped with the applicable maximum controlled pressure.*

Model code position 6	*Max. pressure with HJ coil*
40	*35 bar (500 psi)*
100	*85 bar (1100 psi)*
160	*140 bar (2000 psi)*
250	*210 bar (3000 psi)*
350	*315 bar (4500 psi)*

12 Design number, 1* series

Subject to change. Installation dimensions unaltered for design numbers 10 to 19 inclusive.

13 Special features

EN46 used with P-type coil connection and Uniplug connector.
Omit if not required.

Operating Data

Standard test conditions are with antiwear hydraulic oil at 36 cSt (168 SUS) and 50°C (122°F)

Maximum pressures: Ports P and X▲ Port T▲ in K(A)CG-*-****-Z- valves Port T▲ in K(A)CG-*-****-1/3-Z- valves Side drain port▲ s *Back pressure at these ports additive to the pressure setting of the valve.*	 350 bar (5000 psi) 2 bar (30 psi) 350 bar (5000 psi) 2 bar (30 psi)
Rated flow at Δp = 6 bar (87 psi): K(A)CG-6 K(A)CG-8	 200 L/min (52.8 USgpm) 400 L/min (105.7 USgpm)
Vent◆ flow with valve at rated flow ◆ *See "Venting", page 6.*	1 L/min (0.26 USgpm)
Pilot control drain flow, when valve is limiting system pressure, i.e. flow P to T occurring: K(A)CG-6 K(A)CG-8	 1,3 L/min (0.34 USgpm) 2,0 L/min (0.53 USgpm)
Coil or amplifier rating: KCG models KACG models	 See 11 in "Model Code" 24V x 40W max. (22 to 36V including 10% pk. to pk. max. ripple)
Command signal ranges, KACG models	0 to +10V DC, or 0 to –10V DC
Dither, KACG models	Factory set, not user adjustable
Monitor point signal, KACG models	0,5V per amp. solenoid current
Power stage PWM, KACG models	2kHz nominal
7-pin plug connections, KACG models: A B C D E F G	 Power supply +ve Power 0V Signal 0V +ve voltage command signal –ve voltage cpommand signal Monitor output Protective ground
Electro-magnetic compatibility (EMC) KACG models only: Emission (10V/m) Immunity (10V/m)	 EN 50081-2 EN 50082-2
Pressure gain, KACG models Factory setting - Maximum with 10V command signal. User adjustment - 30 to 120% of factory setting. Note that altering this setting will affect valve to valve interchangeability.	See graph
Pressure override when relieving and when off-load	See graphs
Hysteresis KCG models KACG models	 <5% (with 100 mA pk.-to-pk. dither) <6% (with factory-set dither)
Linearity, between 10% and 100% of rated pressure: K(A)CG-6 models at 100 L/min (26 USgpm) K(A)CG-8 models at 200 L/min (52 USgpm)	 <6% <6%

Operating Data

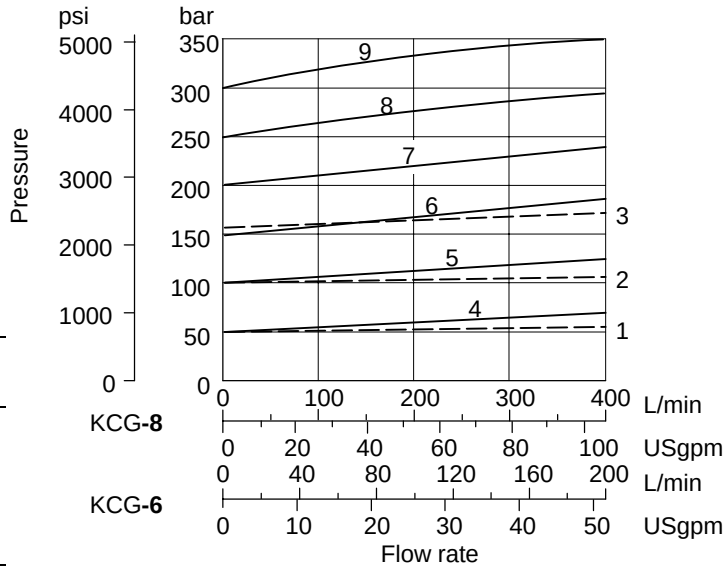
Repeatability	<1,3% of rated pressure
Protection, Electrical (KACG models)	Reverse-polarity protected
Mass (weight) KCG-6 KACG-6 KCG-8 KACG-8	 4,9 kg (10.8 lb) 5,3 kg (11.7 lb) 5,8 kg (12.8 lb) 6,2 kg (13.7 lb)
Supporting products: Amplifiers for KCG valves with “H” type coils only: EHH-AMP-724-C/D-10 (Uniplug) EHH-AMP-7*2 series (power plug) EEA-PAM-513-A-14 (1 adjustable ramp) EEA-PAM-513-A-3* (2 adjustable ramps) Auxilliary electronic modules (Din-rail mounting) for KACG models: EHA CON 201 A 2* 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 1* power supply ISO 4400 (DIN 43650) electrical connector: Black, marked “B” Gray, marked “A” Subplates, size 03 Mounting bolts■ ■ *Note: If not using Vickers recommended bolt kits, bolts must be to ISO 898 grade 12.9 or stronger.*	 See catalog 2367 See catalogs 2114, 2115 and 2282 See catalog 2137 See catalog 2464 See catalog 2410B See catalog 2470 See catalog 2410B See catalog 2427 See catalog 2410B Part number 710775 Part number 710776 See catalog 2425 See catalog 2314A
Installation and start-up (commissioning): Installation and start-up (commissioning) guide Mounting attitude	 ML-B-9133B (Multi-lingual English, German, French and Italian), shipped with each product and also available separately on request. No restriction, provided that the valve is kept full of fluid through port T.
Ordering procedure	Valves, subplates, bolt kits and Vickers amplifiers should be ordered by full model code designation. Order ISO (DIN) electrical connectors by part number.

Performance Data

Typical with oil at 36 cSt (168 SUS) and at 50°C (122°F)

Pressure Override when Relieving

Model	Curve number 1	2	3	4	5	6	7	8	9
K(A)CG-**-40	●								
K(A)CG-**-100	●	●							
K(A)CG-**-160	●	●	●						
K(A)CG-**-250				●	●	●	●	●	●
K(A)CG-**-350				●	●	●	●	●	●



Pressure Override Off-Load

Graphs show the minimum pressures obtainable:

a) With 0 mA current to the solenoid coil

b) When the valve is vented (see following explanation).

Venting

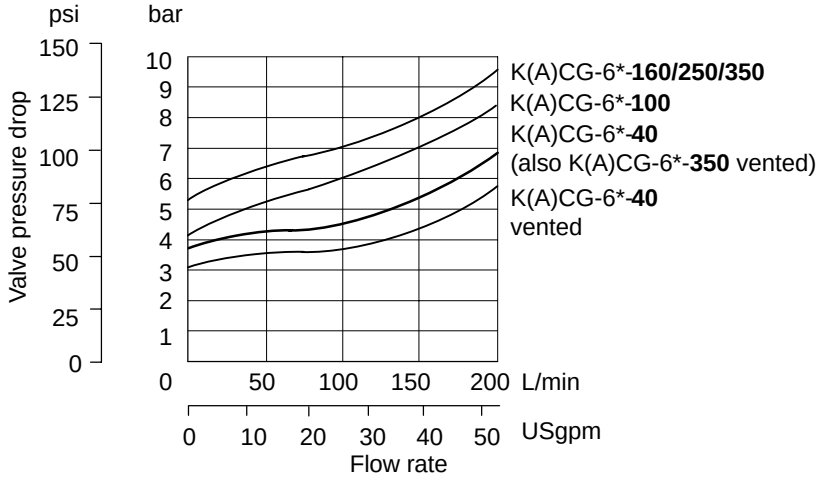
When the vent port X (or alternative vent port in the valve body) is connected to the reservoir via a suitable 2-way pilot valve, the mainstage of the relief valve opens to allow full flow from P to T at low pressure drop. The minimum pressure drop is obtained when the pilot valve is also de-energized. The total pressure drop through the venting 2-way valve and pipework is additive to the pressure at P.

While the valve is vented the system pressure cannot be controlled via the proportional solenoid.

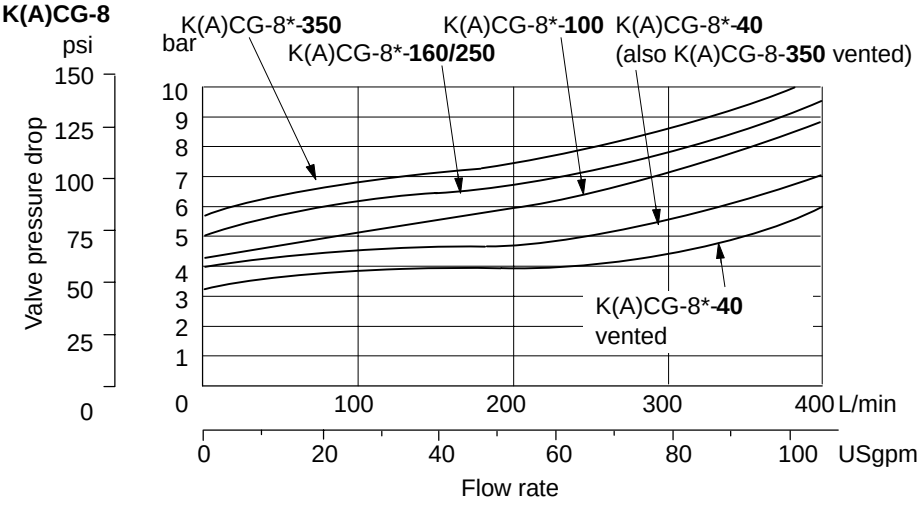
This control feature is frequently used during off-load periods in machine cycle times. If lower off-load system pressures are required then additional full flow unloading valves are recommended, e.g. Vickers CV series cartridge valves.

Note: All valves are with pilot valve de-energized.

K(A)CG-6

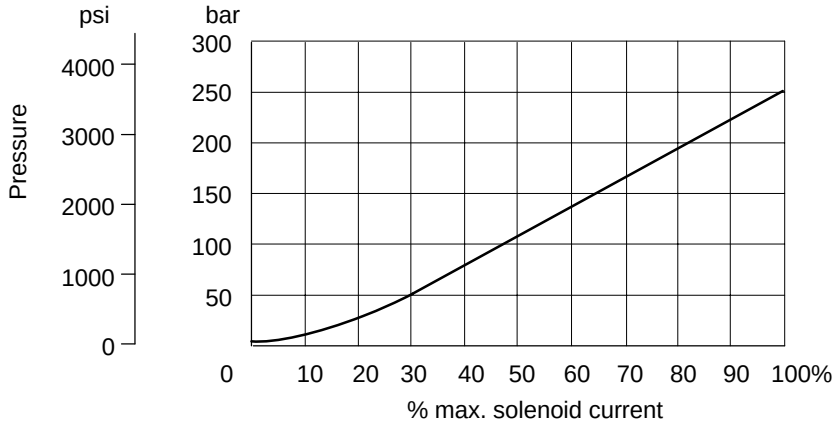


K(A)CG-8



Valid for models driven from Vickers amplifier with appropriate settings of gain and offset

Pressure Gain



Step Response

KACG models with factory settings of gain and offset.
KCG models driven from Vickers amplifier with appropriate settings of gain and offset.

Test method

1. Trapped volume between pump and test valve, as in table.
2. Flow rate set at pump, as in table.
3. Response = time from step input signal until pressure reaches 90% of step change, as measured by transducer.

Valve size	Test conditions: Trapped volume	Flow rate	Step size: Pressure demand	Response time (ms)
6	2,0 liters (0.53 USg)	100 L/min (26 USgpm)	0 to 100% 100% to 0 25 to 100% 100 to 25%	100 70 40 50
8	4,0 liters (1.06 USg)	200 L/min (52 USgpm)	0 to 100% 100% to 0 25 to 100% 100 to 25%	110 70 50 65

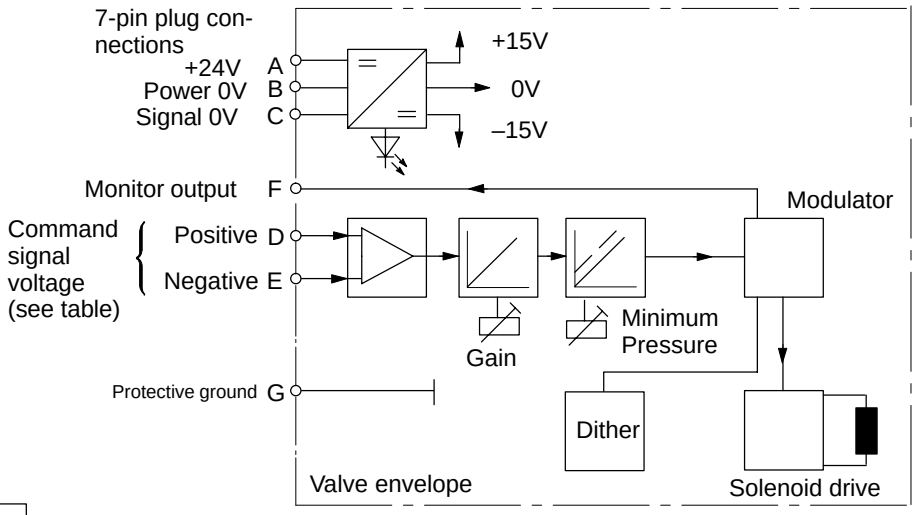
KACG-6/8 Electrical Block Diagram

Wiring
Connections must be made via the 7-pin plug mounted on the amplifier.
Recommended cable sizes are:

Power cables:
For 24V supply
0,75 mm^2 (18 AWG) up to 20m (65 ft)
1,00 mm^2 (17 AWG) up to 40m (130 ft)

Signal cables:
0,50 mm^2 (20 AWG)

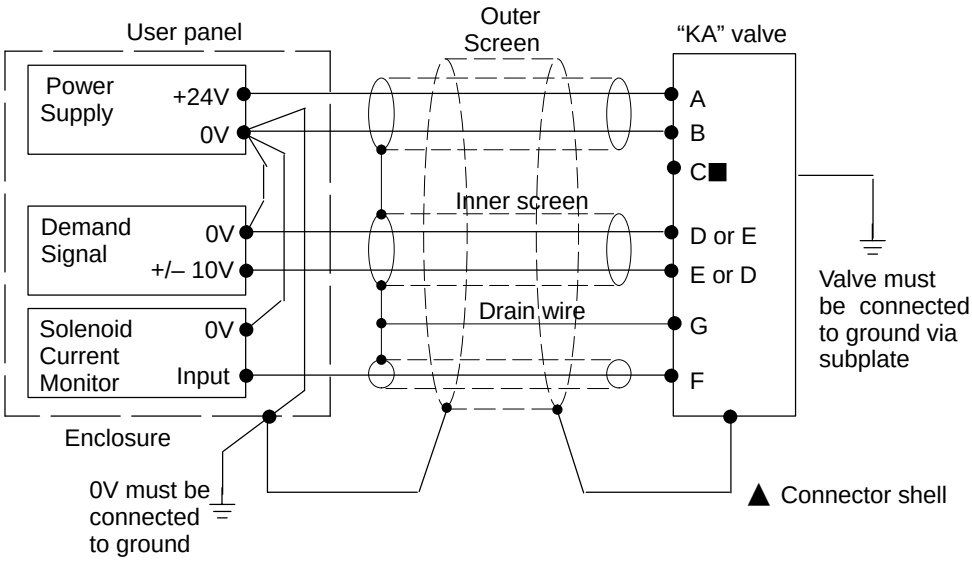
Screen:
A suitable cable would have 7 cores, a separate screen for the signal wires and an overall screen.
See wiring connection diagram on page NO TAG



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

KACG-6/8 Typical Connection Arrangements

Wiring Connections for Valves with integral Amplifier



■ Solenoid current monitor voltage (pin F) will be referenced to the KA valve local ground. A "local ground" (pin C) is provided for optional use by differential input customer supplied electronics.

▲ 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

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.

Warning

Electromagnetic Compatibility (EMC)

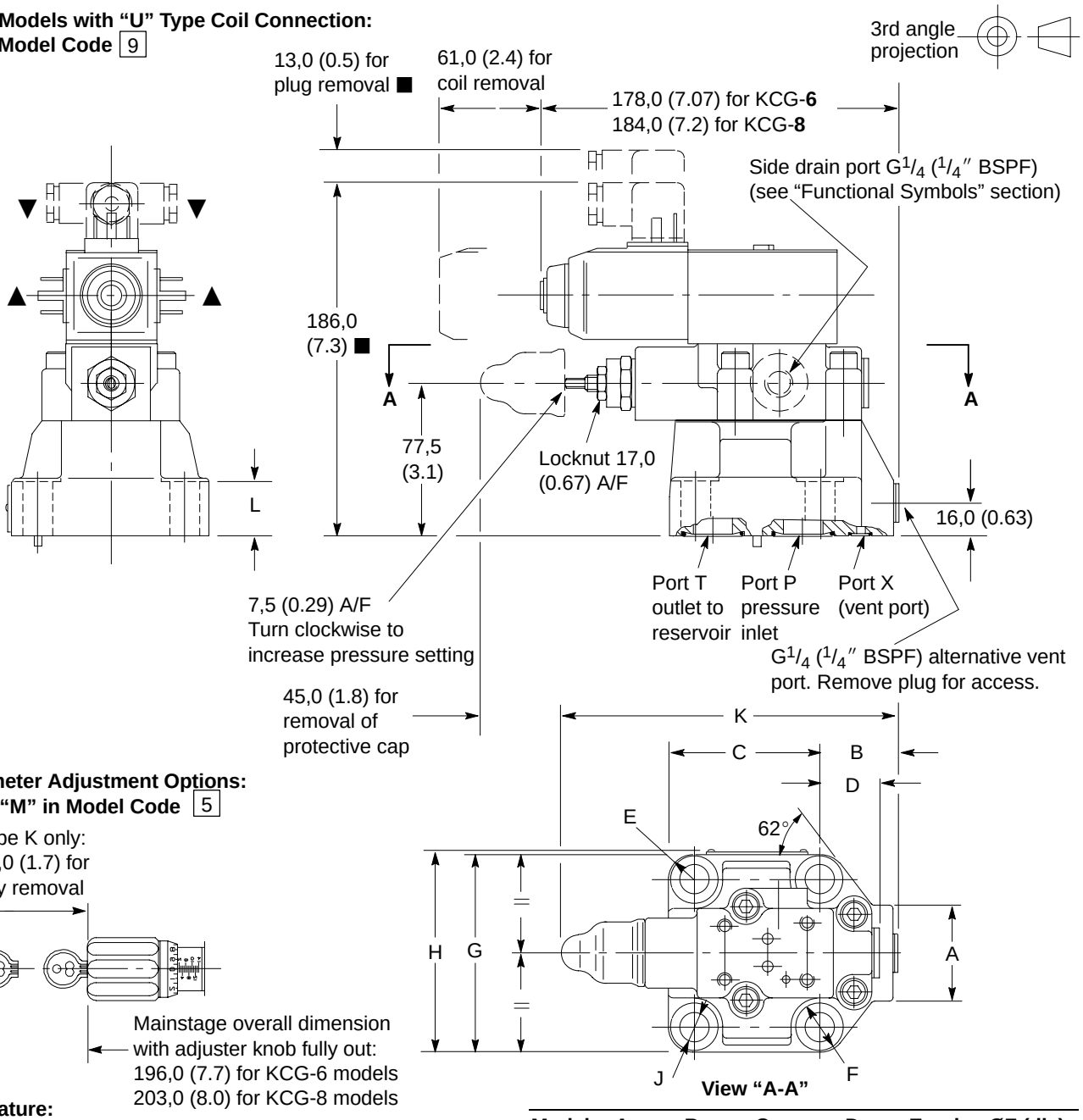
It is necessary to ensure that the valve is wired-up as above. For effective protection, the user electrical cabinet, the valve subplate or manifold, and the cable screens should be connected to efficient ground points. The metal 7-point connector, part no. 934939, should be used for the integral amplifier.

In all cases, both valve and cable should be kept as far 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.

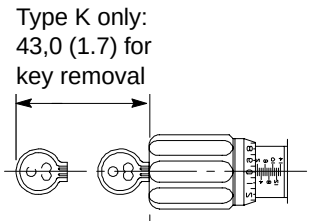
It is important to connect the 0V lines as shown above. The multi-core cable should have at least two screens to separate the demand signal and monitor output from the power lines.

Installation Dimensions in mm (inches)

KCG-* Models with "U" Type Coil Connection:
"U" at Model Code 9



Micrometer Adjustment Options:
"K" or "M" in Model Code 5



"K" Feature:
To adjust pressure setting, insert key and turn clockwise. Turn micrometer knob clockwise to increase pressure setting; counter-clockwise to decrease setting. When the key is removed the knob can spin freely without affecting the pressure setting.

▲ *Alternative plug positions by loosening knurled nut counter-clockwise, turning coil and re-tightening nut.*
■ *Dimensions may vary according to source of plug.*
▼ *The cable entry on this plug can be repositioned at 90° intervals by reassembly of the contact holder relative to the plug housing. The cable entry is Pg 11 for cables Ø6-10 mm (0.24-0.4 dia).*

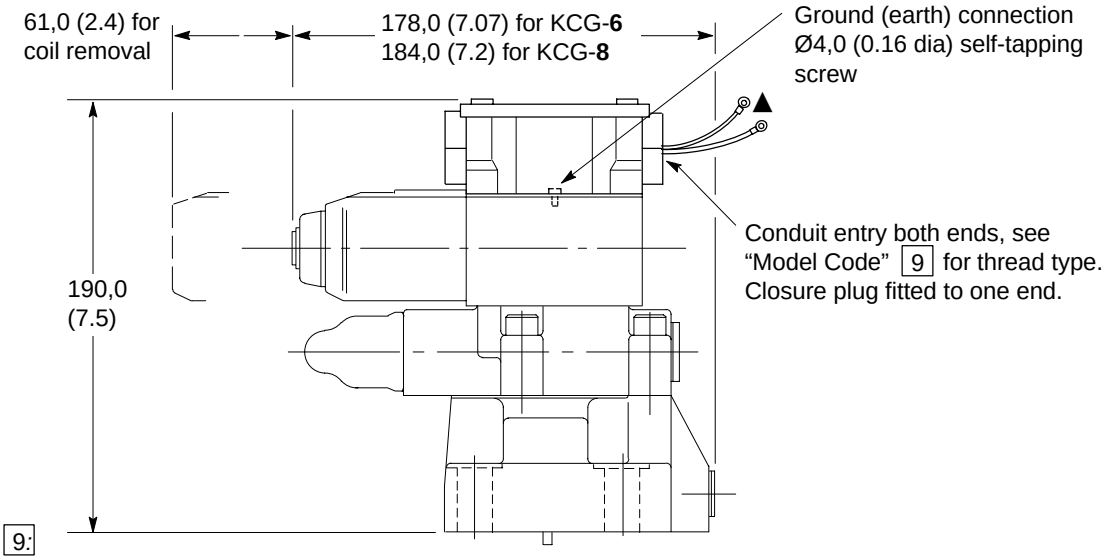
Model	A	B	C	D	E rad	ØF (dia)
KCG-6	58,0 (2.3)	35,0 (1.4)	68,0 (2.7)	35,0 (1.4)	12,0 (0.5)	20,0 (0.78)
KCG-8	42,0 (1.7)	39,0 (1.54)	83,0 (3.3)	30,0 (1.2)	16,0 (0.63)	26,0 (1.02)

Model	G	H	ØJ (dia)	K	L
KCG-6	79,0 (3.1)	82,0 (3.23)	13,5 (0.53)	176,0 (7.0)	20,0 (0.78)
KCG-8	103,0 (4.1)	106,0 (4.2)	17,0 (0.7)	183,0 (7.2)	25,0 (1.0)

KCG-* Models with “F” Type Coil Connection:
“F(T)W” or“F(T)J” at Model Code 9

3rd angle projection

For dimensions not shown see page 10.



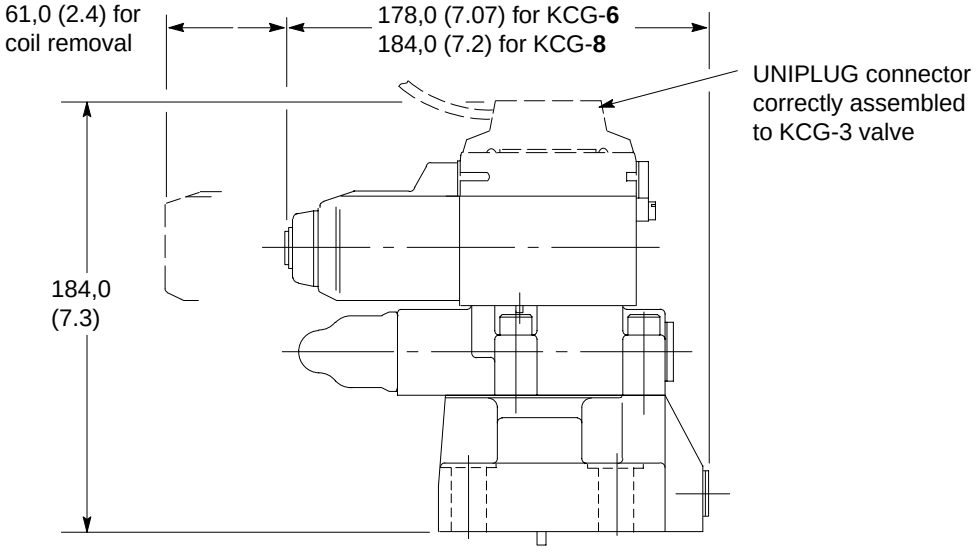
▲ *Ref. Model Code* 9:
Codes “FJ” and “FW”: 2 lead wires approx. 150.0 (6.0) long. M3 terminals provided for customer connection.
Codes “FTJ” and “FTW”: Lead wires connected into terminal strip suitable for M3 terminals on customer connection.

KCG-*---EN46 Models for Use with Vickers UNIPLUG, Single Cable Connector:
“P” at Model Code 9 **; “H” at Model Code** 11

For use with Vickers single-cable UNIPLUG connectors:
For “Soft Switch” Control:
Use UNIPLUG model type EHH-AMP-724-C**-1*
For Proportional Control:
Use UNIPLUG model type EHH-AMP-724-D**-1*
UNIPLUG connectors should be ordered separately; see catalog 2367.

To fit UNIPLUG connector to KCG-3 pilot valve:
Unscrew coil retention nut and remove coil.
Slide UNIPLUG connector onto dummy pins (at non-solenoid end) then replace coil, ensuring pins are fully engaged.
Replace and tighten coil retention nut.

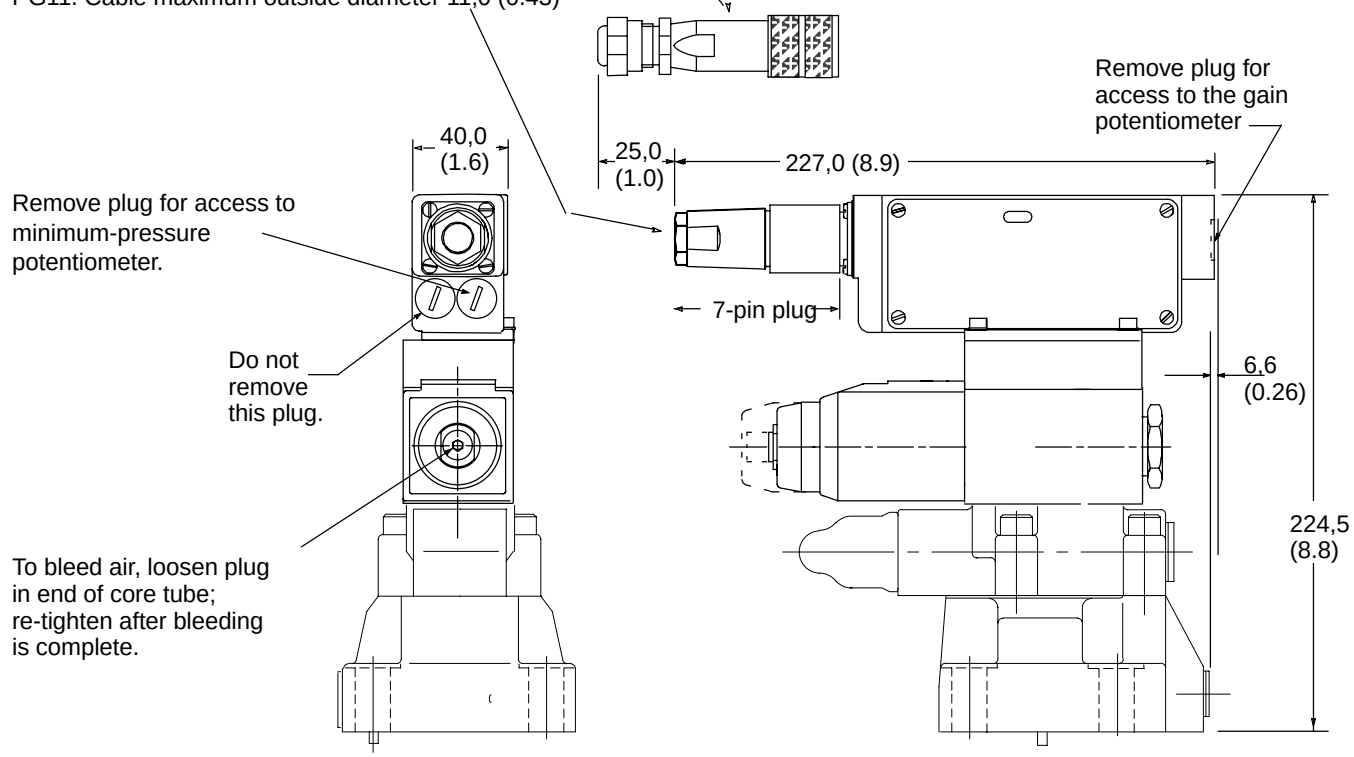
For dimensions not shown see page 10.



KACG-* Models (With integrated amplifier)

Metal plug 934939
Cable outside diameter 8,0 to 10,5 (0.31 to 0.41)
Must be used for full EMC protection. See also warning note below

Plastic plug 694534
PG11. Cable maximum outside diameter 11,0 (0.43)

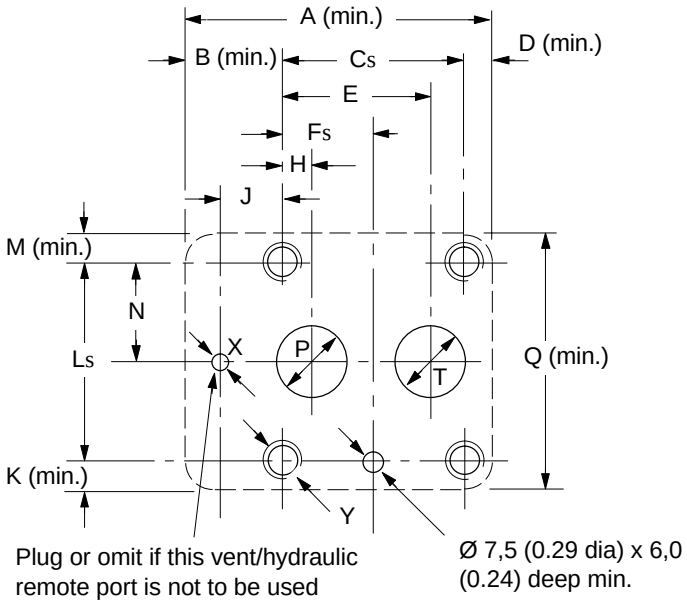


Warning
To conform to the EC Electromagnetic Compatibility directive (EMC) this KACG valve must be fitted with a metal 7-pin plug. The screen of the cable must be securely connected to the shell of the metal connector. A suitable IP67 rated connector is available from Vickers, part no. 934939. Alternatively a non IP67 rated connector is available from ITT-Cannon, part no.CA 02 COM-E 14S A7 P.
Additionally the cable must be fitted with a ferrite EMC suppression core not more than 4cm from the connector referred to above. Suitable types include Farnell 535-898 or Farnell 535-904 which snap fit over the cable.
The plastic plug, part number 694534, is only suitable for use in a sealed electromagnetic environment or outside of the European Community.

Mounting Surfaces, ISO 6264
AR-06-2-A
AS-08-2-A

When a subplate is not used, a raised pad must be provided for mounting. The pad must be flat within 0,001 mm/ 100 mm (0.0001″/10″) and smooth within 0,8 μm (32 μin). Dimensional tolerances are ±0,2 mm (± 0.008″) except where indicated.

Port functions:
P = Pressure inlet
T = Outlet to reservoir
X = Vent, or remote control port

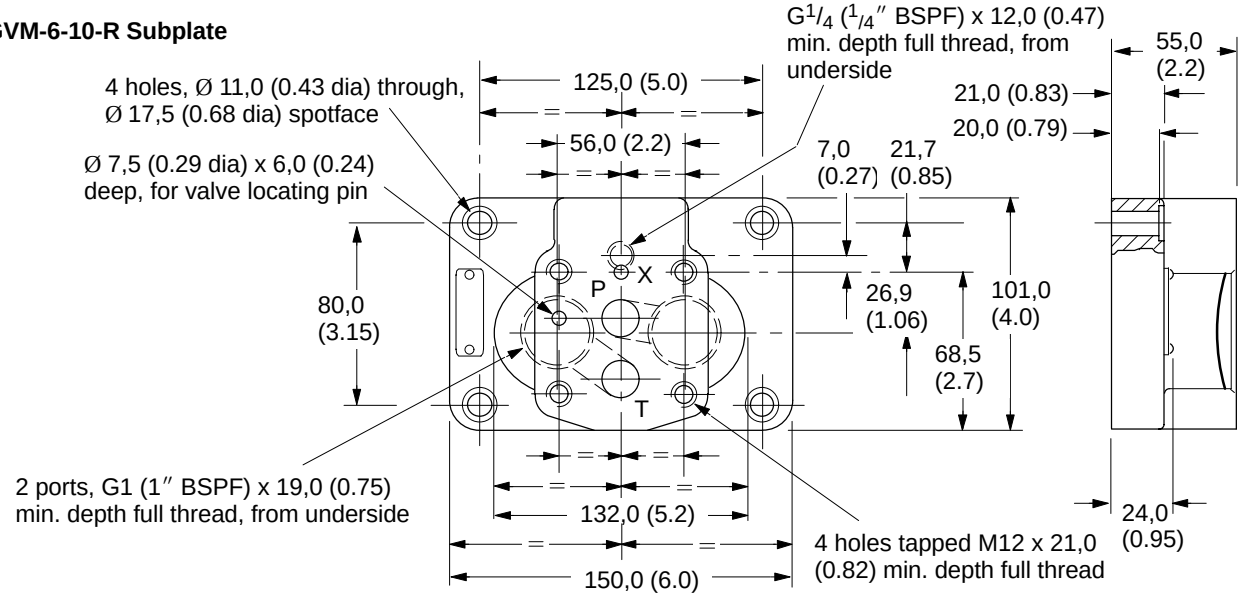


Size	A	B	C	D	E	F	H	J	K	L
AR-06	80 (3.2)	13,1 (0.5)	53,8 (2.12)	13,1 (0.5)	47,5◆ (1.87)	22,1 (0.87)	22,1◆ (0.87)	0	13,1 (0.5)	53,8 (2.12)
AS-08	118 (4.7)	35,0 (1.4)	66,7 (2.63)	16,3 (0.7)	55,6 (2.19)	33,4 (1.35)	11,1 (0.44)	23,8 (0.94)	16,0 (0.63)	70,0 (2.76)

Size	M	N	ØP (dia)	Q	ØT (dia)	ØX (dia)	Y thread x min. full thread depth
AR-06	13,1 (0.5)	26,9 (1.06)	14,7 (0.58)	80 (3.2)	14,7 (0.58)	4,8 (0.19)	M12 x 21 ($^{7}/_{16}$″ UNF x 0.83)▼
AS-08	16,0 (0.63)	35,0 (1.38)	23,4 (0.92)	102 (4.0)	23,4 (0.92)	6,3 (0.25)	M16 x 30 ($^{5}/_{8}$″ UNF x 1.2)▼

▲ *Tolerance on bolt and pin locations ± 0,1 mm (± 0.004″).*
◆ *These ISO standard dimensions can be used, but improved flow paths to and from valve are obtained by using 48,0 (1.89) instead of 47,5 (1.87), and 22,6 (0.89) instead of 22,1 (0.87).*
▼ *ISO standard does not give UNC bolt sizes. These are recommended equivalents to metric sizes specified in the standard.*

CGVM-6-10-R Subplate



Further Information

Hydraulic Fluids
Materials and seals used in these valves are compatible with:
Anti-wear petroleum oils . . . . . L-HM
For use with non-alkyl based phosphate esters, L-HFD, use F3 version in model code.
The extreme operating range is 500 to 13 cSt (270 to 70 SUS) but the recommended running range is 54 to 13 cSt (245 to 70 SUS). For further technical information about fluids see 694

Contamination Control Requirements
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 μm, 5 μm and 15 μm.

For products in this catalog the recommended levels are:
Up to 210 bar (3000 psi) 18**/16/13**
Above 210 bar (3000 psi) 17**/15/12**

Installation and Start-up Guidelines
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.

If this proves to be the case any accumulated air can be bled from the solenoid bleed screw. This task is easier if the valve has been mounted base downwards. Good installation practice dictates that the tank port, and any drain port, are piped so as to keep the valve full of fluid once the system start-up has been completed.

Temperatures
For petroleum oil:
Min. . . . . –20°C (–4°F)
Max.* . . . . . +70°C (158°F)

* *To obtain optimum service life from both fluid and hydraulic system, 65°C (150°F) normally is the maximum temperature.*

For other fluids where limits are outside those of petroleum oil, consult fluid manufacturer or Vickers representative. Whatever the actual temperature range, ensure that viscosities stay within those specified under “Hydraulic Fluids”.

Ambient for:
Valves at full performance specification: –20 to +60°C (–4 to +140°F).
Valves, as above, will operate at temperatures of 0 to –20°C (32 to –4°F) but with a reduced dynamic response.

Storage:
–25 to +85°C (–13 to +185°F)

Eurocard electronics:
0 to 50°C (32 to 122°F)

Seal Kits
Pilot valves:

K(A)CG-3 (KA + DIN)	02-138201
KCG-3 (’F’ & ’P’ versions) . .	02-145869

Mainstage valves:

K(A)CG-6	614824
K(A)CG-8	614931

VICKERS®

Proportional Valves

Proportional Pressure Reducing Valves

K(A)X(C)G-6/8, 1* Series

Basic Characteristics

Max. inlet pressure . 350 bar (5000 psi)
Max. reduced
pressure . . . . . 330 bar (4750 psi)
Max. flow rate . . 300 L/min (80 USgpm)
Mounting face to ISO 5781 (B port high pressure inlet):
For K(A)X(C)G-6 . . . . . AG-06-2-A
For K(A)X(C)G-8 . . . . . AH-08-2-A

General Description

These two-stage pressure reducing valves (based on Vickers type X(C)G2V valves, featured in catalog 2321) incorporate an electro-hydraulic proportional pressure pilot stage (Vickers type KCG-3 valve, described in catalog 2162) by which the reduced pressure setting is adjustable in response to an electrical input. Each model (in two sizes, with optional free reverse flow check valve) responds to variations of current input to its solenoid, for which separate Vickers drive amplifiers, with PWM output stage and output current control, are available.

Design Features

A maximum outlet pressure to suit the application requirements is preset by the manual adjustment. Below this maximum setting, the outlet pressure is controlled by the solenoid operated proportional pilot valve, according to the current applied to the solenoid.

The “normally open” condition of the mainstage allows full flow from inlet to outlet port until the required reduced pressure is reached, whereupon the mainstage closes, or reduces the flow sufficient only to maintain the required outlet pressure.

High valve response ensures that the reduced outlet pressure is unaffected by inlet pressure peaks. Excess build-up of outlet pressure (during long holding periods, or flow back from an actuator reacting to an overload) is prevented by the small check valve in the mainstage spool, allowing fluid to bleed-off across the pilot stage.

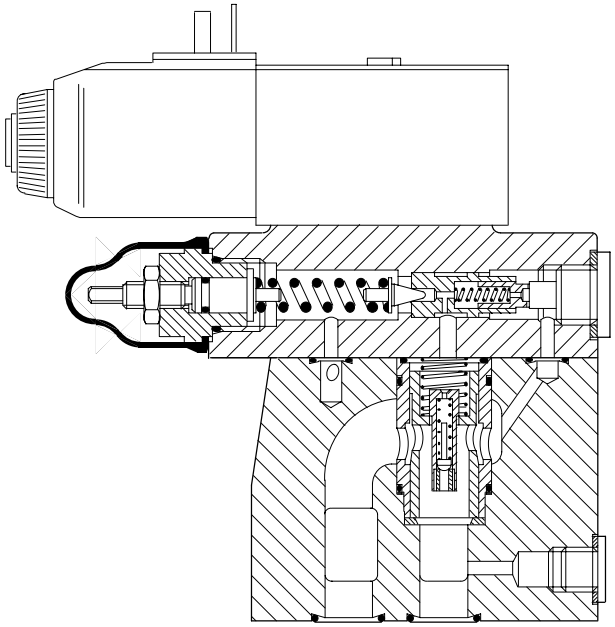
KAX(C)G-6/8

The addition of an integral amplifier allows the pressure to be controlled from a 0 to +10V, or 0 to –10V command signal range. The amplifier is mounted in a robust metal housing and electrical connections are via an industry standard 7-pin plug. Factory-set adjustments ensure high reproducibility valve -to-valve.

Features and Benefits

- Remote electrical proportional control of reduced pressure from a choice of five pressure ranges per valve size.
- Excellent repeatability and stable performance results from cartridge design of mainstage parts.
- Low installed cost and space requirement from high power/size ratios (more than double that of many conventional designs).

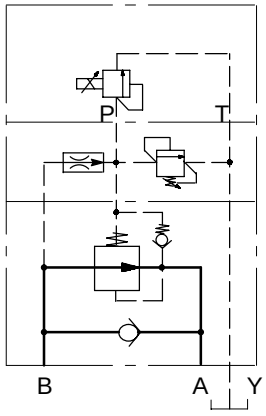
KX(C)G-6 Valve with Type “U” Coil Connection



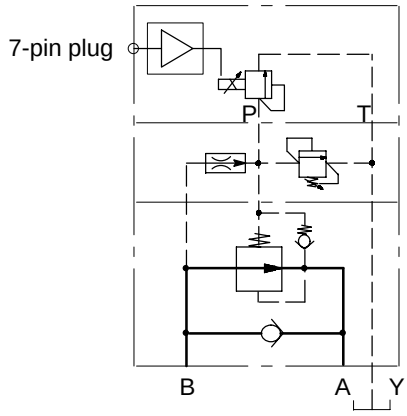
This product has been designed and tested to meet specific standards outlined in the European Electromagnetic Compatibility Directive (EMC) 89/336/EEC, amended by 91/263/EEC, 92/31/EEC and 93/68/EEC, article 5. For instructions on installation requirements to achieve effective protection levels, see this leaflet, the Installation Wiring Practices for Vickers Electronic Products leaflet 2468 and leaflet 02-123931A which is packed with every KA valve. Wiring practices relevant to this Directive are indicated by ⚠ Electromagnetic Compatibility (EMC).

Functional Symbols

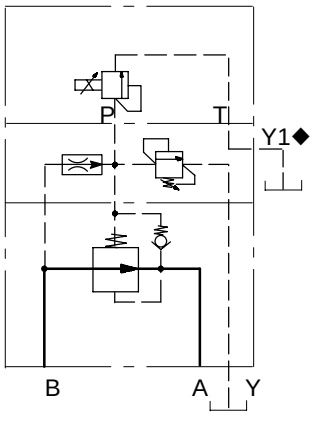
Manual and Electrical Pilots Drained to Port Y:
Model Code 7 = Blank
Symbol for KXCG models.
For KXG models omit check and internal connection A-B.



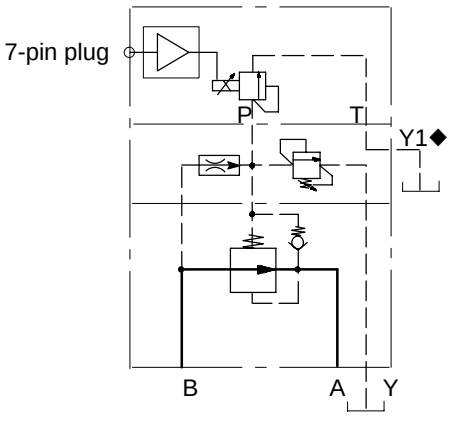
Manual and Electrical Pilots Drained to Port Y:
Model Code 7 = Blank
Symbol for KAXCG, models with integral amplifier.
For KAXG models omit check and internal connection A-B.



Manual Pilot Drained to Port Y; Electrical Pilot Drained to Port Y1◆:
Model Code 7 = 3
Symbol for KXG models.
For KXCG models add check valve symbol and internal connection A-B.



Manual Pilot Drained to Port Y; Electrical Pilot Drained to Port Y1◆:
Model Code 7 = 3
Symbol for KAXG, models with integral amplifier.
For KAXCG models add check valve symbol and internal connection A-B.



Model Code

Features in brackets () may be omitted. All other features must be specified.

Models requiring separate amplifiers

(F3-)KX(C)G- * - * * -*- Z-M- *** - *** -1* (-EN46)**

1 2 3 4 5 6 7 8 9 10 12 13 14

Models with integral amplifier

(F3-)KAX(C)G- * - * * -*- Z-M- PD7- H1 -1***

1 2 3 4 5 6 7 8 9 11 12 13

1 Fluid compatibility

Blank = Antiwear hydraulic oil (class L-HM)
F3 = As above or phosphate ester (class L-HFD)

2 Valve type

KX = Proportional pressure relief
KAX = Proportional pressure relief with integral amplifier

3 Reverse flow check

C = Reverse flow check
Omit if not required

4 Mounting type

G = Subplate mounted

5 Mounting surface, ISO 6264

With port B high pressure inlet and port A reduced pressure outlet
6 = AR-06-2-A
8 = AS-08-2-A

6 Type of manual adjustment

K = Micrometer with keylock
M = Micrometer without keylock
W = Screw/locknut

Note: Reduced pressure adjustment range 7 is based on an inlet pressure of 350 bar (5000 psi). With an inlet pressure of 100 bar (1450 psi) the lower limits are 2 to 3 bar (30 to 40 psi) lower.

7 Reduced pressure adjustment control range (see footnote)

(All coils except type HJ, see position 12 footnote ■)
40 = 10 - 40 bar (145 - 580 psi)
100 = 12 - 100 bar (175 - 1450 psi)
160 = 14 - 160 bar (200 - 2300 psi)
250 = 15 - 250 bar (220 - 3600 psi)
330 = 15 - 330 bar (220 - 4750 psi)

8 Pilot drain options

See also “Functional Symbols”

9 Standard features

Z-M = For KX(C)G-6/8 and KAX(C)G-6/8

10 Coil connection type (KCG only)

U = ISO 4400 (DIN43650) interface▼
FW = Flying-leads in wiring box tapped $^1/_2$″ NPT
FTW= As “FW” plus terminal strip
FJ = Flying-leads in wiring box tapped M20
FTJ = As “FJ” plus terminal strip
P = Plug-in coil (type “H” only) Use with “EN46”

▼ *Female connector to be supplied by user.*

11 Connections (KACG only)

PD7 = 7 pin connector with plastic plug.
See **Warning** note regarding CE compliance on page . 12

12 Coil rating

Code = amps x ohms◆
G1 = 3,5 x 1,65
GP1 = 3,0 x 2,0
H1 = 1,6 x 7,3▼
HA1 = 0,94 x 22
HJ1 = 1,0 x 14,25■
HL1 = 0,80 x 29●

◆ *Resistance at 20°C (68°F).*
▼ *KACG valves must have H1 coils*
l *For valves replacing CGEV models.*
■ *This lower power coil is limited to the following maximum controlled pressures. Valves supplied with type HJ coils will be stamped with the applicable maximum controlled pressure.*

Model code position 7	***Max. pressure with HJ coil***
40	*35 bar (500 psi)*
100	*85 bar (1100 psi)*
160	*140 bar (2000 psi)*
250	*210 bar (3000 psi)*
330	*315 bar (4500 psi)*

13 Design number, 1* series

Subject to change. Installation dimensions unaltered for design numbers 10 to 19 inclusive.

14 Special features

EN46 used with P-type coil connection and Uniplug connector.
Omit if not required.

Operating Data

Standard test conditions are with antiwear hydraulic oil at 36 cSt (168 SUS) and 50°C (122°F)

Maximum pressures: Port B (pressure inlet) Port A (reduced pressure outlet) Port Y▲ and side drain port Y1▲ ▲ *Back pressure at these ports is additive to the reduced pressure setting of the valve.*	 350 bar (5000 psi) See 7 in “Model Code” 2 bar (30 psi)
Rated flow at Δp = 12 bar (175 psi) and 0 mA to coil: K(A)X(C)G-6 K(A)X(C)G-8	 200 L/min (53 USgpm) 300 L/min (80 USgpm)
Pressure adjustment ranges	See 7 in “Model Code”
Minimum pressure differential (P_B-P_A) for effective reduced pressure control, all models	20 bar (300 psi)
Pilot control drain flow, all models	1,5 L/min (0.4 USgpm) max.
Coil or amplifier rating KX(C)G KAX(C)G	 See 12 in “Model Code” 24V x 40W max. (22 to 36V incl. 10% pk. to pk. max.ripple)
Command signal ranges, KAC(C)G models	0 to +10V DC, or 0 to – 10V DC
Dither, KAX(C)G models	Factory set, not user adjustable
Monitor point signal, KAX(C)G models	0,5V per amp. solenoid current
Power stage PWM, KAX(C)G models	2kHz nominal
7-pin plug connections, KAX(C)G models: A B C D E F G	 Power supply +ve Power 0V Signal 0V +ve voltage command signal –ve voltage cpommand signal Monitor output Protective ground
Electro-magnetic compatibility (EMC) KAX(C)G models only: Emission (10v/m) Immunity (10v/m)	 EN 50081-2 EN 50082-2
Pressure gain Factory setting - Maximum with 10V command signal. User adjustment - 30 to 120% of factory setting. Note that altering this setting will affect valve to valve interchangeability.	See graph
Pressure underride	See graph
Hysteresis, using Vickers drive amplifier KX(C)G KAX(C)G	 <6% <7%
Linearity at conditions: 1. “Dead-head” (no flow from reduced pressure outlet port) 2. Between 10% and 100% rated pressure	<6% of rated pressure
Repeatability	< ± 1,3% of rated pressure
Protection, Electrical (KA(C)G models)	Reverse-polarity protected

Mass (weight) KCG-6 KACG-6 KCG-8 KACG-8	 4,9 kg (10.8 lb) 5,3 kg (11.7 lb) 5,8 kg (12.8 lb) 6,2 kg (13.7 lb)
Supporting products: Amplifiers for KCG valves with “H” type coils only: EHH-AMP-724-C/D-10 (Uniplug) EHH-AMP-7*2 series (power plug) EEA-PAM-513-A-14 (1 adjustable ramp) EEA-PAM-513-A-3* (2 adjustable ramps) Auxilliary electronic modules (Din-rail mounting) for KACG models: EHA CON 201 A 2* 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 1* power supply ISO 4400 (DIN 43650) electrical connector: Black, marked “B” Gray, marked “A” Subplates, size 03 Mounting bolts■ ■ *Note: If not using Vickers recommended bolt kits, bolts must be to ISO 898 grade 12.9 or stronger.*	 See catalog 2367 See catalogs 2114, 2115 and 2282 See catalog 2137 See catalog 2464 See catalog 2410B See catalog 2470 See catalog 2410B See catalog 2427 See catalog 2410B Part number 710775 Part number 710776 See catalog 2425 See catalog 2314A
Installation and start-up (commissioning): Installation and start-up (commissioning) guide Mounting attitude	 ML-B-9133B (Multi-lingual English, German, French and Italian), shipped with each product and also available separately on request. No restriction, provided that the valve is kept full of fluid through port T.
Ordering procedure	Valves, subplates, bolt kits and Vickers amplifiers should be ordered by full model code designation. Order ISO (DIN) electrical connectors by part number.

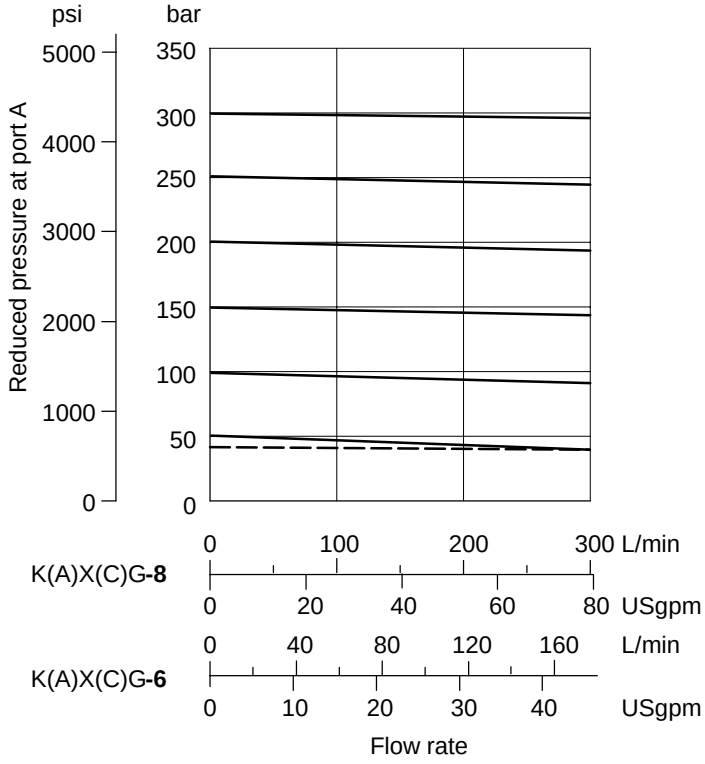
Performance Data

Typical with oil at 36 cSt (168 SUS) and at 50°C (122°F)

Pressure Underride

——— K(A)X(C)G-6/8-*-330---- models, at inlet pressure 350 bar (5000 psi)

– – – – K(A)X(C)G-6/8-*-100---- models, at inlet pressure 100 bar (1450 psi)



Pressure Drop

From port B to A at pressures below reduced pressure setting:

K(A)X(C)G-**6** valves . . . . . Curve A

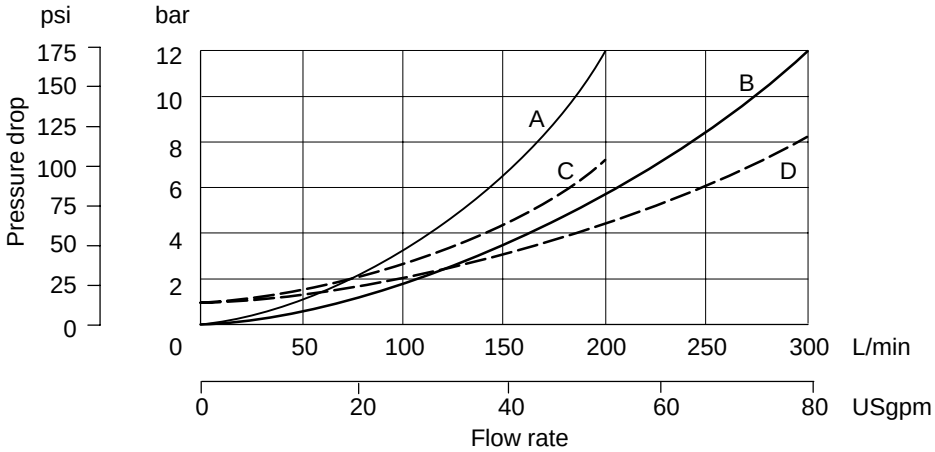
K(A)X(C)G-**8** valves . . . . . Curve B

From port A to B through check valve (mainstage assumed closed).

Types K(A)XCG only:

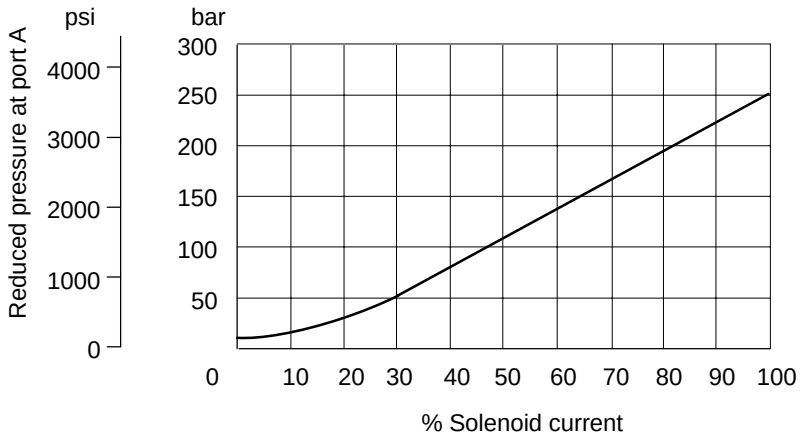
K(A)XCG-**6** valves . . . . . Curve C

K(A)XCG-**8** valves . . . . . Curve D



Pressure Gain

Typical example K(A)X(C)G-6/8-*-250, at inlet pressure 350 bar (5000 psi). Valid for models driven from Vickers amplifier with appropriate settings of gain and offset.



Step Response

Typical data for K(A)X(C)G-*-*-250 model with factory settings of gain and offsett and KX(C)G-*-*-250 driven by Vickers Eurocard amplifier with appropriate settings of gain and offset, and with a ramp time of 80 ms▲.

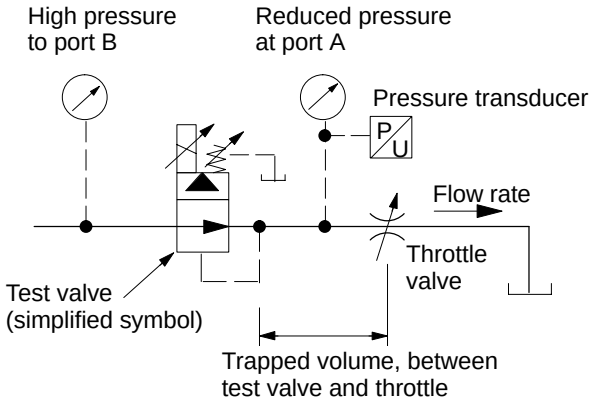
▲ *Recommended minimum ramp rate to avoid excessive pressure overshoot: 80 ms/100% solenoid current.*

Valve size	Test conditions: Trapped volume	Flow rate	Step size: Pressure demand	Response time (ms)
6	1,5 liters (0.4 USg)	75 L/min (20 USgpm)	0 to 100% 100% to 0 25 to 100% 100 to 25%	75 60 60 50
8	3,0 liters (0.8 USg)	150 L/min (40 USgpm)	0 to 100% 100% to 0 25 to 100% 100 to 25%	70 70 45 70

Test method

1. Inlet pressure set 300 bar (4350 psi)
2. Trapped volume as in table
3. Steady state flow rate adjusted by downstream throttle valve with Δp = 250 bar (3600 psi)
4. Response = time from step input signal until reduced output pressure reaches 90% of step change, as measured by transducer

Test Circuit



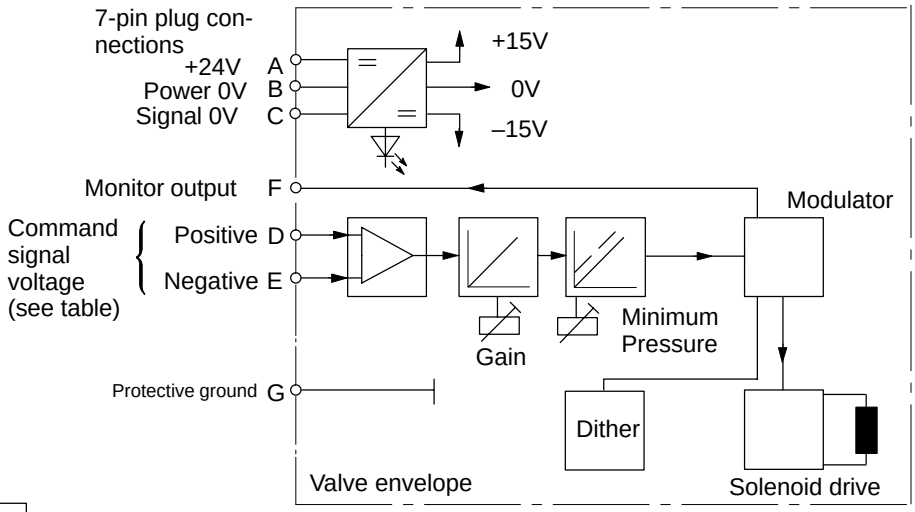
KAX(C)G-6/8 Electrical Block Diagram

Wiring
Connections must be made via the 7-pin plug mounted on the amplifier.
Recommended cable sizes are:

Power cables:
For 24V supply
0,75 mm^2 (18 AWG) up to 20m (65 ft)
1,00 mm^2 (17 AWG) up to 40m (130 ft)

Signal cables:
0,50 mm^2 (20 AWG)

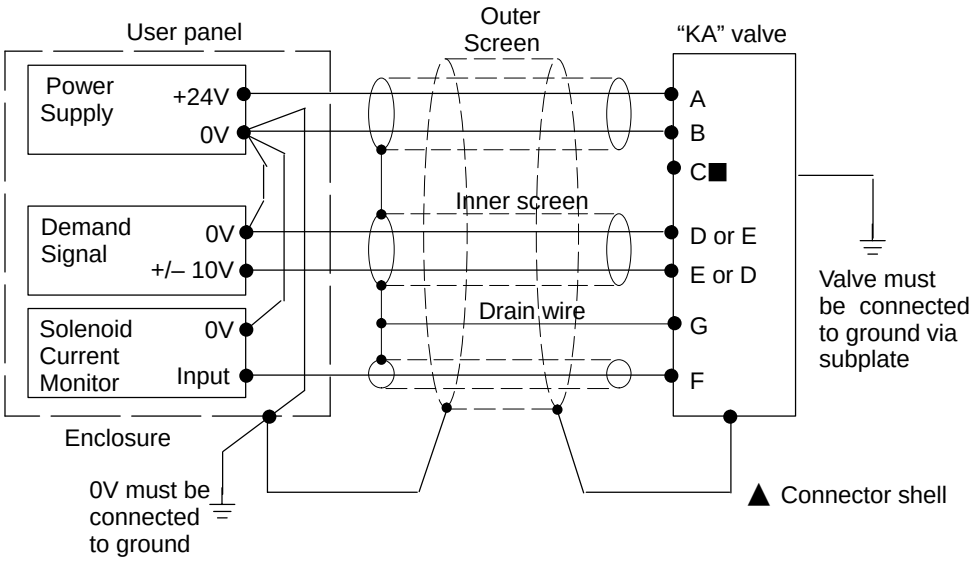
Screen:
A suitable cable would have 7 cores, a separate screen for the signal wires and an overall screen.
See wiring connection diagram on page NO TAG



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

KAX(C)G-6/8 Typical Connection Arrangements

Wiring Connections for Valves with integral Amplifier



■ Solenoid current monitor voltage (pin F) will be referenced to the KA valve local ground. A "local ground" (pin C) is provided for optional use by differential input customer supplied electronics.

▲ 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

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.

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-point connector, part no. 934939, should be used for the integral amplifier.

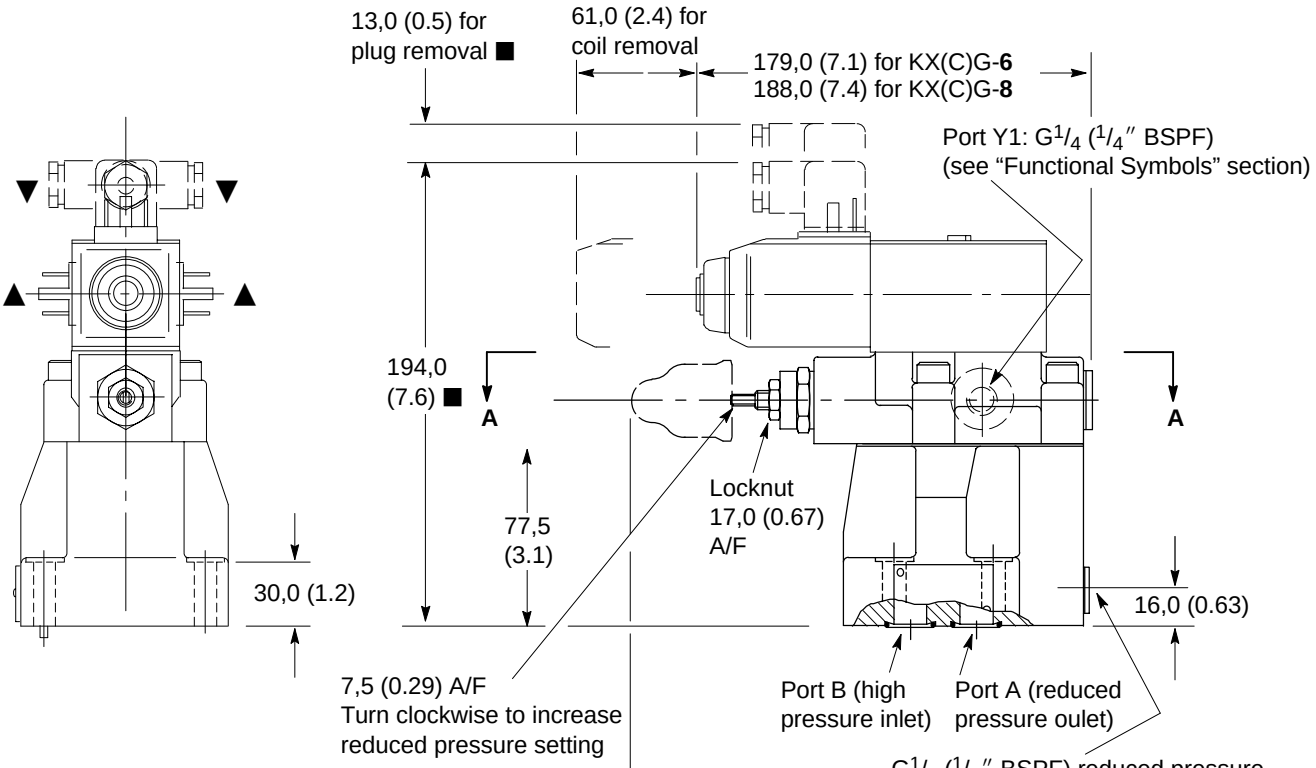
In all cases, both valve and cable should be kept as far as possible from any sources of electromagnetic radiation such as cables carrying heavy current, relays and certain kinds of portable radio transmitters, etc. Difficult environments could mean that extra screening may be necessary to avoid the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

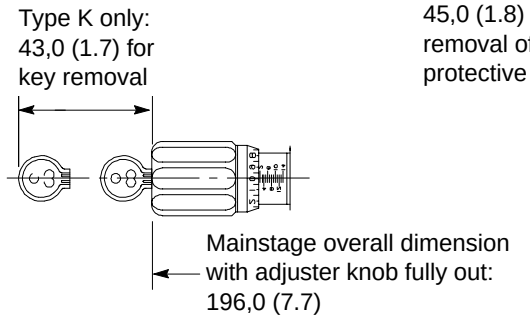
Installation Dimensions in mm (inches)

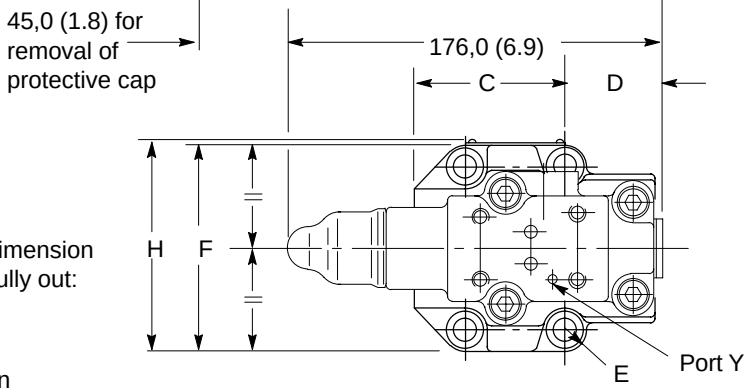
KX(C)G-* Models with Type “U” Coil Connection:
“U” at Model Code 9

3rd angle projection



Micrometer Adjustment Options:
“K” or “M” in Model Code 5





View “A-A”

“K” Feature:
To adjust pressure setting, insert key and turn clockwise. Turn micrometer knob clockwise to increase pressure setting; counter-clockwise to decrease setting. When the key is removed the knob can spin freely without affecting the pressure setting.

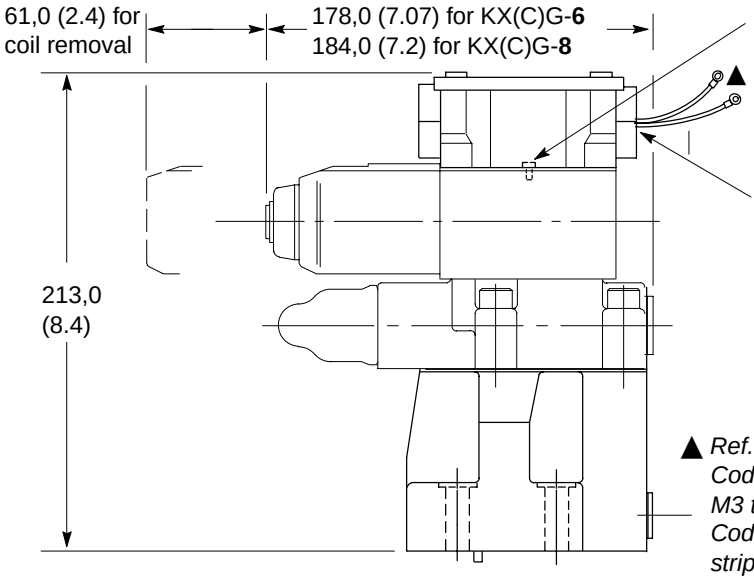
▲ *Alternative plug positions by loosening knurled nut counter-clockwise, turning coil and re-tightening nut.*
■ *Dimensions may vary according to source of plug.*
▼ *The cable entry on this plug can be repositioned at 90° intervals by reassembly of the contact holder relative to the plug housing. The cable entry is Pg 11 for cables Ø6-10 mm (0.24-0.4 dia).*

Model	C	D	E rad.	F	H
KX(C)G-6	42,0 (1.7)	66,0 (2.6)	10,0 (0.4)	89,0 (3.5)	92,0 (3.65)
KX(C)G-8	40,0 (1.6)	77,0 (3.1)	11,0 (0.43)	104,0 (4.1)	107,0 (4.25)

KX(C)G-* Models with Type “F” Coil Connection:
“F(T)W” or “F(T)J” at Model Code 7

3rd angle projection

For dimensions not shown see page 10.



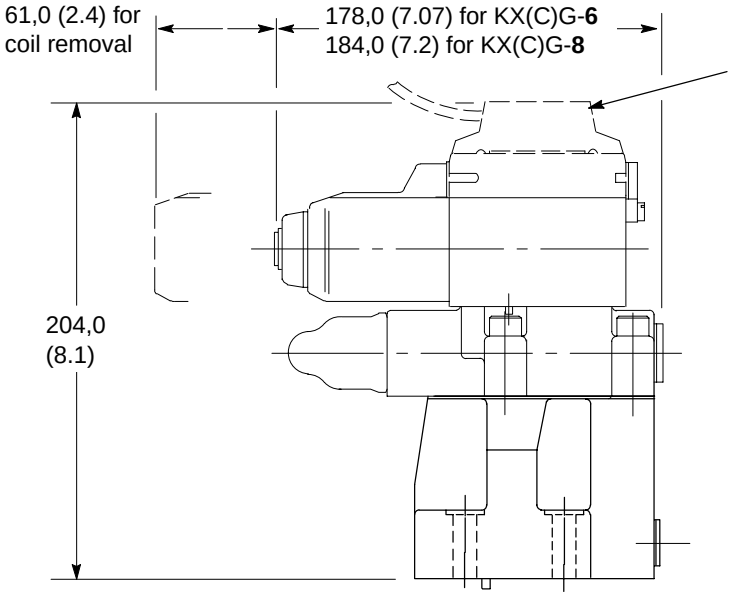
▲ *Ref. Model Code* 9 *:*
Codes “FJ” and “FW”: 2 lead wires approx. 150,0 (6.0) long. M3 terminals provided for customer connection.
Codes “FTJ” and “FTW”: Lead wires connected into terminal strip suitable for M3 terminals on customer connection.

KX(C)G-*---EN46 Models for Use with Vickers
UNIPLUG, Single Cable Connector:
“P” at Model Code 11 **; “H” at Model Code** 11

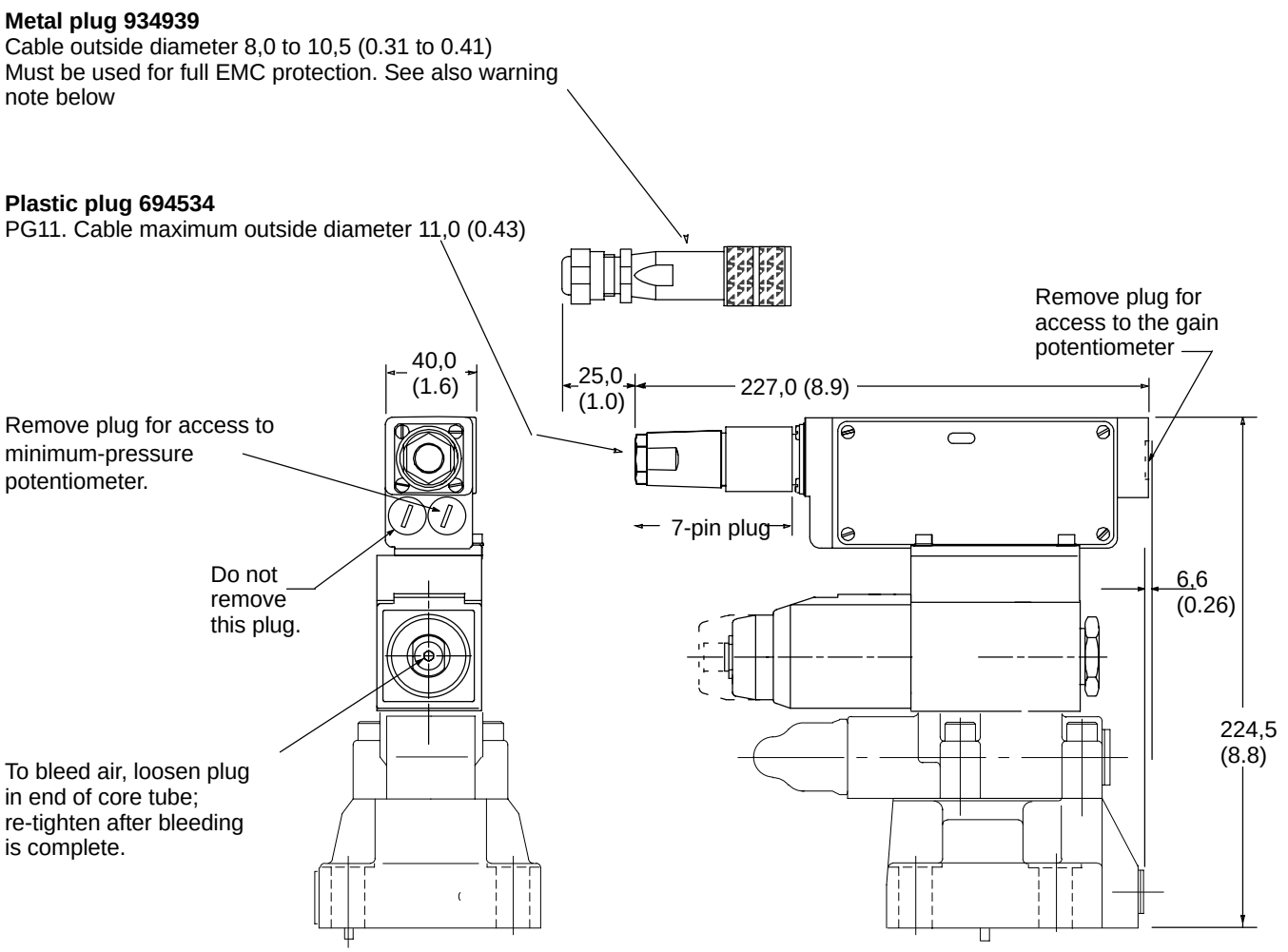
For use with Vickers single-cable UNIPLUG connectors:
For “Soft Switch” Control:
Use UNIPLUG model type EHH-AMP-724-C**-1*
For Proportional Control:
Use UNIPLUG model type EHH-AMP-724-D**-1*
UNIPLUG connectors should be ordered separately; see catalog 2367.

To fit UNIPLUG connector to KCG-3 pilot valve:
Unscrew coil retention nut and remove coil.
Slide UNIPLUG connector onto dummy pins (at non-solenoid end) then replace coil, ensuring pins are fully engaged.
Replace and tighten coil retention nut.

For dimensions not shown see page 10.



KAX(C)G-* Models (With integrated amplifier)



Warning

To conform to the EC Electromagnetic Compatibility directive (EMC) this KACG valve must be fitted with a metal 7-pin plug. The screen of the cable must be securely connected to the shell of the metal connector. A suitable IP67 rated connector is available from Vickers, part no. 934939. Alternatively a non IP67 rated connector is available from ITT-Cannon, part no.CA 02 COM-E 14S A7 P.

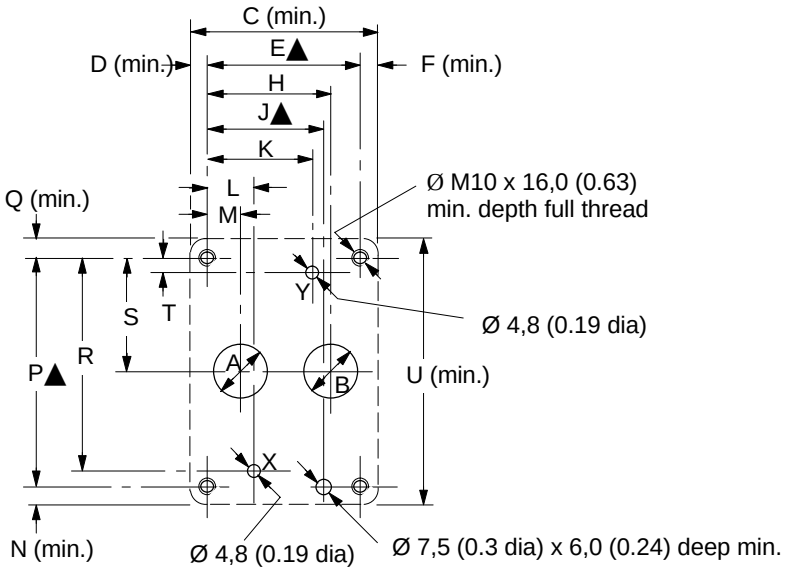
Additionally the cable must be fitted with a ferrite EMC suppression core not more than 4cm from the connector referred to above. Suitable types include Farnell 535-898 or Farnell 535-904 which snap fit over the cable.

The plastic plug, part number 694534, is only suitable for use in a sealed electromagnetic environment or outside of the European Community.

Mounting Surfaces, ISO 5781
(B Port High Pressure Inlet)
AG-06-2-A
AH-08-2-A

When a subplate is not used a raised machined pad must be provided for mounting. The pad must be flat within 0,001 mm/100 mm (0.0001″/10″) and smooth within 0,8 μm (32 μin). Dimensional tolerances are ±0,2 mm (±0.008″) except where indicated.
Port functions

A = Reduced pressure outlet (Also free reverse flow inlet for KXCG valves)
B = High pressure inlet (Also free reverse flow outlet for KXCG valves)
X = Not used for KX(C)G valves; can be omitted or plugged
Y = Drain port

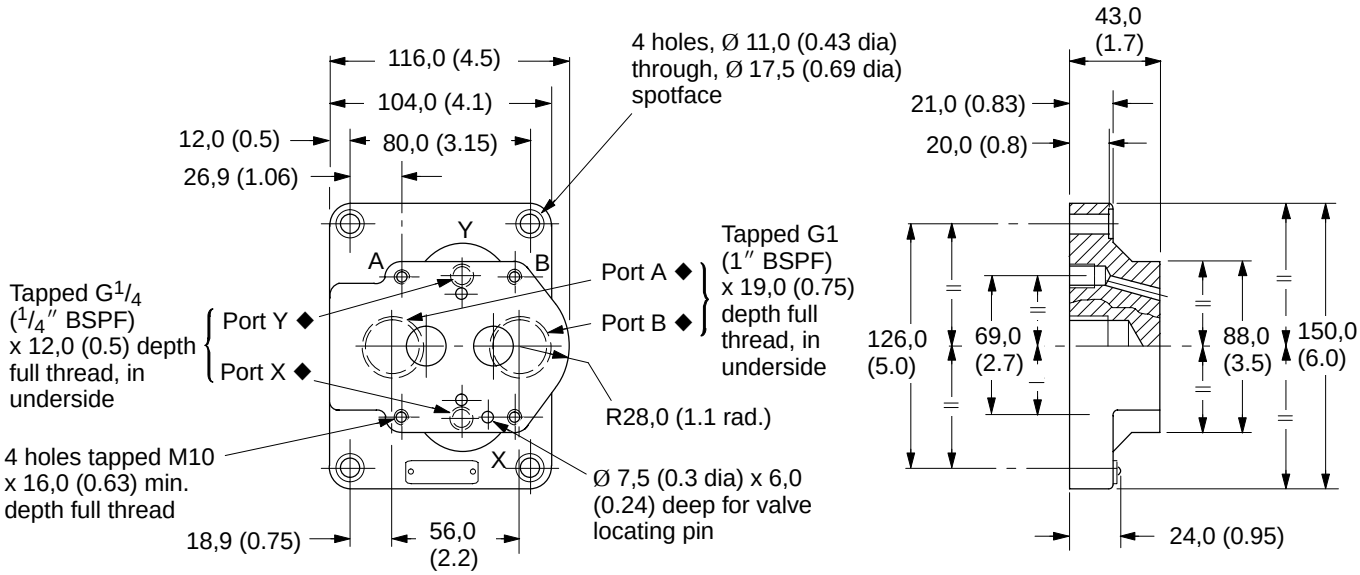


Size	A dia.	B dia.	C	D	E	F	H	J	K
06	14,7 (0.58)	14,7 (0.58)	61,0 (2.4)	9,0 (0.4)	42,9 (1.69)	9,0 (0.4)	35,7 (1.4)	31,8 (1.25)	21,4 (0.84)
08	23,4 (0.92)	23,4 (0.92)	78,0 (3.1)	8,8 (0.35)	60,3 (2.37)	8,8 (0.35)	49,2 (1.94)	44,5 (1.75)	39,7 (1.56)

Size	L	M	N	P	Q	R	S	T	U
06	21,4 (0.84)	7,1 (0.28)	10,0 (0.4)	66,7 (2.62)	10,0 (0.4)	58,7 (2.3)	33,3 (1.3)	7,9 (0.31)	87,0 (3.4)
08	20,6 (0.81)	11,1 (0.44)	10,8 (0.43)	79,4 (3.125)	10,8 (0.43)	73,0 (2.87)	39,7 (1.56)	6,4 (0.25)	101,0 (4.0)

▲ *Tolerance on bolt and pin locations ±0,1 mm (±0.004″).*

XCGVM-6-10R Subplate



◆ *See "Mounting Surfaces" section above for port usage.*

Further Information

Hydraulic Fluids
Materials and seals used in these valves are compatible with:
Anti-wear petroleum oils . . . . . L-HM
For use with Non-alkyl based phosphate esters (L-HFD), use F3 version in model code.
The extreme operating range is 500 to 13 cSt (270 to 70 SUS) but the recommended running range is 54 to 13 cSt (245 to 70 SUS). For further technical information about fluids see 694.

Contamination Control Requirements
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 μm, 5 μm and 15 μm.

For products in this catalog the recommended levels are:
Up to 210 bar (3000 psi) 18**/16/13**
Above 210 bar (3000 psi) 17**/15/12**

Installation and Start-up Guidelines
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.

If this proves to be the case any accumulated air can be bled from the solenoid bleed screw. This task is easier if the valve has been mounted base downwards. Good installation practice dictates that the tank port, and any drain port, are piped so as to keep the valve full of fluid once the system start-up has been completed.

Temperatures
For petroleum oil:
Min. . . . . –20°C (–4°F)
Max.* . . . . . +70°C (158°F)

* *To obtain optimum service life from both fluid and hydraulic system, 65°C (150°F) normally is the maximum temperature.*

For other fluids where limits are outside those of petroleum oil, consult fluid manufacturer or Vickers representative. Whatever the actual temperature range, ensure that viscosities stay within those specified under “Hydraulic Fluids”.

Ambient for:
Valves at full performance specification: –20 to +60°C (–4 to +140°F).
Valves, as above, will operate at temperatures of 0 to –20°C (32 to –4°F) but with a reduced dynamic response.

Storage:
–25 to +85°C (–13 to +185°F)

Eurocard electronics:
0 to 50°C (32 to 122°F)

Seal Kits
Pilot valves
K(A)CG-3 (KA + DIN) 02-138201
KCG-3 (’F’ & ’P’ versions) . . 02-145869
Mainstage valves
K(A)X(C)G-6 614824
K(A)X(C)G-8 614826

EATON | Vickers

Proportional Pressure Relief Valves

Technical Catalog

KBCG-3-1*

Contents

General Description	Page 3
Functional Symbol	Page 3
Typical Section	Page 3
Model Codes	Page 4
Operating Data	Page 5
Performance Data	Page 7
Installation Dimensions	Page 8
Electrical Information	
Block Diagram	Page 9
Typical Connection Arrangements	Page 10
Further Information	Page 11

CE *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).*

General Description

An electro-hydraulic proportional relief valve designed to regulate pressure in a hydraulic system in proportion to an applied electrical input.

These open-loop, single-stage valves can be used for direct control of pressure in low flow systems, or for pilot control of larger pressure controls, and for such applications as pressure-controlled pumps.

The integral amplifier allows the pressure to be controlled from a low power command signal: either a voltage or current command. The amplifier is mounted in a robust metal housing and electrical connections are via an industry standard 7-pin plug. Factory-set adjustments ensure high reproducibility valve-to-valve.

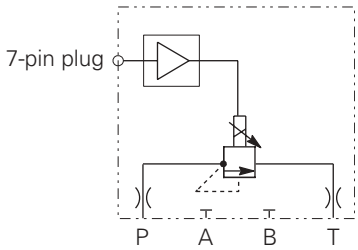
Other Models

For proportional pressure relief valves with flow ratings up to 400 L/min (106 USgpm), see catalog V-VLPO-MC003-E (model types KBCG, sizes 6 and 8).

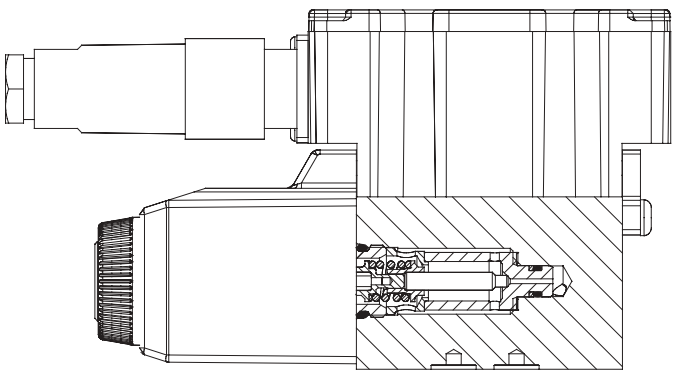
Features and Benefits

- Valve design ensures low hysteresis and good repeatability.
- Self-bleeding design simplifies installation and ensures consistent performance.
- When used for piloting a large pressure relief or reducing valve, a low minimum pressure is obtainable, combined with fast and stable response to step input signals.
- On-board ramp adjustment

Functional Symbol



Typical Section



Model Codes

KB	*	G	*	*	***	D-Z-M	*	*	A	P*7	*	10
1	2	3	4	5	6	7	8	9	10	11	12	13

1 Valve Type

KB - Proportional valve with integral amplifier, B series

2 Type

C - Pressure relief

3 Mounting

G - Subplate mounted

4 Interface

3 - ISO 4401, size 3 (NFPA D03)

5 Build Orientation

Blank - Right hand (standard)

L - Left hand

6 Controlled Pressure Range

At rated flow of 1 L/min (0.26 USgpm)

40 - 2-40 bar (29-580 psi)

100 - 3-100 bar (44-1450 psi)

160 - 4-160 bar (58-2300 psi)

250 - 5-250 bar (73-3625 psi)

350 - 6-350 bar (87-5000 psi)

7 Standard Features

DZM - for KBCG3

8 Electrical Command Options

1 - +/- 10 volts control signal

2 - 4-20 mA control signal

9 Ramp Options

1 - No ramp

2 - Standard ramp (typically 65 ms)

3 - Long ramp (typically 80 ms)

10 Command/Pressure Characteristic

A - Standard

11 Electrical Connection

PC7 - 7 pin connector, without plug supplied

PE7 - 7 pin connector, with plug supplied

PH7 - As PE7 but with pin 'C' used for enable signal

PR7 - as PC7 but with pin 'C' used for enable signal

12 Coil Rating

H1 - 24V DC amplifier supply

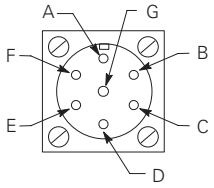
13 Design Number, 1* Series

Subject to change. Installation dimensions unaltered for design numbers 10 to 19 inclusive.

Warning

To conform to the EC Electromagnetic Compatibility directive (EMC) this KBCG valve must be fitted with a metal 7-pin plug. The screen of the cable must be securely connected to the shell of the metal connector. A suitable IP67 rated connector is available from Eaton, part no. 934939. Alternatively a non IP67 rated connector is available from ITT-Cannon, part no.CA 02 COM-E 14S A7 P.

Operating Data

Standard test conditions are with antiwear hydraulic oil at 36 cSt (168 SUS) and 40˚C (104˚F)	
Maximum pressures:	
Port P:	
Operating	See 6 in "Model Code"
Static	350 bar (5075 psi)
Port T:	
Operating	2 bar (29 psi). See "Back pressure at port T" under "Installation and start-up" below.
Static	210 bar (3000 psi)
Flow limits:	
Rated flow	1 L/min (0.26 USgpm)
Maximum flow	5 L/min (1.3 USgpm)
Coil or amplifier rating	24V x 40W max. (22 to 36V including 10% pk.-to-pk. max. ripple)
Command signal:	
Volts (see model code 8 - 1)	0 to +10V or 0 to -10V
Input impedance	47 kΩ
Common mode voltage to pin B	4V
Current (see model code 8 - 2)	4 to 20 mA
Input impedance	100Ω
Valve enable signal:	
Enable	>9.0V (36V max)
Disable	<2.0V
Input impedance	36 kΩ
7-pin plug connector	Pin Description
	A Power supply positive (+) B Power supply 0V and current command return C Valve enable (PH7 & PR7) D Command signal (+V or current in) E Command signal (-V or current GND) F Output monitor G Protective ground
View of pins of fixed half	
Electromagnetic compatibility (EMC):	
Emission (10 V/m)	EN 50081-2
Immunity (10 V/m)	EN 50082-2
Monitor signal (pin F)	1.7 V/amp solenoid current
Output impedance	10 kΩ
Pressure gain	See graph
Factory setting - Maximum with 100% command signal.	
Pressure override	See graph
Pressure step response	Typical times to reach 90% of commanded step:
(20 cm^3 volume, 1 L/min (0.26 USgpm)):	Model code 9:

KBCG-3-250 model:	1	2	3
0 to 100% step	60 ms	65 ms	87 ms
100 to 0% step	48 ms	55 ms	73 ms

Linearity, between 10% and 100% of controlled pressure range	<4%
Hysteresis	<5% (with factory-set dither)
Repeatability	<+/-1.0% of rated pressure
Reproducibility, valve-to-valve (at factory settings):	
Pressure at 100% command signal	≤5%

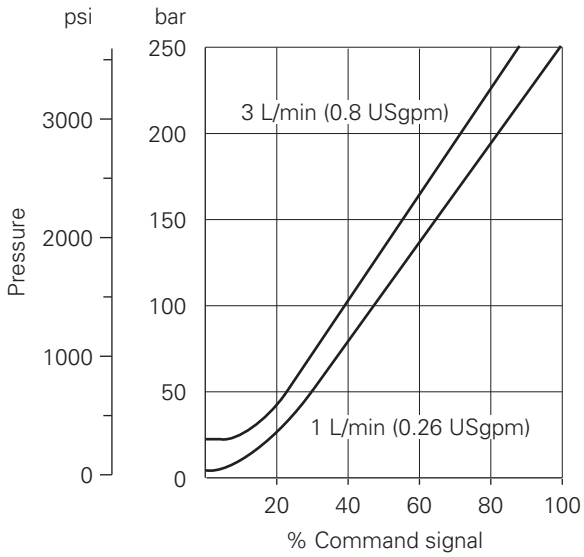
Operating Data (continued)

Protection:	
Electrical	Reverse polarity protected
Environmental	IEC 529, Class IP67
Mass	2,2 kg (4.85 lb)
Supporting products:	
Auxiliary electronic modules (DIN-rail mounting):	
EHA-CON-201-A-2* Signal converter	See catalog 2410B
EHD-DSG-201-A-1* Command signal generator	See catalog 2470
EHA-RMP-201-A-2* Ramp generator	See catalog 2410B
EHA-PID-201-A-2* PID controller	See catalog 2427
EHA-PSU-201-A-10 Power supply	See catalog 2410B
Installation and start-up:	
Back pressure at port T	Port T should be piped directly to reservoir with minimum restriction. Any back pressure at this port is additive to the controlled pressure at port P. The recommended max. pressure at port T when the valve is controlling pressure is 2 bar (29 psi); the max. pressure at T under static conditions is 210 bar (3000 psi)

Pressure Gain, Typical

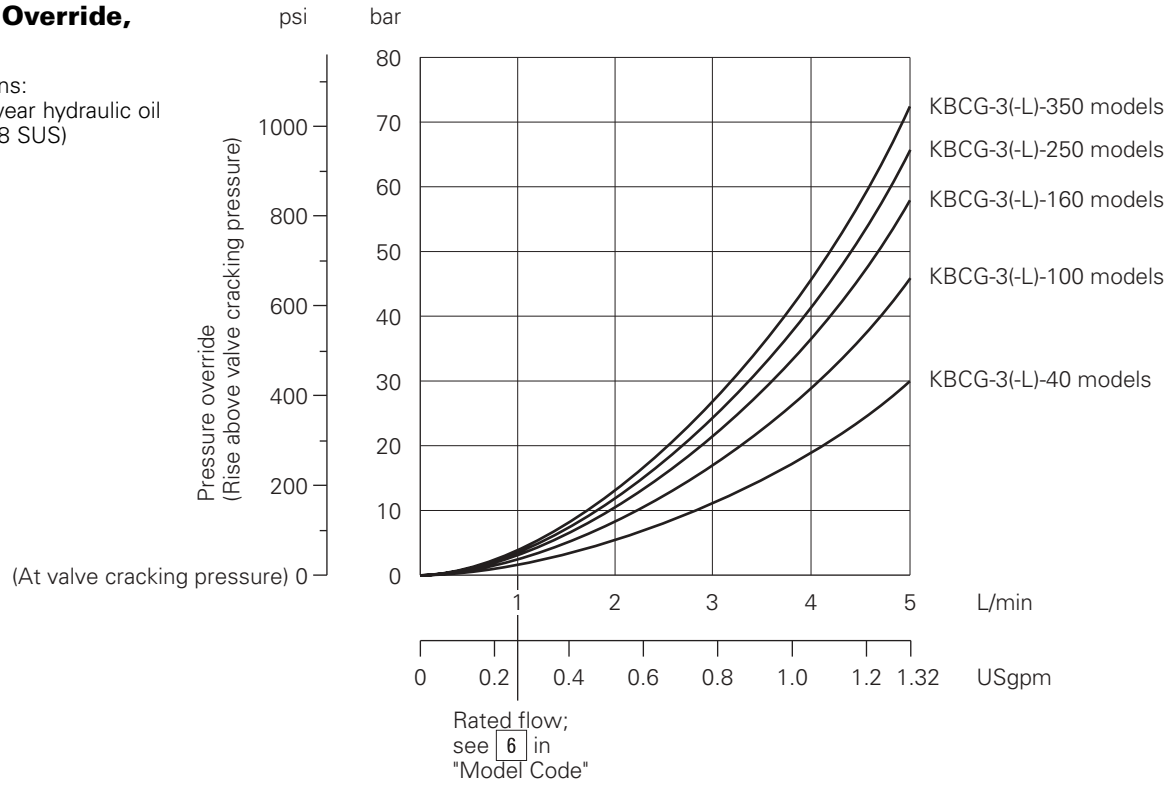
Typical pressure v. command signal response of KBCG-3-250 models

Test conditions:
Fluid = Antiwear hydraulic oil at 36 cSt (168 SUS)

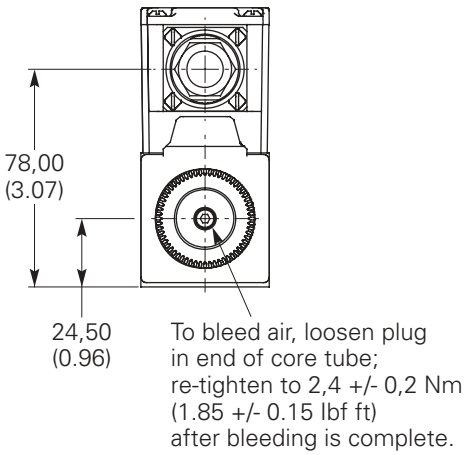


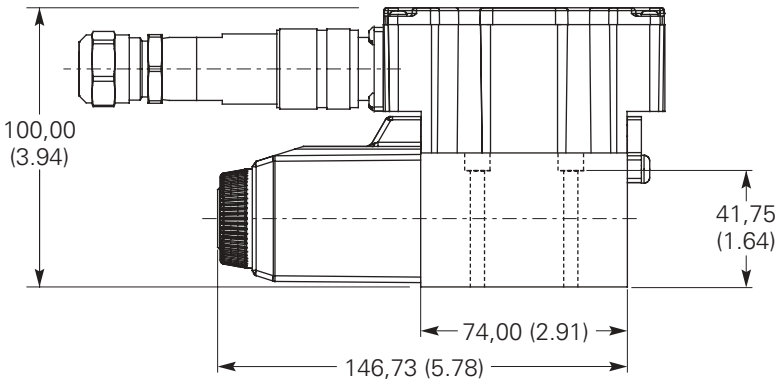
Pressure Override, Typical

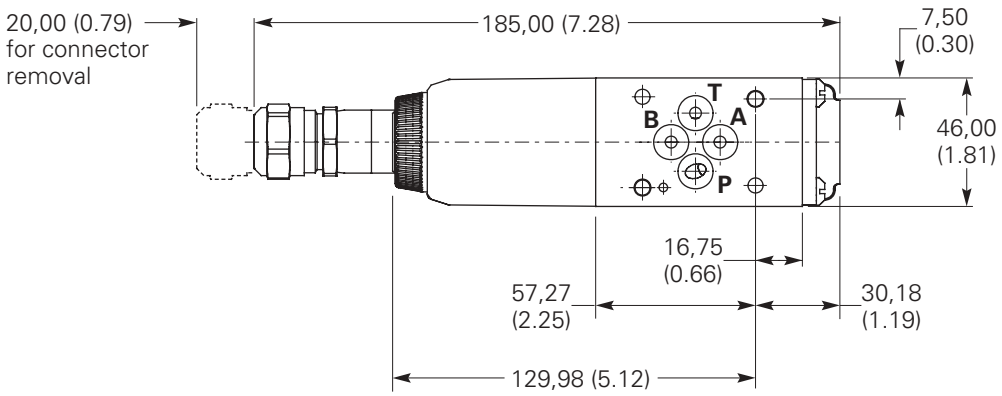
Test conditions:
Fluid = Antiwear hydraulic oil at 36 cSt (168 SUS)



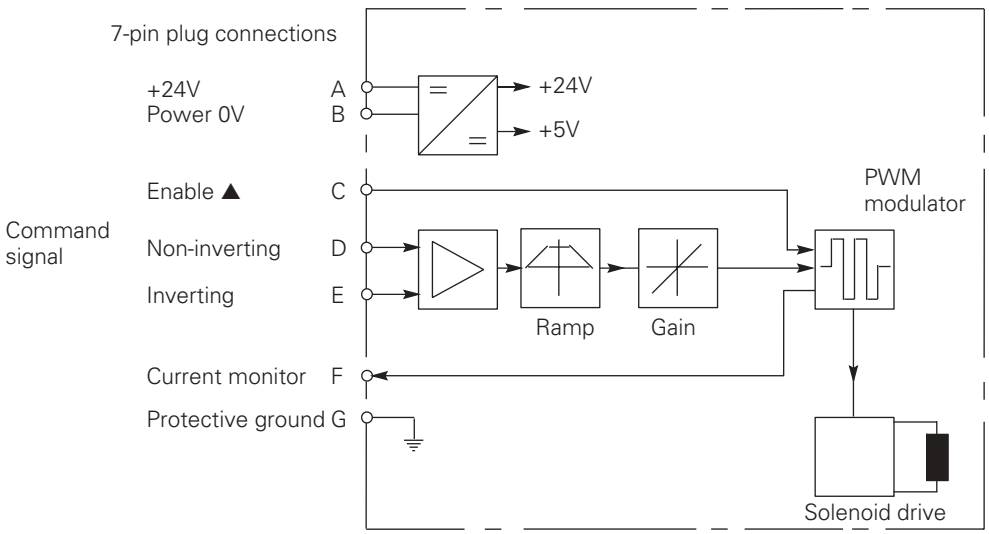
Installation
Dimensions







Block Diagram



▲ In valves with PH7 or PR7 type electrical connection.

Wiring

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

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)

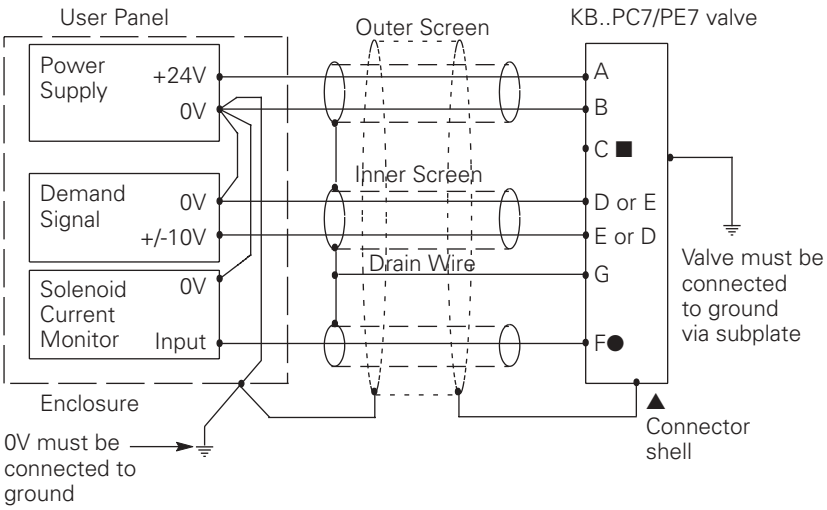
Screen (Shield)

A suitable cable should have at least 6 cores with pairs of conductors individually screened and an overall screen. Cable outside diameter 8,0-10,5 mm (0.31- 0.41 inches). See connection diagrams on next page.

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

Typical Connection Arrangements

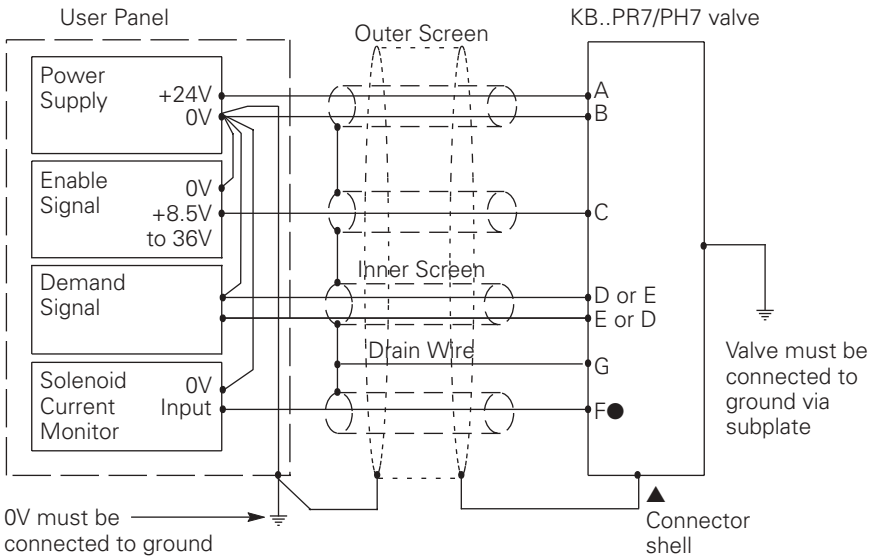
Wiring Connections



■ Pin C may be connected to ground or left unconnected.

● Output monitor voltage (pin F) will be referenced to the power 0 volts (pin B).

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.

Further Information

Hydraulic Fluids

Materials and seals used in these valves are compatible with:
Anti-wear petroleum oils...L-HM
Non-alkyl based phosphate esters.....L-HFD

The extreme operating range is 500 to 13 cSt (270 to 70 SUS) but the recommended running range is 54 to 13 cSt (245 to 70 SUS). For further technical information about fluids see 694.

Contamination Control Requirements

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:
Up to 210 bar (3000 psi).....18/**16/13**
Above 210 bar (3000 psi).....17/**15/12**

Installation and Start-up Guidelines

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.

If this proves to be the case any accumulated air can be bled from the solenoid bleed screw. This task is easier if the valve has been mounted base downwards. Good installation practice dictates that the tank port, and any drain port, are piped so as to keep the valve full of fluid once the system start-up has been completed.

Temperatures

For petroleum oil:
Min.....-20°C (-45°F)
Max.....+70°C (158°F)

For fluids where limits are outside those of petroleum oil, consult fluid manufacturer or Eaton representative. Whatever the actual temperature range, ensure that viscosities stay within those specified under "Hydraulic Fluids".

Ambient for:
Valves at full performance specification: -20 to +70°C (-4 to +158°F).

Valves, as above, will operate at temperatures of 0 to -20°C (32 to -4°F) but with a reduced dynamic response.

Storage:
-25 to +85°C (-13 to +185°F)

Seal Kit

02-352521

Eaton
14615 Lone Oak Road
Eden Prairie, MN 55344-2287
USA
Tel: (+1) 952 937-9800
Fax: (+1) 952 974-7722
www.hydraulics.eaton.com

Eaton
20 Rosamond Road
Footscray
Victoria 3011
Australia
Tel: (+61) 3 9319 8222
Fax: (+61) 3 9318 5714

Eaton
Dr.-Reckeweg-Str. 1
D-76532 Baden-Baden
Germany
Tel: +49 (0) 7221 682-0
Fax: +49 (0) 7221 682-788

EATON | Vickers

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May 2003

Proportional Pressure Relief Valves

KCG-3, 1* Series; KACG-3, 1* series

Basic Characteristics

Max. pressure . . . . . 350 bar (5075 psi)
Max. flow . . . . . 5 L/min (1.3 USgpm)
Mounting face to ISO 4401 size 03

General Description

An electro-hydraulic proportional relief valve designed to regulate pressure in a hydraulic system in proportion to an applied electrical input.

These open-loop, single-stage valves can be used for direct control of pressure in low flow systems, or for pilot control of larger pressure controls, and for such applications as pressure-controlled pumps.

KCG-3

The valve responds to variations in current supply to its solenoid; separate Vickers amplifiers, with PWM output stage and output current control, are available for driving this model, see “Operating Data”.

KACG-3

The addition of an integral amplifier allows the pressure to be controlled from a 0 to +10V, or 0 to –10V command signal range. The amplifier is mounted in a robust metal housing and electrical connections are via an industry standard 7-pin plug. Factory-set adjustments ensure high reproducibility valve -to-valve.

Other Models

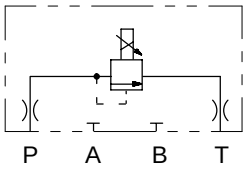
For proportional pressure relief valves with flow ratings up to 400 L/min (106 USgpm), see catalog 2324 (model types KCG, sizes 6 and 8)

Features and Benefits

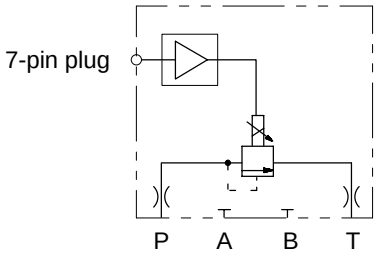
- Valve design ensures low hysteresis and good repeatability.
- Self-bleeding design simplifies installation and ensures consistent performance.
- When used for piloting a large pressure relief or reducing valve, a low minimum pressure is obtainable combined with fast and stable response to step input signals.

Functional Symbol

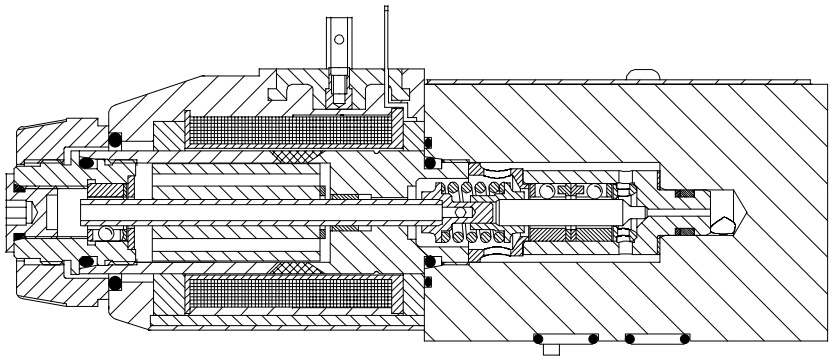
KCG-3



KACG-3



Typical Section: KCG-3 Valve with Type “U” Coil Connection



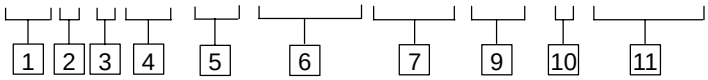
This product has been designed and tested to meet specific standards outlined in the European Electromagnetic Compatibility Directive (EMC) 89/336/EEC, amended by 91/263/EEC, 92/31/EEC and 93/68/EEC, article 5. For instructions on installation requirements to achieve effective protection levels, see this leaflet, the Installation Wiring Practices for Vickers Electronic Products leaflet 2468 and leaflet 02-123931A which is packed with every KA valve. Wiring practices relevant to this Directive are indicated by ⚠ Electromagnetic Compatibility (EMC).

Model Code

Features in brackets () may be omitted. All other features must be specified.

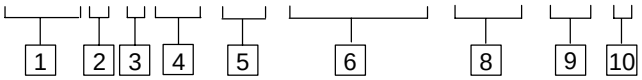
Models requiring separate amplifier

KCG-3(-L)- * -D-Z-M-***** - *** -1* (-EN46)**



Models with integral amplifier

KACG-3(-L)- * -D-Z-M- 2- PD7- H1-1***



1 Valve type

KC = Proportional pressure relief
KAC = Proportional pressure relief with integral amplifier

2 Mounting type

G = Subplate mounted

3 Interface

3 = ISO 4401, size 03 (NFPA D03)

4 Solenoid location

Blank = At port B end
L = At port A end

5 Controlled pressure range

(All coils except type HJ, see position 9 footnote▼)
At rated flow of 1 L/min (0.26 USgpm)
40 = 2-40 bar (29-580 psi)
100 = 3-100 bar (44-1450 psi)
160 = 4-160 bar (58-2300 psi)
250 = 5-250 bar (73-3625 psi)
350 = 6-350 bar (87-5000 psi)

6 Standard features

DZM = For KCG-3
DZM2 = For KACG-3

7 Coil connections (KCG only)

U = ISO 4400 (DIN 43650) interface
FW = Flying-leads in wiring box tapped $^1/_2''$ NPT
FTW= As “FW” plus terminal strip
FJ = Flying-leads in wiring box tapped M20
FTJ = As “FJ” plus terminal strip
P = Plug-in coil (type “H” only) Use with “EN46”

8 Connections (KACG only)

PD7 = 7 pin connector with plastic plug. See **Warning** note below.

9 Coil rating

Code = amps x ohms▲
G1 = 3,5 x 1,65
GP1 = 3,0 x 2,0
H1 = 1,6 x 7,3 ●
HA1 = 0,94 x 22
HJ1 = 1,00 x 14,25▼
HL1 = 0,80 x 29 ◆

▲ *Resistance at 20°C (68°F).*
●*KACG valves must have H1 coils*
◆ *For valves replacing ECG-02 models.*
▼ *This low power coil is limited to the following maximum controlled pressures.*

Valves supplied with type HJ1 coils will be stamped with the applicable maximum controlled pressure.

Model code position 5	***Max. pressure with HJ1 coil***
40	*35 bar (500 psi)*
100	*85 bar (1230 psi)*
160	*140 bar (2000 psi)*
250	*210 bar (3000 psi)*
350	*315 bar (4500 psi)*

10 Design number, 1* series

Subject to change. Installation dimensions unaltered for design numbers 10 to 19 inclusive.

11 Special features

EN46 used with P-type coil connection and Uniplug connector. Omit if not required.

Warning
To conform to the EC Electromagnetic Compatibility directive (EMC) this KACG valve must be fitted with a metal 7-pin plug. The screen of the cable must be securely connected to the shell of the metal connector. A suitable IP67 rated connector is available from Vickers, part no. 934939. Alternatively a non IP67 rated connector is available from ITT-Cannon, part no.CA 02 COM-E 14S A7 P.
Additionally the cable must be fitted with a ferrite EMC suppression core not more than 4cm from the connector referred to above. Suitable types include Farnell 535-898 or Farnell 535-904 which snap fit over the cable.
The plastic plug, part number 694534, is only suitable for use in a sealed electromagnetic environment or outside of the European Community.

Operating Data

Standard test conditions are with antiwear hydraulic oil at 36 cSt (168 SUS) and 40°C (104°F)	
Maximum pressures: Port P: Operating Static Port T: Operating Static	 See 5 in “Model Code” 350 bar (5075 psi) 2 bar (29 psi). See “Back pressure at port T” under “Installation and start-up” on next page. 210 bar (3000 psi)
Flow limits: Rated flow Maximum flow	 1 L/min (0.26 USgpm) 5 L/min (1.3 USgpm)
Coil or amplifier rating: KCG models KACG models	 See 9 in “Model Code” 24V x 40W max. (22 to 36V including 10% pk.-to-pk. max. ripple
Command signal ranges, KACG models	0 to +10V DC, or 0 to –10V DC
Dither, KACG models	Factory set, not user adjustable
Monitor point signal, KACG models	0,5V per amp. solenoid current
Power stage PWM, KACG models	2kHz nominal
7-pin plug connections, KACG models: A B C D E F G	 Power supply +ve Power 0V Signal 0V +ve voltage command signal –ve voltage cpommand signal Monitor output Protective ground
Electro-magnetic compatibility (EMC) KACG models only: Emission (10V/m) Immunity (10V/m)	 EN 50081-2 EN 50082-2
Pressure gain Factory setting - Maximum with 10V command signal. User adjustment - 30 to 120% of factory setting. Note that altering this setting will affect valve to valve interchangeability.	See graph
Pressure override	See graph
Minimum-pressure adjustment	50% of maximum pressure limit of model
Pressure step response: KCG-3-250-D-Z-M-*****-H1 model using EEA-PAM-513-A-1* amplifier: 0 to 100% step 100 to 0% step 25 to 100% step 100 to 25% step KACG-3-250 model: 0 to 100% step 100 to 0% step 25 to 100% step 100 to 25% step	Typical times to reach 90% of commanded step: 48 ms 9 ms 37 ms 18 ms 40 ms 18 ms 26 ms 30 ms
Linearity, between 10% and 100% of controlled pressure range	<4%

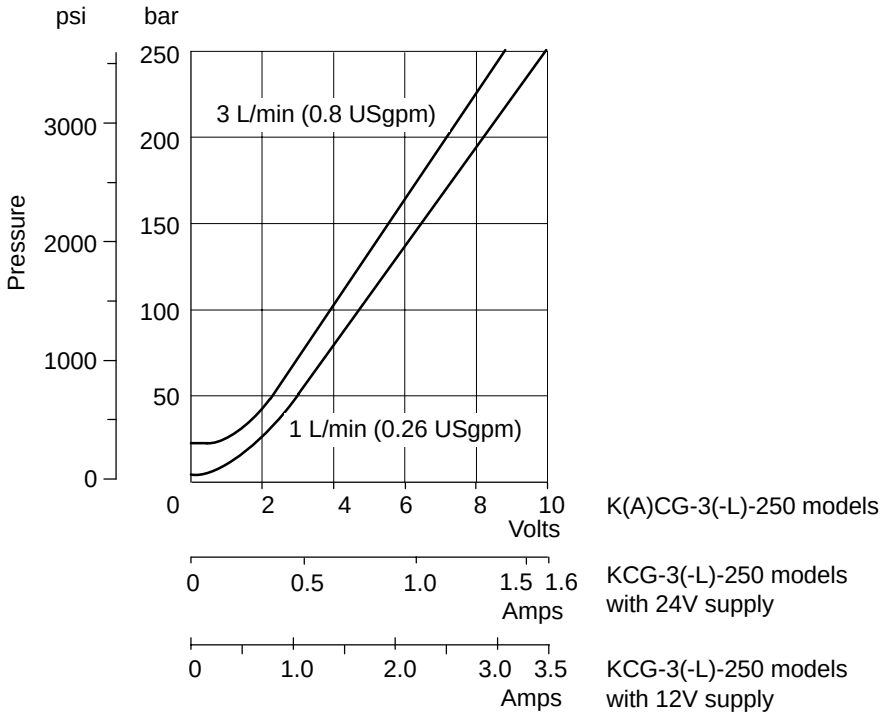
Hysteresis KCG models KACG models	 <4% (with 100 mA pk.-to-pk. dither) <5% (with factory-set dither)
Repeatability KCG models KACG models	 < ± 0,5% of rated pressure for a constant coil current < ± 1.0% of rated pressure for a constant amplifier supply voltage and constant command signal
Reproducibility (valve to valve) KACG models only	<3% at factory settings
Protection, Electrical (KACG models)	Reverse-polarity protected
Mass (weight) KCG KACG	 1,7 kg (3.8 lb) 2,1 kg (4.6 lb)
Supporting products: Amplifiers for KCG valves with “H” type coils only: EHH-AMP-724-C/D-10 (Uniplug) EHH-AMP-7*2 series (power plug) EEA-PAM-513-A-14 (1 adjustable ramp) EEA-PAM-513-A-3* (2 adjustable ramps) Auxilliary electronic modules (Din-rail mounting) for KACG models: EHA CON 201 A 2* 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 1* power supply ISO 4400 (DIN 43650) electrical connector: Black, marked “B” Gray, marked “A” Subplates, size 03 Mounting bolts■ ■ *Note: If not using Vickers recommended bolt kits, bolts must be to ISO 898 grade 12.9 or stronger.*	 See catalog 2367 See catalogs 2114, 2115 and 2282 See catalog 2137 See catalog 2464 See catalog 2410B See catalog 2470 See catalog 2410B See catalog 2427 See catalog 2410B Part number 710775 Part number 710776 See catalog 2425 See catalog 2314A
Installation and start-up (commissioning): Installation and start-up (commissioning) guide Electrical data Electromagnetic capability Mounting attitude Back pressure at port T	 ML-B-9133B (Multi-lingual English, German, French and Italian), shipped with each product and also available separately on request. See under that heading on previous page. See under that heading on previous page. No restriction, provided that the valve is kept full of fluid through port T. Port T should be piped directly to reservoir with minimum restriction. Any back pressure at this port is additive to the controlled pressure at port P. The recommended max. pressure at port T when the valve is controlling pressure is 2 bar (29 psi); the max. pressure at T under static conditions is 210 bar (3000 psi).
Ordering procedure	Valves, subplates, bolt kits and Vickers amplifiers should be ordered by full model code designation. Order ISO (DIN) electrical connectors by part number.

Performance Data

Pressure Gain, Typical

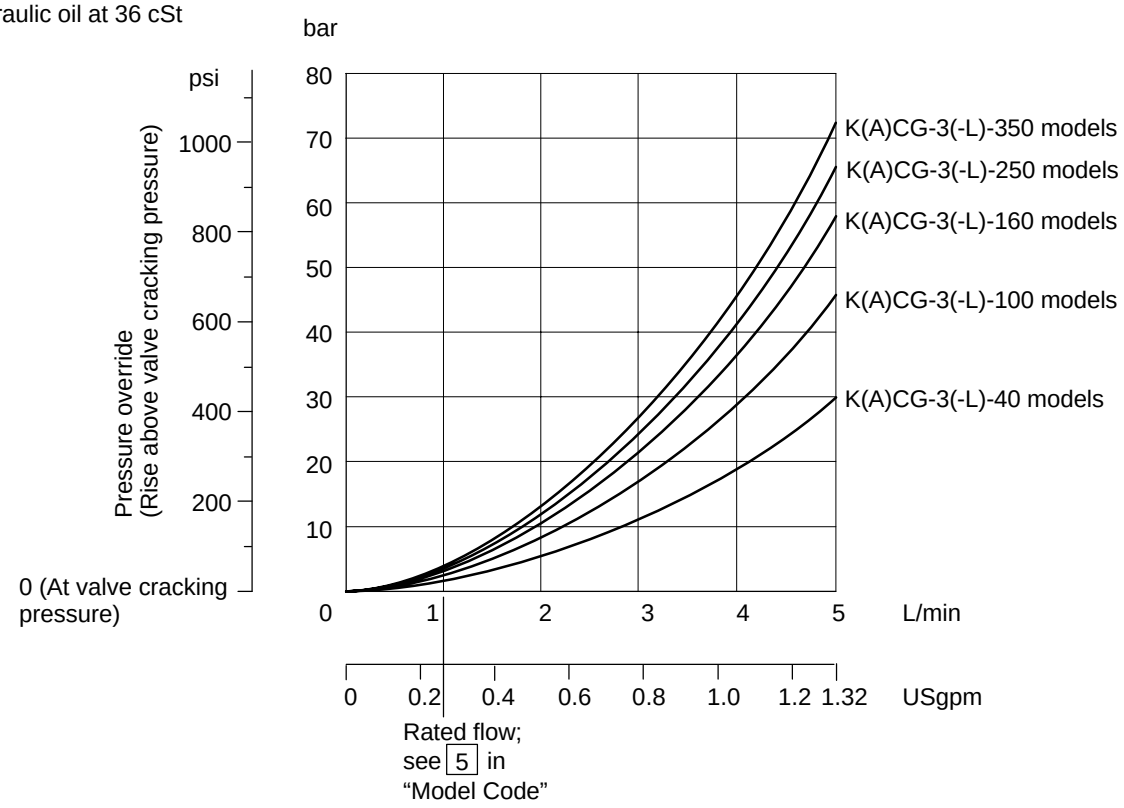
Typical pressure v. command signal response of K(A)CG-3-250 models

Test conditions:
Fluid = Antiwear hydraulic oil at 36 cSt (168 SUS)



Pressure Override, Typical

Test conditions:
Fluid = Antiwear hydraulic oil at 36 cSt (168 SUS)



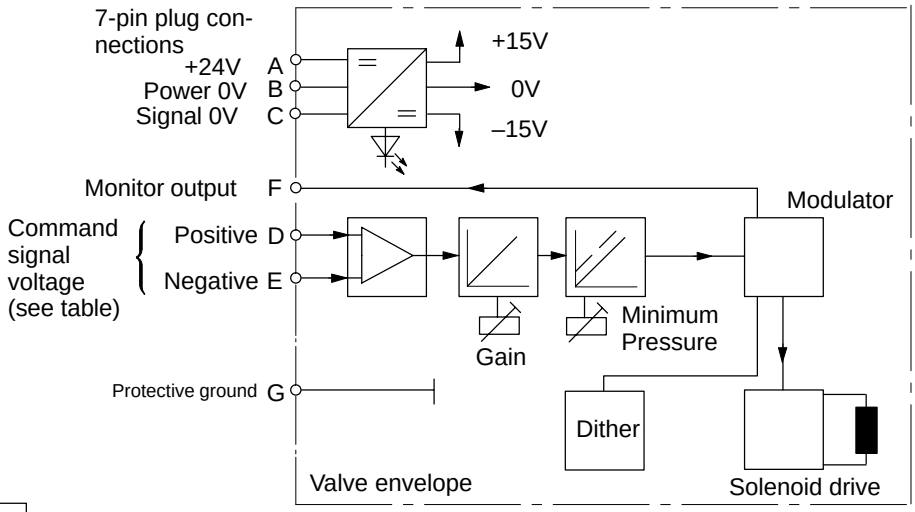
KACG-3 Electrical Block Diagram

Wiring
Connections must be made via the 7-pin plug mounted on the amplifier.
Recommended cable sizes are:

Power cables:
For 24V supply
0,75 mm^2 (18 AWG) up to 20m (65 ft)
1,00 mm^2 (17 AWG) up to 40m (130 ft)

Signal cables:
0,50 mm^2 (20 AWG)

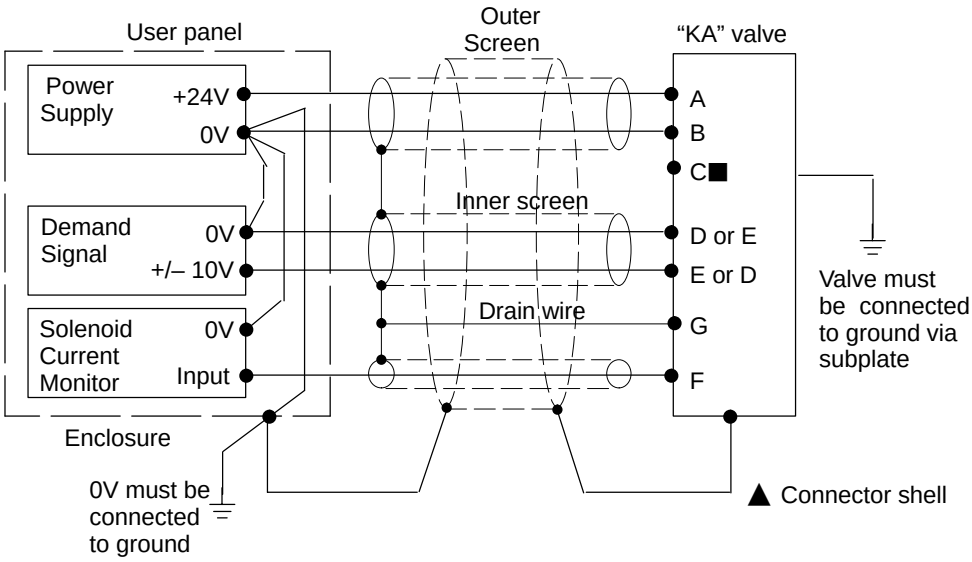
Screen:
A suitable cable would have 7 cores, a separate screen for the signal wires and an overall screen.
See wiring connection diagram on page 7



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

KACG-3 Typical Connection Arrangements

Wiring Connections for Valves with integral Amplifier



■ Solenoid current monitor voltage (pin F) will be referenced to the KA valve local ground. A "local ground" (pin C) is provided for optional use by differential input customer supplied electronics.

▲ 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

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.

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-point connector, part no. 934939, should be used for the integral amplifier.

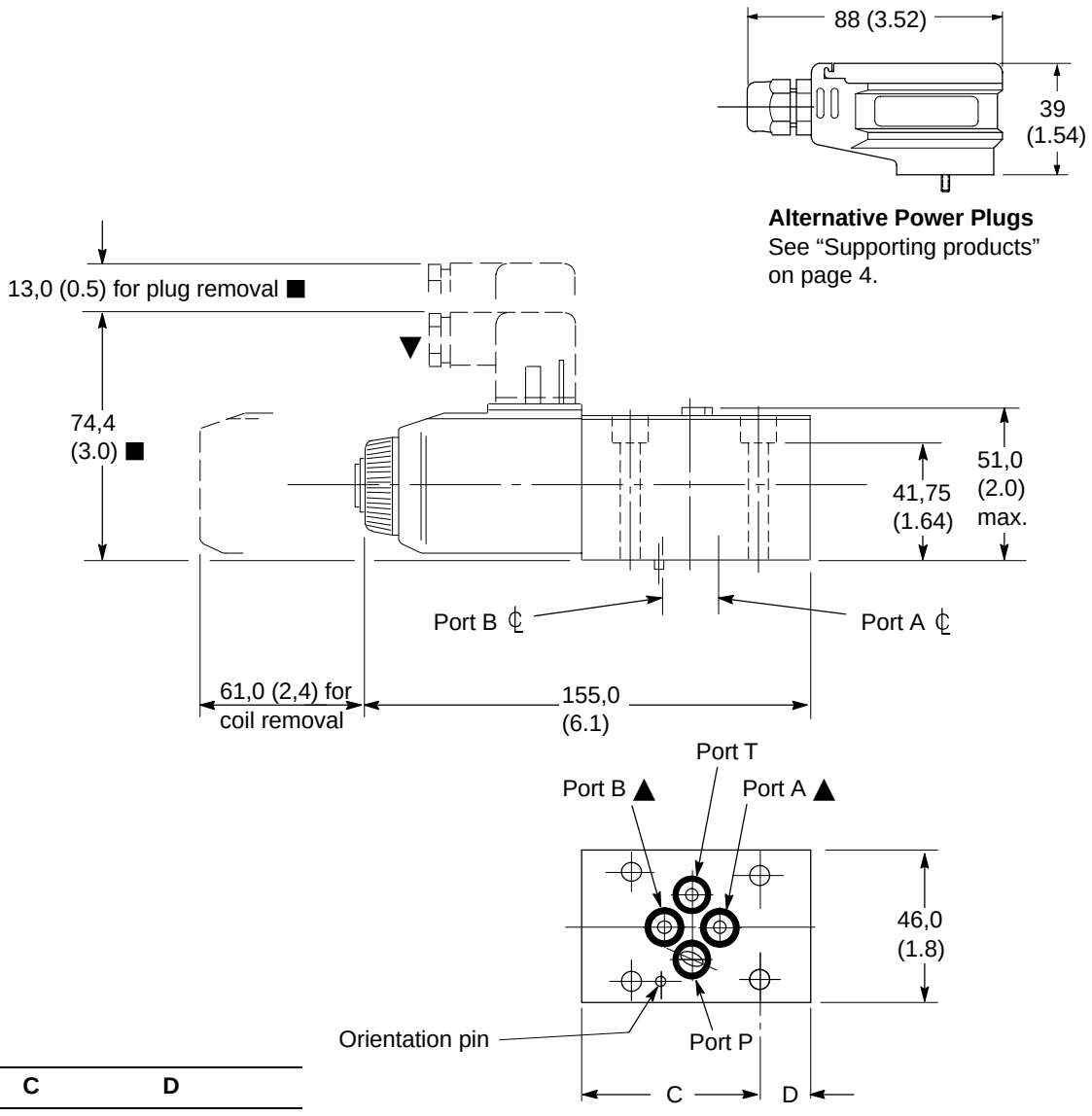
In all cases, both valve and cable should be kept as far as possible from any sources of electromagnetic radiation such as cables carrying heavy current, relays and certain kinds of portable radio transmitters, etc. Difficult environments could mean that extra screening may be necessary to avoid the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

Installation Dimensions in mm (inches)

KCG-3-*-D-Z-M-U-10 models**
For KCG-3-**L**-***-D-Z-M-U models the solenoid is mounted at port A-end of body, which then has C and D dimensions as in table.

3rd angle projection



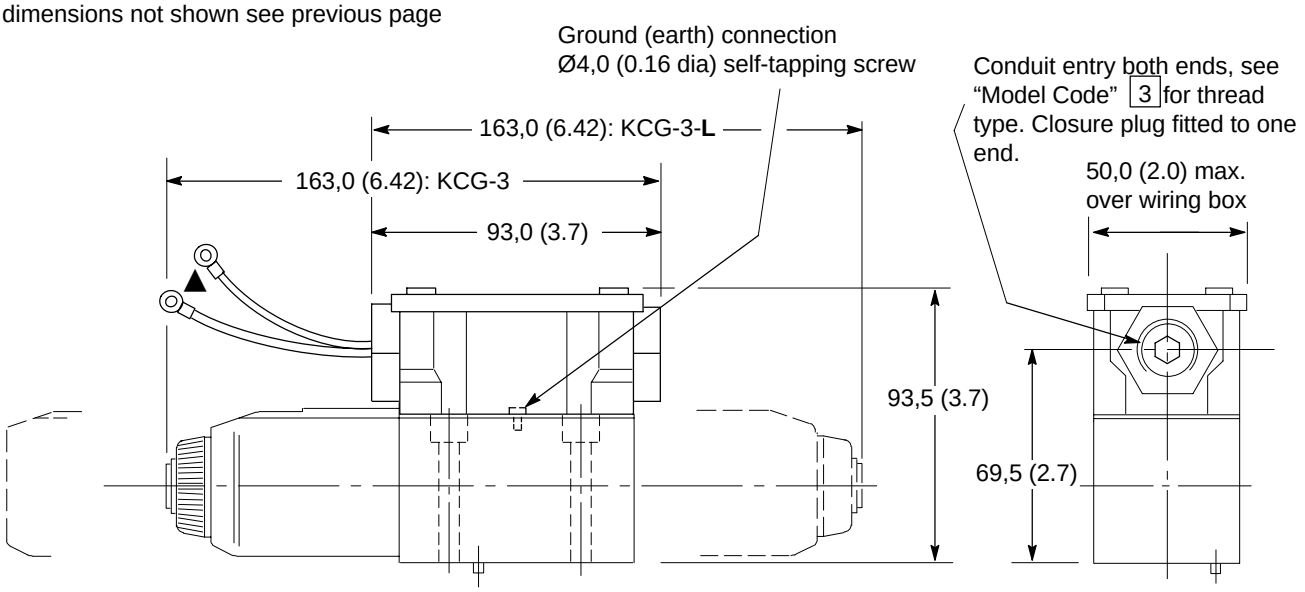
Alternative Power Plugs
See “Supporting products” on page 4.

Model	C	D
KCG-3-***	57,3 (2.26)	20,5 (0.81)
KCG-3-L-***	61,2 (2.41)	16,8 (0.66)

■ *KCG-3-(L)-***-D-Z-M-U models. Dimensions may vary according to source of plug.*
▲ *Ports A and B are blind holes with O-ring recesses.*
▼ *The cable entry on this plug can be repositioned at 90° intervals by reassembly of the contact holder relative to the plug housing. The cable entry is Pg 11 for cables Ø6-10 mm (0.24-0.4″ dia).*

KCG-3-(L)-*-D-Z-M-F**-**1-10 models**

For dimensions not shown see previous page



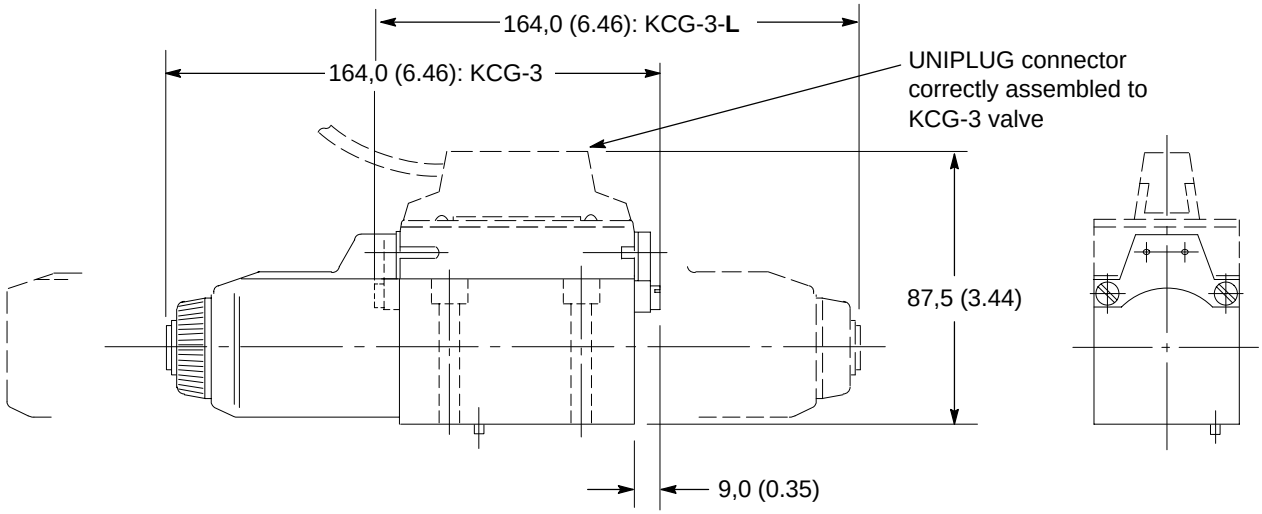
▲ *Ref. Model Code* 7 *:*
Codes "FJ" and "FW": 2 lead wires approx. 150,0 (6.0) long. M3 terminals provided for customer connection.
Codes "FTJ" and "FTW": Lead wires connected into terminal strip suitable for M3 terminals on customer connection.

KCG-3-(L)-*-D-Z-M-P-H1-10-EN46**

For use with Vickers single-cable UNIPLUG connectors:
For "Soft Switch" Control:
Use UNIPLUG model type EHH-AMP-724-C**-1*
For Proportional Control:
Use UNIPLUG model type EHH-AMP-724-D**-1*
UNIPLUG connectors should be ordered separately; see catalog 2367.

To fit UNIPLUG connector to KCG-3 valve:
Unscrew coil retention nut and remove coil.
Slide UNIPLUG connector onto dummy pins (at non-solenoid end) then replace coil, ensuring pins are fully engaged.
Replace and tighten coil retention nut.

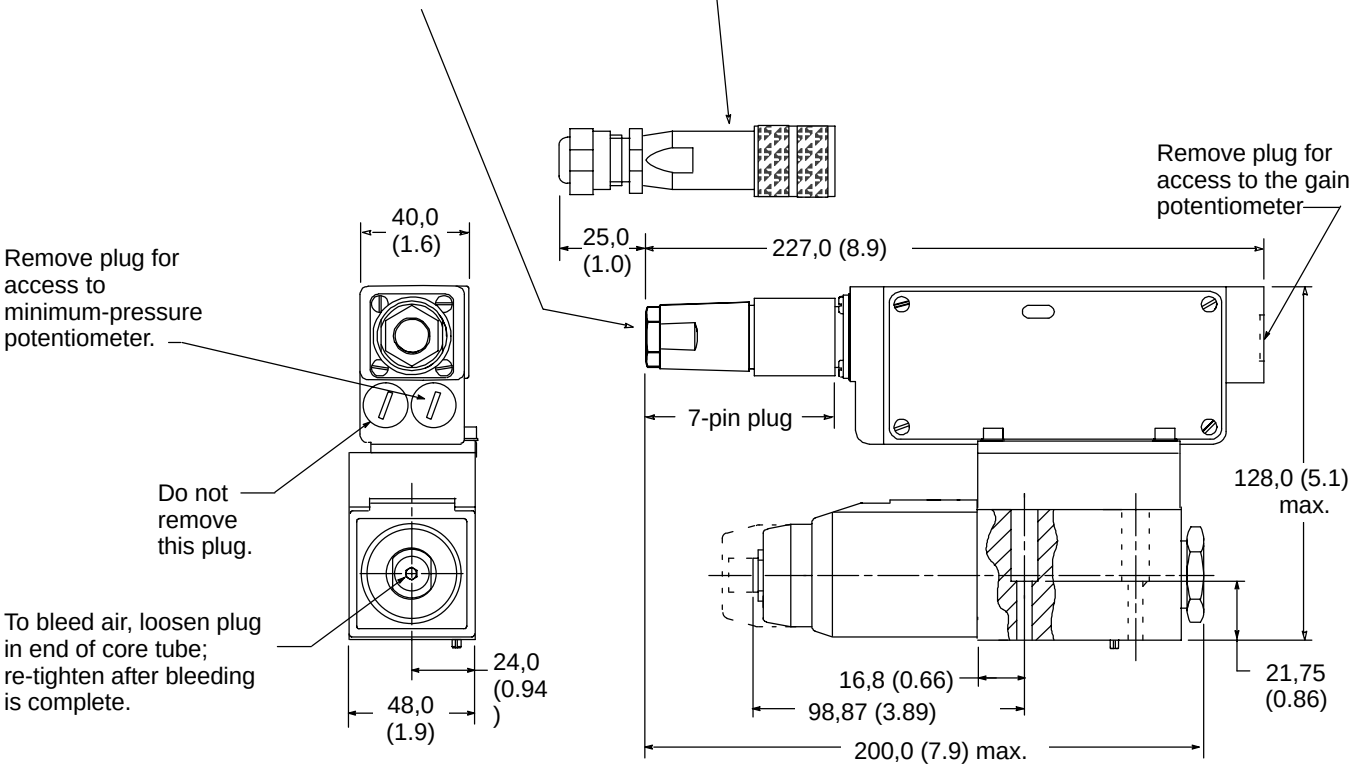
For dimensions not shown see previous page.



KACG-3- models**
For KACG-3-**L**-*** models the solenoid is mounted at port A-end of body (both versions have C and D dimensions as in table on page 8) and the amplifier turned through 180°

Metal plug 934939
Cable outside diameter 8,0 to 10,5 (0.31 to 0.41)
Must be used for full EMC protection. See also warning note on page 2

Plastic plug 694534
PG11. Cable maximum outside diameter 11,0 (0.43)



See **Warning** note on page 2 regarding the use of 7-pin plugs.

Further Information

Hydraulic Fluids
Materials and seals used in these valves are compatible with:
Anti-wear petroleum oils . . . . . L-HM
Non-alkyl based
phosphate esters . . . . . L-HFD
The extreme operating range is 500 to 13 cSt (270 to 70 SUS) but the recommended running range is 54 to 13 cSt (245 to 70 SUS). For further technical information about fluids see 694.

Contamination Control Requirements
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 μm, 5 μm and 15 μm.

For products in this catalog the recommended levels are:
Up to 210 bar (3000 psi) 18**/16/13**
Above 210 bar (3000 psi) 17**/15/12**

Installation and Start-up Guidelines
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.

If this proves to be the case any accumulated air can be bled from the solenoid bleed screw. This task is easier if the valve has been mounted base downwards. Good installation practice dictates that the tank port, and any drain port, are piped so as to keep the valve full of fluid once the system start-up has been completed.

Temperatures
For petroleum oil:
Min. . . . . –20°C (–4°F)
Max.* . . . . . +70°C (158°F)

* *To obtain optimum service life from both fluid and hydraulic system, 65°C (150°F) normally is the maximum temperature.*

For other fluids where limits are outside those of petroleum oil, consult fluid manufacturer or Vickers representative. Whatever the actual temperature range, ensure that viscosities stay within those specified under “Hydraulic Fluids”.

Ambient for:
Valves at full performance specification:
–20 to +60°C (–4 to +140°F).
Valves, as above, will operate at temperatures of 0 to –20°C (32 to –4°F) but with a reduced dynamic response.

Storage:
–25 to +85°C (–13 to +185°F)

Eurocard electronics:
0 to 50°C (32 to 122°F)

Seal Kits
K(A)CG-3 (KA + DIN) 02-138201
KCG-3 (’F’ & ’P’ versions) . . 02-145869

Vickers®

Control Valve

11-07-702
EN-0400
Old No. 689

Proportional Pressure Control Valve with Integrated Electronics

EHST-3-30 Series & EHST-3-40 Series (CE Compliant)

General Information

Description

The EHST-3 is a high performance electro-hydraulic proportional relief valve with integral electronics. The valves' extremely linear performance is attributed to a unique innovative design which includes "frictionless" mechanical design, and the use of electronic linearization circuitry.

The -40 design option is the latest addition to the product family which features European CE approval for electromagnetic compatibility.

Application

The EHST-3 valve is ideal for use as a pilot valve for larger pressure control valves, or for control of variable displacement piston pumps. It is particularly suited in applications requiring remote control where an electrical signal can be used to remotely control pressure of a hydraulic system function. Any electronic control system or programmable logic controller which can produce a 0 to 10 volt or a 4-20 mA current command, can be interfaced to the EHST valve.

Operation

The EHST-3 design implements a floating disk armature with a frictionless self-centering ball and seat metering arrangement. A proportional solenoid/disk armature forces the ball into a metering seat area, thus controlling the "P" port pressure proportional to command signal.

The total lack of springs, bearings, or sliding components provides a design which is essentially free of mechanical friction.

The very repeatable transfer function of the basic solenoid / valve arrangement is linearized by an onboard electronic compensation network. The combination of a very repeatable inherent valve transfer function and onboard compensation electronics results in a valve linearity which is within 1% of full scale.

Model Code

EHST–3– * * * –40

1 2 3 4 5 6

1 Proportional Pressure Control with Integrated Electronics

2 Mounting interface

3 – ISO 4401 Size 3, ANSI/B93.7M size D03

3 Pressure range

(At nominal flow rating; 1 l/min [0.26 US gpm])
B – 4-90 bar (58-1305 psi)
F – 5,5-210 bar (78-3045 psi)

4 Command (input) signal

I – 4 to 20 mA, DC
V – 0 to +10V, DC

5 Output bias

E – Pressure bias
F – Signal bias

6 Design number, 30 series

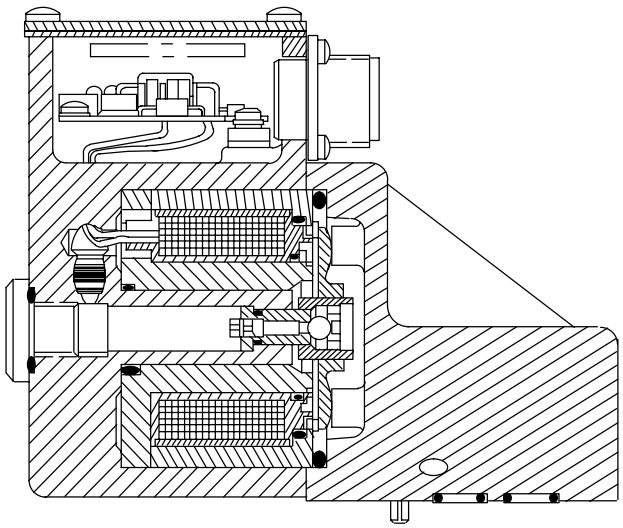
–30 Standard unit
–40 CE compliant unit

Subject to change; installation dimensions unaltered for design numbers 40 to 49 inclusive.▲

CE

▲Note:
The -40 design series product has been designed and tested to meet specific standards outlined in the European Electromagnetic Compatibility Directive as specified by EN 50 082-2; emission, and EN 50 082-2; susceptibility. For installation requirements, refer to Installation Wiring Practices for Vickers Electronic Products leaflet 2468.

Construction of EHST-3 valve



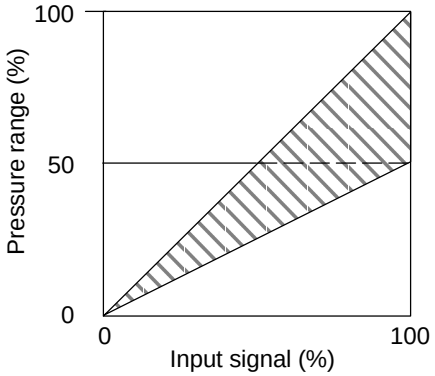
Operating Data

EHST-3-30 & EHST-3-40 Proportional Pressure Control Valves	
Valve control function	Proportional relief
Valve hydraulic interface	ISO 4401, size 3 ANSI/B93.7M size D03
Command signal voltage CMD option: current CMD option:	0-10V DC (nominal impedance 32 kΩ) 4-20 mA (nominal impedance 200Ω)
Linearity	⩽1.0%
Hysteresis (between 5 and 100% of rated output)	⩽2.4%
Maximum pressures: Port P Port T Minimum controllable pressure @ 1 l/min. 210 bar (3045 psi) F model 90 bar (1300 psi) B models	 90 bar (1305 psi) or 210 bar (3045 psi) depending on model 20 bar (290 psi) NOTE: Pressure in port T is *additive* to the controlled pressure and significantly affects minimum pressure capability of the valve. For optimum performance and to avoid high cyclic system pressure peaks, connect port T directly to tank. 5.5 bar (80psi) 4.0 bar (60 bar)
Flow rates: Rated flow (Optimum valve performance) Maximum flow	 1 l/min (0.26 US gpm) 2,5 l/min (0.65 US gpm)
Power supply	24V (22 to 28V) DC at 1,2A Max. ripple 10% peak to peak
Protection classifications: Coil winding Valve fitted with MS3102E-14S-6P receptacle Mating 3 plug	 Class F insulation IEC 144 Class IP65 MS3106A–14S–6P
Relative duty factor	100% (continuously rated)
Operating temperatures: Ambient Fluid	 -20°C to 50°C (-4°F to 122°F) 80°C (176°F) maximum
Hydraulic fluids	These valves are fitted with standard (nitrile rubber) seals are suitable for use with anti-wear hydraulic oils. Optimum valve performance is obtained using fluids in the viscosity range 54 to 13 cSt (245 to 70 SUS). The extreme operating viscosity range is 500 to 13 cSt (2200 to 70 SUS).
Filtration	*System Pressure psi (bar)* <70 (<2000) 70–210 (2000–3045) 210+ (3045+) 17/15/12 17/15/12 15/13/11
Installation data: Mounting attitude	 No restrictions.
Weight	2,6 kg (4.8 lbs.)

Valve Performance

Maximum pressure envelope

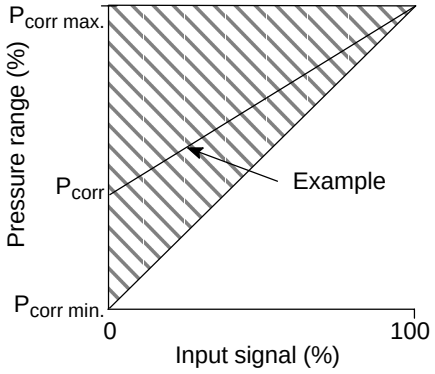
Set by on-board potentiometer "P_{max}"



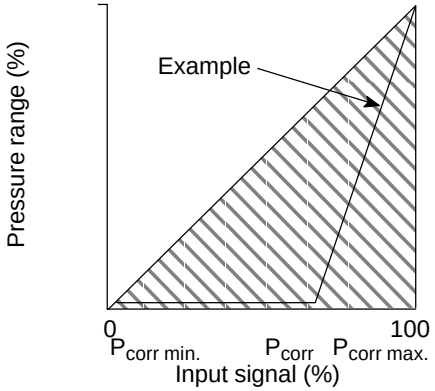
Bias setting

Relative to max. pressure, and set by on-board potentiometer "P_{corr}"

Pressure bias, EHST-3-**E



Signal bias, EHST-3-**F



Pressure override: bar (psi)

Valve type	Set pressure	Pressure over-ride at 1 l/min (0.26 US gpm)	Pressure over-ride at 2 l/min (0.52 US gpm)
–E**–	90 (1305)	1 (14.5)	2,7 (39)
	60 (870)	0,7 (10)	2 (29)
	30 (435)	0	0,2 (2.9)
–F**–	210 (3045)	10 (145)	20 (290)
	180 (2610)	9 (130)	19 (275)
	120 (1740)	8 (116)	18 (261)
	60 (870)	6 (87)	18 (261)

Temperature drift: bar (psi)

Valve type	Set pressure @ 30°C (86°F)	Drift coefficient ▲ bar/°C	psi/°F	Reduction from set pressure @ 70°C (158°F)
–E**–	90 (1305)	0,066	(0.53)	2,64 (38)
	60 (870)	0,046	(0.37)	1,86 (27)
	30 (435)	0,016	(0.13)	0,66 (10)
–F**–	210 (3045)	0,131	(1.1)	5,24 (76)
	120 (174)	0,075	(0.6)	3 (44)
	60 (870)	0,037	(0.23)	1,48 (22)

▲ Pressure reduces as temperature increases; pressure increases as temperature reduces.

Dynamic performance

Frequency response at conditions of:
Trapped volume . . . . . 10 ml (0.6 in^3)
Operating point . . . . . 50% max. signal
Amplitude . . . . . ± 10% max. signal
Input signal form . . . . . sinusoidal
Flow rate . . . . . 1 l/min (0.26 US gpm)

Valve type	Frequency at -3 dB	Frequency at 90° phase lag
–E**–	190 Hz	120 Hz
–F**–	120 Hz	70 Hz

Configuration & Adjustments

Configuration

EHST valves are pre-configured by model code when ordered from the factory. Configuration options include selection of command input type (voltage or current), and output bias (command or pressure). These configurations can be field selected by setting the configuration jumpers on the internal circuit board. Refer to the chart on this page for the required jumper positions, and the circuit board illustrations for placement.

Warning: Disconnect the valve electrical connector before making any jumper changes.

Potentiometer Adjustments

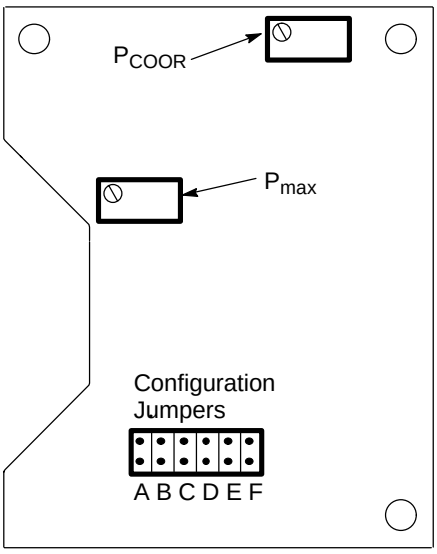
Two adjustments are provided on the internal circuit board; maximum pressure, and the pressure bias. The locations on the circuit board is dependent on the model series number as shown below.

Configuration Jumper Settings

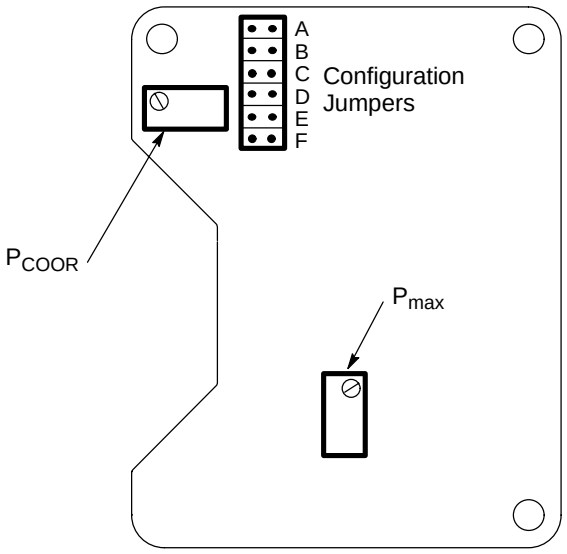
	Jumper Position					
Command Signal	A	B	C	D	E	F
Voltage option		X		X		
Current option	X		X			
Output Bias						
Pressure option					X	
Signal option						X

X=Jumper installed

Refer to VIckers Installation and Commissioning guidelines; leaflet #B9055 (P/N 866371) for start-up assistance.



EHST-3-30 Series



EHST-3-40 Series (CE compliant)

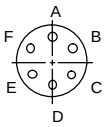
Installation – Electrical

Wiring

Wiring connections are made to the EHST via a 6-pin plug connector. Note hat the minimum wire gage specified is for applications less than 30 meters (100 feet). Consideration should be given for additional installed length, and mechanical robustness.

Mating Connector

Type: MS3106A-14S Plug (connections shown are solder side)



Plug (solder side)

Electrical plug pins

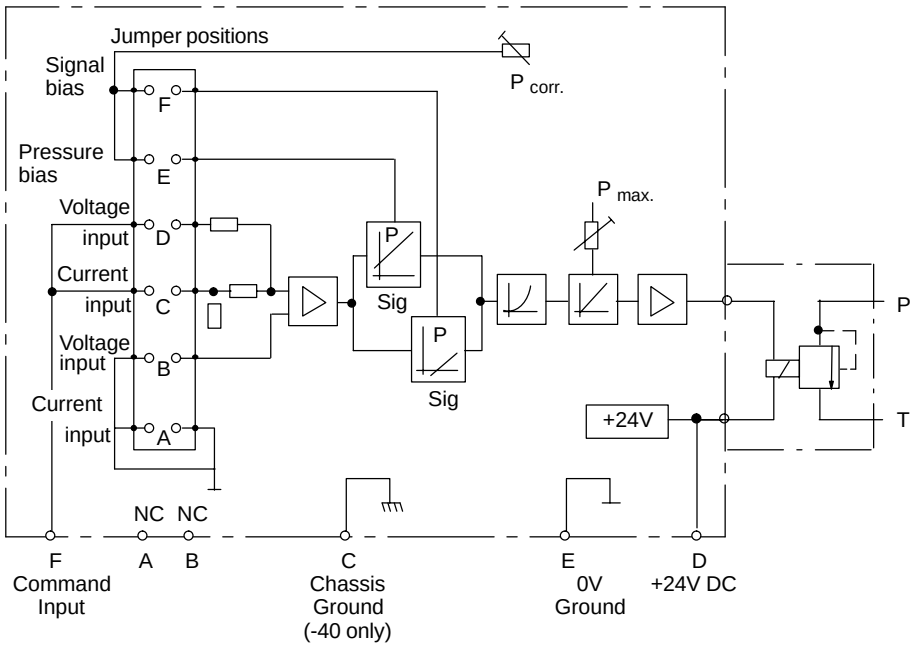
A – not used
B – not used
C – chassis gnd (-40 design only)
D – +24 VDC power supply
E – 0V (Ground)
F – Command (input)
0 to +10 VDC (EHST-3-***V*** models)
4 to 20 mA (EHST-3-***I***models)

Wire

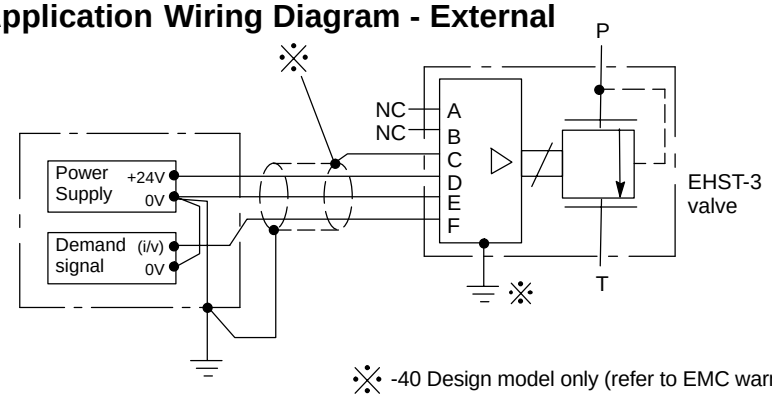
0,5/1,5 mm^2 section (20 gage) minimum. Shielded, 3 insulated conductors, with 1 bare in contact with shield braid.

Cable outside diameter: 8/12 mm (0.31/0.47") to fit plug strain relief.

Electrical Block Diagram - Internal



Application Wiring Diagram - External



※ -40 Design model only (refer to EMC warning)

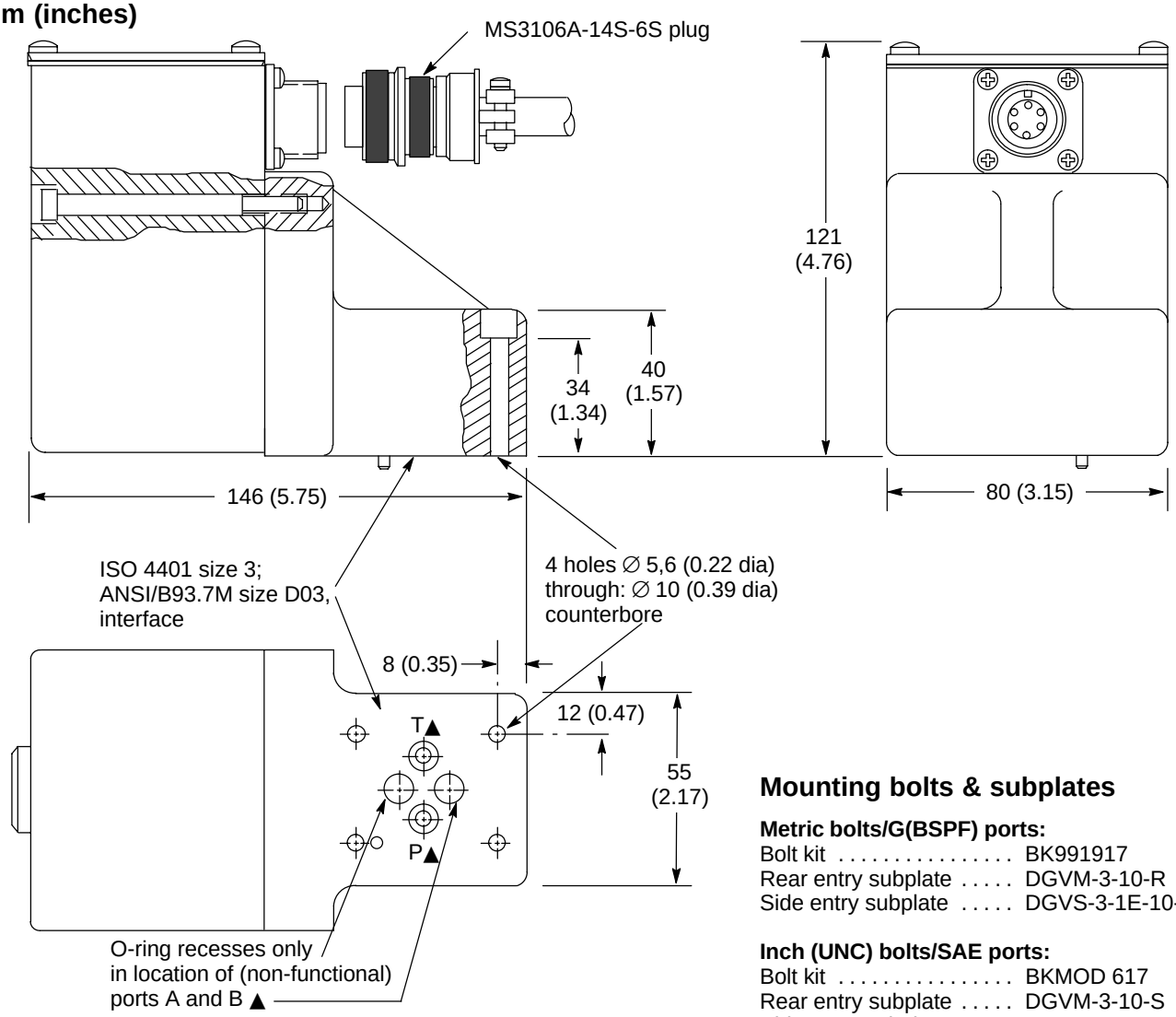
Warning
Electromagnetic Compatibility (EMC)

The -40 design series product has been designed and tested to meet specific standards outlined in the European Electromagnetic Compatibility Directive. It is necessary to ensure that the valve is wired as shown. In all cases both valve and interconnecting cabling should be kept as far as possible from any sources of electromagnetic radiation such as cables carrying large currents, relays and radio transmitters, etc. Difficult environments could mean that extra screening may be necessary to avoid interference.

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

Installation Dimensions

mm (inches)



▲ O-rings (4 req'd) supplied with valve

Mounting bolts & subplates

Metric bolts/G(BSPF) ports:

Bolt kit	BK991917
Rear entry subplate	DGVM-3-10-R
Side entry subplate	DGVS-3-1E-10-R

Inch (UNC) bolts/SAE ports:

Bolt kit	BKMOD 617
Rear entry subplate	DGVM-3-10-S
Side entry subplate	DGMS-3-1E-10-S

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.

Essential information on the correct methods for treating hydraulic fluid is included in Vickers publication 561;"Vickers Guide to Systemic Contamination Control," available from your local Vickers distributor or by contacting Vickers, Incorporated. Recommendations on filtration and the selection of products to control fluid condition are included in 561.

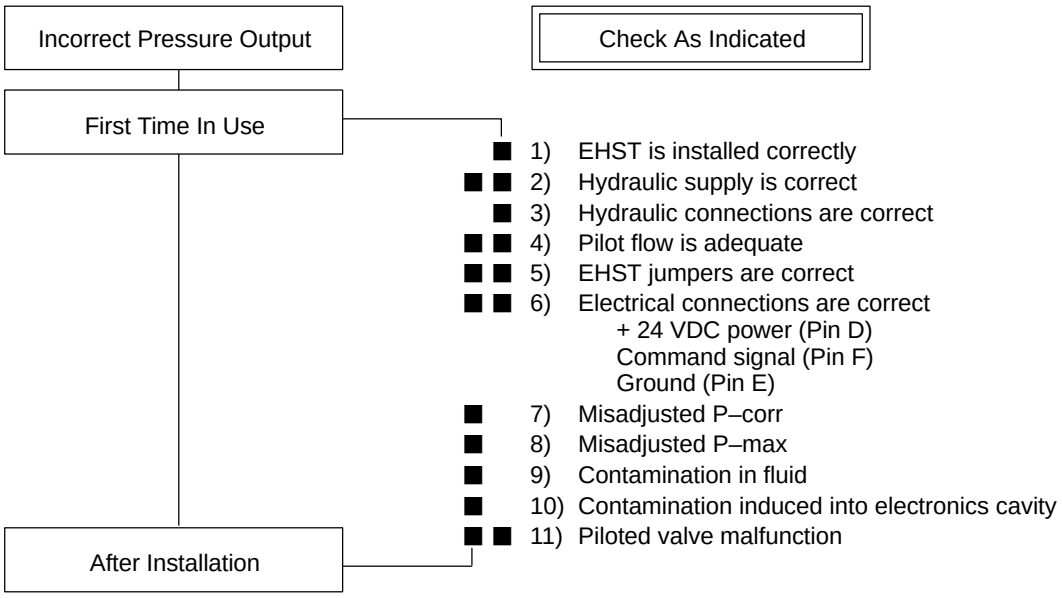
Vickers products, as any components, will operate with apparent satisfaction in fluids with higher cleanliness codes than those described. Other manufacturers will often recommend levels above those specified.

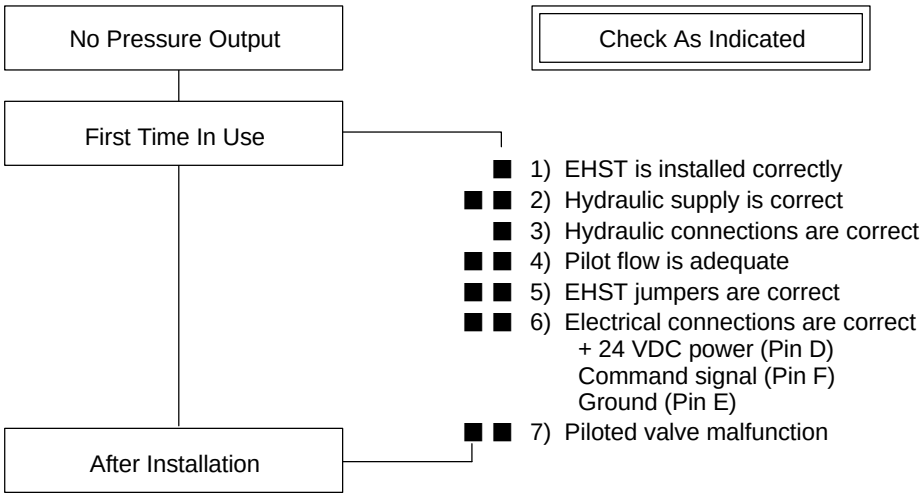
Experience has shown, however, that life of any hydraulic components is shortened in fluids with higher cleanliness codes than those listed below. These codes have been proven to provide a long trouble-free service life for the products shown, regardless of the manufacturer.

Fire resistant fluids usually have higher specific gravities than oil. The specific gravity of a fluid may be obtained from its producer.

Recommended cleanliness levels, using petroleum oil under common conditions, are based on the highest fluid pressure levels in the system and are coded in the chart below. Fluids other than petroleum, severe service cycles or temperature extremes are cause for adjustment of these cleanliness codes.

Troubleshooting





Eaton Hydraulics
14615 Lone Oak Road
Eden Prairie, MN 55344
Telephone: 952 937-7254
Fax: 952 937-7130
www.eatonhydraulics.com

46 New Lane, Havant
Hampshire PO9 2NB
England
Telephone: (44) 170-548-6451
Fax: (44) 170-548-7110

11-07-702-0200

VICKERS®

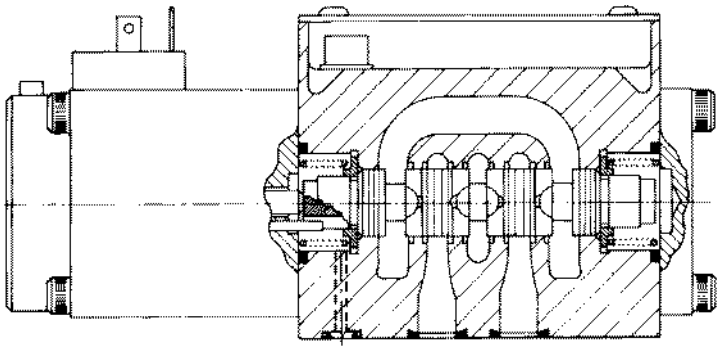
Proportional Valves

Proportional Directional Valves Without Feed Back

K(A)D/TG4V-5, 3* Series

Typical Section

KTG4V-5



General Description

Vickers proportional valves shown in this catalog are designed to provide a controlled oil flow in proportion to a command signal. They are available in two types, firstly a double solenoid version that will provide reversible flow and return to an actuator, and secondly a single solenoid version that provides a single direction of flow. Hydrostats are available for load compensation and if flow enhancement is required for the single solenoid version, parallel flow path modules are available that will boost the flow capacity to nearly twice that of the standard valve.

Additionally, both of these valve types can be supplied with or without an integral amplifier built directly onto the valve.

KD/TG4V-5

This version is supplied without the integral amplifier.

Features and Benefits

- Wide range of spool and flow rate options
- Supported by amplifiers and auxiliary function modules from the Vickers range
- Electronic feedback LVDT ensures accurate speed control
- Current feedback provides inherent protection from electrical interference
- Vibration and shock tested

KAD/TG4V-5KAD/TG4V-5

A range of proportional directional and throttle valves with control amplifiers built directly on, and prewired to, the valves. Factory-set adjustments of gain, spool deadband compensation, dither and offset ensure high repeatability valve-to-valve.

The only electrical inputs required are power supply (24V) and a voltage command signal of ±10V. Electrical connections are via a standard 7-pin plug.

A monitor point allows the function of the amplifier to be checked. Ramp functions, if required, must be generated externally.

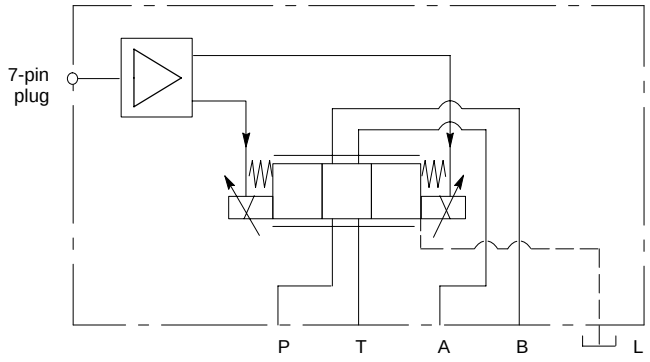
Features and Benefits

- Factory-sealed adjustments increase valve-to-valve accuracy
- Valve and amplifier selected, ordered, delivered and installed as a performance-tested package
- Standard 24V DC supply with wide tolerance band
- Standard ±10V DC command signals
- Installation wiring reduced and simplified
- Standard 7-pin connector
- LED status indication and monitor point help troubleshooting
- Simple valve removal and replacement for service
- Vibration and shock tested
- Supported by auxiliary function modules

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, the Installation Wiring Practices for Vickers Electronic Products leaflet 2468 and leaflet 02-123931A which is packed with every KA valve. Wiring practices relevant to this Directive are indicated by ⚠ Electromagnetic Compatibility (EMC).

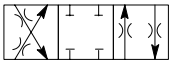
Functional Symbols

Model Types KADG4V-5

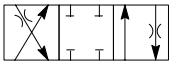


Available Spools for K(A)DG4V-5

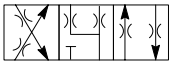
2C**N, meter-in/meter-out



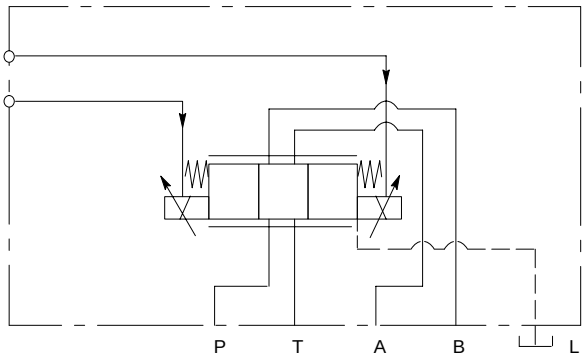
2C65S, meter-out only



33C**N, meter-in/meter-out

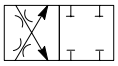


Model Types KDG4V-5

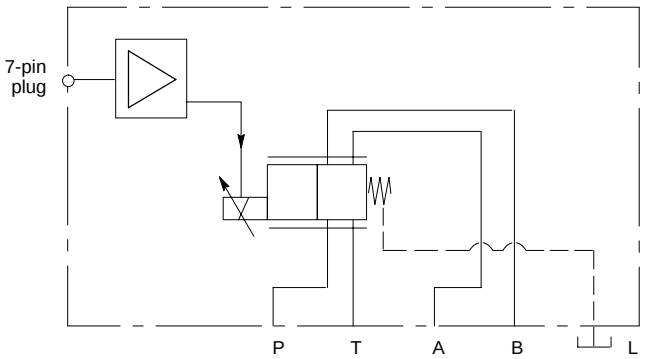


Available Spools for K(A)TG4V-5

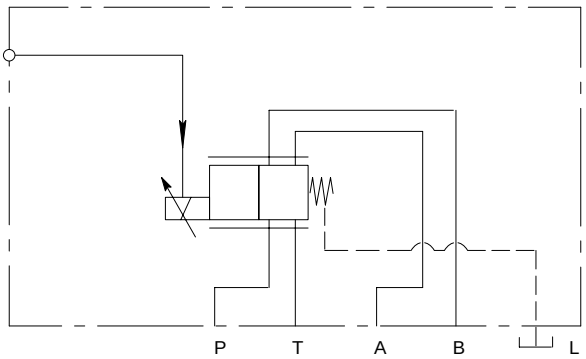
2B**N, meter-in/meter-out



Model Types KATG4V-5



Model Types KTG4V-5



Model Code

K(A) * G4V-5- ** * *** -Z- (V) M- * - *** -H * - 3***

1 2 3 4 5 6 7 8

1 Series type designator

A = Integral amplifier
Omit for non-integral amplifier

2 Control type

D = Directional valve
T = Throttle valve

3 Spool type

See “Functional Symbols” on previous page

Flow rating and metering

Δp = 5 bar (72 psi) per metering flow path, e.g. B to T

Spools for K(A)TG valves

2B30N = 30 L/min (7.9 USgpm)
2B50N = 50 L/min (13.2 USgpm)
2B70N = 70 L/min (18.5 USgpm)

Symmetric spools for K(A)DG valves

2C30N = 30 L/min (7.9 USgpm)
2C50N = 50 L/min (13.2 USgpm)
2C65S = 65 L/min (17.2 USgpm)
33C30N = 30 L/min (7.9 USgpm)
33C50N = 50 L/min (13.2 USgpm)

Asymmetric spools for K(A)DG valves

2C50N25 = 50 L/min (13.2 USgpm) “A” port flow
25 L/min (6.6 USgpm) “B” port flow

4 Solenoid energization identity

V = Solenoid “A” is at port “A” end and solenoid “B” at port “B” end, independent of spool type
Blank = US ANSI B93.9 standard requiring solenoid “A” energization to connect P to A and solenoid “B” to connect P to B

5 Solenoid electrical connector

U = ISO 4400/DIN 43650, non-integral amplifier type only
F = Flying lead, integral amplifier type only

6 Electrical connection
(KA valves only)

PD7 = 7-pin connector with plastic plug
See warning note below

7 Port T limit code

6 = For 2C**S spools
7 = For all other spools

8 Design number, 30 series

Subject to change. Installation dimensions unaltered for design numbers 30 to 39 inclusive.

Solenoid plugs
KD/TG4V valves only

To be ordered separately.
710775, for black plugs, marked B
710776, for gray plugs, marked A

Warning

To conform to the EC Electromagnetic Compatibility Directive (EMC) the valve with integral amplifiers must be fitted with a metal 7-pin plug. The screen of the cable must be securely connected to the shell of the metal connector. A suitable IP67 rated connector is available from Vickers, part no. 934939. This must be tightened with a torque of 2-2,5 Nm (1.5-2.0 lbf-ft) to achieve the IP67 rating. Alternatively a non IP67 rated connector is available from ITT-Cannon, part no.CA 06 COM-E 14S A7 S.
The plastic plug, part number 694534, is only suitable for use in a sealed electromagnetic environment or outside of the European Community.

Operating Data

Performance data is typical with fluid at 36 cSt (168 SUS) and 50°C (122°F) while using the basic Vickers power amplifier.

KD/TG4V-5 and KAD/TG4V-5 Valves

Relative duty factor	Continuous rating (ED = 100%)
Type of protection, with electrical plugs fitted correctly	IEC 144, Class IP65
Hysteresis, with flow through P-A-B-T, Δp = 5 bar (72 psi) per metering path e.g. P-A	<8% of rated flow
Step input response, with flow through P-A-B-T, Δp = 5 bar (72 psi) per metering path e.g. P-A Required flow step: 0 to 100% 100% to 0 +90 to –90% (KADG4V-5 only)	 Time to reach 90% of required step: 75 ms (0.075s) 50 ms (0.050s) 80 ms (0.080s)
Mass: KDG4V-5 KADG4V-5 KTG4V-5 KATG4V-5	6,8 kg (15.00 lb) approx. 7,2 kg (15.90 lb) approx. 5,3 kg (11.70 lb) approx. 5,7 kg (12.60 lb) approx.

KD/TG4V-5 Valves

Max. current, at 50°C (122°F) ambient: Coil type G Coil type GP Coil type H Coil type HA	 3,5A 3,0A 1,6A 0,94A
Coil resistance, at 20°C (68°F): Coil type G Coil type GP Coil type H Coil type HA	 1,68Ω – 7,7Ω 23,5Ω
Coil inductance at 1000 Hz & 150 mV: Coil type G Coil type GP Coil type H Coil type HA	 8 mH – 38 mH 114 mH
Repeatability, valve-to-valve	Optimized by adjustment of deadband, gain and ramp potentiometers on associated Vickers amplifier
Supporting products: Eurocard amplifier Power supply	 EEA-PAM-525-*-32 EEA-PSU-704-*-20

KAD/TG4V-5 Valves with Integral Amplifiers

Power supply	24V DC (21V to 36V including 10% peak-to-peak max. ripple) max. current 3A
Command signal Input impedance	0 to +10V DC, or 0 to –10V DC, or –10V to +10V DC 47 kΩ
7-pin plug connector Pin connections: A B C D E F G	 Power supply +ve Power 0V Signal 0V +ve voltage command signal –ve voltage command signal Monitor output Protective ground
Electro-magnetic compatibility (EMC): Emission (10 v/m) Immunity (10 v/m) See “Warning” note regarding EMC on page 11.	 EN 50081-2 EN 50082-2
Gain adjustment	25 to 125%
Zero adjustment	±18%
Factory set adjustments	Deadband, gain, dither and offset
Monitor point signal Output impedance	0,5V per amp solenoid current 10 kΩ
Power stage PWM frequency	2 kHz nominal
Repeatability, valve-to-valve (at factory settings): Flow gain at 100% command signal	 ≤5%
Protection: Electrical Mechanical	 Reverse polarity protected IEC 144, Class IP65
Relative humidity	85 to 95% at 20 to 70°C (68 to 158°F)
Supporting products: Auxiliary electronic modules (DIN-rail mounting): EHA-CON-201-A-2* signal converter EHD-DSG-201-A-1* command signal generator EHA-RMP-201-A-2* ramp generator EHA-PID-201-A-2* PID controller Subplates, size 05 Mounting bolts Note: If not using Vickers recommended bolt kits, bolts must be to ISO 898 grade 12.9 or stronger.	

CE

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 and leaflet 02-123931A which is packed with every KA valve.. Wiring practices relevant to this Directive are indicated by ⚠ Electromagnetic Compatibility (EMC).

Maximum Pressures, bar (psi)

Model	Port L condition [s]	Ports P, A & B	T	L_S
K(A)DG4V-5-**C**N-Z-(V)M-U1-H7	Externally drained	315 (4567)	210 (3000)	10 (145)
All K(A)DG4V-5 models	Blocked by mating surface	315 (4567)	160 (2320)	160 (2320)
K(A)TG4V-5	Externally drained	315 (4567)	210 (3000)	10 (145)
	Blocked by mating surface		160 (2320)	160 (2320)

[s] *If port T pressure will not exceed 160 bar (2320 psi), port L need not be connected to tank.*

Minimum Recommended Flow Rates

For spool types 2C and 33C
Δp = 10 bar (145 psi) for looped flow
P-A-B-T (or P-B-A-T).

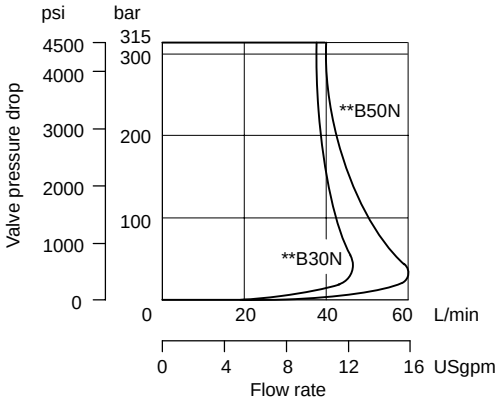
Valve size/spool code	Min. flow rate: L/min	in^3/min
K(A)DG4V-5-**C30N	1,5	91
K(A)DG4V-5-**C50N	2,5	152
K(A)DG4V-5-**C65S	3,0	182

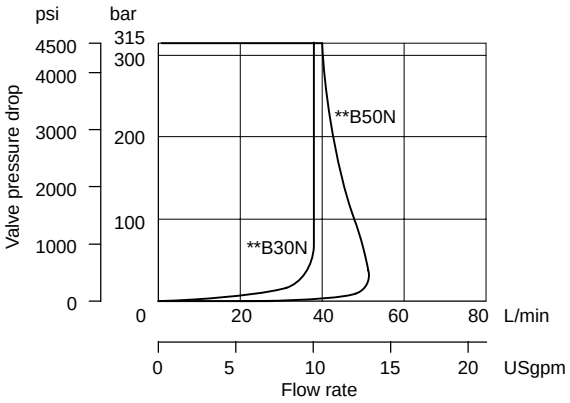
Power Capacity Envelopes

Single Solenoid Models:
K(A)TG4V-5
Spool types as noted

Single Flow Path
P to B

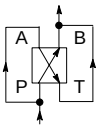
Looped Flow Path
P to B plus A to T



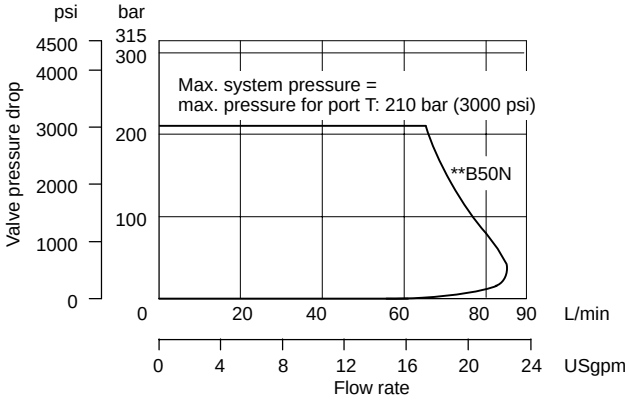


Single Solenoid Models:
K(A)TG4V-5

Parallel Flow Path
P to B and A to T using parallel flow path module:
KDGMA-5-616877-10Rn or
KDGMA-5-02-139150-10Sn

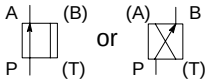


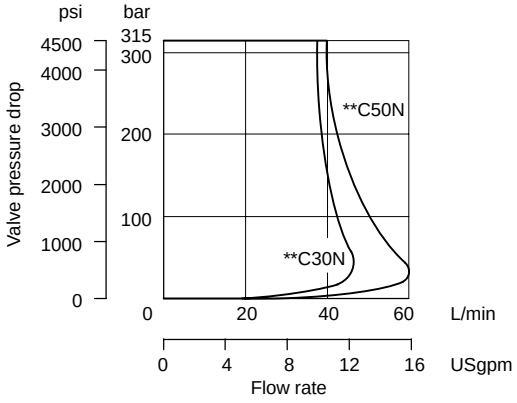
n *See catalog 2336, "Subplates and Auxiliary Connection Plates, Size 05".*



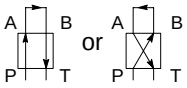
Double Solenoid Models:
K(A)DG4V-5
Spool types as noted

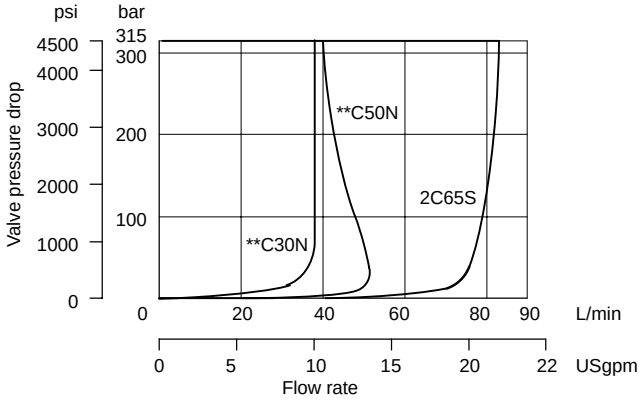
Single Flow Path
P to A, or P to B



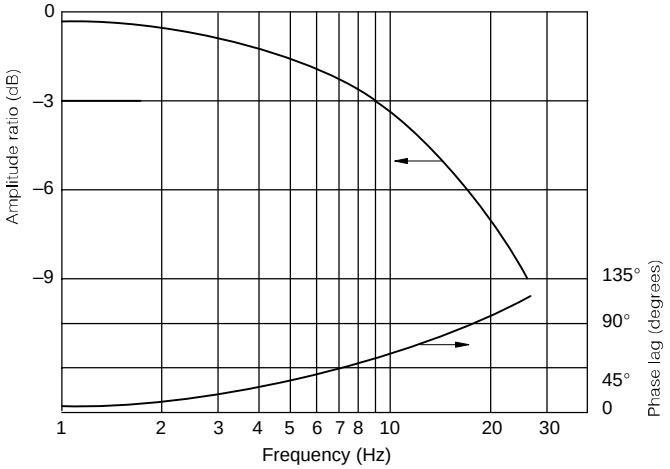


Looped Flow Path
P to A (or B) plus B (or A) to T





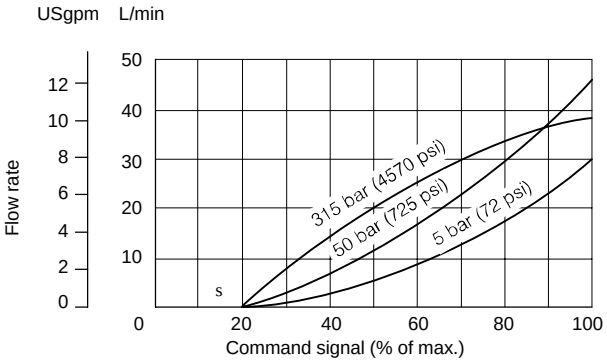
Frequency Response



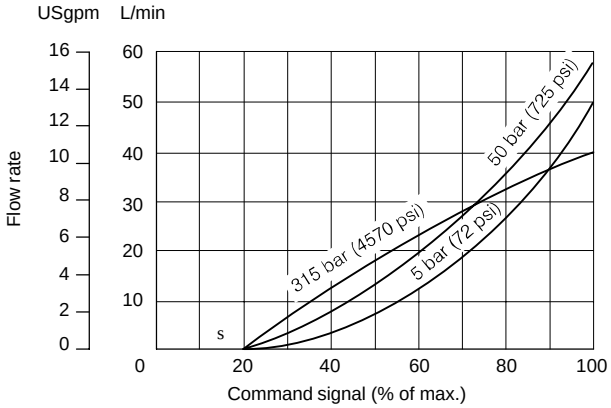
Flow Gain
Single Solenoid Models, K(A)TG4V-5

Single Flow Path
P to B

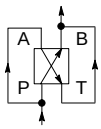
Spool types **B30N



Spool types **B50N

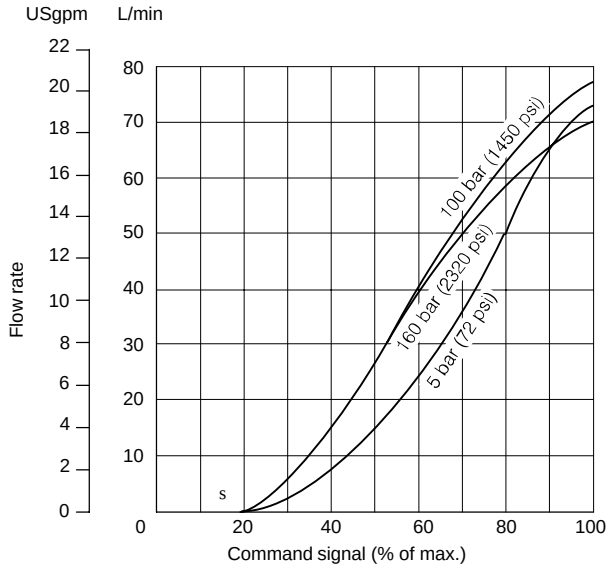


Parallel Flow Paths
P to B and A to T using
parallel flow path module:
KDGMA-5-616877-10Rn or
KDGMA-5-02-139150-10Sn



Maximum system pressures for this configuration:
With “L” port externally drained .... 210 bar (3000 psi)
With “L” port blocked ..... 160 bar (2320 psi)

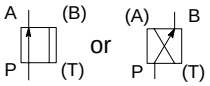
Spool types **B50N



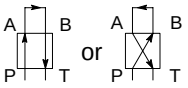
s *Curves shown are for spool types “2”. These points will vary from valve to valve, but can be adjusted using the deadband compensation feature of the drive amplifier.*
For spool types “33” the curves are similar but flow starts at slightly higher command signals.

Flow Gain
Double Solenoid Models, K(A)DG4V-5

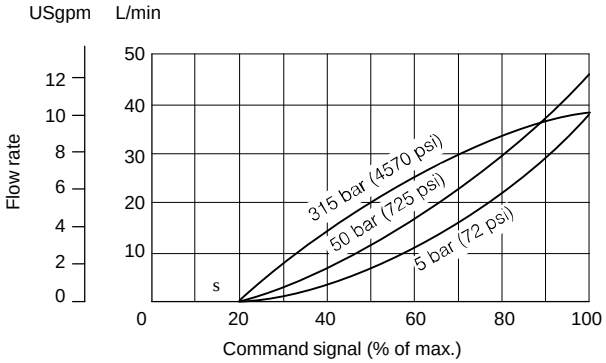
Single Flow Path
P to A, or P to B



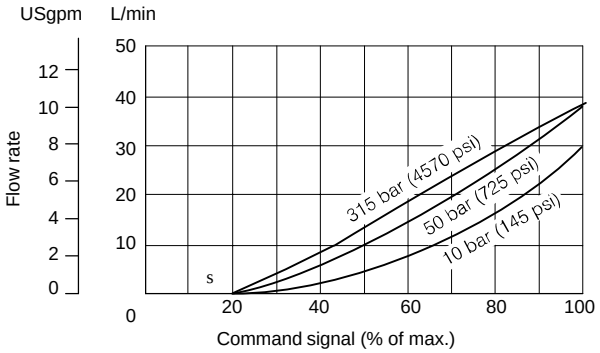
Looped Flow Paths
P to A (or B), plus B (or A) to T



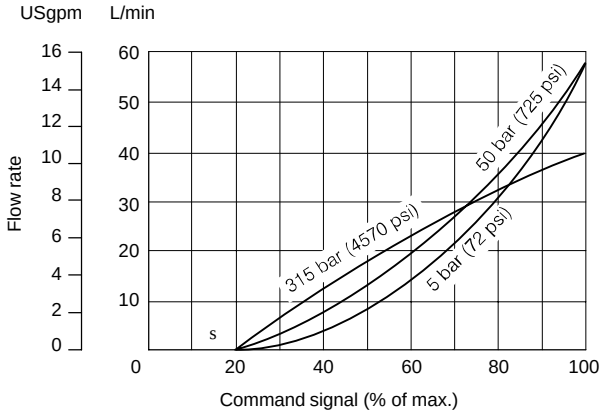
Spool types **C30N



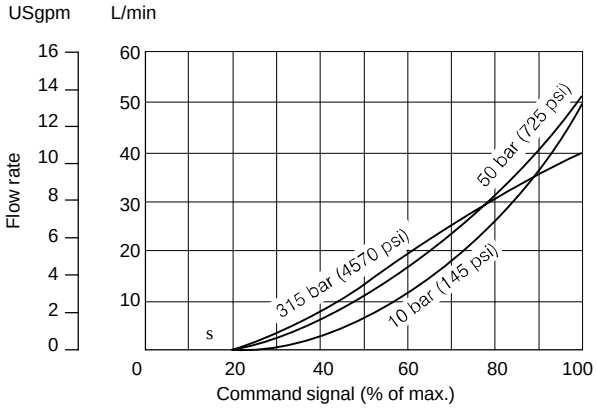
Spool types **C30N



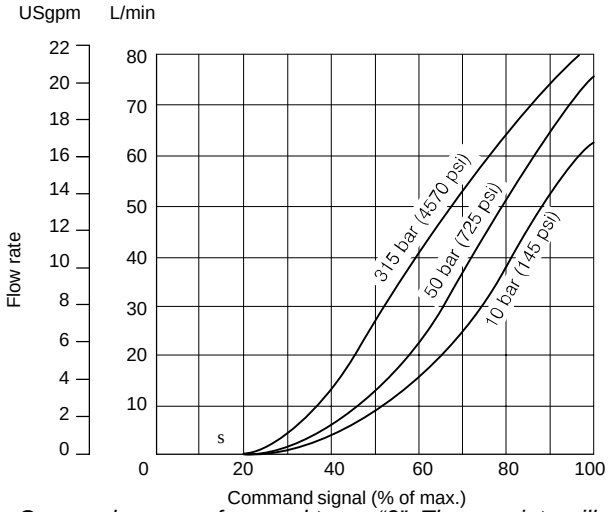
Spool types **C50N



Spool types **C50N



Spool type 2C65S



s *Curves shown are for spool types "2". These points will vary from valve to valve, but can be adjusted using the deadband compensation feature of the drive amplifier.*
For spool types "33" the curves are similar but flow starts at slightly higher command signals.

Electrical 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		
Negative	0V	P to B
0V	Positive	
U_D - U_E = Negative		

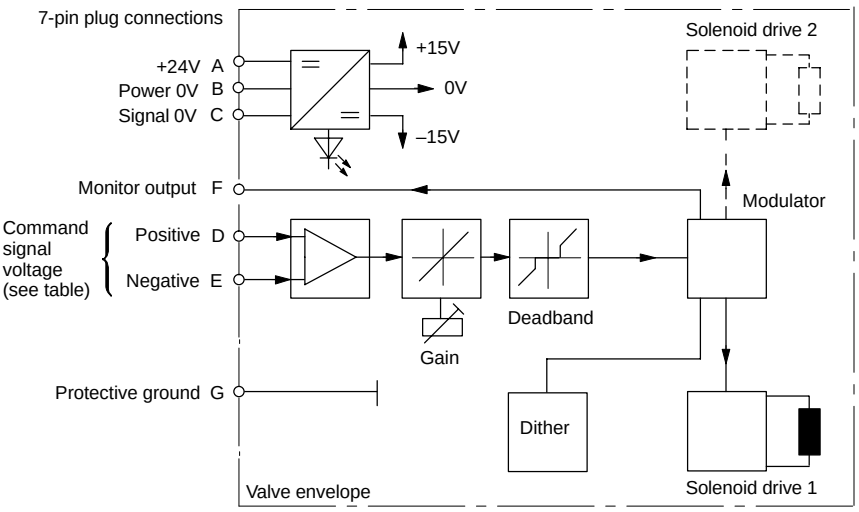
KADG4V-5 and KATG4V-5

Wiring
Connections must be made via the 7-pin plug mounted on the amplifier.
Recommended cable sizes are:

Power cables:
For 24V supply
0,75 mm^2 (18 AWG) up to 20m (65 ft)
1,00 mm^2 (17 AWG) up to 40m (130 ft)

Signal cables:
0,50 mm^2 (20 AWG)

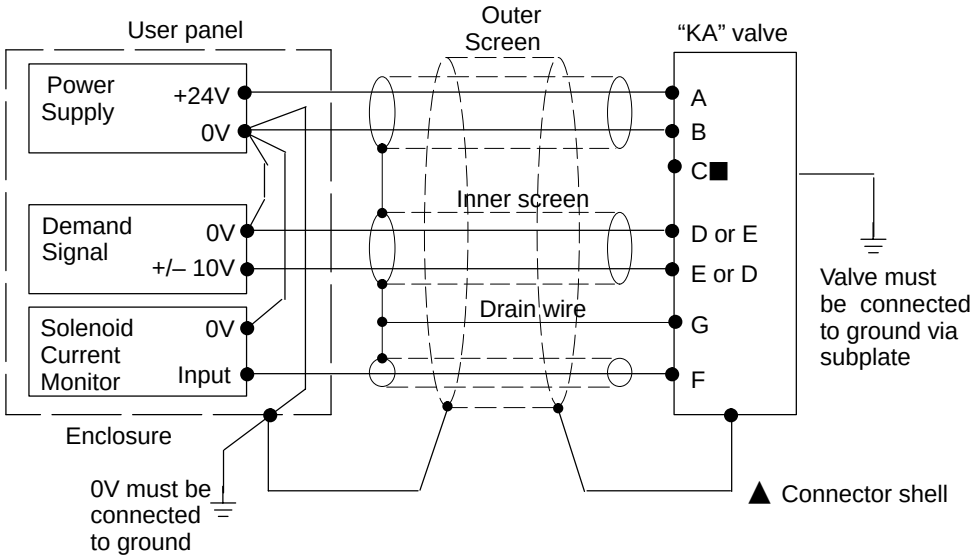
Screen:
A suitable cable would have 7 cores, a separate screen for the signal wires and an overall screen.



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

Typical Connection Arrangements
KADG4V-5 and KATG4V-5

Wiring Connections for Valves with integral Amplifier



■ Solenoid current monitor voltage (pin F) will be referenced to the KA valve local ground. A "local ground" (pin C) is provided for optional use by differential input customer supplied electronics.

▲ 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

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.

Warning

Electromagnetic Compatibility (EMC)

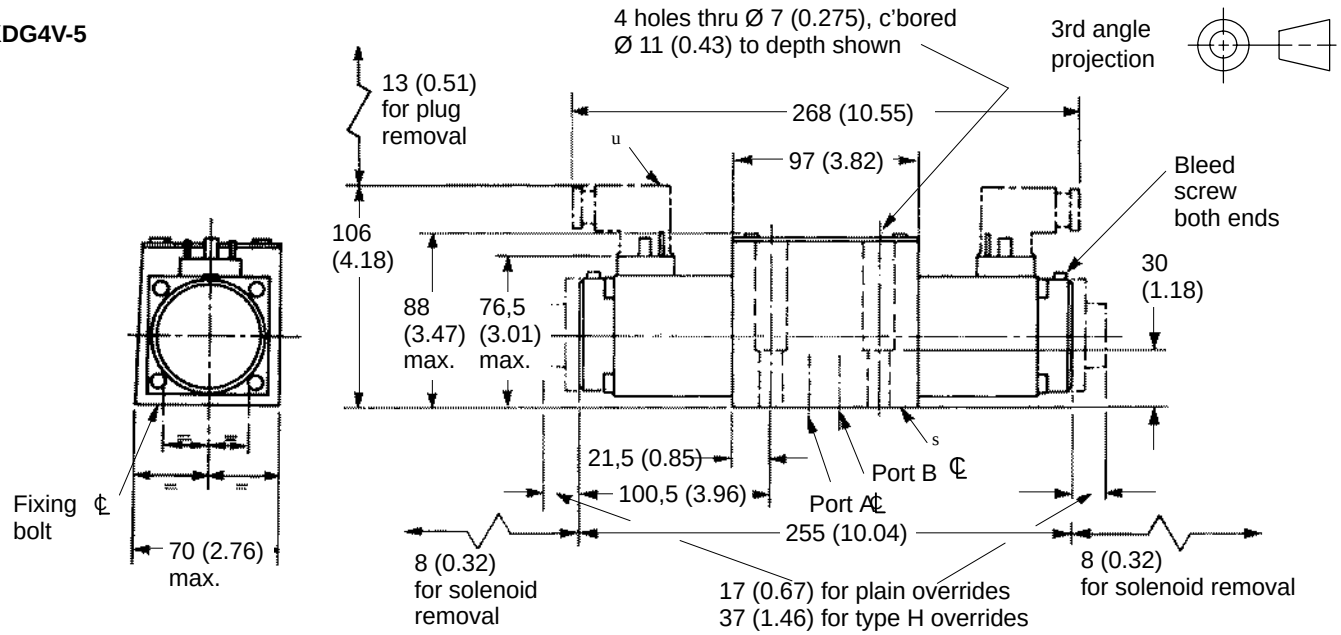
It is necessary to ensure that the valve is wired-up as above. For effective protection, the user electrical cabinet, the valve subplate or manifold, and the cable screens should be connected to efficient ground points. The metal 7-point connector, part no. 934939, should be used for the integral amplifier.

In all cases, both valve and cable should be kept as far 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 b 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.

Installation Dimensions in mm (in)

KDG4V-5



u *Electrical plug connections (without indicator light) to ISO 4400/DIN 43650. Must be separately ordered by part number(s).*

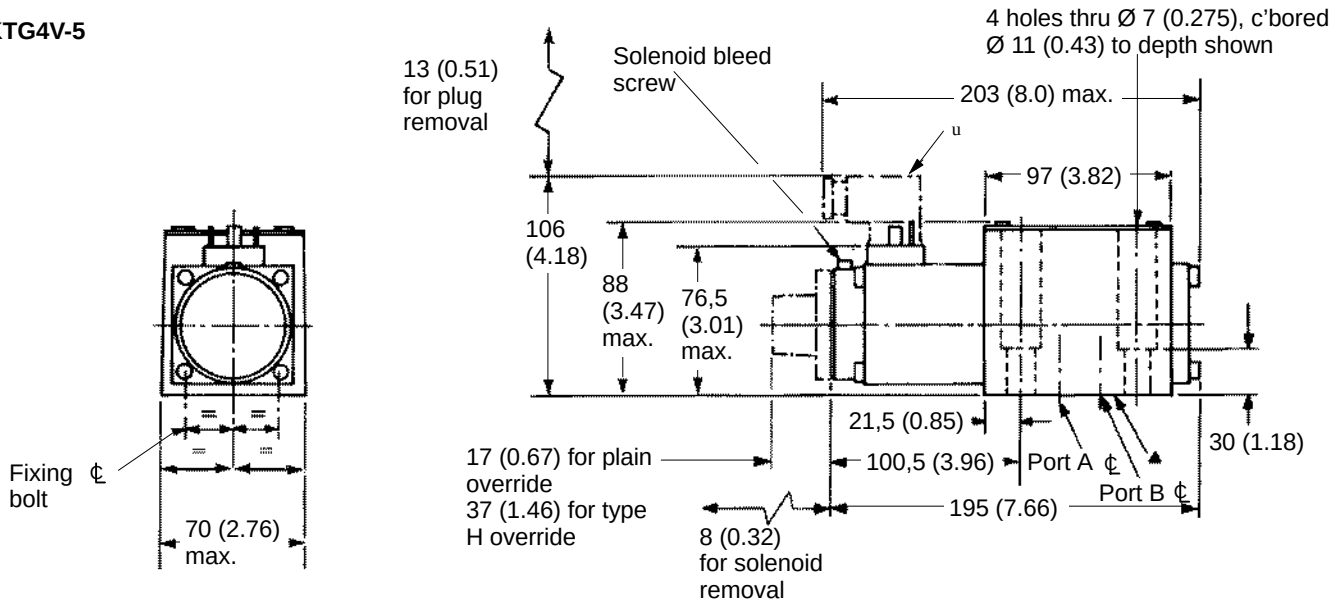
Part No	Color	Solenoid coil	Cable gland
710775	*Black*	*Solenoid B*	*Pg. 11*
710776	*Gray*	*Solenoid A*	*Ø 6-10 (0.23-0.39 dia)*

Solenoid and plug identities

At port "A" end	At port "B" end	For
A	*B*	*KDG4V-5-*C***(-*)-VM*
B	*A*	*KDG4V-5-*C***(-*)-M*

The cable entry can be repositioned at 90° intervals form the position shown. This is done by re-assembling the contact holder into the appropriate position inside the plug connector housing.

KTG4V-5



u *Electrical plug connections (without indicator light) to ISO 4400/DIN 43650. Must be separately ordered by part number(s).*

Part No	Color	Solenoid coil	Cable gland	For valve
710775	*Black*	*Solenoid B*	*Pg. 11*	*KTG4V-5-*B***(-*)-M*
710776	*Gray*	*Solenoid A*	*Ø 6-10 (0.23-0.39 dia)*	*KTG4V-5-*B***(-*)-VM*

The cable entry can be repositioned at 90° intervals from the position shown. This is done by re-assembling the contact holder into the appropriate position inside the plug connector housing.

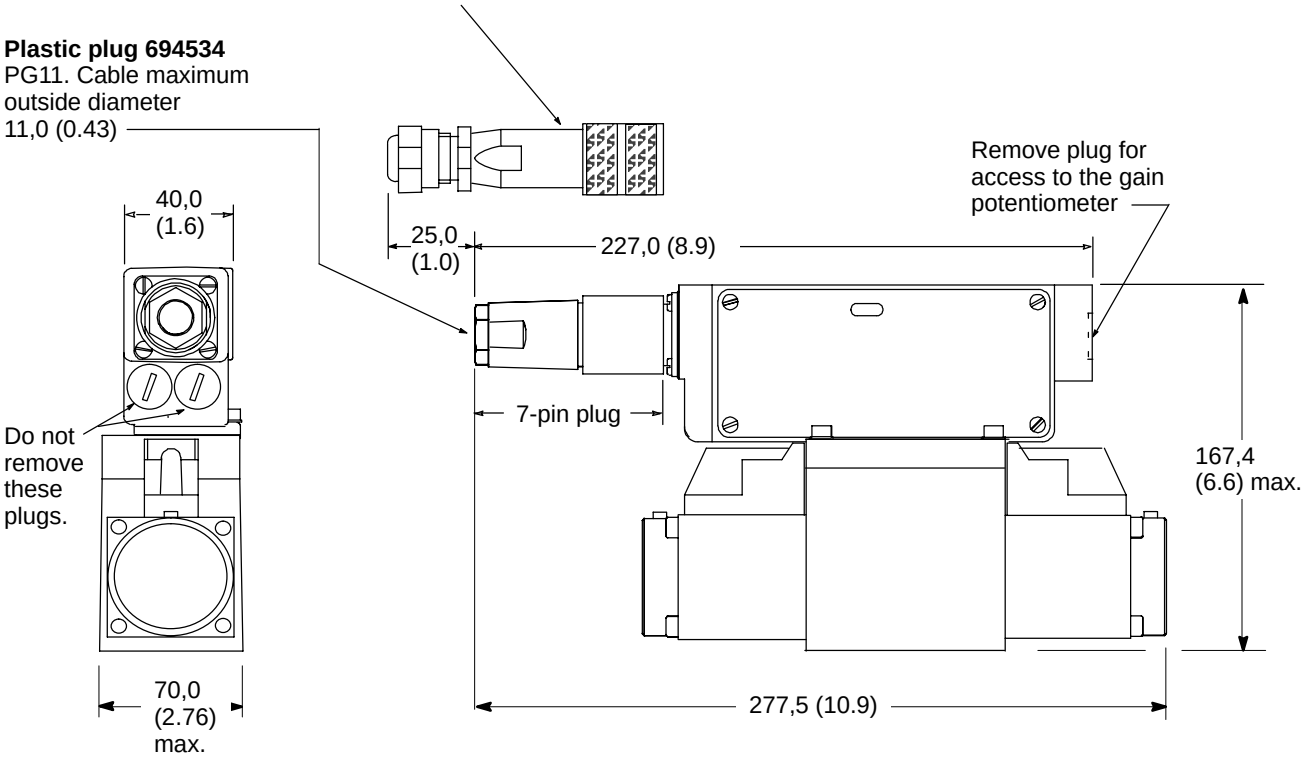
s *Mounting surface, seals supplied.*
For mating surface dimensions and subplate options, see catalog 2336.
For mounting bolt kit options see catalog 2314.

Installation Dimensions in mm (in)

KADG4V-5

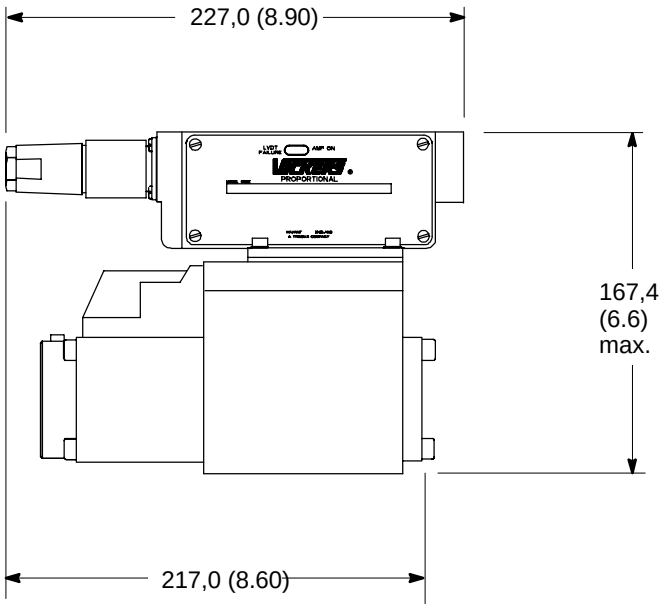
Metal plug 934939
Cable outside diameter 8,0 to 10,5 (0.31 to 0.41) Must be used for full EMC protection. See “Warning” note on page 11.

Plastic plug 694534
PG11. Cable maximum outside diameter 11,0 (0.43)



See warning note on page 3 regarding the use of 7-pin plugs.

KATG4V-5



Further Information

Hydraulic Fluids
Materials and seals used in these valves are compatible with:
Anti-wear petroleum oils . . . . . L-HM
Non-alkyl based
phosphate esters . . . . . L-HFD
The extreme operating range is 500 to 13 cSt (270 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-286-S.

Contamination Control Requirements
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 μm, 5 μm and 15 μm.
For products in this catalog the recommended levels are:
Up to 210 bar (3050 bar) 18**/16/13**
Above 210 bar (3050 bar) 17**/15/12**

Installation and Start-up Guidelines
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. If this proves to be the case any accumulated air can be bled from the solenoid bleed screws. This task is easier if the valve has been mounted base downwards. Good installation practice dictates that the tank port, and any drain port, are piped so as to keep the valve full of fluid once the system start-up has been completed.

Temperatures
For petroleum oil:
Min. . . . . –20°C (–4°F)
Max.* . . . . . +70°C (158°F)

* *To obtain optimum service life from both fluid and hydraulic system, 65° C (150°F) normally is the maximum temperature.*

For other fluids where limits are outside those of petroleum oil, consult fluid manufacturer or Vickers representative. Whatever the actual temperature range, ensure that viscosities stay within those specified under “Hydraulic Fluids”.

Ambient for:
Valves, including any feedback transducers and integral amplifiers at full performance specification: –20 to +60°C (–4 to +140°F).
Valves, as above, will operate at temperatures of 0 to –20°C (32 to –4°F) but with a reduced dynamic response.

Storage:
–25 to +85°C (–13 to +185°F)

Eurocard electronics:
0 to 50°C (32 to 122°F)

Service Information
The products from this range are preset at the factory for optimum performance, disassembling critical items would destroy those 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 to you.

Field repair is restricted to the replacement of the listed parts below.
Seal kit (KD/TG) 565110
Seal kit (KAD/TG) 02-139127

Proportional Directional and Throttle Valves – Solenoid Operated

KDG4V-3S and KTG4V-3S standard performance series
K(A)DG4V-3 and K(A)TG4V-3 high performance series
ISO 4401-03 (NFPA D03) – Pressures to 350 bar (5075 psi)

Introduction

KDG and KTG Valves

Vickers KDG and KTG valves are non-feedback type proportional valves.

The KDG is a proportional directional valve with two solenoids (C models). It incorporates control of flow, direction, acceleration, and deceleration in a single control valve.

The KTG is a proportional throttle valve with a single solenoid. B models are spring centered with solenoid A removed. F models are spring offset to port A and respond to an increasing signal by reducing the flow rate. The KTG's spool can be infinitely positioned to achieve throttling (restriction) of the fluid flow.

The primary function of these valves is to direct and meter fluid flow in proportion to current received by the solenoid. This fluid flow controls the velocity, direction, and acceleration
or deceleration of a work cylinder
or fluid motor.

These valves are designed to fill the performance gap between conventional solenoid operated directional valves and servo valves or feedback-type proportional valves. They provide control of spool position and metered fluid flow in applications that don't require the high levels of accuracy, repeatability, or response possible with feedback-type proportional valves or servos.

Used with Vickers electronic amplifiers, these valves provide an interface between control system intelligence and hydraulic muscle. This is a very practical way to control actuator direction and speed while eliminating shock caused by rapid acceleration and deceleration of machine loads.

In addition to improving machine performance and life, these proportional valves substantially simplify system design by combining direction and flow control capabilities in one package that mounts to a standard NFPA/ISO subplate or manifold interface.

The valve can also be readily tailored to a vast array of applications by specifying the specific valve configuration which best meets system requirements.

The valve is controlled by applying current to either solenoid A or solenoid B. This current produces a force at the solenoid push pin which, in turn, causes spool travel. The spool will continue its motion until the solenoid force is balanced by the return spring force. Therefore, spool travel is proportional to the amount of current passing through the solenoid coil.

KADG and KATG Valves

The above description of KDG and KTG valves also applies to KADG and KATG valves, with one exception. "KA" valves have an integral amplifier, whereas KDG and KTG valves do not.

The control amplifier of KA models is housed in a sturdy metal enclosure built directly on, and prewired to, the valve. Factory-set adjustments of gain, balancing deadband and dither ensure high repeatability valve-to-valve. The only electrical inputs required are power supply (24V) and a voltage command signal of ±10V.

Features and Benefits

- These global products, manufactured to world-class quality standards, are sold and serviced throughout the world.
- KDG4V and KTG4V valves have a low installed cost due to commonality of parts with Vickers DG4V-3(S) solenoid operated directional valve.
- These valves open up expanded application opportunities as a cost-effective alternative to feedback-type proportional and servo valves.
- Sustained high machine productivity and uptime result from the proven fatigue life and endurance of reliable KDG4V and KTG4V valves.
- Vickers flexible design approach provides optimum performance. A wide variety of matching electronic amplifiers, valve options, and spool ratings allows the system designer flexibility in meeting application requirements.
- All valves are NFPA fatigue rated at 350 bar (5075 psi) for improved reliability and performance.
- The fully encapsulated solenoid coils are impervious to common industrial fluids. Coils can be removed and replaced quickly and easily without breaking into the hydraulic envelope.
- The valves' standard ISO 4401-03 mounting is interchangeable with any NFPA D03 or CETOP 3 interface.
- The engineering resin junction box is NEMA 4 rated for resistance to water and all commonly used industrial fluids.
- Advantages of KADG and KATG valves with integral amplifier:
- Factory-sealed adjustments for increased valve-to-valve accuracy and simplified system set-up • Valve and amplfier selected, ordered, delivered and installed as a performance-tested package
- Installation wiring reduced and simplified
- Simplified valve removal and replacement
- The use of Viton* O-rings throughout provides multi-fluid capability and prevents outside fluids from contacting internal valve parts.

* Viton is a registered trademark of the DuPont Co.

Contents

General Information

Typical Applications, Meter-in and Meter-out, Valve Spool Position, Flow Rates, Recommended Fluids, Pressure Compensation, Accessories, Electrical Signals, Electrical Connectors 4

Cross Section of Typical Valve, Graphical Symbols 5

System Calculations for Valve Selection 6

KDG4V-3S and KTG4V-3S Standard Performance Valves – 100 bar (1450 psi) tank line rating

Model Code 7

Application Data

Specifications, Performance, Solenoid Specifications, Step Response Time Spool, Spool/Spring, Metering, Amplifiers, Drain 8

Flow Paths 9

Flow Gain Curves 10

Power Capacity Envelopes 13

Frequency Response 14

Installation Dimensions 15

EN-427 Feature 16

Electrical Connections 17

K(A)DG4V-3 and K(A)TG4V-3 High Performance Valves – 210 bar (3000 psi) tank line rating

Model Code 18

Application Data

Specifications, Performance, Solenoid Specifications, Step Input Time, Amplifiers, Drain 19

Flow Paths 21

Flow Gain Curves 22

Power Capacity Envelopes 26

Frequency Response 27

Electrical Block Diagram for KADG4V-3 and KATG4V-3 28

Connection Arrangements for KADG4V-3 and and KATG4V-3 29

Installation Dimensions 30

Mounting Requirements 32

Fluid Cleanliness 33

General Information

Typical Applications

This type of valve is often used in both mobile and industrial “line-of-sight” applications where speed and position are controlled by an operator. Some examples are aerial work platforms, entertainment industry rides, farm combine controls, material handling equipment, and process controls. Any application using a DG4V-3(S) 60-design solenoid operated directional valve is a potential application for the KDG4V-3(S) or KTG4V-3(S)

The standard performance KDG4V-3S or KTG4V-3S should be used on most applications where a tank line pressure rating of 100 bar (1450 psi) is acceptable. The high performance KDG4V-3 or KTG4V-3 should be used on applications where a tank line pressure rating of 210 bar (3000 psi) is required.

Commonly used electrical input devices include joystick controllers, proportional push buttons, potentiometers, power plugs, and amplifier cards. Input devices that operate on the principle of direct voltage rather than current control will require the appropriate coil type (GP or HA).

Meter-in and Meter-out

System requirements must be clearly understood and taken into consideration when selecting a valve spool. Meter-out spools have the metering notches positioned between the actuator port and the tank port, creating a throttle in the hydraulic actuator’s return line. Meter-out is the most common spool configuration and is typically used in applications with over center loads and/or requiring deceleration control.

Meter-in spools have the metering notches positioned between the pressure port and the actuator port, creating a throttle in the hydraulic actuator’s inlet line. Meter-in spools are commonly used with hydrostat modules for pressure compensation in applications that don’t have an overrunning load as well as in load sensing pump circuits.

Spools with both meter-in and meter-out flow characteristics should be specified in applications where load changes (resistive to overrunning or vice versa) will occur. They should also be selected when uncertain system dynamics prevent the selection of specific meter-in or meter-out spool types.

Valve Spool Position

Spring centered and spring offset valves will be spring positioned unless the solenoid is energized continuously.

NOTE

Due to silting, any sliding spool valve held shifted under pressure for long periods may stick and not spring return. It is recommended that such valves be cycled periodically to prevent this from occurring.

Flow Rates

The rate of flow through a proportional valve is dependent on spool position and valve pressure differential. This is similar to flow through a needle valve. Like a needle valve, as a proportional valve is opened, the rate of flow increases, and if the pressure differential across the valve changes (because of load pressure changes, for example), the flow will vary. Because of this phenomenon, “rated flow” is an arbitrary term, dependent on the above parameters.

Unlike a needle valve, however, proportional valves exhibit an inherent degree of load compensation whereby increasing valve pressure drop has progressively less effect on flow rate (see Power Capacity Envelopes on pages 13 and 26). To eliminate the effects of pressure changes, a hydrostat module can be installed under the proportional valve to achieve pressure compensation.

Recommended Fluids

Petroleum oils are recommended for use with the KDG4V and KTG4V. Fluorocarbon seals are standard and are suitable for use with phosphate ester type fluids or blends, water glycol, water-in-oil emulsion fluids, and petroleum oils. Refer to publication 694 for fluid and temperature recommendations. HWBF (95% water) is not recommended.

Pressure Compensation

For information on using a SystemStak reducing valve to achieve pressure compensation control, please contact your Vickers Representative.

Accessories

See page 32 for information onmounting surface, subplate, and bolt kits.

Electrical Signals

It is important to note that solenoid force and valve flow are proportional to current—not voltage. Therefore, for optimum performance, a constant current electrical signal should be used. This type of signal will help compensate for the drift that would otherwise occur when current flow causes solenoid temperature and resistance to increase.

Flow is metered directly in proportion to the command signal applied to the amplifier. Metering performance is enhanced by machined metering notches on the valve spool. As the spool travels from its centered position, these metering notches create an increasingly greater orifice area, allowing more fluid to pass.

Electrical Connectors

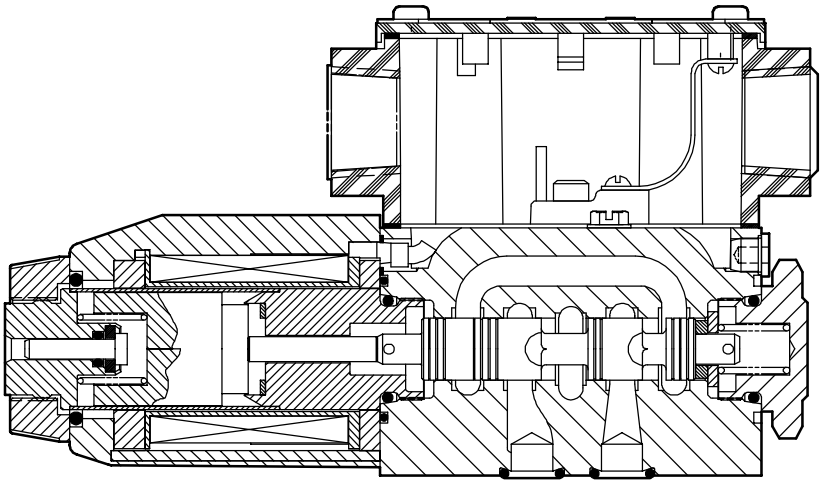
KDG4V-3S and KTG4V-3S

On FT (flying lead) models, electrical connections to the valve are made in the wiring housing, and a ground terminal is provided. SP1 and SP2 models have spade type terminals on each solenoid. DIN 43650 connectors are also available by specifying the U coil type. When U**1** is specified, DIN 443650 mating plugs are included.

KDG4V-3 and KTG4V-3

DIN 43650 connectors are standard. Mating plugs must be ordered separately.

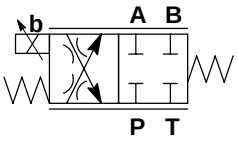
Cross Section of Typical Valve (KTG4V-3S)



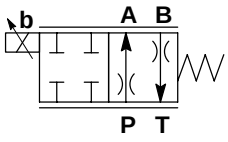
Graphical Symbols

KTG4V

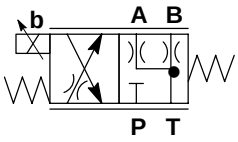
KTG4V-3S-2BN**



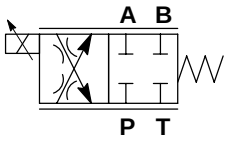
KTG4V-3S-2FN**



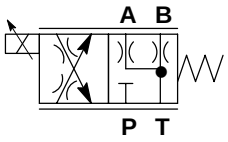
KTG4V-3S-33BA**



KTG4V-3-2B

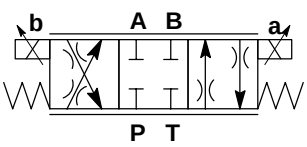


KTG4V-3-33B

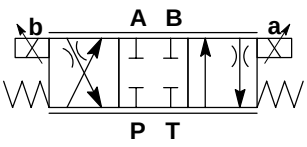


KDG4V

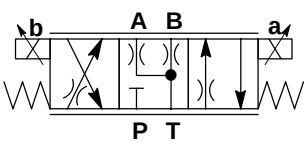
KDG4V-3(S)-2CN**



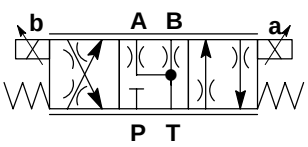
KDG4V-3(S)-2CS**



KDG4V-3S-33CA**



KDG4V-3-33CN**



Note: On all models, when solenoid “a” is energized, flow is always “P” to “A”. When solenoid “b” is energized, flow is always “P” to “B”. This is in accordance with the ANSI−B93.9 standard. Solenoid designations “a” and “b” are identified on the diagram plate on the side of the valve.

System Calculations for Valve Selection

The “rated flow” values for this range of proportional valves are determined with a looped flow path pressure drop (e.g. P→A→B→T) of 10 bar (145 psi) when the valve is fully open. As explained on page 4, however, “rated flow” is an arbitrary term dependent upon external factors.

It is important to properly size a proportional valve to achieve good resolution. A common mistake in specifying proportional valves is selecting too high a rated flow. The result may be poor control of the actuator, particularly with respect to velocity and resolution. The ideal valve size is usually one that provides just enough maximum flow to achieve the required actuator velocity.

The following steps can be used to determine the proper size for a proportional valve. This procedure applies to a conventional four-way valve controlling an equal area piston driving a load in an application in which velocity is the critical parameter. For differential area cylinders, base the calculations on the maximum cylinder flow rate.

Constants

- A = Actuator piston area, cm^2 (in^2)
- F_M = Maximum force required, N (lbf)
- F_D = Force required to accelerate and maintain velocity, N (lbf)
- P_S = Supply pressure less other system pressure drops, bar (psi)
- P_L = Maximum pressure required to drive or accelerate actuator under dynamic conditions, bar (psi)
- P_V = Allowable valve pressure drop, bar (psi)
- V = Desired actuator velocity, m/s (in/s)
- Q = Flow required to drive actuator at desired velocity, L/min (USgpm)

1. Determine required actuator area:

$$A(cm^2) = \frac{F_M(N)}{10 \times P_S(bar)}$$

$$\left[A(in^2) = \frac{F_M(lbf)}{P_S(psi)} \right]$$

2. Determine flow required to drive actuator at desired velocity:

$$Q(L/min) = 6 \times A(cm^2) \times V(m/s)$$

$$\left[Q(USgpm) = \frac{A(in^2) \times V(in/s)}{3.85} \right]$$

3. Determine maximum load pressure drop under dynamic conditions:

$$P_L(bar) = \frac{F_D(N)}{10 \times A(cm^2)}$$

$$\left[P_L(psi) = \frac{F_D(lbf)}{A(in^2)} \right]$$

4. Determine valve pressure drop:

$$P_V(bar) = P_S(bar) - P_L(bar)$$

$$\left[P_V(psi) = P_S(psi) - P_L(psi) \right]$$

5. Refer to Flow Gain Curves starting on page 10 and determine most suitable valve spool based on flow (Q) and pressure drop (P_V).

6. Refer to Power Capacity Envelopes on page 13 and verify that flow (Q) determined in step 2 at the valve pressure drop (P_V) determined in step 4 falls within (to the left of) the power curve for the spool selected in step 5.

Example

A hydraulic system consisting of a pressure compensated pump, proportional valve, and equal area cylinder must develop a maximum force of 6400 N (1440 lbf) and move a 200 N (45 lbf) load at a velocity of 0,25 m/s (9.84 in/s).The force required to maintain this velocity is 1000 N (225 lb), and the pump’s compensator is set at 60 bar (870 psi).

1. Determine required actuator area:

$$A = \frac{F_M}{10 \times P_S} = \frac{6400}{10 \times 60} = 10,7 \text{ cm}^2$$

$$\left[A = \frac{F_M}{P_S} = \frac{1440}{870} = 1.66 \text{ in}^{2*} \right]$$

** 2 inch bore, 1.375 inch rod cylinder has actuator area = 1.66 in^2*

2. Determine flow required to drive actuator at desired velocity:

$$Q = 6 \times A \times V$$
$$= 6 \times 10,7 \times 0,25 = 16,1 \text{ L/min}$$

$$\left[Q = \frac{A \times V}{3.85} = \frac{1.66 \times 9.84}{3.85} = 4.24 \text{ USgpm} \right]$$

3. Determine maximum load pressure drop under dynamic conditions:

$$P_L = \frac{F_D}{10 \times A} = \frac{1000}{10 \times 10,7} = 9,4 \text{ bar}$$

$$\left[P_L = \frac{F_D}{A} = \frac{225}{1.66} = 136 \text{ psi} \right]$$

4. Determine valve pressure drop:

$$P_V = P_S - P_L = 60 - 9,4 = 50,6 \text{ bar}$$

$$\left[P_V = P_S - P_L = 800 - 136 = 734 \text{ psi} \right]$$

5. Refer to Flow Gain Curves and determine most suitable valve spool based on flow (Q) and pressure drop (P_V):

Calculated flow (Q) is 16,1 L/min (4.24 USgpm), and valve pressure drop (P_V) is 50,6 bar (734 psi). Reference to the KDG4V-3S “Flow Gain” graphs (see page 10) shows that the 15N spool (meter-in and meter-out) will do the job. A KDG4V–3S–2C15N would be selected.

Model Code – K*G4V-3S Standard Performance Valves

K * G 4 V - 3 S - * * * (L) * * * - (* *) - (V) M * * * * * * * (1) - * * 5 - 60 - (EN * *)

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23

1 Valve type

K – Proportional

2 Valve function

D – Directional valve (Double solenoid, C models. See item 9.)
T – Throttle valve (Single solenoid, B and F models. See item 9.)

3 Mounting

G – Subplate/manifold mounted

4 Operation

4 – Solenoid operated

5 Pressure rating

V – 350 bar (5075 psi) on P, A, and B ports

6 Interface

3 – ISO 4401-03, CETOP 3 (NFPA D03)

7 Performance

S – Standard performance

8 Spool type (center condition)

2 – Closed center (all ports)
33 – P port closed, bleed A and B to T

9 Spool/spring arrangement

B – Spring centered, solenoid A removed
C – Spring centered, dual solenoid
F – Spring offset to A port, shift to center

10 Build

L – Left-hand build (single solenoid only)
Blank – Standard right-hand build

11 Spool flow rating

For looped flow path P→A→B→T or P→B→A→T: Δp=10 bar (145 psid).
For single flow path P→A or B→T: Δp= 5 bar (72 psi).

08 – 8 L/min (2 USgpm)
15 – 15 L/min (4 USgpm)
19 – 19 L/min (5 USgpm)
22 – 22 L/min (5.8 USgpm) – available with KDG4V-3S-33C22A only

12 Metering condition

S – Meter out only
A – Meter in only
N – Meter in and meter out

Note: See table on page 8 for available combinations of spools, spool/spring arrangements, and metering conditions.

13 Manual override

P2 – Plain override in both ends of single solenoid models
H – Waterproof override in solenoid ends only
Blank – Plain override in solenoid ends only

14 Solenoid energization identity

V – Solenoid identification determined by position of solenoid (solenoid A on A port end, solenoid B on B port end)
Blank – Standard per ANSI B93.9 (energize solenoid A, flow is (P→A)

15 Flag symbol

M – Electrical options and features

16 Coil type

F – Flying lead and wiring box
U – DIN 43650 connector
SP1 – Single 6,3 mm spade IEC-760 (direct DC only)
SP2 – Dual 6,3 mm spade IEC-760

17 Electrical connections

T – Wiring terminal block
PA3 – 3-pin conduit connector
PA5 – 5-pin conduit connector

18 Wiring housing thread

W – $^1/_2$" NPT
J – 20 mm

19 Electrical options

1 – ISO 4400 with DIN 43650 plug supplied (U coil type models only)

20 Coil voltage rating

G – 12V DC*
H – 24V DC*
GP – Direct 12V DC or EM-VP/VT amplifier
HA – Direct 24V DC or EM-VP/VT amplifier

** Amplified models, current controlled*

21 Tank pressure rating

5 – 100 bar (1450 psi) for

22 Design number

Subject to change.

23 Special modifications

EN-427 – Applies to KTG4V only. One spool designation only and preset adjuster; see page 16.
Note: This valve is recommended for use with Vickers Valvistor® control valve.

KDG4V-3S and KTG4V-3S Application Data

Specifications

Maximum operating pressure (A, B and P ports)
350 bar (5000 psi)
(See “Flow Gain Curves”)

Maximum tank line pressure (T port)
K*G4V-3S:100 bar (1450 psi)

Maximum recommended pressure drop (four–way models at max. flow)
210 bar (3000psi)*

*At pressure drops above 10 bar (145 psid) dither amplitudes in the electronic controller may need to be set at or near minimum to eliminate potential high frequency circuit noise.

Mounting pattern
ISO–4401–AB–03–4–A, NFPA D03, CETOP 3

Operating temp . . . 20° to 82°C (–4° to 180°F)

Fluid viscosity . . . 16 – 54 cSt (75–250 SUS)

Weights (approximate)
KDG4V–3S–*–60 . . 2,3 kg (5.06 lbs.)
KTG4V–3S–*–60 . . 1,75 kg (3.85 lbs.)

Performance

Frequency Response
18Hz @ –3db
(10Hz @ 45 degree phase lag)
For an amplitude of 25% max stroke (center to offset) about the 50% position and ΔP (P–A–B–T) = 10 bar (145 psid). See graph on page 14.

Hysteresis
With pulse width modulation: 4%
With direct DC voltage (GP & HA): 8%

Repeatability: 1%

Deadband : 15–35% of full solenoid input. Vickers electronic controllers have a deadband eliminator to reduce this value to near zero.

Solenoid Specifications

Maximum current @ 50°C (122° F) ambient
G 3.2A
H 1.6A

Power Consumption @ 20°C (68°F)
G 18 Watts
H 18 Watts
GP 30 Watts
HA 30 Watts

Coil Resistance @ 20°C (68° F)
G 1.8 Ohms
H 7.3 Ohms
GP 4.9 Ohms
HA 19.6 Ohms

Coil Inductance @ 1000 Hz
G 7.5 mH
H 29 mH
GP 16 mH
HA 67 mH

Step Response Time

The following response times were measured from the point of energization/de-energization to the point of first indication of inlet pressure change.

Response up to full system pressure is dependent on the system’s compressed volume and can vary with each application.

0–100% (center to full spool travel)
100 msec

100–0% (full spool travel to center – fast drop out)
15 msec

10–90% (10% full flow to 90% full flow)
100 msec

90–10% (90% full flow to 10% full flow)
25 msec

100–100% (100% full flow travel in one direction to 100 % full flow travel in the reverse direction)
80 msec

Spool, Spool/Spring, Metering

Refer to the table below for the available spools, spool/spring arrangements and metering conditions.

For example, if a KD valve with a “33” spool is required, the spool/spring arrangement is “C” and the metering condition available is “A”. Refer to “Model Code” for a definition of these codes.

Model	Spool	Spool/Spring Arrangement	Metering Condition
KD	2	C	N or S
	33	C	A
KT	2	B or F	N
	33	B	A

Amplifiers

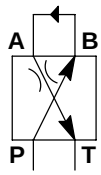
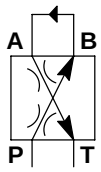
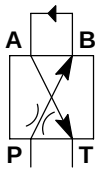
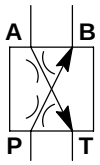
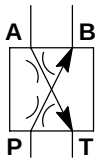
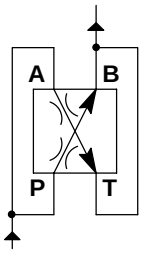
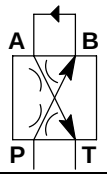
Coil Voltage Identification Letter	Amplifier
H	EEA–PAM–523–A–32 EEA–PAM–523–B–32 EEA–PAM–523–C–32 EEA–PAM–523–D–32 EEA–PAM–523–E–32 EEA–PAM–523–F–32
H	EEA–PAM–520–A–14 (for use with EN427 models)
GP	EM–VT–12–10† EM–VP–12–10†
HA	EM–VT–24–10† EM–VP–24–10†
	Plug Amplifier
G	EHH–AMP–712–D/G–20
H	EHH–AMP–702–C–20 EHH–AMP–702–D–20 EHH–AMP–702–E–20 EHH–AMP–702–F–20

† *Refer to drawing I-521575 for information.*

Drain

On 2-way valves, “T” is the drain and must be connected to the tank through a surge-free line, so there will be no back pressure at this port.

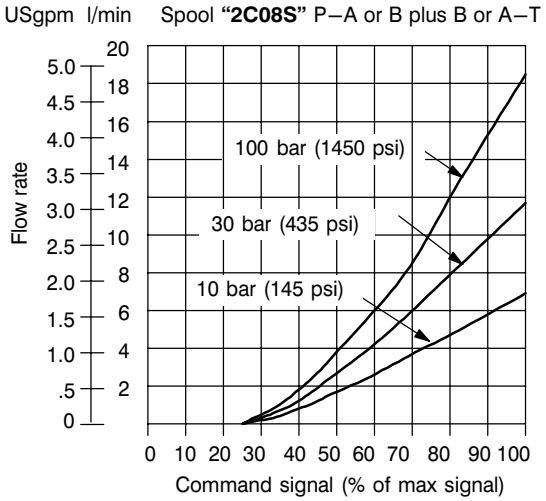
KDG4V-3S and KTG4V-3S Flow Paths

Valve/Flow Path	Spool	Symbol
KDG4V-3S with Looped Flow Path. P→A or B, plus B or A→T	2C08S 2C15S 2C19S	
	2C08N 2C15N 2C19N	
	33C08A 33C15A 33C22A	
KDG4V-3S with Single Flow Path. P→A or B, or A or B→T	2C08N 2C15N 2C19N	
KTG4V-3S with Single Flow Path. P→A or B, or A or B→T	2B08N 2B15N 2B19N	
KTG4V-3S with Parallel Flow Path. P→B and A→T	2B08N 2B15N 2B19N	
KTG4V-3S with Looped Flow Path. P→A or B, plus B or A→T	2B08N 2B15N 2B19N	

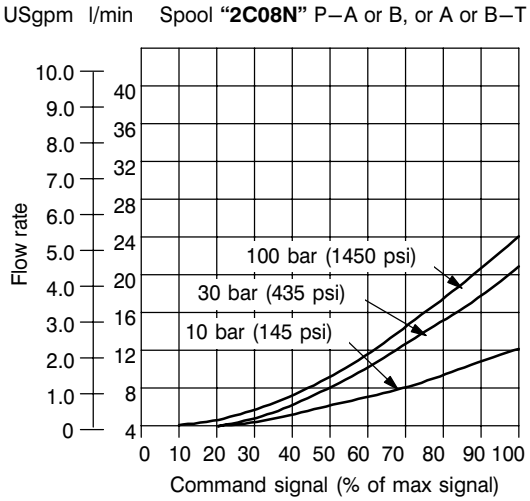
KDG4V-3S Flow Gain Curves

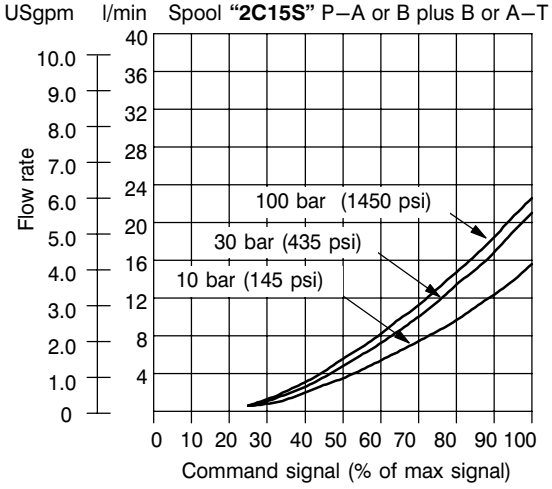
At the stated valve pressure drops, the percentage command signals are applicable to whichever solenoid is energized.

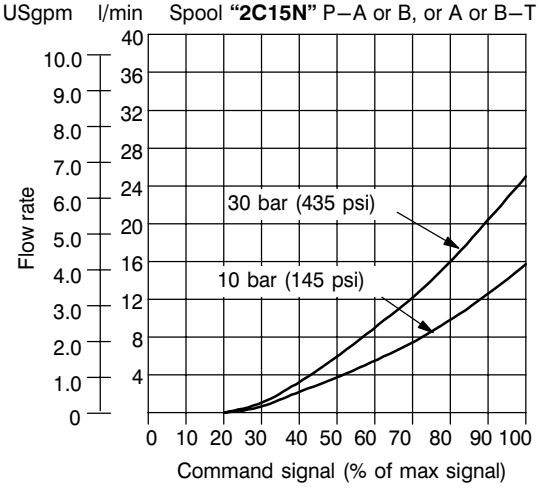
Looped Flow Path

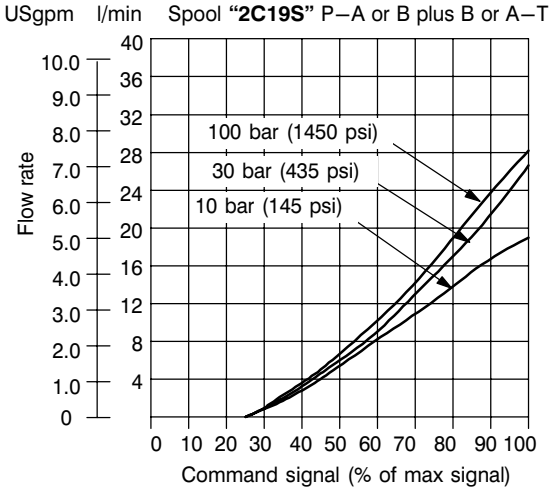


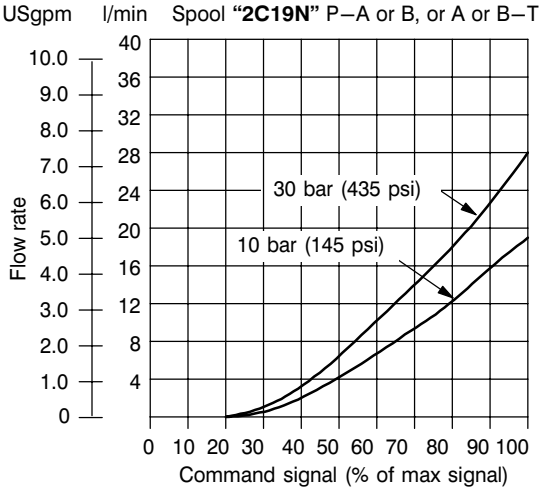
Looped Flow Path





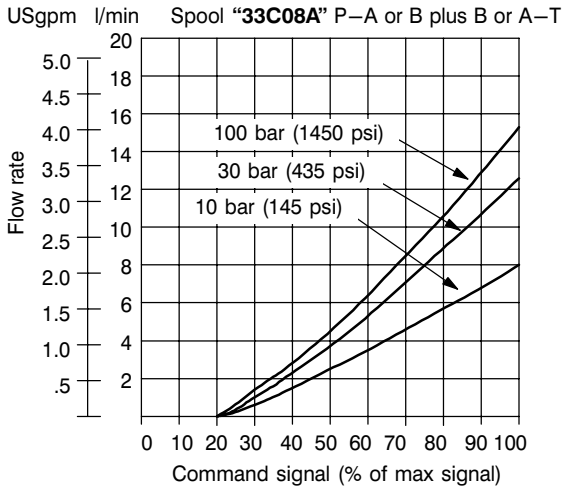


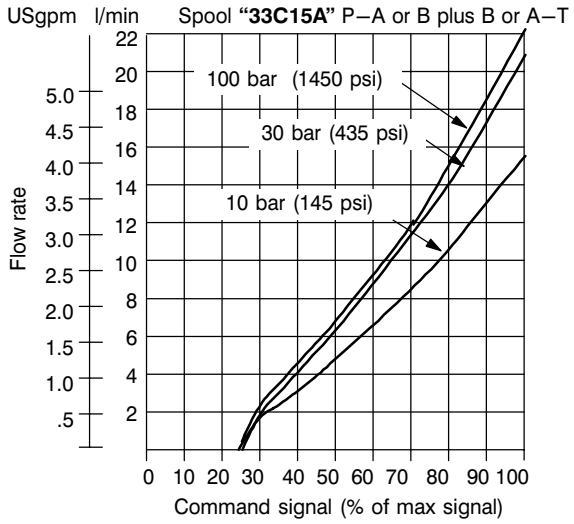


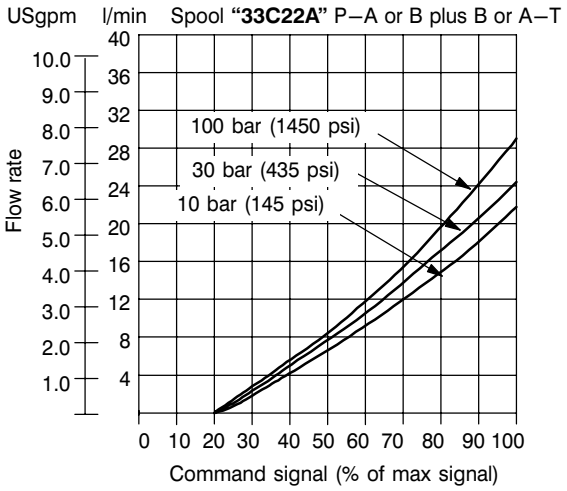


At the stated valve pressure drops, the percentage command signals are applicable to whichever solenoid is energized.

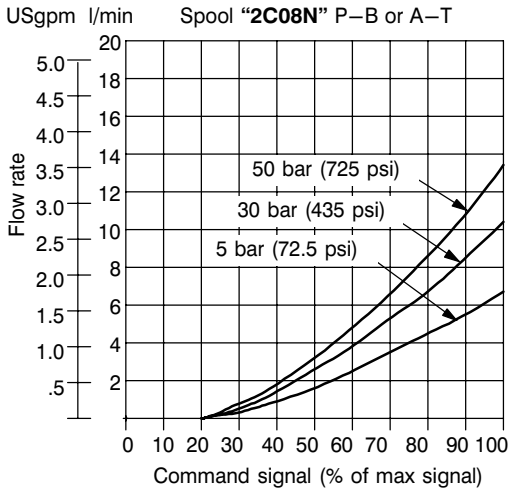
Looped Flow Path

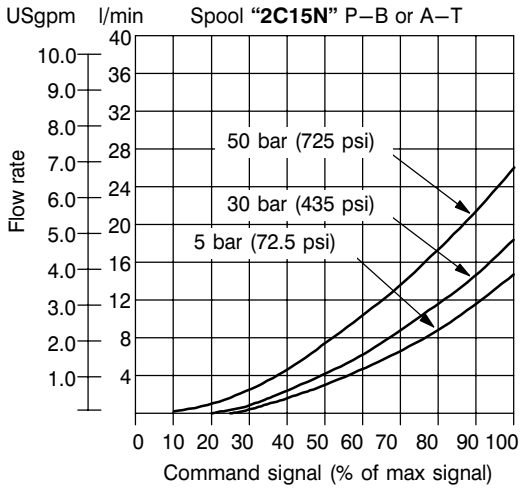


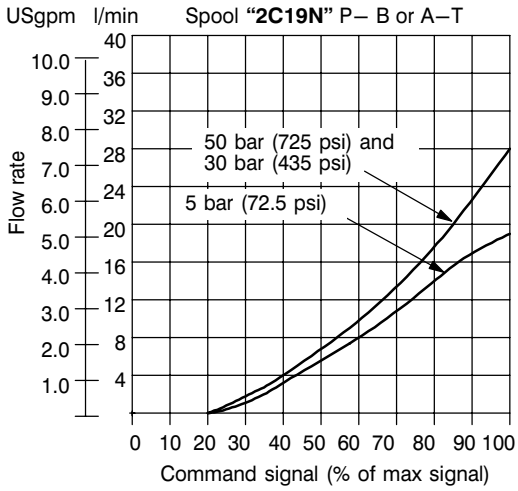




Single Flow Path



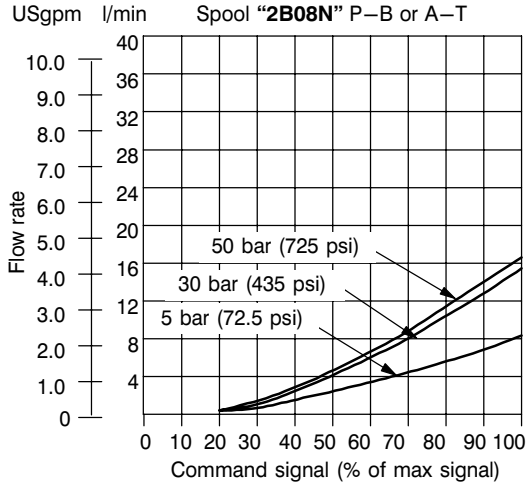


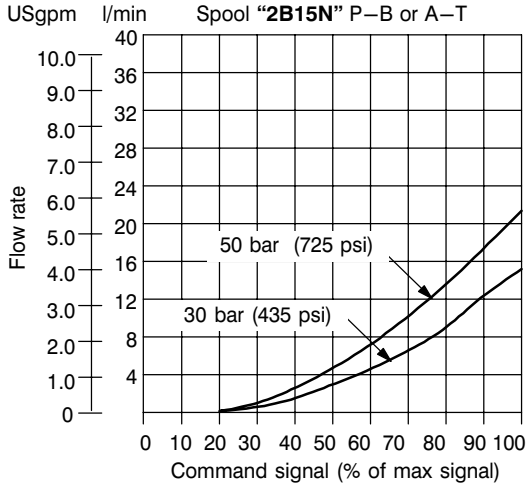


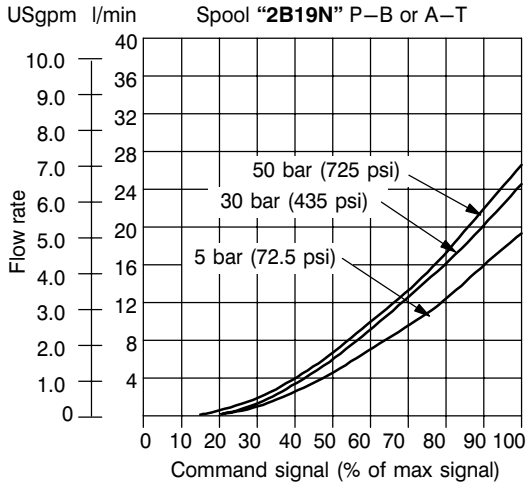
KDG4V-3S Flow Gain Curves

At the stated valve pressure drops, the percentage command signals are applicable to whichever solenoid is energized.

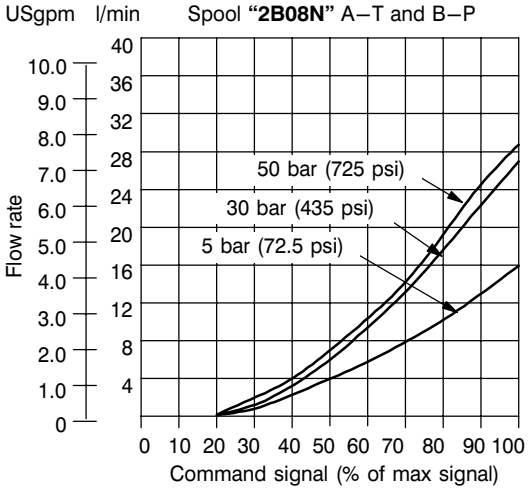
Single Flow Path

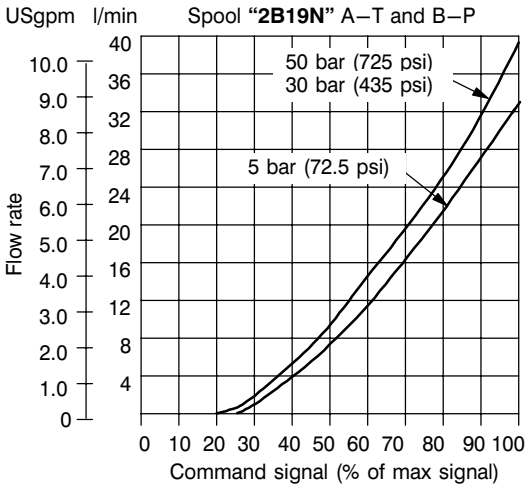


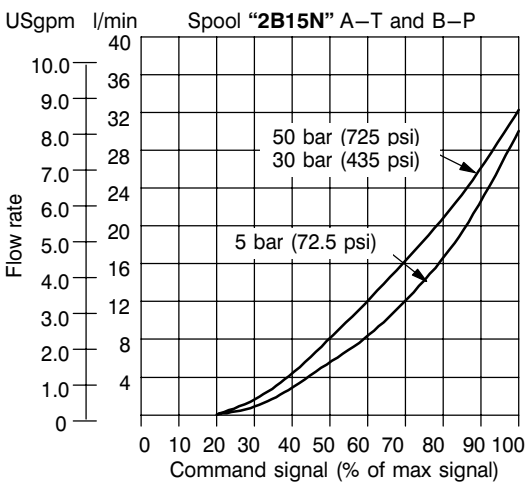




Parallel Flow Path

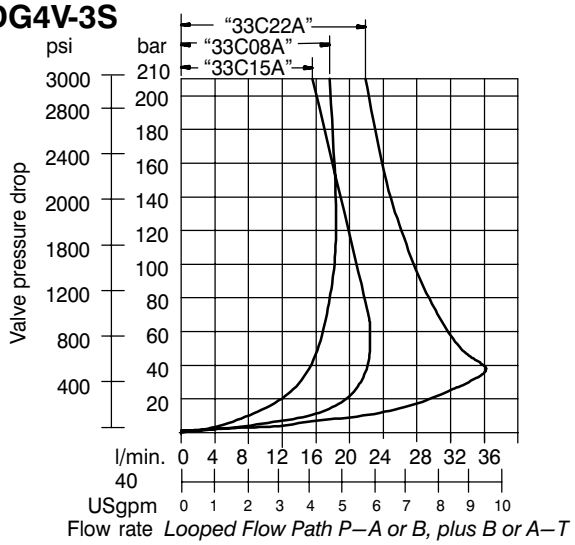


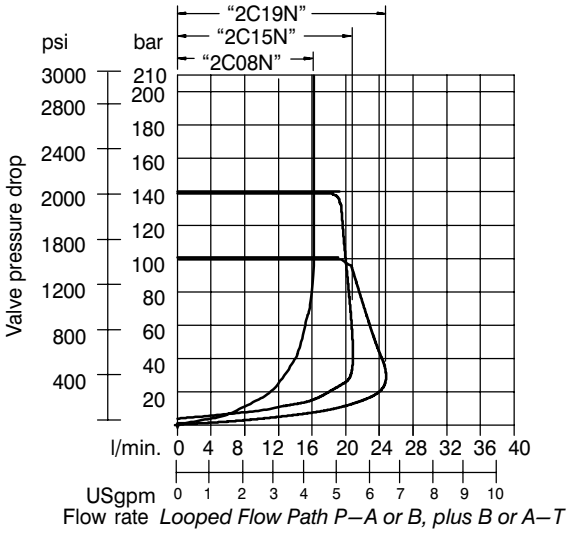


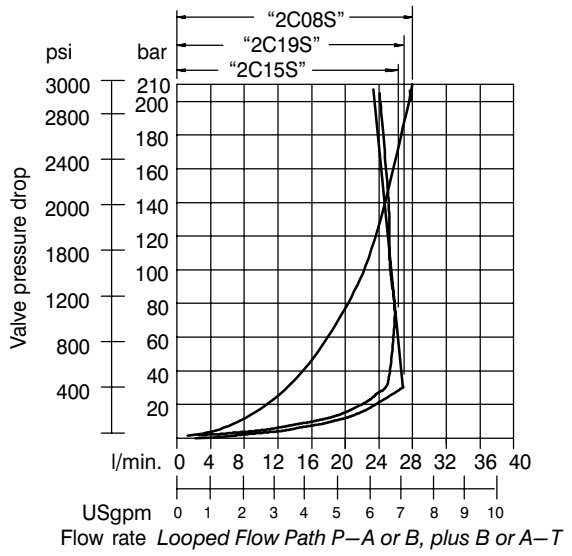


KDG4V-3S and KTG4V-3S Power Capacity Envelopes

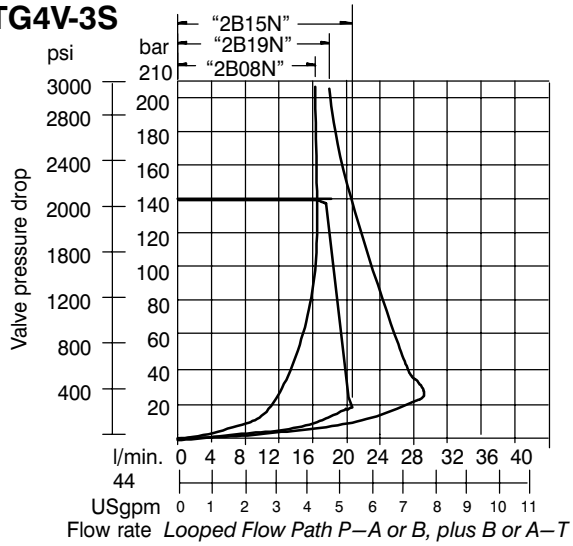
KDG4V-3S

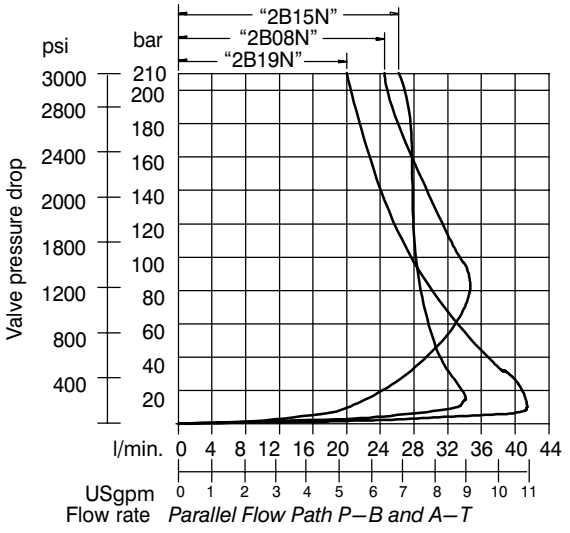


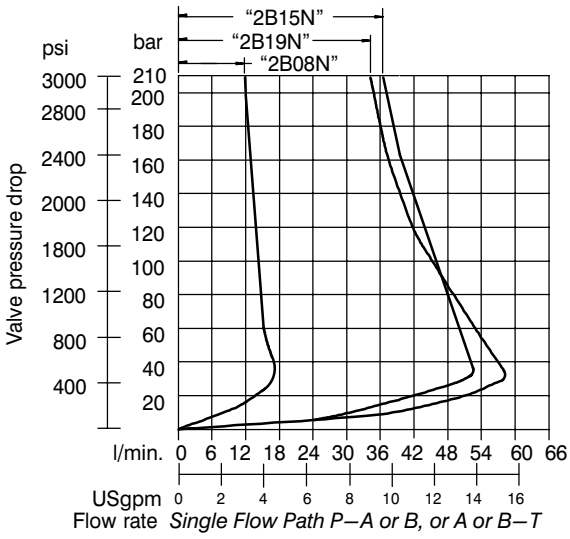




KTG4V-3S

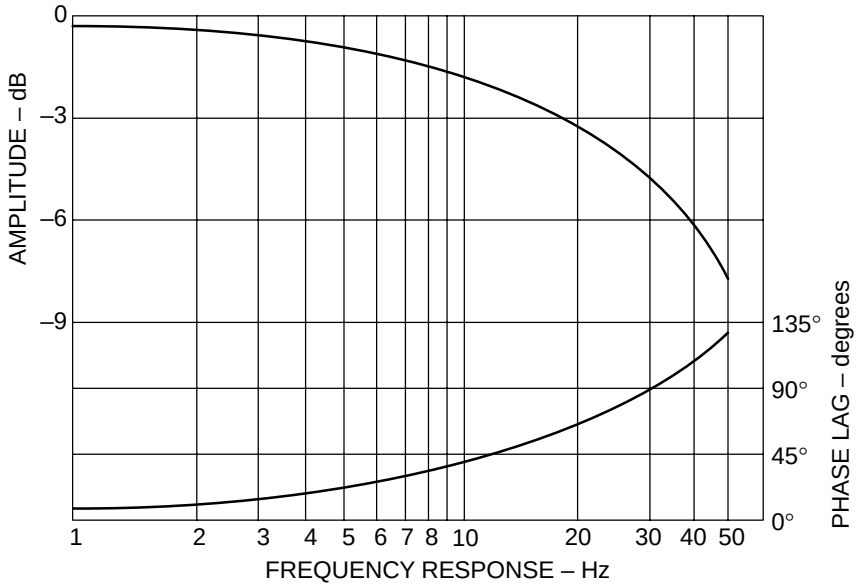






KDG4V-3S and KTG4V-3S Frequency Response

For amplitude of ±25% maximum stroke
(center to offset) about 50% position and
Δp (P→A→B→T)=10 bar (145 psi).

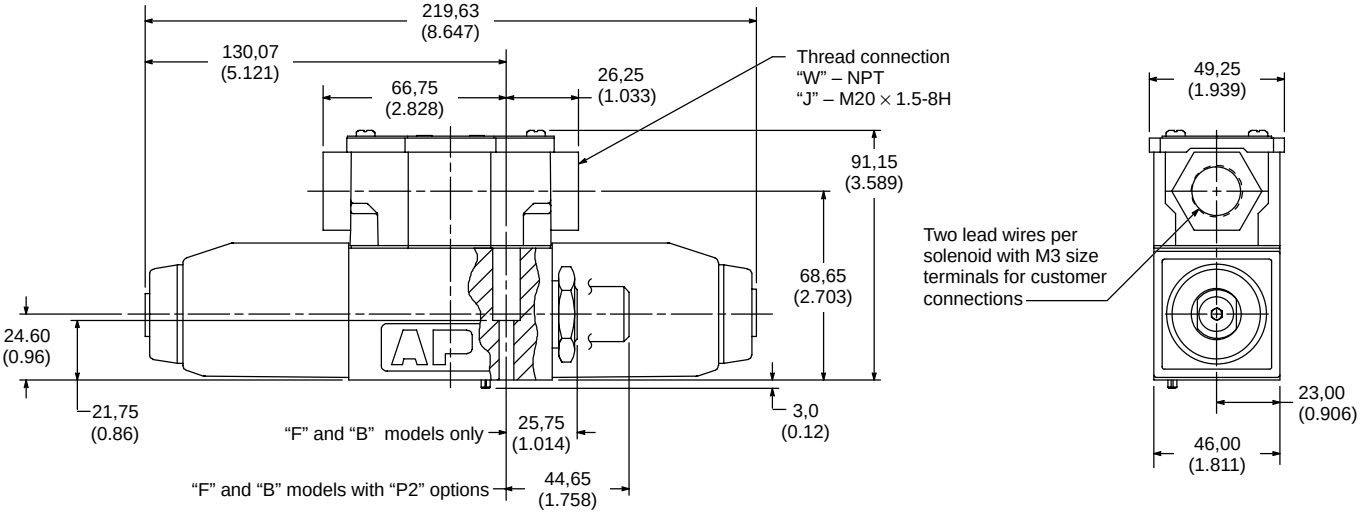


KDG4V-3S and KTG4V-3S Installation Dimensions

KDG4V-3S and KTG4V-3S with Junction Box

Dimensions in mm (inches)

3rd angle projection



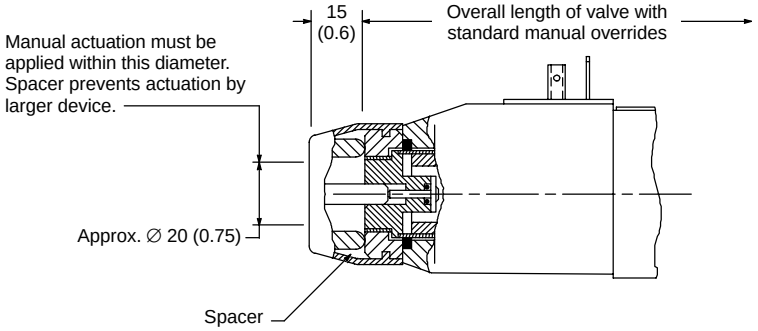
Water-resistant Manual Override on Solenoid

K*G4V-3S-(L)-H-(V)M-**-**-60**

Dimensions in mm (inches)

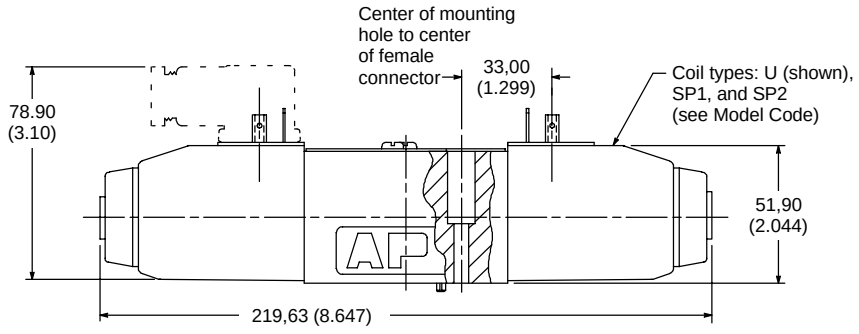
Use where finger operation is required. (Standard manual overrides cannot be operated without using small tool.)

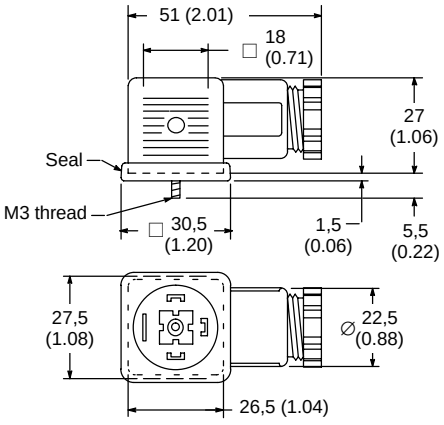
This "H" feature is not field-convertible from other models. Please specify with order.



KDG4V-3S (shown) and KTG4V-3S with DIN Connectors

Dimensions in mm (inches).





Plug connector can be positioned in 90° increments on valve by removing connector housing and re-assembling contact holder at desired orientation inside housing.

DIN 43650 plug connector can be ordered separately or included with valve by specifying 1 for Model Code item 19.

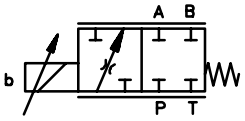
Means of connection: screw terminals

Conductor cross-sectional area:
0,5 to 1,5 mm^2 (0.0008 to 0.0023 in^2)

Cable diameter:
6 to10 mm (0.24 to 0.40 in)

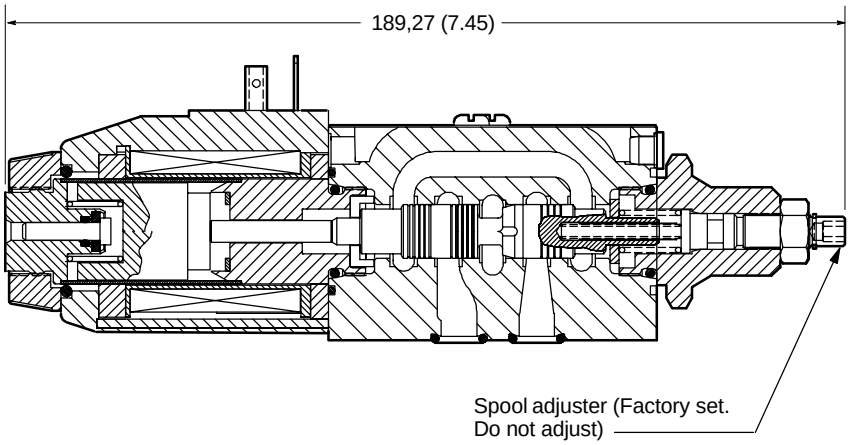
KTG4V-3S with EN427 Feature

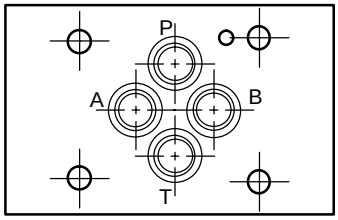
KTG4V-3S-2B 08N-(V)M-*** *** *(1)-H5-60-EN427



This valve feature is recommended for use as a pilot valve with the Valvistor® Slip-in Cartridge Valve.

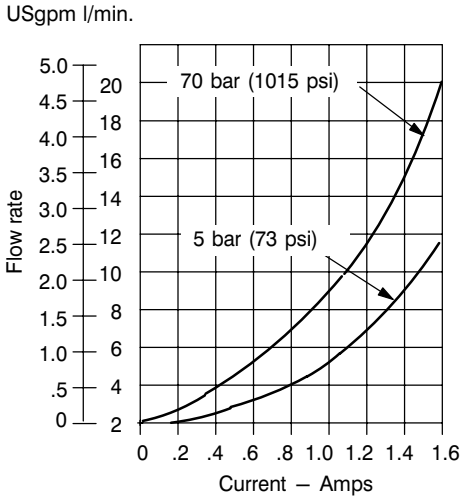
The spool adjuster is preset at the factory. Do not adjust. Improper operation will result.



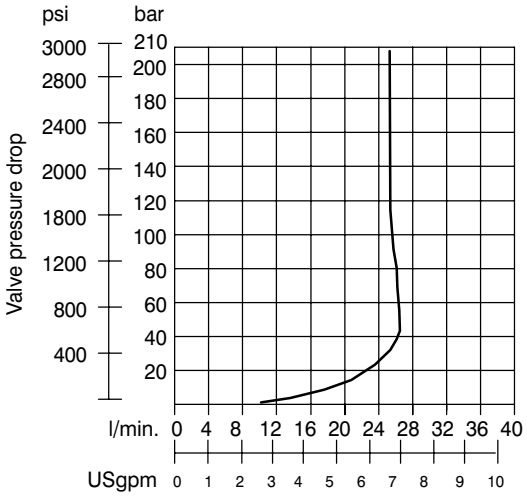


EN427 Performance

Flow Gain Curve



Power Capacity Curve



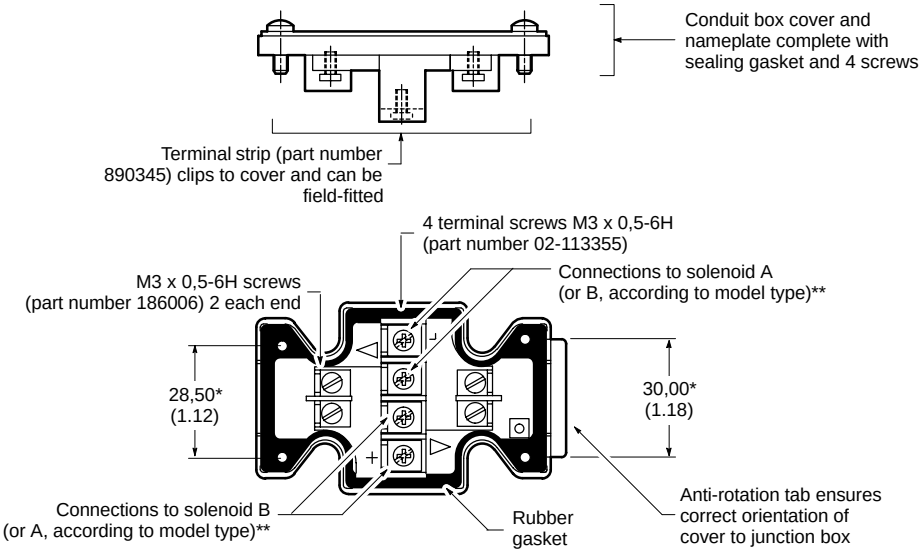
KDG4V-3S and KTG4V-3S Electrical Connections

Terminal Strip for FT (Flying Lead) Models

Dimensions in mm (inches)

* Difference in dimensions helps ensure correct orientation of nameplate to valve.

** For DC coils, positive + lead(s) must be connected to terminal(s) marked +. When using 3-wire incoming leads to double solenoid valves (i.e. common neutral), inner pair of terminals must be interconnected.



NFPA Connector (Standard T.3.5.29-1980) for FPA3 and FPA5 Models

Dimensions in mm (inches)

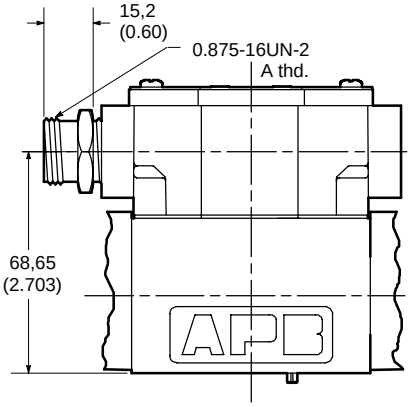
The receptacle is a standard three-pole or five-pole electrical connector with shortened leads and terminals added. The five-pole plug has four leads 101,6 (4.0) long and one lead 177,8 (7.0) long. All wires have non-solder insulated eyelet terminals. The green wire is used for the ground connection (No. 8 screw furnished). Valves are supplied pre-wired.

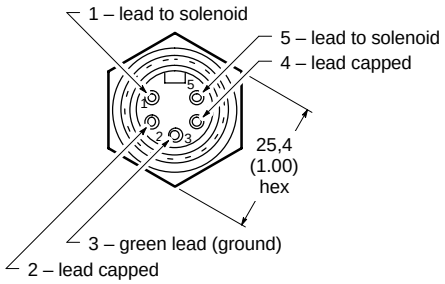
WARNING

Electrical power must be disconnected before removing or replacing this receptacle.

Electrical connection is over solenoid A on single solenoid models and over solenoid B on dual solenoid models. See diagram plate for solenoid B location.

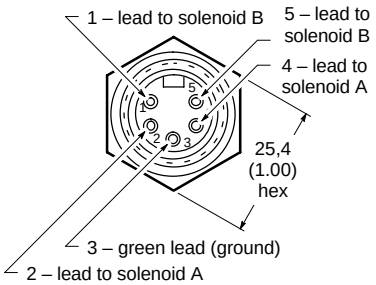
Receptacle is pre-wired to solenoid eyelets. Connection is made with No. 6 screws and nuts insulated with black electrical tape.





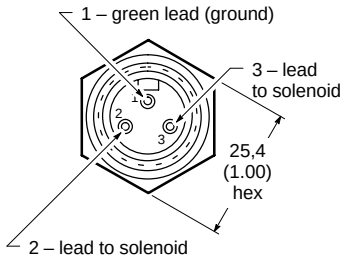
KTG4V-3S- * * -M-FPA5

B models
F models



KDG4V-3S- * C-M-FPA5

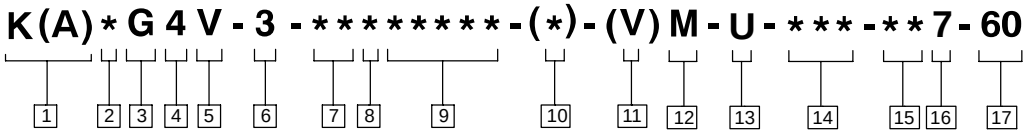
C models



KTG4V-3S- * * -M-FPA3

B models
F models

Model Code – K(A)*G4V-3 High Performance Valves



1 Valve type

K – Proportional
KA– Proportional with integral amplifier

2 Valve function

D – Directional valve (Double solenoid, C models. See item 8.)
T – Throttle valve (Single solenoid, B models. See item 8.)

3 Mounting

G – Subplate/manifold mounted

4 Operation

4 – Solenoid operated

5 Pressure rating

V – 350 bar (5075 psi) on P, A, and B ports

6 Interface

3 – ISO 4401-03, CETOP 3 (NFPA D03)

7 Spool type (center condition)

2 – Closed center (all ports)
33 – P port closed, bleed A and B to T

8 Spool/spring arrangement

B – Spring centered, solenoid A removed – KTG4V-3
C – Spring centered, dual solenoid – KDG4V-3

9 Spool flow rating

For looped flow path P→A→B→T or P→B→A→T: Δp= 10 bar (145 psi).
For single flow path P→A or B→T: Δp= 5 bar (72 psi).

Symmetric Spools
03F – 3 l/min (0.8 USgpm)
07N – 7 l/min (1.8 USgpm)
13N – 13 l/min (3.4 USgpm)
20N – 20 l/min (5.3 USgpm)
28S – 28 l/min (7.4 USgpm) – available with type 2 spool only

Asymmetric Spool – KDG4V Only
First figure (20N) is flow rating P→A or A→T; last figure (N10) is flow rating P→B or B→T.
20N10 – 20 l/min (5.3 USgpm) "A" port flow, and 10 l/min (2.65 USgpm) "B" port flow

10 Manual override(s)

H – Water-resistant
Z – No override(s)
Blank – Plain override(s)

11 Solenoid energization identity

V – Solenoid identification determined by position of solenoid (solenoid A on A port end, solenoid B on B port end)
Blank – Standard per ANSI B93.9 (energize solenoid A, flow is (P→A)

12 Flag symbol

M – Electrical options and features

13 Coil type

U – DIN 43650 connector. Order solenoid plug separately; see page 30.
F – Flying lead solenoids (KA type valves only)

14 Electrical connection (KA valves only)

PD7 – 7-pin connector with plastic plug. *See warning note below.*

15 Coil voltage rating

G – 12V DC
H – 24V DC†
GP – Direct 12V DC or EM-VP/VT amplifier
HA – Direct 24V DC or EM-VP/VT amplifier
† *KA type valves must have H type coils.*

16 Tank pressure rating

7 – 210 bar (3000 psi)

17 Design number

Subject to change.

Warning: To conform to the EC Electromagnetic Compatibility directive (EMC), this KADG4V or KATG4V valve must be fitted with a metal 7-pin plug. The screen of the cable must be securely connected to the shell of the metal connector. A suitable IP67 rated connector is available from Vickers, part no. 934939. Alternatively, a non IP67 rated connector is available from ITT-Cannon, part no. CA 02 COM-E 14S A7 P.
Additionally, the cable must be fitted with a ferrite EMC suppression core not more than 4cm from the connector referred to above. Suitable types include Farnell 535-898 or Farnell 535-904 which snap-fit over the cable. The plastic plug, part no. 694534, is only suitable for use in a sealed electromagnetic environment or outside of the European Community

K(A)DG4V-3 and K(A)TG4V-3 Application Data

Specifications

Maximum operating pressure (A, B and P ports)
350 bar (5000 psi)
(See “Flow Gain Curves”)

Maximum tank line pressure (T port)
210 bar (3000 psi)

Maximum recommended pressure drop (four–way models at max. flow)
210 bar (3000 psi)*

*At pressure drops above 10 bar (145 psid) dither amplitudes in the electronic controller may need to be set at or near minimum to eliminate potential high frequency circuit noise.

Minimum recommended flow rates for K(A)DG4V-3

Spool Code	l/min	in^3/min
**C03F	0,2	12
**C07F	0,4	24
**C13F	0,6	36
**C20F	1,0	60
**C28S	1,4	85

Mounting pattern
ISO–4401–AB–03–4–A, NFPA D03, CETOP 3

Operating temp . . . 20° to 82°C (–4° to 180°F)

Fluid viscosity . . . 16 – 54 cSt (75–250 SUS)

Weights (approximate)
KDG4V–3–*–60 . . . 2,4 kg (5.30 lbs.)
KTG4V–3–*–60 . . . 1,7 kg (3.75 lbs.)
KADG4V–3–*–60 . . 2,8 kg (6.20 lbs.)
KATG4V–3–*–60 . . 2,1 kg (4.65 lbs.)

Performance

Frequency Response
See graph on page 14.

Hysteresis
At ∆p = 5 bar (72 psi) . . . . . < 8% at rated flow

Reproducibility, valve-to-valve
Optimized by adjustment of deadband compensation, gain and ramp potentiometers on associated Vickers amplifier.

Solenoid Specifications

Maximum current @ 50°C (122° F) ambient

G	3.5A
H	1.6A
GP	3.0A
HA	0.94A

Coil Resistance @ 20°C (68° F)

G	1.55 Ohms
H	7.3 Ohms
GP	2.0 Ohms
HA	22.1 Ohms

Coil Inductance @ 1000 Hz

G	4 mH
H	20 mH
GP	6 mH
HA	55 mH

Relative duty factor
Continuous rating ED = 100%

Type of protection, with electrical plugs fitted correctly
IEC 144 Class IP65

Step Input Response

At ∆p = 5 bar (72 psi) per metering path.

Required step:	Time to reach 90% of req’d step:
0 to 100%	25 ms
100% to 0	30 ms
+90 to –90% . . .	35 ms

Amplifiers

Coil Voltage Identification Letter	Amplifier
H	EEA–PAM–523–A–30
	EEA–PAM–523–B–30
	EEA–PAM–523–C–30
	EEA–PAM–523–D–30
	EEA–PAM–523–E–30
	EEA–PAM–523–F–30
GP	EM–VT–12–10†
	EM–VP–12–10†
HA	EM–VT–24–10†
	EM–VP–24–10†
	Plug Amplifier
G	EHH–AMP–712–D/G–20
H	EHH–AMP–702–C–10
	EHH–AMP–702–D–10
	EHH–AMP–702–E–10
	EHH–AMP–702–F–10

† *Refer to drawing I-521575 for information.*

Drain

On 2-way valves, “T” is the drain and must be connected to the tank through a surge-free line, so there will be no back pressure at this port.

KADG4V-3 and KATG4V-3 Application Data

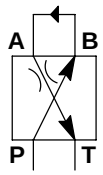
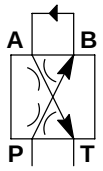
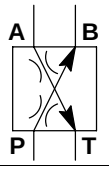
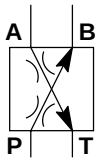
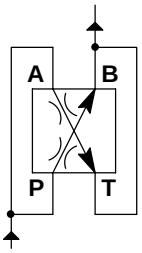
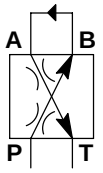
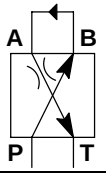
KAD/TG4V-3 Valves with Integral Amplifiers

Power supply	24V DC (21V to 36V including 10% peak-to-peak max. ripple) max. current 3A
Command signal Input impedance	0 to +10V DC, or 0 to –10V DC, or –10V to +10V DC 47 kΩ
7-pin plug connector Pin connections: A B C D E F G	 Power supply +ve Power 0V Signal 0V +ve voltage command signal –ve voltage command signal Monitor output Protective ground
Electro-magnetic compatibility (EMC): Emission (10 v/m) Immunity (10 v/m) See notes regarding EMC, below and on pages 18 and 29.	 EN 50081-2 EN 50082-2
Gain adjustment	25 to 125%
Factory set adjustments	Deadband, gain, dither and offset
Monitor point signal Output impedance	0,5V per amp solenoid current 10 kΩ
Power stage PWM frequency	2 kHz nominal
Repeatability, valve-to-valve (at factory settings): Flow gain at 100% command signal	 ≤5%
Protection: Electrical Mechanical	 Reverse polarity protected IEC 144, Class IP65
Relative humidity	65 to 85% at 20 to 70°C (68 to 158°F)
Supporting products: Auxiliary electronic modules (DIN-rail mounting): EHA-CON-201-A-2* signal converter EHD-DSG-201-A-1* command signal generator EHA-RMP-201-A-2* ramp generator EHA-PID-201-A-2* PID controller Subplates, size 03 Mounting bolts Note: If not using Vickers recommended bolt kits, bolts must be to ISO 898 grade 12.9 or stronger.	

CE

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, the Installation Wiring Practices for Vickers Electronic Products leaflet 2468, and leaflet 02-123931A which is packed with every KA valve. Wiring practices relevant to this Directive are indicated by Electromagnetic Compatibility (EMC).

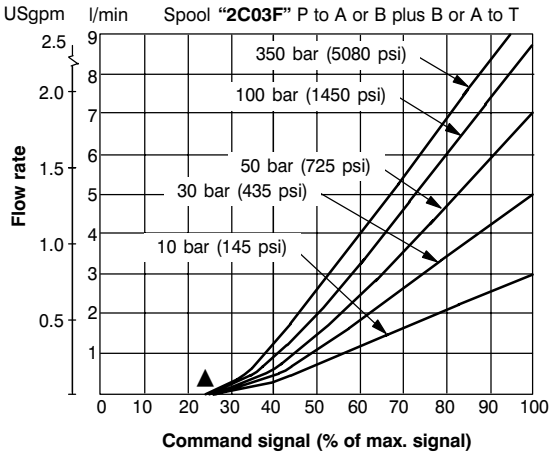
K(A)DG4V-3 and K(A)TG4V-3 Flow Paths

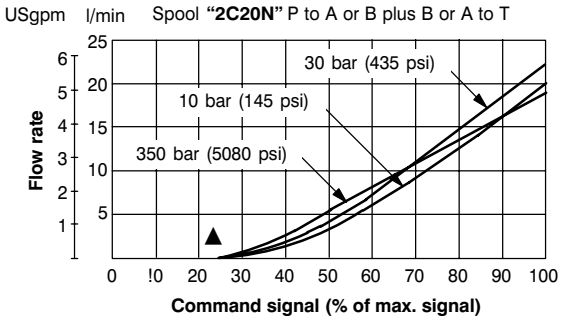
Valve/Flow Path	Spool	Symbol
K(A)DG4V-3 with Looped Flow Path. P→A or B, plus B or A→T	**C28S	
	**C03F **C07N **C13N **C20N	
K(A)DG4V-3 with Single Flow Path. P→A or B, or A or B→T	**C03F **C07N **C13N **C20N	
K(A)TG4V-3 with Single Flow Path. P→A or B, or A or B→T	**B03F **B07N **B13N **B20N	
K(A)TG4V-3 with Parallel Flow Path. P→B and A→T	**B13N **B20N	
K(A)TG4V-3 with Looped Flow Path. P→A or B, plus B or A→T	**B03N **B07N **B13N	
K(A)TG4V-3 with Looped Flow Path. P→A or B, plus B or A→T	**B28S	

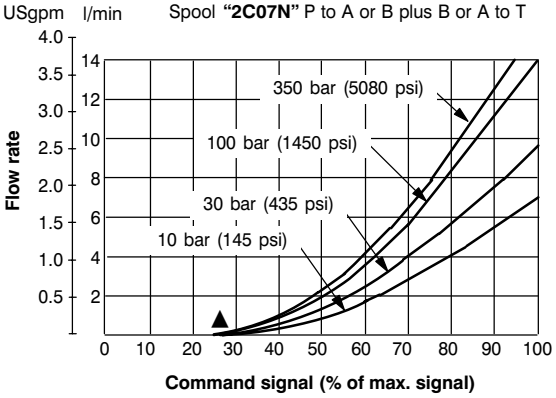
K(A)DG4V-3 Flow Gain Curves

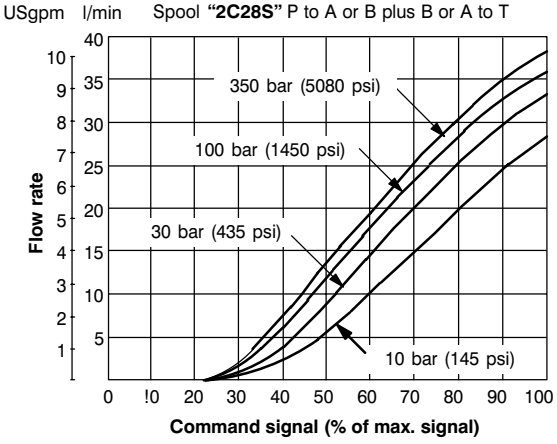
At the stated valve pressure drops, the percentage command signals are applicable to whichever solenoid is energized.

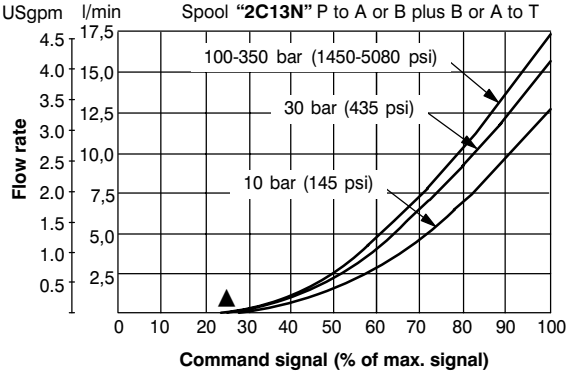
Looped Flow Path







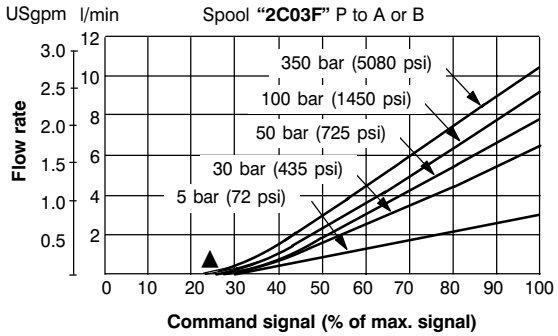


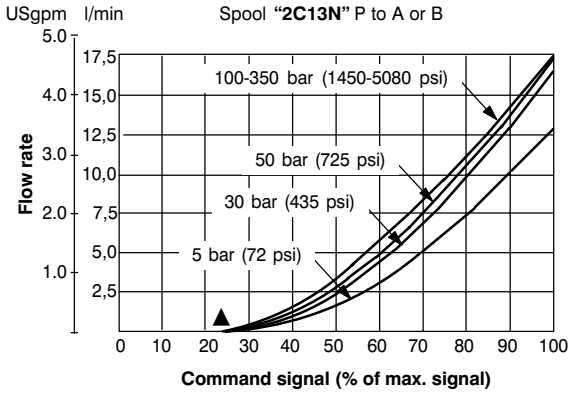


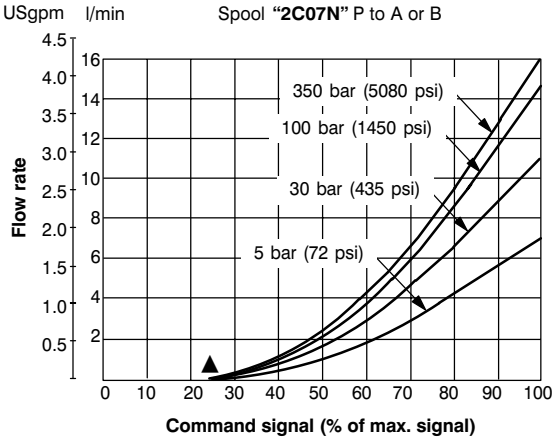
▲Curves shown are for spool types "2". These points will vary from valve to valve, but can be adjusted using the deadband-compensation feature of the drive amplifier. For spool types "33", the curves are similar, but flow starts at slightly higher command signals.

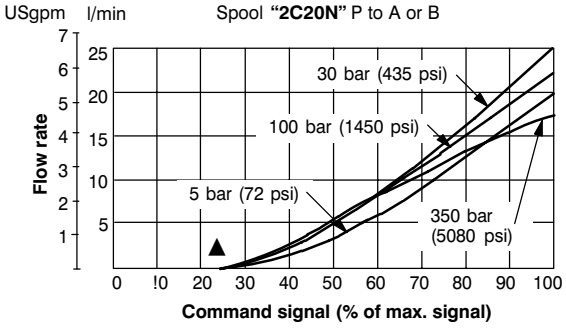
At the stated valve pressure drops, the percentage command signals are applicable to whichever solenoid is energized.

Single Flow Path







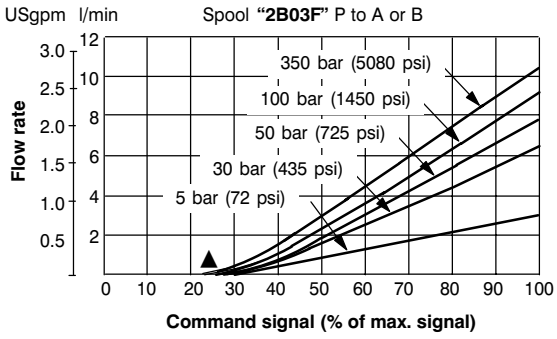


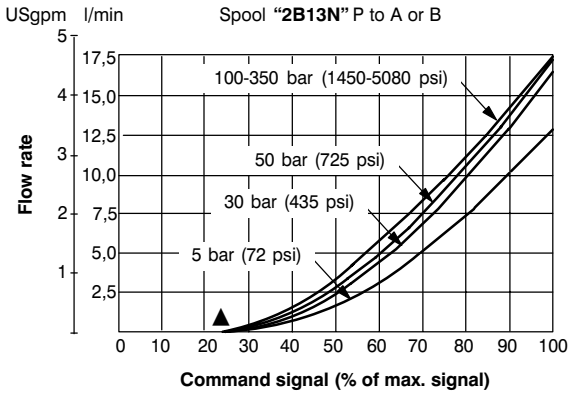
▲Curves shown are for spool types "2". These points will vary from valve to valve, but can be adjusted using the deadband-compensation feature of the drive amplifier. For spool types "33", the curves are similar, but flow starts at slightly higher command signals.

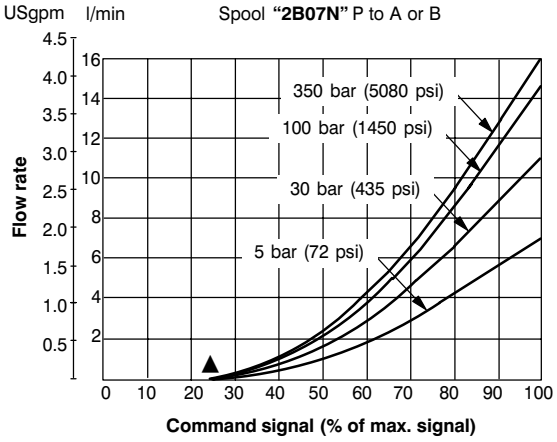
K(A)TG4V-3 Flow Gain Curves

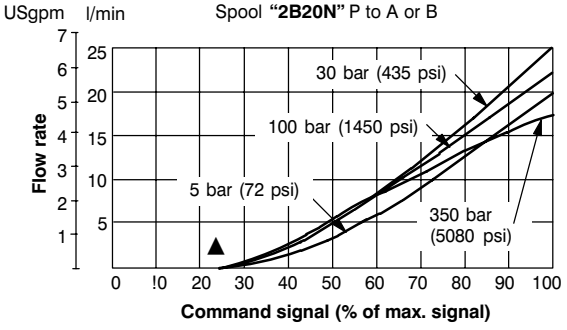
At the stated valve pressure drops, the percentage command signals are applicable to whichever solenoid is energized.

Single Flow Path





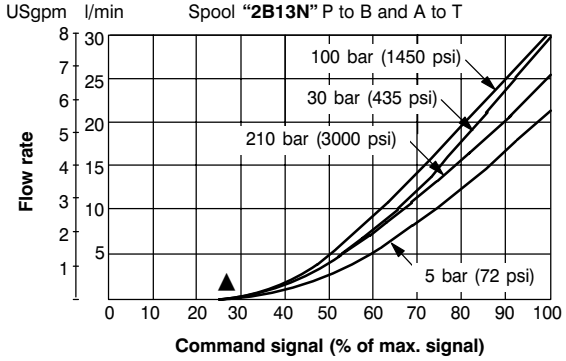


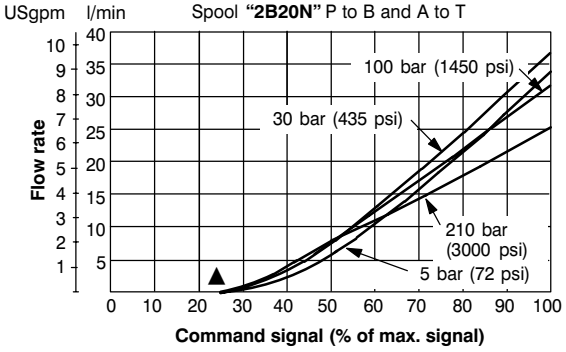


▲Curves shown are for spool types "2". These points will vary from valve to valve, but can be adjusted using the deadband-compensation feature of the drive amplifier. For spool types "33", the curves are similar, but flow starts at slightly higher command signals.

At the stated valve pressure drops, the percentage command signals are applicable to whichever solenoid is energized.

Parallel Flow Path

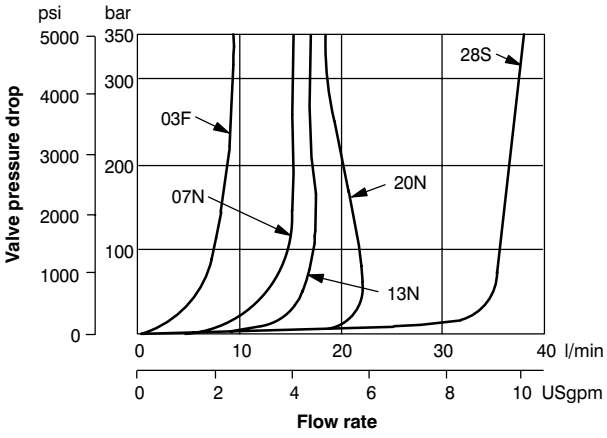




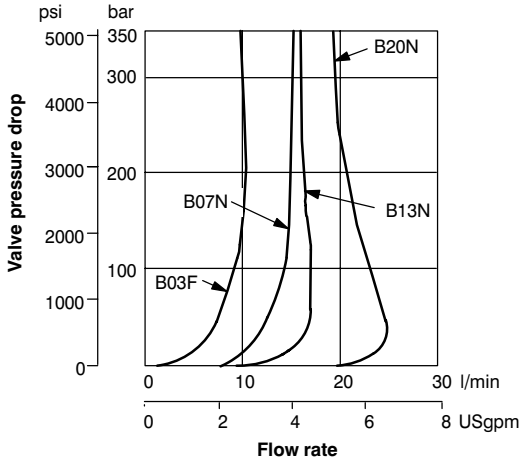
▲Curves shown are for spool types "2". These points will vary from valve to valve, but can be adjusted using the deadband-compensation feature of the drive amplifier. For spool types "33", the curves are similar, but flow starts at slightly higher command signals.

Power Capacity Envelopes

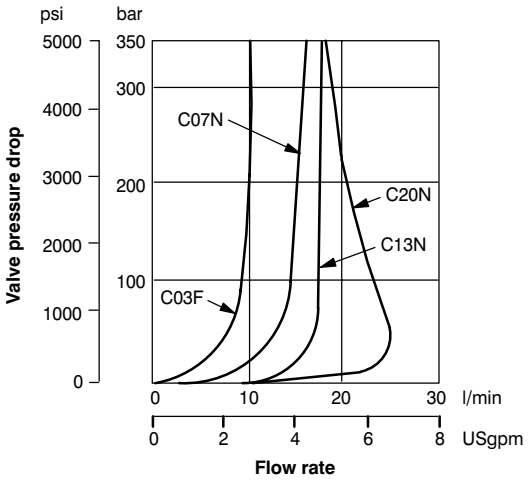
K(A)DG4V-3 and K(A)TG4V-3 Looped Flow Path



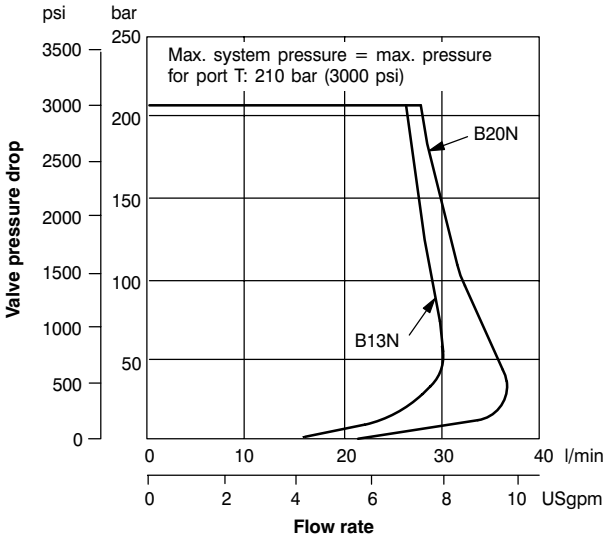
K(A)TG4V-3 Single Flow Path



K(A)DG4V-3 Single Flow Path

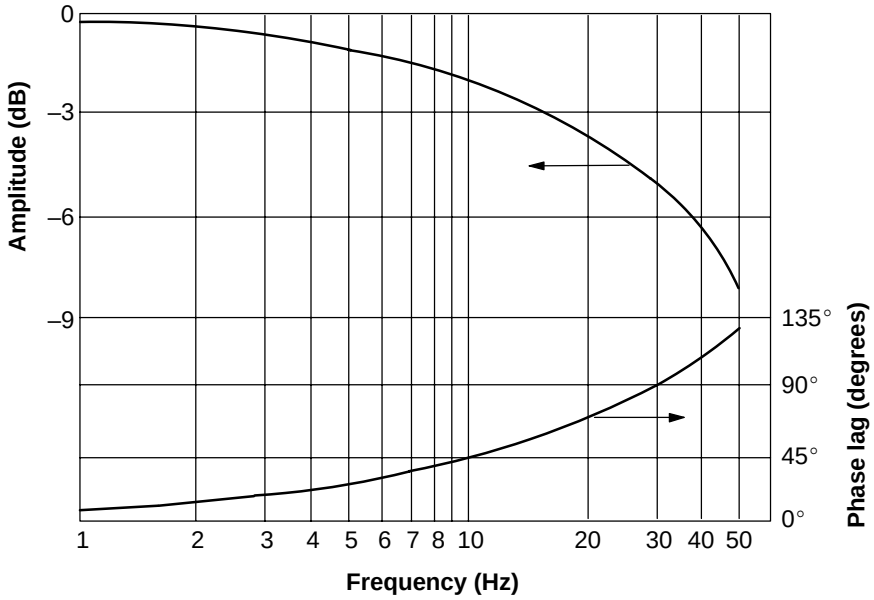


K(A)TG4V-3 Parallel Flow Path



K(A)DG4V-3 and K(A)TG4V-3 Frequency Response

For amplitude of ±25% maximum stroke about the 50% position, at Δp (P→B) = 5 bar (72 psi).



KADG4V-3 & KATG4V-3 Electrical Block Diagram

Command Signals and Outputs

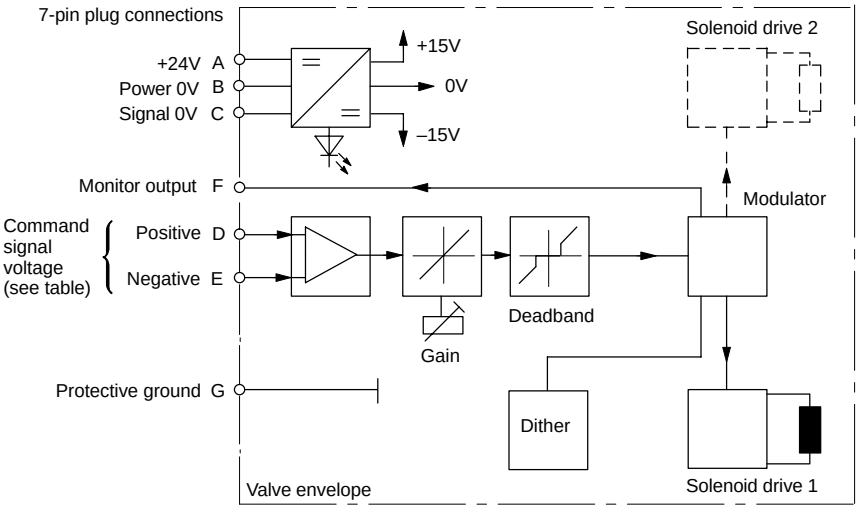
7-pin plug		Flow direction
Pin D	Pin E	
Positive	0V	P to A
0V	Negative	
U_D-U_E= Positive		
Negative	0V	P to A
0V	Positive	
U_D-U_E= Negative		

Wiring
Connections must be made via the 7-pin plug mounted on the amplifier.
Recommended cable sizes are:

Power cables:
For 24V supply
0,75 mm^2 (18 AWG) up to 20m (65 ft)
1,00 mm^2 (17 AWG) up to 40m (130 ft)

Signal cables:
0,50 mm^2 (20 AWG)

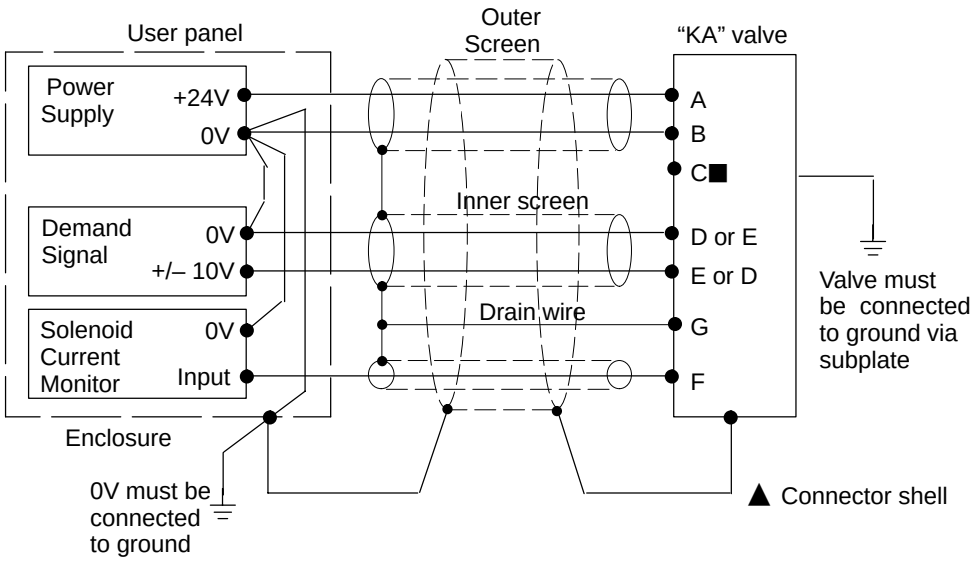
Screen:
A suitable cable would have 7 cores, a separate screen for the signal wires, and an overall screen. See wiring connection diagram on page 29.



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

KADG4V-3 & KATG4V-3 Typical Connection Arrangements

Wiring Connections for Valves with integral Amplifier



■ Solenoid current monitor voltage (pin F) will be referenced to the KA valve local ground. A "local ground" (pin C) is provided for optional use by differential input customer supplied electronics.

▲ 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

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.

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-point connector, part no. 934939, should be used for the integral amplifier.

In all cases, both valve and cable should be kept as far 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.

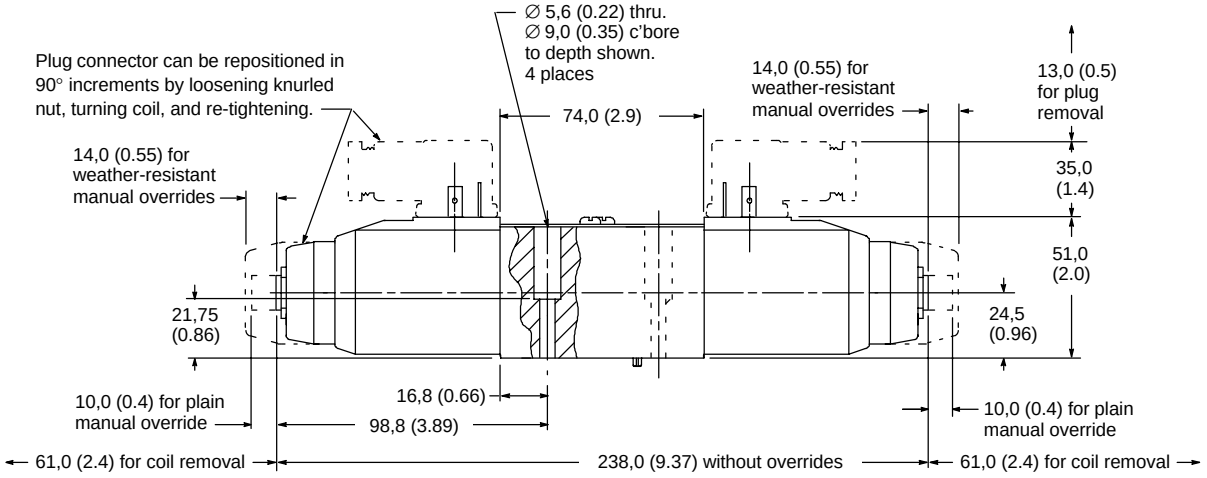
It is important to connect the 0V lines as shown above. The multi-core cable should have at least two screens to separate the demand signal and monitor output from the power lines.

KDG4V-3 and KTG4V-3 Installation Dimensions

KDG4V-3

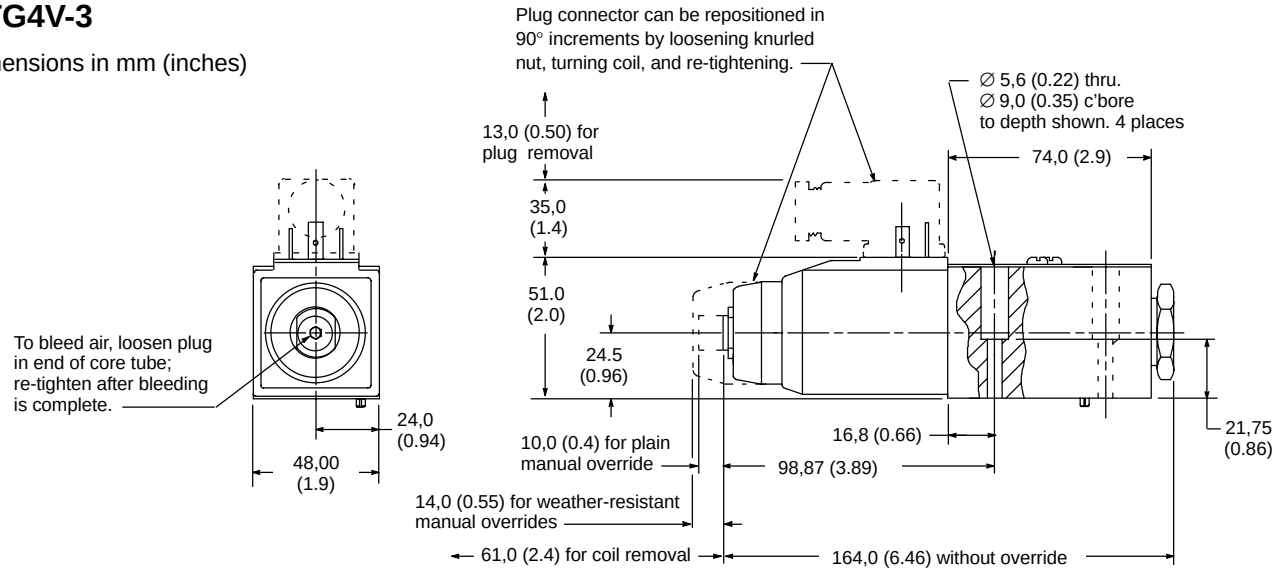
Dimensions in mm (inches)

3rd angle projection



KTG4V-3

Dimensions in mm (inches)



Solenoid Plug Connectors

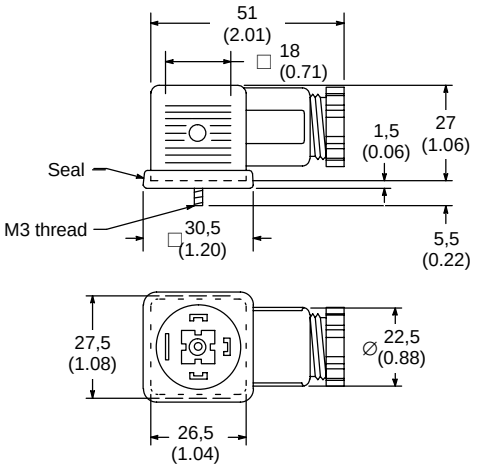
Dimensions in mm (inches)

DIN 43650 plug connector is not included with valve and must be ordered separately. For black plug marked B, order part 710775. For gray plug marked A, order part 710776.

Conductor cross-sectional area:
0,5 to 1,5 mm^2 (0.0008 to 0.0023 in^2)

Cable diameter range:
6 to 10 mm (0.24 to 0.40 in)

Means of connection: screw terminals

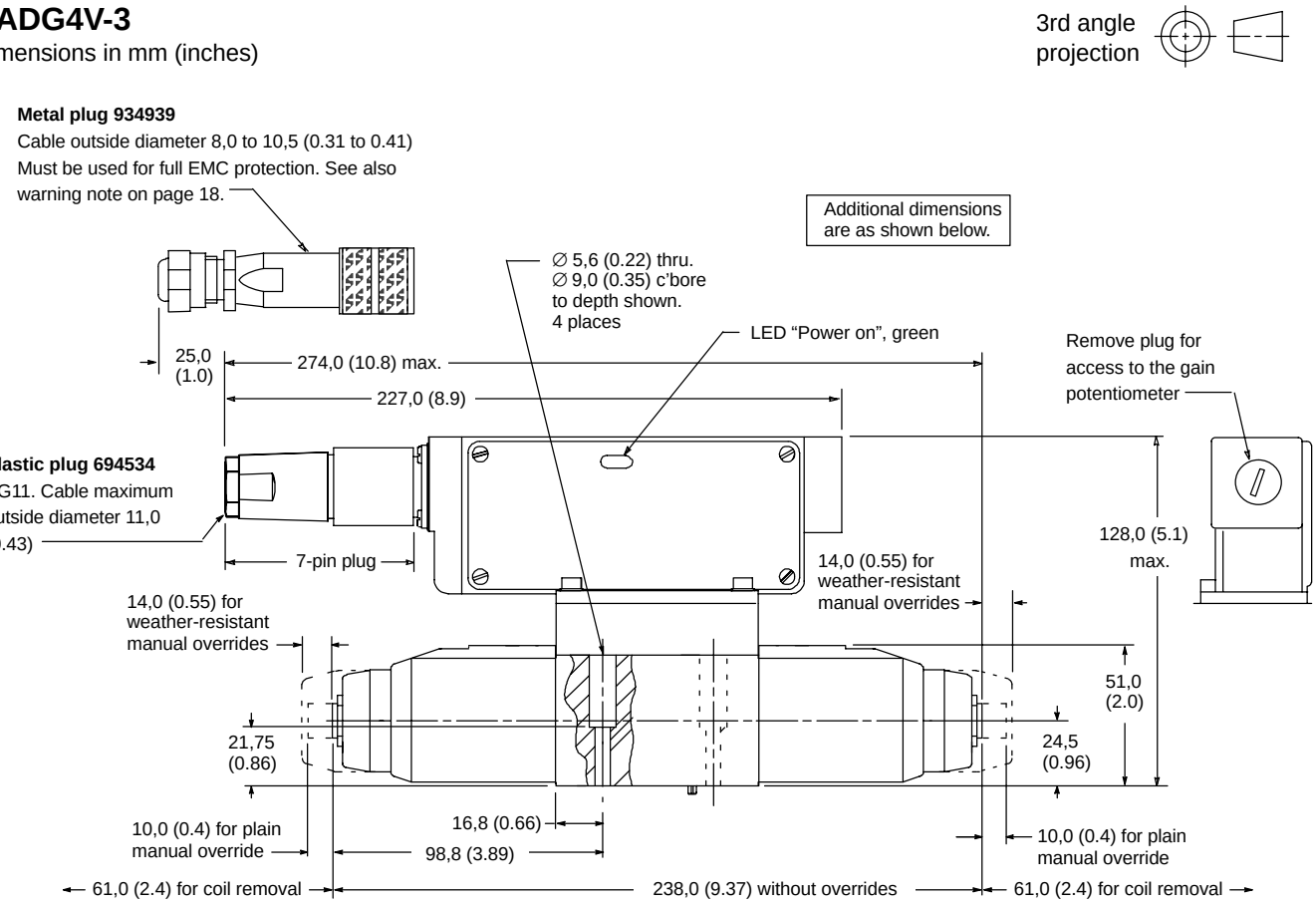


KADG4V-3 and KATG4V-3 Installation Dimensions

KADG4V-3

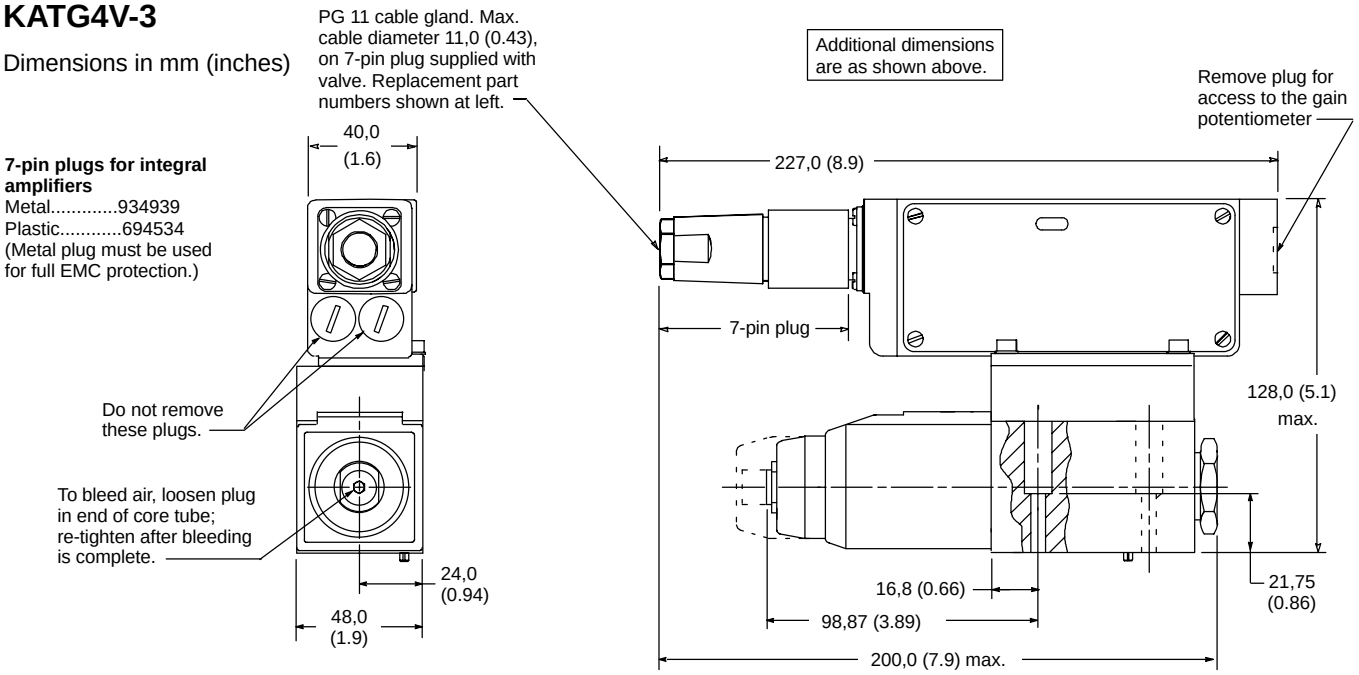
Dimensions in mm (inches)

3rd angle projection



KATG4V-3

Dimensions in mm (inches)



Mounting Requirements

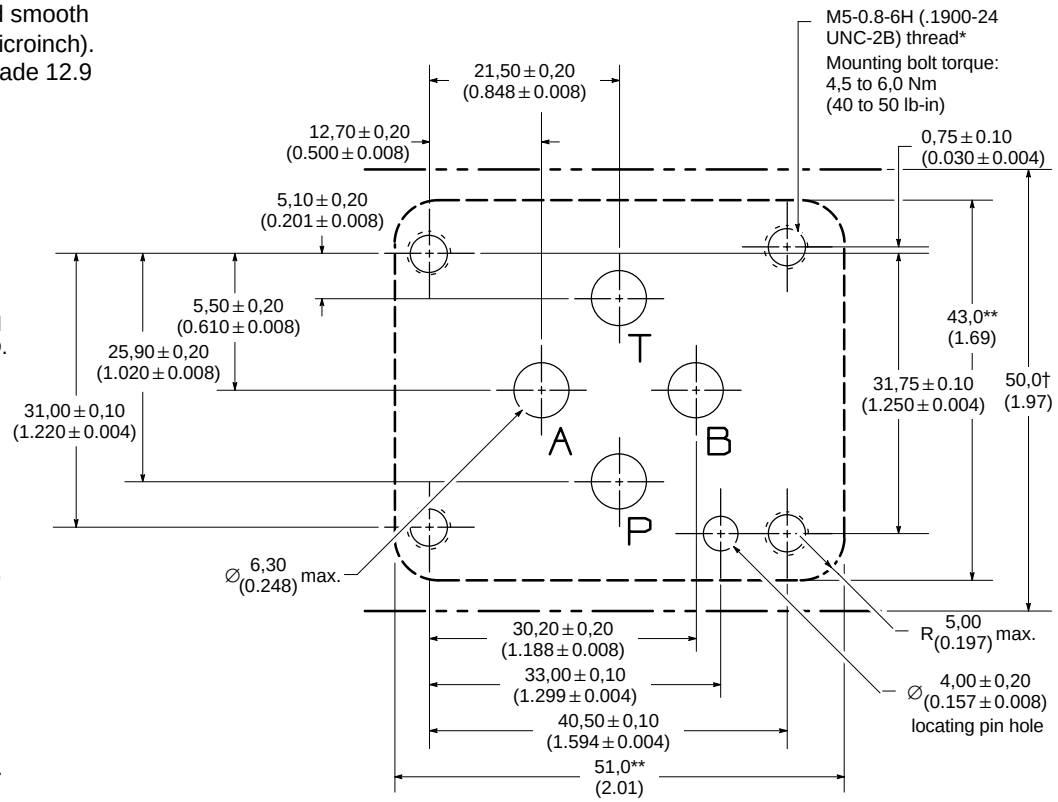
Mounting Surface

Mounting surface must be flat within 0,013 mm (0.0005 inch) and smooth within 1,1 micrometer (45 microinch). Mounting bolts should be grade 12.9 (SAE grade 7) or better.

* Minimum thread depth is $1^1/_2 \times$ bolt diameter (D). Recommended full thread depth is $2 \times D + 6$ mm. This aids in interchangeability of valves and reduces number of fixing bolt lengths. Recommended engagement of fixing bolt thread for ferrous mountings is $1^1/_4 \times D$.

** Dimensions specifying area within dotted lines are minimum dimensions for mounting surface. Corners of rectangle may be radiused as shown.

† Dimension is minimum spacing distance between valve and adjacent obstructions such as wall or other valve. Dimension is also minimum distance from centerline to centerline of two similar mounting surfaces placed on manifold block. Fixing holes are at equal distances to dimension.



Subplate and Bolt Kits

Valve subplates and mounting bolts are available and must be ordered separately.

Example:
(1) KDG4V-3S-2C08S-M-FW-G5-60 valve
(1) KDG4V-3S-2C08S-MU1-H5-60 valve
(1) DGVM-3-10-S subplate
(1) BK590716 inch mounting bolt kit
(1) BK616452M metric mounting bolt kit

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.

Essential information on the correct methods for treating hydraulic fluid is included in Vickers publication 561 “Vickers Guide to Systemic Contamination Control,” available from your local Vickers distributor or by contacting Vickers, Incorporated. Recommendations on filtration and the selection of products to control fluid condition are included in 561.

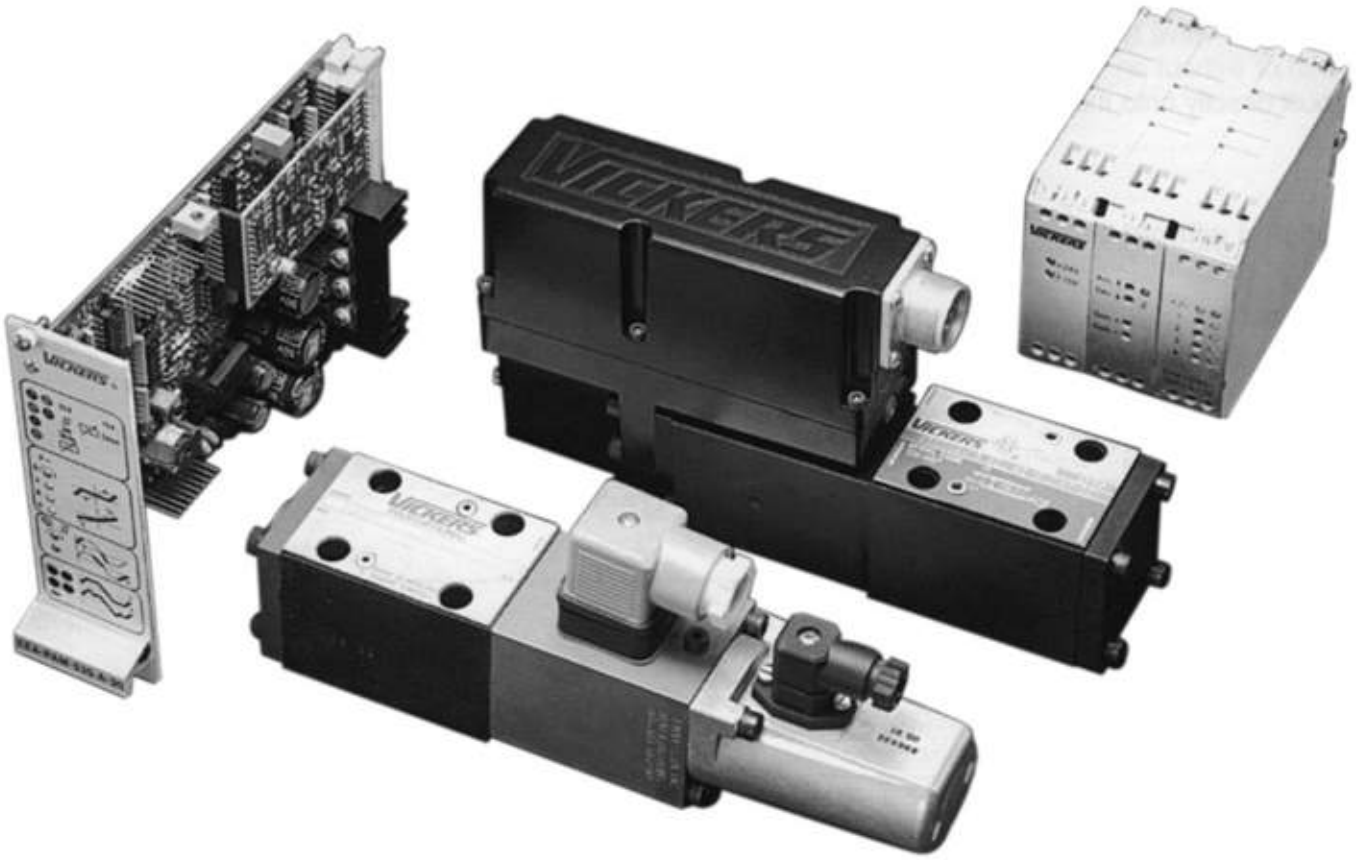
Recommended cleanliness levels, using petroleum oil under common conditions, are based on the highest fluid pressure levels in the system and are coded in the chart below. Fluids other than petroleum, severe service cycles, or temperature extremes are cause for adjustment of these cleanliness codes. See Vickers publication 561 for exact details.

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 component is shortened in fluids with higher cleanliness codes than those listed below. These codes have been proven to provide a long, trouble-free service life for the products shown, regardless of the manufacturer.

	System Pressure Level bar (psi)		
Product	**<138 (<2000)**	**138–207 (2000–3000)**	**207+ (3000+)**
Vane pumps, fixed	20/18/15	19/17/14	18/16/13
Vane pumps, variable	18/16/14	17/15/13	
Piston pumps, fixed	19/17/15	18/16/14	17/15/13
Piston pumps, variable	18/16/14	17/15/13	16/14/12
Directional valves	20/18/15	20/18/15	19/17/14
Proportional valves	**18/16/13**	**18/16/13**	**17/15/12**
Servo valves	16/14/11	16/14/11	15/13/10
Pressure/Flow controls	19/17/14	19/17/14	19/17/14
Cylinders	20/18/15	20/18/15	20/18/15
Vane motors	20/18/15	19/17/14	18/16/13
Axial piston motors	19/17/14	18/16/13	17/15/12
Radial piston motors	20/18/14	19/17/13	18/16/13

Vickers® Proportional Valves
Proportional Directional Valves with Feedback

K(B)FD/TG4V-3, 1*/2* Series
Pressures to 350 bar (5000 psi)



Powering Business Worldwide

Table of Contents

Introduction . . . 3
Typical Section View . . . 3
Model Code . . . 4
Spool Data . . . 5
Functional Symbols . . . 5

Operating Data
Valves with Amplifier, KBFD/TG4V-3 . . . 6
Valves without Amplifier,KFD/TG4V-3 . . . 7
KBFD/TG4V-3 & KFD/TG4V-3 . . . 7

Pressure and Flow Rates . . . 7

Performance Curves
Power Capacity Envelopes, Single Solenoid Models . . . 8
Power Capacity Envelopes, Double Solenoid Models . . . 8
Flow Gain Curves . . . 9
Frequency Response . . . 9

Installation Dimensions
KFDG4V-3 . . . 10
KFTG4V-3 . . . 10
KBFDG4V-3 . . . 11
KBFTG4V-3 . . . 11

Subplates and Mounting Surfaces
Parallel Path Flow Module . . . 12
Subplate Functional Symbol . . . 12
Interface with Additional Drain Port . . . 12
Installation Dimensions, KDGVM-3-1*-R . . . 13
Installation Dimensions, KDGVM-3-676803-1* . . . 13
Mounting Surface Interface to ISO 4401 (Size 03) . . . 13

Electrical Information
Block Diagram Voltage Input (M1) . . . 14
Block Diagram Current Input (M2) . . . 15
Wiring Connection Voltage Input (M1) . . . 16
Wiring Connections Current Input (M2) . . . 17

Application Data . . . 18

Introduction

General Description

Eaton's Vickers® K(B)FD/TG4V proportional valves are designed to provide a controlled oil flow in direct proportion to a command signal. They are available in two types; a double solenoid version that will provide reversible flow to an actuator and a single solenoid throttle version that provides a single direction of flow. Hydrostats are available for load compensation and parallel flow path modules are available that will boost the flow capacity of single solenoid throttle versions to nearly twice that of the standard valve.

Additionally, both of these valve types can be supplied with or without an integral amplifier built directly onto the valve.

KFD/TG4V-3

This version is supplied **without** the integral amplifier.

Features and Benefits

- Wide range of spool and flow rate options
- Electronic feedback LVDT ensures accurate spool position control
- Vibration and shock tested
- Supported by a broad range of amplifiers and auxiliary function modules
- Full CE electromagnetic compatibility

KBFD/TG4V-3

A range of proportional directional and throttle valves **with** integral control electronics. Factory-set adjustments of gain, spool deadband compensation and offset ensure consistent repeatability valve-to-valve.

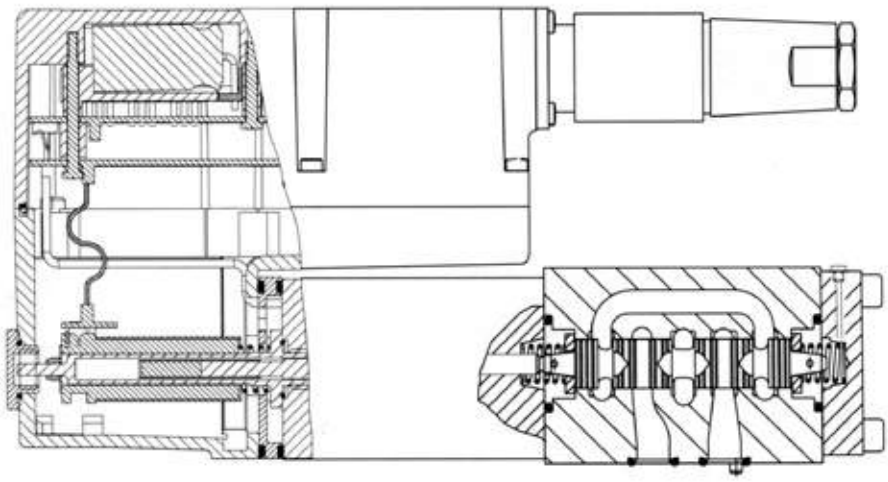
The only electrical inputs required are power supply (24V) and a voltage command signal of ± 10V or 4-20 mA. The amplifier is housed in a robust metal enclosure, sealed against ingress of water and other fluids. Electrical connections are via a standard 7-pin plug.

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

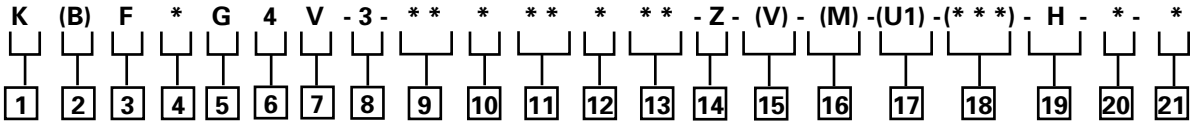
- Factory-sealed adjustments ensure valve-to-valve reproducibility
- Installation wiring reduced and simplified
- Standard 7-pin connector
- Standard 24V DC supply with wide tolerance band
- Optional ± 10V DC or 4-20 mA command signals
- Valve with integrated amplifier selected, ordered, delivered and installed as one performance-tested package
- Spool position monitor pin to help with trouble-shooting
- Simple valve removal and replacement for service (plug and play)
- Vibration and shock tested
- Auxiliary DIN rail mounted electronic function modules available
- Full CE electromagnetic compatibility
- IP65 and IP67 valve environmental protection rating
- Optional valve enable function

Typical Section View



KBFD/TG4V-3-*PE7, 1* Design

Model Codes



1 Valve Type

K Proportional valve

2 Integral Amplifier

B Integral amplifier "B" series. Omit for models without integral amplifier

3 Feedback Arrangement

F Spool position

4 Control Type

D Directional valve

T Throttle valve

5 Mounting

G Subplate mounted

6 Operation

4 Solenoid operation

7 Pressure Rating

V 350 bar (5000 psi) on ports P, A & B

8 Interface

3 ISO 4401, size 03-02-0-94 ANSI/B93.7M-D03

9 Spool Type (center condition) (see spool data, page 5)

2 All ports closed

5 All ports closed (zero lap)

33 P port closed, bleed A & B to T

10 Spool/Spring Arrangement

B Spring centered single solenoid valve (solenoid "B" only) Solenoid "A" for "V" version, Throttle valve

C Spring centered, dual solenoid, Direction valve

11 Spool Flow Rating

Δ p = 5 bar (75 psi) per metering flow path, e.g. B to T. (For actual maximum flow refer to power capacity envelope curves.

03 3 L/min (0.79 USgpm) Δ

07 7 L/min (1.85 USgpm) ▲

13 13 L/min (3.43 USgpm) ▲

20 20 L/min (5.28 USgpm) ▲

28 28 L/min (7.40 USgpm) ❑

30 30 L/min (7.92 USgpm) ■

▲ Meter-in/meter-out

❑ Meter-out only; type 2 spool only

Δ Fine meter-in/meter-out

■ 5C Spool only

12 Spool Metering Type

N Meter-in and meter-out

F Fine meter-in and meter-out (only 03 spool)

S Meter-out only

13 Flow Rating ("B" port flow for asymmetric spools) K(B)FDG Valves only

10 10 L/min (2.64 USgpm) (20N10 only)

Omit for symmetrical spools

14 Manual Overrides

Z No manual overrides

15 Solenoids Energization Identity

(non-integral amplifier types KF only, omit for valves with integral amplifier)

V Solenoid "A" is at port "A" end and Solenoid "B" is at port "B" end independent of spool type

Blank US ANSI B93.9 standard (energize solenoid "A", flow symbol is (P→A)

16 Command Input

M Electrical feature flag (KF only)

M1 ± 10VDC (KBF only)

M2 4-20 mA (KBF only)

17 Solenoid Connector

Omit for valves with integral amplifier KBF

U1 ISO 4400/DIN 43650, non-integral amplifier type KF only (mating plug supplied)

18 Electrical Connection (KBF valves only)

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

19 Coil Rating

H 24 VDC amplifier supply

20 Port T Pressure Limit Code

6 For 2C**S spools

7 For all other spools

21 Design Number

1* & 2* Series

Subject to change

WARNING

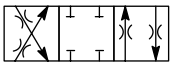
Valves with integral amplifier are supplied with or without the metal 7-pin plug. The Eaton plug, part no. 934939, must be correctly fitted to ensure that the EMC rating and IP67 rating are achieved. The plug retaining nut must be tightened with a torque of 2-2,5 Nm (1.5-2.0 lbf ft) to effect a proper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

Spool Data

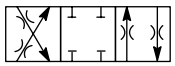
Spool Symbols

Available Spools for K(B)FDG4V-3

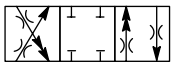
Spool type 2C**N, meter-in/meter-out



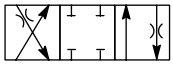
Spool type 5C**N, meter-in/meter-out (zero lap)



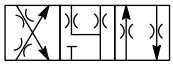
Spool type 2C20N10, asymmetric flow



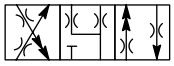
Spool type 2C28S, meter-out only



Spool 33C**N, meter-in/ meter-out

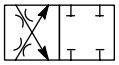


Spool type 33C20N10, asymmetric flow



Available Spools for K(B)FTG4V-3

Spool type 2B**N, meter-in/meter-out



Spool Type and Flow Rating

Symmetric Spools

Base line starting at Δ p = 5 bar (75 psi) per metering flow pat, e.g. B to T. For actual maximum flow refer to power capacity envelope curves.

For K(B)FDG4V-3 Valves

Spool Code	Spool Symbol	Flow Rating
2C03F	2C	3 L/min (0.79 USgpm)
2C07N	2C	7 L/min (1.85 USgpm)
2C13N	2C	13 L/min (3.43 USgpm)
2C20N	2C	20 L/min (5.28 USgpm)
2C30N	2C	30L/min (7.92 USgpm)
2C28S	2C	28 L/min (7.40 USgpm)
33C03F	33C	3 L/min (0.79 USgpm)
33C07N	33C	7 L/min (1.85 USgpm)
33C13N	33C	13 L/min (3.43 USgpm)
33C20N	33C	20 L/min (5.28 USgpm)
5C30N	5C	30/min (7.92 USgpm)

For K(B)FTG4V-3 Valves

Spool Code	Spool Symbol	Flow Rating
2B03F	2B	03 L/min (0.79 USgpm)
2B07N	2B	07 L/min (1.85 USgpm)
2B13N	2B	13 L/min (3.43 USgpm)
2B20N	2B	20 L/min (5.28 USgpm)

Asymmetric Spools

Figure preceding metering type designator, "N" (e.g. 2C***N) is flow rating P–A, or A–T ("A" port flow); figure after "N" (N***) is flow rating P–B, or B–T ("B" port flow).

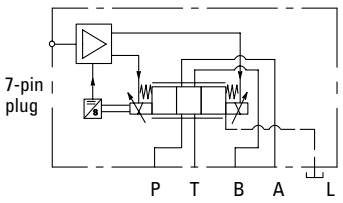
For K(B)FDG4V-3 Valves

Spool Code	Spool Symbol	Flow Rating
2C20N10	2C	20 L/min (5.28 USgpm), "A" port flow
		10 L/min (2.64 USgpm), "B" port flow
33C20N10	33C	20 L/min (5.28 USgpm), "A" port flow
		10 L/min (2.64 USgpm), "B" port flow

Functional Symbols

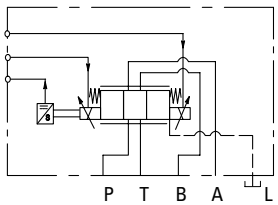
Model Types KBFDG4V-3

proportional directional valve (with integrated electronics)



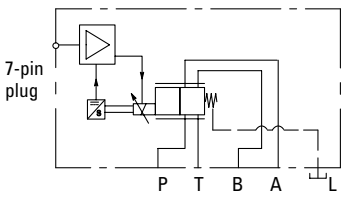
Model Types KFDG4V-3

proportional directional valve (requires amplifier card)



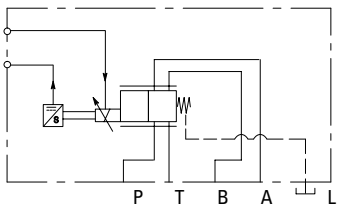
Model Types KBFTG4V-3

proportional throttle valve (with integrated electronics)



Model Types KFTG4V-3

proportional throttle valve (requires amplifier card)

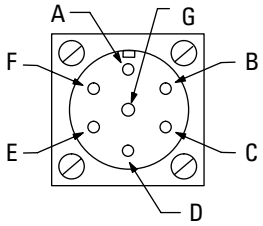


Operating Data

K(B)FD/TG4V-3

Valves with Amplifier

KBFD/TG4V-3 Valves with Integral Amplifier

Data is typical with fluid at 36 cSt (168 SUS) and 50° C (122° F).	
Power supply	24V DC (21 V to 36V including 10% peak-to-peak max. ripple) max current 3A
Command signal	
Voltage mode M1	0 to +10V DC, or 0 to -10V DC, or -10V to +10V DC
Input impedance	47 Ω
Common mode voltage to pin B	18V (max)
Current mode M2	4-20 mA
Input impedance	100 Ω
Max differential voltage to pin E to pin D	100 mV
Valve enable signal for model codes PH7 & PR7	
Enable	>8.5V (36V max)
Disable	<6.5 V
Input impedance	10 Ω
7-pin plug connector View of pins of fixed half 	Pin Description A Power supply positive (+) B Power Supply 0V and current command return C Not connected (PE7 & PC7) C Valve enable (PH7 & PR7) D Command signal (+V or current IN) E Command signal (–V or current GND) F Mounting input G Protective ground
Electromagnetic compatibility (EMC)	
Emmission (10V/m)	EN 61326-2
Immunity (10V/m)	EN 61326-2
Threshold command voltage (minimum voltage for minimum flow)	0.25V
Monitor signal (pin F) KBFD valves	± 10V DC for full spool stroke
KBFT valves	0 to -10 V DC for full spool stroke
Output impedance	10 Ω
Power stage PWM frequency	10 kHz nominal
Step input response with flow through P–A–B–T Δ p=5 bar (75 psi) per metering path, e.g. P–A	
Required flow step:	Time to reach 90% of required step:
0 – 100%	17 ms
100% – 0	16 ms
+90 – -90% (KBFDG4V-3 only)	25 ms
Reproducibility, valve-to-valve (at factory settings):	
Flow at 100% command signal	≤ 5%
Protection	
Electrical	Reverse polarity protected
Environmental	I EC 60529, Class IP65 and IP67
Ambient air temperature range for full performance	0° C to 70° C (32° F to 158° F)
Oil temperature range for full performance	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):	
EHD-DSG-201-A-1* command signal generator	See catalog GB 2470
EHA-RMP-201-A-2* Ramp generator	See catalog GB 2410A
EHA-PID-201-A-2* PID controller	See catalog GB 2427
EHA-PSU-201-A-10 Power supply	See catalog GB 2410A

Operating Data

KFD/TG4V-3

Valves without Amplifier

KFD/TG4V-3 Valves without Integral Amplifier (requires a Eurocard amplifier, refer to Supporting Products)

Data is typical with fluid at 36 cSt (168 SUS) and 50° C (122° F).	
Max current, at 50° C (122° F)	2,7 A
Coil resistance, at 20° C (68° F)	1,87 Ω
Step response Step size (% of max spool stroke) 0 – 100% 100% – 0 +90 – -90% (KBFDG4V3-3 only)	 Time to reach 90% of required step: 18 ms 19 ms 30 ms
Type of protection, with electrical plugs fitted correctly	IEC60529, Class IP65
Electromagnetic compatibility (EMC) Emmision (10V/m) Immunity (10V/m)	 EN 50081-2 EN 50082-2
Maximum allowable ambient air temperature Maximum allowable oil temperature	60° C (140° F) 60° C (140° F)
Supporting products: Eurocard amplifiers EEA PAM 533 A/B/C/D/E/F	 See catalog GB-2464

KFD/TG4V-3 and KBFD/4V-3 Valves (All Valves)

Relative duty factor	Continuous rating (ED = 100%)
Hysteresis with flow through P–A–B–T	<1% of max stroke (center-to-offset)
Mass: KFDG4V-3 KBFDG4V-3 KFTG4V-3 KBFTG4V-3	2,7 kg (5.9 lb) approx. 3,1 kg (6.8 lb) approx. 2,1 kg (4.6 lb) approx. 2,5 kg (5.5 lb) approx.
Portable test equipment EBA TEQ 460 A 10	 See catalog V-ELAC-TM001-E

Pressure and Flow Rates

Maximum pressures, bar (psi)

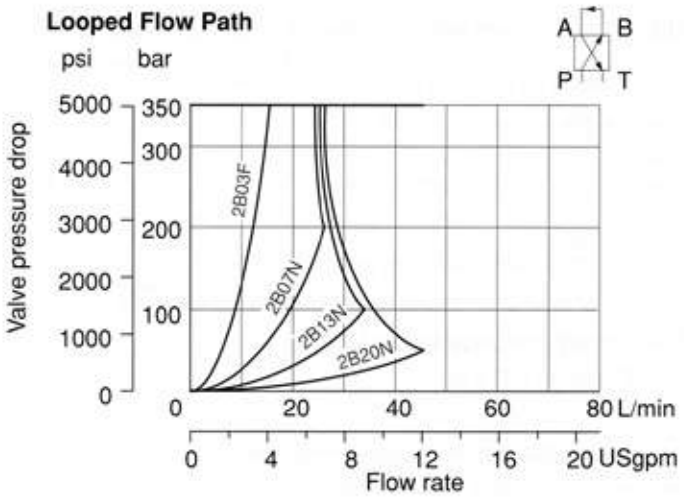
Model	**Port L Condition**	**Ports P, A, B**	**T**	**L**
All models for normal usage (L port not connected) 105 (1500)	Normally blocked by mounting surface	315 (4500)	160 (2300) 350 (5000)	160 (2300) 105 (1500)
For K(B)FDG4V-3**C**N/F-Z models only a higher “T” port pressure is allowed if the “L” port is connected directly to tank.	Drained directly to tank	350 (5000)	210 (3000)	10 (150)

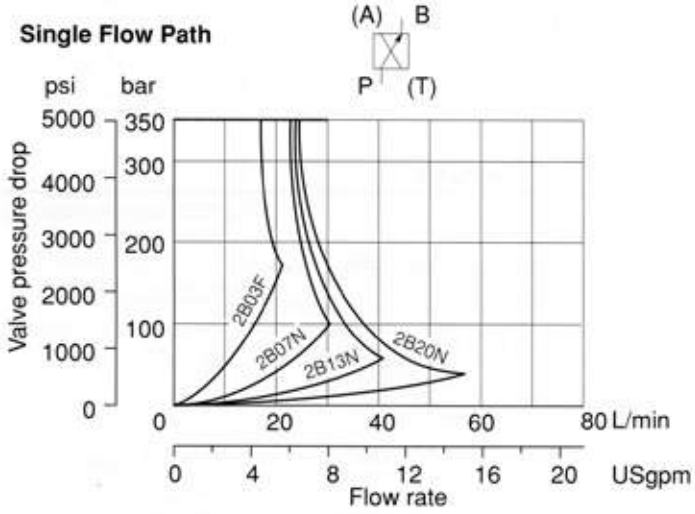
Performance Curves

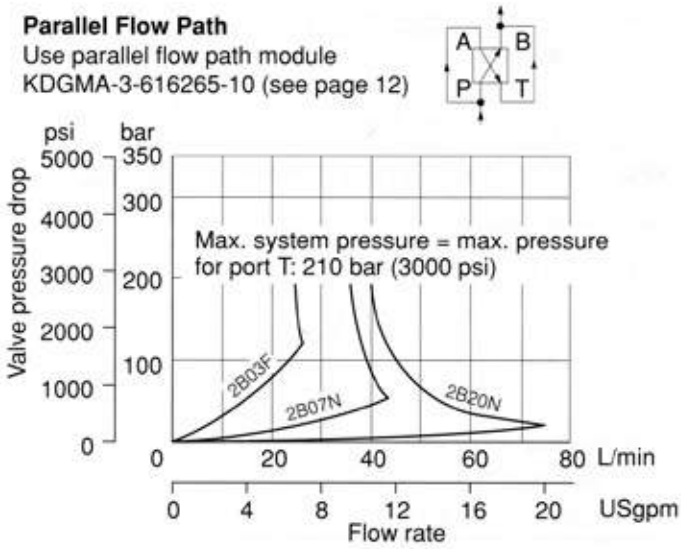
Power Capacity Envelopes

Single Solenoid Models: K(B)FTG4V-3

Spool types as noted

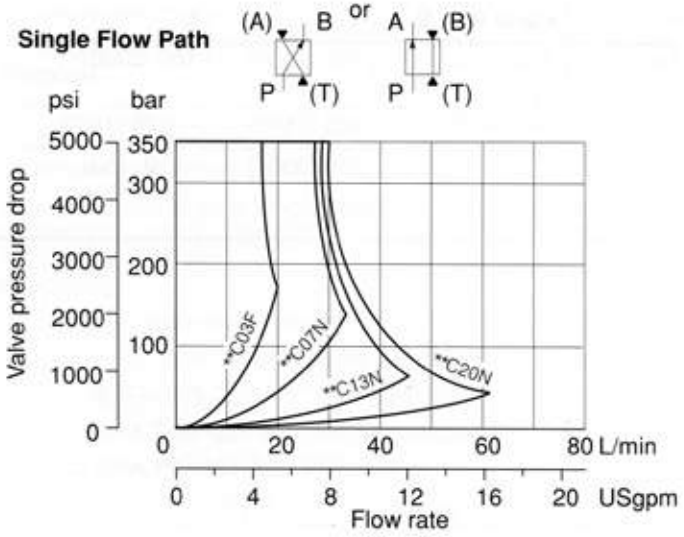


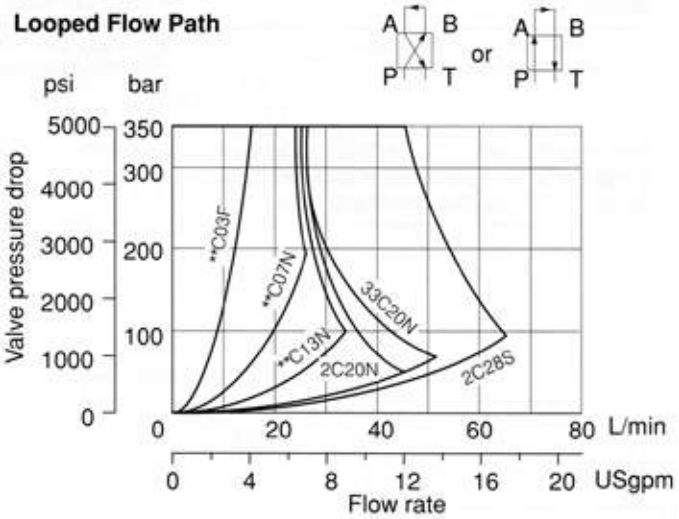




Double Solenoid Models: K(B)FDG4V-3

Spool types as noted





Performance Curves

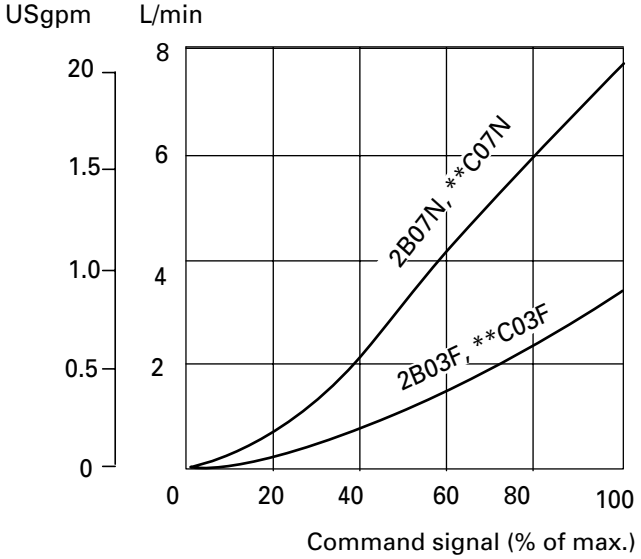
Flow Gain Curves

When using the single solenoid throttle valves version (K*FT) a parallel flowpath module (page 12) can used to approximately double the flow rate.

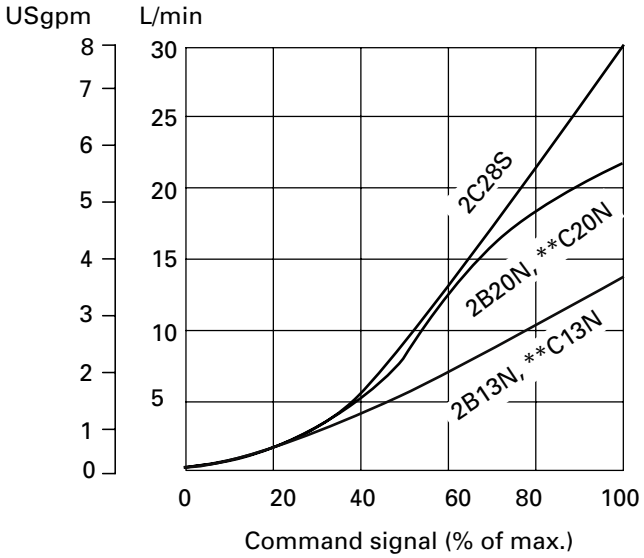
KBF valves are preset at the factory to compensate for the effect of spool overlap. Curves shown include deadband compensation provided for the KF valve by Eaton's Vickers Eurocard Amplifier EEA-PAM-533-*-32 (user adjustable).

K(B)FD/TG4V-3

Spool types as noted



Single flowpath (e.g. P–A) pressure drop, Δ p = 5 bar (72 psi) ■.



■ At other Δ p values and within the power capacity envelopes, flow rates approximate to:

$$Q_x = Q_d \sqrt{\frac{\Delta p_x}{\Delta p_d}}$$

where Q_d = Datum flow rate

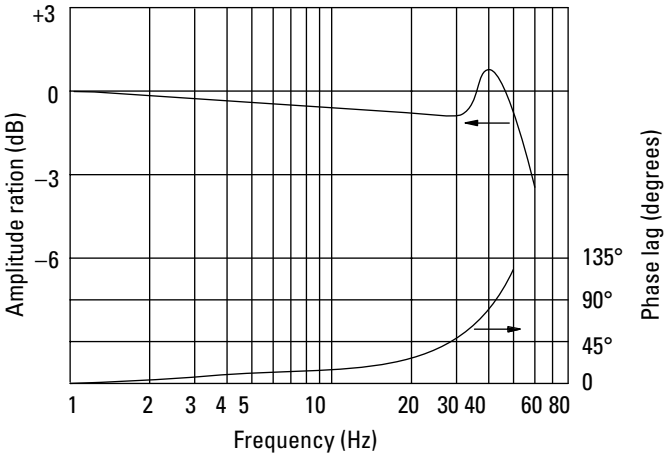
Δp_d = Pressure drop at datum flow rate

Δp_x = Required Δp

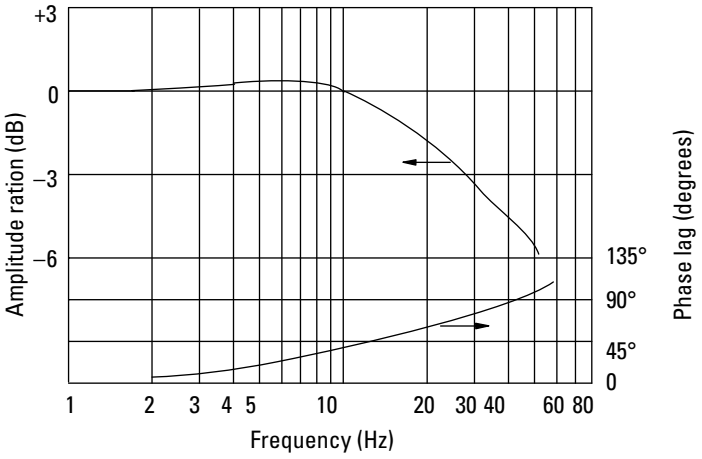
Frequency Response (Typical)

For an amplitude of ± 25% max. flow about the 50% flow, at Δ p (P–B) = 5 bar (72 psi)

KBFD/TG4V-3



KFD/TG4V-3



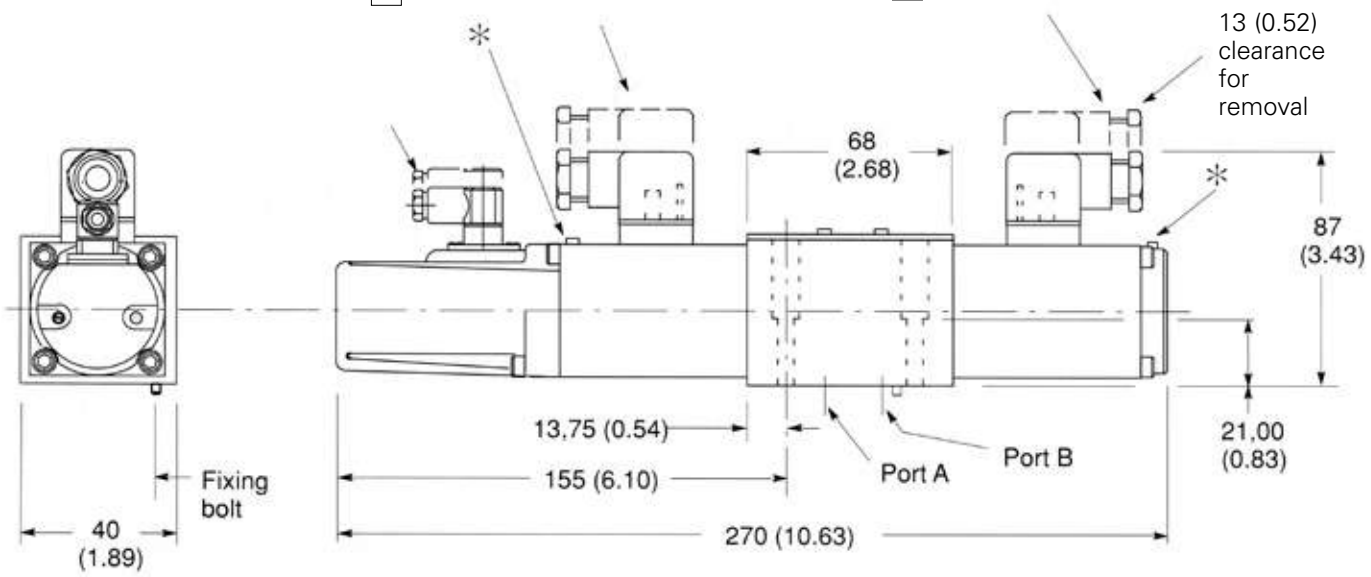
Installation Dimensions

3rd angle projection

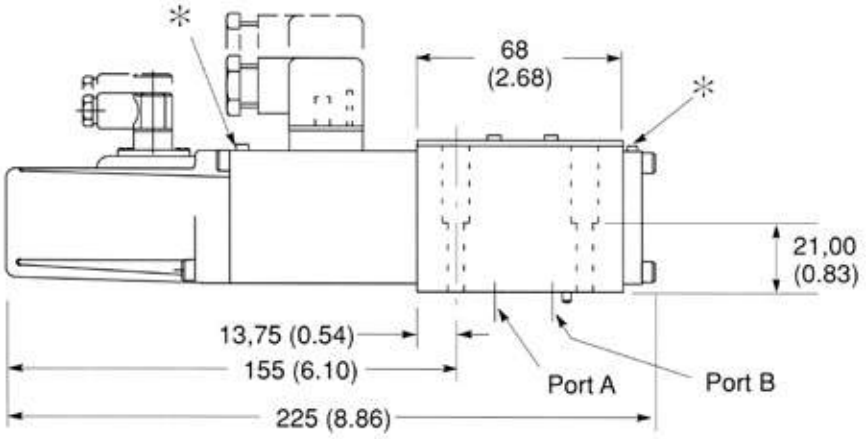
KFDG4V-3
mm (inch)

Solenoid plug (ISO 4400/DIN 43650); gray, marked A, for V models, or black, marked B, for non-V models; see 15 in "Model Code"

Solenoid plug (ISO 4400/DIN 43650); black, marked B, for V models, or gray, marked A, for non-V models; see 15 in "Model Code"



KFTG4V-3
mm (inch)



▲ Mounting surface seals supplied

NOTE: For optimum valve operation, bleed the air from the proportional solenoids at initial start-up. This may be done as follows:

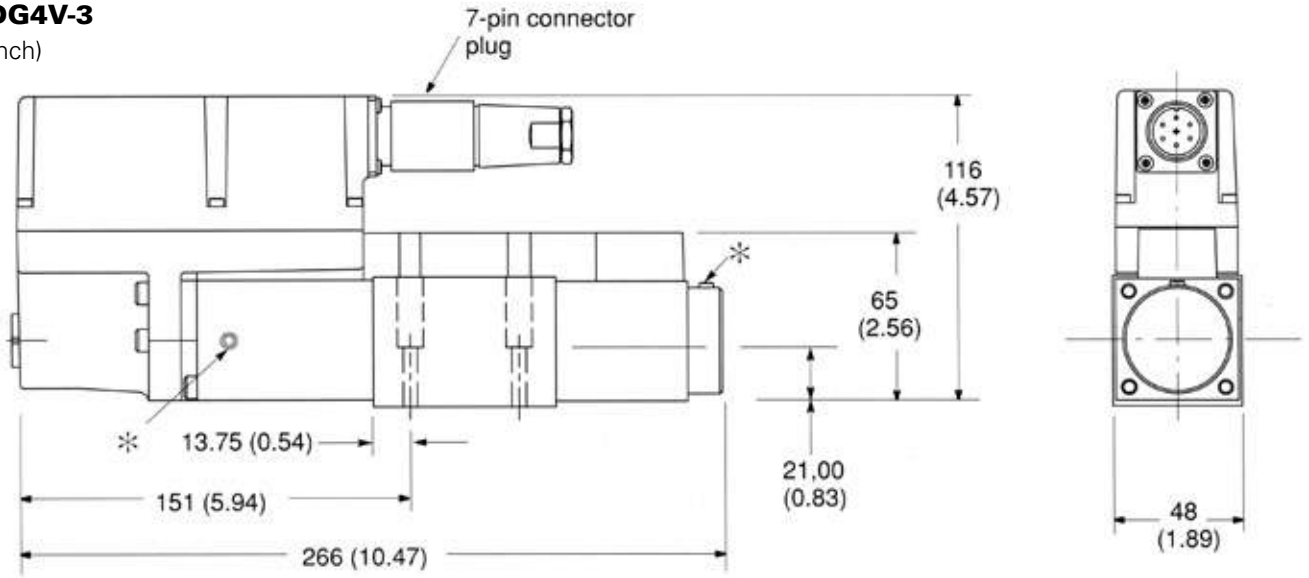
- The valve may be pressurized by removing the bleed screws until no bubbles appear and then reinstalling bleed screws, or...
- Remove both bleed screws, and use a standard oil can nozzle to pump fluid in one side until it flows, free of air bubbles, out the other side. Reinstall screws.

If there is no inherent back pressure in the tank port of the circuit do not allow the tank line to empty. This may be prevented by installing a check valve in the tank line. The cracking pressure of the check valve should be in the range of 22 - 45 psi (1.5 - 3 bar).

Installation Dimensions

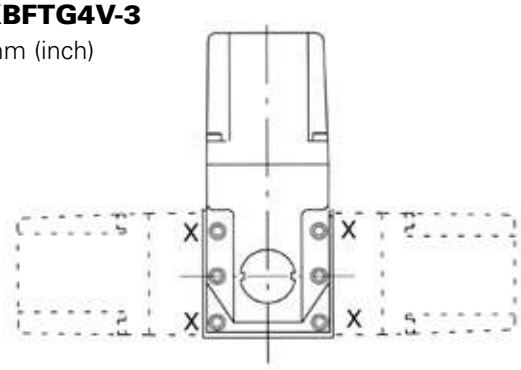
KBFDG4V-3

mm (inch)

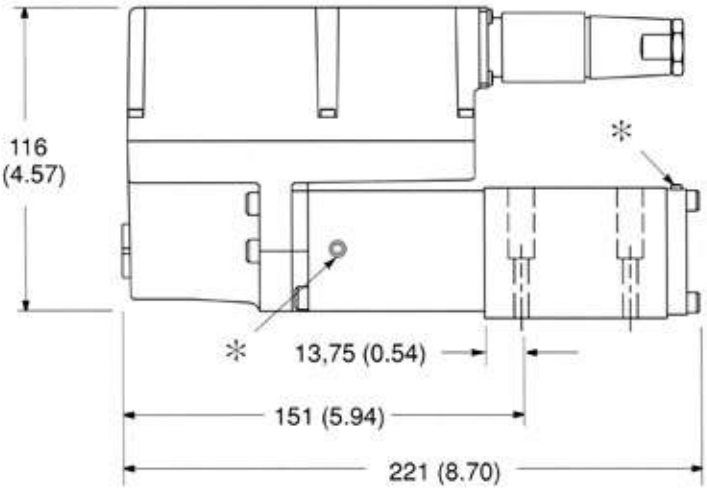


KBFTG4V-3

mm (inch)



Amplifier and solenoid may be rotated 90° as shown by removing 4 screws shown X. Re-torque to 7-9 Nm (6-7 lbf ft)



Warning

Valves with integral amplifiers are supplied with or without the metal 7-pin plug. The Eaton 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.

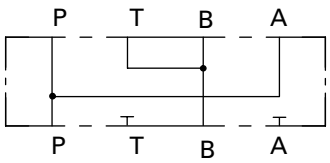
***** Bleed screw locations Air bleed, Socket Head Cap Screw.

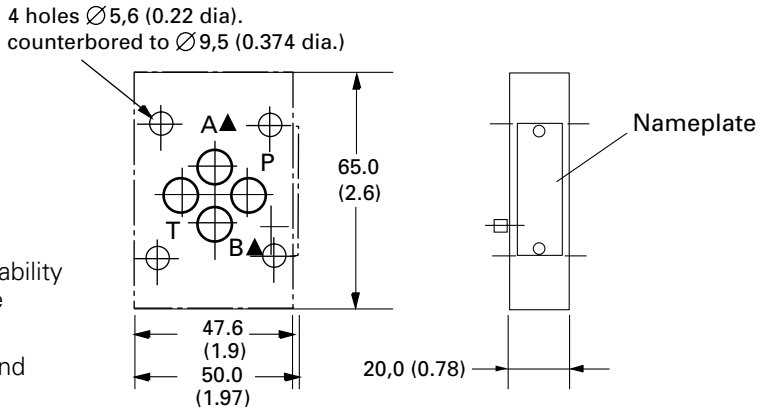
Torque to 2,5-3,0 Nm (2.0-2.5 lbf ft)

Parallel Path Flow Module

Size 03
Parallel-Flow-Path Module

KDGMA-3-616265-1*





Typically used for doubling effective flow capability of single solenoid proportional valves (throttle valves), as illustrated in "Typical Applications'.

▲ A, TA and TB ports at subplate face are blind holes fitted with O-seals.

Subplates and Mounting Surfaces

General Description

If 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 ±0.2 mm (±0.008") except where otherwise stated. ISO 4401 specifies inch conversion to ±0.01".

Conversion for Metric

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

Mounting Bolt Tapping

ISO 4401 gives metric thread tappings. Alternate UNC tapping are Eaton's recommendations that allow these plates and associated valves to be used up to their maximum pressures, when using Eaton 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.

Subplates

Description and Mass kg (lb)	Functional Symbol	Model Code	Max. Pressure
Single-station subplate; rear ports P, T, A, B; side port L Cast iron 1,3 (2.9)		KDGVM-3-1*-R ▲ KDGVM-3-676803-1* (SAE/UNF ports	250 bar (3600 psi)

* Design number subject to change. No change of installation dimensions for design numbers 10 to 19 or 21 to 29 inclusive.

▲ "S" suffix = SAE/UNC ports and /or UNC fixing bolt tappings and/or orifice plugs as appropriate.

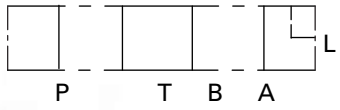
"R" suffix = BSPF and/or metric fixing bolt tapping and/or orifice plugs as appropriate.

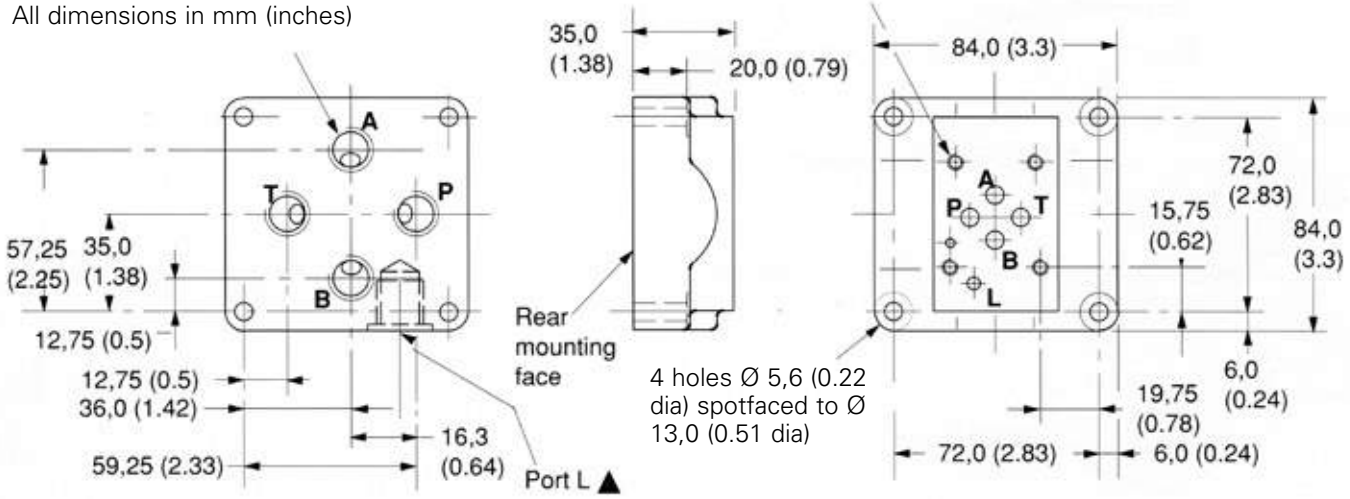
Installation Dimensions

Single-Station Subplates

All dimensions in mm (inches)

Four holes tapped according to model type (see table): For models with BSPF ports, M5 x 12 (0.47) deep. For models with SAE ports, #10.24 UNC-2B x 12,7 (0.5) deep.





Port Threads

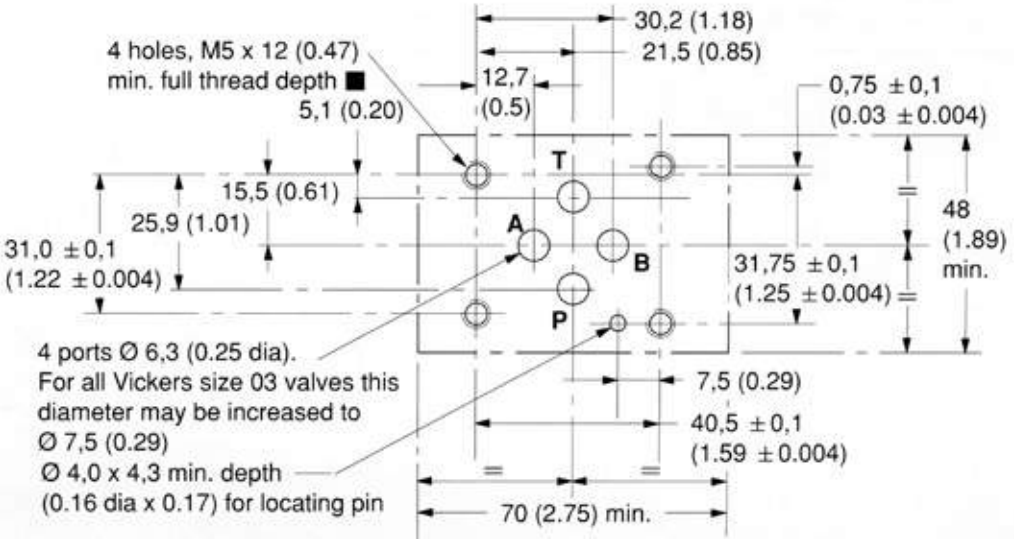
Ports P, T, A, B

Model		Ports P, T, A, B	Port L
BSPF ports / M5 mounting bolts:			
KDGVM-3-1*-R	Rear	G 3/8" (3/8" BSPF) x 12,0 (0.47) deep	G 1/8" (1/8" BSPF x 12,0 (0.47) deep
SAE ports/#10-24 UNC mounting bolts:			
KDGVM-3-676803-1*	Rear	3/4"-16 UNF-2B x 14,3 (0.56) deep (SAE)	7/16"-20 UNF-2B x 11,6 (0.46) deep (SAE)

Mounting Surface to ISO 4401 (Size 03)

This interface conforms to:

ISO 4401-03-02-0-05

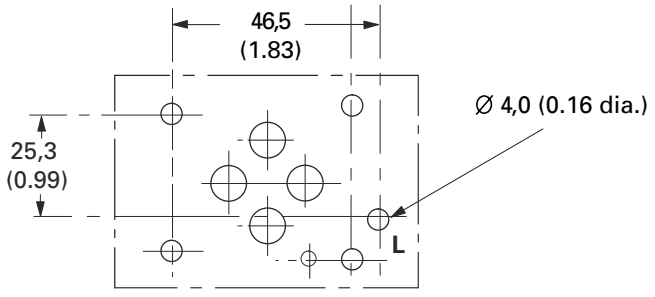


■ #10-24 UNC-2B optional

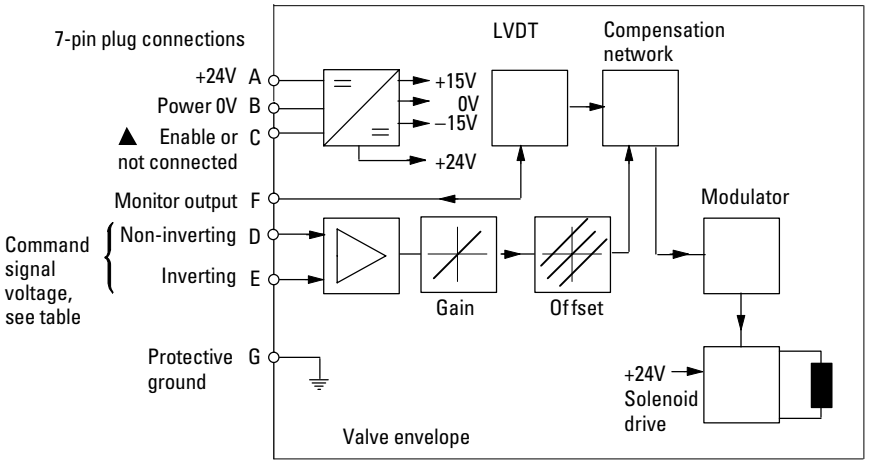
Interface with Additional Drain Port

ANSI/B93.7M (and NFPA) size 03 CETOP R35H4.2-4-03, plus location pin hole.

Typically used for proportional and other valves requiring an additional drain port.



Block Diagram
Voltage Input (M1)
KBFDG 4V-3



▲ Pin C is used for a valve enable signal with electrical connections PH7 and PR7.

KBFDG4V-3 Wiring

Connections must be made via the 7-pin plug mounted on the amplifier. See page 15 of this leaflet and Eaton's Installation Wiring Practices for Vickers® Electronic Products, leaflet 2468.

Recommended cable sizes are:

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 seven 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.

KFDG4V-3 Wiring

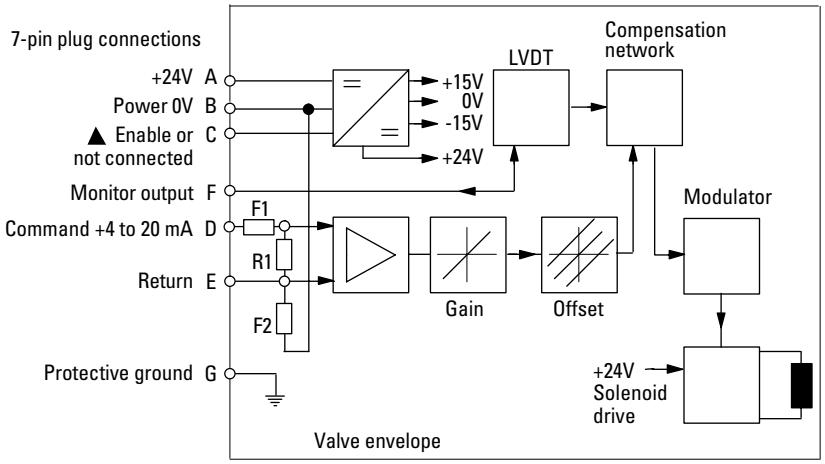
Wiring details for these valves are contained in the appropriate Eurocard literature and Eaton's Installation Wiring Practices for Vickers® Electronic Products leaflet 2468.

Command Signals and Outputs, M1

7-pin Plug Flow direction		
Pin D	Pin E	
Positive	OV	
OV	Negative	P to A
$U_d - U_e$ = Positive		
Negative	OV	
OV	Positive	P to B
$U_d - U_e$ = Negative		

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

Block Diagram
Current Input (M2)
KFSDG4V-3



▲ Pin C is used for a valve enable signal with electrical connections PH7 and PR7.

R1 shunt resistor 100R

F1, F2 resettable fuse

KBSDG4V-3 Wiring

Connections must be made via the 7-pin plug mounted on the amplifier. See page 15 of this leaflet and Eaton's Installation Wiring Practices for Vickers® Electronic Products, leaflet 2468.

Recommended cable sizes are:

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 seven 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.

KFDG4V-3 Wiring

Wiring details for these valves are contained in the appropriate Eurocard literature and Eaton's Installation Wiring Practices for Vickers® Electronic Products leaflet 2468.

Command Signals and Outputs, M2

7-pin plug

Pin D	Pin E	Pin B	Flow direction
More than 12 mA	Current return	Power ground	P to A
Less than 12 mA	Current return	Power ground	P to B

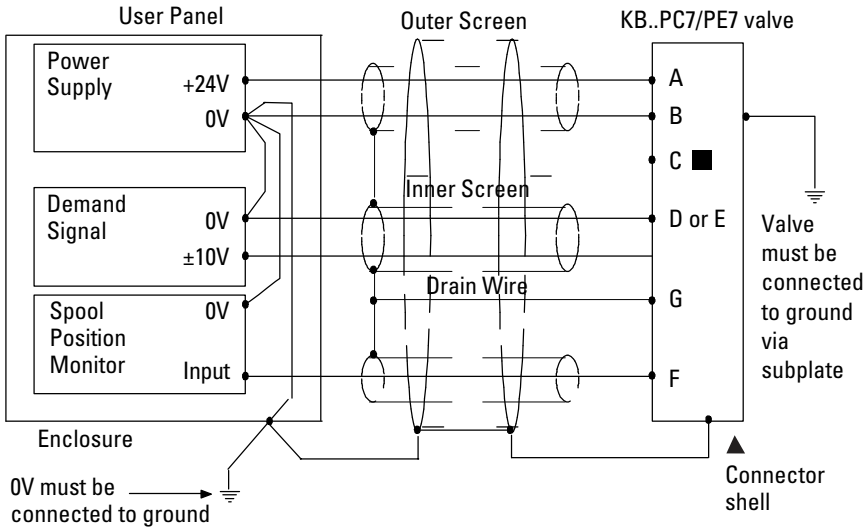
WARNING

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

Wiring Connections Voltage Input (M1)

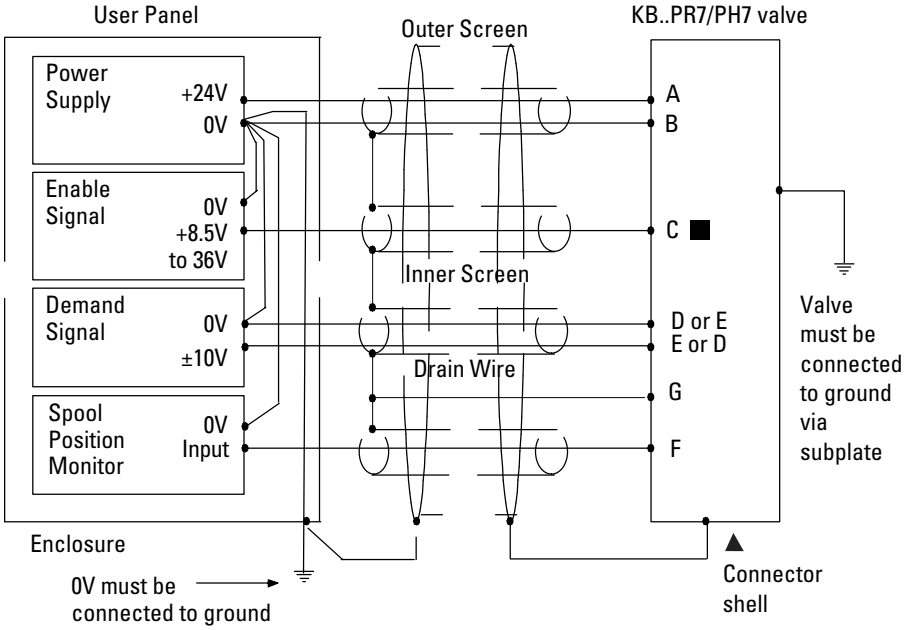
■ Spool position monitor voltage (pin F) will be referenced to the KB valve local ground.

WARNING
Do not ground pin C.



Wiring Connections for M1 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.



Wiring Connections Current Input (M2)

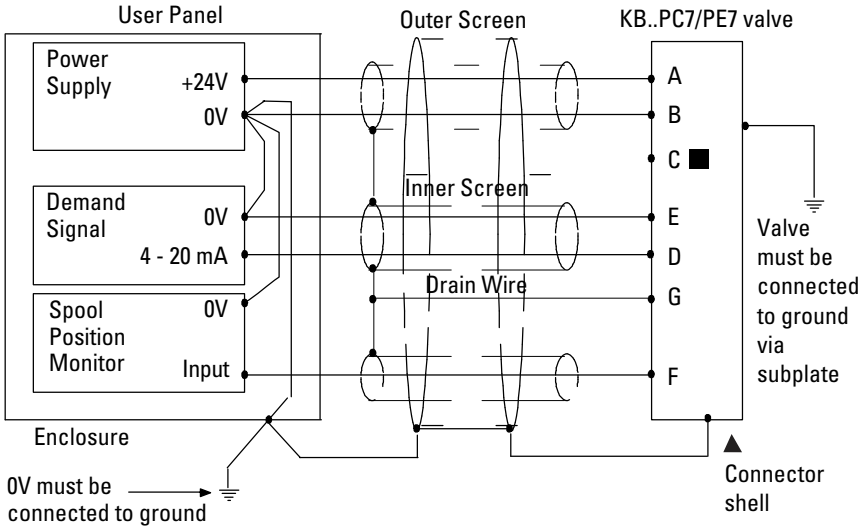
■ Spool position monitor voltage (pin F) will be referenced to the KB valve local ground.

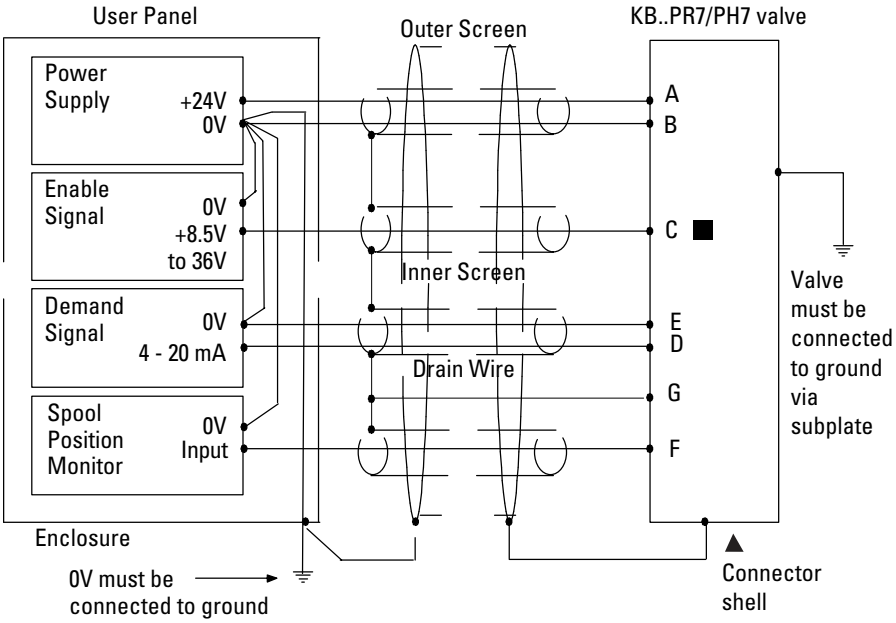
WARNING

Do not ground pin C.

Wiring Connections for M2 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.

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 Eaton's publication 9132 or 561, "Vickers Guide to Systemic Contamination Control". The book also includes information on the Eaton's 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

Eaton 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 K(B)FD/TG4V-3

BK02-156493M (metric)

BK590716(inch)

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

Seal Kits

KFD/TG4V-3 565108

KBFD/TG4V-3-1* 02-332693

Plugs

KBFDG4V

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.

KFDG4V

Solenoid (black) 710775

Solenoid (gray) 710776

LVDT (gray) 458939

Extension Cable

Extension Cable: Adapter for extending seven 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 Eaton 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.

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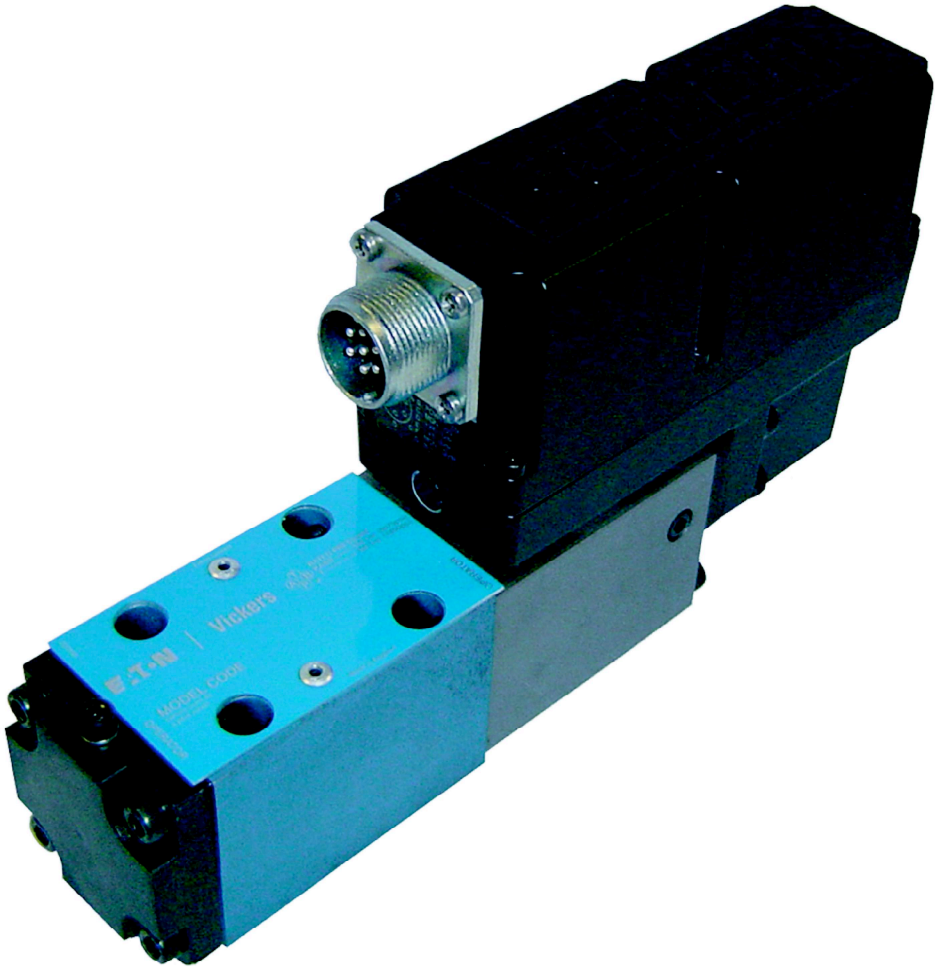
April 2009

EATON | Vickers

Servo-Performance Proportional Directional Valves with Feedback

Pressures to 350 bar (5075 psi)

K(B)SDG4V-3
1* Series



Contents

Introduction

- General Description 3
- KSDG4V-3 Features and Benefits 3
- KBSDG4V-3 Features and Benefits 3
- Typical Section View 3

Model Code 4

Spool Data 5

Functional Symbol 5

Operating Data 6

Pressures and Flow Rates 7

Performance Curves

- Flow Gain 8
- Pressure Gain 8
- Power Capacity Envelopes 8
- Frequency Response 9

Installation Dimension KSDG4V-3 10

Installation Dimension KBSDG4V-3 10

Subplates and Mounting Surface Interfaces 11

Electrical Information

- Block Diagram Voltage Input M1 13
- Block Diagram Current Input M2 14
- Typical Connection Arrangements M1 15
- Typical Connection Arrangements M2 16

Application Data

- Fluid Cleanliness 17
- Hydraulic Fluids 17
- Installation 17
- Mounting Bolt Kits 17
- Seal Kits 17
- Electrical Connectors 17
- Service Information 17

Introduction

General Description

The KBSDG4V-3 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 40 L/min (10.6 USgpm). Working pressures are to 350 bar (5000 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 type can be supplied with or without an integral amplifier built directly onto the valve.

KSDG4V-3

Without the integral amplifier.

Features and Benefits

- Wide range of spool and flow rate options.
- Supported by a broad range of amplifiers and 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.

KBSDG4V-3

With integral control electronics.

Factory-set adjustments of gain and offset ensure consistent repeatability valve-to-valve.

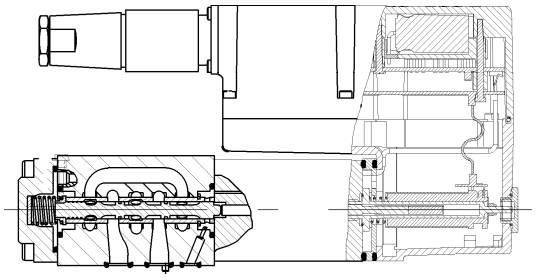
The only electrical inputs required are power supply (24V) and a command signal, either ±10V or 4-20 mA (model code selectable). The amplifier is housed in a robust metal enclosure, sealed against ingress of water and other fluids. Electrical connections are via a standard 7-pin plug.

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

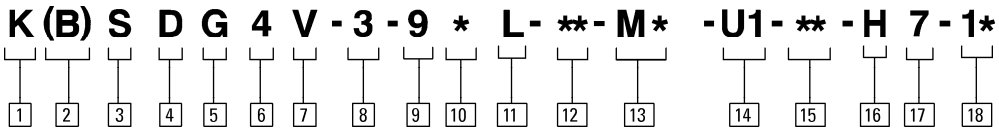
- Factory-sealed adjustments ensure valve-to-valve reproducibility.
- Installation wiring reduced and simplified.
- Standard 7-pin connector.
- Standard 24V DC supply with wide tolerance band.
- Optional command signal, ±10V or 4-20 mA (model code selectable).
- Valve with integrated amplifier selected, 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).
- Vibration and shock tested.
- Auxiliary DIN rail mounted electronic function modules available.
- Full CE electromagnetic compatibility.
- IP67 valve, environmental protection rating.
- Optional valve enable function.

Typical Section View



KBSDG4V-3

Model Code



1 **Valve type**
K – Proportional valve

2 **Integral amplifier**
B – Integral amplifier "B" series

Omit for models without integrated amplifiers.

3 **Feed back arrangement**
S – Closed-loop

4 **Control type**
D – Directional valve

5 **Mounting**
G – Subplate mounted

6 **Operation**
4 – Solenoid operated

7 **Pressure rating**
V – >250 bar (3625 psi) on ports P,A, & B

8 **Interface**
3 – ISO 4401, size 03-02-0-94

ANSI/B93.7M-D03

9 **Spool type (center condition)**
9 – Zero lap (biased underlap)

10 **Spool type, spring offset condition**
2 – Ports P, A, & T blocked

6 – Port P blocked, A & B to tank

11 **Valve build**
L – Standard build

12 **Rated flow at 70 bar (1000 psi) loop Δp pressure drop**
05 – 5 L/min (1.3 USgpm)

12 – 12 L/min (3.2 USgpm)

24 – 24 L/min (6.3 USgpm)

40 – 40 L/min (10.6 USgpm)

For actual maximum flow refer to Power capacity envelope curves, page 8.

13 **LVDT plug**
(omit for valves with integral amplifier)

M1 – ±10V voltage command signal

M2 – 4-20 mA current command signal

14 **Solenoid connector**
(omit for valves with integral amplifier)

U1 – ISO 4400/DIN 43650, non-integral amplifier type only (mating plugs supplied)

15 **Electrical connection (KBS valves only)**
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

16 **Coil rating**
H – 24V DC amplifier supply

17 **Port T pressure limit code**
7 – For all spools

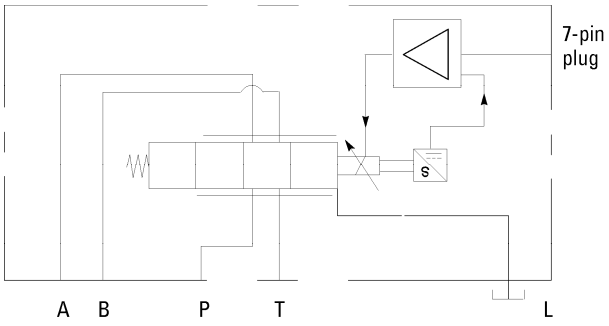
18 **Design number**
1* series. Subject to change

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 2-2,0 Nm (1.5-2.5 lbf ft) to effect a proper seal.

Spool Data

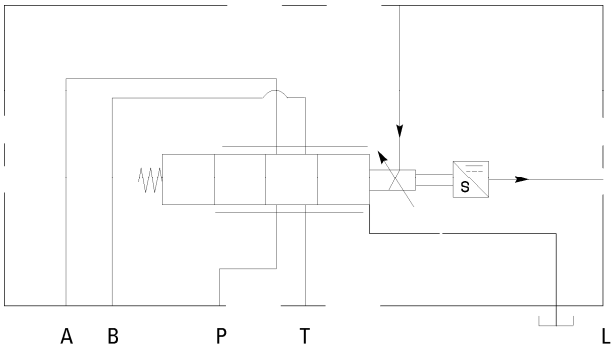
Spool Symbols

Functional Symbol



Model Types KBSDG4V-3

proportional directional valve (with integral electronics)



Model Types KSDG4V-3

proportional directional valve (requires amplifier card)

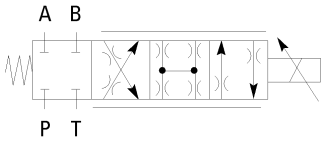
Spool Types and Flow Ratings

Symmetric Spools

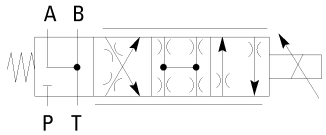
Base line starting at Δp = 35 bar (500 psi) per metering flow path, e.g. B to T. For actual maximum flow refer to power capacity envelope curves.

Spool code	Spool symbol	Flow rating
For K(B)SDG4V-3 valves:		
92L05	92L	5 L/min (1.3 USgpm)
92L12	92L	12 L/min (3.2 USgpm)
92L24	92L	24 L/min (6.3 USgpm)
92L40	92L	40 L/min (10.6 USgpm)
96L05	96L	5 L/min (1.3 USgpm)
96L12	96L	12 L/min (3.2 USgpm)
96L24	96L	24 L/min (6.3 USgpm)
96L40	96L	40 L/min (10.6 USgpm)

Available Spools for K(B)SDG4V-3



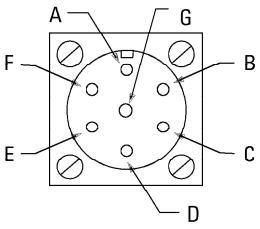
Spool type 92L



Spool type 96L

Operating Data

KBSDG4V-3 Valves with integral amplifier: 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 3A
Command signal	
Voltage mode	0 to 10V DC, or 0 to –10V DC, or –10V to + 10V DC
Input impedance	M1: 47 kΩ - M2: 100R
Common mode voltage to pin D	18V (max)
Current mode	4-20 mA
Max differential voltage to pin E to pin B	100 mV
Valve enable signal for model code PH7	
Enable	>8.5V (36V max)
Disable	<6.5V
Input impedance	10 kΩ
7-pin plug connector  View of pins of fixed half.	Pin Description A Power supply positive (+) B Power supply 0V and current command return C Not connected (PE7 & PC7) C Valve enable (PH7 & PR7) D Command signal (+V or current in) E Command signal (-V or current GND) F Output monitor G Protective ground
Electromagnetic compatibility (EMC):	IEC61326-2-1
Zero adjustment	±18% mechanical adjustment accessible under plug in LVDT
Monitor points signal	
Voltage mode	±10V DC for full stroke
Output impedance	10 kΩ
Power stage PWM frequency	10 kHz nominal
Reproducibility, valve-to-valve (at factory settings):	
Flow gain at 100% command signal	≤5%
Protection:	
Electrical	Reverse polarity protected
Mechanical	IEC 144, Class IP67
Relative humidity	85 to 95% at 20 to 70°C (68 to 158°F)
Ambient air temperature range for full performance	0°C to 70°C (32°F to 158°F)
Oil temperature range for full performance	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	See catalog GB 2410A
EHD-DSG-201-A-1* command signal generator	See catalog GB 2470
EHA-RMP-201-A-2* ramp generator	See catalog GB 2410A
EHA-PID-201-A-2* PID controller	See catalog GB 2427
EHA-PSU-201-A-10 power supply	See catalog GB 2410A

Operating Data

KSDG4V-3 Valves without integral amplifier (requires a Eurocard amplifier, refer to Supporting Products)	
Standing current at null	1,7A
Max current, at 50°C (122°F) ambient	3,2A
Coil resistance, at 20°C (68°F)	1,87Ω
Coil inductance, at 1000 Hz & 150 mV	7.2 mH
Max solenoid power	30W
LVDT supply voltage	+15V DC
LVDT output signal	4 to 20 mA for spool stroke of 2,1 mm
Electromagnetic compatibility (EMC)	IEC61326-2-1
Base amplifier	EEA-PAM-553-A-3* Power requirements: 20 to 40V DC at 40W
Mechanical protection	IEC 144, Class IP65
Maximum allowable ambient air temperature Maximum allowable oil temperature	60°C (140°F) 60°C (140°F)
KSDG4V-3 and KBSDG4V3 Valves (all valves)	
Relative duty factor	Continuous rating (ED = 100%)
Hysteresis	<0.5%
Step response: Step size (% of max spool stroke): 0-100% or 100-0% 10-90% or 90-10% ±10% to ±10% ±25% to ±25% 10-90%	 Time to reach 90% of required step: 10 mS 6 mS 4 mS 5 mS 6 mS
Mass: KSDG4V-3 KBSDG4V-3	 2,09 kg (4.6 lb) approx. 2,49 kg (5.5 lb) approx.

Pressures and Flow Rates

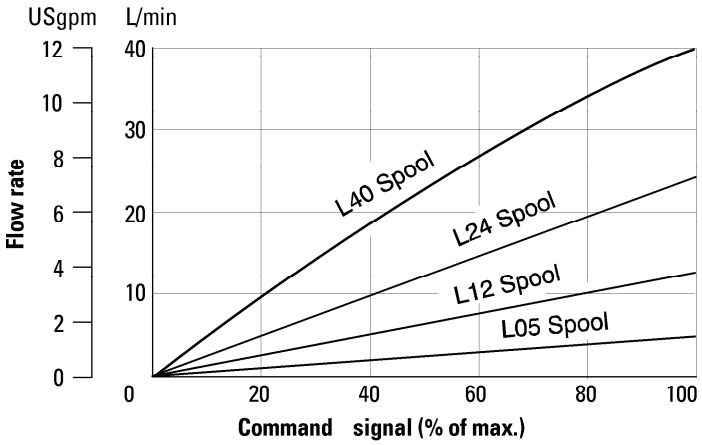
Maximum pressures, bar (psi)

Port L condition	Ports P, A, B	T	L
Normally blocked by mounting surface	350 (5000)	50 (720)	50 (720)
Drained directly to tank	350 (5000)	210 (3000)	10 (145)

Performance Curves

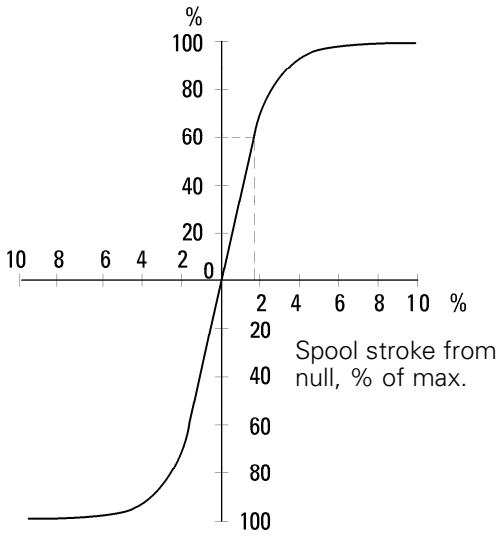
Flow Gain

Flow from port P-A-B-T or P-B-A-T at 70 bar (1000 psi) total valve Δp, 35 bar (500 psi) per metering edge



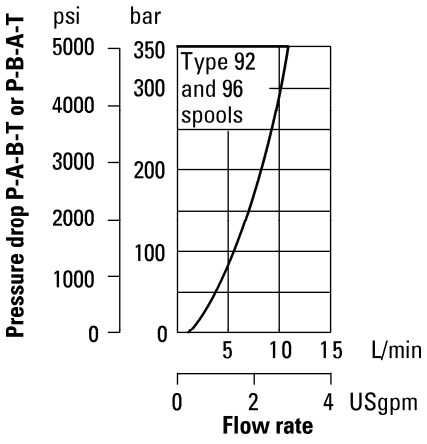
Pressure Gain

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

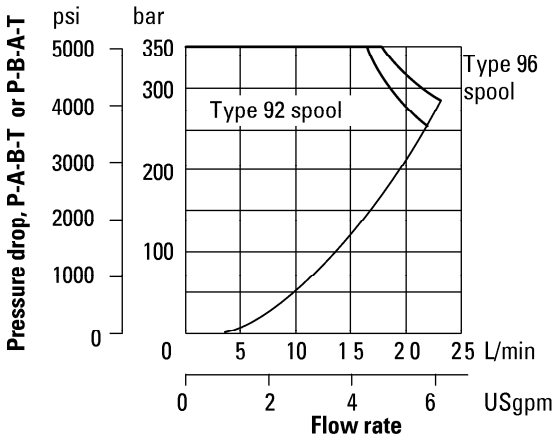


Power Capacity Envelopes

K(B)SDG4V-3-9*L-05 Valves



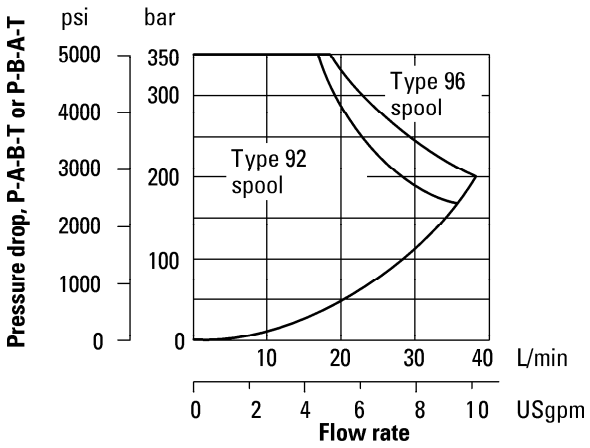
K(B)SDG4V-3-9*L-12 Valves



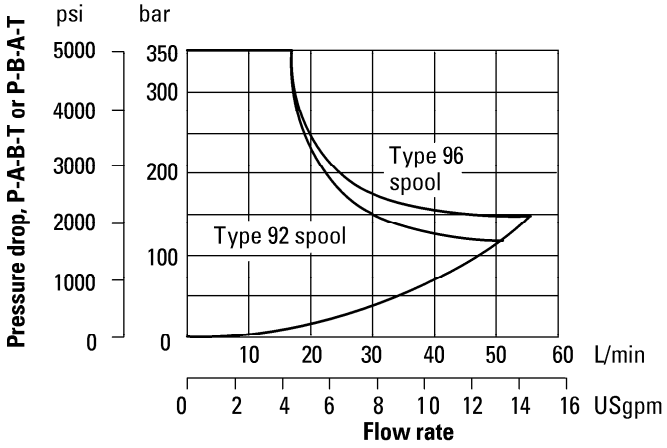
Performance Curves

Power Capacity Envelopes

K(B)SDG4V-3-9*L-24 Valves

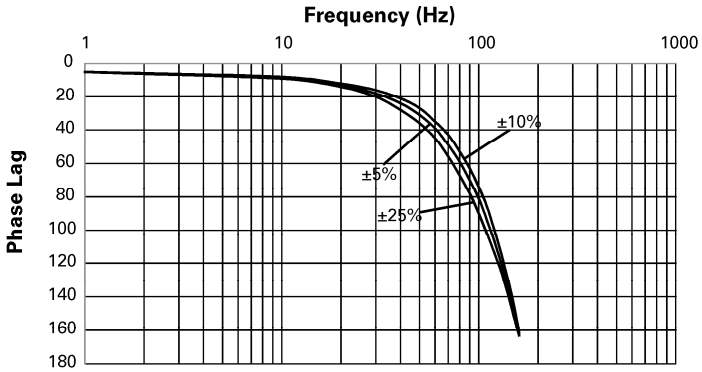


K(B)SDG4V-3-9*L-40 Valves



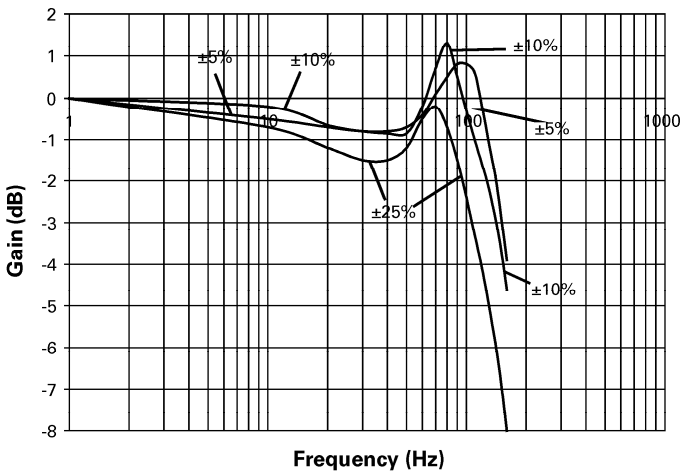
Frequency Response, typical

For amplitudes of ±5%, ±10, ±25% with zero offset.
Δp (P to T) = 70 bar (1000 psi)



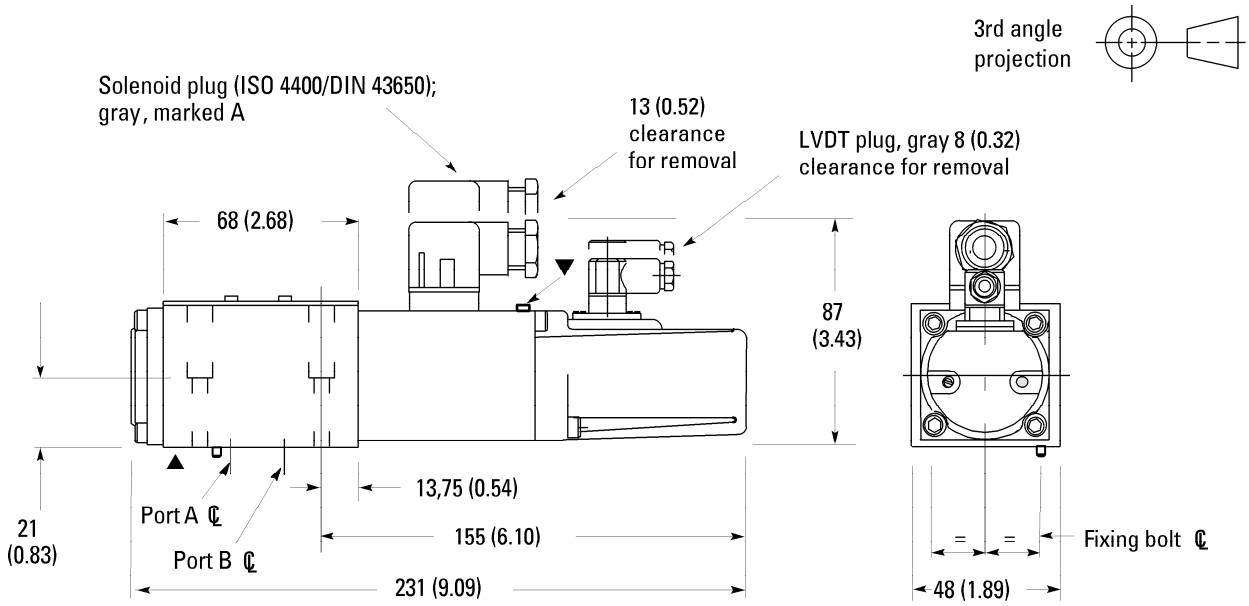
Frequency Response

Looped flow at 70 bar valve pressure drop
Amplitudes based on % of rated flow

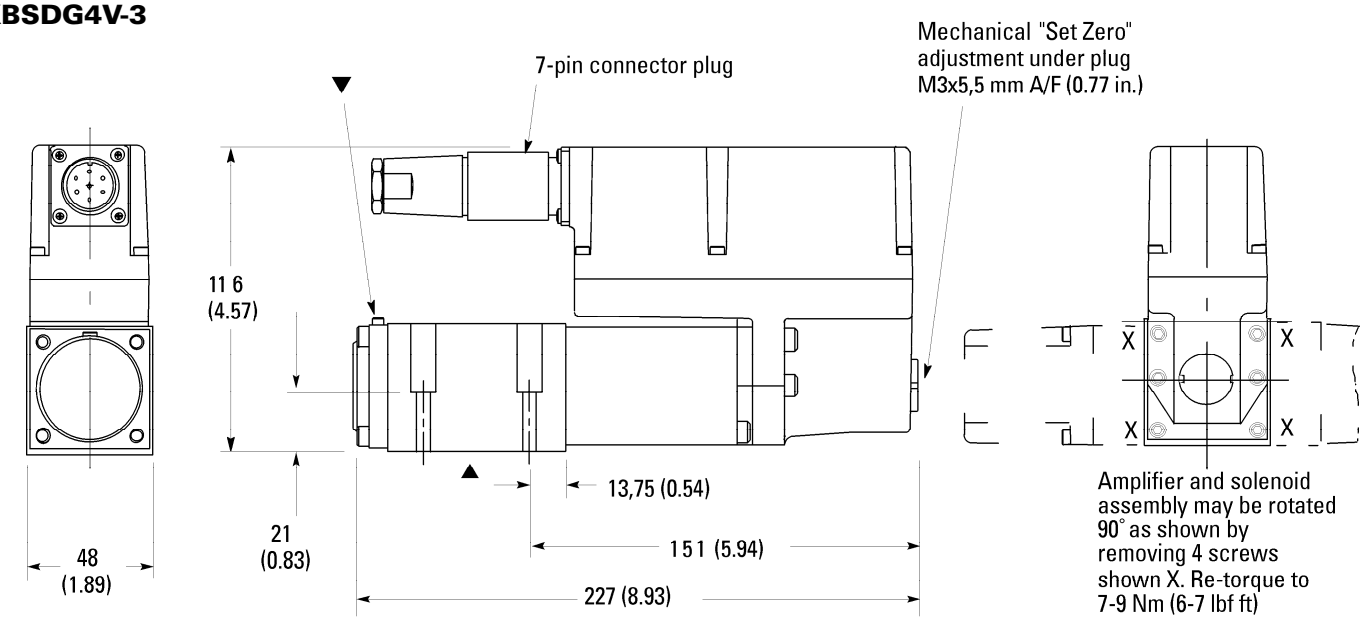


Installation Dimensions

KSDG4V-3



KBSDG4V-3



▲ Mounting surface seals supplied.
For mounting surface dimensions and subplate options see page 11.

▼ Bleed screw location
Air bleed, socket head cap screw
Torque to 2,5-3,0 Nm (2.0-2.5 lbf ft)

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 2-2,5 Nm (1.5-2.0 lbf ft) to effect a proper seal.

Subplates and Mounting Surfaces

General Description

If 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 ±0,2 mm (±0.008") except where otherwise stated. ISO 4401 specifies inch conversion to ±0.01".

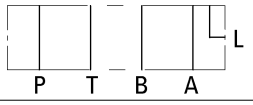
Conversion from Metric

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 Eaton recommendations that allow these plates and associated valves to be used up to their maximum pressures, when using Eaton 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.

Subplates

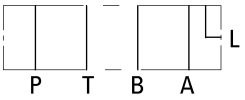
Description and Mass kg (lb)	Functional Symbol	Model Code	Max. Pressure
Single-station subplate; rear ports P, T, A, B; side port L Cast iron 1,3 (2.9)		KDGVM-3-1*-R▲ KDGVM-3-676803-1* (SAE/UNF ports)	250 bar (3600 psi)

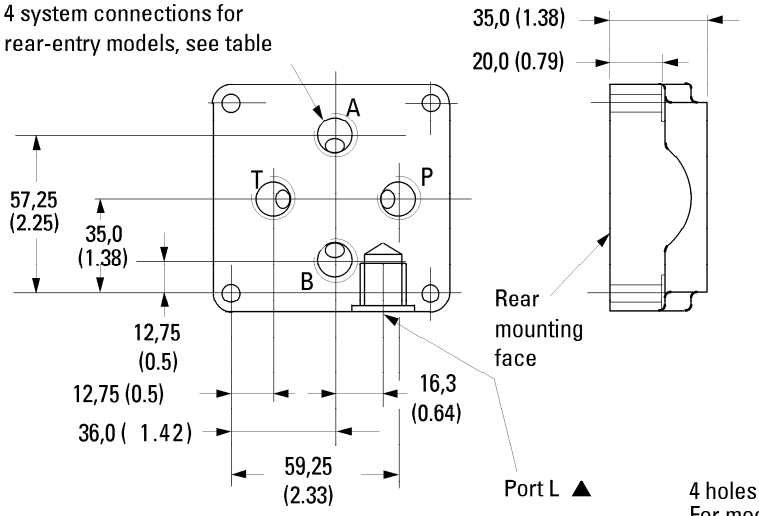
* Design number subject to change. No change of installation dimensions for design numbers 10 to 19 or 21 to 29 inclusive.

▲ "S" suffix = SAE/UNC ports and/or UNC fixing bolt tappings and/or orifice plugs as appropriate.
"R" or "B" = ISO 228 (BSPF) ports and/or metric fixing bolt tappings and/or orifice plugs as appropriate.

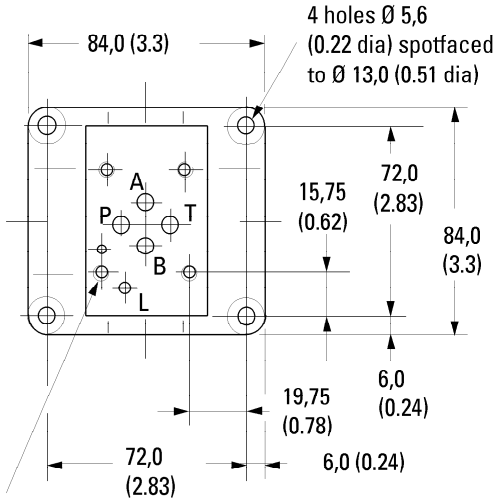
Installation Dimensions

Single-Station Subplates,
Rear and Side Tapped Ports





▲ *11,5 (0.45) from rear mounting face to port center line.*



4 holes tapped according to model type (see table):
For models with BSPF ports, M5 x 12 (0.47) deep
For models with SAE ports, #10-24 UNC-2B x 12,7 (0.5) deep

Port Threads Model	Ports P, T, A, B, at rear or side		Port L
BSPF ports/M5 mounting bolts KDGVM-3-1*-R	Rear	G3/8 (3/8" BSPF) x 12,0 (0.47) deep	G1/8 (1/8" BSPF) x 12,0 (0.47) deep
SAE ports/#10-24 UNC mounting bolts: KDGVM-3-676803-1*	Rear	3/4"-16 UNF-2Bx14,3 (0.56) deep (SAE)	7/16" -20 UNF-2B x 11,6 (0.46) deep (SAE)

Mounting Surfaces

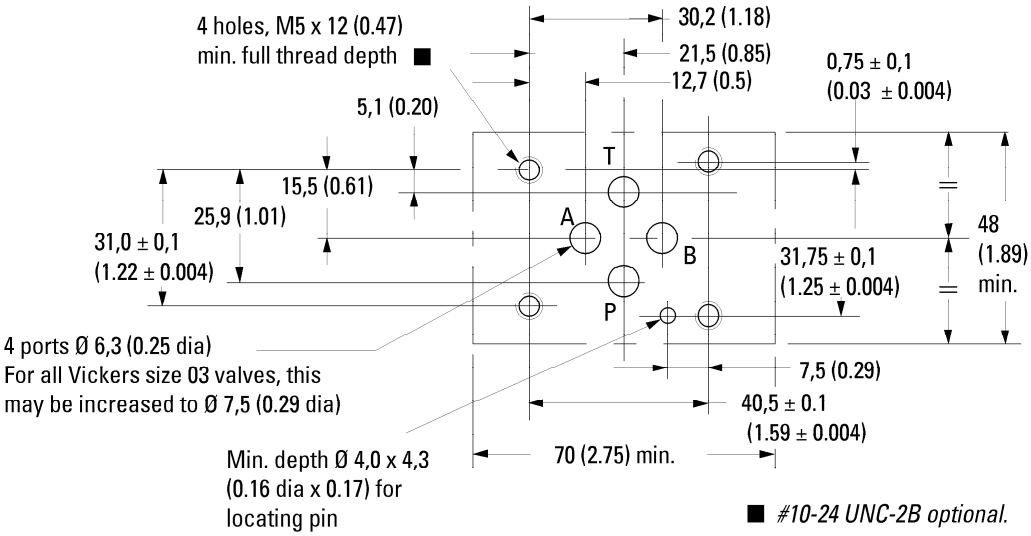
Mounting Surfaces to ISO 401 (Size 03)

This interface conforms to: ISO 4401-03-02-0-94 plus location pin hole

ANSI/B93.7M (and NFPA) size 03

CETOP R35H4.2-4-03, plus location pin hole

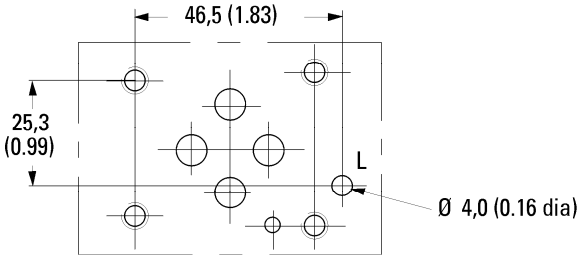
DIN 24340 Form A6 plus location pin hole



Interface with Additional Drain Port

The interface conforms to Eaton standard, plus hole "L"

Typically used for proportional and other valves requiring an additional drain port.



Block Diagram Voltage Input (M1) KBSDG4V-3

KBSDG4V-3 Wiring

Connections must be made via the 7-pin plug mounted on the amplifier. See page 15 of this leaflet and Eaton's Installation Wiring Practices for Vickers™ Electronic Products, leaflet 2468. Recommended cable sizes are:

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):

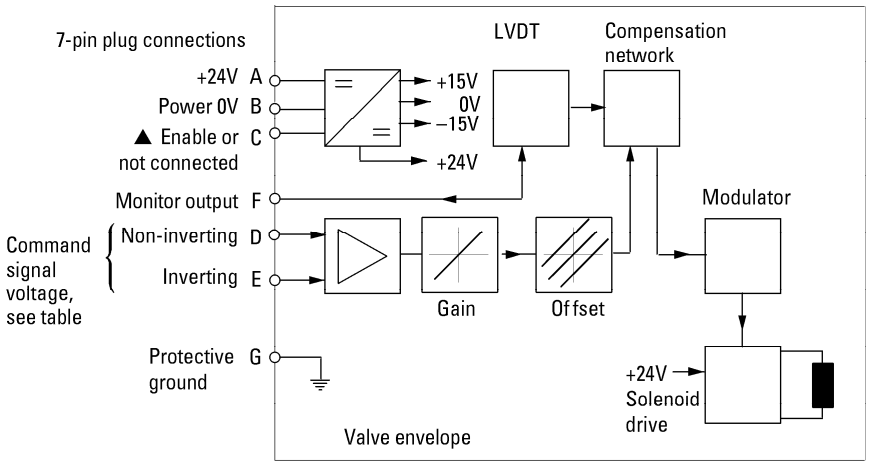
A suitable cable would have 7 cores, a separate screen for the signal wires and an overall screen.

Cable outside diameter 8,0–10,5 mm (0.31–0.41 inches)

See connection diagram on next page.

KSDG4V-3 Wiring

Wiring details for these valves are contained in the appropriate Eurocard literature and Eaton's Installation Wiring Practices for Vickers™ Electronic Products leaflet 2468.



▲ Pin C is used for a valve enable signal with electrical connections PH7 and PR7.

Command Signals and Outputs, M1

7-pin plug		Flow direction
Pin D	**Pin E**	
Positive	0V	
0V	Negative	P to A
$U_D - U_E$ = Positive		
Negative	0V	
0V	Positive	P to B
$U_D - U_E$ = Negative		

WARNING

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

Electrical Information

Block Diagram Current Input (M2) KBSDG4V-3

KBSDG4V-3 Wiring

Connections must be made via the 7-pin plug mounted on the amplifier. See page 15 of this leaflet and Eaton's Installation Wiring Practices for Vickers™ Electronic Products, leaflet 2468. Recommended cable sizes are:

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 7 cores, a separate screen for the signal wires and an overall screen.

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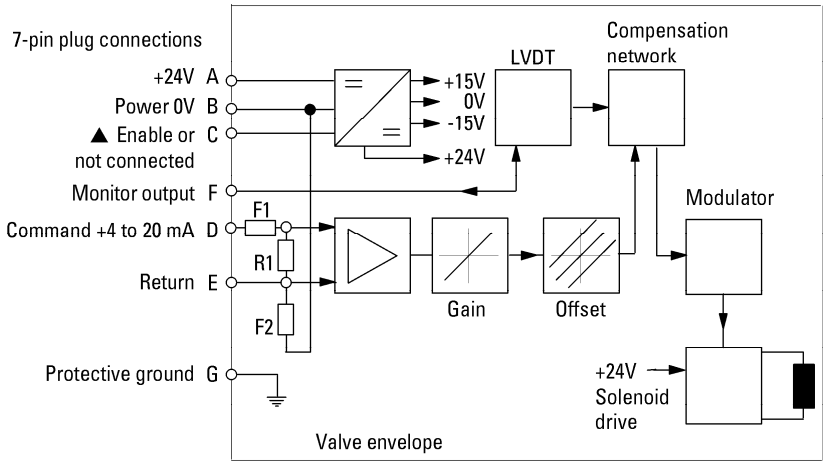
See connection diagram on next page.

KSDG4V-3 Wiring

Wiring details for these valves are contained in the appropriate Eurocard literature and Eaton's Installation Wiring Practices for Vickers™ Electronic Products leaflet 2468.



▲ Pin C is used for a valve enable signal with electrical connections PH7 and PR7.

R1 shunt resistor 100R

F1, F2 resettable fuse

Command Signals and Outputs, M2

7-pin plug			
Pin D	**Pin E**	**Pin B**	**Flow direction**
More than 12 mA	Current return	Power ground	P to A
Less than 12 mA	Current return	Power ground	P to B

WARNING

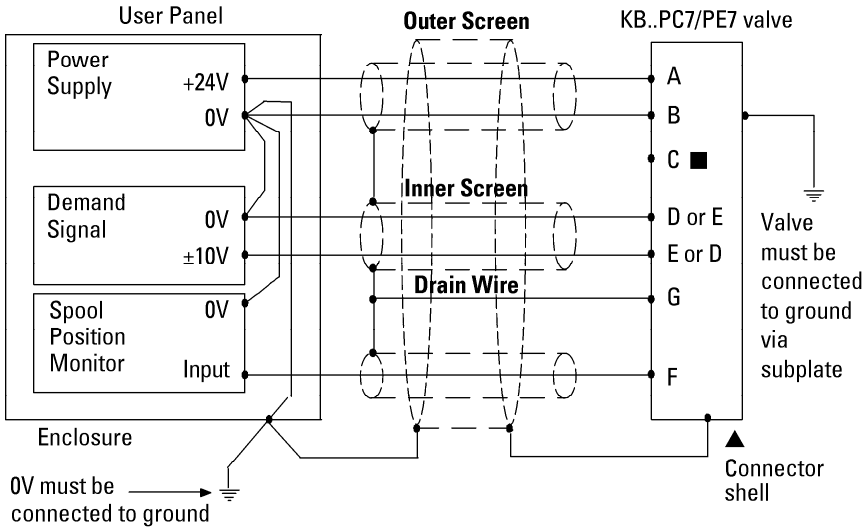
All power must be switched off before connecting/disconnecting any plugs.

Wiring Connections Voltage Input (M1)

■ Spool position monitor voltage (pin F) will be referenced to the KB valve local ground.

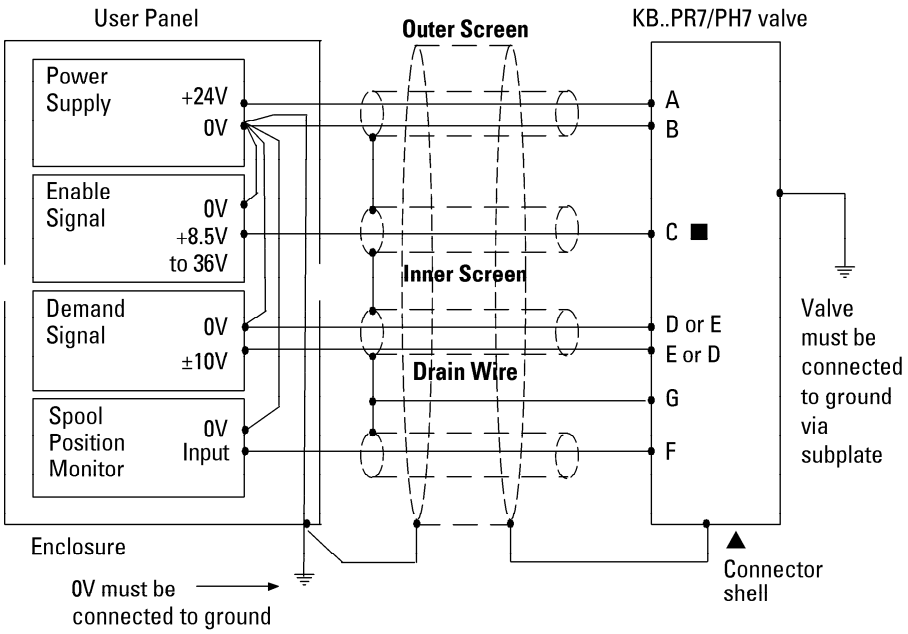
WARNING

Do not ground pin C.



Wiring Connections for M1 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.

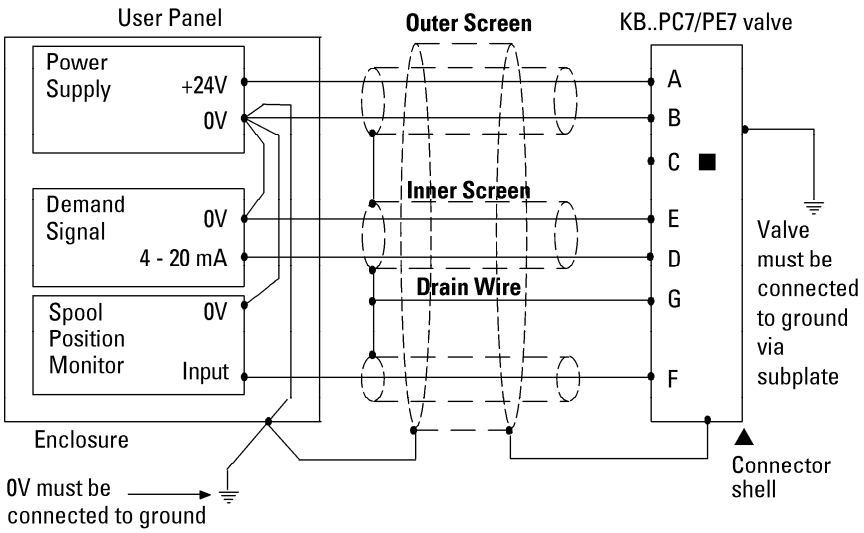


Wiring Connections Current Input (M2)

■ Spool position monitor voltage (pin F) will be referenced to the KB valve local ground.

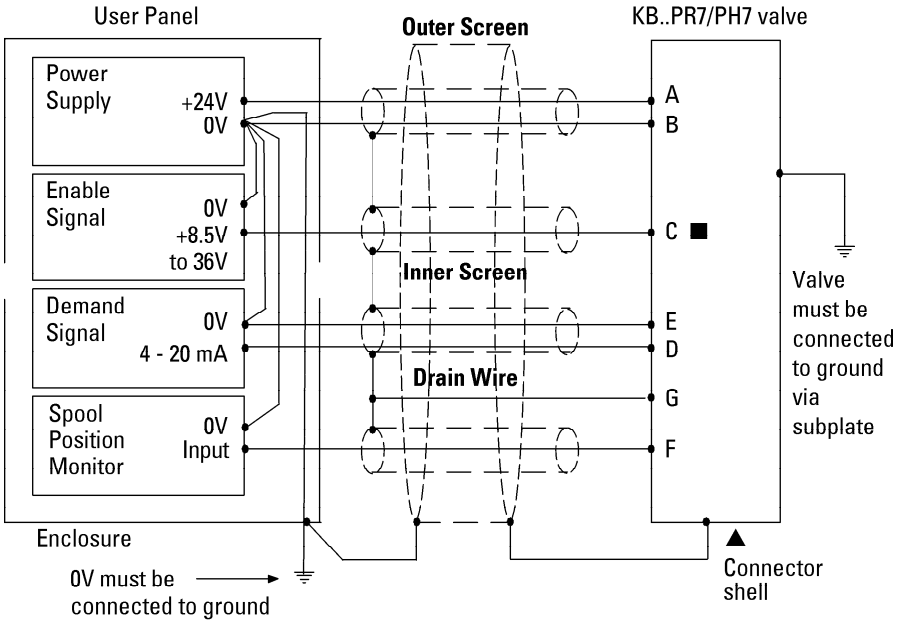
WARNING

Do not ground pin C.



Wiring Connections for M2 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 Eaton's publication 9132 or 561, "Vickers™ Guide to Systemic Contamination Control." The book also includes information on the Eaton 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**

Eaton 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 K(B)SDG4V-3

BK02-156493M (metric)

BK590716 (inch)

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

Seal Kits

KSDG4V-3-1* 565108

KBSDG4V-3-1* 02-332693

Electrical Connectors

KBSDG4V

7-pin plug (metal).....934939

7-pin plug (plastic).....694534

(metal plug must be used for full EMC protection)

KSDG4V

Solenoid (gray) 710776

LVDT (gray) 458939

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 Eaton 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.

Typical Part Numbers and Model Codes

5996404-001	KBSDG4V-3-92L-05-M1-PC7-H7-11	5996420-001	KBSDG4V-3-92L-40-M2-PE7-H7-11
5996398-001	KBSDG4V-3-92L-05-M1-PE7-H7-11	5996414-001	KBSDG4V-3-96L-05-M1-PC7-H7-11
5996399-001	KBSDG4V-3-92L-05-M1-PH7-H7-11	5996410-001	KBSDG4V-3-96L-05-M1-PE7-H7-11
5996405-001	KBSDG4V-3-92L-12-M1-PC7-H7-11	5996415-001	KBSDG4V-3-96L-12-M1-PE7-H7-11
5996400-001	KBSDG4V-3-92L-12-M1-PE7-H7-11	5996416-001	KBSDG4V-3-96L-12-M2-PE7-H7-11
5996401-001	KBSDG4V-3-92L-12-M1-PH7-H7-11	5996423-001	KBSDG4V-3-96L-12-M2-PE7-H7-11
5996406-001	KBSDG4V-3-92L-24-M1-PC7-H7-11	5996417-001	KBSDG4V-3-96L-24-M1-PC7-H7-11
5996402-001	KBSDG4V-3-92L-24-M1-PE7-H7-11	5996411-001	KBSDG4V-3-96L-24-M1-PE7-H7-11
5996407-001	KBSDG4V-3-92L-24-M1-PH7-H7-11	5996418-001	KBSDG4V-3-96L-40-M1-PC7-H7-11
5996421-001	KBSDG4V-3-92L-24-M2-PC7-H7-11	5996412-001	KBSDG4V-3-96L-40-M1-PE7-H7-11
5996408-001	KBSDG4V-3-92L-40-M1-PC7-H7-11	5996413-001	KBSDG4V-3-96L-40-M1-PH7-H7-11
5996403-001	KBSDG4V-3-92L-40-M1-PE7-H7-11	5996422-001	KBSDG4V-3-96L-40-M2-PE7-H7-11
5996409-001	KBSDG4V-3-92L-40-M1-PH7-H7-11		

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Vickers

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August 2008

EATON | Vickers

Proportional Direction Valves without Feedback

Pressures to 315 bar (4500 psi)

KBD/TG4V-5, 1* Series

VICKERS®

Contents

General Description 3
Typical Section 3
Model Codes 4
Spool Data 5
Functional Symbols 5
Operating Data 6
Power Capacity Envelopes 8
Frequecy Response 8
Flow Characteristics 9
Installation Dimensions
KBDG4V-5 11
KBTG4V-5 11
Mounting Surface Interface to ISO 4401 (Size 05) 12
Electrical Information
Block Diagram 13
Typical Connection Arrangements 14
Application Data 15

Introduction

General Description

Vickers™ KB*G4V-5 proportional valves are designed to provide controlled oil flow in proportion to an electrical command signal. They are available in two versions. Firstly a double solenoid version that will provide reversible flow and return to an actuator. Secondly a single solenoid version that provides a single direction of flow.

The KB valve incorporates an integral control amplifier. Factory set adjustments for gain, spool deadband compensation and dither ensure excellent reproducibility valve-to-valve.

Electrical connection is via a standard 7-pin plug and requires a power supply and command signal which can be either voltage or current (model code option).

In addition to improving machine performance and life, the KB proportional valves substantially simplify system design by combining direction and flow capabilities in one single package that mounts onto a standard ISO 4401 interface.

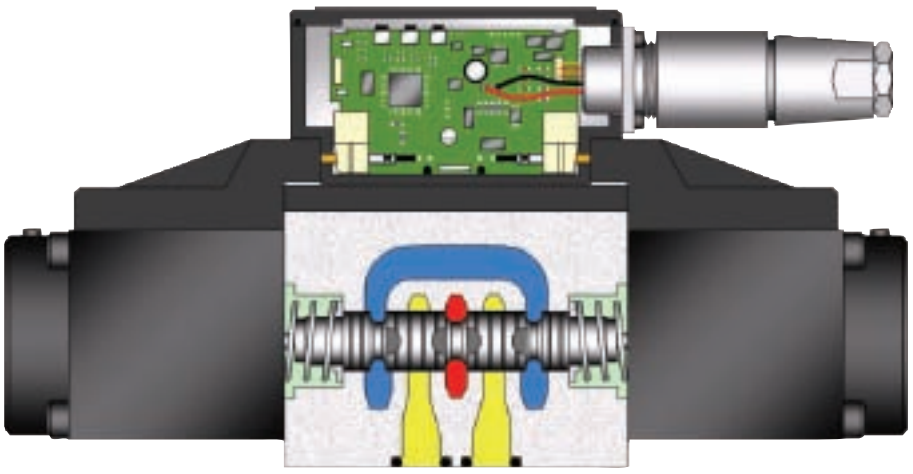
New Features and Benefits

- State of the art digital electronic technology
- Rugged and robust die-cast housing
- Optional voltage (+/-10 volt) or current (4-20 mA) demand input
- Adjustable ramp (2 sec)
- Wide range of supply voltage
- Optional external enable feature
- IP67 environmental protection
- Full CE electromagnetic capability to EN 50081-2 and EN 50082-2
- Vibration and shock tested

Standard Features and Benefits

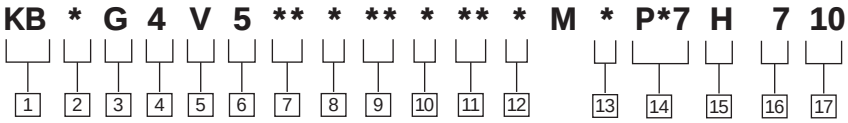
- Factory adjusted to ensure excellent valve-tovalve reproducibility
- Installation wiring reduced and simplified
- Wide range of spool and flow rate options
- Simple valve removal and replacement for service i.e. plug and play
- Standard 7-pin connector
- 315 bar (4500 psi) pressure rating
- Supported by auxiliary function electronic modules

Typical Section



KBDG4V-5-PE, 1* Series

Model Code



1 **Valve type**

KB – Proportional valve with integral amplifier, B series

2 **Control Type**

D – Directional valve

T – Throttle valve

3 **Mounting**

G – Subplate mounted

4 **Operation**

4 – Solenoid operated

5 **Pressure rating**

V – 315 bar (4500 psi), ports P, A & B

6 **Interface**

5 – ISO 4401, size 05-02-0-94, ANSI B93.7M-D05

7 **Spool Type**

2 – Closed center

33 – P port closed, A & B to tank

8 **Spool/Spring Arrangement**
(See next page for Spool Configurations)

C – Spring centered, dual solenoid

B – Spring centered, single solenoid

9 **Spool Flow Rating - at 5 bar (75 psi) per metering flow path**

30 – 30 L/min (7.9 USgpm)

50 – 50 L/min (13.2 USgpm)

65 – 65 L/min (17.2 USgpm)

70 – 70 L/min (18.5 USgpm)

10 **Spool Metering Type**

S – Meter-out only (65 spool only)

N – Meter-in and meter-out

11 **Flow Rating for Asymmetric Flow Spools**
(Omit for symmetrical spools)

25 – 25 L/min (6.6 USgpm) (2C50N25 only)

35 – 35 L/min (9.24 USgpm)

12 **Manual Overrides**

Z – No overrides

13 **Electrical Command Option**

1 – +/- 10V control signal

2 – 4-20 mA control signal

14 **Electrical Connection**

PC7 – 7 pin connector without plug supplied

PE7 – 7 pin connector with plug supplied

PH7 – As PE7 but with pin "C" used for enable signal

PR7 – As PC7 but with pin "C" used for enable signal

15 **Coil Rating**

H – 24V DC amplifier supply

16 **T Port Pressure**

6 – 160 bar (2270 psi) (65S spool only)

7 – 210 bar (3000 psi) (not available with 65S spool)

17 **Design number**

1 – 1* series - Subject to change

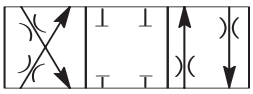
WARNING

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 2-2,5 Nm (1.5-2.0 lbf ft) to effect a proper seal.

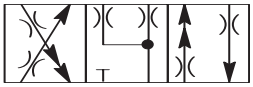
Spool Data

Spool Symbols

Available Spools for KBDG4V-5



Spool type 2C



Spool type 33C

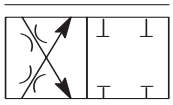
Spool Type and Flow Ratings

Symmetric Spools

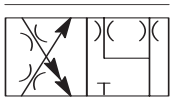
Base line starting at p = 5 bar (72 psi) per metering flow path, e.g. B to T. For actual maximum flow refer to power capacity envelope curves.

Spool code	Spool symbol	Flow rating
For KBDG4V-5 valves:		
2C30N	2C	30 L/min (7.9 USgpm)
2C50N	2C	50 L/min (13.2 USgpm)
2C70N	2C	70 L/min (18.5 USgpm)
2C65S	2C	65 L/min (17.2 USgpm)
33C30N	33C	30 L/min (7.9 USgpm)
33C50N	33C	50 L/min (13.2 USgpm)
For KBTG4V-5 valves:		
2B30N	2B	30 L/min (7.9 USgpm)
2B50N	2B	50 L/min (13.2 USgpm)
2B70N	2B	70 L/min (18.5 USgpm)

Available Spools for KBTG4V-5



Spool type 2B
meter-in/meter-out



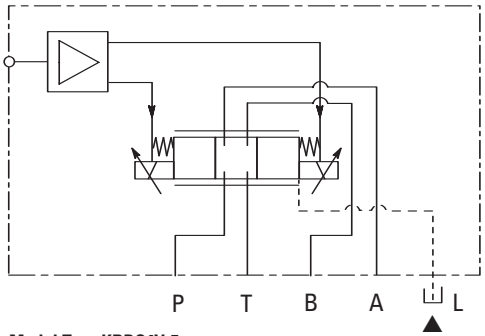
Spool type 33B
meter-in/meter-out

Asymmetric Spools

Figure preceding metering type designator, "N" (e.g. 2C***N) is flow rating P-A, or A-T ("A" port flow); figure after "N" (N***) is flow rating P-B, or B-T ("B" port flow).

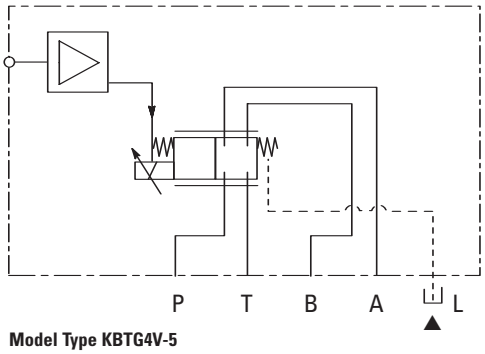
Spool code	Spool symbol	Flow rating
For KBDG4V-5 valves:		
2C50N25	2C	50 L/min (13.2 USgpm) "A" port flow 25 L/min (6.6 USgpm) "B" port flow
2C60N35	2C	60 L/min (15.8 USgpm) "A" port flow 35 L/min (9.24 USgpm) "B" port flow
33C50N25	33C	50 L/min (13.2 USgpm) "A" port flow 25 L/min (6.6 USgpm) "B" port flow

Functional Symbols



Model Type KBDG4V-5

Proportional directional valve (with integrated electronics)



Model Type KBTG4V-5

Proportional throttle valve (with integrated electronics)

▲ If port T pressure will not exceed 160 bar (2320 psi), port L need not to be connected to tank.

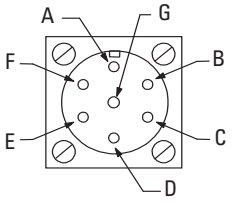
Operating Data

Proportional Directional

Valves without Feedback

KBD/TG4V-5

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

Power supply	24V DC (21V to 34V including 10% peak-to-peak ripple) max current 1.2A
Command signal (Volts) 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 4V
Command signal (Current) Input impedance	4 to 20 mA 100Ω
Valve enable signal Enable Disable Input impedance	 >9.0V (34V max) <2.0V 36 kΩ
7-pin plug connector  View of pins of fixed half	Pin Description A Power supply positive (+) B Power 0V C Valve enable (PH7 & PR7) D Command signal (+V or current in) E Command signal (–V or current return) F Output monitor G Protective ground
Electromagnetic compatibility (EMC): Emission (10 V/m) Immunity (10 V/m)	 EN 50081-2 EN 50082-2
Monitor signal (pin F) KDB values Output impedance	2V for 1.2 solinoid current 10kΩ
Power stage PWM frequency	1.2 kHz nominal
Step input response, with flow through P–A–B–T, Δp=5 bar (72 psi) per metering path, e.g. P–A Required flow step for 24V version: 0 to 100% 100% to 0	 Time to reach 90% of required step: 115 ms 105 ms
Reproducibility, valve-to-valve (at factory settings): Flow at 100% command signal	≤5%
Protection: Electrical Environmental	 Reverse polarity protected IEC 529, 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-PSU-201-A-10 Power supply EHA-PID-201-A-20 PID controller	 See catalog GB 2410A See catalog GB 2470 See catalog GB 2410A See catalog GB 2410A See catalog GB 2427
Ramp time	0-2 sec for full step input (0-100%)
Relative duty factor	Continuous rating (ED = 100%)
Hysteresis with flow through P-A-B-T	<8% of rated flow
Mass: KBDG4V-5 KBTG4V-5	 7.2 kg (15.9 lb) approx. 5.7 kg (12.6 lb) approx.

Operating Data

Pressure and Flow Rates

MAXIMUM PRESSURES, BAR (PSI)

Model	Port L Condition ▲	Ports P, A & B	T	L ▲
KBDG4V-5-**C**N-Z-M*-P*7-H7-10	Externally drained	315 (4500)	210 (3000)	10 (142)
All KBDG4V-5 models	Blocked by mating surface	315 (4500)	160 (2300)	160 (2300)
KBTG4V-5	Externally drained	315 (4500)	210 (3000)	10 (142)
	Blocked by mating surface	315 (4500)	160 (2300)	160 (2300)

▲ If port T pressure will not exceed 160 bar (2320 psi), port L need not be connected to tank.

For spool types 2C and 33C

Δp = 10 bar (142 psi) for looped flow P–A–B–T (or P–B–A–T)

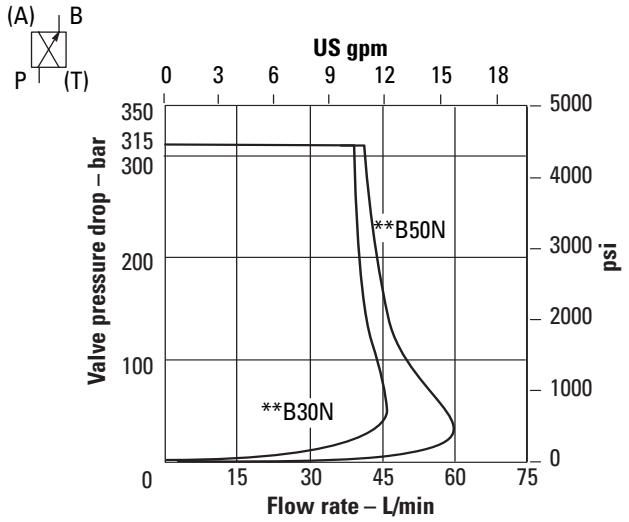
MINIMUM RECOMMENDED FLOW RATES

Valve Size/Spool Code	L/min	In^3/min
KBDG4V-5-**C30N	1,5	91
KBDG4V-5-**C50N	2,5	152
KBDG4V-5-**C70N	3,0	182
KBDG4V-5-**C65S	3,0	182

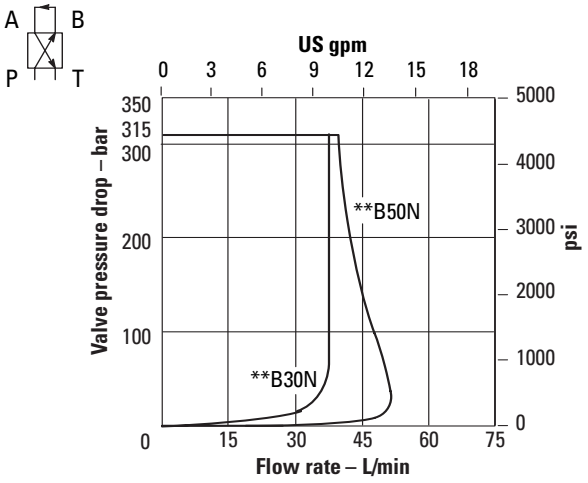
KBTG4V-5 Power Capacity Envelopes

Single Solenoid Models

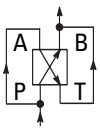
Single Flow Path P to B



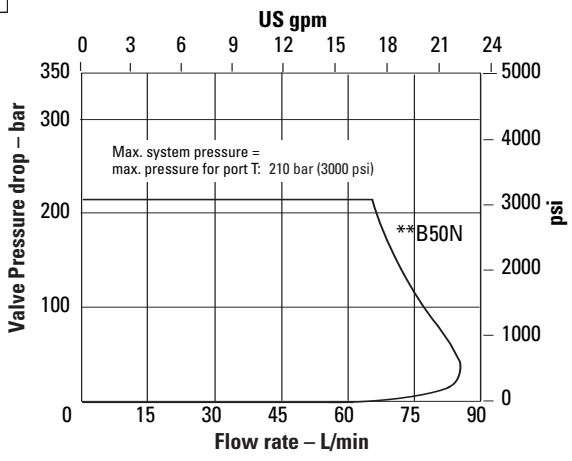
Looped Flow Path P to B plus A to T



Parallel Flow Path P to B and A to T using parallel flow path module:



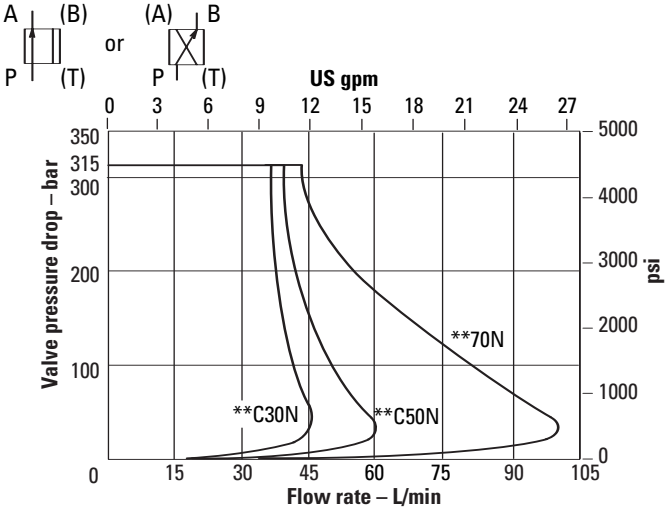
KDGMA-5-616877-10R■ or
KDGMA-5-02-139150-10S■



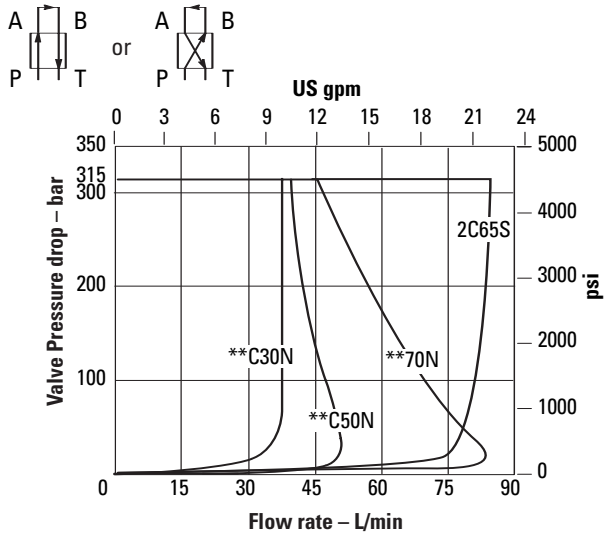
KBDG4V-5 Power Capacity Envelopes

Double Solenoid Models

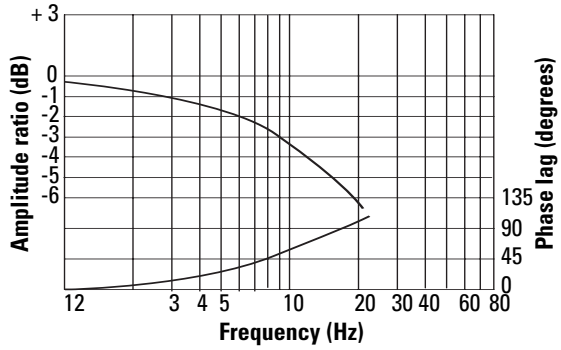
Single Flow Path P to A, or P to B



Looped Flow Path P to A (or B) plus B (or A) to T



Frequency Response



■ See catalog 2336, "Subplates and Auxiliary Connection Plates, Size 05".

Performance Curves

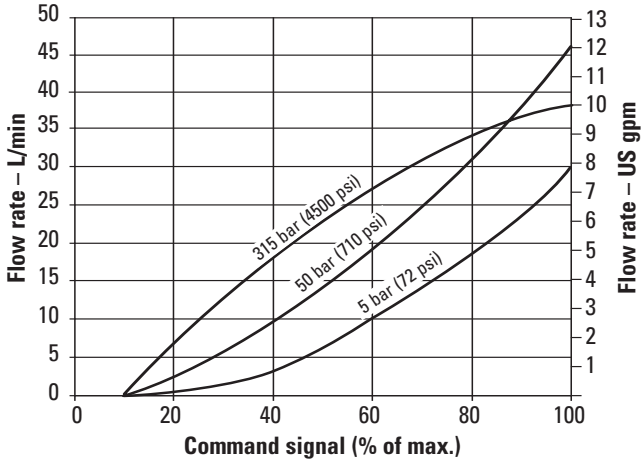
KBTG4V-5

Single Solenoid Models

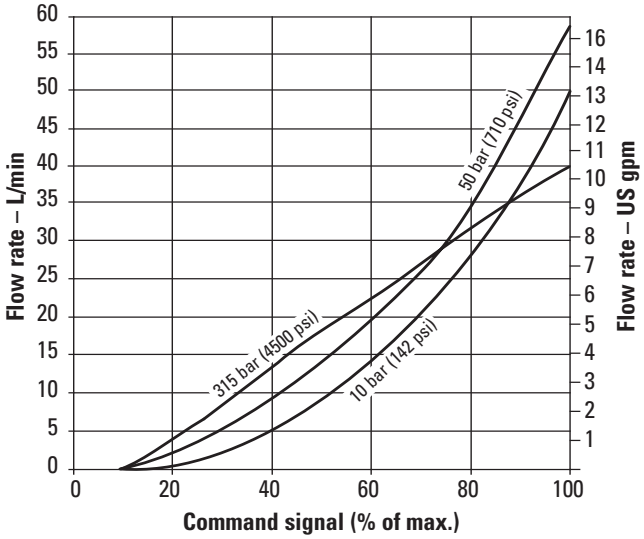
Flow gain

Single Flow Path P to B

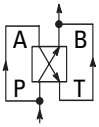
****B30N Spools**



****B50N Spools**



Parallel Flow Paths P to B and A to T using parallel flow path module:



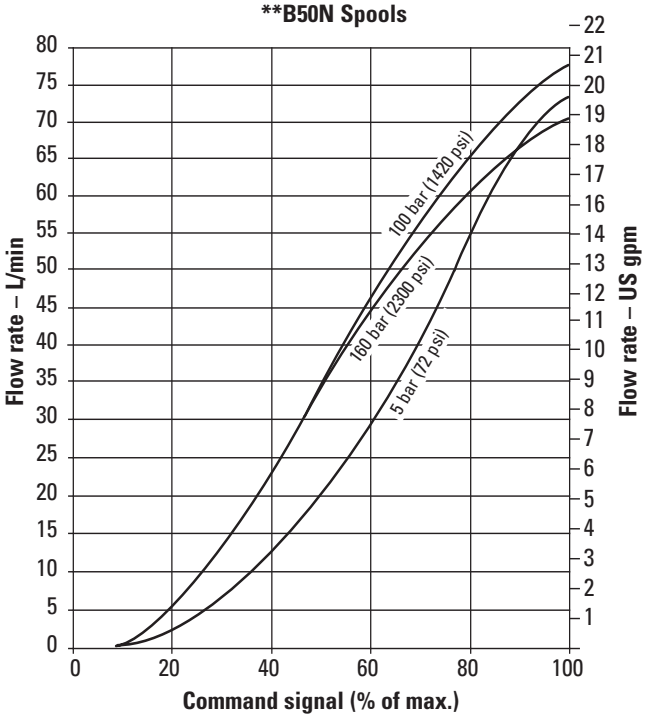
KDGMA-5-616877-10R■ or
KDGMA-5-02-139150-10S■

Maximum system pressures for this configuration:

With "L" port externally drained - 210 bar (3000 psi)

With "L" port blocked - 160 bar (2320 psi)

****B50N Spools**

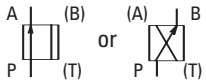


■ See catalog 2336, "Subplates and Auxiliary Connection Plates, Size 05".

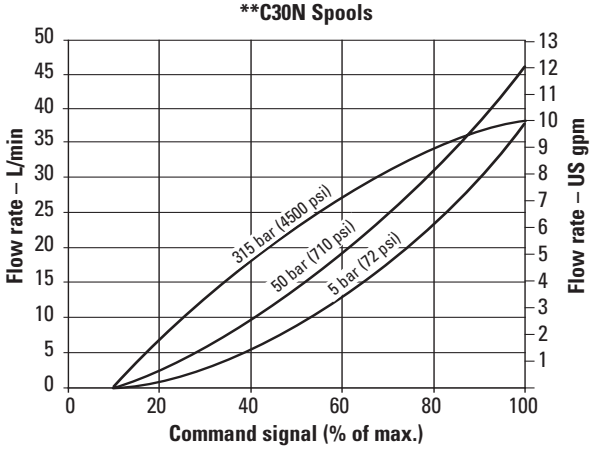
Performance Curves

KBDG4V-5 Double Solenoid Models

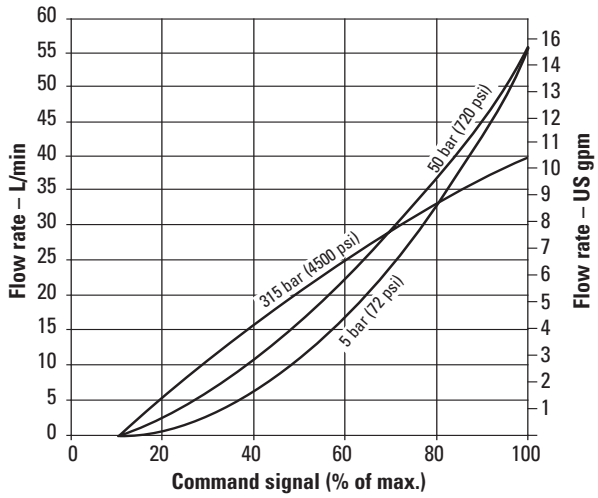
Flow gain
Single Flow Path P to A or P to B



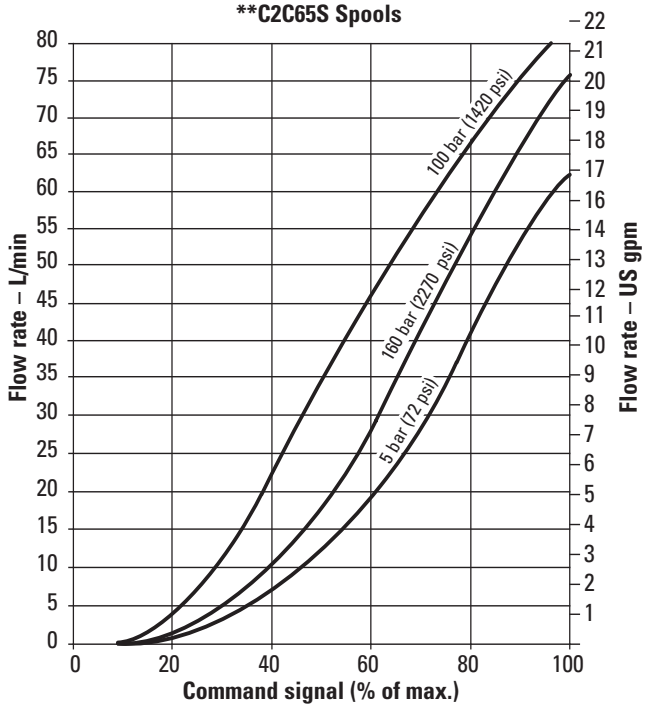
****C30N Spools**



****C50N Spools**

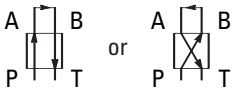


****C2C65S Spools**

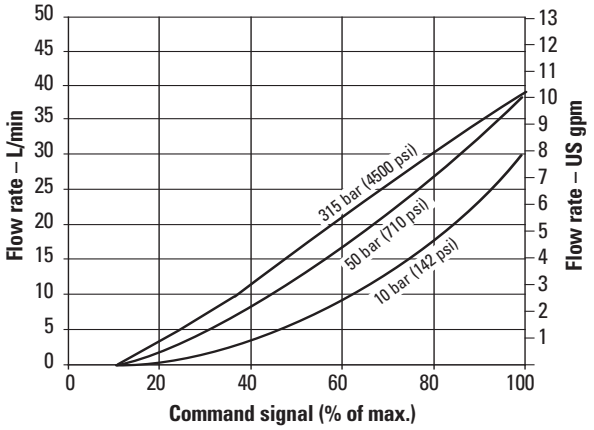


KBDT4V-5 Double Solenoid Models

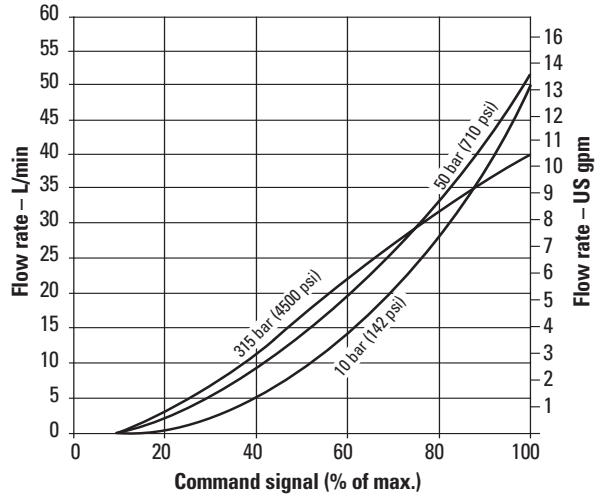
Flow gain
Looped Flow paths P to A, (or B), plus B (or A) to T



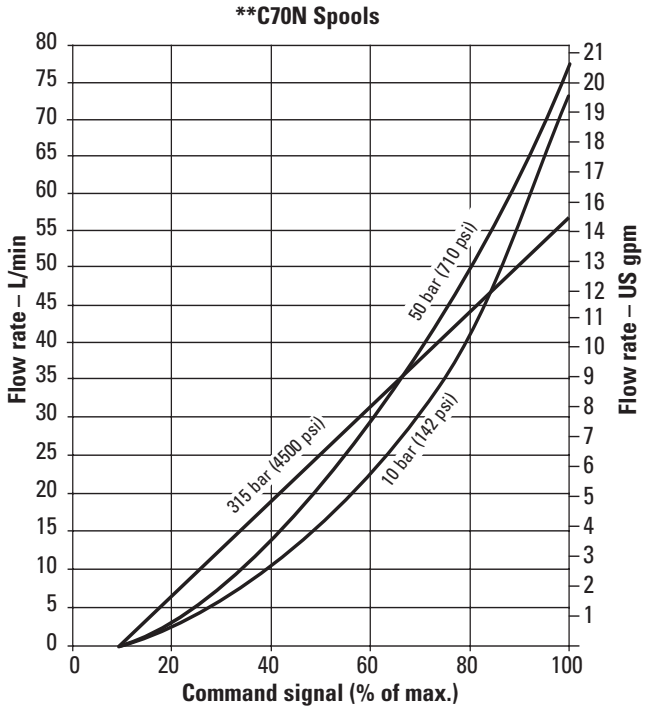
****C30N Spools**



****C50N Spools**



****C70N Spools**

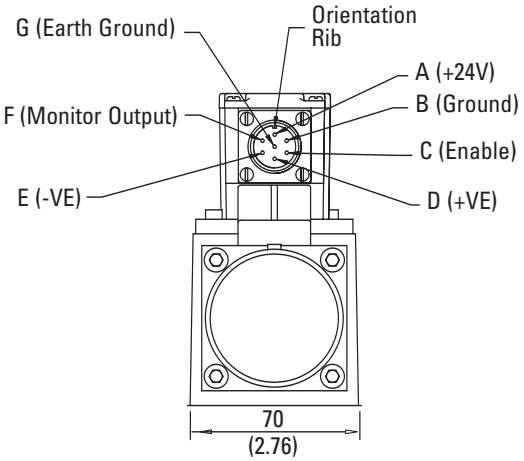


Installation Dimensions

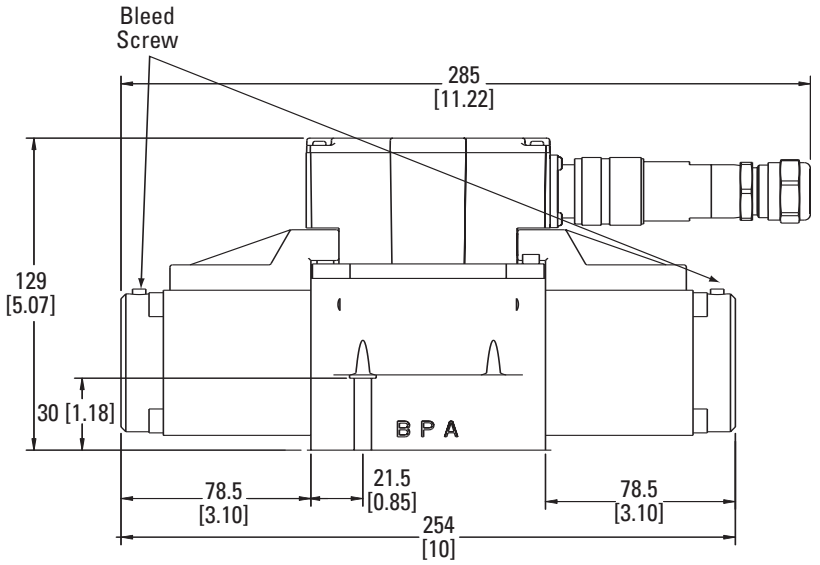
KBDG4V-5

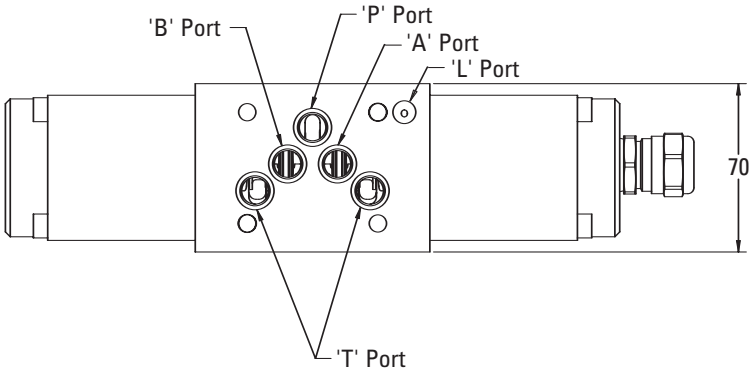
mm (Inch)

3rd angle projection



View with Connector Removed to Show Pin Designations KBD & KBT Models

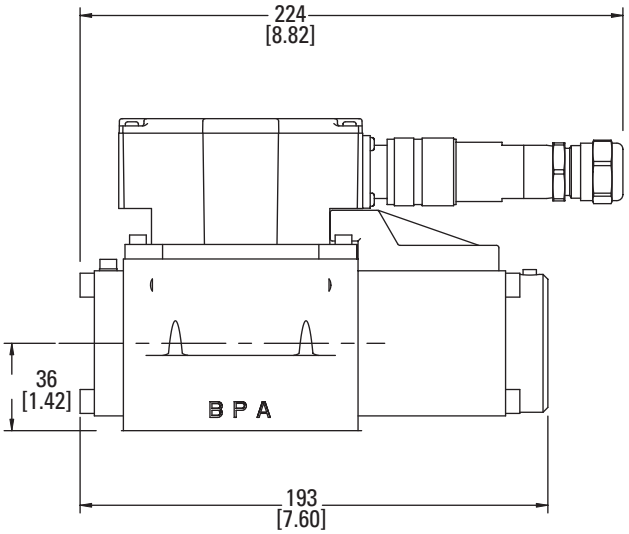




KBDG4V-5-*C-***-Z-M*-P*7-H*-10
Models Shown with "PE7" Option Installed

KBTG4V-5

mm (Inch)



KBTG4V-5-*B***-Z-M*-P*7-H*-10
Models Shown with "PE7" Option Installed

▲ Mounting surface seals supplied
For subplate options, see attached catalogue 2336; for mounting bolt kit options, see catalogue 2314.

† Note: Bleed screw locations. Air bleed: torque to 3,4-4,4 Nm (30-39 lbf ft).

NOTE: For optimum valve operation, bleed the air from the proportional solenoids at initial start-up. This may be done as follows:

• Remove the bleed screws until no bubbles appear and then reinstall bleed screws, or...

• Remove both bleed screws, and use a standard oil can nozzle to pump fluid in one side until it flows, free of air bubbles, out the other side. Reinstall screws.

If there is no inherent back pressure in the tank port of the circuit, do not allow the tank line to empty. This may be prevented by installing a check valve in the tank line. The cracking pressure of the check valve should be in the range of 15-3 bar (22-45 psi).

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.

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 0,2 mm (0.008”) except where otherwise stated. ISO 4401 specifies inch conversion to 0.01”.

Conversion from Metric

IISO 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.

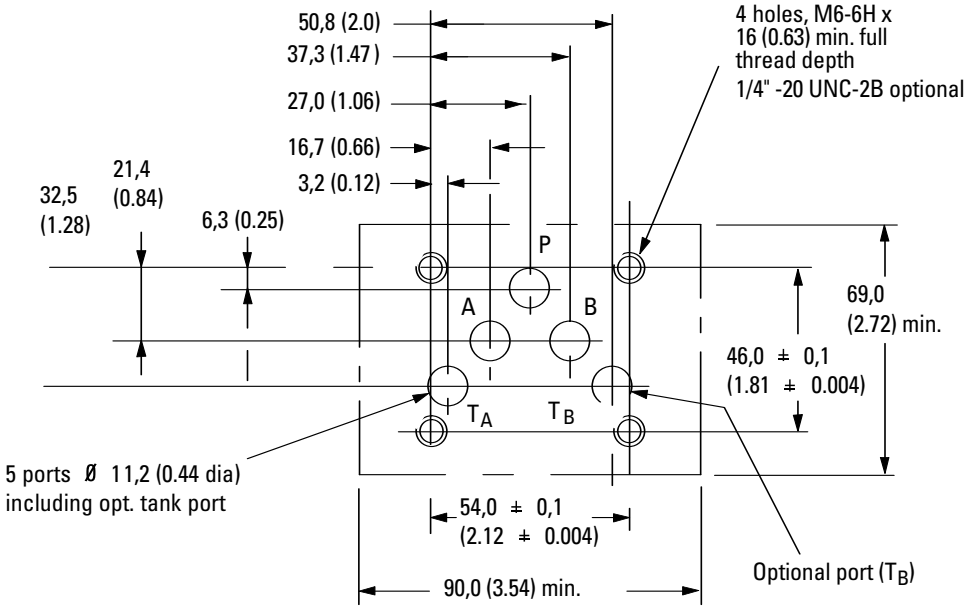
Mounting Surface Interface ISO 4401

Size 05

This interface conforms to:
ISO 4401-05-04-0-94
ANSI/B93.7M (and NFPA) size 05

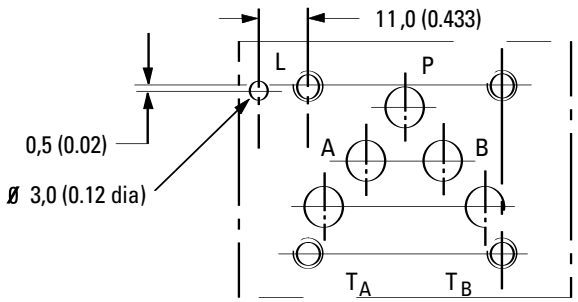
CETOP R35H4.2-05

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.



Electrical Information

Electrical Block Diagram

Wiring

Connections must be made via the 7-pin plug mounted on the amplifier. See this leaflet and Installation Wiring Practices for VickersTM Electronic Products leaflet 2468. Recommended cable sizes are:

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:

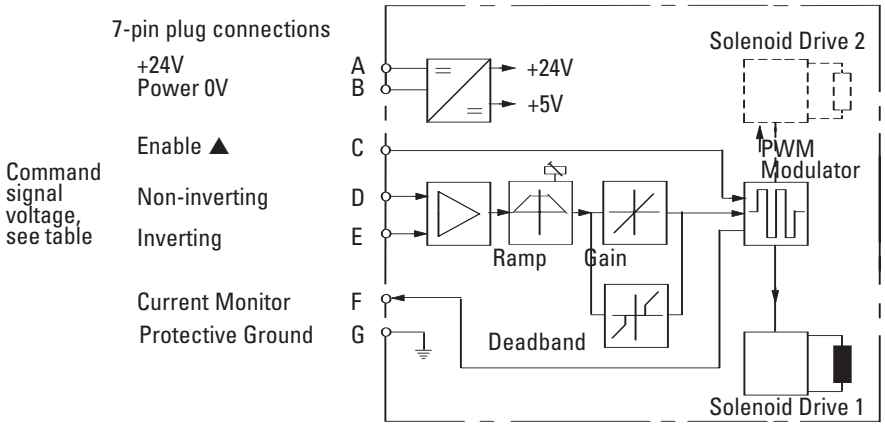
0,50 mm2 (20 AWG)

Screen (shield):

A suitable cable would have 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.



▲Note: In valves with PH7 or PR7 type electrical connection.

WARNING

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

COMMAND SIGNALS AND OUTPUTS

7-pin plug			Flow direction
	Pin D	Pin E	
Command = Volts (±10V)	Positive 0V U_D - U_E = Positive	0V Negative	P to A
	Negative 0V U_D - U_E = Negative	0V Positive	P to B
	Pin D	Pin E	Flow direction
Command = Current (4-20mA)	more than 12 mA	Current return	P to A
	less than 12 mA	Current return	P to B

Electrical Information

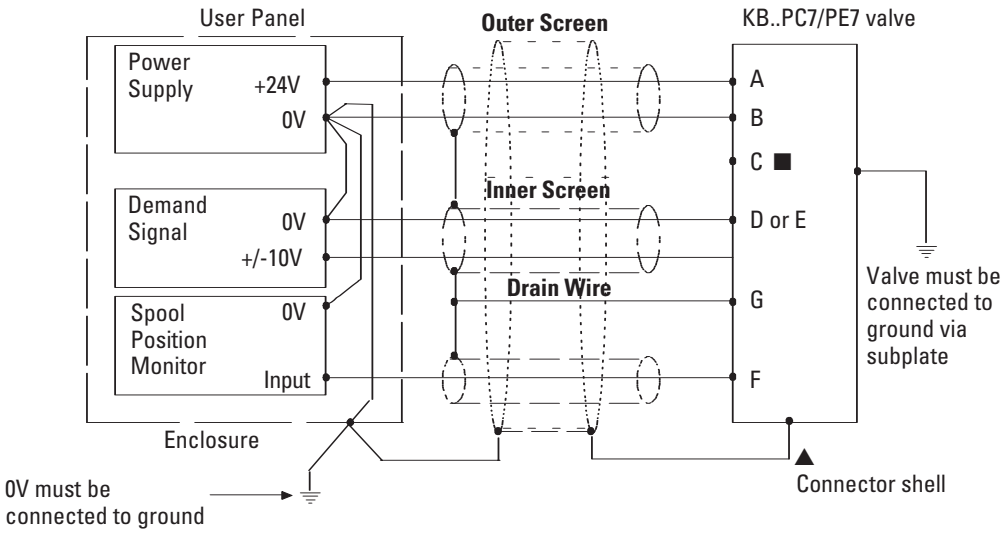
Typical Connection Arrangements

Wiring Connections

■ Pin C may be connected to ground or left unconnected.

WARNING

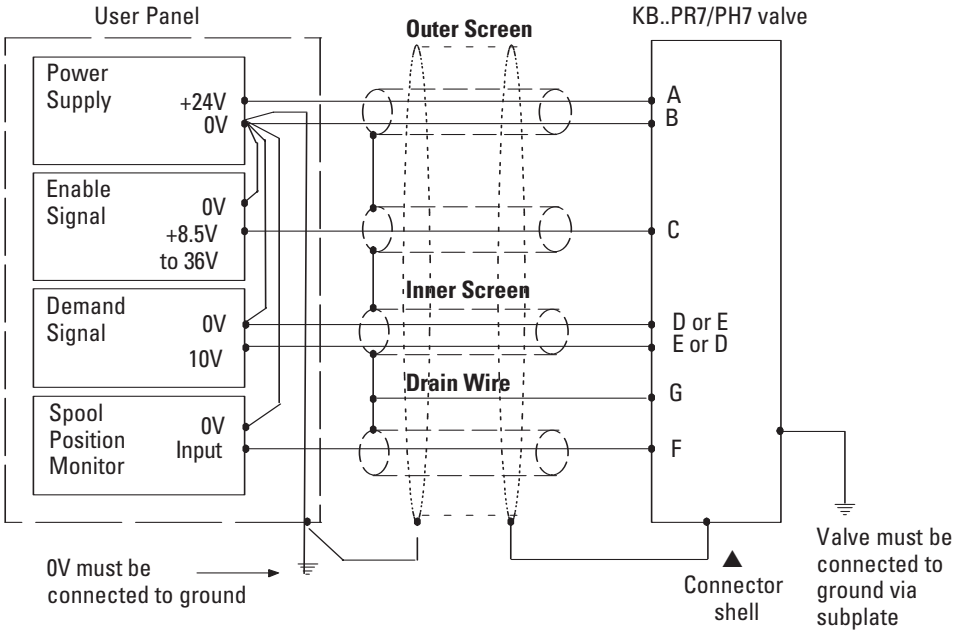
Do not ground pin C. If the local ground (pin C) is not used for differential monitor electronics, do not use. Read monitor pin F with respect to ground.



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 outputfrom the power lines.

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

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 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 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

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

KBDG4V-5.....4998180-001

KBTG4V-5.....4998179-001

Plugs

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.

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.

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VICKERS®

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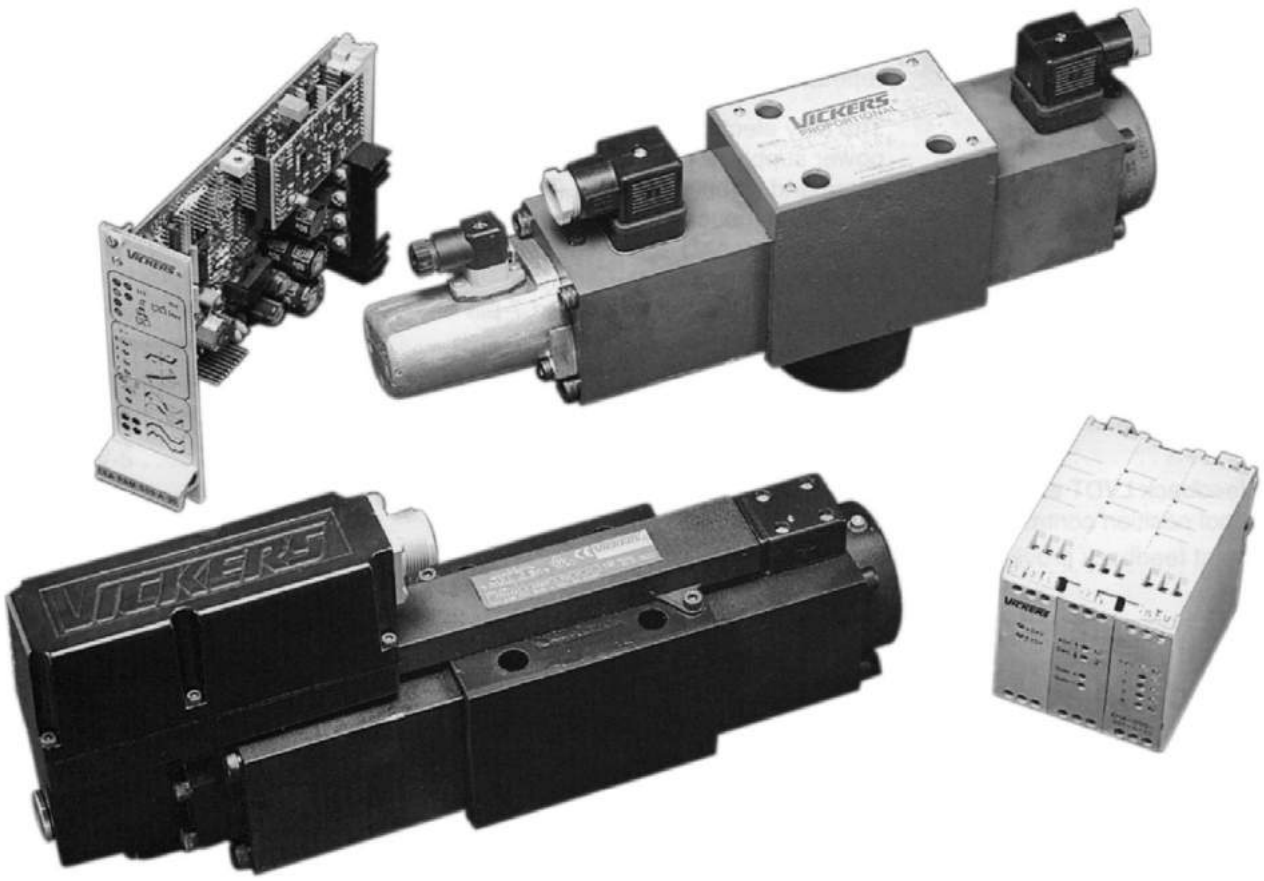
September 2004

Vickers® Proportional Valves
Proportional Directional Valves with Feedback

K(B)FD/TG4V-5, 1*/2* Series
Pressures to 315 bar (4500 psi)



Powering Business Worldwide

Table of Contents

Introduction . . . 3
Typical Section View . . . 3
Model Code . . . 4
Spool Data . . . 5
Fuctional Symbols . . . 5

Operating Data
Valves with Amplifier, KBFD/TG4V-5 . . . 6
Valves without Amplifier, KFD/TG4V-5 . . . 7
KBFD/TG4V-5 & KFD/TG4V-5 . . . 7

Pressures and Flow Rates . . . 7

Performance Curves
Power Capacity Envelopes, Single Solenoid Models . . . 8
Power Capacity Envelopes, Double Solenoid Models . . . 8
Flow Gain Curves . . . 9
Frequency Response . . . 9

Installation Dimensions
KFDG4V-5 . . . 10
KFTG4V-5 . . . 10
KBFDG4V-5 . . . 11
KBFTG4V-5 . . . 11

Subplates and Mounting Surfaces
General Description . . . 12
Installation Dimensions, KDGSM-5-676805-2* (w/rear port L) . . . 13
Installation Dimensions, EKDGSM-01Y-1*-R (w/side port L) . . . 13
Installation Dimensions, KDGSM-5-615225-1* . . . 14
Installation Dimensions, KDGSM-5-615226-1* . . . 14
Mounting surface interface . . . 15
Parallel Path Flow Module . . . 16

Electrical Information
Block Diagram Voltage Input (M1) KBFDG4V-5 . . . 17
Block Diagram Current Input (M2) KBFDG4V-5 . . . 18
Wiring Connections Voltage Input (M1) . . . 19
Wiring Connections Current Input (M2) . . . 20

Application Data . . . 21

Introduction

General Description

Eaton Vickers® K(B)FD/TG4V proportional valves are designed to provide a controlled oil flow in direct proportion to a command signal. They are available in two types; a double solenoid version that will provide reversible flow to an actuator and a single solenoid throttle version that provides a single direction of flow. Hydrostats are available for load compensation and parallel flow path modules are available that will boost the flow capacity of single solenoid throttle versions to nearly twice that of the standard valve.

Additionally, both of these valve types can be supplied with or without an integral amplifier built directly onto the valve.

KFD/TG4V-5

This version is supplied **without** the integral amplifier.

Features and Benefits

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

KBFD/TG4V-5

A range of proportional directional and throttle valves **with** integral control electronics. Factory-set adjustments of gain, spool deadband compensation and offset ensure consistent repeatability valve-to-valve.

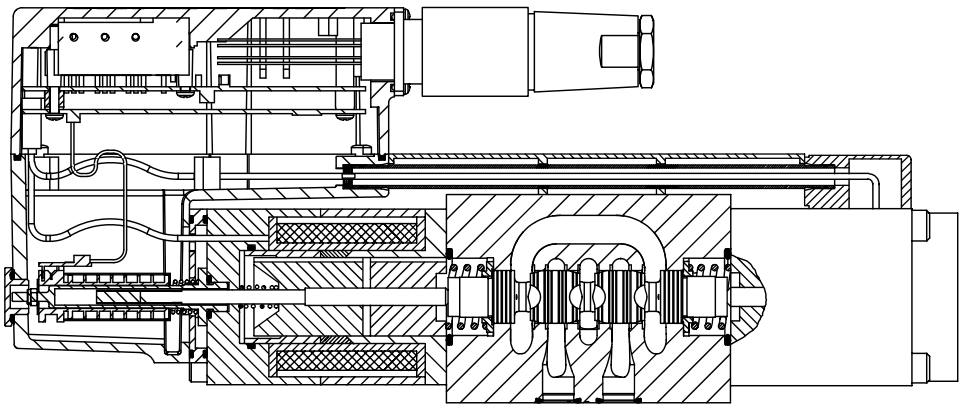
The only electrical inputs required are power supply (24V) and a voltage command signal of ±10V or 4-20 mA. The amplifier is housed in a robust metal enclosure, sealed against ingress of water and other fluids. Electrical connections are via a standard 7-pin plug.

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

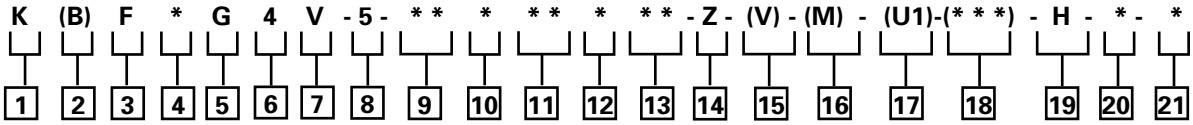
- Factory-sealed adjustments ensure valve-to-valve reproducibility.
- Installation wiring reduced and simplified.
- Standard 7-pin connector.
- Standard 24V DC supply with wide tolerance band.
- Optional ±10V DC or 4-20 mA command signals.
- Valve with integrated amplifier selected, ordered, delivered and installed as one performance-tested package.
- Spool position monitor pin to help with troubleshooting.
- Simple valve removal and replacement for service (plug & play).
- Vibration and shock tested.
- Auxiliary DIN rail mounted electronic function modules available. Full CE electromagnetic compatibility.
- IP65 & IP67 valve environmental protection rating.
- Optional valve enable function.

Typical Section View



KBFD/TG4V-5-*PE7, 1* Design

Model Codes



1 Valve Type

K Proportional valve

2 Integral Amplifier

B Integral amplifier "B" series. Omit for models without integral amplifier

3 Feedback Arrangement

F Spool position

4 Control Type

D Directional valve

T Throttle valve

5 Mounting

G Subplate mounted

6 Operation

4 Solenoid operation

7 Pressure Rating

V 315 bar (4500 psi) on ports P, A & B

8 Interface

5 ISO 4401, size 05-04-0-05 ANSI/B93.7M-D05. ISO 4401, size 05-06-0-05 (with L ports)

9 Spool Type (center condition)

(see spool data)

2 All ports closed

9 All ports closed (zero lap, 50N only)

33 P port closed, bleed A & B to T

10 Spool/Spring Arrangement

B Spring centered single solenoid valve (solenoid "B" only) Solenoid "A" for "V" version, throttle valve

C Spring centered, dual solenoid, directional valve

11 Spool Flow Rating

Δ p = 5 bar (75 psi) per metering flow path, e.g. B to T. (For actual maximum flow refer to power capacity envelope curves.)

30 30 L/min (7.9 USgpm) ▲

50 50 L/min (13.2 USgpm) ▲

65 65 L/min (17.2 USgpm) ❑

70 70 L/min (18.5 USgpm) ▲■

▲ Meter-in/meter-out

❑ Meter-out only

▲■ Type 2 spool only

12 Spool Metering Type

N Meter-in and meter-out

S Meter-out only

13 Flow Rating ("B" port flow for asymmetric spools) K(B)FDG Valves Only

25 25 L/min (6.6 USgpm) (50N25 only)

Omit for symmetrical spools

14 Manual Overrides

Z No manual overrides

15 Solenoids Energization Identity

(non-integral amplifier types KF only, omit for valves with integral amplifier)

V Solenoid "A" is at port "A" end and Solenoid "B" is at port "B" end independent of spool type

Blank US ANSI B93.9 standard (energize solenoid "A", flow symbol is (P→A)

16 Command Input

(omit for valves with integral amplifier)

M Electrical feature flag (KF only)

M1 ±10VDC (KBF only)

M2 4-20 mA (KBF only)

17 Solenoid Connector

(omit for valves with integral amplifier KBF)

U1 ISO 4400/DIN 43650, non-integral amplifier type KF only (mating plug supplied)

18 Electrical Connection (KBF valves only)

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

19 Coil Rating

H 24 VDC amplifier supply

20 Port T Pressure Limit Code

6 For 2C**S spools

7 For all other spools

21 Design Number 1* & 2* Series

Subject to change

WARNING

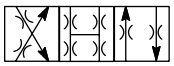
Valves with integral amplifier are supplied with or without the metal 7-pin plug. The Vickers plug, part no. 934939, must be correctly fitted to ensure that the EMC rating and IP67 rating are archieved. The plug retaining nut must be tightened with a torque of 2-2,5 Nm (1.5-2.0 lbf ft) to effect a proper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

Spool Data

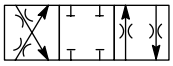
Spool Symbols

Available Spools for K(B)FDG4V-5

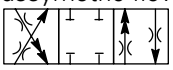
Spool type 9C**N, meter-in/meter-out (zero lap)



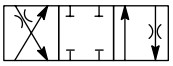
Spool type 2C**N, meter-in/meter-out



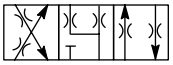
Spool type 2C50N25, assymetric flow



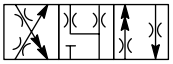
Spool type 2C65S, meter-out only



Spool 33C**N, meter-in/meter-out

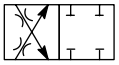


Spool type 33C50N25, assymetric flow



Available Spools for K(B)FTG4V-5

Spool type 2B**N, meter-in/meter-out



Spool Type and Flow Rating

Symmetric Spools

Base line starting at Δ p = 5 bar (75 psi) per metering flow pat, e.g. B to T. For actual maximum flow refer to power capacity envelope curves.

For K(B)FDG4V-5 Valves

Spool Code	Spool Symbol	Flow Rating
2C30N	2C	30 L/min (7.9 USgpm)
2C50N	2C	50 L/min (13.2 USgpm)
2C65S	2C	65 L/min (17.2 USgpm)
2C70N	2C	70 L/min (18.5 USgpm)
9C50N	9C	50 L/min (13.2 USgpm)
33C30N	33C	30 L/min (7.9 USgpm)
33C50N	33C	50 L/min (13.2 USgpm)

For K(B)FTG4V-5 Valves

Spool Code	Spool Symbol	Flow Rating
2B30N	2B	30 L/min (7.9 USgpm)
2B50N	2B	50 L/min (13.2 USgpm)
2B70N	2B	70 L/min (18.5 USgpm)

Asymmetric Spools

Figure preceding metering type designator, "N" (e.g. 2C***N) is flow rating P–A, or A–T ("A" port flow); figure after "N" (N***) is flow rating P–B, or B–T ("B" port flow).

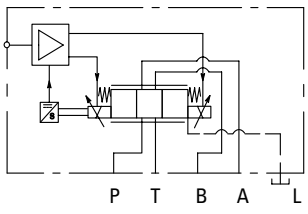
For K(B)FDG4V-5 Valves

Spool Code	Spool Symbol	Flow Rating
2C75N45	2C	75 L/min (19.8 USgpm), "A" port flow
		45 L/min (11.9 USgpm), "B" port flow
2C50N25	2C	50 L/min (13.2 USgpm), "A" port flow
		25 L/min (6.6 USgpm), "B" port flow
33C50N25	33C	50 L/min (13.2 USgpm), "A" port flow
		25 L/min (6.6 USgpm), "B" port flow

Functional Symbols

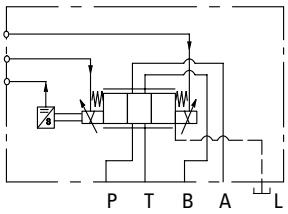
Model Types KBFDG4V-5

proporational directional valve (with intergated electronics)



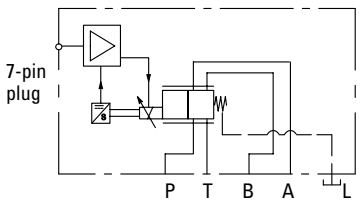
Model Types KFDG4V-5

proporational directional valve (requires amplifier card)



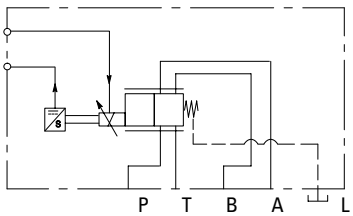
Model Types KBFTG4V-5

proporational throttle valve (with intergated electronics)



Model Types KFTG4V-5

proporational throttle valve (requires amplifier card)

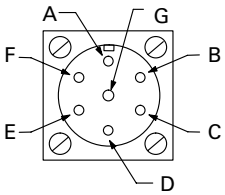


Operating Data

K(B)FD/TG4V-5

Valves with Amplifier

KBFD/TG4V-5 Valves with Integral Amplifier

Data is typical with fluid at 36 cSt (168 SUS) and 50° C (122° F).		
Power supply		24V DC (21 V to 36V including 10% peak-to-peak max. ripple) max current 3A
Command signal		
Voltage mode M1		0 to +10V DC, or 0 to -10V DC, or -10V to +10V DC
	Input impedance	47 Ω
	Common mode voltage to pin D	18V (max)
Current mode M2		4-20 mA
	Input impedance	100 Ω
	Max differential voltage to Pin E to Pin B	100mV
Valve enable signal for model codes PH7 & PR7		
Enable		>8.5V (36V max)
Disable		<6.5 V
Input impedance		10 Ω
7-pin plug connector		Pin Description A Power supply positive (+) B Power supply 0V and current command return C Not connected (PE7 & PC7) C Valve enable (PH7 & PR7) D Command signal (+V or current IN) E Command signal (–V or current GND) F Mounting input G Protective ground
Electromagnetic compatibility (EMC)		
Emmision (10V/m)		EN 61326-2
Immunity (10V/m)		EN 61326-2
Threshold command voltage (minimum voltage for minimum flow)		0.25V
Monitor signal (pin F)	KBFD valves	± 10V DC for full spool stroke
	KBFT valves	0 to –10 V DC for full spool stroke
Output impedance		10 Ω
Power stage PWM frequency		10 kHz nominal
Step input response with flow through P–A–B–T Δ p = 5 bar (75 psi) per metering path, e.g. P–A		
Required flow step:		Time to reach 90% of required step:
0 – 100%		30 ms
100% – 0		40 ms
+90 – -90% (KBFDG4V3-3 only)		32 ms
Reproducibility, valve-to-valve (at factory settings):		
Flow at 100% command signal		≤ 5%
Protection		
	Electrical	Reverse polarity protected
	Environmental	IEC 60529, Class IP65 & IP67
Ambient air temperature range for full performance		0° C to 70° C (32° F to 158° F)
Oil temperature range for full performance		0° C to 70° C (32° F to 158° F)
Mimimum 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):		
EHD-DSG-201-A-1* command signal generator		See catalog GB 2470
EHA-RMP-201-A-2* Ramp generator		See catalog GB 2410A
EHA-PSU-201-A-10 Power supply		See catalog GB 2410A
EHA-PID-201-A-20 PID controller		See catalog GB 2427

Operating Data

KFD/TG4V-5

Valves without Amplifier

KBFD/TG4V-5 Valves without Integral Amplifier – (requires a Eurocard Amplifier, Refer to Supporting Products)	
Data is typical with fluid at 36 cSt (168 SUS) and 50° C (122° F).	
Max current, at 50° C (122° F)	2,7 A
Coil reistance, at 20° C (68° F)	1,87 Ω
Step response Step size (% of max spool stroke) 0 to 100% 100% to 0 +90 to -90% (KFDG4V-5 only)	 Time to reach 90% of required step: 31 ms 30 ms 45 ms
Type of protection, with electrical plugs fitted correctly	IEC 60529, Class IP65
Electromagnetic compatibility (EMC) Emmision (10V/m) Immunity (10V/m)	 EN 50081-2 EN 50082-2
Maximum allowable ambient air temperature Maximum allowable oil temperature	60° C (140° F) 60° C (140° F)
Supporting products: Eurocard amplifiers EEA PAM 533 A/B/C/D/E/F	 See catalog GB-2464

KFD/TG4V-5 and KBFD/TG4V-5 Valves (All Valves)	
Relative duty factor	Continuous rating (ED = 100%)
Hysteresis with flow through P–A–B–T	<1% of max stroke (center-to-offset)
Mass: KFDG4V-5 KBFDG4V-5 KFTG4V-5 KBFTG4V-5	7,2 kg (15.86 lb) approx. 7,6 kg (16.76 lb) approx. 5,5 kg (12.10 lb) approx. 5,9 kg (13.00 lb) approx.
Portable test equipment EBA TEQ 460 A 10	 See catalog V-ELAC-TM001-E

Pressure and Flow Rates

Maximum pressures, bar (psi)

Model	Port L Condition	Ports P, A, B	T	L
All models for normal usage (L port not connected)	Normally blocked by mounting surface	315 (4500)	160 (2300)	160 (2300)
For K(B)FDG4V-5**C**N-Z models only a higher "T" port pressure is allowed if the "L" port is connected directly to tank	Drained directly to tank	315 (4500)	210 (3000)	10 (150)

Performance Curves

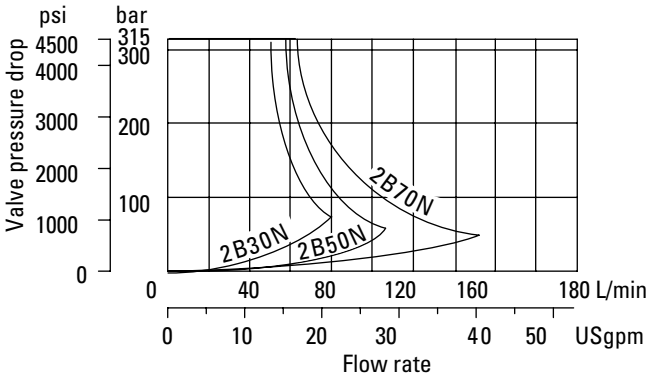
Power Capacity Envelopes

Single Solenoid Models: K(B)FTG4V-5

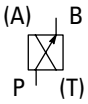
Spool types as noted

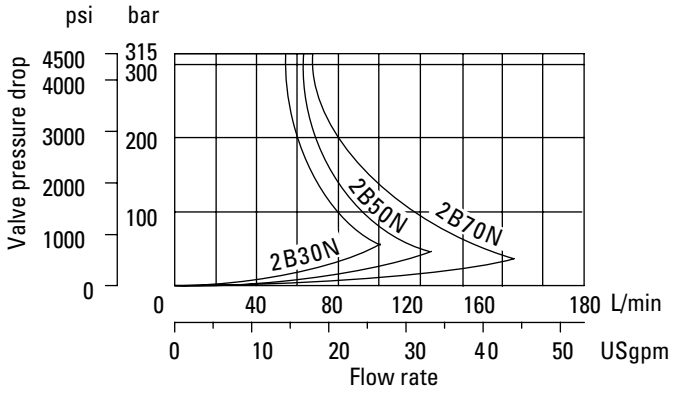
Looped Flow Path

Looped Flow Path



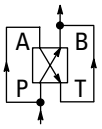
Single Flow Path

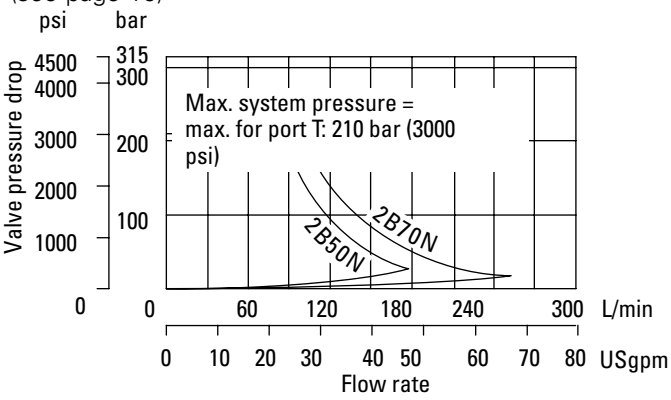




Parallel Flow Path use parallel flow path module:

KDGMA-5-616877-10R or
KDGMA-5-02-139150-10S
(see page 16)

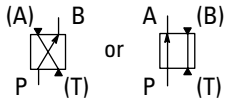


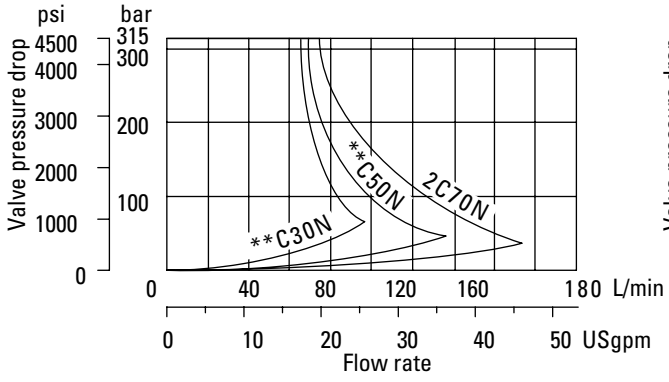


Double Solenoid Models: K(B)FDG4V-5

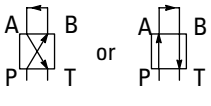
Spool types as noted

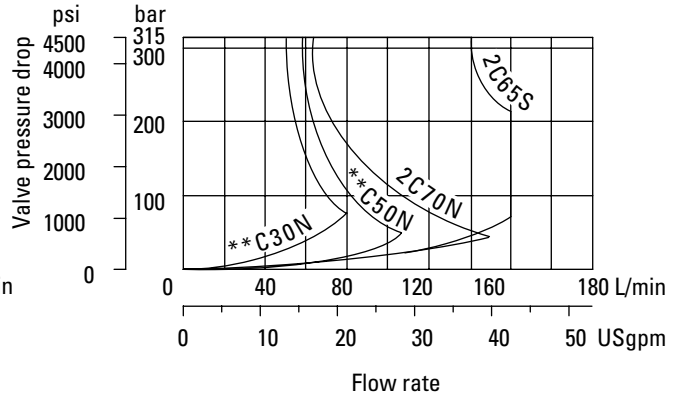
Single Flow Path





Looped Flow Path





Performance Curves

Flow Gain Curves

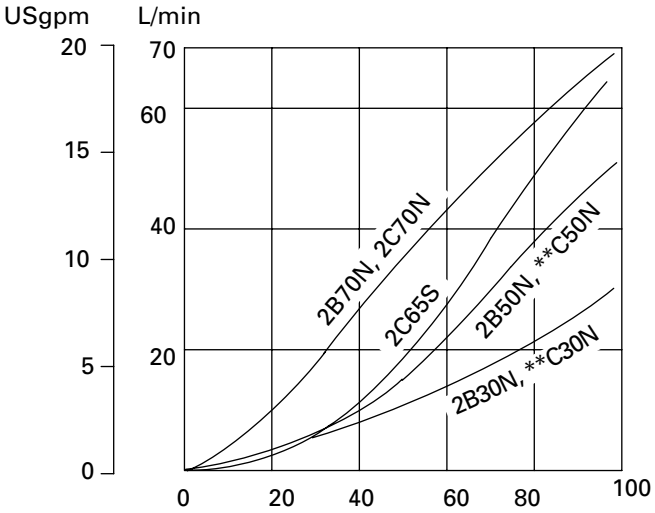
When using the single solenoid throttle valve (K*FT), a dual flowpath module (page 16) can be used to approximately double the flow rate.

Curves shown include deadband compensation provided for the KF valve by the Eaton's Vickers Eurocard Amplifier EEA-PAM-535-*-32 (user adjustable).

KB valves are preset at the factory to compensate for the effect of spool overlap.

K(B)FD/TG4V-5

Spool types as noted



Single flowpath (e.g. P–A) pressure drop, Δ p = 5 bar (72 psi) ■.

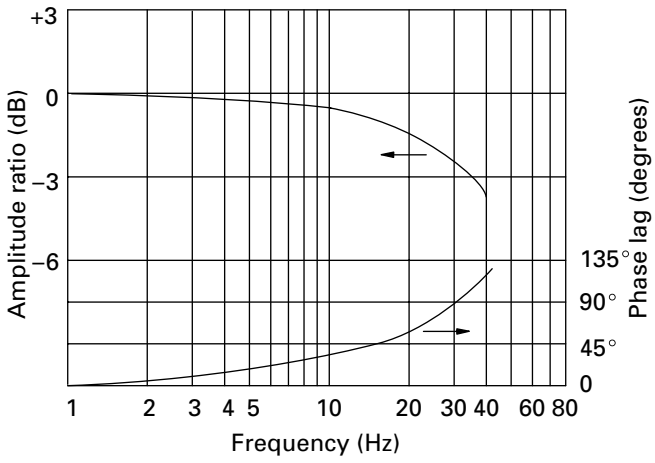
■ At other Δ p values and within the power capacity envelopes, flow rates approximate to:

$$Q_x = Q_d \sqrt{\frac{\Delta p_x}{\Delta p_d}}$$

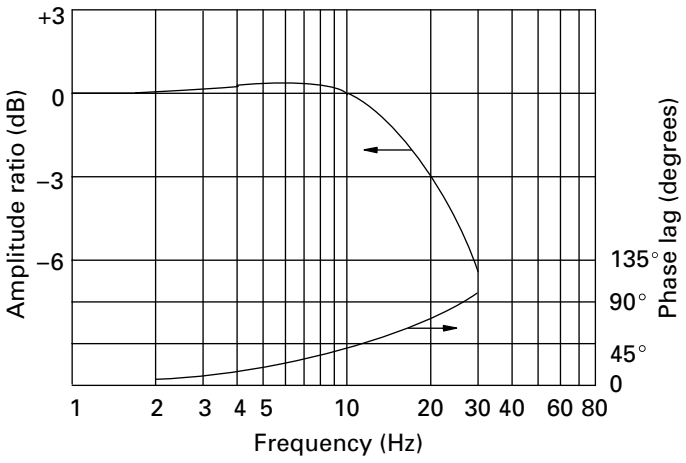
Frequency Response (Typical)

For an amplitude of ± 25% max. flow about the 50% flow , at Δ p (P–B) = 5 bar (72 psi)

KBFD/TG4V-5



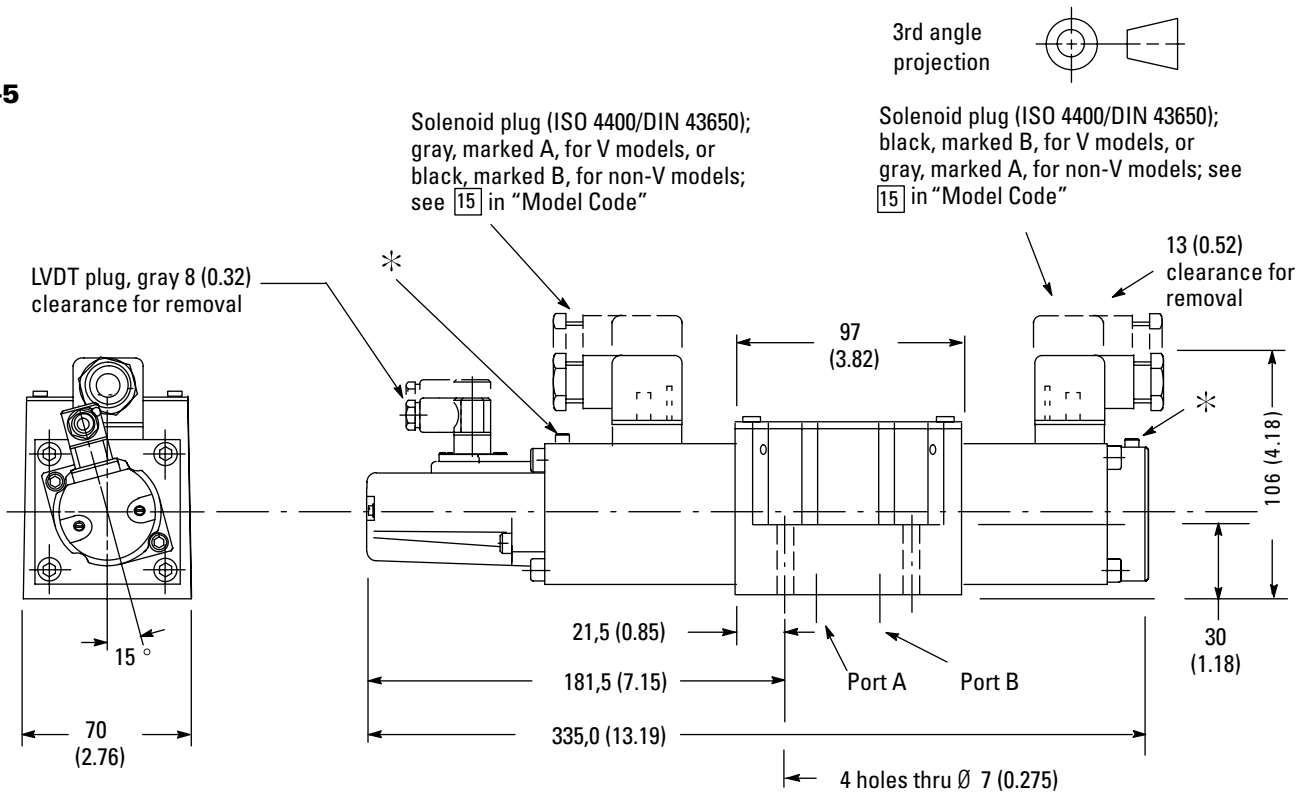
KFD/TG4V-5



Installation Dimensions

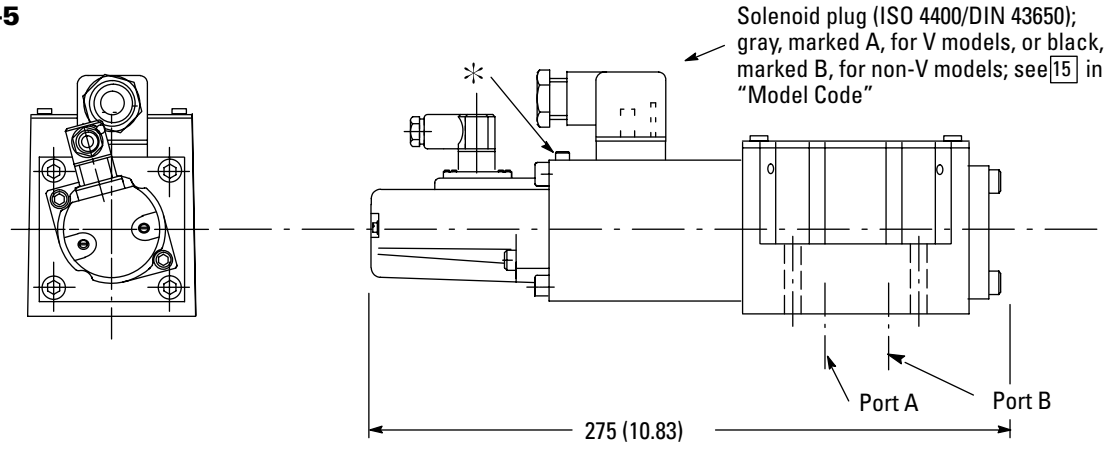
KFDG4V-5

mm (inch)



KFTG4V-5

mm (inch)



***** Bleed screw locations Air bleed, Socket Head Cap Screw.

Torque to 2,5-3,0 Nm (2.0-2.5 lbf ft)

NOTE: For optimum valve operation, bleed the air from the proportional solenoids at initial start-up. This may be done as follows:

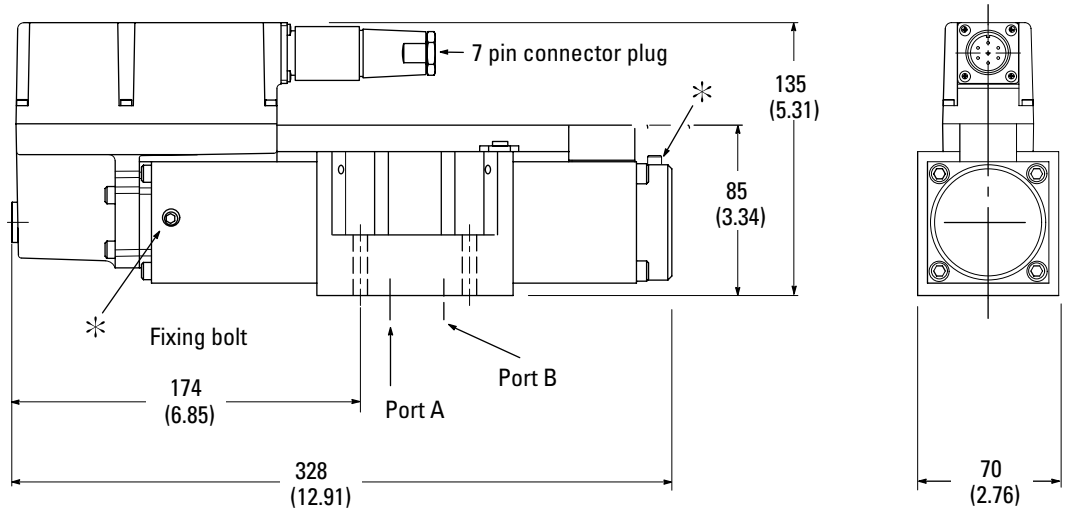
- The valve may be pressurized by removing the bleed screws until no bubbles appear and then reinstalling bleed screws, or...
- Remove both bleed screws, and use a standard oil can nozzle to pump fluid in one side until it flows, free of air bubbles, out the other side. Reinstall screws.

If there is no inherent back pressure in the tank port of the circuit do not allow the tank line to empty. This may be prevented by installing a check valve in the tank line. The cracking pressure of the check valve should be in the range of 22 - 45 psi (1.5 - 3 bar).

Installation Dimensions

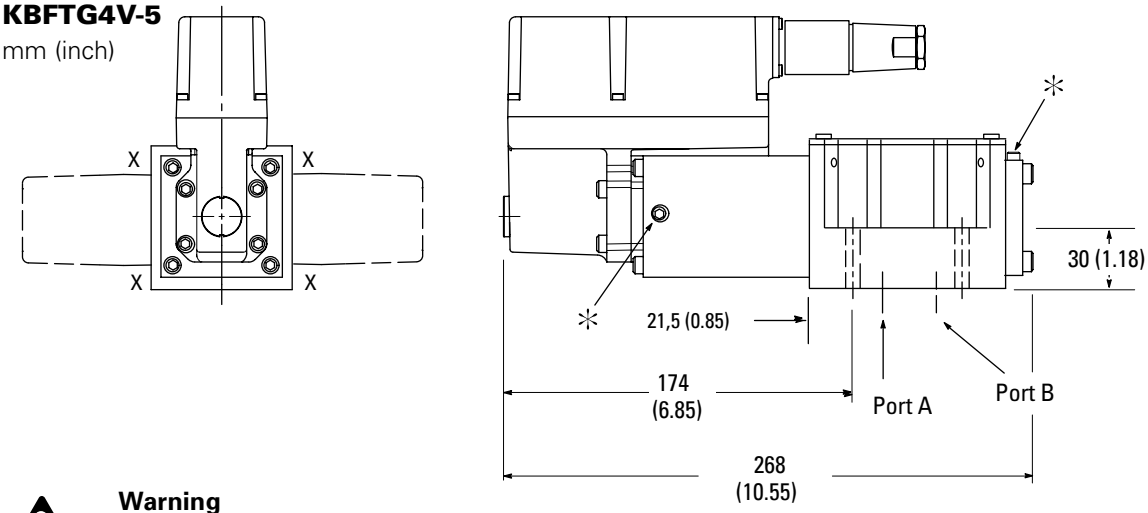
KBFDG4V-5

mm (inch)



KBFTG4V-5

mm (inch)



Warning

Valves with integral amplifiers are supplied with or without the metal 7-pin plug. The Eaton 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.

***** Bleed screw locations Air bleed, Socket Head Cap Screw.

Torque to 2,5-3,0 Nm (2.0-2.5 lbf ft)

Subplates and Mounting Surfaces

General Description

If 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 ± 0,2 mm (±0.008") except where otherwise stated. ISO 4401 specifies inch conversion to ± 0.01".

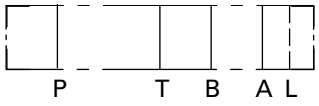
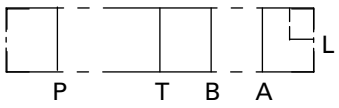
Conversion for Metric

ISO 4401 gives dimensions in mm. Inch conversons are accurate to 0.01" unless othewise stated.

Mounting Bolt Tapping

ISO 4401 gives metric thread tappings. Alternate UNC tapping are Eaton's recommendations that allow these plates and associated valves to be used up to their maximum pressures, when using Eaton 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.

Subplates

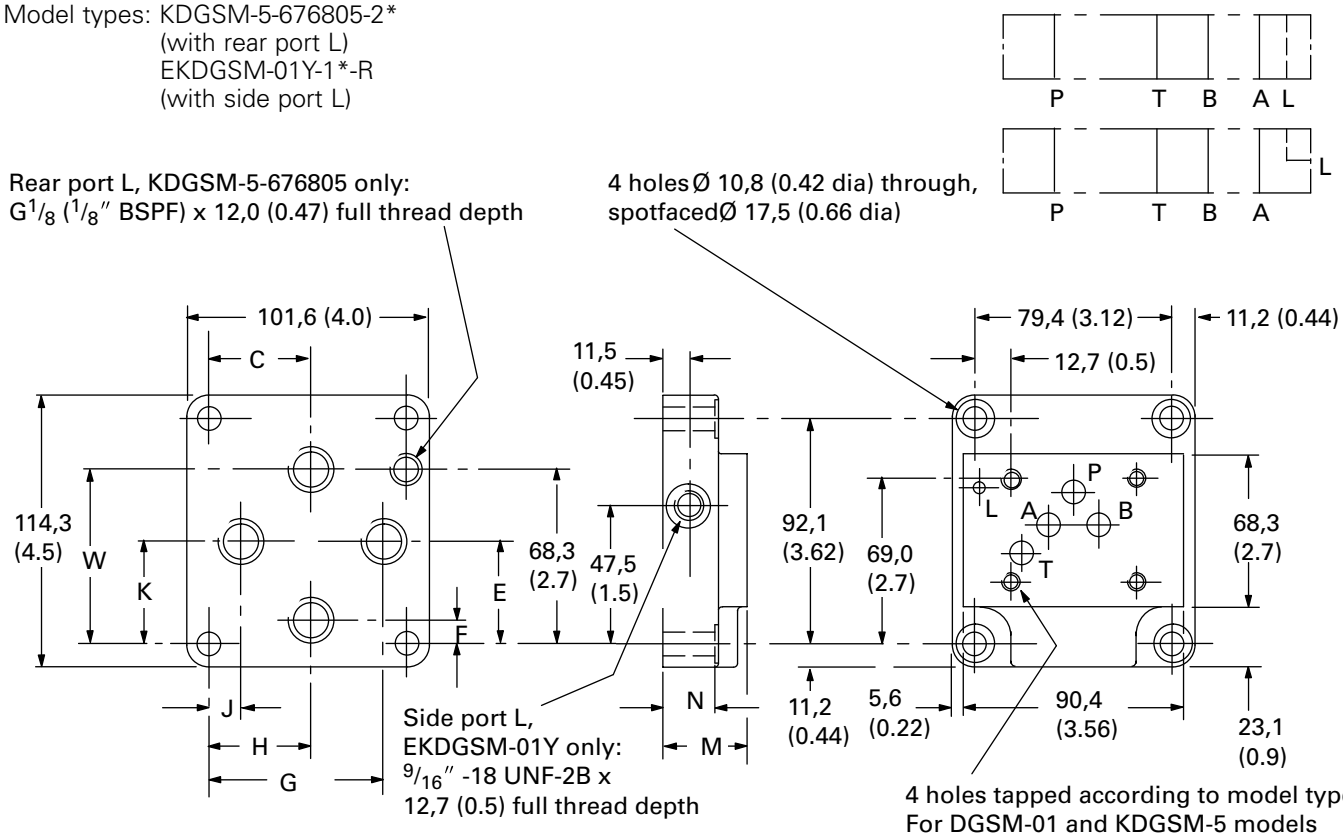
Description and Mass kg (lb)	Fucntional Symbol	Model Code	Max. Pressure
Single-station subplate; rear ports P, T, A, B; side port L		KDGSM-5-67805-20 (SAE/UNF ports)	210 bar (3000 psi)
Cast iron 1,3 (2.9)		KDGSM-5-615225-10 1/2" BSPF ports	315 bar (4500 psi)
		KDGSM-5-615226-10 3/4"BSPF ports	
		EKDGSM-01Y-10-R	280 bar (4000 psi)

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)



Port Threads

Ports P, T, A, B Threads	Ports P, T, A, B Threads
Model	**Port thread**
210 bar (3000 psi) KDGSM-5-676805-2*	3/4 -16 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)	45,2	42,1	19,0	68,3	45,2	23,8	42,1	31,8	23,9	57,1
KDGSM-5-676805-2*	(1.78)	(1.66)	(0.75)	(2.69)	(1.78)	(0.94)	(1.7)	(1.25)	(0.94)	(2.25)
280 bar (4000 psi)	39,7	40,5	9,9	70,6	69,7	10,7	40,5	36,5	28,6	72,6
EKDGSM-01Y-1*-R	(1.56)	(1.56)	(0.39)	(2.78)	(1.56)	(0.42)	(1.59)	(1.44)	(1.13)	(2.86)

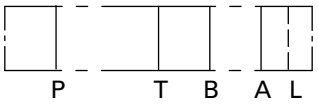
Installation Dimensions

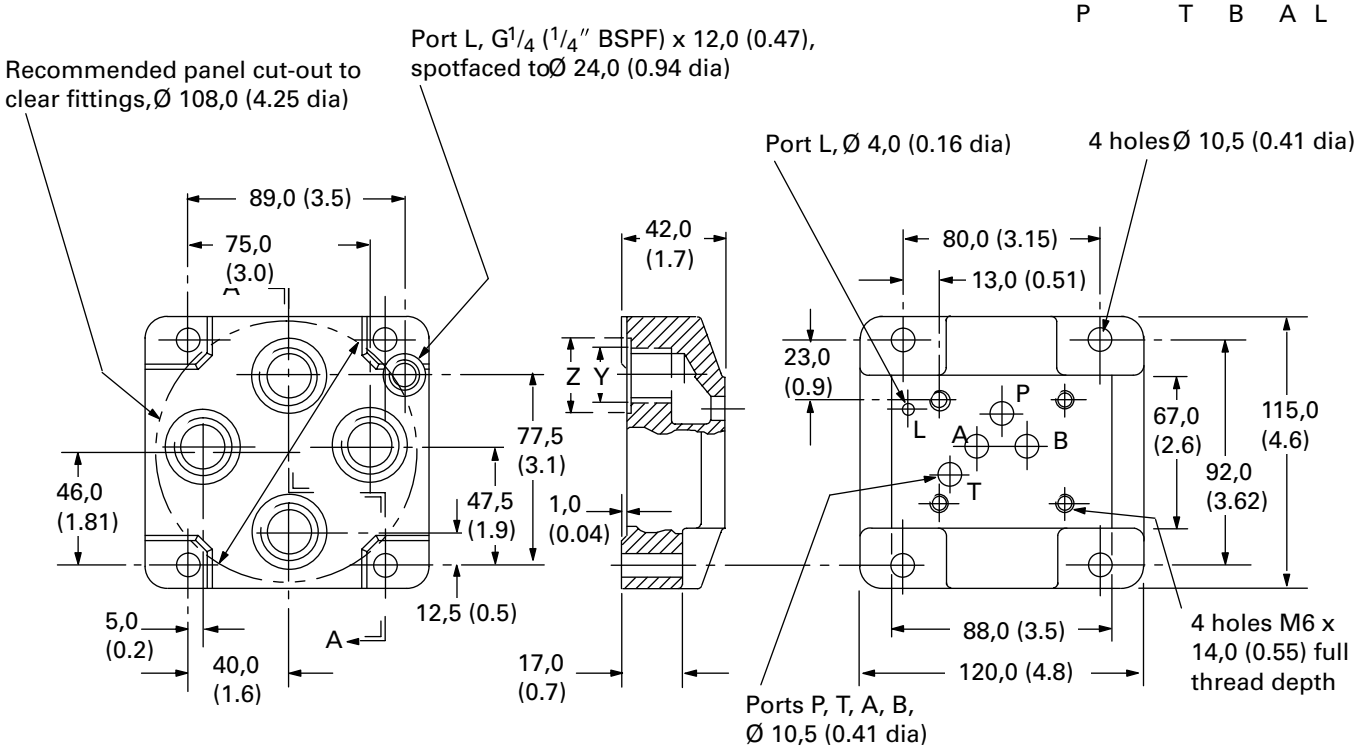
Subplates with Rear Ports P, T, A, B, L

Maximum Pressure 315 bar (4500 psi)

Model types: KDGSM-5-615225-1*
KDGSM-5-615226-1*

All dimensions in mm (inches)





Part Section A-A

Ports P, T, A, B

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

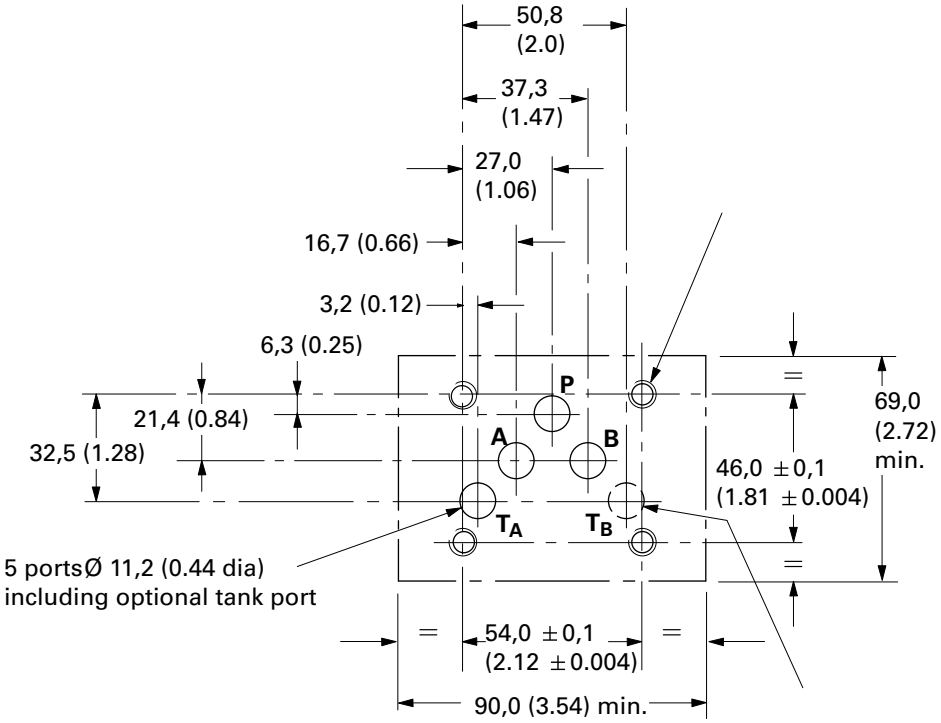
Installation Dimensions

Mounting Surfaces to ISO 4401 (Size 05)

This interface conforms to:

ISO 4401-05-04-0-05

ANSI/B93.7M (and NFPA) size 05



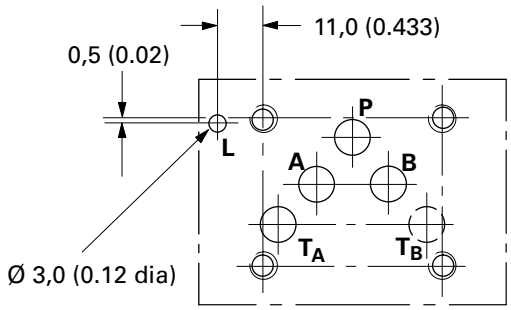
Interface with Additional Drain Port

The interface conforms to ISO 4401-05-06-0-05

Typically used for proportional and other valves requiring an additional drain port, e.g.:

K(B)FDG4V-5

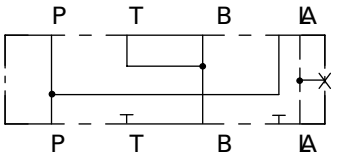
K(B)FTG4V-5



Parallel Path Flow Module

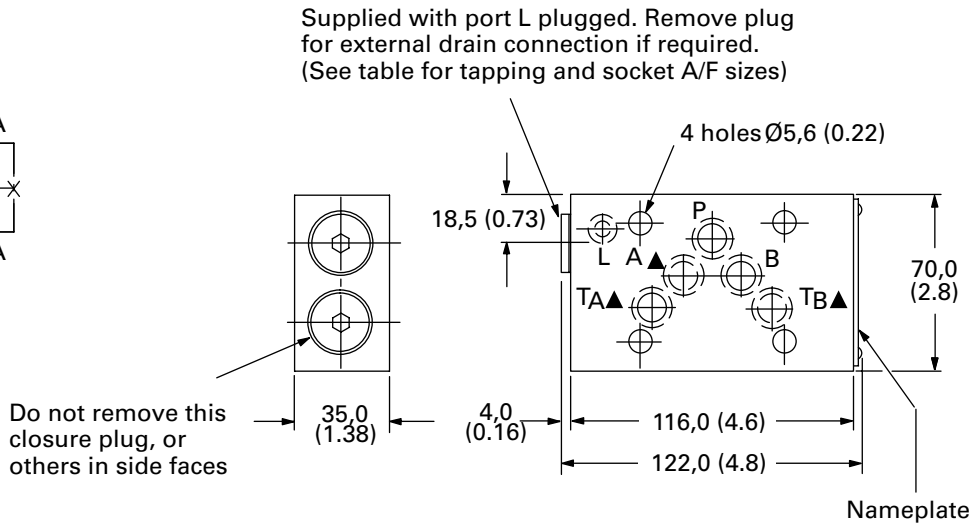
Size 05
Parallel-Flow-Path Modules

KDGMA-5-616877-1*-R
KDGMA-5-02-139150-1*-S



Typically used for doubling effective flow capability of single solenoid proportional valves (throttle valves), as illustrated in "Typical Applications'.

▲ A, T_A and T_B ports at subplate face are blind holes fitted with O-seals.

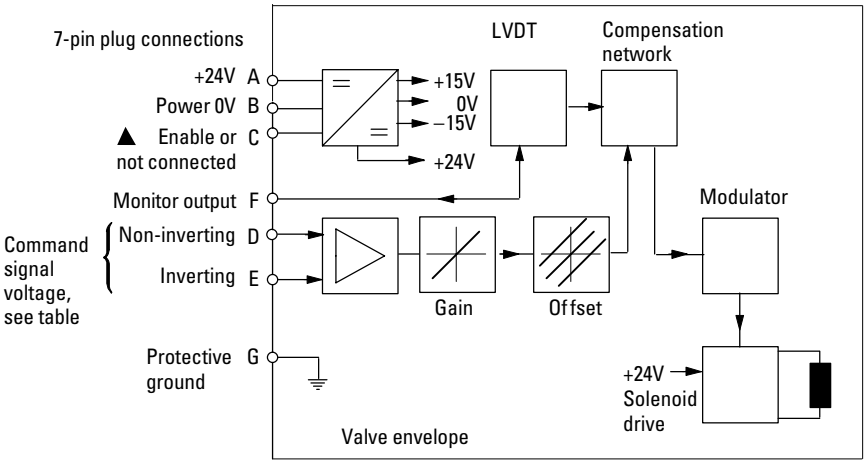


Model	Port L Thread	Socket Wrench A/F for Plug Removal	Mass (approx)
KDGMA-5-616877-1*-R	G1/4 (1/4" BSPF) x 11,0 (0.43) full thread depth	6,0 (0.23)	1,5 kg (3.3 lb)
KDGMA-5-02-139150-1*-S	9/16"-18 UNF x 12,7 (0.5) full thread depth	6,3 (0.25)	1,5 kg (3.3 lb

Max. Pressures and Flow Ratings

No functional limitations; dependent on valves used.

Block Diagram
Voltage Input (M1)
KBFDG4V-5



▲ Pin C is used for a valve enable signal with electrical connections PH7 and PR7.

KBFDG4V-5 Wiring

Connections must be made via the 7-pin plug mounted on the amplifier. See page 15 of this leaflet and Eaton's Installation Wiring Practices for Vickers® Electronic Products, leaflet 2468.

Recommended cable sizes are:

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 seven 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.

KFDG4V-5 Wiring

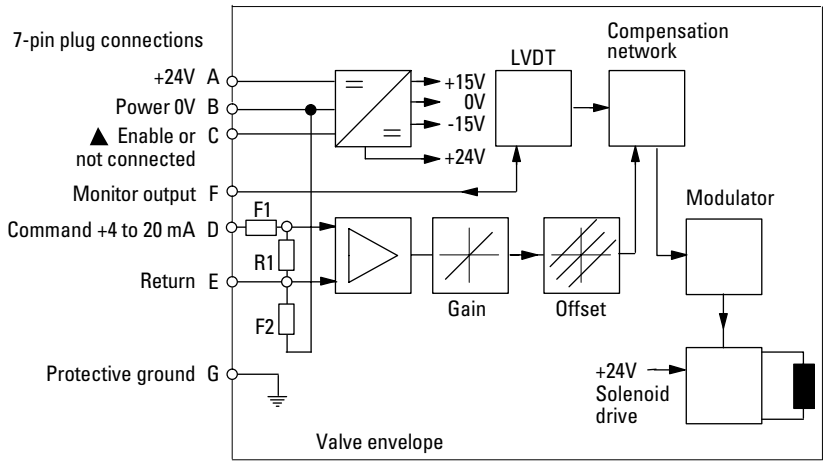
Wiring details for these valves are contained in the appropriate Eurocard literature and Eaton's Installation Wiring Practices for Vickers® Electronic Products leaflet 2468.

Command Signals and Outputs, M1

7-pin plug Flow direction		
Pin D	Pin E	
Positive	OV	
OV	Negative	P to A
$U_d - U_e$ = Positive		
Negative	OV	
OV	Positive	P to B
$U_d - U_e$ = Negative		

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

Block Diagram
Current Input (M2)
KBFDG4V-5



▲ Pin C is used for a valve enable signal with electrical connections PH7 and PR7.

R1 shunt resistor 100R

F1, F2 resettable fuse

KBFDG4V-5 Wiring

Connections must be made via the 7-pin plug mounted on the amplifier. See page 15 of this leaflet and Eaton's Installation Wiring Practices for Vickers® Electronic Products, leaflet 2468.

Recommended cable sizes are:

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 seven 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.

Command Signals and Outputs, M2

7-pin plug			
Pin D	**Pin E**	**Pin B**	**Flow direction**
More than 12 mA	Current return	Power ground	P to A
Less than 12 mA	Current return	Power ground	P to B

KFDG4V-5 Wiring

Wiring details for these valves are contained in the appropriate Eurocard literature and Eaton's Installation Wiring Practices for Vickers® Electronic Products leaflet 2468.

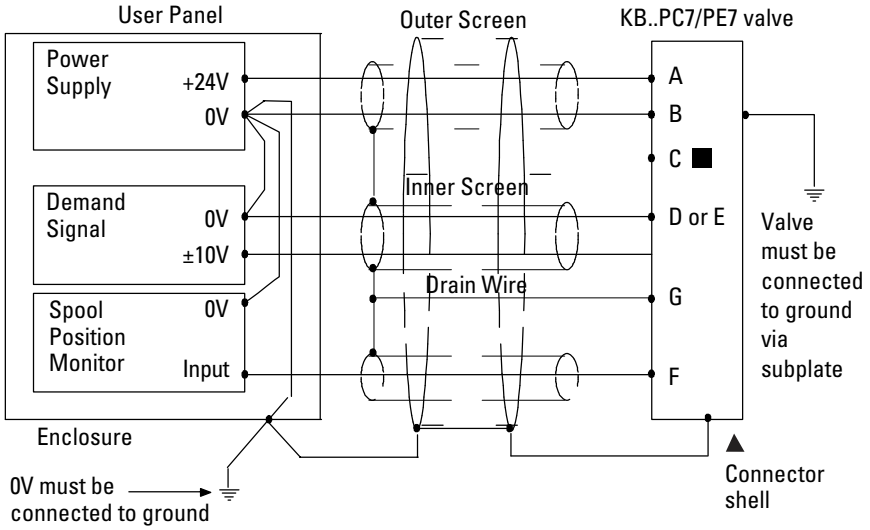
WARNING

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

Wiring Connections Voltage Input (M1)

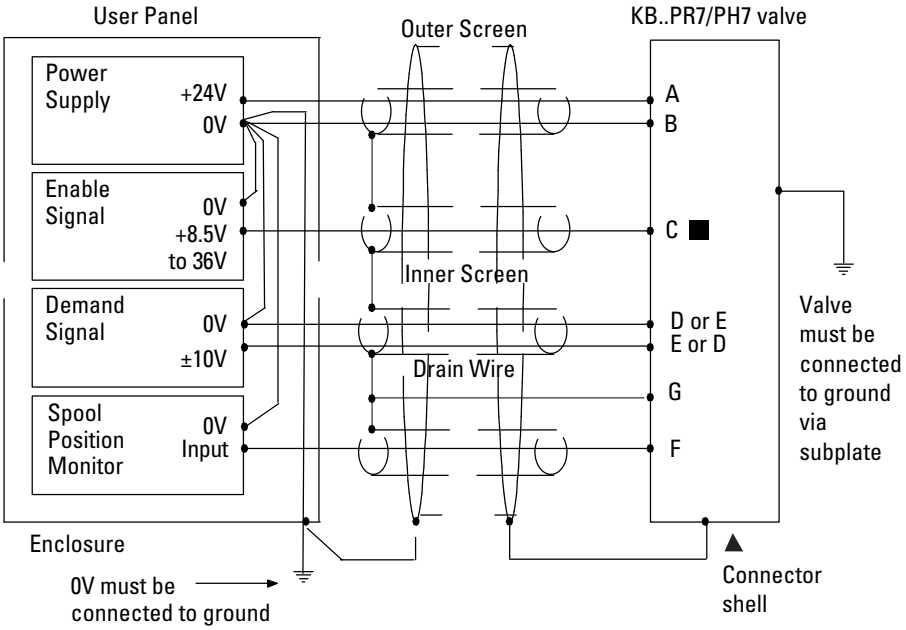
■ Spool position monitor voltage (pin F) will be referenced to the KB valve local ground.

WARNING
Do not ground pin C.



Wiring Connections for M1 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.



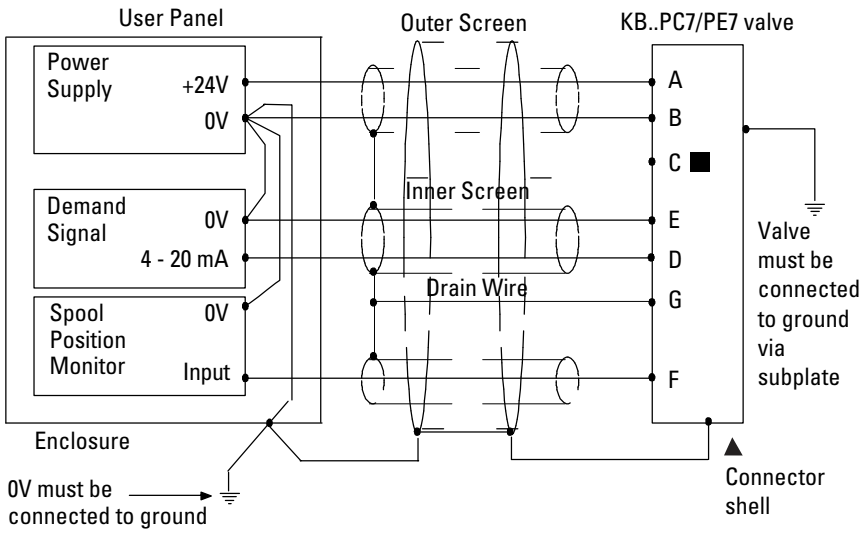
Wiring Connections Current Input (M2)

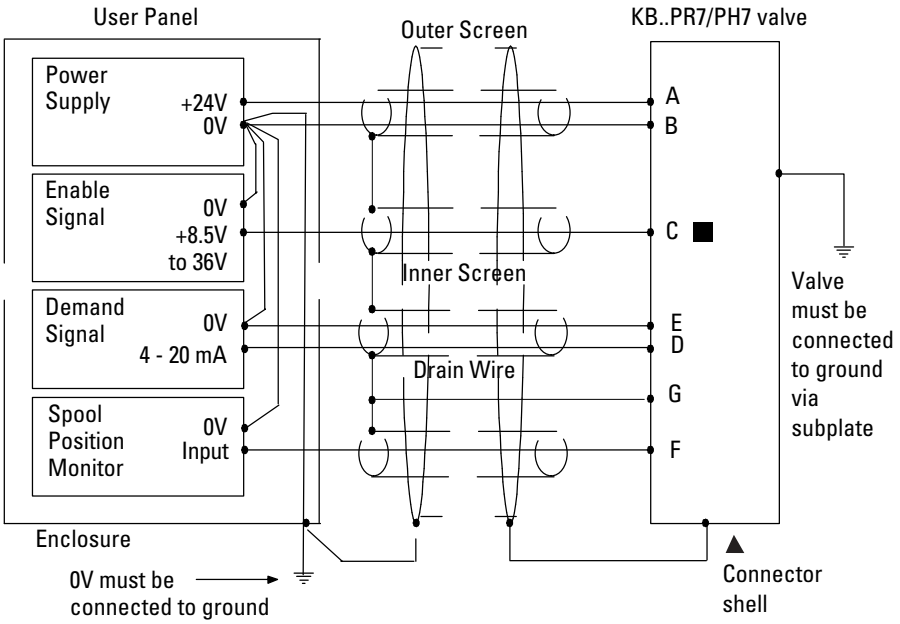
■ Spool position monitor voltage (pin F) will be referenced to the KB valve local ground.

WARNING
Do not ground pin C.

Wiring Connections for M2 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.

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 Eaton's publication 9132 or 561, "Vickers Guide to Systemic Contamination Control". The book also includes information on the Eaton's 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

Eaton 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). 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, 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 K(B)FD/TG4V-5

BKDG01633M (metric)

BK869705 (inch)

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

Seal Kits

KFD/TG4V-5 565110

KBFD/TG4V-5-1* 02-332751

Plugs

KBFDG4V

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.

KFDG4V

Solenoid (black) 710775

Solenoid (gray) 710776

LVDT (gray) 458939

Extension Cable

Extension Cable: Adapter for extending seven 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 Eaton 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.

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Powering Business Worldwide

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Eaton Servo-Performance Proportional Directional Valve

AxisPro™

KBS*-5 10 Series

Powering Business Worldwide

Contents

Introduction

General Description 3

Typical Section View 3

Model Code 4

Spool Sleeve Details 6

Spool Data 8

Spool/Sleeve Combinations 9

Performance Curves 10

Operating Data 12

Software Information 15

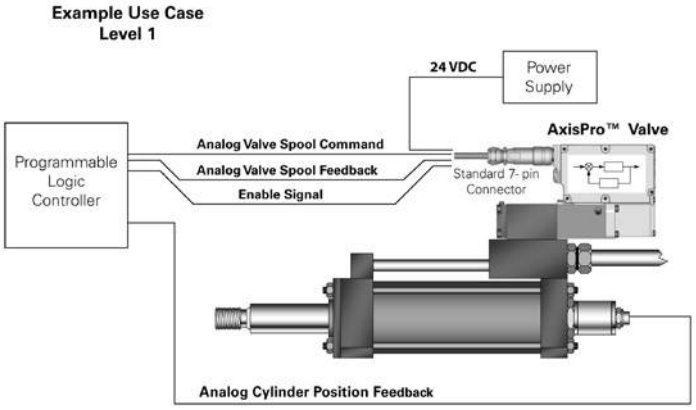
Electrical Information 16

Installation Dimensions 20

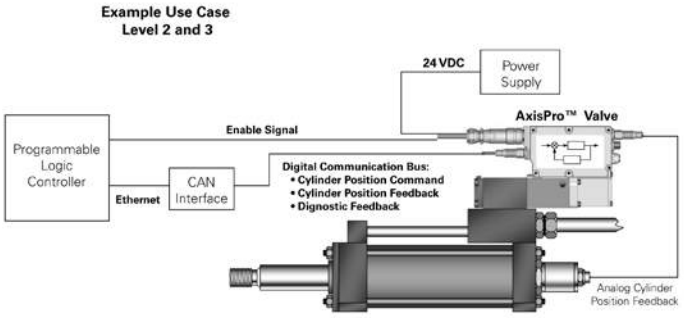
Mounting Surfaces 22

Application Data 23

AxisPro is a game changing machine control valve. Its embedded intelligence simplifies traditionally complex control practices. Plug and play design reduces machine build time, and its ability to predict potential maintenance issues increases machine reliability.



AxisPro level 1 valves, such as KBS1-5 (ISO size 5), can be used to control machine motions in open loop or closed loop control applications. The valve receives its analog command input on the 7-pin, main, connector from an external axis control device.



AxisPro level 2 or level 3 valves, such as KBS2-5(or KBS3-5 with sensors), can be used to control machine motion in open or closed loop control applications. The valve can receive its analog command input on the 7-pin connector from an external axis control device or, with the available on-board motion control feature activated (via Eaton Pro-FX Configure), can close the external control loop around the actuator on the valve (taking feedback signal from cylinder or motor) – eliminating the separate motion controller. In this case the AxisPro valve receives a position, speed or force command and will create its own valve command needed to comply with the requested machine motion. In addition, digital communications over the CANopen bus is available for machine control or monitoring purposes.

Introduction

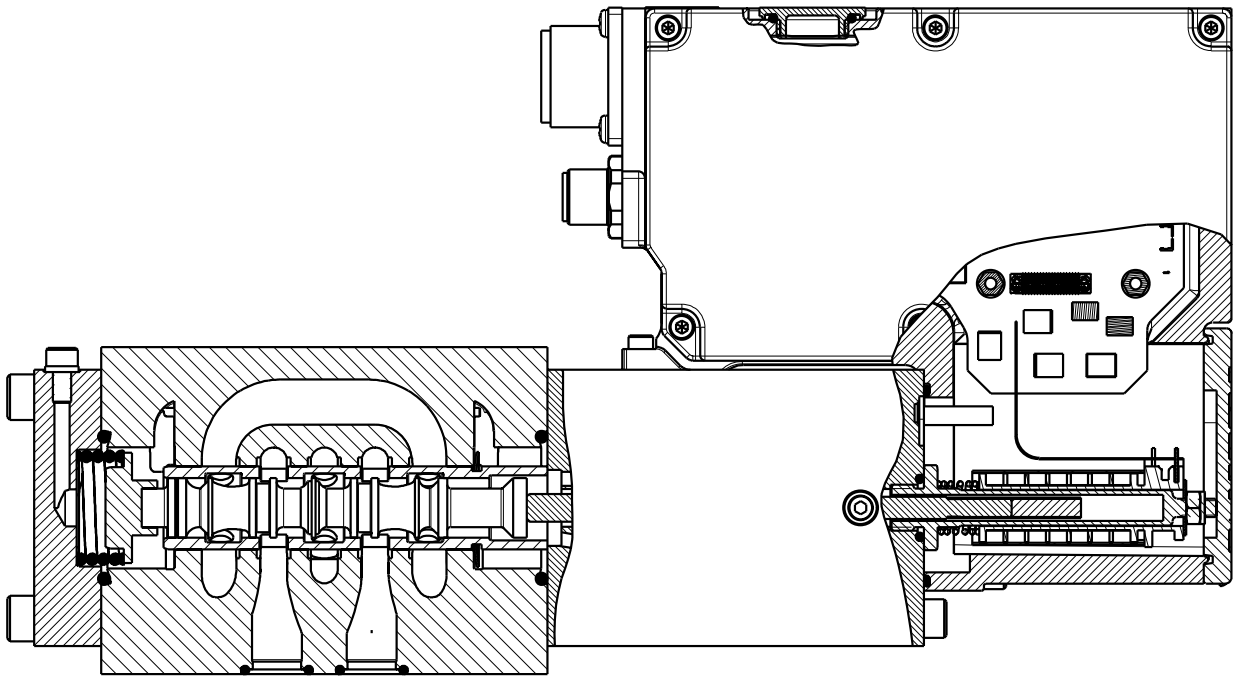
General Description

Built on the proven KBS servo Proportional Valve technology, Eaton' s new AxisPro™ Proportional Valve provides a range of controls capability in a modular design. These four-way solenoid operated proportional valves offer high dynamic performance which enables them to be used in closed-loop control applications previously only possible using servo valves. Best-in-class ingression protection rated to IP65 and IP 67, combined with up to 85C (185F) ambient temperature allows operation in demanding environments.

Unique benefits from AxisPro

Reliable, extended uptime is enabled by valve and systems diagnostics capability. LED lens provides on-valve diagnostics information for level-1, 2 and 3 valves. Access to systems and machine health data can be made available via CANopen networked valves and systems data collected from external sensors input to level-2 valves, or from integrated sensors on level-3 valves featuring pressure sensors in A, B, P and T ports along with temperature data sensed from the T-port.

Leverage inventory of AxisPro valves by configuration through software. One valve SKU can serve multiple needs: Level-1 valves can be configured via Eaton's Pro-FX™ Configure software tool for optional command signal: Voltage or current, as well as activating the "enable"-pin. Level-2 and 3 valves can also have CAN bus activated and control modes selected and configured: VSC for valve-spool control, or for axis-control drive modes: DPC Cylinder position control, DSC Speed control, DFP Force/Pressure control, DPQ Pressure/Flow control. User applications can be developed in Eaton's Pro-FX Control software tool, which is based on the popular CODESYS development environment. This feature is available option on level-2 and 3 valves allowing the use of pre-developed motion control blocks from Eaton's Pro-FX Control library or custom developed solutions that can be loaded into a "white space" reserved in the on-board controller memory.



KBS1-5

Model Code

KBS1 - 5 - ** - NS - ** - * - NS - 001 - 10

1 2 3 4 5 6 7 8 13 14 15

1 **Valve Type**

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

2 **1 –** Level 1

3 **Interface**

5 – ISO 4401, size 05-04-0-05 ANSI/B93.7M-D05

4 **Spool/Sleeve**

1 – Symmetric -100ℓ/min - At Failsafe -all ports blocked (legacy 92L100)
2 – Symmetric - 80ℓ/min - At Failsafe -all ports blocked (legacy 92L80)
3 – Symmetric - 50ℓ/min - At Failsafe -all ports blocked (legacy 92L50)
4 – Symmetric - 25ℓ/min - At Failsafe -all ports blocked (legacy 92L25)
5 – Symmetric -100ℓ/min - At Failsafe -P port blocked, A,B,T connected (legacy 96L100)
6 – Symmetric - 80ℓ/min - At Failsafe -P port blocked, A,B,T connected (legacy 96L80)
7 – Symmetric - 50ℓ/min - At Failsafe -P port blocked, A,B,T connected (legacy 96L50)
8 – Symmetric - 25ℓ/min - At Failsafe -P port blocked, A,B,T connected (legacy 96L25)
17 – Asymmetric -100ℓ/min A; 70ℓ/min B - At Failsafe -all ports blocked (legacy 92L100N70)
18 – Asymmetric -100ℓ/min A; 50ℓ/min B - At Failsafe -all ports blocked (legacy 92L100N50)
19 – Asymmetric -100ℓ/min A; 25ℓ/min B - At Failsafe -all ports blocked (legacy 92L100N25)
20 – Asymmetric - 50ℓ/min A; 25ℓ/min B - At Failsafe -all ports blocked (legacy 92L50N25)
21 – Asymmetric -100ℓ/min A; 70ℓ/min B - At Failsafe -P port blocked, A,B,T connected (legacy 96L100N70)
22 – Asymmetric -100ℓ/min A; 50ℓ/min B - At Failsafe -P port blocked, A,B,T connected (legacy 96L100N50)
23 – Asymmetric -100ℓ/min A; 25ℓ/min B - At Failsafe -P port blocked, A,B,T connected (legacy 96L100N25)
24 – Asymmetric - 50ℓ/min A; 25ℓ/min B - At Failsafe -P port blocked, A,B,T connected (legacy 96L50N25)
25 – 2-gain Symmetric –10ℓ/min @ 40% -100ℓ/min @100%-@Failsafe -all ports blocked (legacy 92L10T100)
26 – 2-gain Symmetric – 5ℓ/min @ 40% - 50ℓ/min @100%-@Failsafe -all ports blocked (legacy 92L05T50)
27 – 2-gain Symmetric –10ℓ/min @ 40% -100ℓ/min @100%-@Failsafe -P port blocked, A,B,T connected (legacy 96L10T100)
28 – 2-gain Symmetric – 5ℓ/min @ 40% - 50ℓ/min @100%-@Failsafe -P port blocked, A,B,T connected (legacy 96L05T50)

5 **Valve Special Feature**

NS – Not Selected

6 **Command Signal**

1 – +/- 10V voltage command signal
2 – +/- 4-20mA current command signal
3 – +/- 10mA current command signal
4 – +/- 15mA current command signal
5 – +/- 20mA current command signal

7 **Monitor Output**

1 – ±10V voltage feedback signal
2 – 4-20mA current feedback signal

8 **Electrical Connection**

C – 7 pin connector without plug
E – 7 pin connector with plug
H – As E but with pin "C" used for enable signal
R – As C but with pin "C" used for enable signal

13 **Electrical Special Feature**

NS – Not Selected

14 **Software Revision**

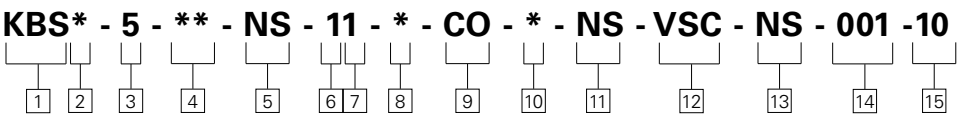
XXX – Software Revision

15 **Design Number**

10 series

To find available product configurations go to www.eaton.com/AxisPro

Model Code



2 **Control Level**

2 – Level 1 plus Network enabled and DS408 control modes

3 – Level 2 plus Integrated pressure and temperature sensors

6 **Command Signal**

1 – +/- 10V voltage command signal

Note: Command signal is shipped with 1 configuration. You may configure to other command signal options using Pro-FX: Configure software.

2 – 4-20mA current command signal

3 – +/- 10mA current command signal

4 – +/- 15mA current command signal

9 – Command over Fieldbus

7 **Monitor Output**

1 – ±10V voltage feedback signal

Note: Monitor Output is shipped with 1 setting. You may configure to other monitor signal options using Pro-FX: Configure software.

2 – 4-20mA current feedback signal

9 – Feedback over Fieldbus

8 **Electrical Connection**

C – 7 pin connector without plug

E – 7 pin connector with plug

Note: You may reconfigure pin "C" as the enable signal using Pro-FX configure software.

9 **Digital Communication Interface**

CO – CANOpen

10 **External Sensor**

A – 4 4-20mA external sensor analog inputs and 2 discrete inputs

D – 1 SSI external digital sensor input

11 **Customer Application Programming Space**

NS – Not Selected

CW – CODESYS White Space

12 **Control Mode**

VSC - Valve spool position control

Note: Control Mode is shipped in valve spool closed loop position control (VSC) configuration. You may reconfigure to other control mode options using Pro-FX: Configure software.

DPC - DS408 Drive Position Control Mode Enabled

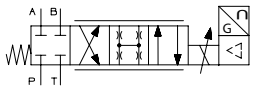
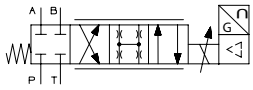
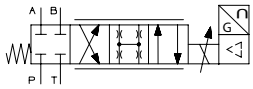
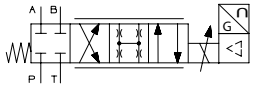
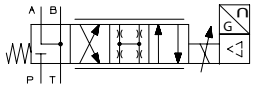
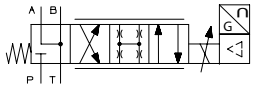
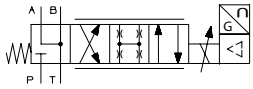
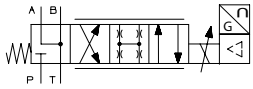
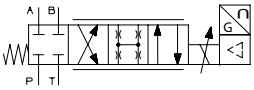
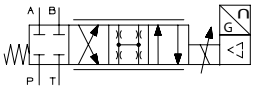
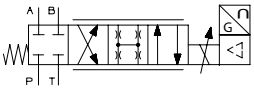
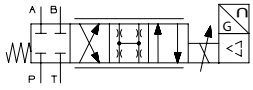
DSC – DS408 Drive Speed Control Mode Enabled

DFP – DS408 Drive Force/Pressure Control Mode Enabled

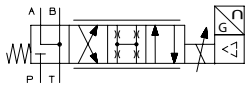
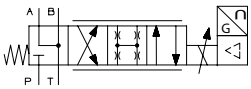
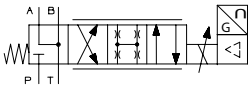
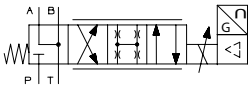
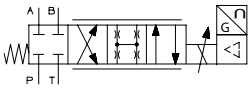
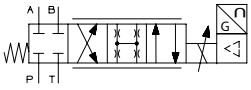
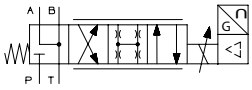
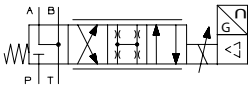
DPQ – Eaton Custom Drive Pressure / Flow Control Mode Enabled

To find available product configurations go to www.eaton.com/AxisPro

Spool Sleeve Details

Spool/Sleeve #	Symbol	Failsafe behavior	Flow ℓ/min@ Δ70 bar	Symmetric	Asymmetric	Single gain	Dual gain	Notes
1		All Ports blocked	100	√		√		
2		All Ports blocked	80	√		√		
3		All Ports blocked	50	√		√		
4		All Ports blocked	25	√		√		
5		P - Blocked A,B,T connected	100	√		√		
6		P - Blocked A,B,T connected	80	√		√		
7		P - Blocked A,B,T connected	50	√		√		
8		P - Blocked A,B,T connected	25	√		√		
17		All Ports blocked	100/70		√	√		
18		All Ports blocked	100/50		√	√		
19		All Ports blocked	100/25		√	√		
20		All Ports blocked	50/25		√	√		

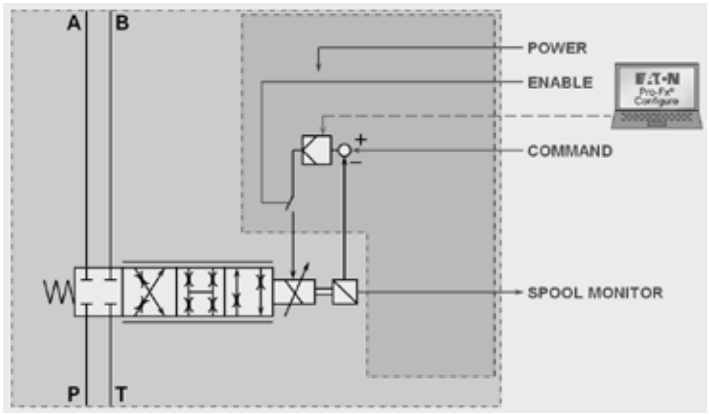
Spool Sleeve Details

Spool/Sleeve #	Symbol	Failsafe behavior	Flow ℓ/min@ Δ70 bar	Symmetric	Asymmetric	Single gain	Dual gain	Notes
21		P - Blocked A,B,T connected	100/70		√	√		
22		P - Blocked A,B,T connected	100/50		√	√		
23		P - Blocked A,B,T connected	100/25		√	√		
24		P - Blocked A,B,T connected	50/25		√	√		
25		All Ports blocked	10 @ 40% 100 @ 100%	√			√	
26		All Ports blocked	5 @ 40% 50 @ 100%	√			√	
27		P - Blocked A,B,T connected	10 @ 40% 100 @ 100%	√			√	
28		P - Blocked A,B,T connected	5 @ 40% 50 @ 100%	√			√	

Spool Data
Spool Symbols

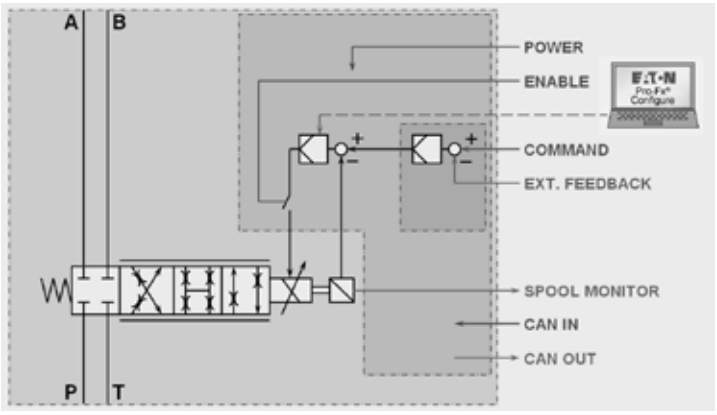
Functional Symbol

Model Type KBS1-5



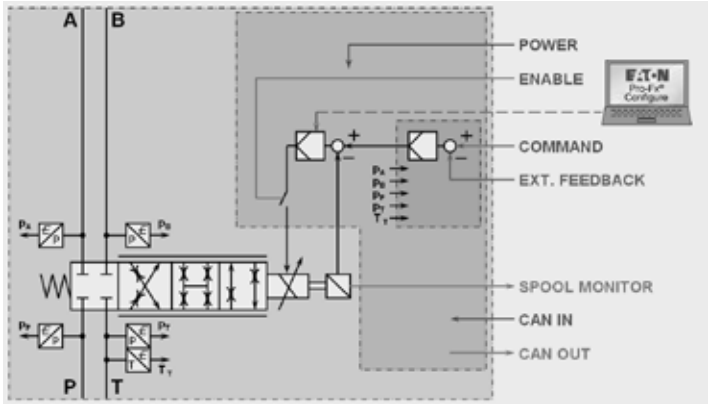
Centralized motion control, relying on external motion controller, not shown in the diagram

Model Type KBS2-5 w/Field 11 = NS



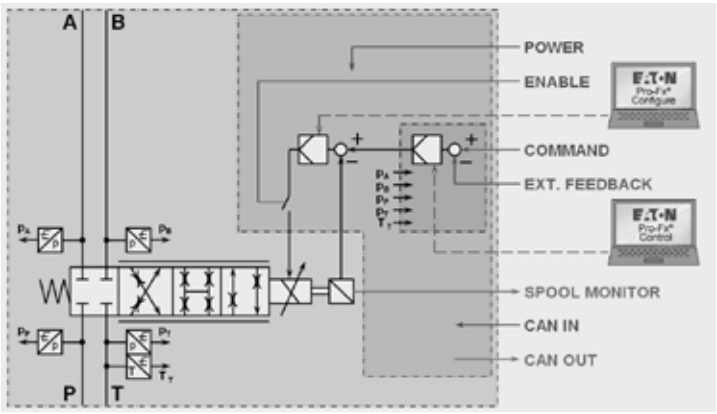
Distributed motion control, taking advantage of the available axis-control function embedded in the valve controller for AxisPro level 2 and 3.Command can be analog via the 7-pin connector or via CANopen using the M12 connections illustrated on page 12.

Model Type KBS3-5 w Field 11 = NS



Level 3 valve integrated pressure sensors can be used for machine health monitoring with data broadcast over the CANopen bus or employed for pressure control in addition to the external motion control illustrated for the level 2 valve.

Model Type KBS3-5 w/Field 11 = CW



Selecting the CW-option allows user specific applications to be developed in Eaton's Pro-FX Control software tool, which is based on the popular CODESYS development environment.

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.

Pressures and Flow Rates

Operating Pressure:
bar (psi)

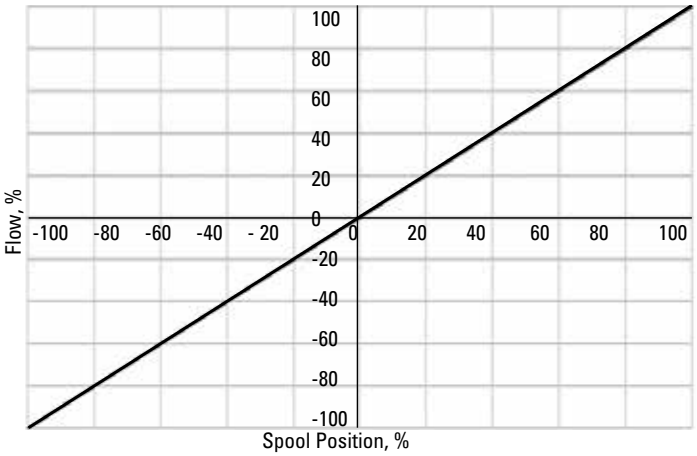
Ports

P,A,B : 350 (5075)
T : 250 (3625)

Spool/Sleeve Combinations
Functional Representation

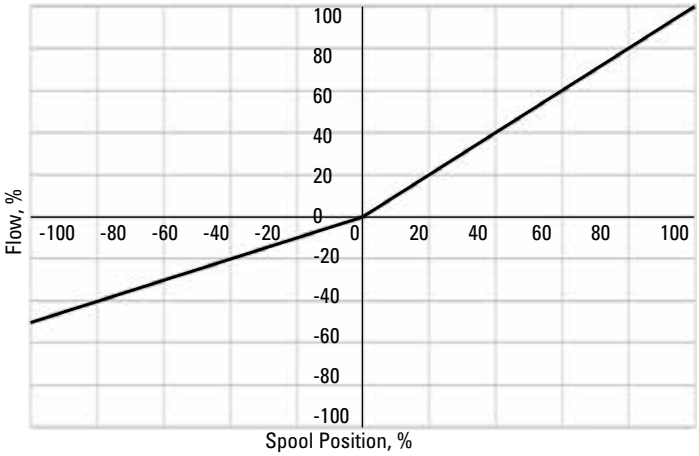
Spool/Sleeve#: 1, 2,3,4,5,6,7,8

Symmetric



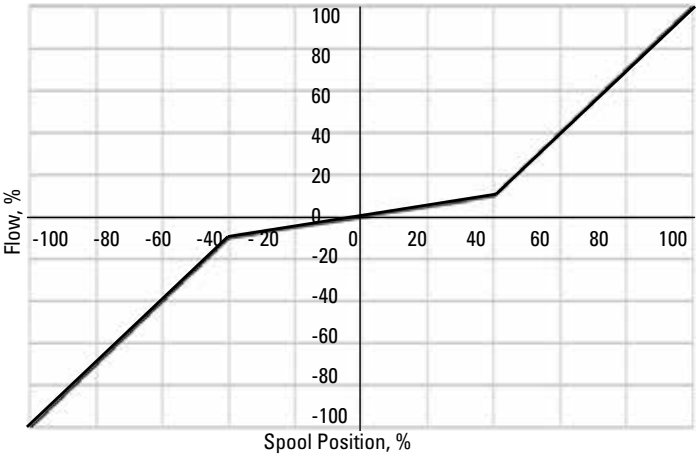
Spool/Sleeve#: 17,18,19,20,21,22,23,24

2:1 Asymmetric



Spool/Sleeve#: 25,26,27,28

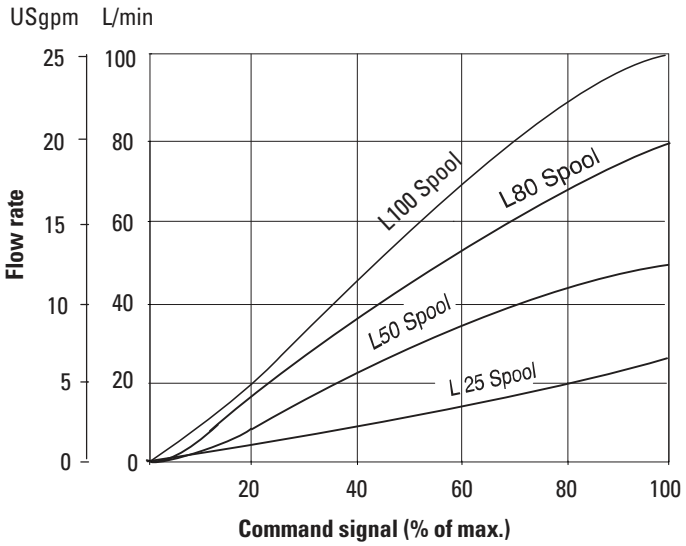
Kink at 40%



Performance Curves

Flow Gain

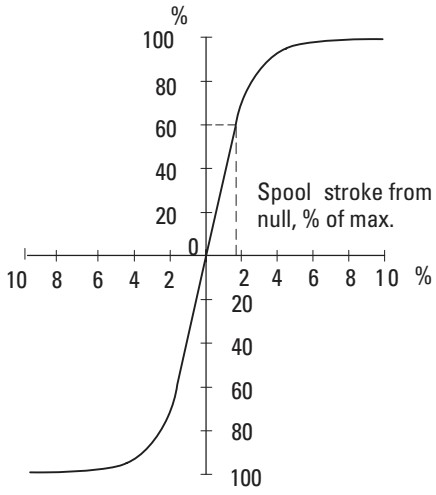
Flow from port P-A-B-T or P-B-A-T at 70 bar (1000 psi) total valve Δp, 35 bar (500 psi) per metering edge



Flow rate, L/min

Pressure Gain

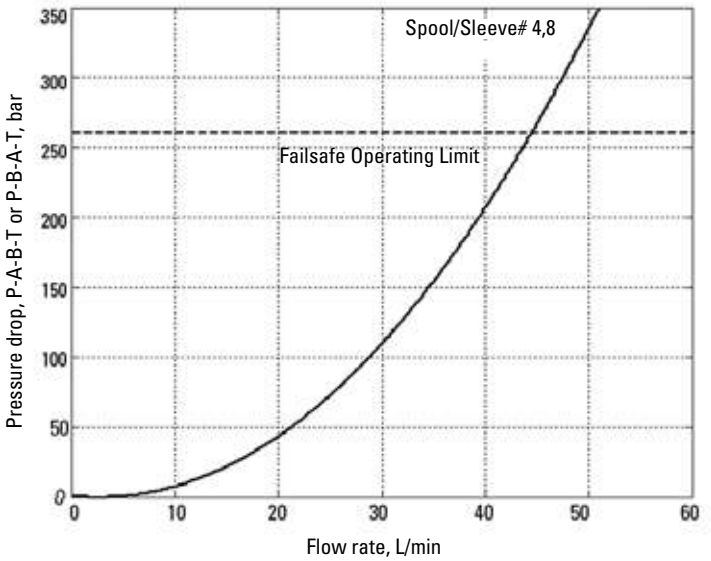
Δp between ports A and B or B and A, as % of port P pressure



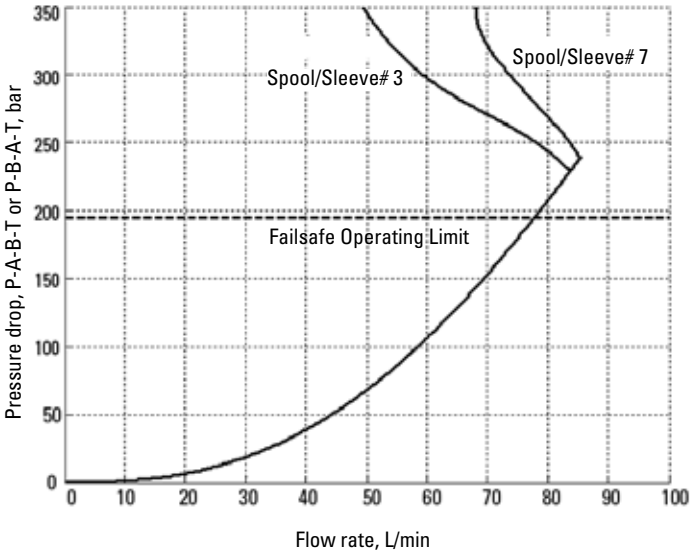
Flow rate, L/min

Power Capacity Envelopes

25 ℓ/min

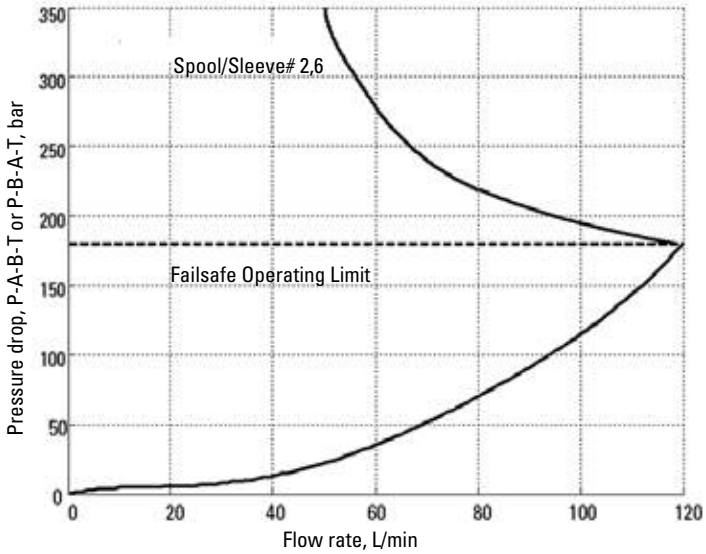


50 ℓ/min

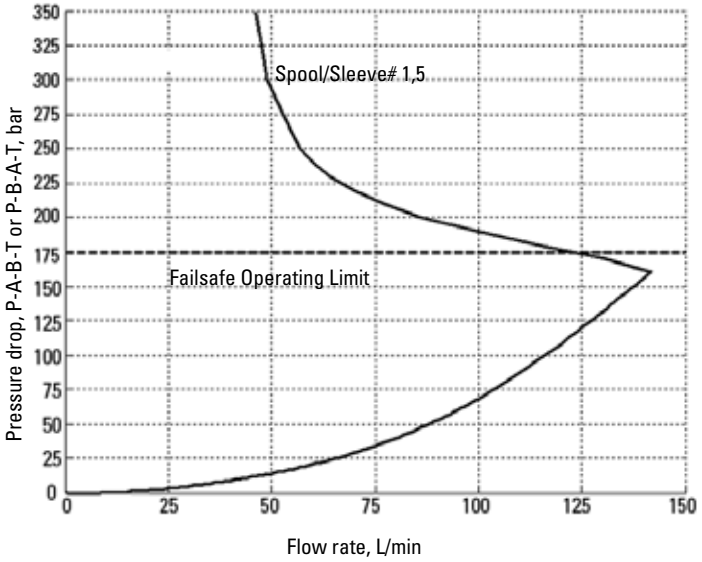


Performance Curves

80 ℓ/min

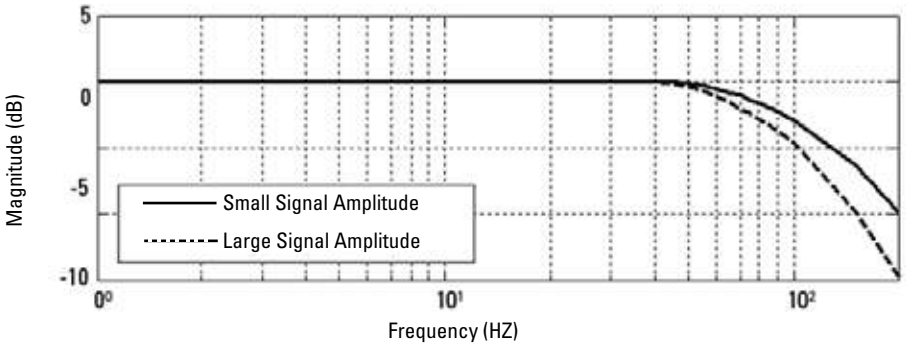


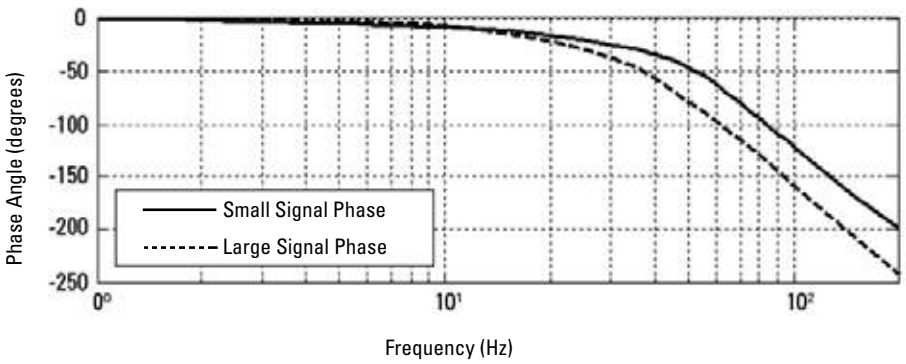
100 ℓ/min



Operating Limit: When operating the valve beyond the operating pressure limit,spool may not return to failsafe when power is removed

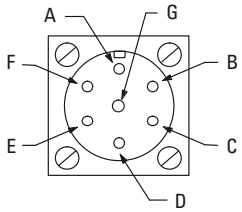
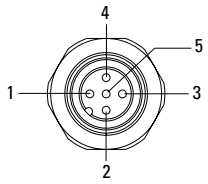
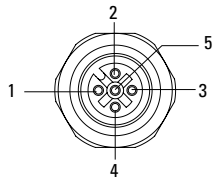
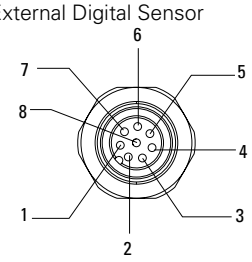
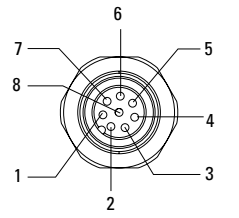
Frequency Response, typical
For amplitudes of +/- 5% with zero offset, +/- 25% with +/- 50% offsets.
Δp (P to T) = 70 bar (1000 psi)





Operating Data

Connector Details

7-pin plug connector 	Pin	Description	Note:
	A	Power supply positive (+)	Present at location 1 of the electronics enclosure (see figure 1 below). To ensure EMI protection use only metal shielded mating connectors. Mating 7-pin (connector) is Eaton part number 934939
	B	Power supply 0V and current command return	
	C	Not connected (Field 8 = C,E)	
	C	Valve enable (Field 8 = H,R)	
	D	Command signal (+V or current in)	
	E	Command signal (-V or current GND)	
	F	Output monitor	
	G	Protective earth	
M12 5-pin CAN Connector (Male) 	Pin	Description	Note:
	1	CAN shield	Present at location 2 and 4 of the electronics enclosure (see figure 1 below). Selection based on model code field number 9, present when CO option enabled. To ensure EMI protection use only metal shielded mating connectors Use only shielded twisted pair (STP) cables for mating connection.
	2	Not Connected	
	3	Power supply 0V	
	4	CAN High	
	5	CAN Low	
M12 5-pin CAN Connector (Female) 	Pin	Description	Note:
	1	CAN shield	Present at location 5 of the electronics enclosure (see figure 1 below). Selection based on model code field number 9, present when CO option enabled. To ensure EMI protection use only metal shielded mating connectors Use only shielded twisted pair (STP) cables for mating connection.
	2	Not Connected	
	3	Power supply 0V	
	4	CAN High	
	5	CAN Low	
M12 8-pin External Digital Sensor 	Pin	Description	Note:
	1	Power supply 0V	Present at location 3 of the electronics enclosure (see figure 1 below). Selection based on model code field number 10, present when D option enabled. To ensure EMI protection use only metal shielded mating connectors 24V to Power supply 0V (pin 2, 1) short circuit protected (max current 1.5 A). Use only shielded twisted pair (STP) cables for mating connection.
	2	+24V Supply	
	3	CLK-	
	4	DATA-	
	5	DATA+	
	6	Not Connected	
	7	CLK+	
	8	Not Connected	
M12 8-pin External Analog Sensor Port 	Pin	Description	Note:
	1	Speed Sensor Input1	Present at location 3 of the electronics enclosure (see figure 1 below). Selection based on model code field number 10, present when A option enabled. To ensure EMI protection use only metal shielded mating connectors 15V to Power supply 0V (pin 4, 6) short circuit protected (max current 500 mA).
	2	Speed Sensor Input2	
	3	4-20mA External Sensor Signal1	
	4	+15V Supply	
	5	4-20mA External Sensor Signal2	
	6	Power supply 0V	
	7	4-20mA External Sensor Signal3	
	8	4-20mA External Sensor Signal4	

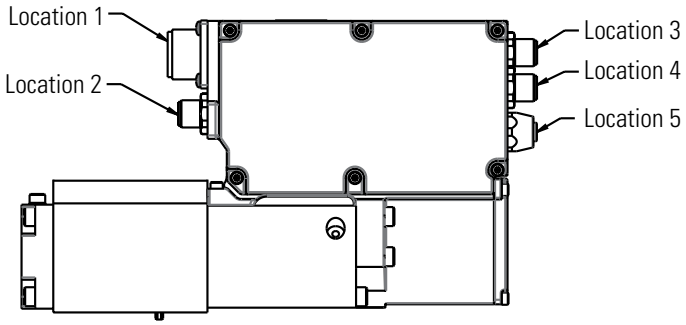
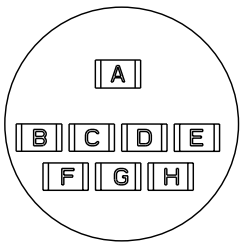


Figure 1

Note: See above for connector plugs specifications.

Operating Data

Data is typical, with fluid at 32 cST (150 SUS) and 40°C (104°F)

Diagnostic		Color A [Green] B [Red] C [Green] D [Red] E [Green]	Description Power CAN Error CAN Run Diagnostic Status
		Note: 1. Figure to the left references the clear plastic window on the top of the valve. 2. LED F will glow as part of general operation.	
Electromagnetic compatibility (EMC):		IEC61326-2-1	
Monitor Points Signal: Voltage mode Current mode Output impedance		 ±10V DC 4 to 20 mA 10 kΩ	
Power stage PWM frequency		20 kHz nominal	
Reproducibility, valve-to-valve (at factory settings): Flow gain at 100% command signal		 ≤5%	
Protection: Electrical		 Reverse polarity protected between pin A and B of the 7 pin plug connector	
Ambient air temperature range for full performance Oil temperature range for full performance		–25°C to +85°C (–13°F to +185°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)	
Power supply		24V DC (18V to 36V including 10% peak-to-peak max ripple) max current 3,7A	
Command Signal: Voltage mode Input impedance Voltage between Pin D and B Voltage between Pin E and B Current mode Max differential voltage to pin E to pin B		 –10V to +10V DC 13 bit resolution, ± 1% Field 6 = 1: 47kΩ, Field 6 = 2,3,4,5: 100Ω Field 6 = 1:18v (max) Field 6 = 1:18v (max) Field 6 = 2,3,4,5: 13 bit resolution based on ±20mA , ±1% Field 6 = 2,3,4,5: 100 mV	
Valve enable signal for model code field 8 = H or R Enable Disable Input impedance		 Disable <6.5V Enable Signal >8.5V (max 36V) 10 kΩ	
Sensor Resolution: External Sensor Port		 4-20 mA: 0-20mA 12 bit resolution ± 1%, 3mA cable break detect, 22mA overcurrent detect. Speed, independent frequency mode: 10Hz to 100 kHz. Speed, incremental count and direction + frequency mode: signed 32bit count, 0 to 100 kHz. Speed, quadrature phase A&B + frequency mode: signed 32 bit count, 0 to 100 kHz. SSI: binary or gray code, 32bits max, adjustable resolution and zero offset.	
Integrated Pressure and Temperature Sensors		Integrated PCB temperature sensor accuracy: ± 2°C For Level 3 valves: Integrated Pressure sensors on all ports Pressure sensors rated to 400bar Integrated Pressure sensors accuracy: ± 0.5% of full scale Bandwidth: >100 Hz Integrated temperature sensor on tank port Accuracy: ± 5°C Bandwidth: ~1 Hz	
Amplifier Temperature Sensing		1°C (1.8°F) resolution, -25°C (-13°F) undertemp detect, 125°C (257°F) overtemp detect	
Power Supply Detect		18-36Vdc, 0.01 V resolution ± 1%, 19V under voltage detect, 36V overvoltage	

Operating Data

KBS*-5 Valves (all valves)	
Relative duty factor	Continuous rating (ED = 100%)
Hysteresis	<0.1%
Mass	5.9 kg (13 lb) approx.
Environmental	IP65 and IP67 rated when using a similarly rated connector Location 2, 3, 4 and 5 connectors have IP65 and IP67 rated shipping covers
Step response:	
Step, % Flow	ms
0% to 100%, 100% to 0%	8.0
10% to 90%, 90% to 10%	8.0
-10% to 10%, 10% to -10%	7.0
25% to 75%, 75% to 25%	7.0
Parts Information:	
Interface Seal Kits	02-414930
Mating Electrical 7-pin Connector	934939

Software Information

KBS1

- Analog commanded spool control.
- Analog command source configuration options.
- Monitor output signal configuration options.
- Enable input signal enable/disable option.

KBS2/KBS3

- KBS1capability.
- Sensor port configuration options. Configurable position, Speed, Pressure, Force and SSI Sensors.
- CANopen DS408 compliant control modes (device options vary per available hardware options).
  - valve spool position control (VPOC/VSC).
  - drive speed control (DSC).
  - drive force/pressure control (DFPC/DFP).
  - drive position control (DPC).
  - drive pressure/flow control (Eaton DPQ).
- CANopen DSP306 compliant electronic data sheet (EDS).
- Diagnostic configuration options.

All levels and models are compatible with the Eaton Pro-FX:
For the latest revision, please visit www.eaton.com/AxisPro

Download Pro-Fx™, Technical Information and Support Materials from Eaton's Website:

http://www.eaton.com/AxisPro

Install the Eaton Pro-Fx™ Configure PC application tool. Installation is supported on a wide range of Windows based operating systems including Windows 7 32 bit and 64 bit.

The Pro-Fx™ configure installation provides several options for PC USB peripheral CANbus adapters supported by the software. During installation the user can choose to install drivers for an available CANbus adapter.

The adapters supported by Pro-Fx™: Configure are:

- PCAN-USB* PEAK-System Technik GmbH (http://www.peak-system.com)
- ValueCAN Intrepid Control Systems, Inc. (http://www.intrepidcs.com)
- Leaf-Light Kvaser AB (http://www.kvaser.com)

* The PCAN-USB adapter is recommended for compatibility with Eaton Pro-Fx: Control development environment used with KBS4DGV-xxx and other Eaton Pro-Fx products.

Block Diagram Voltage Input (Field 6 = 1)

Wiring connections must be made via the 7-pin plug mounted on the amplifier. See page 18 of this leaflet and Eaton's Installation Wiring Practices for Vickers™ Electronic Products, leaflet 2468. Recommended cable sizes are:

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:

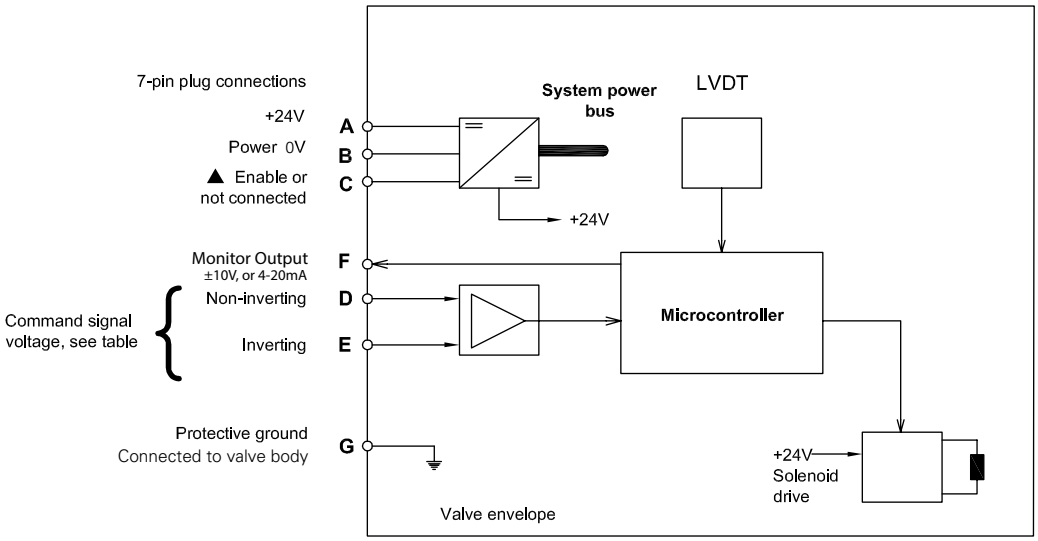
0.50 mm² (20 AWG)

Screen (shield):

A suitable cable would have 7 cores, a separate screen for the signal wires and an overall screen.

Cable outside diameter 8.0 - 10.5 mm (0.31 - 0.41inches)

See connection diagram on page 18.



▲ Pin C is used for a valve enable signal with electrical connections Field 8 = H or R.

Command Signals and Outputs, Field 6 = 1

7-pin plug		Flow direction
Pin D	**Pin E**	
Positive OV $U_D - U_E$ = Positive	OV Negative	P to A
Negative OV $U_D - U_E$ = Negative	OV Positive	P to B

Warning

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

Block Diagram Current Input (Field 6 = 2, 3, 4,5)

Wiring connections must be made via the 7-pin plug mounted on the amplifier. See page 19 of this leaflet and Eaton's Installation Wiring Practices for Vickers™ Electronic Products, leaflet 2468. Recommended cable sizes are:

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:

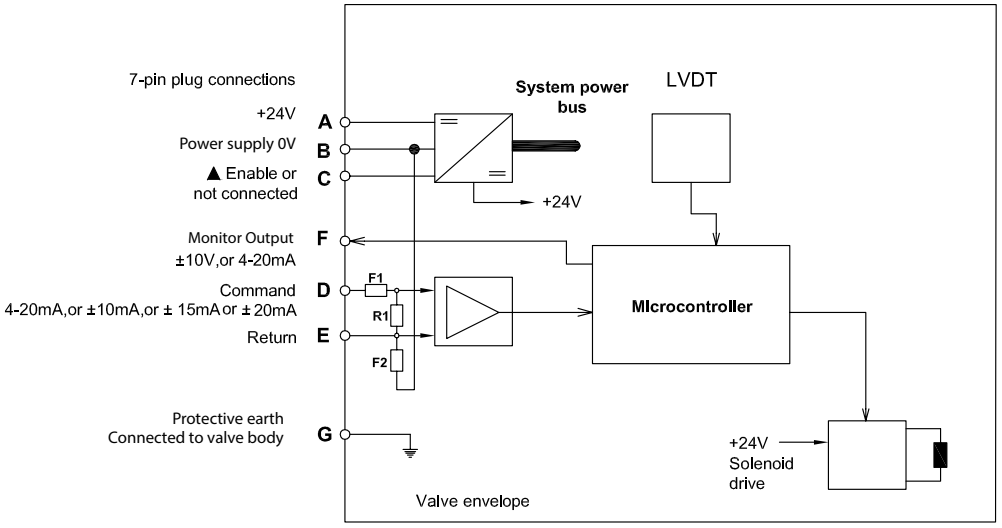
0.50 mm² (20 AWG)

Screen (shield):

A suitable cable would have 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 page 19.



▲ Pin C is used for a valve enable signal with electrical connections Field = H or R

R1 shunt resistor 100R
F1, F2 resettable fuse

Command Signals and Outputs, Field 6 = 2

7-pin plug			
Pin D	**Pin E**	**Pin B**	**Flow direction**
More than 12 mA	Current return	Power ground	P to A
Less than 12 mA	Current return	Power ground	P to B

Command Signals and Outputs, Field 6 = 3,4,5

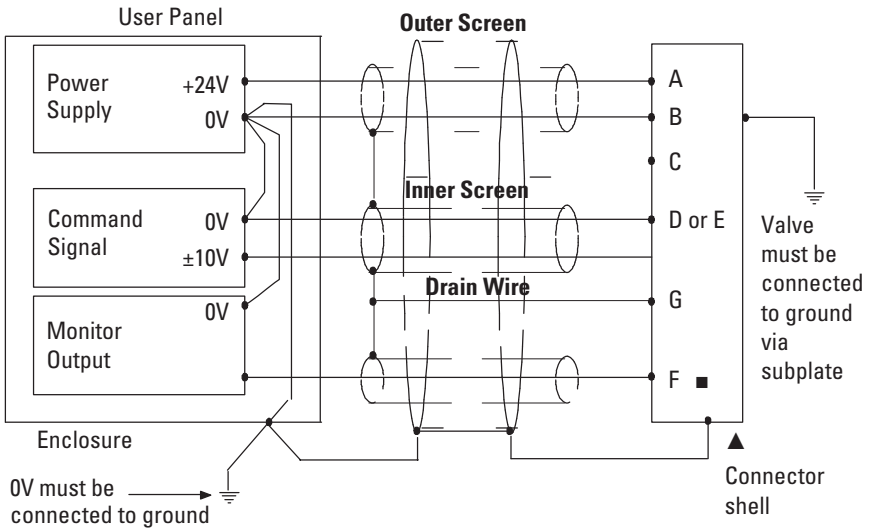
7-pin plug			
Pin D	**Pin E**	**Pin B**	**Flow direction**
More than 0 mA	Current return	Power ground	P to A
Less than 0 mA	Current return	Power ground	P to B

Warning

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

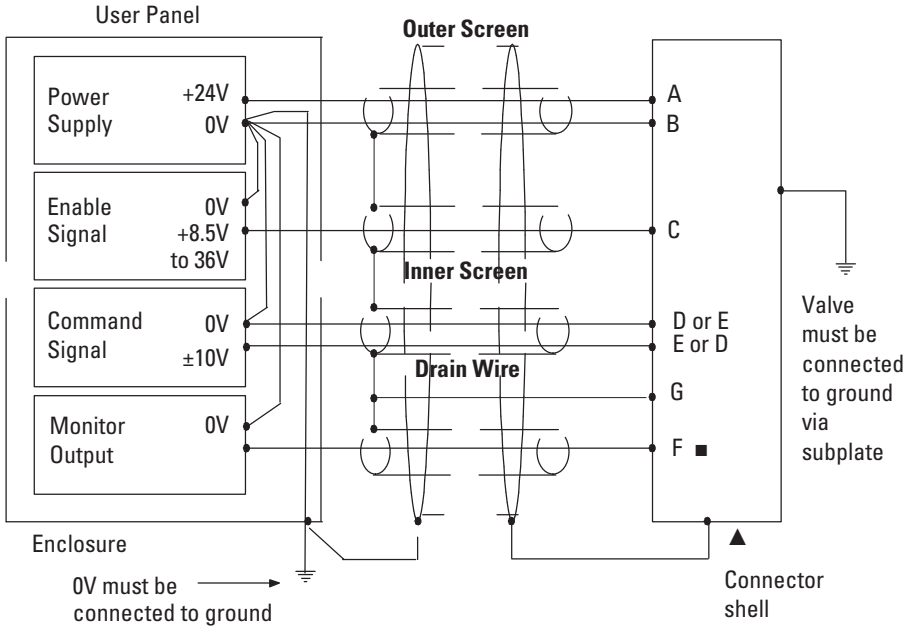
Wiring Connections Voltage Input (Field 6 = 1)

■ Spool position monitor voltage (pin F) will be referenced to the KB valve local ground (pin B).



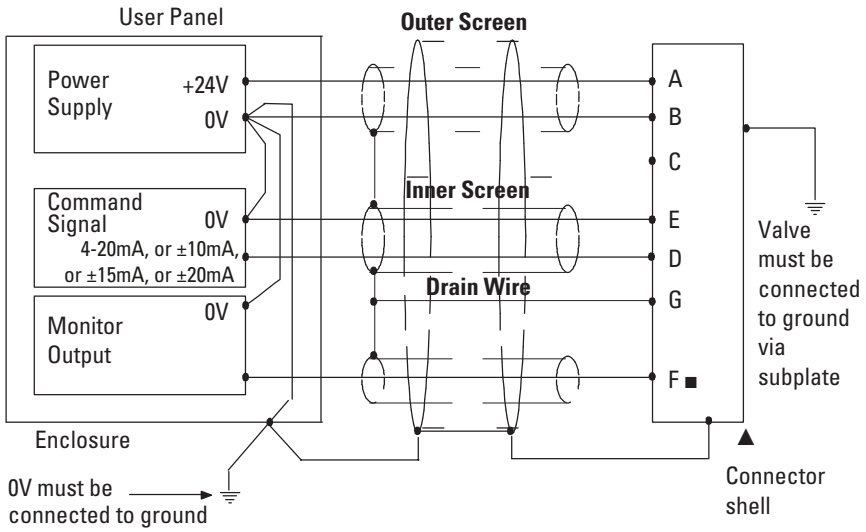
Wiring Connections for Voltage Mode (Field 6 = 1) Valves with Enable Feature

▲ 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.



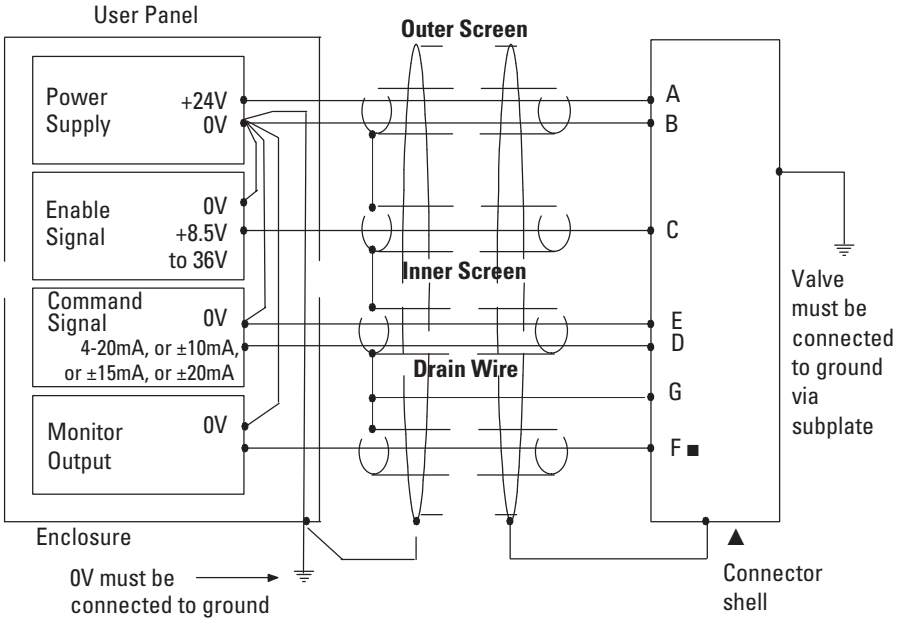
Wiring Connections Current Input (Field 6 = 2, 3, 4, 5)

■ Spool position monitor voltage (pin F) will be referenced to the KB valve local ground (pin B).



Wiring Connections for Current Input (Field 6 = 2, 3, 4, 5) 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 of 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.

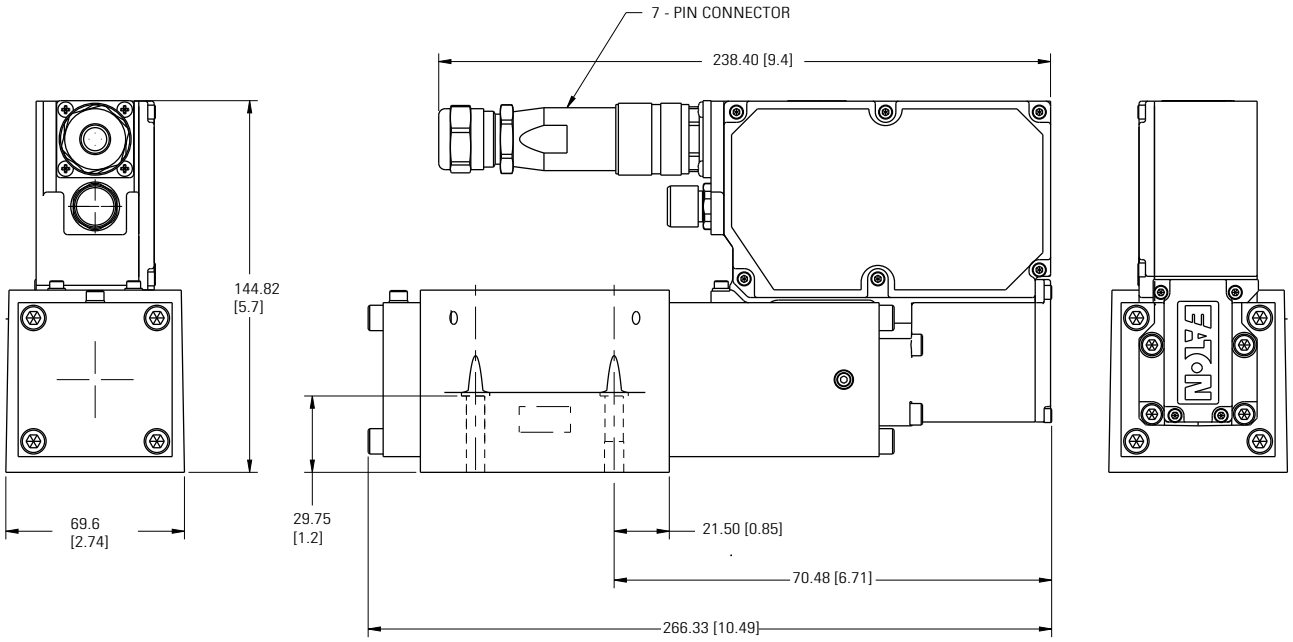
The enable line to pin C should be outside the screen which contains the demand signal cables.

To ensure EMI protection use only metal shielded mating connectors.

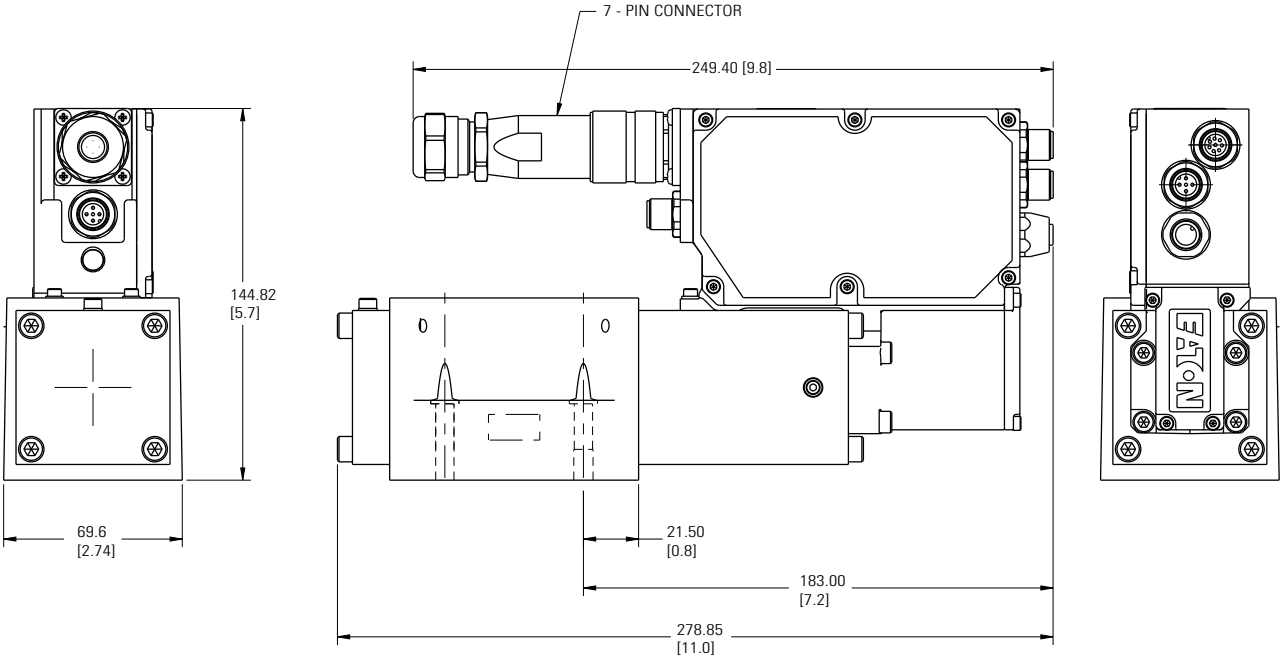
Installation Dimensions

mm (inch)

KBS1-5

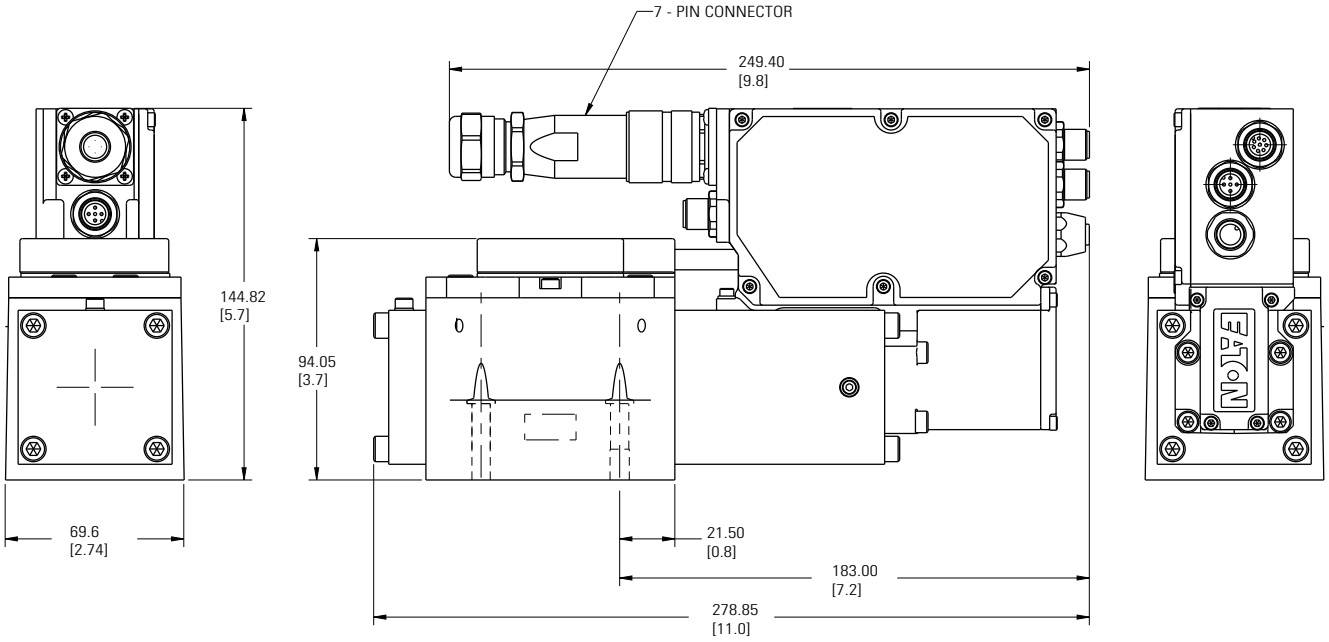


KBS2-5



Installation Dimensions
mm (inch)

KBS-3-5



Mounting Surfaces

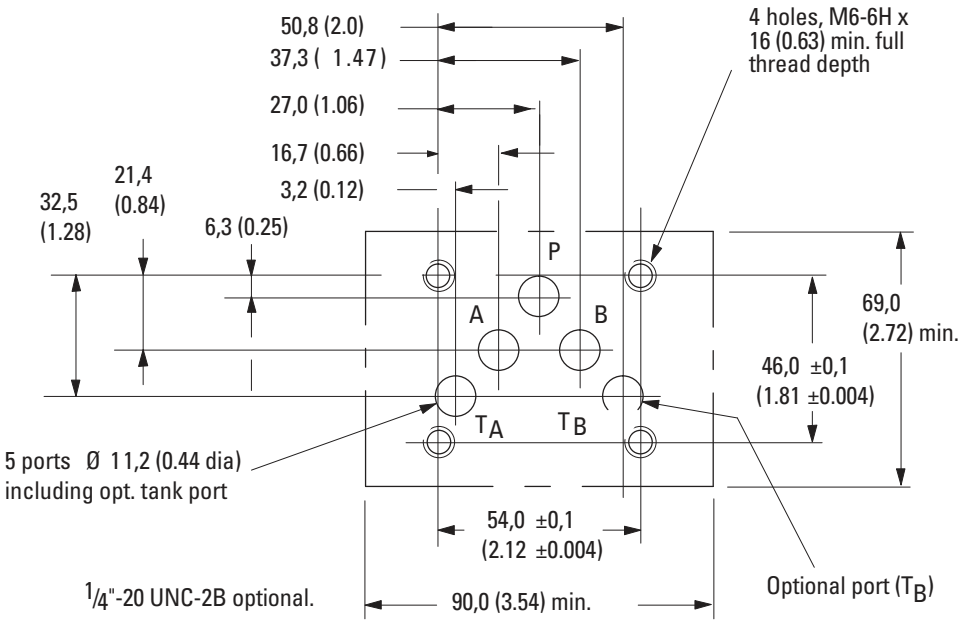
Mounting Surface Interface to ISO 4401 (Size 05)

This interface conforms to:
ISO 4401-05-04-0-05

ANSI/B93.7M (and NFPA) size 05

CETOP R35H4.2-05

DIN 24340 Form A10



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.

The following recommendations are based on ISO cleanliness levels at 2 µm, 5 µm and 15 µm. For products in this catalog the recommended level is:

17/15/12

Eaton 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 aryl phosphate ester. 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.

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 Eaton repair center.

The products will be refurbished as necessary and retested to specification before return. Field repair is restricted to the replacement of the interface seals.

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Powering Business Worldwide

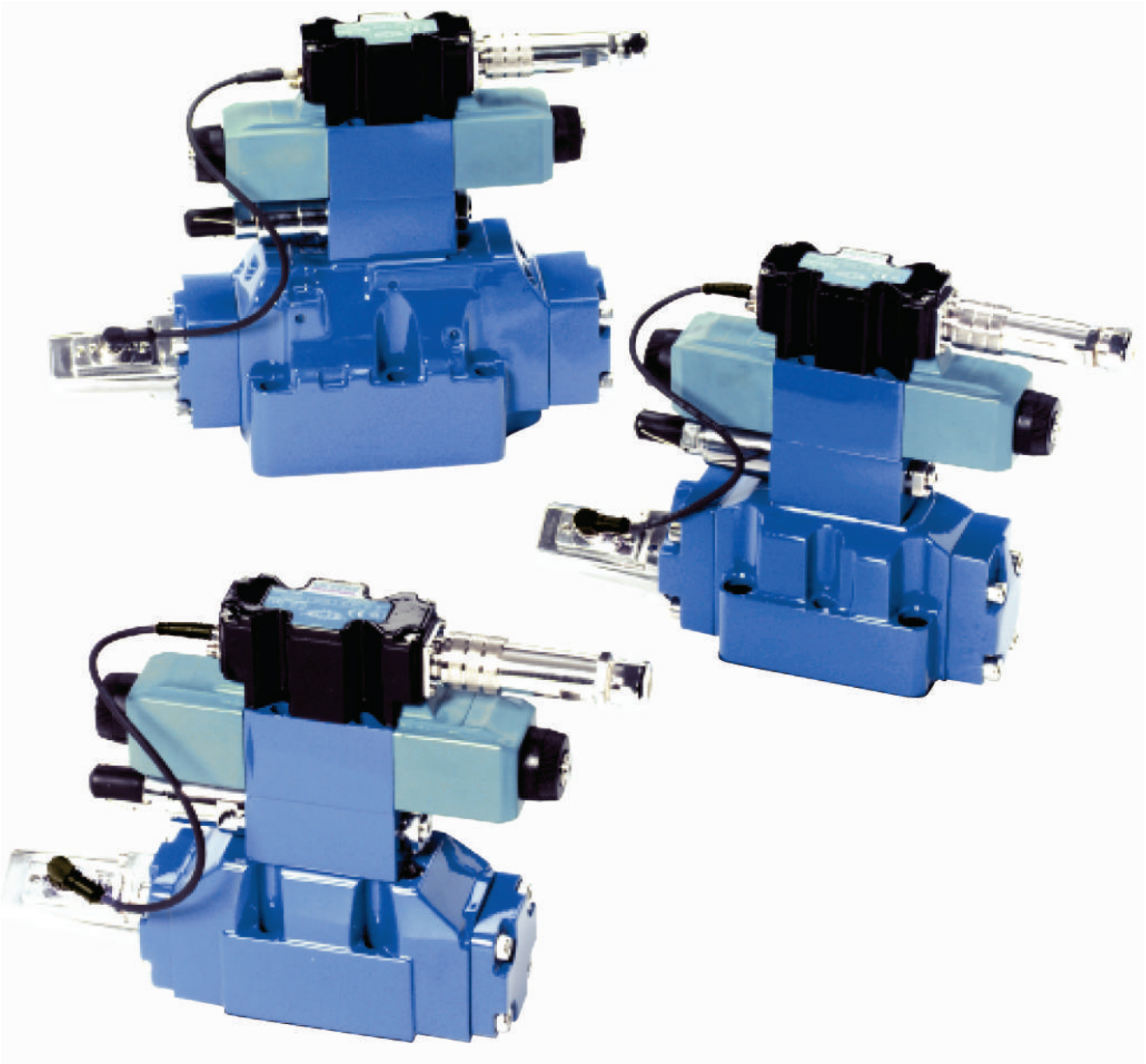
Printed in USA
Document No. E-VLPO-MC003-E2
March 2015

EATON | Vickers

Proportional Two-Stage Directional Valves
High Performance with Main Stage Spool Feedback

Pressures to 350 bar (5000 psi)

KBFDG5V-5/7/8/10 Series



Contents

Introduction
- General Description 3
- Features and Benefits 3
- Typical Section 3

Model Code 4

Spool Data 5

Functional Symbol 5

Operating Data 6

Pressures and Minimum Flow Rates 7

Performance Curves
- Power Capacity Envelope 8
- Pressure Gain 8
- Frequency Response 8
- Flow Gain 9

Dimension KBFDG5V-5/7/8/10 11

Mounting Surface Interface KBFDG5V-5/7/8/10 13

Electrical Information
- Block Diagram 15
- Typical Connection Arrangements 16

Application Data
- Fluid Cleanliness 17
- Hydraulic Fluids 17
- Installation 17
- Mounting Bolt Kits 17
- Seal Kits 17
- Plugs 17
- Extension Cable 17
- Service Information 17

Released Assembly Numbers 18

Introduction

General Description

Vickers proportional valves shown in this catalog are suitable for working pressures up to 350 bar (5000 psi) and flow rates to 375 l/min (99 USgpm).

They are designed to provide a controlled oil flow in proportion to a command signal, with spool position feedback to provide accurate control.

KBFDG5V-5/7/8/10

A range of proportional directional valves with control amplifiers built directly on, and prewired to the valves. Factory-set adjustments of gain, spool deadband compensation, and offset ensure high valve-to-valve reproducibility.

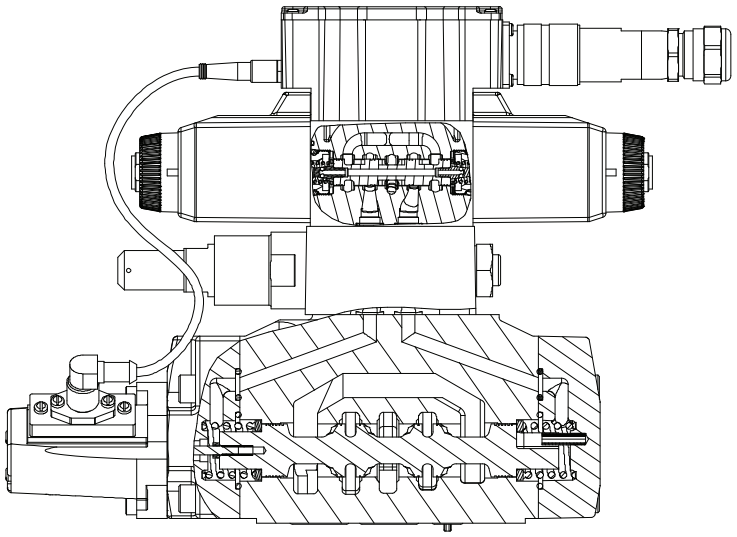
The only electrical inputs required are power supply (24V) and a voltage command signal of ±10V or 4-20 mA. The amplifier is housed in a robust metal enclosure, sealed against ingress of water and other fluids. Electrical connections are via a standard 7-pin plug.

A spool position monitor point allows the function of the valve to be electrically monitored.

Features and Benefits

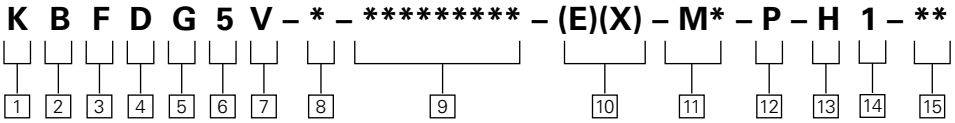
- Factory-sealed adjustments increase valve-to-valve reproducibility.
- Valve with integrated amplifier selected, ordered, delivered and installed as one performance-tested package.
- Electronic feedback LVDT ensures accurate spool position control.
- Vibration and shock tested.
- Standard 24V DC supply with wide tolerance band.
- Wide range of spool and flow rate options.
- Standard ±10 V DC or 4-20 mA command signals.
- Installation wiring reduced and simplified.
- Standard 7-pin connector.
- Simple valve removal and replacement for service.
- Supported by auxiliary function modules.
- Full CE electromagnetic compatibility.
- IP65 and IP67 environmental protection rating.
- Optional valve enable function.
- On board ramp adjustment.
- Failsafe feature.

Typical Section View



KBFDG5V-7, 10 design

Model Code



1 **Valve type**
K – Proportional valve

2 **Integral amplifier**
B – Integral amplifier "B" series

3 **Feed back arrangement**
F – From main stage

4 **Control type**
D - Directional valve

5 **Mounting**
G – Subplate mounted

6 **Operation**
5 – Solenoid controlled, pilot operated

7 **Pressure rating**
V – 310 bar (4500 psi) Size 05
– 350 bar (5000 psi) Size 07
– 350 bar (5000 psi) Size 08
– 350 bar (5000 psi) Size 10

8 **Interface**
ISO 4401
5 – Size 05
7 – Size 07
8 – Size 08
10 – Size 10

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 2-2,5 Nm (1.5-2.0 lbf ft) to effect a proper seal.

9 **Spool type, flow rating and metering**
See "Functional Symbol" on page 5. p = 5 bar (72 psi) per metering flow path, e.g. B to T.

Symmetric spools

For KBFDG5V-5 valves:

2C95N – 100 L/min (26 US gpm)

33C80N – 80 L/min (21 US gpm)

For KBFDG5V-7 valves:

2C200N – 200 L/min (52 US gpm)

33C160N – 160 L/min (42 US gpm)

For KBFDG5V-8 valves:

2C375N – 375 L/min (99 US gpm)

33C375N – 375 L/min (99 US gpm)

For KBFDG5V-10 valves:

2C700N – 700 L/min (185 US gpm)

33C700N – 700 L/min (185 US gpm)

Asymmetric spools

First figure (***N) is flow rating P-A, or A-T ("A" port flow); last figure (N***) is flow rating P-B, or B-T ("B" port flow)

For KBFDG5V-5 valves:

2C70N45 – 70 L/min (18.5 US gpm), "A" port flow 45 L/min (11.9 US gpm), "B" port flow

33C60N40 – 60 L/min (17.2 US gpm), "A" port flow 40 L/min (10.6 US gpm), "B" port flow

For KBFDG5V-7 valves:

2C150N85 – 150 L/min (40 US gpm), "A" port flow; 85 L/min (22.4 US gpm), "B" port flow

2C80N150 – 80 L/min (21 US gpm), "A" port flow; 150 L/min (40 US gpm), "B" port flow

33C130N65 – 130 L/min (33.3 US gpm), "A" port flow; 65 L/min (17.2 US gpm), "B" port flow

For KBFDG5V-8 valves:

2C375N250 – 375 L/min (99 US gpm), "A" port flow; 250 L/min (66 US gpm), "B" port flow

12C375N250 – 375 L/min (99 US gpm), "A" port flow; 250 L/min (66 US gpm), "B" port flow

33C375N250 – 375 L/min (99 US gpm), "A" port flow; 250 L/min (66 US gpm), "B" port flow

133C375N250 – 375 L/min (99 US gpm), "A" port flow; 250 L/min (66 US gpm), "B" port flow

733C375N250 – 375 L/min (99 US gpm), "A" port flow; 250 L/min (66 US gpm), "B" port flow

72C375N250 – 375 L/min (99 US gpm), "A" port flow; 250 L/min (66 US gpm), "B" port flow

For KBFDG5V-10 valves:

2C700N420 – 700 L/min (185 US gpm), "A" port flow; 420 L/min (110 US gpm), "B" port flow

33C700N420 – 700 L/min (185 US gpm), "A" port flow; 420 L/min (110 US gpm), "B" port flow

12C700N420 – 700 L/min (185 US gpm), "A" port flow; 420 L/min (110 US gpm), "B" port flow

133C700N420 – 700 L/min (185 US gpm), "A" port flow; 420 L/min (110 US gpm), "B" port flow

72C700N420 – 700 L/min (185 US gpm), "A" port flow; 420 L/min (110 US gpm), "B" port flow

733C700N420 – 700 L/min (185 US gpm), "A" port flow; 420 L/min (110 US gpm), "B" port flow

For actual maximum flows refer to power capacity envelopes, page 8.

10 **Pilot supply**
X – Internal
EX– External
(Pilot drain - External ONLY)

11 **Control signal**
M1 – ±10V
M2 – 4-20mA

12 **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

13 **Coil rating**
H – 24 VDC amplifier supply

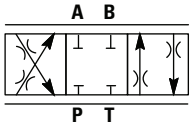
14 **Pilot drain port**
1 – 4 bar (58 psi)

15 **Design number**
10 – 10 series

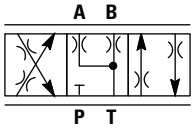
Spool Data

Spool Symbols

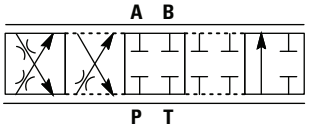
Available Spools for KBFDG5V



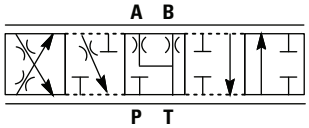
Spool type 2C



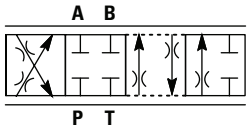
Spool type 33C



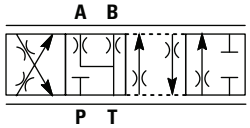
Spool type 12C



Spool type 133C



Spool type 72C



Spool type 733C

Spool Type and Flow Ratings

Symmetric Spools

Base line pressure drop Δp = 5 bar (72 psi) per metering flow path, e.g. B to T. For actual maximum flow refer to power capacity envelope curves.

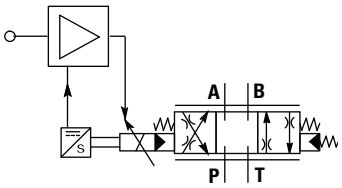
Spool code	Spool symbol	Flow rating
For KBFDG5V-5 valves:		
2C95N	2C	95 L/min (25 USgpm)
33C80N	33C	80 L/min (21 USgpm)
For KBFDG5V-7 valves:		
2C200N	2C	200 L/min (52 USgpm)
33C160N	33C	160 L/min (42 USgpm)
For KBFDG5V-8 valves:		
2C375N	2C	375 L/min (99 USgpm)
33C375N	33C	375 L/min (99 USgpm)
For KBFDG5V-10 valves:		
2C700N	2C	700 L/min (185 USgpm)
33C700N	33C	700 L/min (185 USgpm)

Asymmetric Spools

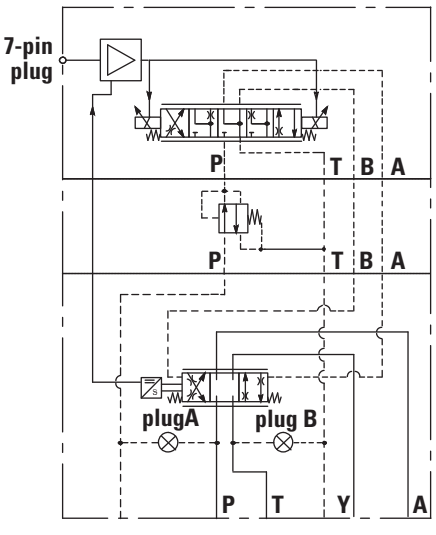
Figure preceding metering type designator, "N" e.g. 2C**N) is flow rating P–A, or A–T ("A" port flow): Figure after "N" (N***) is flow rating P–B, or B–T ("B" port flow).

Spool code	Spool symbol	Flow rating
For KBFDG5V-5 valves:		
2C70N45	2C	70 L/min (18.5 USgpm) "A" port flow 45 L/min (11.9 USgpm) "B" port flow
33C60N40	33C	60 L/min (17.2 USgpm) "A" port flow 40 L/min (10.6 USgpm) "B" port flow
For KBFDG5V-7 valves:		
2C150N85	2C	150 L/min (40 USgpm) "A" port flow 85 L/min (22.4 USgpm) "B" port flow
2C80N150	2C	80 L/min (21 USgpm) "A" port flow 150 L/min (40 USgpm) "B" port flow
33C130N65	33C	130 L/min (33.3 USgpm) "A" port flow 65 L/min (17.2 USgpm) "B" port flow
For KBFDG5V-8 valves:		
2C375N250	2C	375 L/min (99 USgpm) "A" port flow 250 L/min (66 USgpm) "B" port flow
33C375N250	33C	375 L/min (99 USgpm) "A" port flow 250 L/min (66 USgpm) "B" port flow
12C375N250	12C	375 L/min (99 USgpm) "A" port flow 250 L/min (66 USgpm) "B" port flow
133C375N250	133C	375 L/min (99 USgpm) "A" port flow 250 L/min (66 USgpm) "B" port flow
72C375N250	72C	375 L/min (99 USgpm) "A" port flow 250 L/min (66 USgpm) "B" port flow
733C375N250	733C	375 L/min (99 USgpm) "A" port flow 250 L/min (66 USgpm) "B" port flow
For KBFDG5V-10 valves:		
2C700N420	2C	700 L/min (185 USgpm) "A" port flow 420 L/min (110 USgpm) "B" port flow
33C700N420	33C	700 L/min (185 USgpm) "A" port flow 420 L/min (110 USgpm) "B" port flow
12C700N420	12C	700 L/min (185 USgpm) "A" port flow 420 L/min (110 USgpm) "B" port flow
133C700N420	133C	700 L/min (185 USgpm) "A" port flow 420 L/min (110 USgpm) "B" port flow
72C700N420	72C	700 L/min (185 USgpm) "A" port flow 420 L/min (110 USgpm) "B" port flow
733C700N420	733C	700 L/min (185 USgpm) "A" port flow 420 L/min (110 USgpm) "B" port flow

Functional Symbol



Simplified Symbol



Detailed Symbol

Application Notes

A. Main-Spool Options

Spools shown are meter-in/meter-out types. Center-condition options are types 2, 33, 12, 133, 72 and 733.

B. Internally Piloted Models

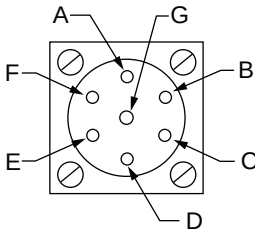
Differ from detailed symbols above by omission of plug A and the blocking of port X by the mating surface.

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 3A
Command signal	–10 V to +10 V DC or 4-20mA
Input impedance	47 kΩ
Common mode voltage to pin B	18V (max)
Valve enable signal for model codes PH7 & PR7	
Enable	>8.5V (36V max)
Disable	<6.5V
Input impedance	10 kΩ

7-pin plug connector



View of pins of fixed half

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

Electromagnetic compatibility (EMC):	
Emission (10 V/m)	EN 50081-2
Immunity (10 V/m)	EN 50082-2
Threshold command voltage (minimum voltage for minimum flow)	0.25V– 2C & 33C Spools
Monitor signal (pin F)	±4.8 – ±9.5VDC (data for individual valve to be published in the catalogue later)
Output impedance	10kΩ
Power stage PWM frequency	10 kHz nominal

Step input response, with flow through P–A–B–T, Δp=5 bar (72 psi) per metering path, e.g. P–A

	Time to reach 90% of required step:			
	KBFDG5V–5	KBFDG5V–7	KBFDG5V–8	KBFDG5V–10
Required flow step (with reducing module):				
0 to 100%	47 ms	52 ms	84 ms	130 ms
100% to 0	30 ms	36 ms	58 ms	150 ms
+90 to –90%	46 ms	52 ms	88 ms	170 ms

Reproducibility, valve-to-valve (at factory settings): Flow at 100% command signal	≤5%
Hysteresis with flow through P-A-B-T Δp=5 bar (72 psi) per metering path (P–A or B–T)	<1%
Protection:	
Electrical	Reverse polarity protected
Environmental	IEC 60529, Class IP67
Ambient air temperature range for full performance	0° C to 70° C (32° F to 158° F)
Oil temperature range for full performance	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)
Relative duty factor	Continuous rating (ED = 100%)
Auxiliary electronic modules (DIN -rail mounting):	
EHA-CON-201-A2* signal converter	See catalog GB 2410B
EHD-DSG-201-A-1* command signal generator	See catalog GB 2470
EHA-RMP-201-A-2* Ramp generator	See catalog GB 2410A
EHA-PSU-201-A-10 Power supply	See catalog GB 2410A
EHA-PID-201-A-20 PID controller	See catalog GB 2427
Mass: Valves with pressure reducer	
KBFDG5V-5	9,9 kg (21.8 lb) approx.
KBFDG5V-7	11,1 kg (24.4 lb) approx.
KBFDG5V-8	17,1 kg (37.6 lb) approx.
KBFDG5V-10	43,9 kg (96.5 lb) approx.

Pressure and Minimum Flow Rates

MAXIMUM PRESSURES, BAR (PSI) VALVES WITH PRESSURE REDUCER

Model	Pilot pressure source †	Pilot drain connection	P Port	A&B Ports	T Port	X Port	Y Port
KBFDG5V-5	External	To Port Y	315 (4500)	315 (4500)	210 (3000)	315 (4500)	4 (58)
	Internal	To Port Y	315 (4500)	315 (4500)	21 (3000)	315 (4500)	4 (58)
KBFDG5V-7/8/10	External	To Port Y	350 (5000)	350 (5000)	350 (5000)	350 (5000)	4 (58)
	Internal	To Port Y	350 (5000)	350 (5000)	350 (5000)	350 (5000)	4 (58)

† Minimum recommended pilot operating pressure = 50 bar (700 psi)

MINIMUM RECOMMENDED FLOW RATES

Valve Size/Spool Code	Min. Flow Rate L/min	In^3/min
KBFDG5V–5–2C100N	0,5	30
KBFDG5V–5–33C80N	0,5	30
KBFDG5V–7–2C200N	1,0	60
KBFDG5V–7–33C160N	1,0	60
KBFDG5V–8–2C375N	1,5	91
KBFDG5V–8–33C375N	1,5	91
KBFDG5V-10-2C700N	3,0	182
KBFDG5V-10-33C700N	3,0	182

For spool types 2C and 33C
Δp = 10 bar (142 psi) for looped flow P–A–B–T (or P–B–A–T)

Performance Curves

KBFDG5V-5/7/8/10

FLOW GAIN

At Δp = 5 bar (72 psi) per metering path (e.g. P-A), with flow through P-A-B-T or P-B-A-T. Percentage command signals applicable for positive and negative values of command signal.

At other Δp values, flow rates approximate to: $Q_X = Q_D \sqrt{\frac{\Delta p_X}{\Delta p_D}}$

where Q_D = Datum flow rate

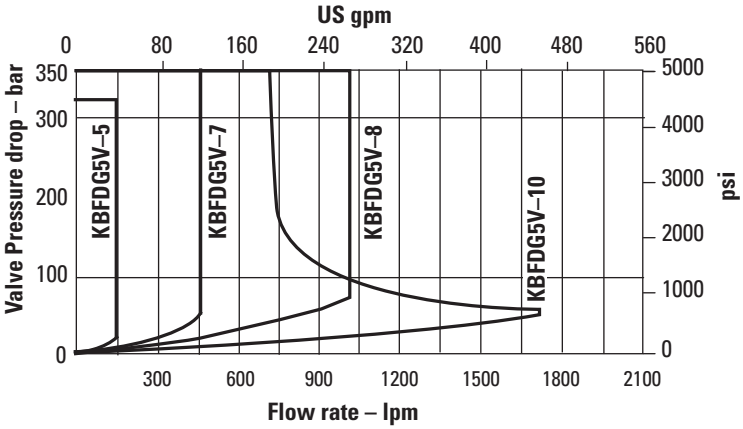
Δp_D = Pressure drop at datum flow rate

Δp_X = Required Δp

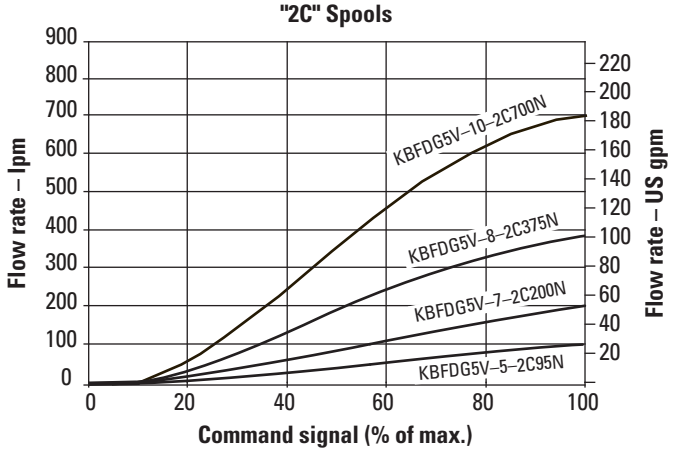
Limited by valve power capacity. Refer to curves on page 8.

POWER CAPACITY ENVELOPE

Flow through P-A-B-T or P-B-A-T

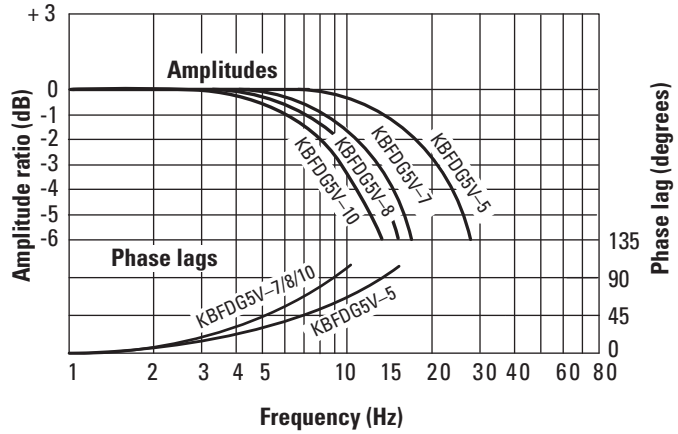


"2C" Spools

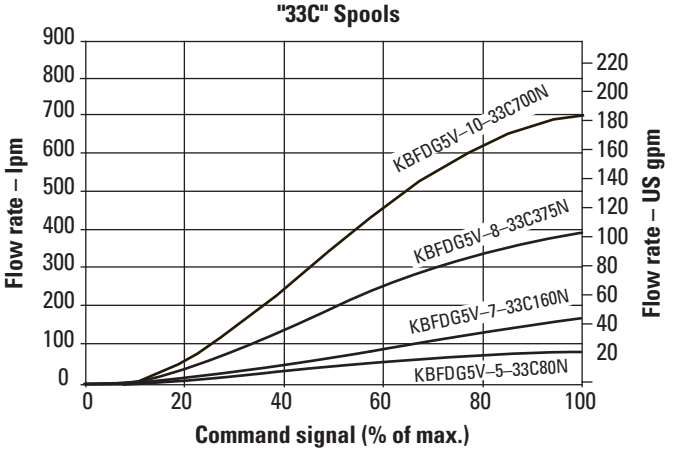


FREQUENCY RESPONSE, TYPICAL

For an amplitude of 50 ±25% of rated flow (ISO-10770-1)
2C spool measured at ν = 36 cSt (168 SUS),
t = 50° C (122° F) and pilot pressure = 40 bar



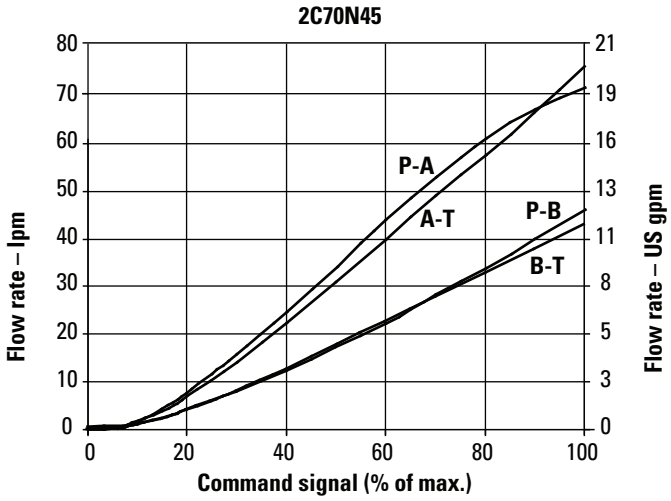
"33C" Spools

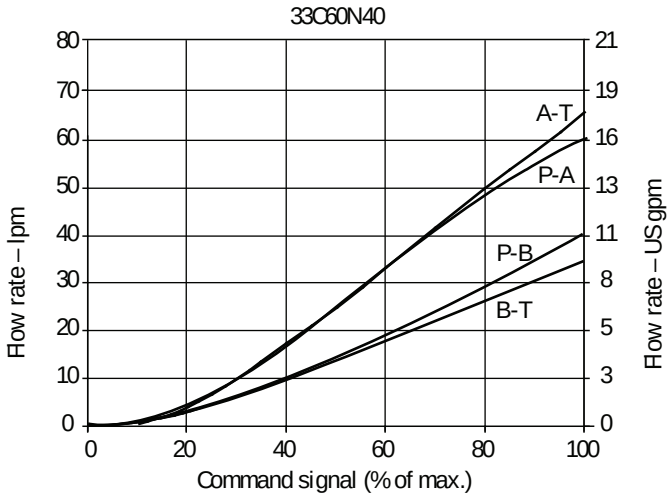


Performance Curves

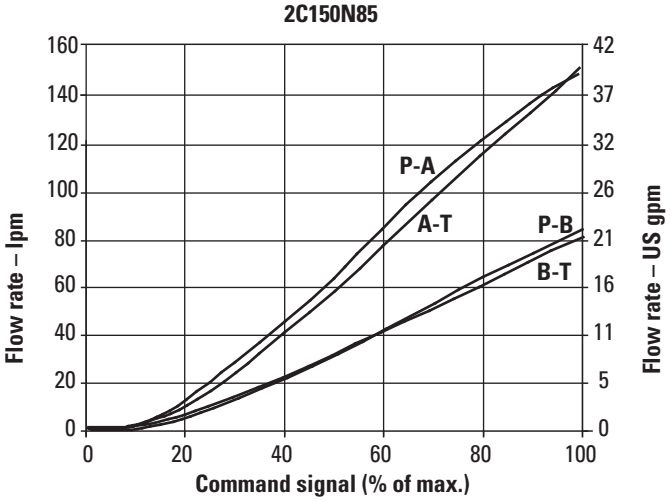
Flow Gain

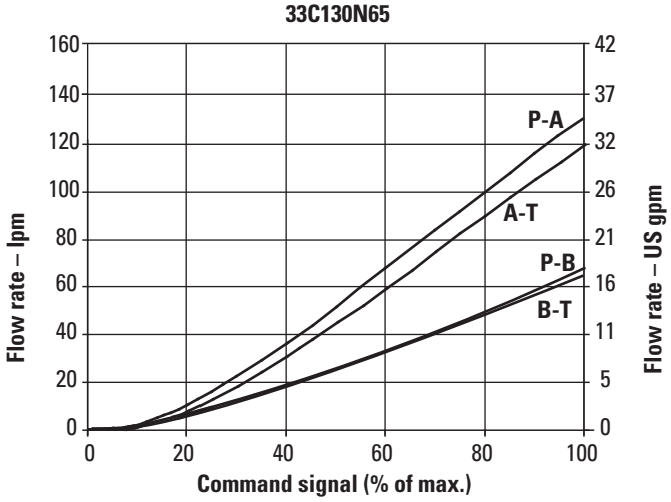
KBFDG5V-5





KBFDG5V-7



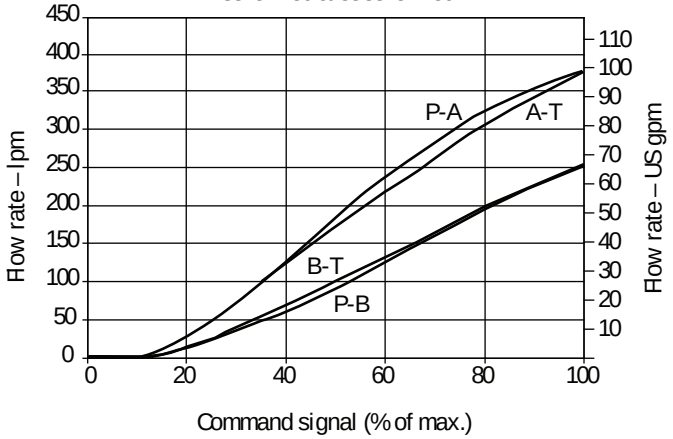


Performance Curves

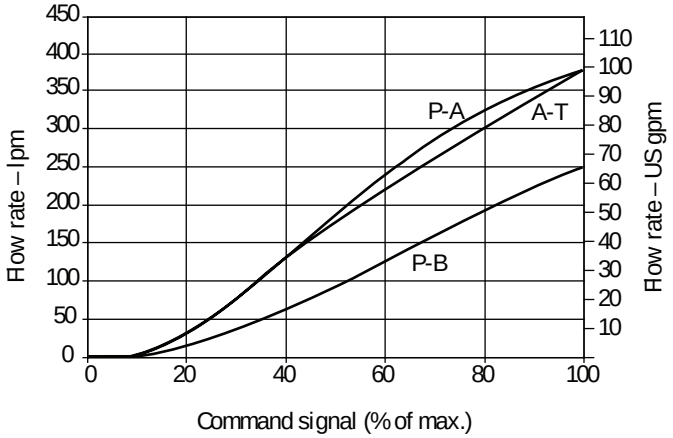
KBFDG5V-8/10

KBFDG5V-8

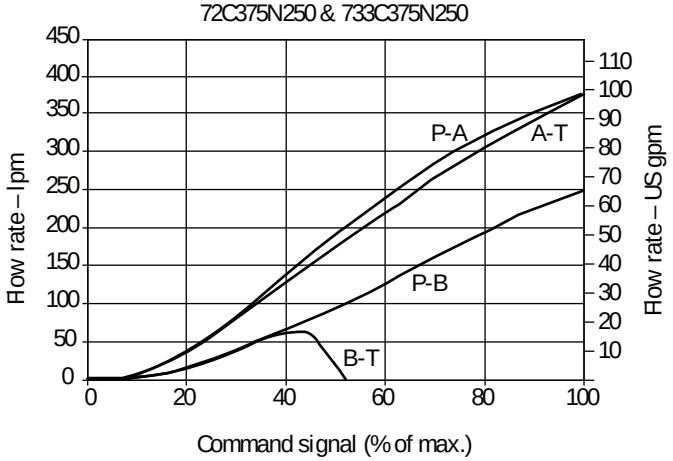
2C375N250 & 33C375N250



12C375N250 & 133C375N250

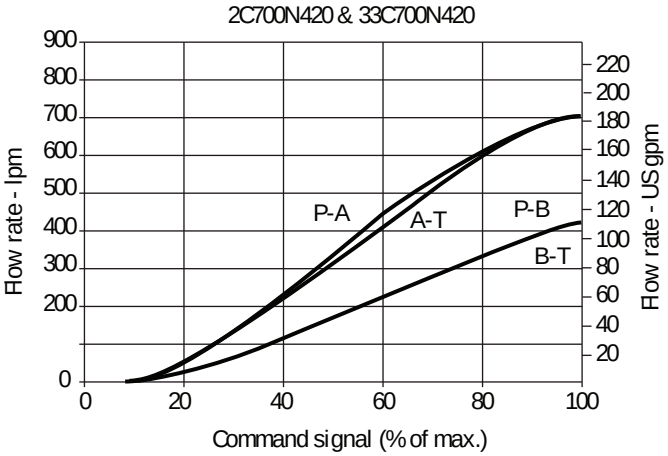


72C375N250 & 733C375N250

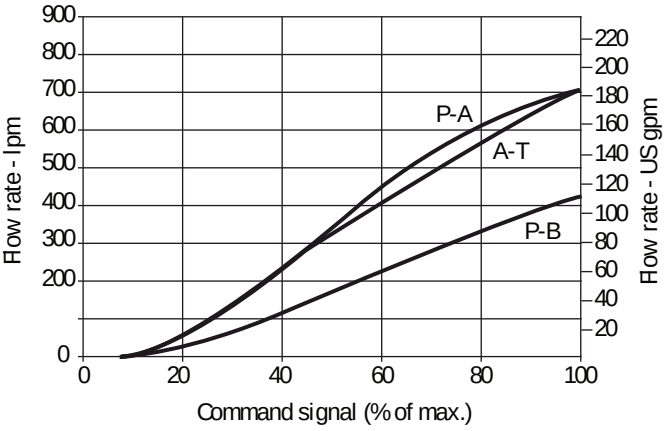


KBFDG5V-10

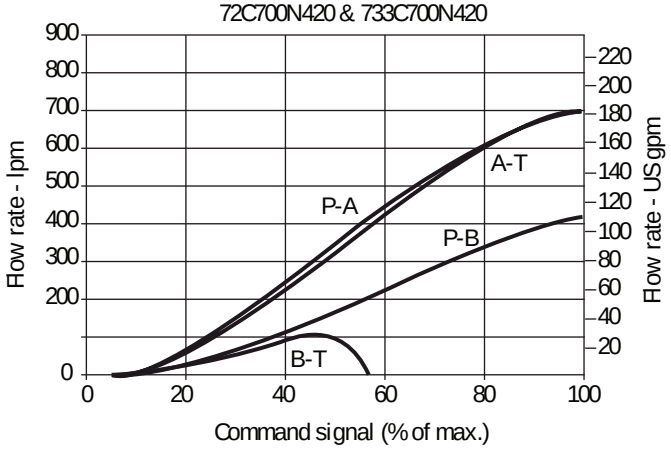
2C700N420 & 33C700N420



12C700N420 & 133C700N420



72C700N420 & 733C700N420

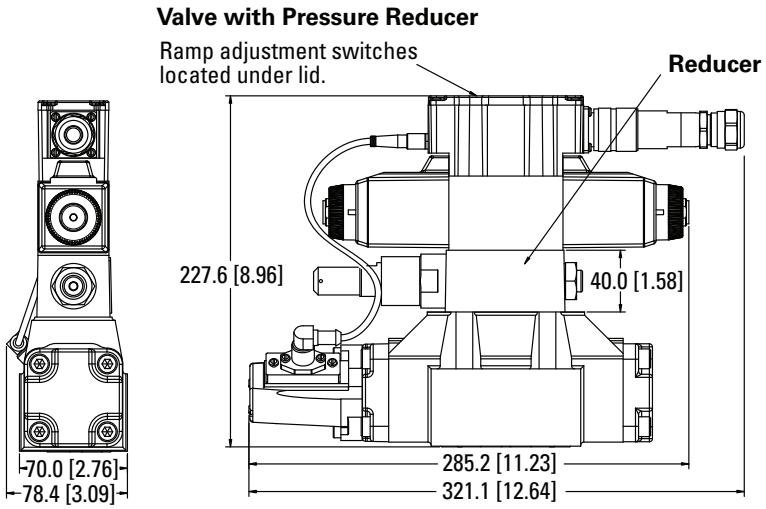


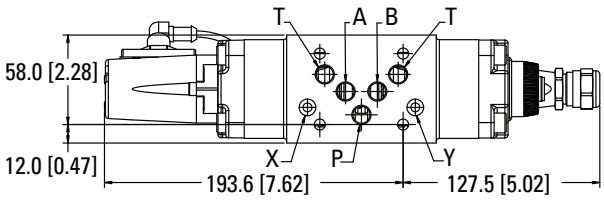
Installation Dimensions

KBFDG5V-5/7

KBFDG5V-5

mm (Inch)

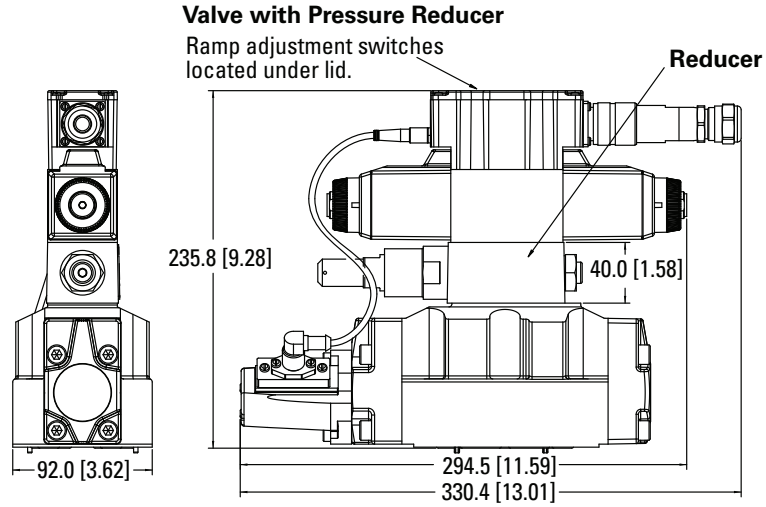


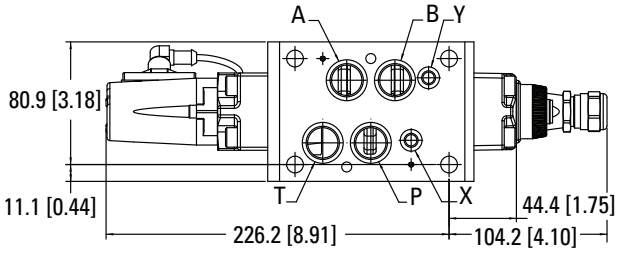


Mounting surface, seals supplied. For mating surface dimensions, see page 14 (size 05 with additional X and Y ports). For mounting subplate options and bolt options, see catalog GB-2425.

KBFDG5V-7

mm (Inch)





Mounting surface, seals supplied. For mating surface dimensions, see page 14. For mounting subplate options and bolt options, see catalog GB-2425.

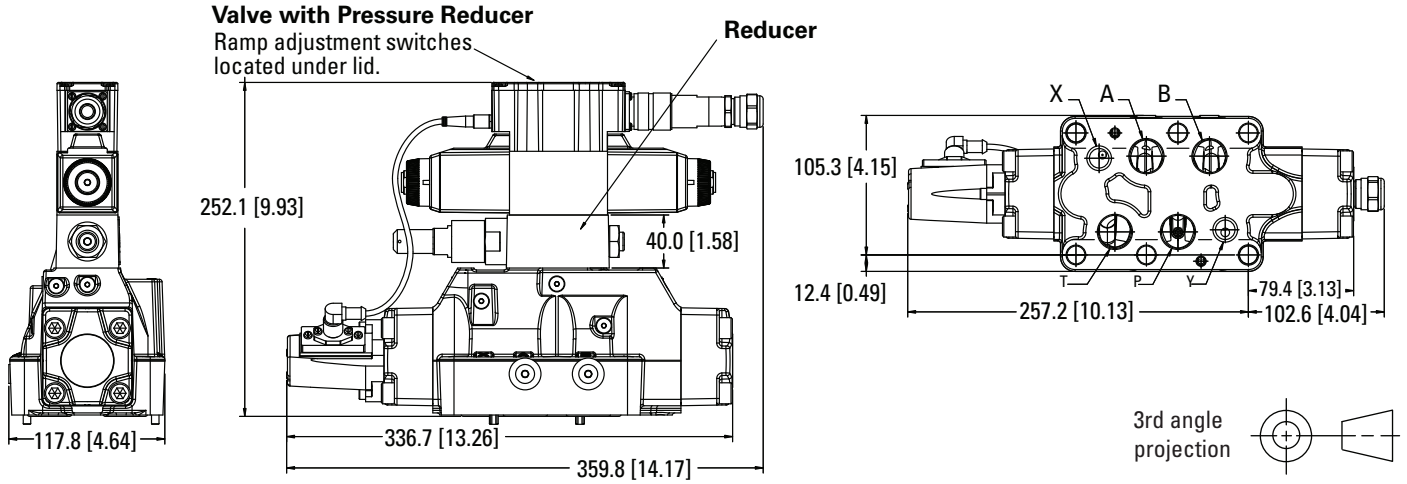
Installation Dimensions

KBFDG5V-8

KBFDG5V-8

mm (Inch)

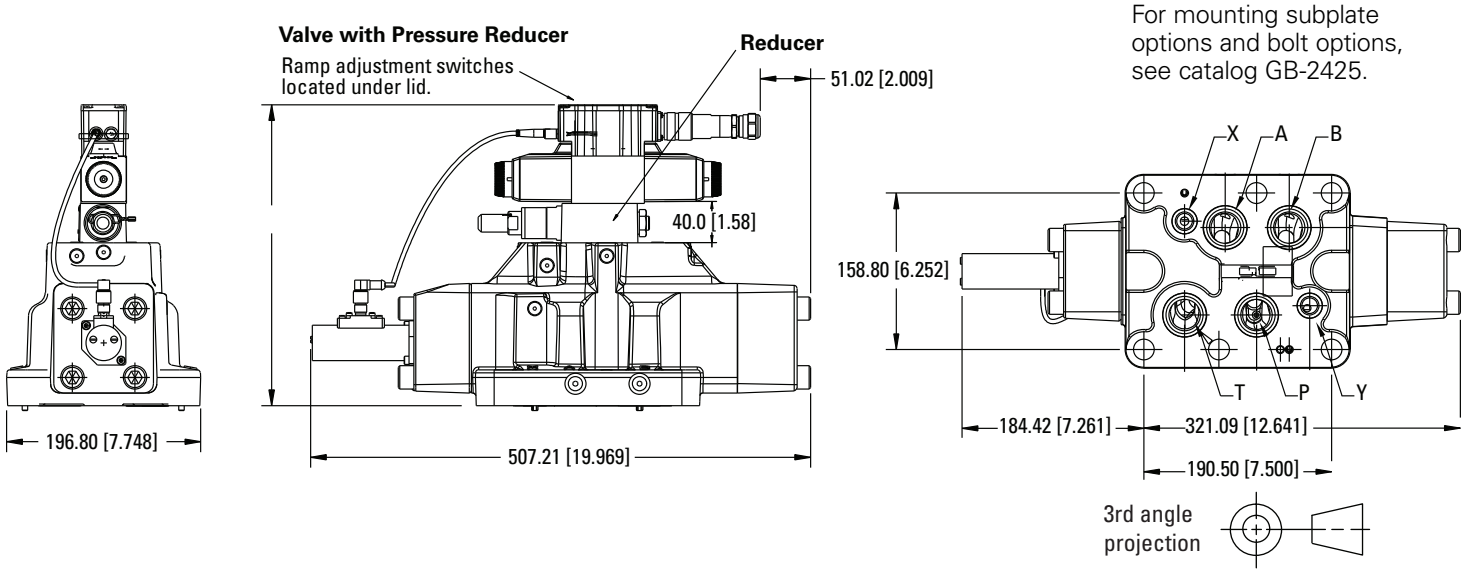
Mounting surface, seals supplied. For mating surface dimensions, see page 15. For mounting subplate options and bolt options, see catalog GB-2425.



KBFDG5V-10

mm (Inch)

Mounting surface, seals supplied. For mating surface dimensions, see page 15. For mounting subplate options and bolt options, see catalog GB-2425.



Mounting Surfaces

Dimensions shown in mm (in).

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 mm (63 microinch). Mounting bolts, when provided by customer, should be ISO 898 class 12.9 or better. Bolt Kits See page 17.

Dimensional Tolerances

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

Conversion from Metric

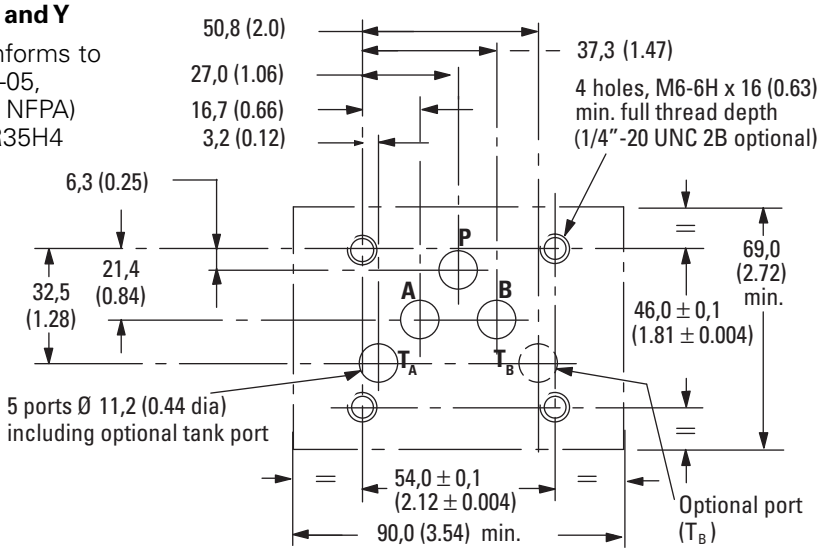
ISO 4401 gives dimensions in mm. Inch conversions are accurate to 0.01" unless otherwise stated.

Mounting Bolt Tappings

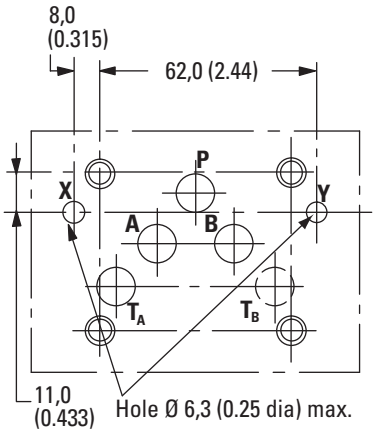
ISO 4401 gives metric thread tappings. Alternate UNC tappings are Vickers recommendations that allow these plates and associated valves to be used up to their maximum pressures, when using Vickers recommended bolt kits, or bolts of an equivalent strength. It is recommended that Customer's own manifold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

ISO Standard Size 05 without Ports X and Y

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

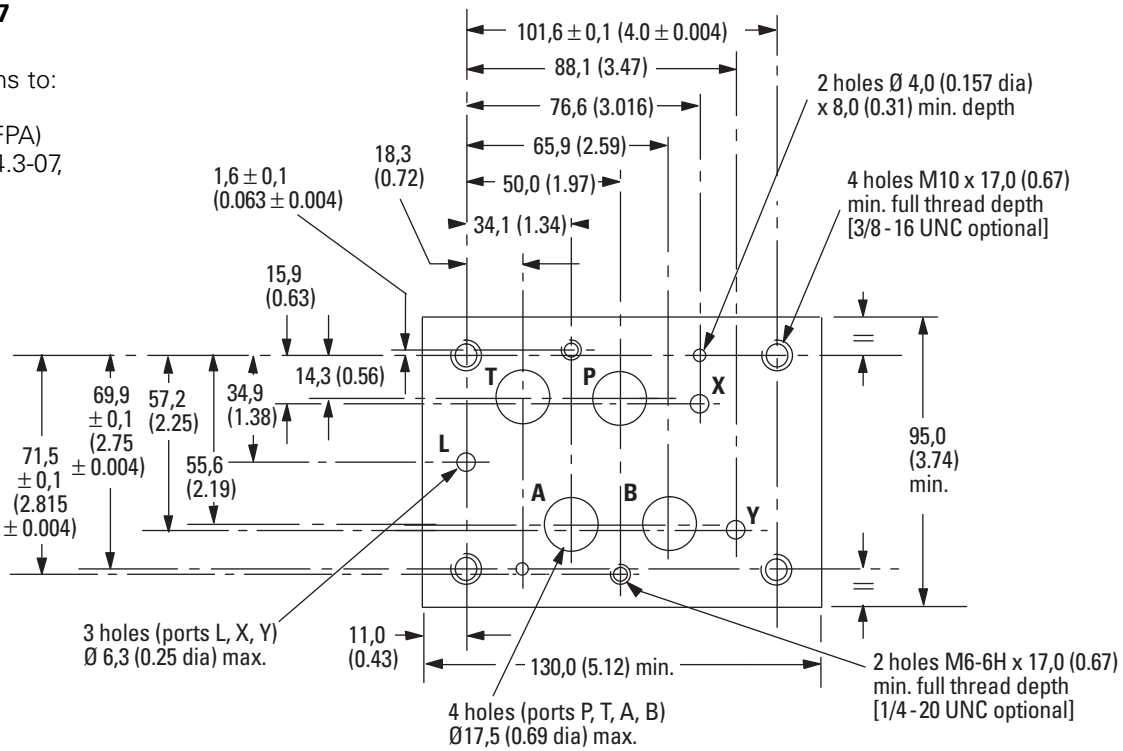


ISO Standard Size 05 with Ports X and Y



ISO Standard Size 07 Interface

This interface conforms to: ISO 4401-07-07-0-05 ANSI/B93.7M (and NFPA) size 07 CETOP R35H4.3-07, DIN 24340 Form A16

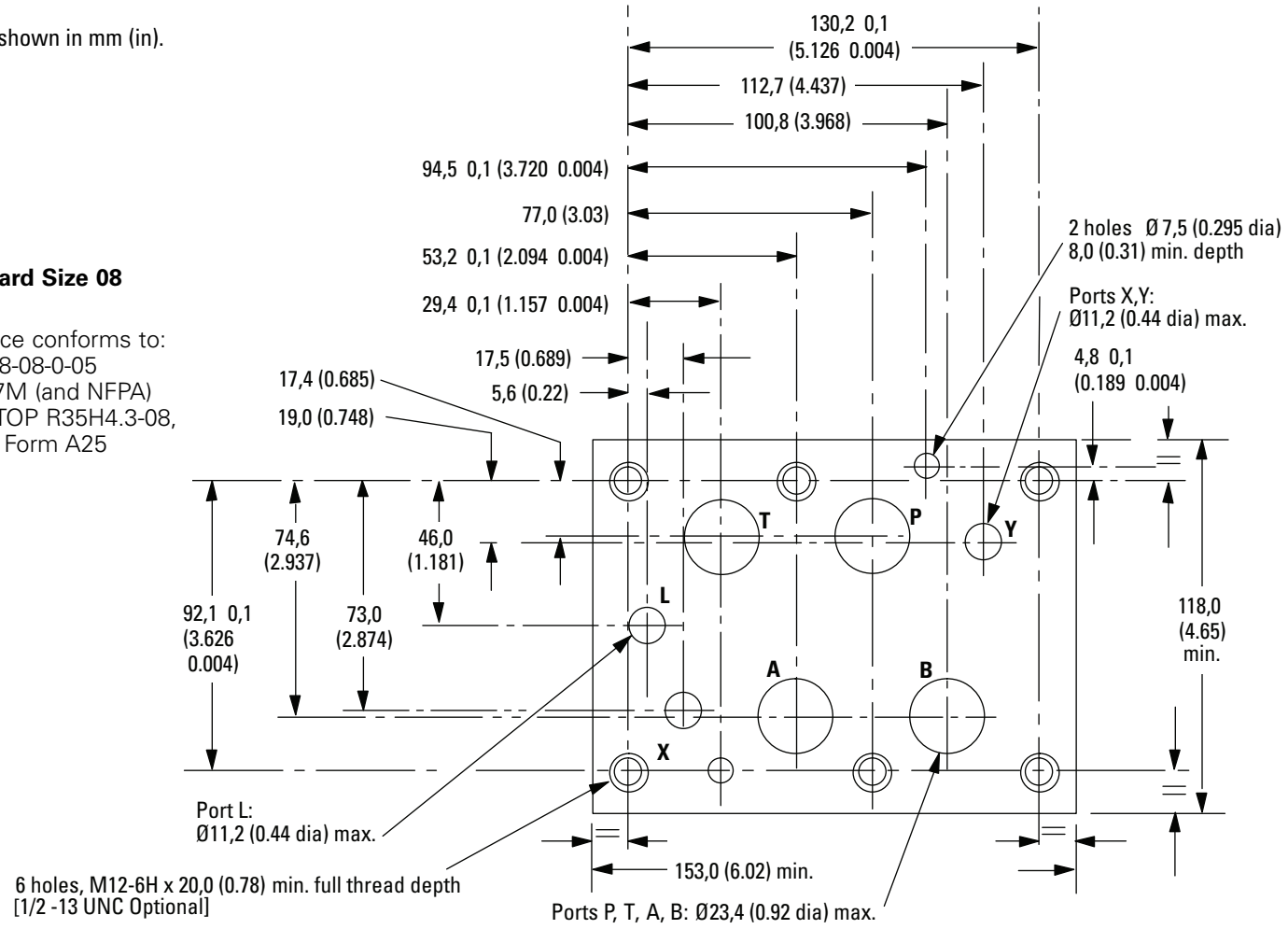


Mounting Surfaces

Dimensions shown in mm (in).

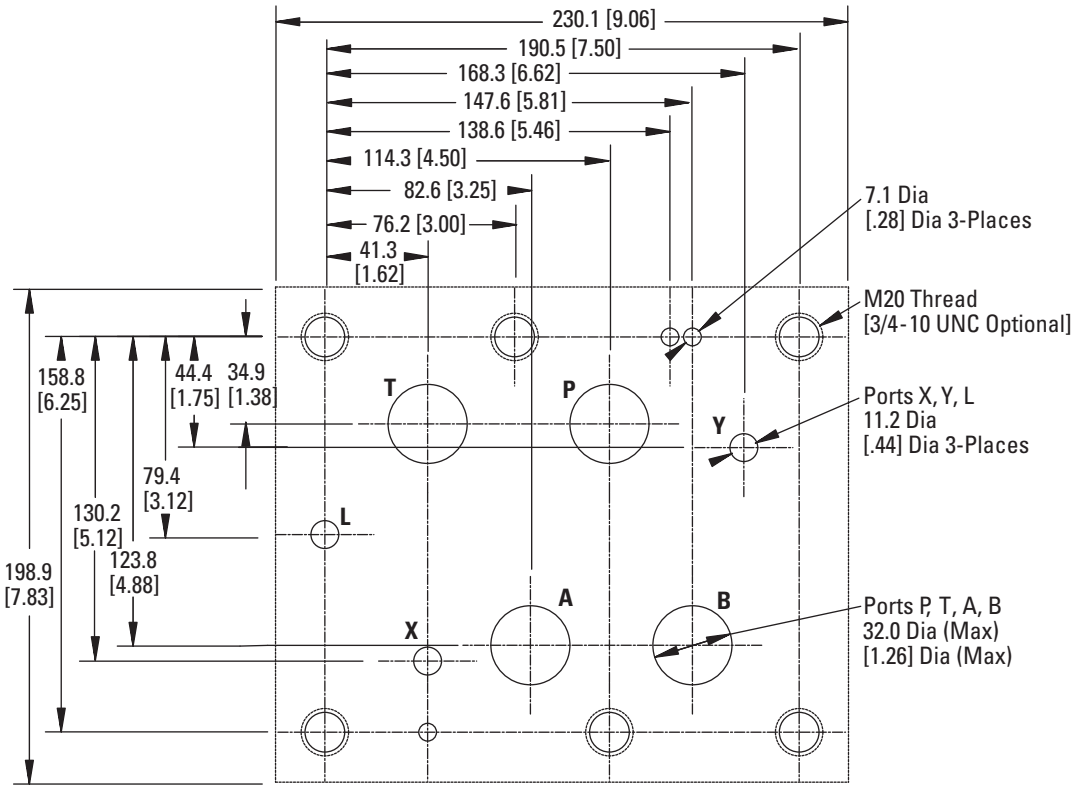
ISO Standard Size 08 Interface

This interface conforms to:
ISO 4401-08-08-0-05
ANSI/B93.7M (and NFPA)
size 08 CETOP R35H4.3-08,
DIN 24340 Form A25



ISO Standard Size 10 Interface

This interface conforms to:
ISO 4401-10-09-0-05
ANSI/B93.7M (and NFPA)
size 10, CETOP 35H4.3-10,
DIN 24340 Form A32

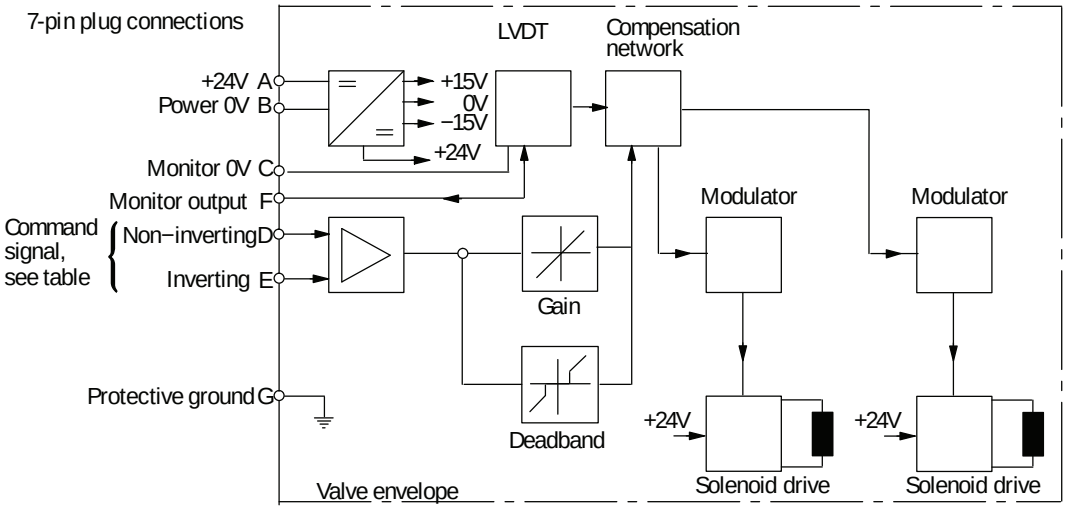


Electrical Information

Electrical Block Diagram

Wiring

Connections must be made via the 7-pin plug mounted on the amplifier. See page NO TAG of this leaflet and Installation and Start-up Guidelines, ML-B-9090A for cable recommendations.



▲ 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
Pin D	Pin E	
Positive 0V U_D - U_E = Positive	0V Negative	P to A
Negative 0V U_D - U_E = Negative	0V Positive	P to B
Current from Pin D to E		
	4-12mA	P to B
	12-20mA	P to A

WARNING

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

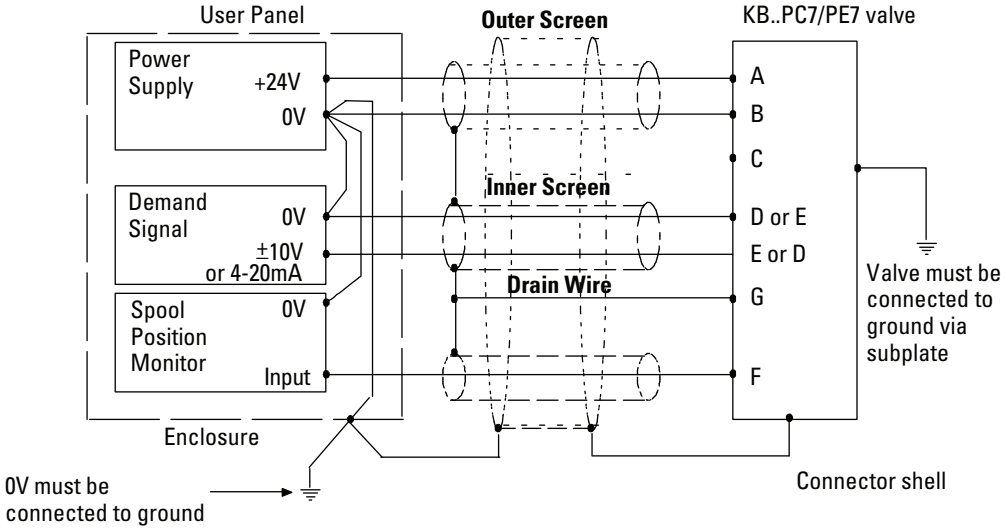
Electrical Information

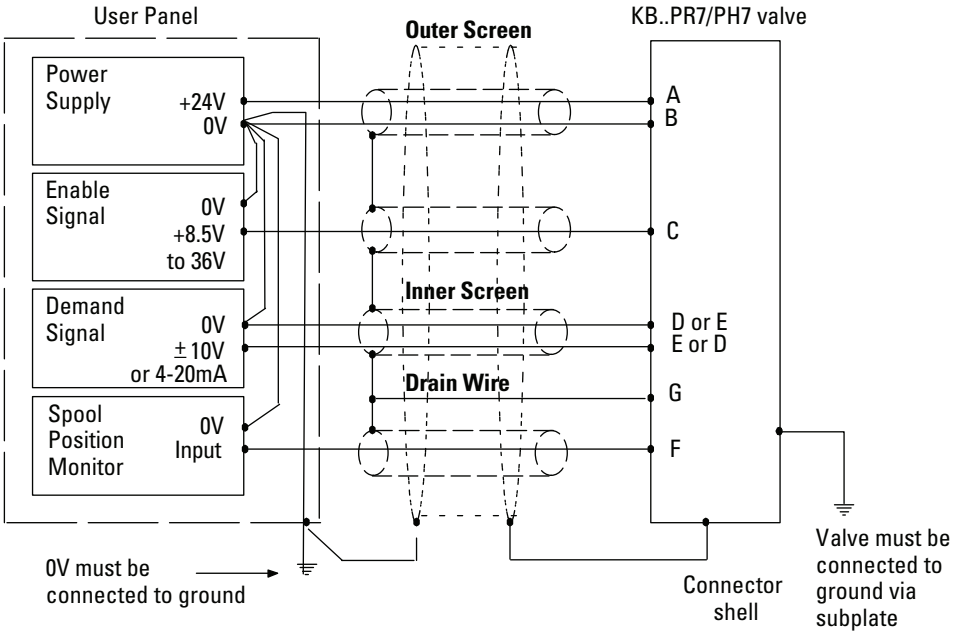
Typical Connection Arrangements

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 multicore 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 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 these valves are compatible with antiwear hydraulic oils, and non-alkyl-based phosphate esters. The extreme operating viscosity range is 500 to 13cSt (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, 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

PILOT WITH REDUCER

metric	inch
BK464125M	BK870017

KBFDG5V-5 MAINSTAGE

metric	inch
BKDG01633M	BKDG01633

KBFDG5V-7 MAINSTAGE

metric	inch
BKDG7858918	BK590724

KBFDG5V-8 MAINSTAGE

metric	inch
BKDG8-655M	BKDG06-635

KBFDG5V-10 MAINSTAGE

metric	inch
BKDG10636M	BKDG10636

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

Seal Kits

PILOT INCLUDING M8 CAP

5986617-001

REDUCER

870739

KBFDG5V-5

Mainstage	Complete valve
565143	5986818-001

KBFDG5V-7

Mainstage	Complete valve
565144	5986819-001

KBFDG5V-8

Mainstage	Complete valve
5986821-001	5986820-001

KBFDG5V-10 MAINSTAGE

Mainstage	Complete valve
02-441686	02-441691

Electrical Connection

7-PIN CONNECTOR

metal	plastic
934939	694534

(metal connector 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.

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.

Released Model Codes

Size D05/NG10

ASSEMBLY NUMBER	MODEL CODE
02-412178	KBFDG5V-5-2C100N-EX-M1-C1-PE7-H1-10
02-412130	KBFDG5V-5-2C70N45-EX-M1-PE7-H1-10
02-359613	KBFDG5V-5-2C70N45-X-M1-PE7-H1-10
02-411449	KBHDG5V-5-2C100N-EX-PH7-H4-10
02-412113	KBFDG5V-5-2C70N45-X-M2-PC7-H1-10
02-412114	KBFDG5V-5-2C95N-EX-M1-PE7-H1-10
02-412116	KBFDG5V-5-2C95N-X-M1-PE7-H1-10
02-412154	KBFDG5V-5-2C95N-X-M2-PE7-H1-10
02-412138	KBFDG5V-5-33C60N40-EX-M1-PE7-H1-10
02-412142	KBFDG5V-5-33C60N40-X-M1-PE7-H1-10
02-412131	KBFDG5V-5-33C80N-EX-M1-PE7-H1-10
02-412171	KBFDG5V-5-33C80N-EX-M2-PE7-H1-10
02-412163	KBFDG5V-5-33C80N-EX-M2-PH7-H1-10
02-412164	KBFDG5V-5-33C80N-X-M1-PC7-H1-10
02-412115	KBFDG5V-5-33C80N-X-M1-PE7-H1-10
02-412160	KBFDG5V-5-33C80N-X-M2-PE7-H1-10

Size D08/NG25

ASSEMBLY NUMBER	MODEL CODE
02-412118	KBFDG5V-8-133C375N250-EX-M1-PC7-H1-10
02-412168	KBFDG5V-8-2C375N-EX-M1-PC7-H1-10
02-412137	KBFDG5V-8-2C375N-EX-M1-PE7-H1-10
04-412121	KBFDG5V-8-2C375N-X-M1-PE7-H1-10
02-412173	KBFDG5V-8-2C375N-X-M2-PC7-H1-10
02-412158	KBFDG5V-8-2C375N-X-M2-PE7-H1-10
02-412165	KBFDG5V-8-2C375N250-EX-M1-PC7-H1-10
02-412140	KBFDG5V-8-2C375N250-EX-M1-PE7-H1-10
02-412119	KBFDG5V-8-2C375N250-EX-M2-PC7-H1-10
02-412120	KBFDG5V-8-33C375N-EX-M1-PE7-H1-10
02-412136	KBFDG5V-8-33C375N-EX-M2-PE7-H1-10
02-412133	KBFDG5V-8-33C375N-X-M1-PE7-H1-10
02-412157	KBFDG5V-8-33C375N-X-M2-PE7-H1-10
02-412161	KBFDG5V-8-33C375N-X-M2-PH7-H1-10
02-412141	KBFDG5V-8-33C375N250-EX-M1-PE7-H1-10
02-412144	KBFDG5V-8-33C375N250-X-M1-PE7-H1-10

Size D07/NG25

ASSEMBLY NUMBER	MODEL CODE
02-412128	KBFDG5V-7-2C150N85-EX-M1-PE7-H1-10
02-412143	KBFDG5V-7-2C150N85-X-M1-PE7-H1-10
02-412124	KBFDG5V-7-2C150N85-X-M2-PC7-H1-10
02-412125	KBFDG5V-7-2C200N-EX-M1-PE7-H1-10
02-412152	KBFDG5V-7-2C200N-EX-M2-PE7-H1-10
02-412167	KBFDG5V-7-2C200N-X-M1-PC7-H1-10
02-412127	KBFDG5V-7-2C200N-X-M1-PE7-H1-10
02-412153	KBFDG5V-7-2C200N-X-M2-PE7-H1-10
02-412175	KBFDG5V-7-2C200N-X-M2-PH7-H1-10
02-412169	KBFDG5V-7-33C130N65-EX-M1-PC7-H1-10
02-412139	KBFDG5V-7-33C130N65-EX-M1-PE7-H1-10
02-412159	KBFDG5V-7-33C130N65-EX-M2-PE7-H1-10
02-412170	KBFDG5V-7-33C130N65-X-M1-PC7-H1-10
02-412151	KBFDG5V-7-33C130N65-X-M1-PE7-H1-10
02-412166	KBFDG5V-7-33C160N-EX-M1-PC7-H1-10
02-412132	KBFDG5V-7-33C160N-EX-M1-PE7-H1-10
02-412156	KBFDG5V-7-33C160N-EX-M2-PE7-H1-10
02-412162	KBFDG5V-7-33C160N-EX-M2-PH7-H1-10
02-412126	KBFDG5V-7-33C160N-X-M1-PE7-H1-10
02-412155	KBFDG5V-7-33C160N-X-M2-PE7-H1-10

Size D10/NG32

ASSEMBLY NUMBER	MODEL CODE
5992990-001	KBFDG5V-10-2C700N-EX-M1-PC7-H1-10
5992991-002	KBFDG5V-10-33700N-EX-M1-PC7-H1-10
5992992-002	KBFDG5V-10-2C700N420-X-M1-PC7-H1-10
5992993-002	KBFDG5V-10-33C700N420-X-M1-PC7-H1-10
5992994-002	KBFDG5V-10-12C700N420-X-M2-PC7-H1-10
5992995-002	KBFDG5V-10-133C700N420-X-M2-PC7-H1-10
5992996-002	KBFDG5V-10-72C700N420-EX-M1-PE7-H1-10
5992997-002	KBFDG5V-10-733C700N420-EX-M1-PE7-H1-10
02-412483	KBFDG5V-10-2C700N420-EX-M1-PE7-H1-10
02-412484	KBFDG5V-10-33C700N420-EX-M1-PE7-H1-10

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Vickers

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Supersedes V-VLDI-MC003-E1
February 2010

Vickers®

Proportional Valves

KDG3V-5/7/8, 10 Series

Single-Stage with Hydraulic Pilot Operation
High Flow Proportional Directional Control Valves

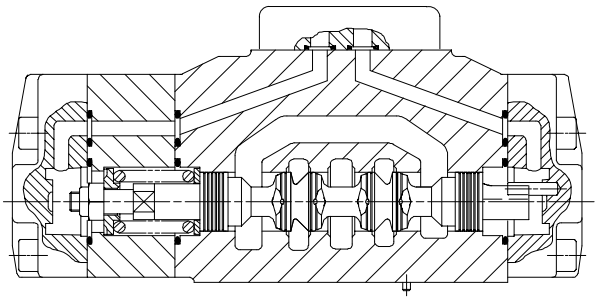
Basic Characteristics

Max. pressure . . . . . up to 350 bar (5000 psi)
Max. flow rate . . . . . up to 700 L/min (190 USgpm)
Mounting interfaces to ISO 4401:
KDG3V-5 . . . . . Size 05*
KDG3V-7 . . . . . Size 07
KDG3V-8 . . . . . Size 08

u**With additional pilot ports X and Y.*

Typical Sectional Arrangement

KDG3V-7



General Description

The remote control facility of these high flow capacity valves allows them to be installed in optimum locations relative to minimizing power transmission losses, close to actuators and distant from machine operators. Remote control can then be achieved using any suitable variable pressure control such as Vickers HRC type hydraulic remote controls which are available with a number of joystick and footpedal options and electrical switch features.

In KDG3V valves, the spool is centered by a spring when the differential of pilot pressures applied to the valve end chambers is less than approx. 6 bar (87 psi). As the pilot pressure differential is increased the spool is moved from its centered position, and at approx. 12 bar (174 psi) differential the fluid flow path through the valve begins to open. The flow path opening then progressively increases, as the pressure is increased up to a level of approx. 30 bar (435 psi) differential, when the spool reaches the end if its travel. Further increase in pilot pressure (up to the maximum permissible) has no further effect on the output characteristics.

Good symmetrical characteristics for each direction of spool travel are achieved by using the same spring for each direction of spool travel.

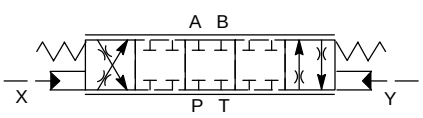
Specially profiled metering notches on the spool give smooth, progressive opening/closing of the flow paths.

Vickers KDG3V valves offer ideal solutions for applications with repetitive load conditions, or where the load is under direct control of the machine operator.

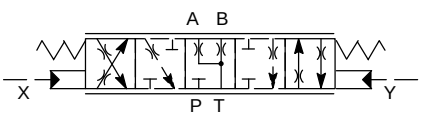
Functional Symbols

Transient flow conditions shown by dotted lines

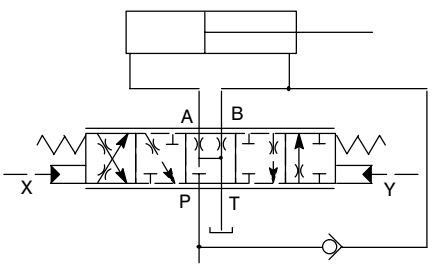
Spool type 2C



Spool type 33C



Spool type 133C, with typical regenerative circuit



Model Codes

KDG3V - * - * C *** N (***) - E - 1***

1 2 3 4 5 6 7 8

1 Mounting interface, ISO 4401

5 = Size 05
7 = Size 07
8 = Size 08

2 Spool type

See Functional Symbols, previous page.
2 = All ports blocked when spool is centered
33 and 133 = Bleed A and B to T when spool is centered

3 Spool control

C = Spool spring centered

4 Spool type

See adjacent table.
Flow rating (L/min) for symmetric spools; “A” port flow rating for asymmetric spools

5 Spool type

See Functional Symbols, previous page.
N = meter-in and meter-out

6 Spool type

See adjacent table.
“B” port flow rating for asymmetric spools

7 Internal plug

E = Plug fitted

8 Design number, 1* series

Subject to change. Installation dimensions unaltered for design numbers 10 to 19 respectively.

Spool Types and Flow Ratings

Flow ratings for flow through P-A-B-T at Δp = 5 bar (72 psi) per flow path, e.g. P-A or B-T. For other pressure drops see “Flow Gain” curves.

Symmetric Spools

Spool code	Symbol	Flow rating
For KDG3V-**5** valves:		
2C90N	2C	85 L/min (22 USgpm)
33C80N	33C	75 L/min (20 USgpm)
For KDG3V-**7** valves:		
2C180N	2C	180 L/min (48 USgpm)
33C170N	33C	170 L/min (45 USgpm)
For KDG3V-**8** valves:		
2C280N	2C	280 L/min (74 USgpm)
33C270N	33C	270 L/min (71 USgpm)

Asymmetric Spools

Figure preceding metering type designator, “N” (e.g. 2C***N) is “A” port flow rating, i.e. P-A, or A-T; figure after “N” (N***) is “B” port flow rating, i.e. P-B or B-T.

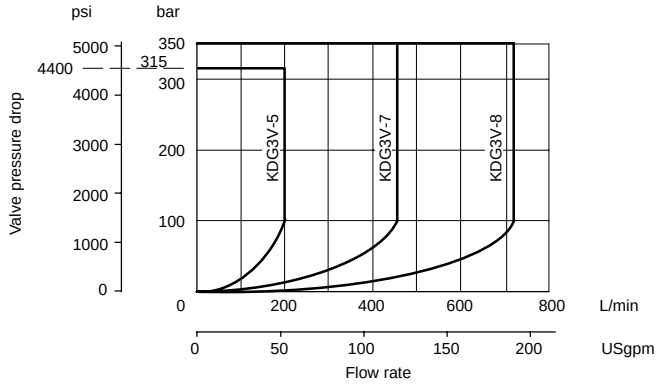
Spool code	Symbol	Flow rating
For KDG3V-**5** valves:		
2C70N45	2C	70 L/min (18.5 USgpm), “A” port flow 45 L/min (12 USgpm), “B” port flow
For KDG3V-**7** valves:		
2C180N100	2C	180 L/min (48 USgpm), “A” port flow 100 L/min (26 USgpm), “B” port flow
For KDG3V-**8** valves:		
33C250N170	33C	250 L/min (66 USgpm), “A” port flow 170 L/min (45 USgpm), “B” port flow
133C250N170	133C	250 L/min (66 USgpm), “A” port flow 170 L/min (45 USgpm), “B” port flow

Operating Data

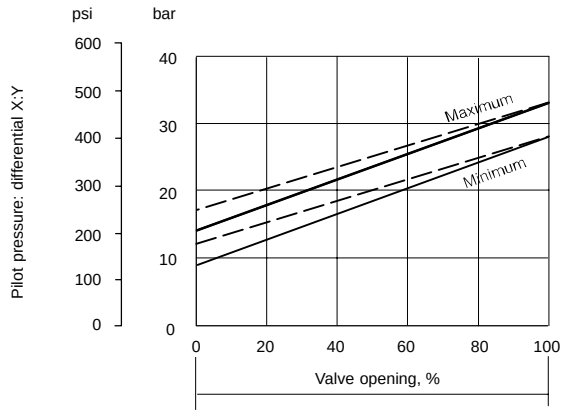
Data is typical with fluid at 36 cSt (168 SUS) and 50°C (122°F)

Max pressures, all ports: For KDG3V-**5** For KDG3V-**7/8**	 315 bar (4500 psi) 350 bar (5000 psi)
Pilot pressure for control	See below
Flow rating	See 4 and 5 in model code
Flow gain	
Power capacity envelopes	See below
Mass: KDG3V-5 KDG3V-7 KDG3V-8	kg (lb) 8,2 (18) 10,2 (22.5) 18,9 (41.6)

Power Capacity Envelopes
KDG3V-5/7/8 valves are not recommended for applications where flow/pressure drop is outside of these envelopes



Pilot Pressure for Control
Spool type 2C: ———
Spool types 33C and 133C: — — —



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

Filtration Requirements
Recommendations on filtration methods and the selection of products to control fluid condition are included in Vickers publication 561 or 9132.

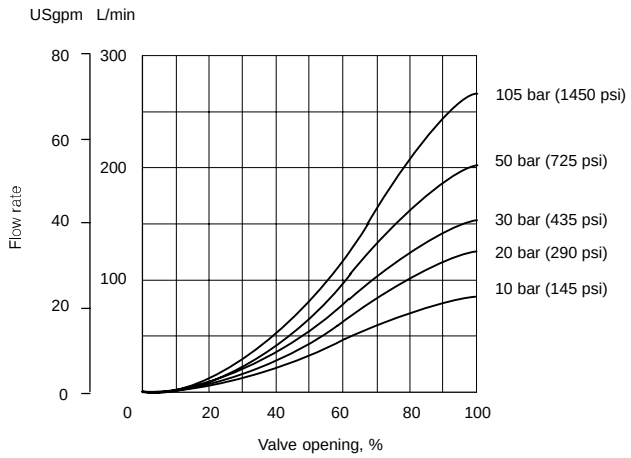
For products in this catalog the recommended fluid cleanliness levels are:
Up to 138 bar (2000 psi) 17/15/12
Above 138 bar (2000 psi) 15/13/11

Fluid Temperatures
For petroleum oil:
Min. . . . . –20°C (–4°F)
Max.* . . . . . +70°C (+158°F)
** To obtain optimum service life from both fluid and hydraulic system, 65°C (150°F) normally is the maximum temperature.*

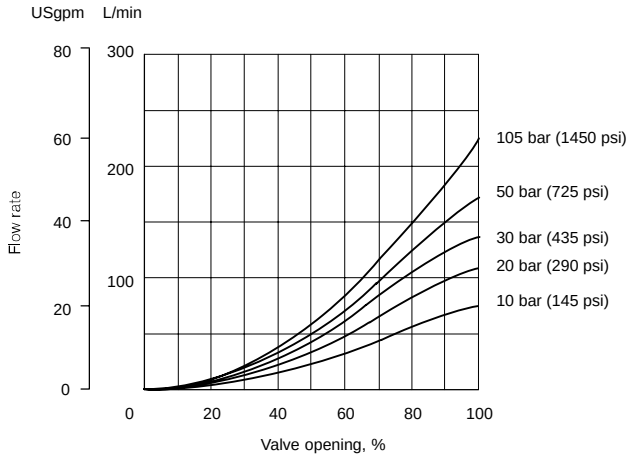
For other fluids where limits are outside those of petroleum oil, consult fluid manufacturer or Vickers representative. Whatever the actual temperature range, ensure that viscosities stay within those specified under “Hydraulic Fluids”.

Flow Gain Curves

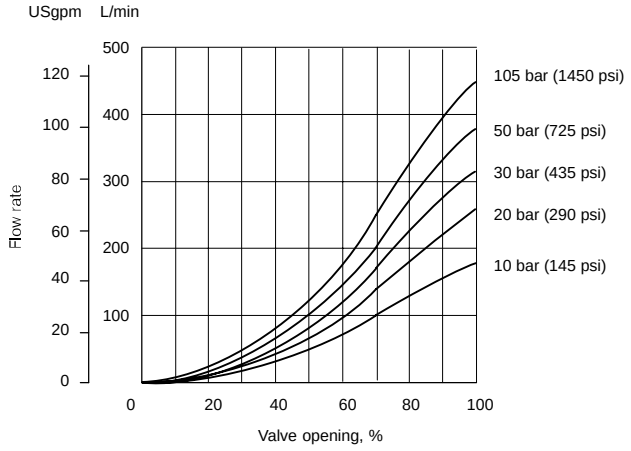
KDG3V-5-**2C90N**



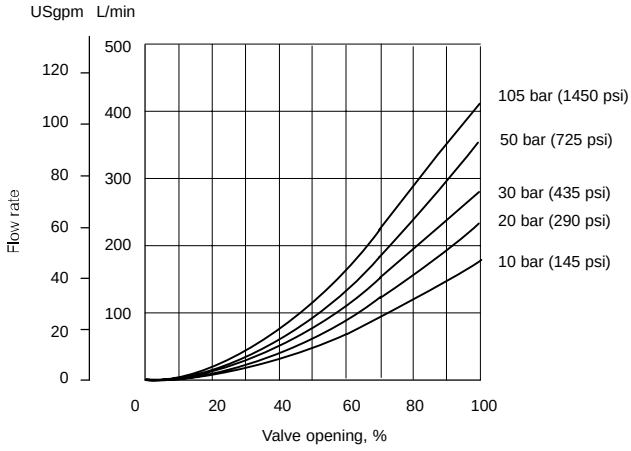
KDG3V-5-**33C80N**



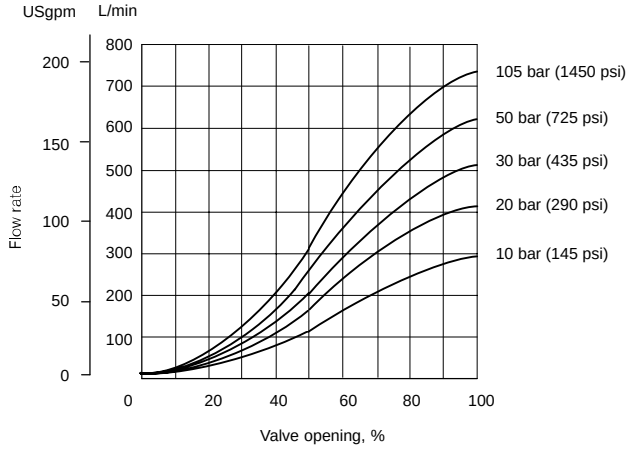
KDG3V-7-**2C180N**



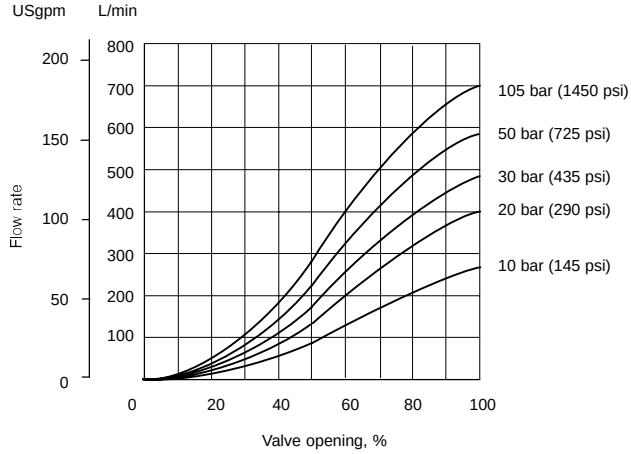
KDG3V-7-**33C170N**



KDG3V-8-**2C280N**



KDG3V-8-**33C270N**



Installation Dimensions in mm (inches)

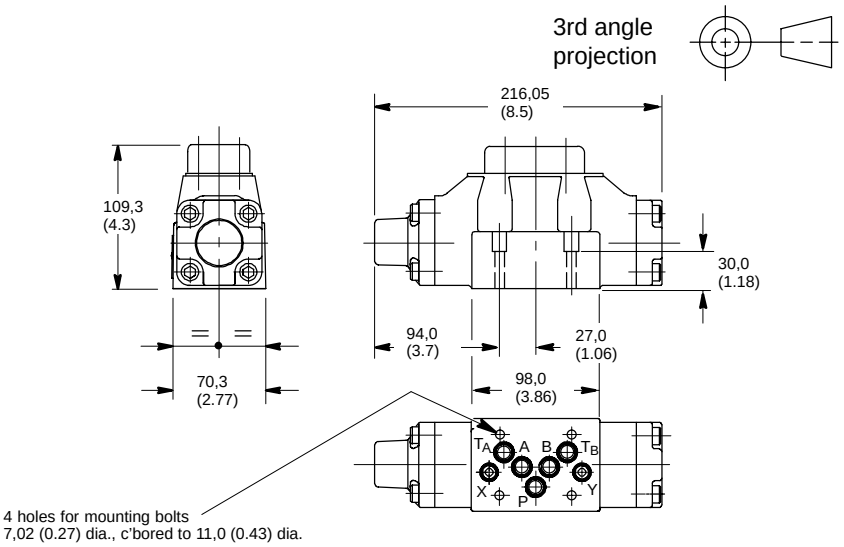
KDG3V-5

Mounting Bolt Kits

Metric, M6 . . . . . BKDG01633M
Inch, $^1/_4$″-20 UNC BKDG01633

Torque Data

Up to 210 bar (3000 psi)
. . . . . 14 Nm (10.3 lbf ft)
Up to 315 bar (4500 psi)
. . . . . 20 Nm (14.75 lbf ft)



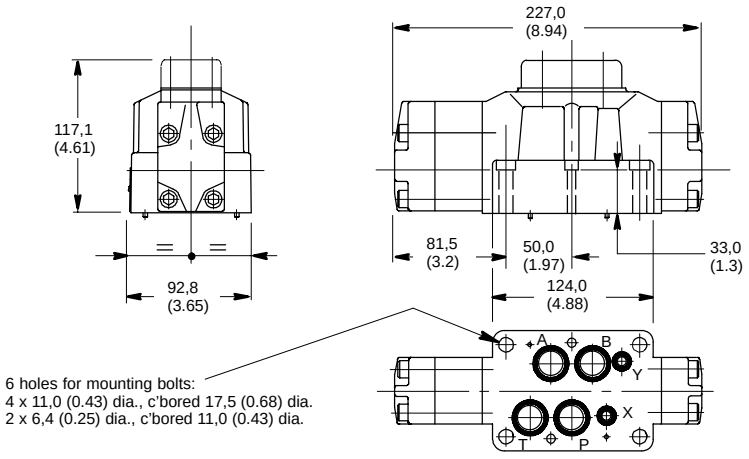
KDG3V-7

Mounting Bolt Kits

Metric, 4 x M10 plus 2 x M6
. . . . . BKDG7858918
Inch, 4 x $^3/_8$″-16 UNC plus 2 x $^1/_4$″-20 UNC BKDG01633

Torque Data

M10; $^3/_8$″-16 UNC . . . . . 49-59 Nm
. . . . . (36-43lbf ft)
M6; $^1/_4$″-20 UNC . . . . . 9-14 Nm
. . . . . (6.6-10.3 lbf ft)



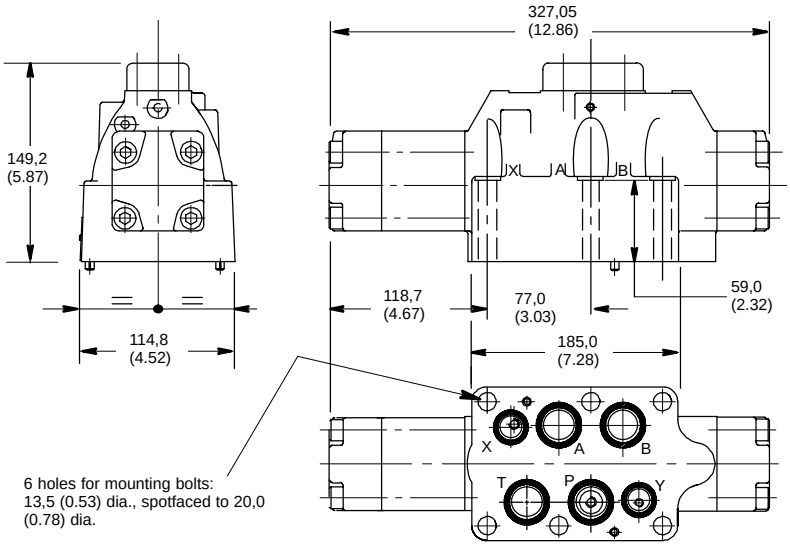
KDG3V-8

Mounting Bolt Kits

Metric, M12 . . . . . BKDG06635M
Inch, $^1/_2$″-13 UNC BKDG06635

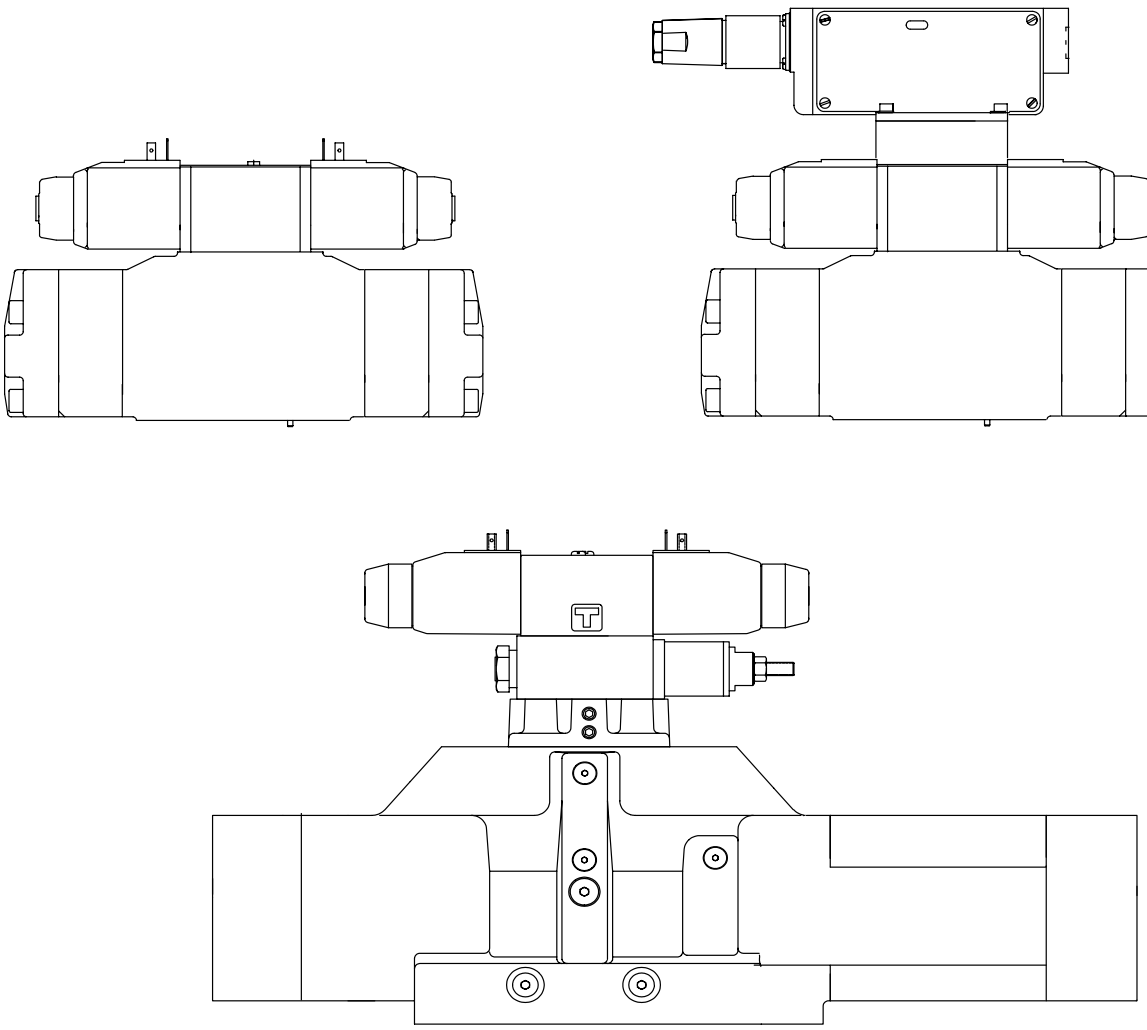
Torque Data

M12; $^1/_2$″-13 UNC . . . . . 103-127 Nm
. . . . . (76-93 lbf ft)



Proportional Directional Control Valves

**K(A)DG5V-5/7/8 & KDG5V-10, 1* Series,
Two-Stage Models without Electrical Feedback
ISO 4401 Sizes 05, 07,08 and 10 ANSI/B93.7M-D07/08/09**



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, the Installation Wiring Practices for Vickers Electronic Products leaflet 2468 and leaflet 02-123931A which is packed with every KA valve. Wiring practices relevant to this Directive are indicated by ⚠ Electromagnetic Compatibility (EMC).

Introduction

Vickers KDG5V-5/7/8/10 are solenoid operated directional control non-feedback type proportional valves.

Two-stage proportional directional control valves in which the main-stage spool is positioned according to the output from an integrally mounted proportional, solenoid-operated , pressure-reducing valve. Direction of main-spool travel depends upon which of the two solenoids of the pilot valve is energized and the amount of travel is dependent upon the current input to the solenoid.

At any intermediate position of the main spool, a force balance exists between the controlled, reduced pilot pressure acting on the spool end and the opposing centering spring, plus the action of flow forces. There is no electrical feedback of the main-stage spool position.

This range of valves offers effective and economic solutions for applications having repetitive load conditions throughout each operating cycle, e.g. mold closure/opening in plastics molding machinery.

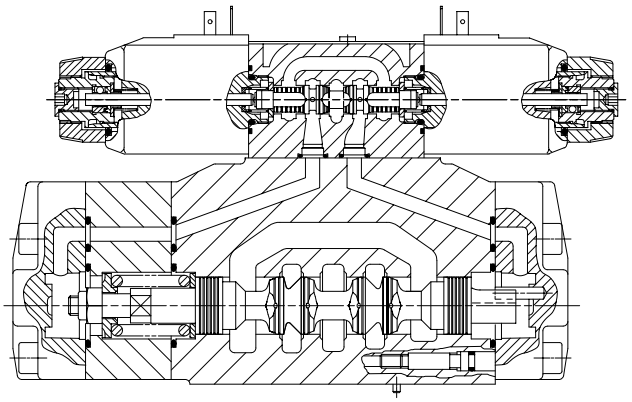
Valve sizes 5,7 & 8 are available with integral amplifiers.

Features and Benefits

- These global products, manufactured to world-class quality standards, are sold and serviced throughout the world.
- These valves open up expanded application opportunities as a cost effective alternative to feedback-type proportional and servo valves.
- Vickers flexible design approach provides a wide variety of matching electronic amplifiers, valve options, and spool ratings.

Typical Section Views

KDG5V-7 shown without “EX” or “X” (Without integral pilot pressure reducer)



KDG5V-10 shown with “EX” or “X” (With integral pilot pressure reducer)

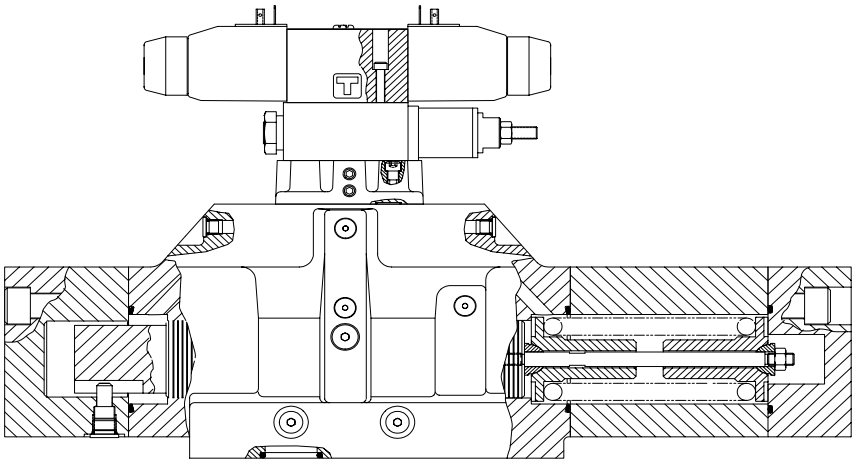


Table of Contents

Introduction B.2

Features and benefits B.2

Typical section B.2

Functional Symbols B.4

Model Codes B.5

Spool Data B.6

Operating Data B.7

Performance Characteristics B.9

Installation Dimensions B.12

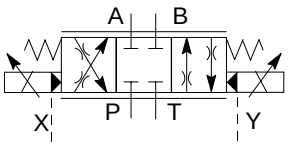
Subplates, Connection Plates and Mounting Surfaces B.17

Electrical Information B.31

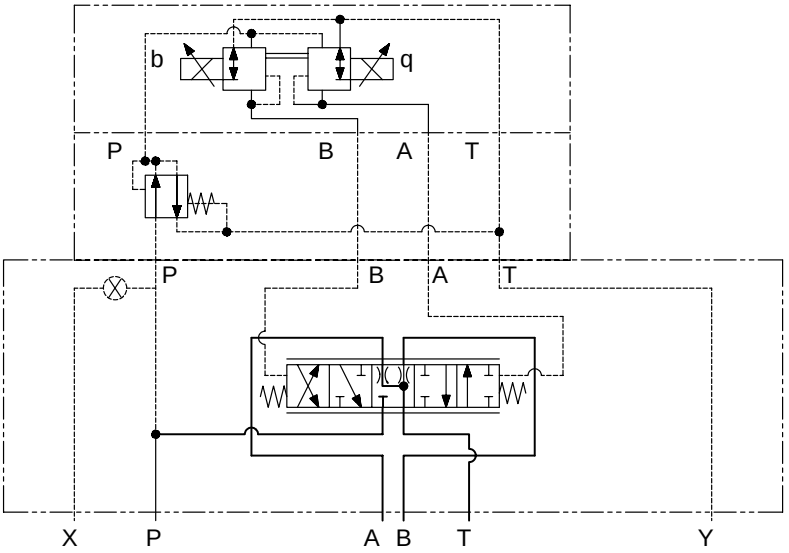
Installation Data B.38

Application Data B.39

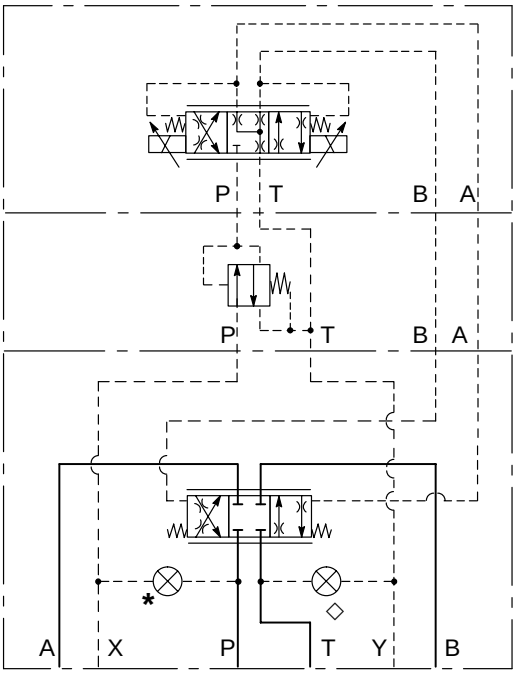
Functional Symbols



Simplified symbol
KDG5V models
(Spool type “2” shown)



Typical Schematic Symbol-Size 10

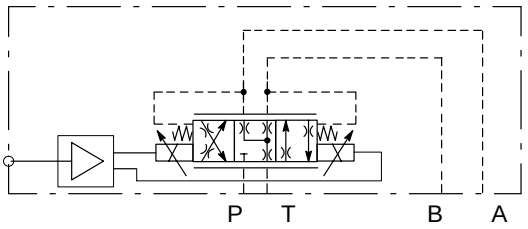


Pilot stage.
Solenoids identified “A”/“B” according to “Model Code” designation.

Pressure reducer module, see “Model Code”

Main-stage.
Spool type “2C” shown

Typical Schematic Symbol-Sizes 5/7/8



Pilot stage with integral amplifier

* *Internal plug shown, for external pilot supply (via port X).*
For internal pilot supply (from port P) plug is not fitted. Port X should be blocked at mounting interface, or otherwise plugged at subplate or manifold block. See “Model Code”.
◇ *Internal plug shown, for external pilot drain (via port Y).*
For internal pilot drain (via port T) plug is not fitted. Port Y should be blocked at mounting interface, or otherwise plugged at subplate or manifold block.
See “Model Code”.
See also “Pilot Drain Application” notes.

Model Codes

K(A)DG5V - * - * C *** N (***) - (**) - (T) - (*) - (V) M - ******* - 1 - 1* - EN47**

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

1 Model Series

K– Proportional
A– Integral amplifier, sizes 5 / 7 & 8 only
D– Directional valve
G– Subplate/manifold mounted
5– Solenoid controlled/pilot operated
V– Pressure rating 350 bar (5000 psi) on P, A & B ports

2 Mounting interface size (ISO 4401)

5 = NFPA D05, CETOP 5
7 = NFPA D07, CETOP 7
8 = NFPA D08, CETOP 8
10 = NFPA D10, CETOP 10

3 Spool type

See “Spool Data”, page B.6

2 = All ports blocked when spool centered
7 = Open P to A&B,
12 = All ports blocked when spool centered, regenerative function when spool energized
33/133 = Bleed A and B to T when spool centered

4 Spool/ spring arrangement

C = Spool spring centered

5 Flow rating

See “Spool Data”, page B.6
Flow rating (L/min) for symmetric spools: “A” port flow rating (L/min) for asymmetric spools

6 Spool metering type

N = Meter-in and meter-out

7 Flow rating

See “Spool Data”, page B.6
“B” port flow rating (L/min) for asymmetric spools

8 Pilot supply

Models without integral, fixed pilot pressure reducer module
E = External pilot supply
Blank= Internal pilot supply

Models with integral, fixed pilot pressure reducer module
X = Internal pilot supply
EX = External pilot supply

For system pressures less than 200 bar (2900 psi) the pilot pressure reducing module is optional.
For system pressures above 200 bar (2900 psi) the pilot pressure reducing module must be fitted.

9 Pilot drain

T = Internal pilot drain
Blank = External pilot drain

10 Manual override

Blank = Plain overrides
H = Water-resistant overrides
Z = No overrides

11 Solenoid identity

V = Solenoid “A” at port A end of pilot valve, solenoid “B” at B end. (Energizing “A” gives main-stage flow from port B; energizing “B” gives flow from port A): German practice.
Blank= Solenoid “A” energized for main-stage flow from port A; solenoid “B” energized for main-stage flow from port B: USA ANSI B93./NFPA standard.

12 Heading electrical flag symbol

M = Features and options for pilot valve

13 Electrical data and connection type

Plug connector type to ISO 4400 (DIN 43650). For coil characteristics see “Operating Data” table (page B.7):

U-G = For use with amplifier with 12V DC supply
U-GP = For use with 12V power
U-H = For use with amplifier with 24V DC supply
U-HA = For use with 24V power plug
U-HR = For use with 800 mA power supply
F-PD7 = 7-pin connector with plastic plug. See warning note below

14 Pilot drain pressure

1 = Standard

(See Pilot Drain Application Notes, page B.9)

15 Design number, 10 series

Subject to change. Installation dimensions unaltered for design numbers 10 to 19 respectively.

16 Special features

EN47 used with P type coil connection and Uniplug connector.
Omit if not required

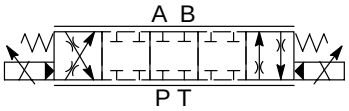
Warning
To conform to the EC Electromagnetic Compatibility directive (EMC) this KACG valve must be fitted with a metal 7-pin plug. The screen of the cable must be securely connected to the shell of the metal connector. A suitable IP67 rated connector is available from Vickers, part no. 934939. Alternatively a non IP67 rated connector is available from ITT-Cannon, part no.CA 02 COM-E 14S A7 P. The plastic plug, part number 694534, is only suitable for use in a sealed electromagnetic environment or outside of the European Community.

Spool Data

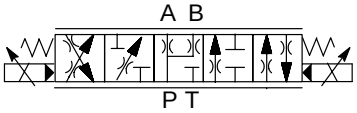
Spool Symbols

Simplified symbols including transient flow conditions (dotted line).

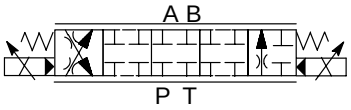
Spool type 2C



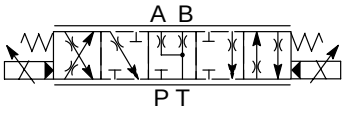
Spool type 7C



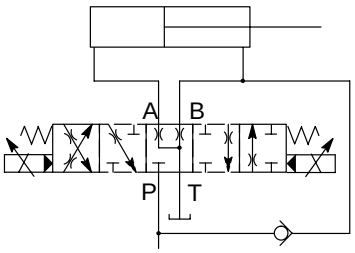
Spool type 12C



Spool type 33C



Spool type 133C, with typical regenerative circuit



Full flow

Restricted flow

Spool Types and Flow Ratings

Symmetric Spools

Flow ratings for flow through P-A-B-T at Δp = 5 bar (72 psi) per flow path, e.g. P-A, or B-T. For other pressure drop values see “Flow Gain” curves on page B.10.

Spool code	Main stage spool symbol	Flow rating
For K(A)DG5V-**5** valves:		
2C90N	2C	90 L/min (24 USgpm)
33C80N	33C	80 L/min (21 USgpm)
For K(A)DG5V-**7** valves:		
2C180N	2C	180 L/min (48 USgpm)
33C170N	33C	170 L/min (45 USgpm)
For K(A)DG5V-**8** valves:		
2C280N	2C	280 L/min (74 USgpm)
33C270N	33C	270 L/min (71 USgpm)
For KDG5V-**10** valves:		
2C550N	2C	550 L/min (145 USgpm)
7C550N	7C	550 L/min (145 USgpm)
12C550N	12C	550 L/min (145 USgpm)
33C550N	33C	550 L/min (145 USgpm)
133C550N	133C	550 L/min (145 USgpm)

Asymmetric Spools

Figure preceding metering type designator, “N” (e.g. 2C***N) is flow rating P-A, or A-T (“A” port flow); figure after “N” (N***) is flow rating P-B, or B-T (“B” port flow).

Spool code	Main stage spool symbol	Flow rating
For K(A)DG5V-**5** valves:		
2C70N45	2C	70 L/min (18.5 USgpm), “A” port flow 45 L/min (12 USgpm), “B” port flow
For K(A)DG5V-**7** valves:		
2C180N100	2C	180 L/min (48 USgpm), “A” port flow 100 L/min (26 USgpm), “B” port flow
For K(A)DG5V-**8** valves:		
33C250N170	33C	250 L/min (66 USgpm), “A” port flow 170 L/min (45 USgpm), “B” port flow
133C250N170	133C	250 L/min (66 USgpm), “A” port flow 170 L/min (45 USgpm), “B” port flow
For KDG5V-**10** valves:		
2C310N550	2C	310 L/min (82 USgpm), “A” port flow 550 L/min (145 USgpm), “B” port flow
2C550N310	2C	550 L/min (145 USgpm), “A” port flow 310 L/min (82 USgpm), “B” port flow
33C310N550	33C	310 L/min (82 USgpm), “A” port flow 550 L/min (145 USgpm), “B” port flow
33C550N310	33C	550 L/min (145 USgpm), “A” port flow 310 L/min (82 USgpm), “B” port flow

Operating Data

Data is typical:
With fluid at 36 cSt (168 SUS) and 50°C (122°F).
Using recommended Vickers amplifier to drive KDG5V models.

KDG5V valves

Installation and Start-up Guidelines	ML-B-9046	
Max. solenoid current Coil type: U-G U-GP U-H U-HA U-HR	 3.5A 3.0A 1.6A 0.94A 0.8A	
Coil resistance Coil type: U-G U-GP U-H U-HA U-HR	At 20°C (68°F) 1.65Ω 2.0Ω 7.3 Ω 22.1Ω 19.1Ω	Max. operating 2.66Ω 3.1Ω 11.3 Ω 34.6Ω 29.9Ω
Coil inductance measured at 1000 Hz and 150 mV Coil type: U-G U-GP U-H U-HA U-HR	 4 mH 6 mH 19 mH 55 mH 51 mH	
Hysteresis Size 5/7/8 Size 10	 ±4% of rated max. flow <6% of rated max. flow	 Size 5/7/8 Size 10
Repeatability: Size 5/7/8 Size 10	 <3% 8%	
Relative duty factor	Continuous rating (ED = 100%)	
Type of electrical protection, with electrical plugs fitted correctly	IEC 144 Class IP65	
Electrical connection	ISO 4400 (DIN 43650)	
Recommended drive amplifier	Vickers Eurocard type: EEA-PAM-520-A-14 (one ramp), or EEA-PAM-523-A-32 (two ramps)	

KADG5V-5/7/8 Valves with Integral Amplifiers

Power supply	24V DC (21V to 36V including 10% peak-to-peak max. ripple) max. current 3A
Command signal Input impedance	±10V DC 47 kΩ
7-pin plug connector Pin connections: A B C D E F G	 Power supply +ve Power 0V Signal 0V +ve voltage command signal –ve voltage command signal Monitor output Protective ground
Electro-magnetic compatibility (EMC): Emission (10 v/m) Immunity (10 v/m)	 EN 50081-2 EN 50082-2
Gain adjustment	25 to 125%
Factory set adjustments	Deadband, gain, dither and offset
Monitor point signal Output impedance	0,5V per amp solenoid current 10 kΩ
Power stage PWM frequency	2 kHz nominal
Reproducibility, valve-to-valve (at factory settings): Flow gain at 100% command signal	 <3% of rated flow
Protection: Electrical Mechanical	 Reverse polarity protected IEC 144, Class IP65
Relative humidity	65 to 85% at 20 to 70°C (68 to 158°F)
Supporting products: Auxiliary electronic modules (DIN-rail mounting): EHA-CON-201-A-2* signal converter EHD-DSG-201-A-1* command signal generator EHA-RMP-201-A-2* ramp generator EHA-PID-201-A-2* PID controller	

Performance Characteristics

Data is typical with fluid at 36 cSt (168 SUS) and 50°C (122°F), using Vickers recommended amplifier to drive KDG5V models.

Minimum Pressure
For full flow performance pilot pressure ≥45 bar (650 psi), i.e.:
Pressure at port P for internal pilot supply ("X" or omit in model code).
Pressure at port X for external pilot supply ("E" or "EX" in model code).

Pilot Drain Application Notes
External pilot drain is to recommended configuration.
Internal pilot drain is possible where a stable "T" port pressure, not exceeding 8 bar (116 psi), can be guaranteed.

Any pressure surges at the "T" port (drain) will cause the main spool to move and change the valve output. This possibility is eliminated by the use of an external drain.

Maximum Pressures, bar (psi)

For models without integral pilot pressure reducer

Model	Pilot Pressure Source	Model code ⍰	Ports P,A,B	T	X	Y▪
KDG5V-**5**	External	E	315 (4500)	210 (3000)	200 (2900)	8 (116)
	Internal	Omit	200● (2900)	210 (3000)	◆	8 (116)
KDG5V-**7/8**	External	E	350 (5000)	350 (5000)	200 (2900)	8 (116)
	Internal	Omit	200● (2900)	350 (5000)	◆	8 (116)
KDG5V-**10**	External	E	350 (5000)	350 (5000)	210 (3000)	8 (116)
	Internal	Omit	200 (2900)	350* (5000)	◆	8 (116)

For models with integral pilot pressure reducer

KDG5V-**5**	External	EX	315 (4500)	210 (3000)	315 (4500)	8 (116)
	Internal	X	315 (4500)	210 (3000)	◆	8 (116)
KDG5V-**7/8**	External	EX	350 (5000)	350 (5000)	315 (4500)	8 (116)
	Internal	X	315● (4500)	350 (5000)	◆	8 (116)
KDG5V-**10**	External	EX	350 (5000)	350* (5000)	315 (4500)	8 (116)
	Internal	X	315 (4500)	350 (5000)	◆	8 (116)

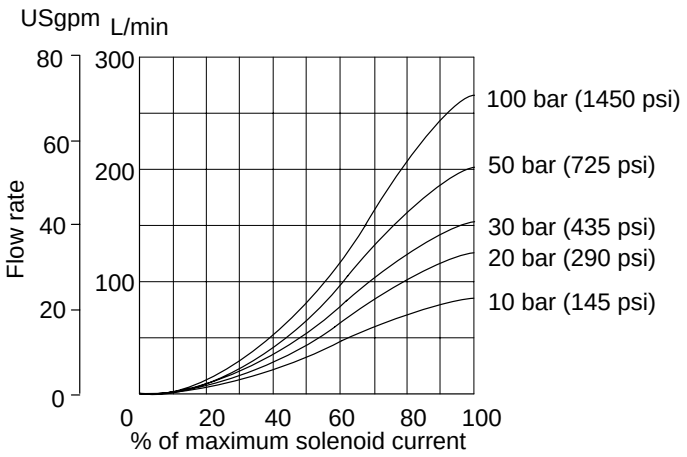
◆ *When using internal pilot pressure, port X should be plugged at the subplate or manifold face (e.g. manifold not drilled for connection to port X).*
● *The maximum pressure for ports A and B is: 315 bar (4500 psi) for size 5; 350 bar (5000 psi) for sizes 7, 8 and 10.*
▪ *See "Pilot Drain Application" note.*
*–*Pilot must be externally drained, otherwise "Y" port pressure applies.*

Performance Curves

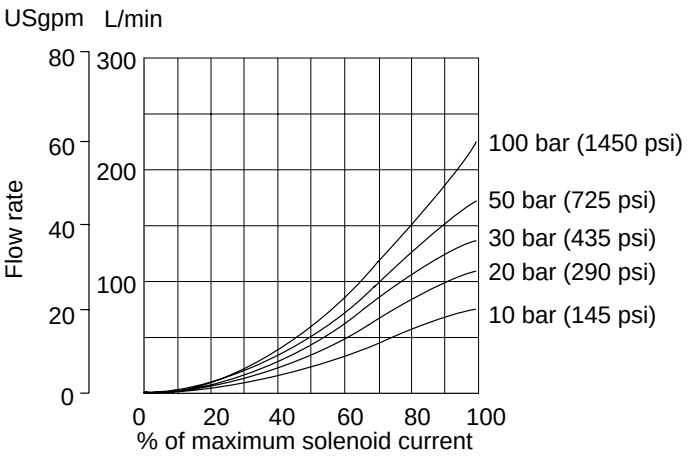
Flow Gain

Flow gain curves at stated values of total valve pressure drop, for flow P-A-B-T, or P-B-A-T.

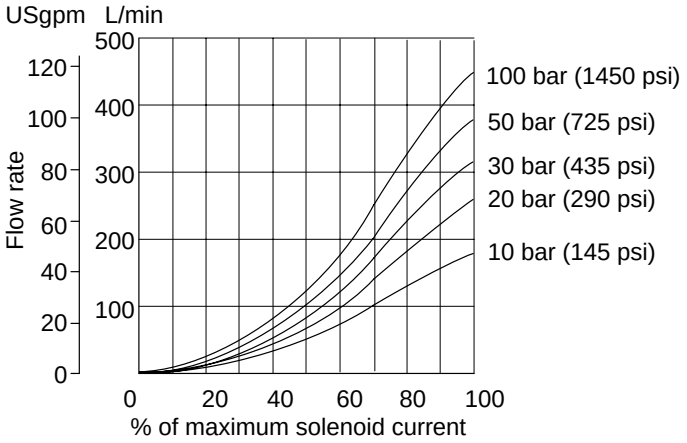
KDG5V-5-**2C90N**



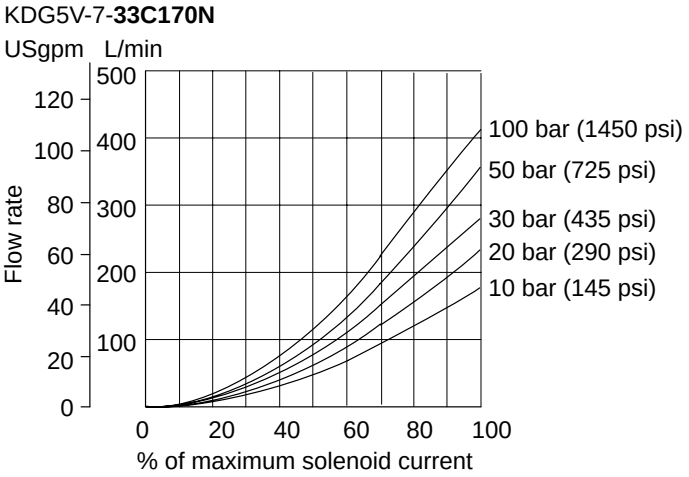
KDG5V-5-**33C80N**



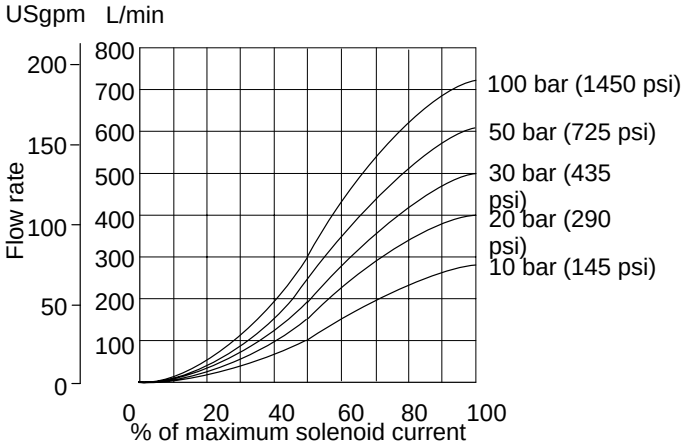
KDG5V-7-**2C180N**



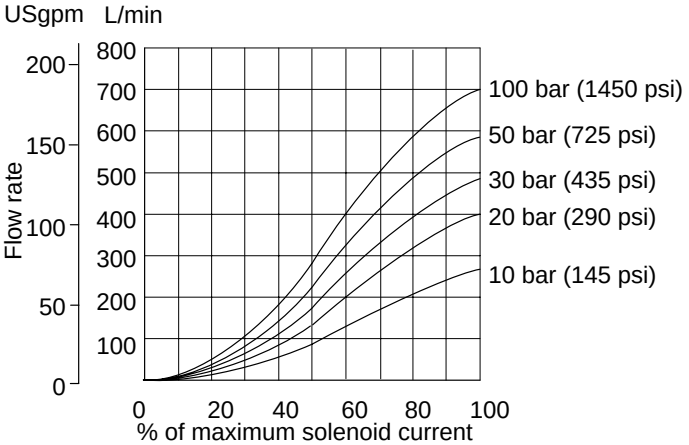
KDG5V-7-**33C170N**



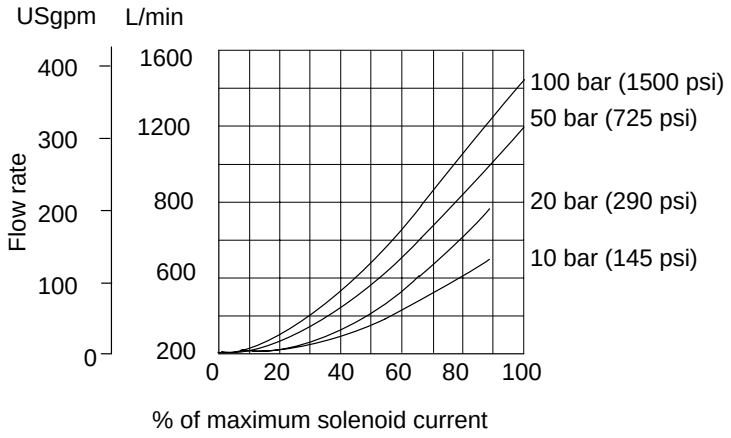
KDG5V-8-**2C280N**



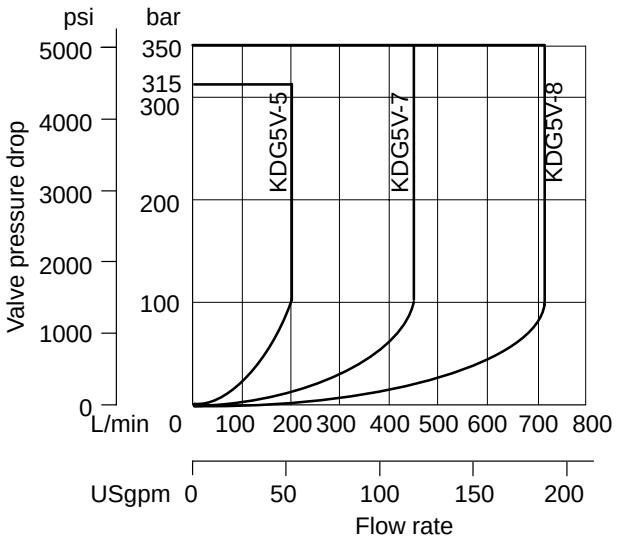
KDG5V-8-**33C270N**



KDG5V-10



Power Capacity Envelopes
Flow through P-A-B-T or P-B-A-T



Subject to maximum pressure limitations according to model type; see “Maximum Pressures”.

Typical Step Response
Test conditions:
No pressure reducer module
Flow P-A-B-T
Total valve Δp = 10 bar (145 psi)
Pilot pressure = 50 bar (725 psi)
“Response” = Time, from step response signal, until output reaches 90% of step change value

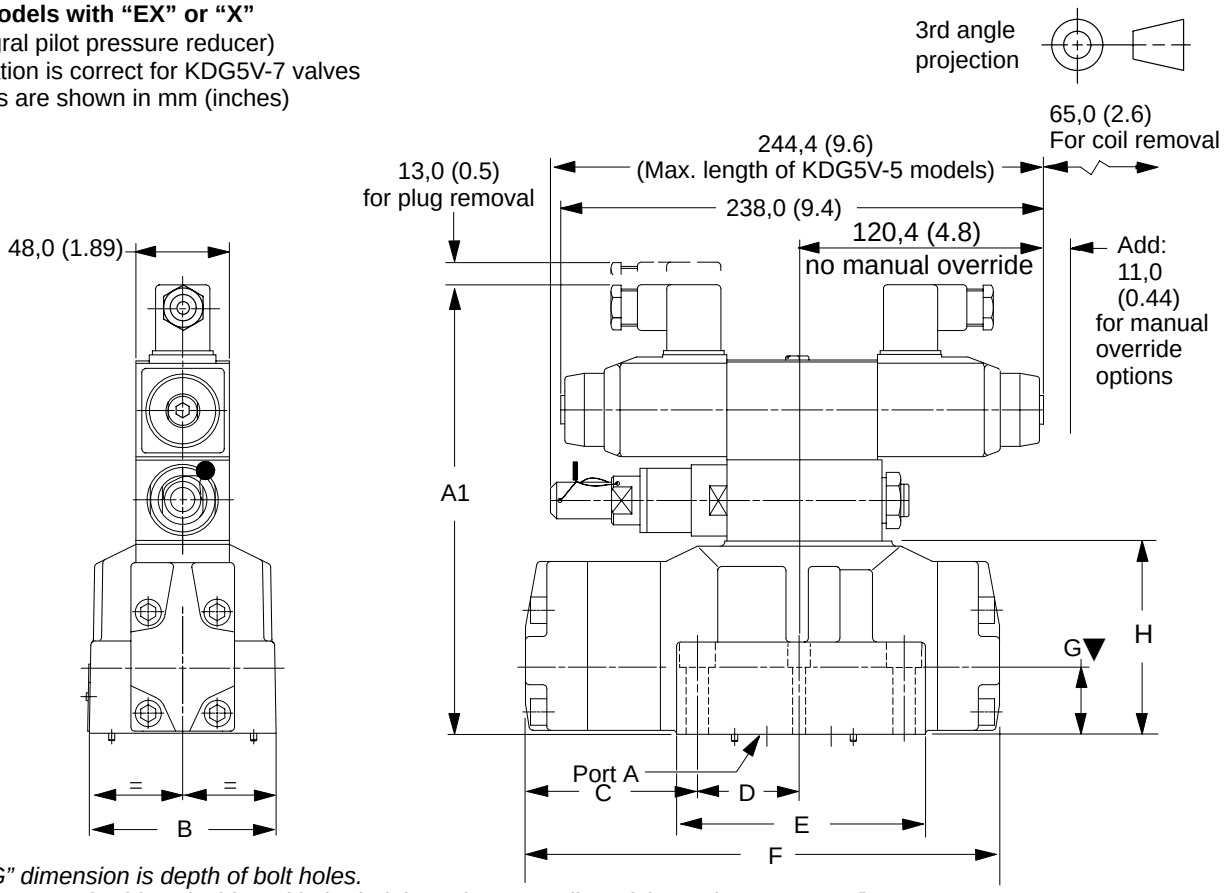
Input signal step change	Spool response times (ms)			
	KDG5V-5	KDG5V-7	KDG5V-8	KDG5V-10
0 to 100%	48	61	80	206
100% to 0	38	43	40	182
10% to 90%	42	58	66	
90% to 10%	50	58	54	
25% to 75%	30	47	49	
75% to 25%	50	58	66	
90% to 90%	70	87	98	
0% to 75%				170
75% to 0%				175
0% to 50%				160
50% to 0%				160
0% to 25%				124
25% to 0%				124

Pilot flow required to achieve above response times:

KDG5V-5	KDG5V-7	KDG5V-8	KDG5V-10
2,7 L/min (0.7 USgpm)	4,2 L/min (1.1 USgpm)	7,5 L/min (2.0 USgpm)	18,75 L/min (5.0 USgpm)

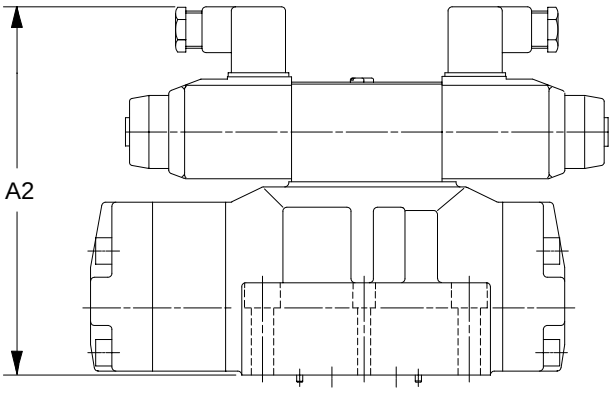
Installation Dimensions

KDG5V Models with "EX" or "X"
(With integral pilot pressure reducer)
The illustration is correct for KDG5V-7 valves
Dimensions are shown in mm (inches)



▼ *"G" dimension is depth of bolt holes.*
(On KDG5V-7 only, this coincides with the height to the center line of the main-stage spool).

KDG5V Models with "E" or No Symbol
(Without integral pilot pressure reducer)

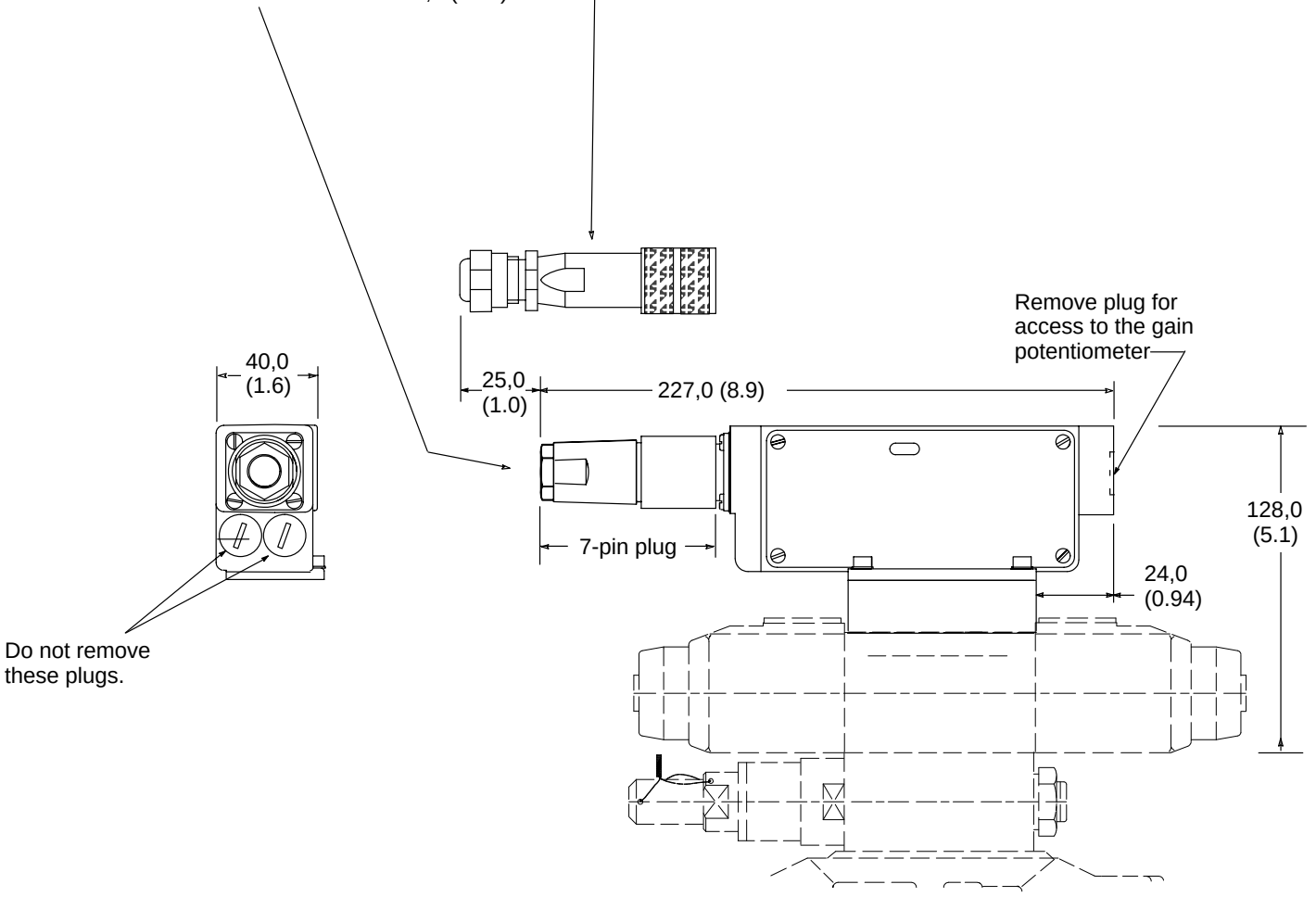


Model	A1	A2	B	C	D	E	F	G	H
KDG5V-5	215,0 (8.47)	175,0 (6.9)	70, (2.77)	94,4 (3.72)	27,0 (1.06)	98, (3.86)	217,0 (8.54)	30,0 (1.18)	87,3 (3.4)
KDG5V-7	223,0 (8.8)	183,0 (7.2)	92,8 (3.65)	83,3 (3.3)	50,0 (1.97)	124,0 (4.88)	232,0 (9.14)	33,0 (1.3)	95,1 (3.7)
KDG5V-8	255,0 (10.1)	215,0 (8.47)	114,8 (4.52)	118,4 (4.66)	77,0 (3.03)	185,0 (7.28)	332,0 (13.1)	59,0 (2.32)	127,2 (5.0)

KADG5V-5/7/8 models fitted with integral amplifier

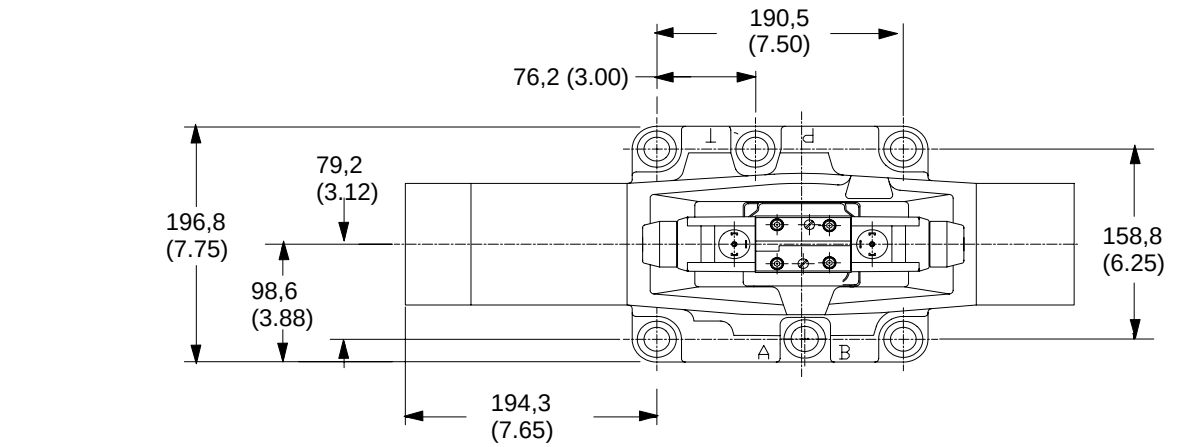
Metal plug 934939
Cable outside diameter 8,0 to 10,5 (0.31 to 0.41)
Must be used for full EMC protection. See also warning note on page B.32.

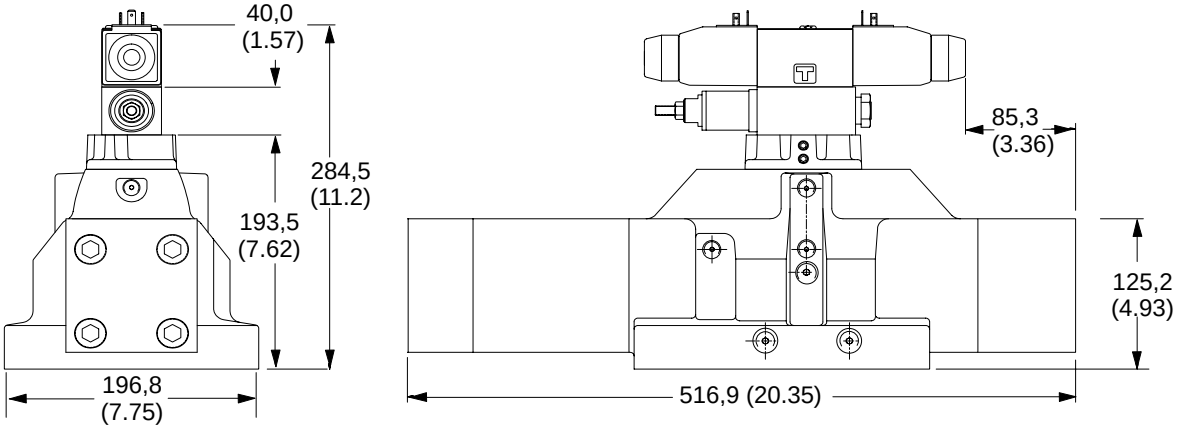
Plastic plug 694534
PG11. Cable maximum outside diameter 11,0 (0.43)



KDG5V-10 Models with “EX” or “X”
(With integral pilot pressure reducer)
Dimensions are shown in mm (inches)

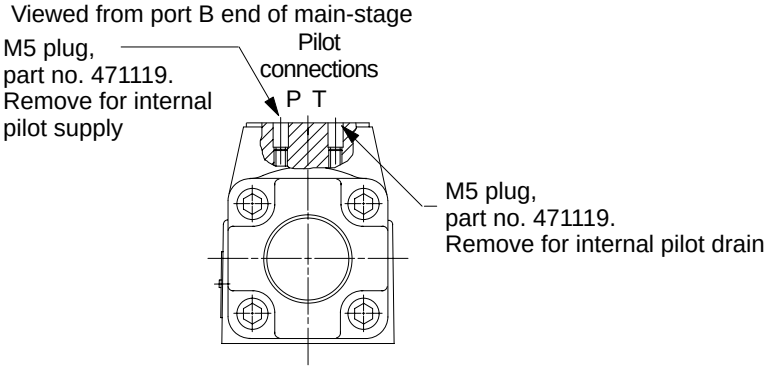
3rd angle projection





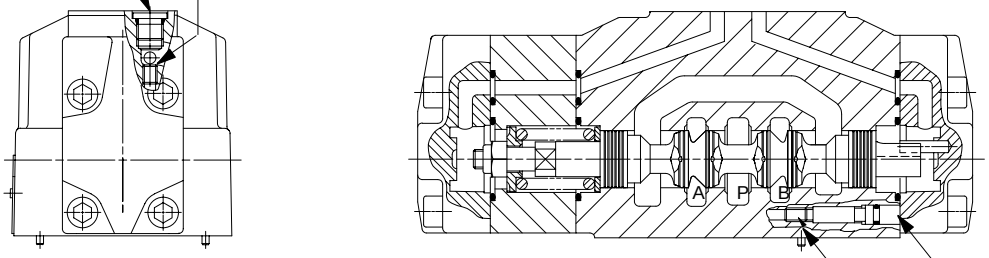
Pilot Supply and Drain Plugs

KDG5V-5 models
Viewed from port B end of main-stage



KDG5V-7 models only*****
Remove this plug for access to pilot drain plug

KDG5V-7 models only*****
M6 x 8mm plug, part no. 471131:
fitted for external pilot drain.
Not fitted for internal pilot drain.

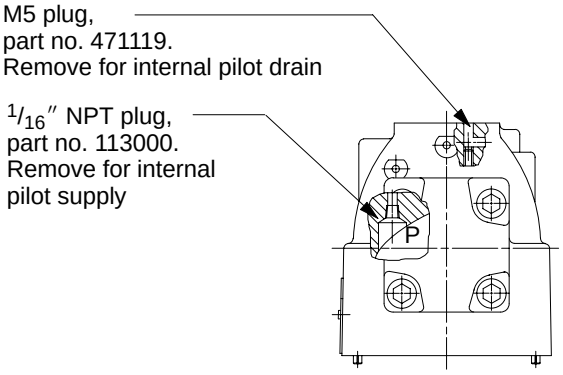


KDG5V-7 models only*****
M6 x 8mm plug, part no. 471131:
fitted for external pilot supply models; not fitted for internal pilot supply models. See “Model Code” .

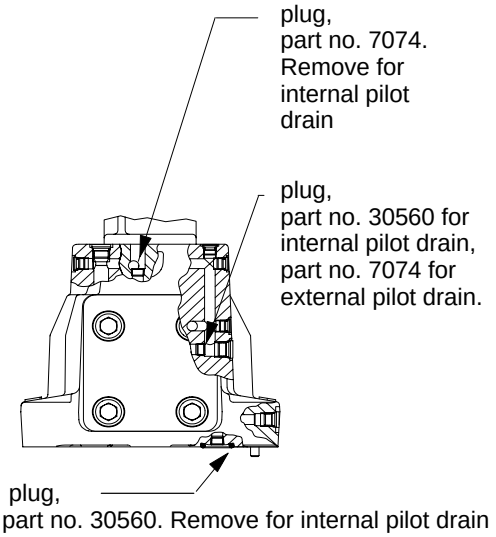
Size 7 only*****
M5 internal thread for removal of closure plug

***** Internal plug shown, for external pilot supply (via port X).
For internal pilot supply (from port P) plug is not fitted. Port X should be blocked at mounting interface, or otherwise plugged at subplate of manifold block. See “Model Code”.

KDG5V-8 models
Section through port P of main-stage

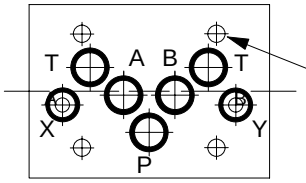


KDG5V-10 models



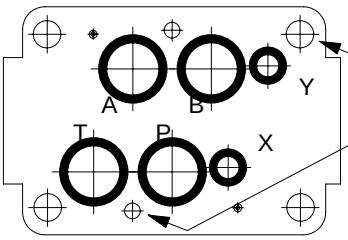
Views on Mounting Faces
All O-seals supplied

KDG5V-5 mounting face



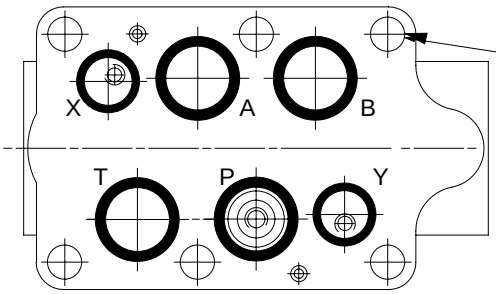
4 holes for mounting bolts
Ø 7,02 (0.27Ø) spotfaced to
Ø 11,0 (0.43 Ø)

KDG5V-7 mounting face



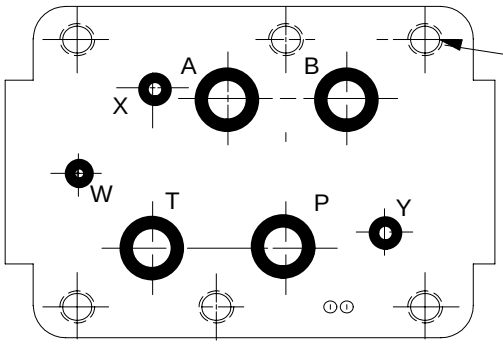
6 holes for mounting bolts
4 x Ø 11,0 (0.43 Ø) c'bored
Ø 17,5 (0.68 Ø)
2 x Ø 6,4 (0.25 Ø) c'bored
Ø 11,0 (0.43 dia)

KDG5V-8 mounting face



6 holes for mounting bolts
Ø 13,5 (0.53 Ø)
spotfaced to
Ø 20,0 (0.78 Ø)

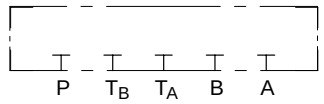
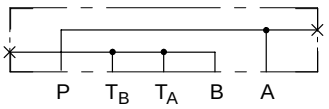
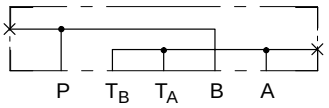
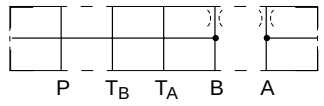
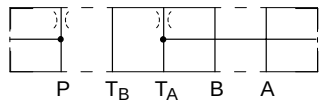
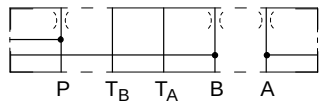
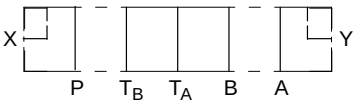
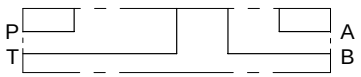
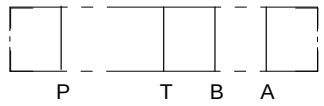
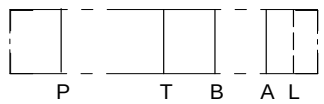
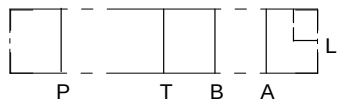
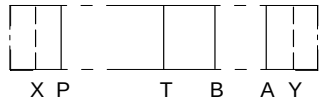
KDG5V-10 mounting face



6 holes for mounting bolts

Subplates, Connection Plates and Mounting Surfaces

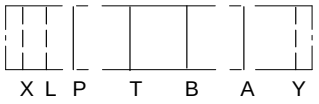
Size 05

Description and Mass kg (lb)	Functional Symbol	Model Code	Max. Pressure
Blanking plate Cast iron 2,9 (6.4)		DGMA-5-B-1*	315 bar (4500 psi)
Crossover plate P-A; B-T Cast iron 2,9 (6.4)		DGMA-5-C1-1*	315 bar (4500 psi)
Crossover plate P-B; A-T Cast iron 2,9 (6.4)		DGMA-5-C2-1*	315 bar (4500 psi)
Tapping plate, ports A and B Cast iron 0,5 (1.1)		DGMA-5-T1-1*-B▲	315 bar (4500 psi)
Tapping plate, ports P and T Cast iron 0,5 (1.1)		DGMA-5-T2-1*-B▲	315 bar (4500 psi)
Tapping plate, ports P, A and B Cast iron 0,5 (1.1)		DGMA-5-T3-1*-B▲	315 bar (4500 psi)
Adaptor plate for pilot ports X and Y Cast iron 1,4 (3.1)		DGAM-5-1*-R▲ DGAM-5-1*-S▲	210 bar (3000 psi)
Single-station subplate; side ports P, T, A, B Cast iron 2,0 (4.4)		DGSME-01-2*-T8▲	210 bar (3000 psi)
Single-station subplate; rear ports P, T, A, B Cast iron 2,0 (4.4)		DGSM-01-2*-T8▲ EDGSM-01-1*-R▲ EDGSM-01X-1*-R▲ EDGSM-01Y-1*-R▲	210 bar (3000 psi) 280 bar (4000 psi)
Single-station subplate; rear ports P, T, A, B; and port L (side or rear) Cast iron 1,3 (2.9)	 	KDGSM-5-676805-2* (SAE/UNF ports) KDGSM-5-615225-1* ($^1/_2$″ BSPF ports) KDGSM-5-615226-1* ($^3/_4$″ BSPF ports) EKDGSM-01Y-1*-R▲	210 bar (3000 psi) 315 bar (4500 psi) 280 bar (4000 psi)
Single-station subplate; rear ports P, T, A, B plus X and Y Cast iron 2,0 (4.4)		EDGSM-03-1*-R▲ EDGSM-03X-1*-R▲ EDGSM-03X-1*-S▲	210 bar (3000 psi)

Design number subject to change. No change of installation dimensions for design numbers 10 to 19 or 21 to 29 inclusive.

▲"S" or "T8" suffix = SAE/UNC ports and/or UNC fixing bolt tappings and/or orifice plugs as appropriate. "R" or "B" = ISO 228 (BSPF) ports and/or metric fixing bolt tappings and/or orifice plugs as appropriate.

Sizes 07 and 08

Description and Mass kg (lb)	Functional Symbol	Model Code	Max. Pressure
Single-station subplate			
Cast iron 3,8 (8.4)		DGSM-04	210 bar (3000 psi)
Cast iron 3,8 (8.4)		EDGVM-7X	350 bar (5000 psi)
Cast iron 6,1 (13.4)		EDGVM-7Y/7Z	350 bar (5000 psi)
Cast iron 5,0 (11)		DGSM-8	210 bar (3000 psi)
Cast iron 5,0 (11)		EDGVM-8X	350 bar (5000 psi)
Cast iron 13 (28.6)		EDGVM-8Y/8Z	350 bar (5000 psi)

General Description

When a subplate is not used, a machined pad must be provided for valve mounting. Pad must be flat within 0,127 mm (.0005 inch) and smooth within 1,6 µm (63 microinch). Mounting bolts, when provided by customer, should be SAE grade 7 or better.

Dimensional Tolerances

Dimensional tolerance on interface drawings is ±0,2 mm (±0.008") except where otherwise stated.

ISO 4401 specifies inch conversion to ±0.01".

Conversion from Metric

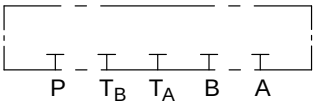
ISO 4401 gives dimensions in mm. Inch conversions are accurate to 0.01" unless otherwise stated.

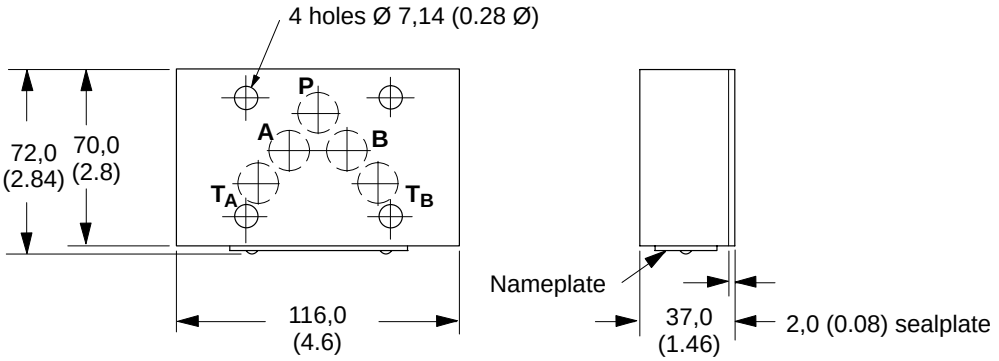
Mounting Bolt Tappings

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 (see page B.38). It is recommended that Customer's own manifold blocks for UNC bolts should be tapped to the minimum depths given in the footnotes.

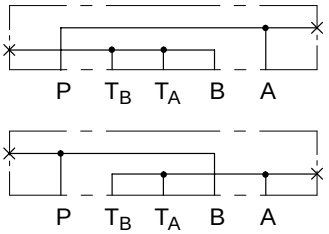
Installation Dimensions

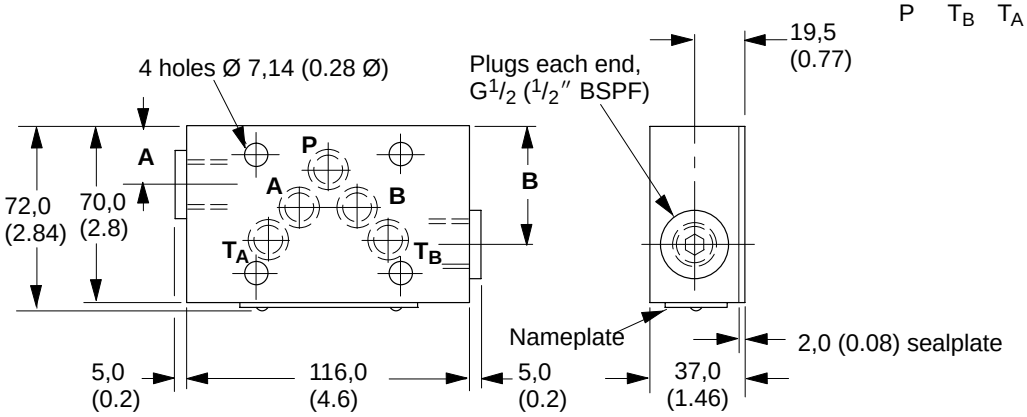
DGMA-5-B-1*
Blanking Plate





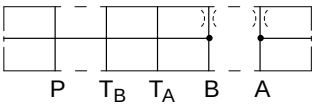
DGMA-5-C*-1*
Crossover Plate

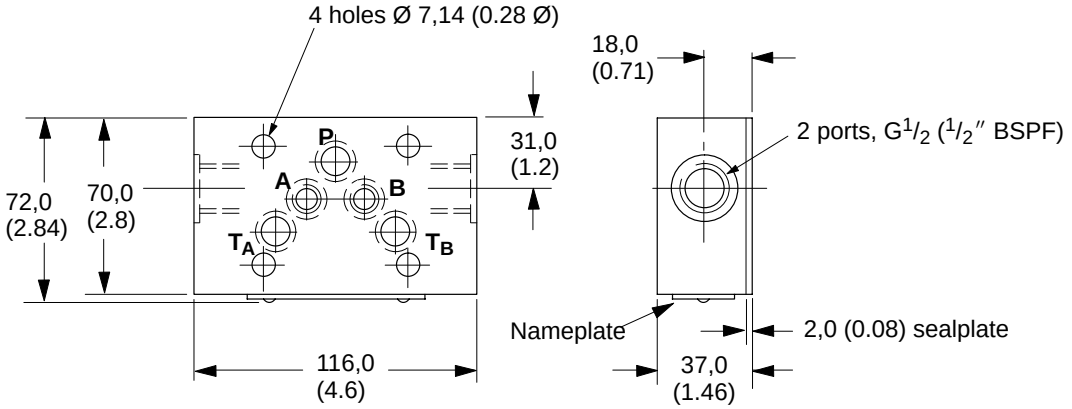




Model	Dimension A	Dimension B
DGMA-5-C1-1*	25,0 (1.0)	40,0 (1.6)
DGMA-5-C2-1*	40,0 (1.6)	25,0 (1.0)

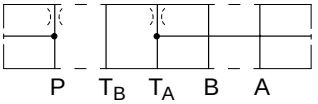
DGMA-5-T1-1*-B
Tapping Plate
Ports A and B

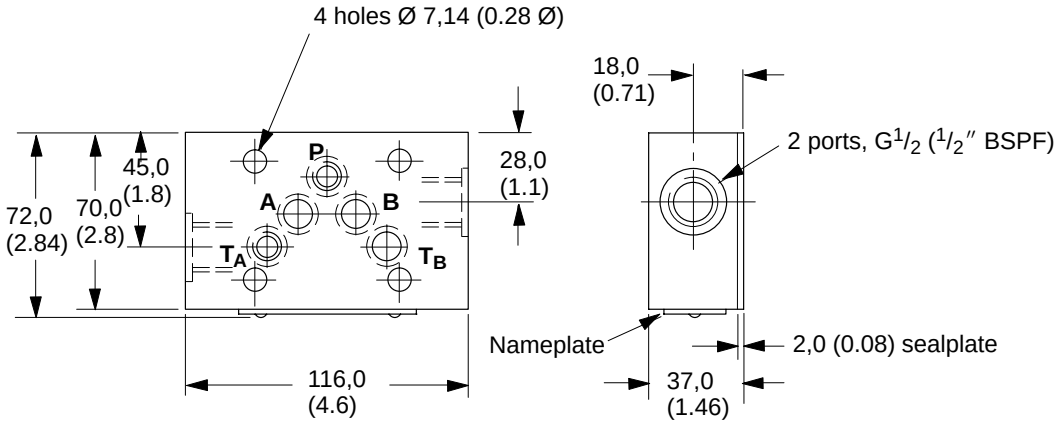




Ports A and B are tapped M12 x 14 (0.55) deep (e.g. for orifice plugs) on opposite face to sealplate.

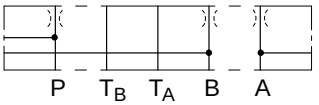
DGMA-5-T2-1*-B
Tapping Plate
Ports P and T

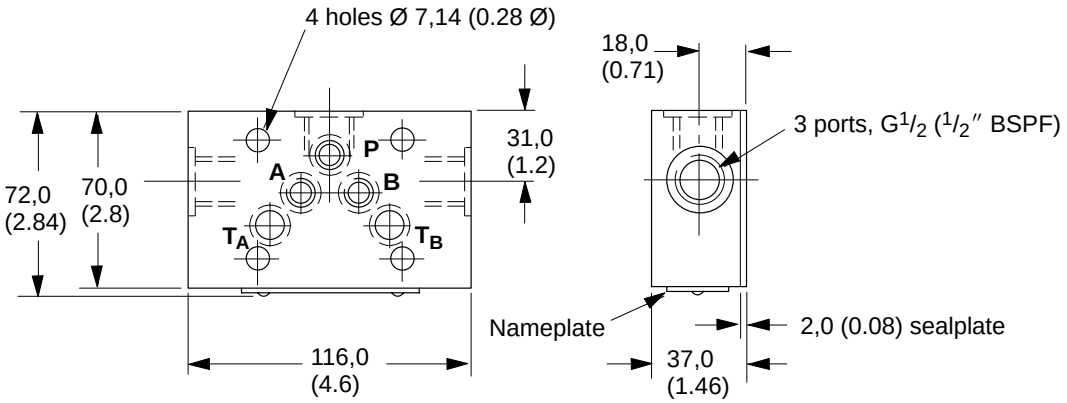




Ports P and T_A are tapped M12 x 14 (0.55) deep (e.g. for orifice plugs) on opposite face to sealplate.

DGMA-5-T3-1*-B
Tapping Plate
Ports P, A and B

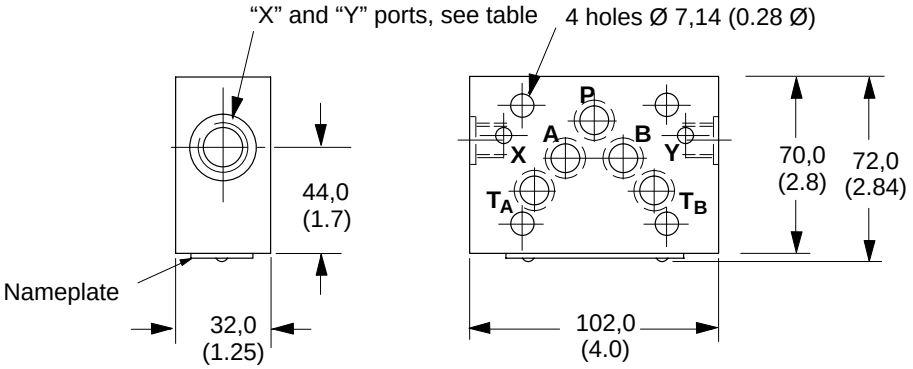




Ports P, A and B are tapped M12 x 14 (0.55) deep (e.g. for orifice plugs) on opposite face to sealplate.

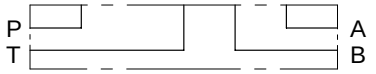
DGAM-5-1*-*, X and Y
Port Adaptor Plates

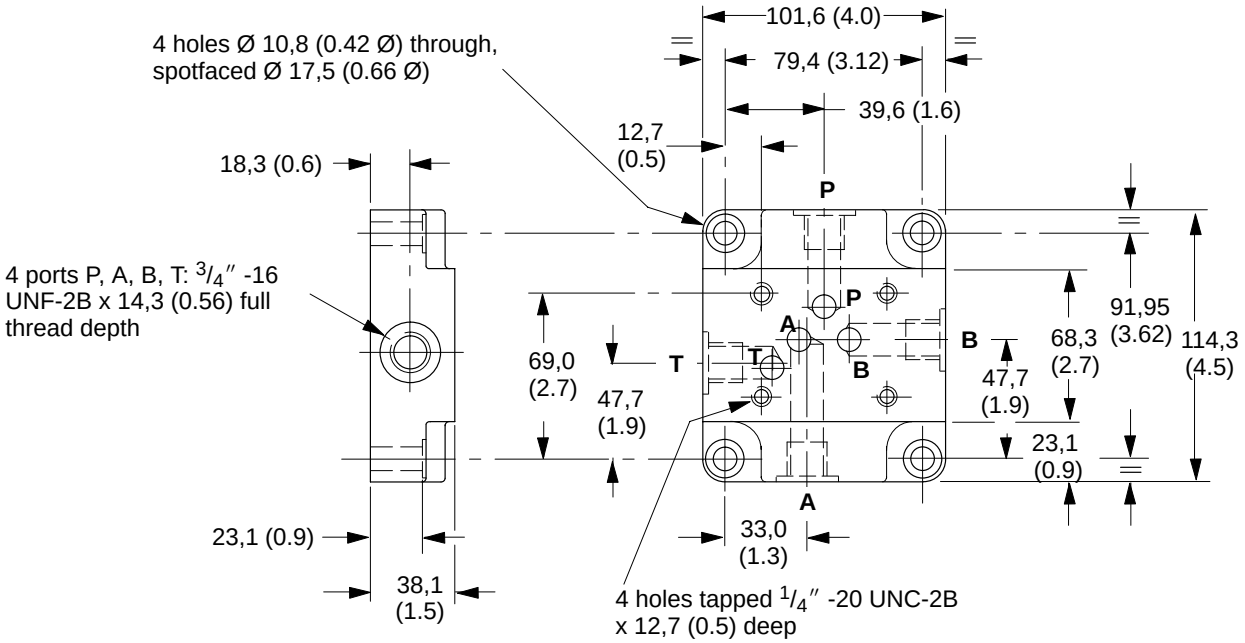
Provides for external connections to additional pilot ports X and Y when these ports are not present in subplate/manifold block. Typically used for two-stage directional and proportional valves.



Model	"X" and "Y" port thread
DGAM-5-1*-R	G1/4 (1/4" BSPF x 11,0 (0.43) full thread depth
DGAM-5-1*-S	9/16"-18UNF x 12,7 (0.5) full thread depth

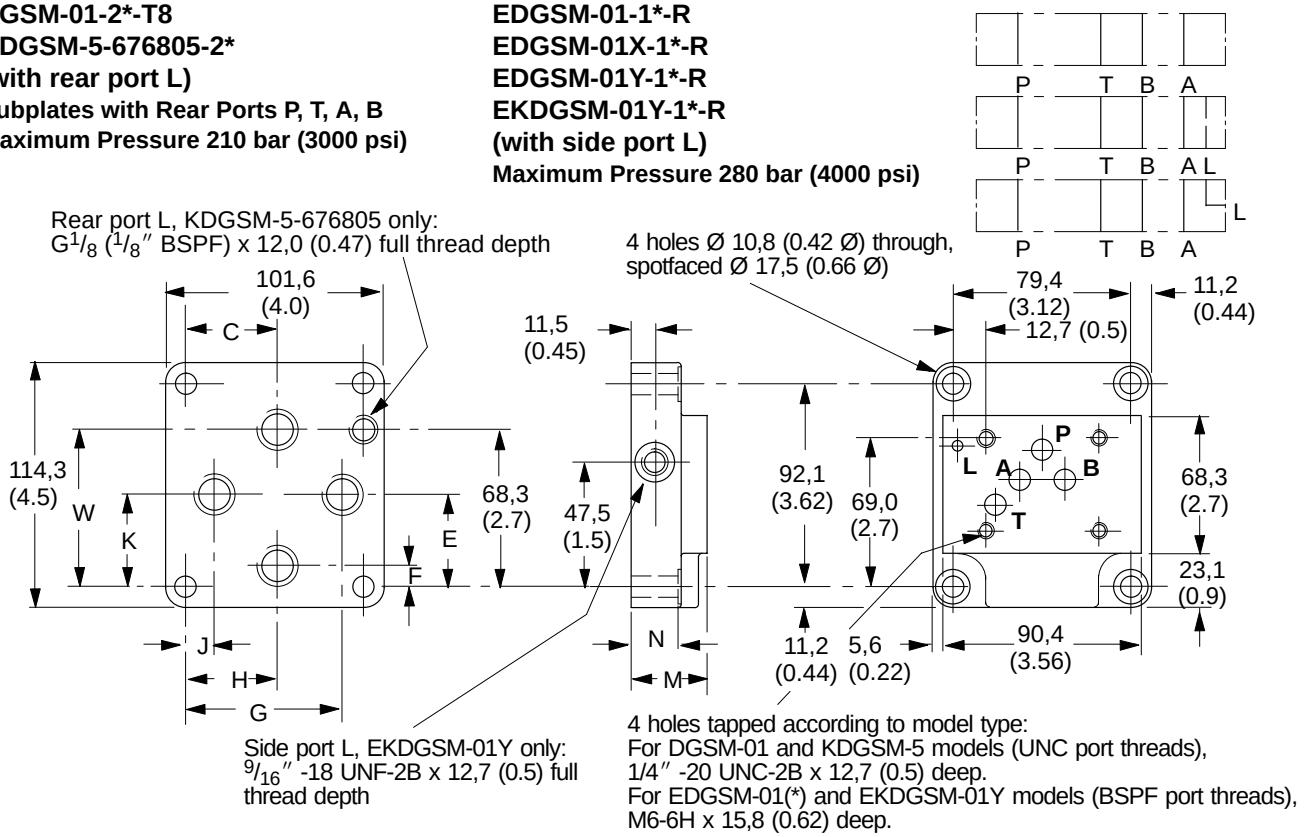
DGSME-01-2*-T8
Subplate with Side Ports P, T, A, B
Maximum Pressure 210 bar (3000 psi)





DGSM-01-2*-T8
KDGSM-5-676805-2*
(with rear port L)
Subplates with Rear Ports P, T, A, B
Maximum Pressure 210 bar (3000 psi)

EDGSM-01-1*-R
EDGSM-01X-1*-R
EDGSM-01Y-1*-R
EKDGSM-01Y-1*-R
(with side port L)
Maximum Pressure 280 bar (4000 psi)



Ports P, T, A, B Threads

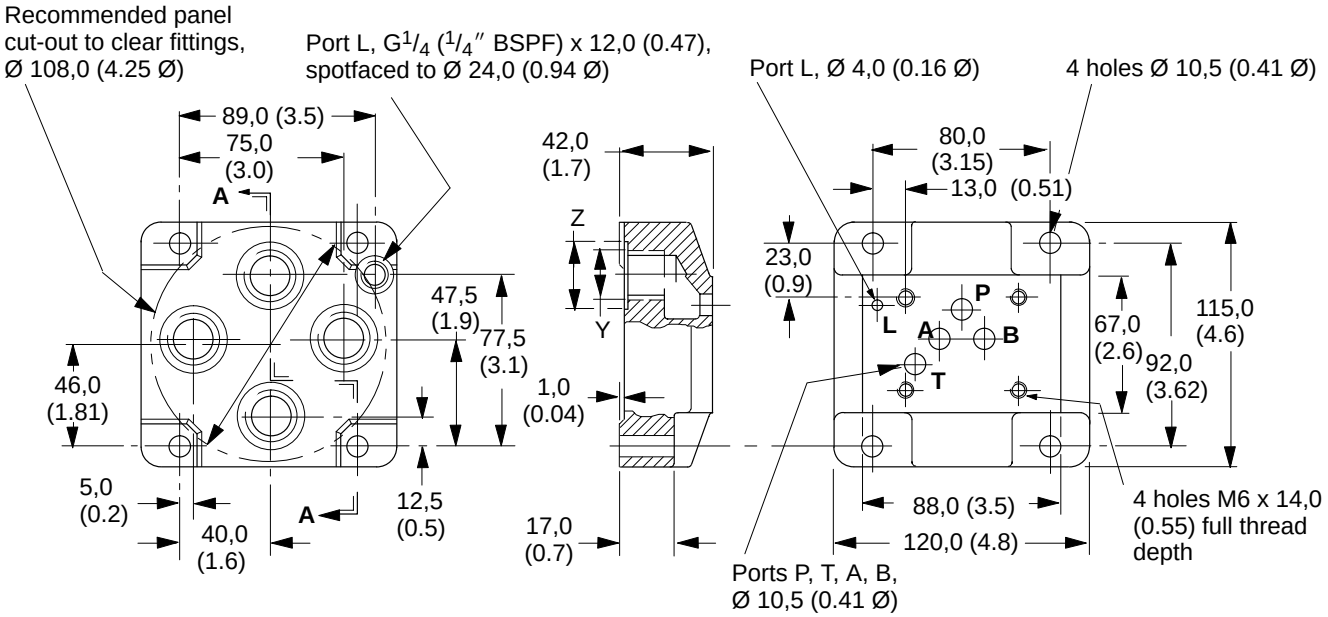
Model	Port thread
210 bar (3000 psi) DGSM-01-2*-T8 KDGSM-5-676805-2*	3/4″-16 UNF-2B x 14,0 (0.56) full thread depth

Ports P, T, A, B Threads

Model	Port thread
280 bar (4000 psi) EDGSM-01-1*-R	G1/4 (1/4″ BSPF) x 12,2 (0.48) full thread depth
EDGSM-01X-1*-R	G3/8 (3/8″ BSPF) x 12,2 (0.48) full thread depth
EDGSM-01Y-1*-R EKDGSM-01Y-1*-R	G1/2 (1/2″ BSPF) x 15,0 (0.59) full thread depth

Model	C	E	F	G	H	J	K	M	N	W
210 bar (3000 psi) DGSM-01-2*-T8 KDGSM-5-676805-2*	45,2 (1.78)	42,1 (1.7)	19,0 (0.75)	68,3 (2.69)	45,2 (1.78)	23,8 (0.94)	42,1 (1.7)	31,8 (1.25)	23,9 (0.94)	57,1 (2.25)
280 bar (4000 psi) EDGSM-01-1*-R	39,7 (1.56)	38,1 (1.5)	13,5 (0.53)	65,5 (2.58)	41,7 (1.64)	10,3 (0.41)	40,9 (1.61)	31,8 (1.25)	23,9 (0.94)	62,7 (2.47)
EDGSM-01X-1*-R	39,7 (1.56)	40,5 (1.59)	13,5 (0.53)	67,5 (2.66)	39,7 (1.56)	12,7 (0.5)	40,5 (1.59)	31,8 (1.25)	23,9 (0.94)	68,6 (2.7)
EDGSM-01Y-1*-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)	31,8 (1.25)	28,6 (1.13)	72,6 (2.86)
EKDGSM-01Y-1*-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)

KDGSM-5-615225-1*
KDGSM-5-615226-1
Subplates with Rear Ports P, T, A, B, L
Maximum Pressure 315 bar (4500 psi)



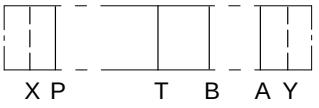
Part Section A-A

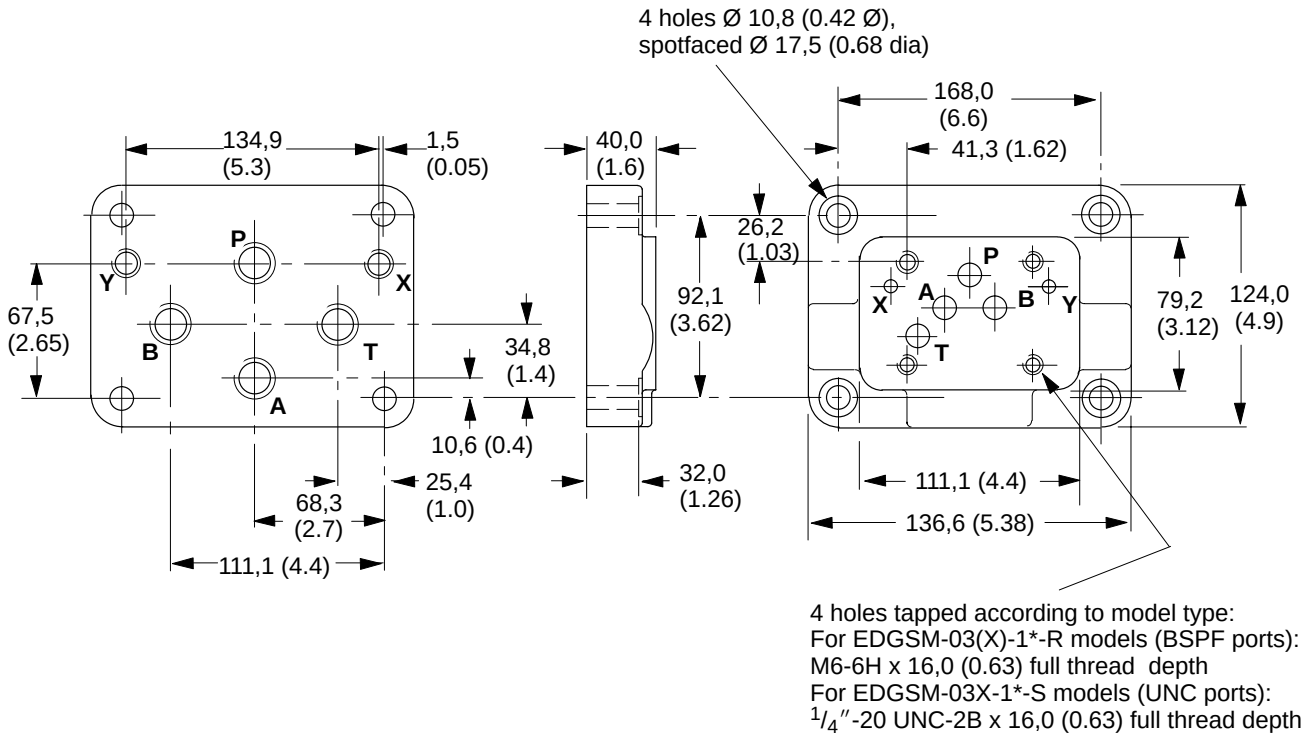
Ports P, T, A, B

Model	Y thread	Z diameter
KDGSM-5-615225-1*	G1/2 (1/2″ BSPF) x 14,0 (0.55) full thread depth	30,0 (1.18)
KDGSM-5-615226-1*	G3/4 (3/4″ BSPF) x 16,0 (0.63) full thread depth	33,0 (1.3)

EDGSM-03-1*-R
EDGSM-03X-1*-R
EDGSM-03X-1*-S

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



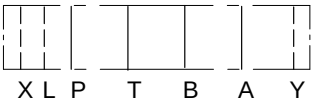


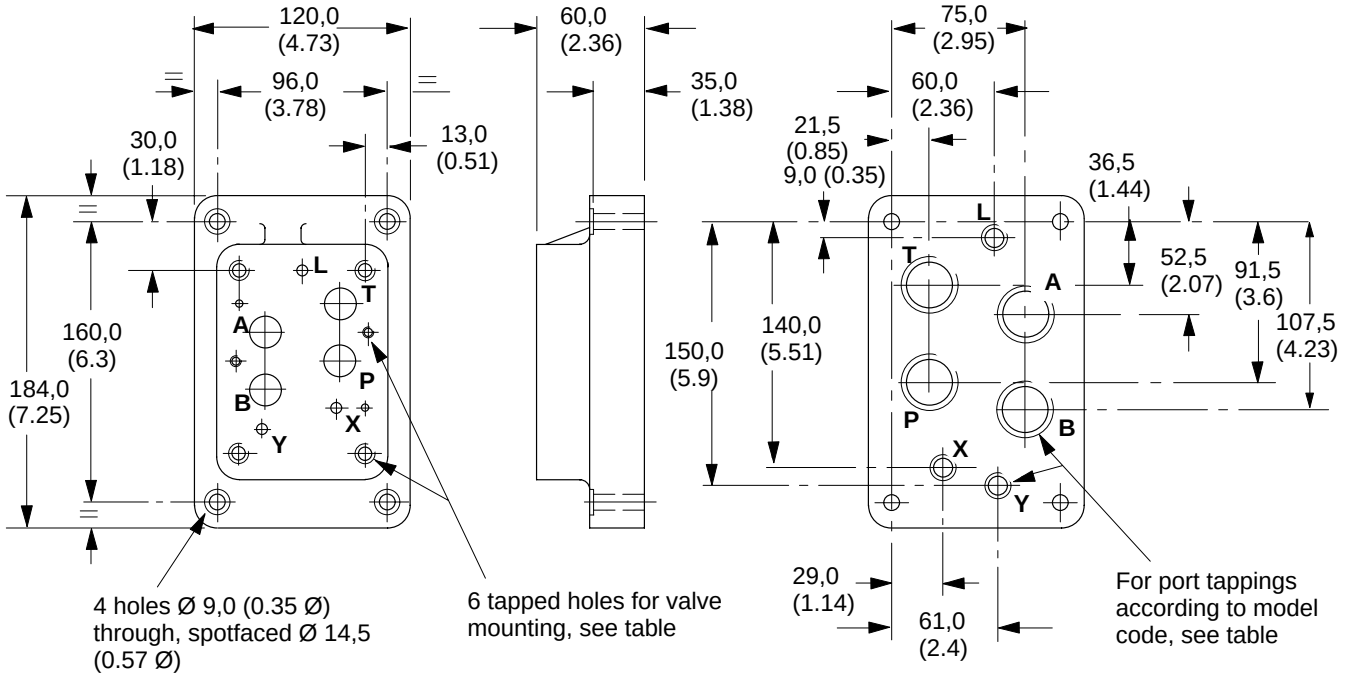
Port Threads

Model	Ports P, T, A, B	Ports X, Y
EDGSM-03-1*-R EDGSM-03X-1*-R	G1/2 (1/2″ BSPF) x 14,0 (0.55) full thread depth	G1/4 (1/4″ BSPF) x 12,2 (0.48) full thread depth
EDGSM-03X-1*-S	1 1/16″-12 UN-2B x 16,0 (0.63) full thread depth	9/16″-18 UNF-2B x 12,7 (0.5) full thread depth

EDGVM-7Y-D-1*-R (BSPF port threads; metric mounting bolts)
EDGVM-7Z-D-1*-S (UNF/SAE port threads; UNC mounting bolts)
Single station subplates

For up to 350 bar (5000 psi) Maximum Pressure
Dimensions in mm (inches)



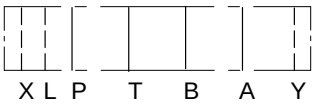


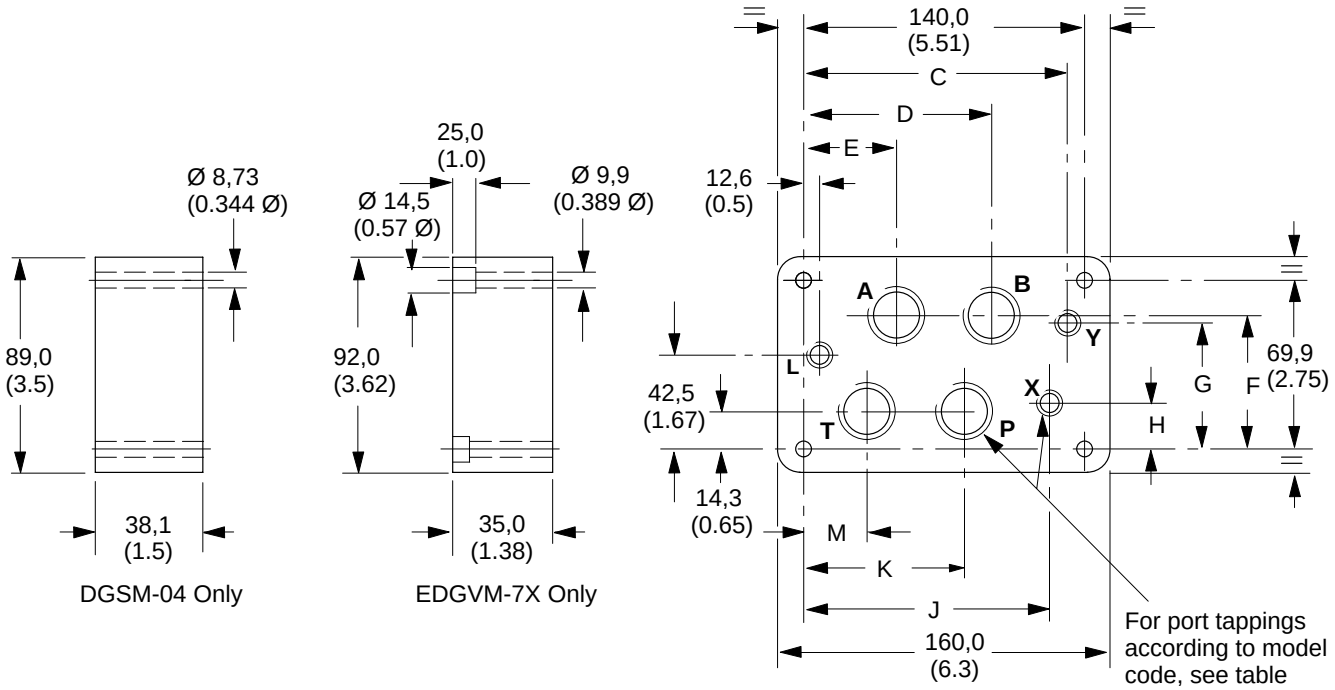
Port and Bolt Threads

Model	Ports P, T, A, B	Ports L, X, Y	Mounting bolt tapping
EDGVM-7Y-D-1*1–R	G1 (1” BSPF) x 19,0 (0.75) full thread depth	G1/4 (1/4” BSPF) x 12,0 (0.47) full thread depth	4 x M10 2 x M6
EDGVM-7Z-D-1*1–S	1 15/16” -12 UN 2B x 19,0 (0.75) full thread depth	3/16” -18 UNF 2B x 12,7 (0.5) full thread depth	4 x 3/8”-16 UNC 2 x 1/4”-20 UNC

DGSM-04-12S-2* (UNF/SAE port threads; UNC mounting bolts)
For up to 210 bar (3000 psi) Maximum Pressure

EDGVM-7X-D-1*-R (BSPF port threads; metric mounting bolts)
For up to 350 bar (5000 psi) Maximum Pressure
Single station subplates





Port and Bolt Threads

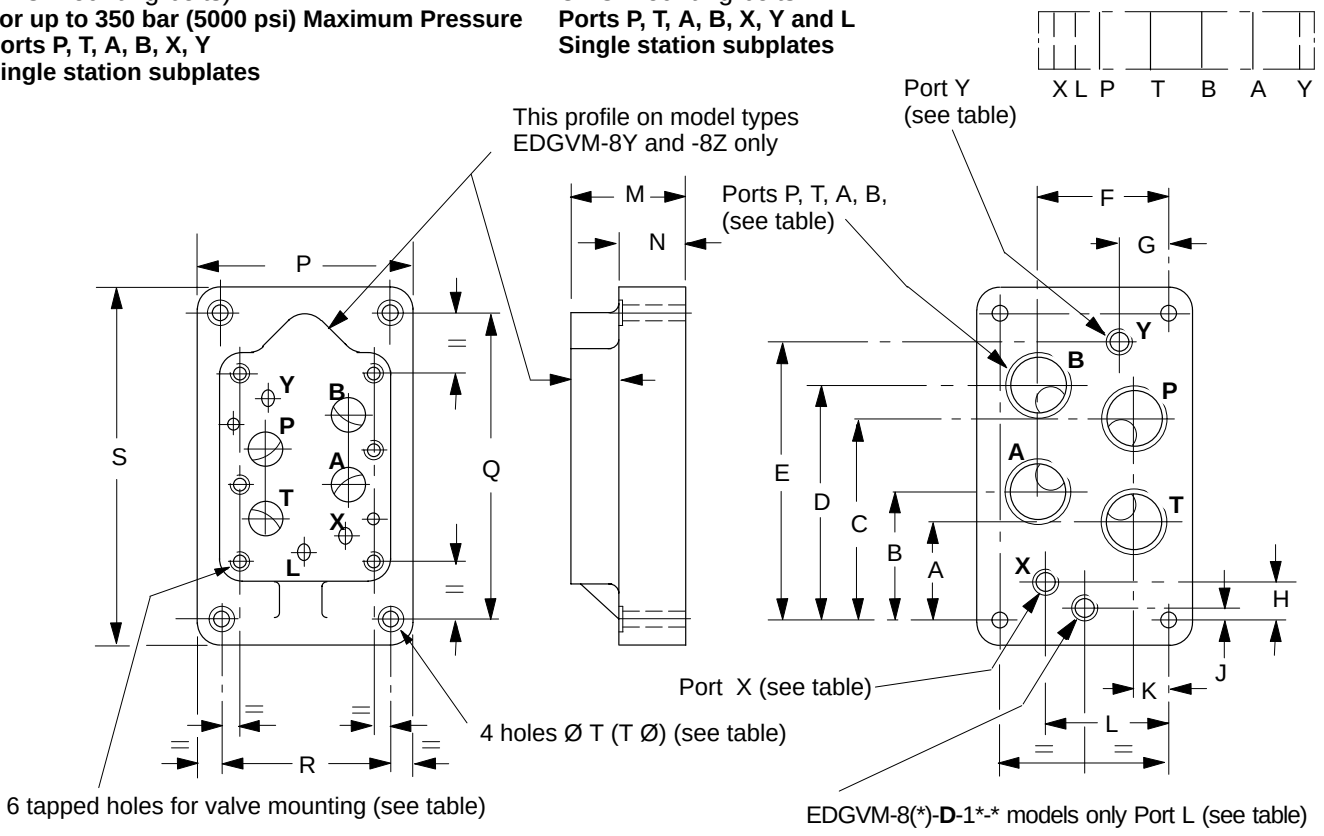
Model	Ports P, T, A, B	Ports L, X, Y	Mounting bolt tapping
DGSM-04-12S-2*	1 1/16″-12 UNF-2B x 19,1 (0.75) full thread depth	9/16″-18 UNF-2B x 12,7 (0.5) full thread depth	4 x 3/8″-16 UNC 2 x 1/4″-20 UNC
EDGVM-7X-D-1*-R	G$^{3}/_{4}$ ($^{3}/_{4}$″ BSPF) x 16,0 (0.63) full thread depth	G1/4 (1/4″ BSPF) x 12,0 (0.47) full thread depth	4 x M10 2 x M6

Dimensions

Model	C	D	E	F	G	H	J	K	M
DGSM-04-12S-2*	121,4 (4.78)	88,4 (3.48)	44,2 (1.74)	56,6 (2.23)	54,9 (2.16)	18,3 (0.72)	121,4 (4.78)	76,7 (3.02)	32,3 (1.27)
EDGVM-7X-D-1*-R	128,6 (5.06)	93,6 (3.68)	50,6 (1.99)	55,6 (2.19)	52,0 (2.05)	15,9 (0.63)	113,6 (4.47)	79,6 (3.13)	36,6 (1.44)

EDGVM-8(*)-1*-R (BSPF port threads; metric mounting bolts)
EDGVM-8Y-1*-S (UNF/SAE port threads; UNC mounting bolts)
For up to 350 bar (5000 psi) Maximum Pressure
Ports P, T, A, B, X, Y
Single station subplates

EDGVM-8(*)-D-1*-R (BSPF port threads; metric mounting bolts)
EDGVM-8Y-D-1*-S (UNF/SAE port threads; UNC mounting bolts
Ports P, T, A, B, X, Y and L
Single station subplates

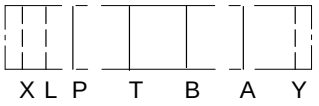


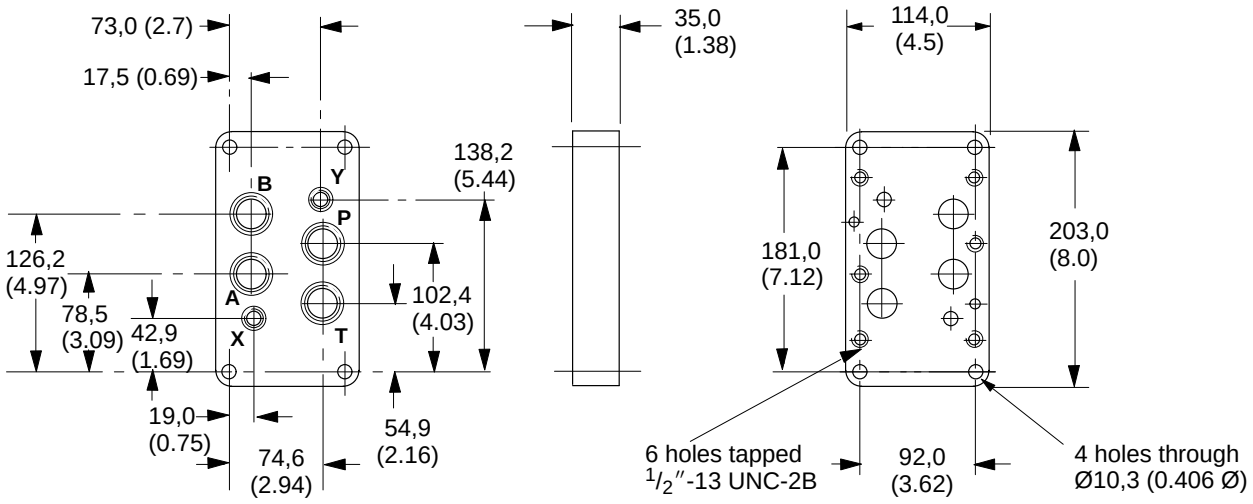
Port Threads, Bolt Tappings and Dimensions

Model	Ports P, A, B, T	Ports L, X, Y	Mounting bolt tappings	A	B	C	D	E	F
EDGVM-8(-D)-1*-R	G$^{3}/_{4}$ x 16 (0.63) deep (BSPF)	G$^{1}/_{4}$ x 12,2 (0.48) deep (BSPF)	M12 x 25 (1.0) deep	54,8 (2.16)	78,6 (3.09)	102,4 (4.03)	126,2 (4.97)	160 (6.30)	74,6 (2.94)
EDGVM-8X(-D)-1*-R	G1 x 19 (0.74) deep (BSPF)	G$^{1}/_{4}$ x12,2 (0.48) deep (BSPF)	M12 x 25 (1.0) deep	49,6 (1.95)	73,4 (2.89)	107,5 (4.23)	131,4 (5.17)	160 (6.30)	74,6 (2.94)
EDGVM-8Y(-D)-1*-R	G1$^{1}/_{4}$ x 21 (0.82) deep (BSPF)	G$^{1}/_{4}$ x12,2 (0.48) deep (BSPF)	M12 x 25 (1.0) deep	50,5 (1.99)	74,2 (2.92)	128,0 (5.04)	151,8 (5.98)	185 (7.28)	103 (4.06)
EDGVM-8Y(-D)-1*-S	1$^{5}/_{8}$″-12 UN x 19,1 (0.75) deep	$^{9}/_{16}$″-18 UNF x 12,7 (0.5) deep	$^{1}/_{2}$″-13 UNC-2B	50,5 (1.99)	74,2 (2.92)	128,0 (5.04)	151,8 (5.98)	185 (7.28)	103 (4.06)
EDGVM-8Z(-D)-1*-R	G1$^{1}/_{2}$ x 22 (0.86) deep (BSPF)	G$^{1}/_{4}$ x12,2 (0.48) deep (BSPF)	M12 x 25 (1.0) deep	50,5 (1.99)	74,2 (2.92)	128,0 (5.04)	151,8 (5.98)	185 (7.28)	103 (4.06)

Model	G	H	J	K	L	M	N	P	Q	R	S	ØT
EDGVM-8(-D)-1*-R EDGVM-8X(-D)-1*-R	19 (0.75)	21 (0.83)	31 (1.22)	17,4 (0.685)	73 (2.87)	– –	35 (1.38)	119 (4.69)	181 (7.13)	92,1 (3.63)	204 (8.03)	10,8 (0.425)
EDGVM-8Y(-D)-1*-R EDGVM-8Y(-D)-1*-S EDGVM-8Z(-D)-1*-R	33 (1.30)	17,5 (0.69)	5,6 (0.22)	27 (1.06)	97 (3.82)	72 (2.84)	45 (1.77)	160 (6.30)	202 (7.95)	130 (5.12)	232 (9.13)	13,5 (0.53)

DGSM-8-1*-T** (UNF/SAE ports; UNC mounting bolts)
For up to 210 bar (3000 psi) Maximum Pressure
Ports P, T, A, B, X, Y
Single station subplates



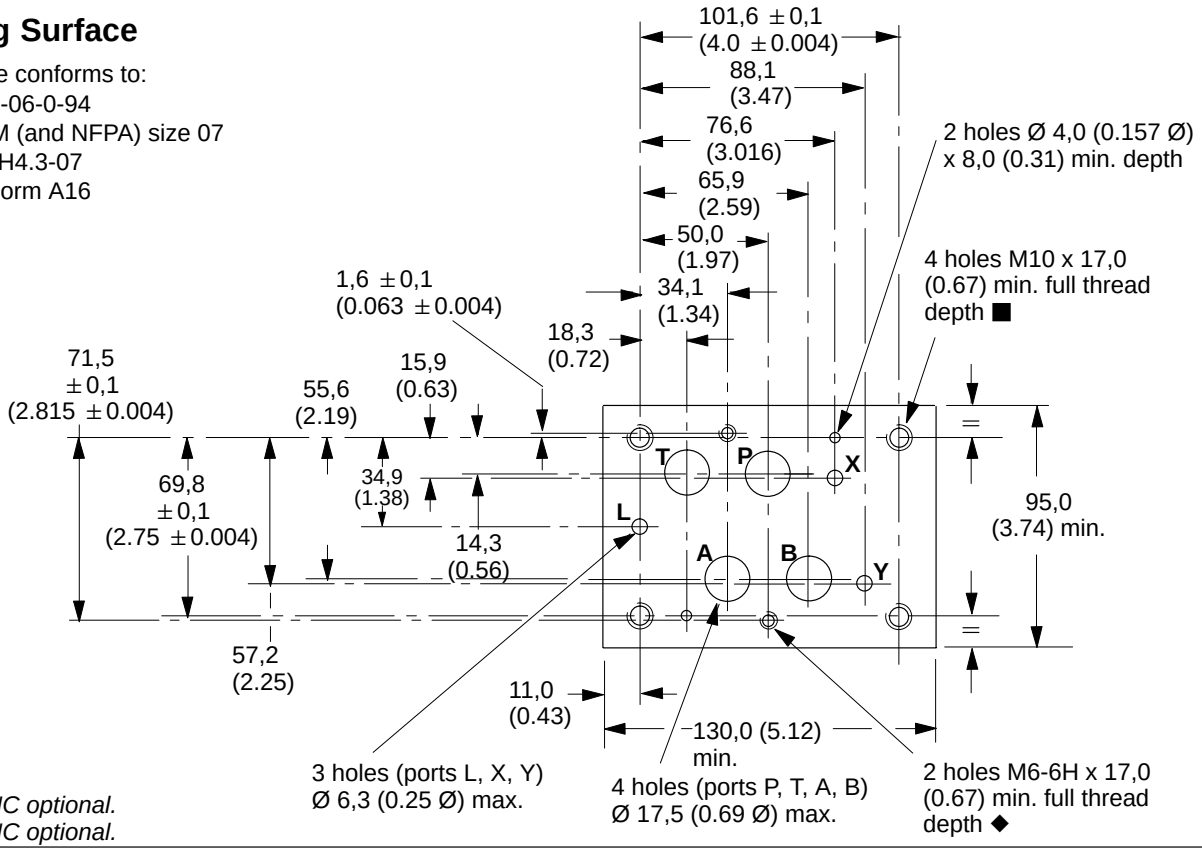


Port Threads

Model	Ports P, T, A, B	Ports X, Y
DGSM-8-1*-T12	1 1/16”-12 UN x 19,1 (0.75) deep	9/16”-18 UNF x 12,7 (0.5) deep
DGSM-8-1*-T16	1 5/16”-12 UN x 19,1 (0.75) deep	9/16”-18 UNF x 12,7 (0.5) deep

Mounting Surface

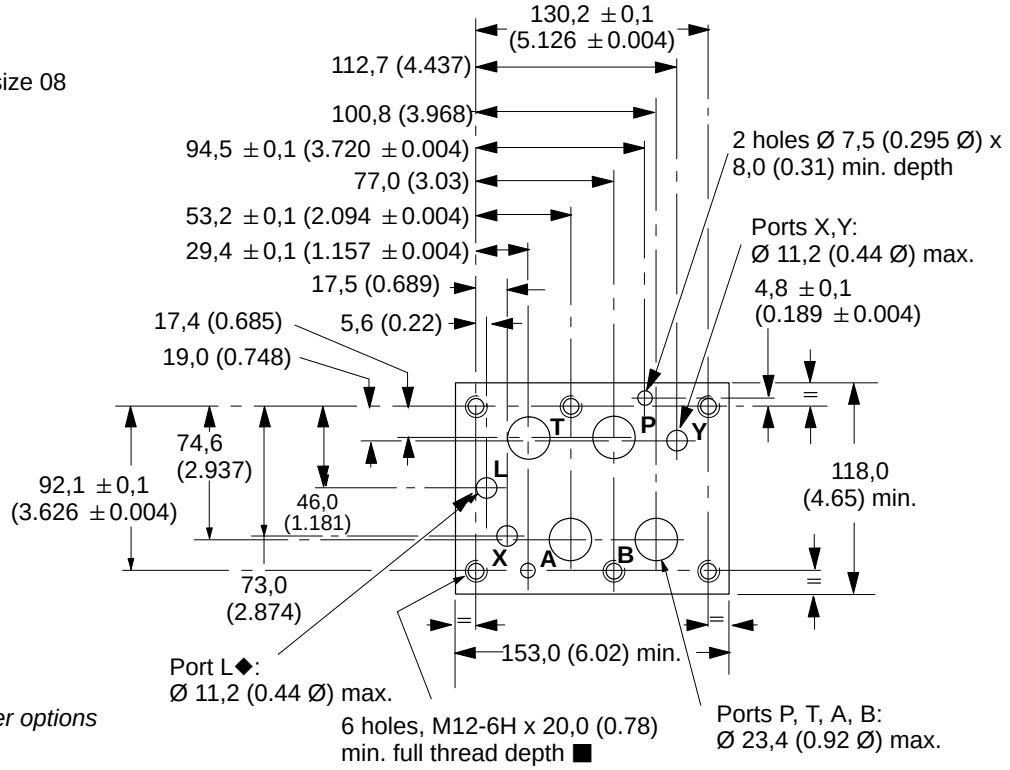
This interface conforms to:
ISO 4401-07-06-0-94
ANSI/B93.7M (and NFPA) size 07
CETOP R35H4.3-07
DIN 24340 Form A16



■ *3/8″-16 UNC optional.*
◆ *1/4″-20 UNC optional.*

Mounting Surface

This interface conforms to:
ISO 4401-08-07-0-94
ANSI/B93.7M (and NFPA) size 08
CETOP R35H4.3-08
DIN 24340 Form A25

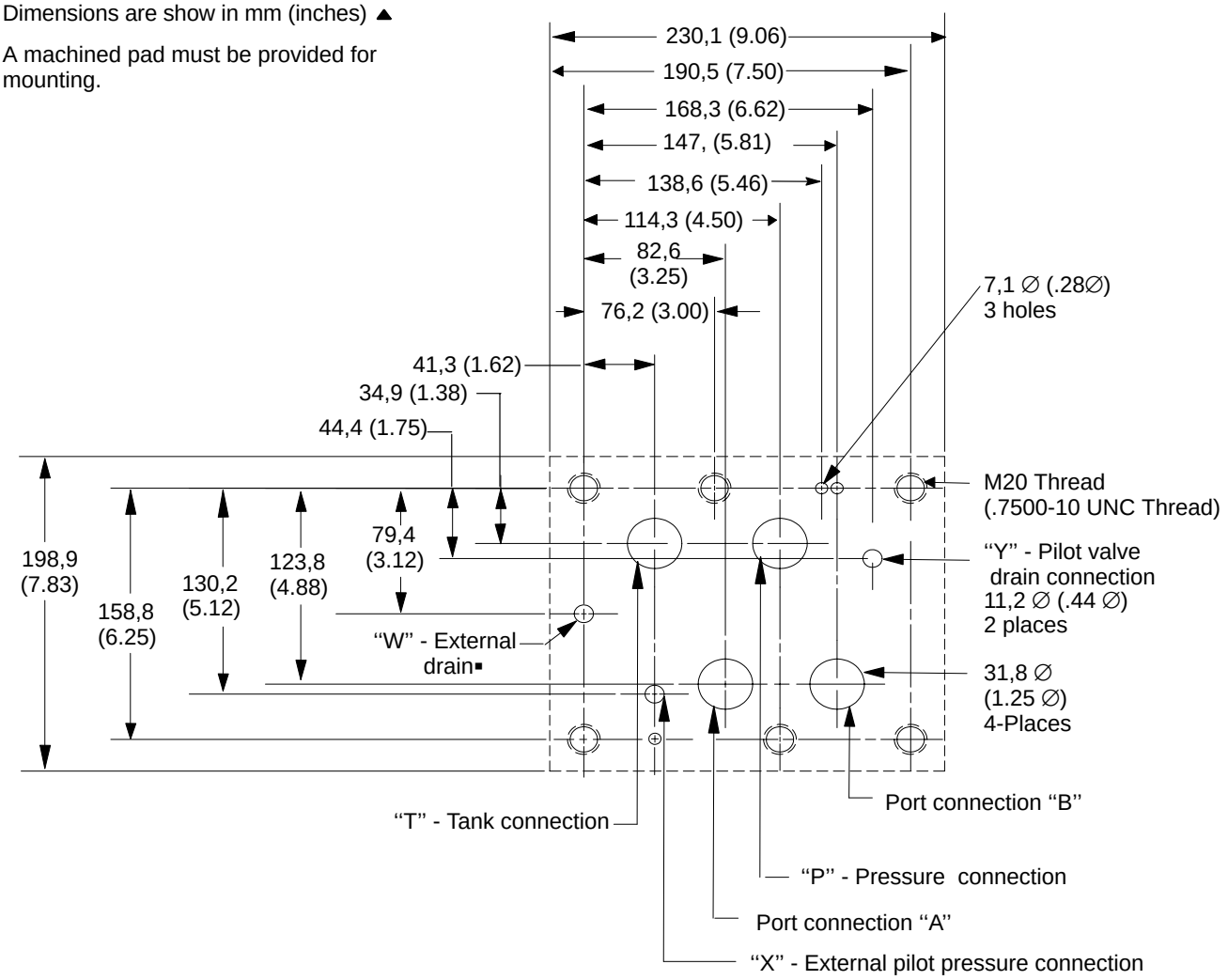


■ *1/2″-13 UNC optional.*
◆ *Vickers uses port L for pressure-centered and other options not in high demand.*

Mounting Surface

Dimensions are show in mm (inches) ▲

A machined pad must be provided for mounting.



▪ Required for 'D' Pressure Centered models only

Mounting Bolt Tapping Options

ISO/DIS 4401–02–02 defines only M5 tapping. Inch tapping options are as available in Vickers subplates and manifolds.

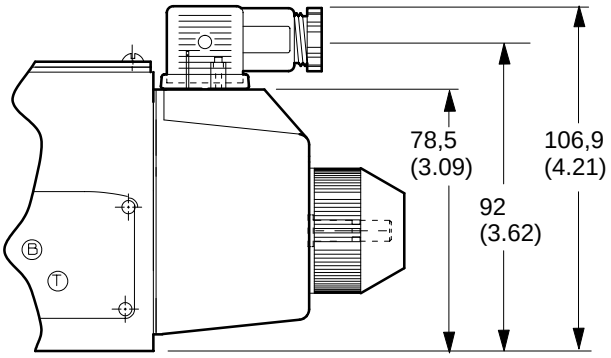
▲ *ISO 4401 gives dimensions in mm. Inch conversions are accurate to 0.01" unless stated.*

▼ *It is recommended that customers' own manifold blocks for UNC bolts be tapped to these minimum depths.*

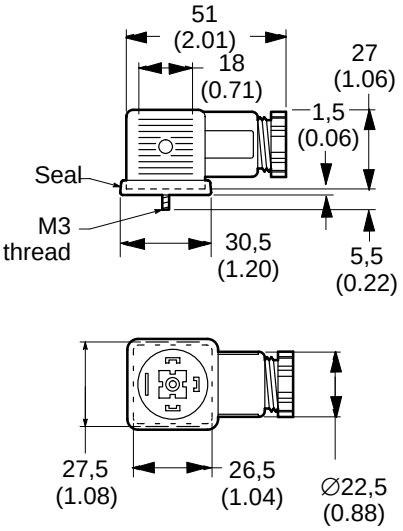
Thread	Min. tapping depth for subplates/manifolds in:		
	Steel	**Cast Iron**	**Aluminum**
Metric M5–6H	12,3 (0.484)	12,3 (0.484)	12,3 (0.484)
Inch #10–24 UNC–2B	12,6 (0.496)▼	14,9 (0.587)▼	14,9 (0.587)▼

Plug connector (Order separately) (ISO4400/DIN 43650)

Cable diameter range . . . Ø6–10 mm (0.24–0.40)
Wire section range . . . . . Ø,5–1,5 mm^2 (0.0008–0.0023 in^2)
Terminals . . . . . Screw type
Type of protection . . . . . IEC144 class IP65, when plugs are fitted correctly to the valves with the interface seals (supplied with plugs) in place.



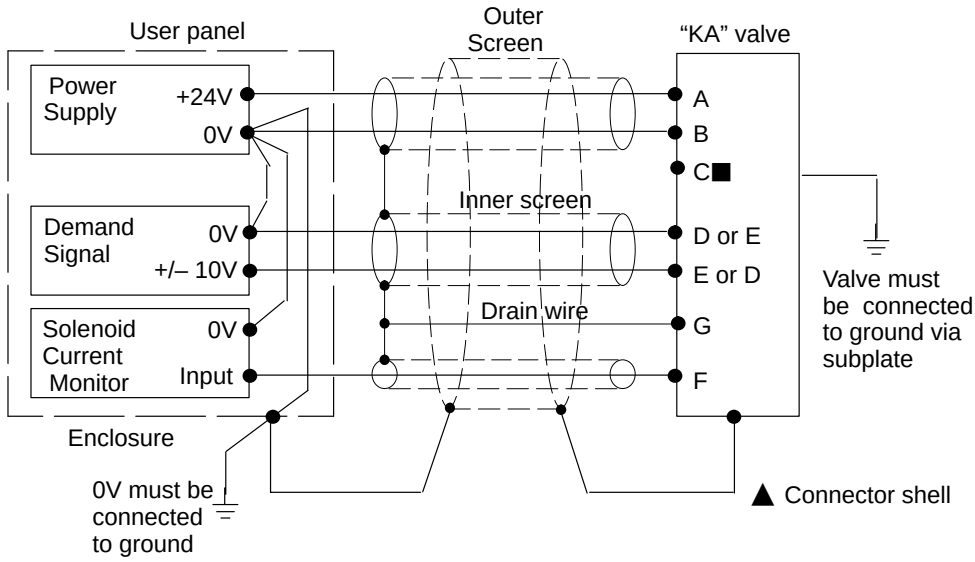
Connector can be positioned at 90° intervals on valve by re-assembling contact holder into appropriate position inside connector housing. Connectors with and without indicator lights are available (order separately).



Receptacle	Voltage (AC or DC)	Gray "A" sol.	Black "B" sol.
Without lights	——	710776	710775
With lights	12-24	977467	977466
	100-125	977469	977468
	200-240	977471	977470

Typical Connection Arrangements

KADG5V-5/7/8, valves with integral amplifier



■ Solenoid current monitor voltage (pin F) will be referenced to the KA valve local ground. A "local ground" (pin C) is provided for optional use by differential input customer supplied electronics.

▲ 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

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.

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-point connector, part no. 934939, should be used for the integral amplifier.

In all cases, both valve and cable should be kept as far 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.

Electrical Block Diagram

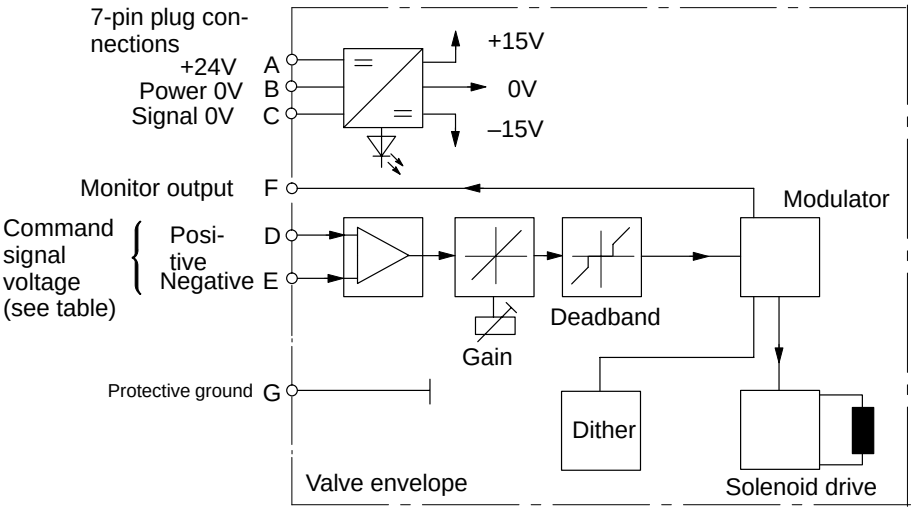
KADG5V5-5/7/8, valves with integral amplifier

Wiring
Connections must be made via the 7-pin plug mounted on the amplifier.
Recommended cable sizes are:

Power cables:
For 24V supply
0,75 mm^2 (18 AWG) up to 20m (65 ft)
1,00 mm^2 (17 AWG) up to 40m (130 ft)

Signal cables:
0,50 mm^2 (20 AWG)

Screen:
A suitable cable would have 7 cores, a separate screen for the signal wires and an overall screen.
See wiring connection diagram on previous page.



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

Single-Cable UNIPLUG Connector

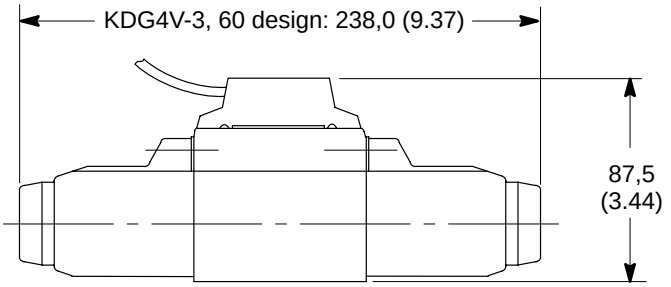
EHH-AMP-724 D ** - 1*

Vickers UNIPLUG is a single-cable electrical connector ideally suited for economical wiring of single and double-solenoid models. It is introduced on the well-established size 3 proportional valves, KDG4V-3(S), 60 series, respectively.The UNIPLUG connector is released in four 24V versions, offering:

- Control of proportional valves from low voltage differential input signal
- Direct switching of 24V DC solenoids

The UNIPLUG connector is supplied loose for customer assembly to valves, *which must be fitted with type "P" plug-in coils*.

The correctly installed UNIPLUG/ valve combination conforms to protection code IEC 529 class IP67.



Double solenoid models

Operating Data

Cable:	
wire size	1 mm^2 (18 AWG)
cable sheathing	Polyurethane
cable screening	Types C and D only
Ambient temperature range:	
operating	–20 to +70°C (–4 to +158°F)
storage	–25 to +70°C (–13 to +158°F)
Electro-magnetic compatibility (EMC)	
emission	EN50081-2
immunity	EN50082-2
Protection class	IEC 529, IP67 when correctly assembled and installed on a designated valve type
Housing material	Ultramid A3 HG3

CE

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. 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 relative to this directive are indicate by ⚠ European Electromagnetic Compatibility (EMC)

Electrical Data, Type D

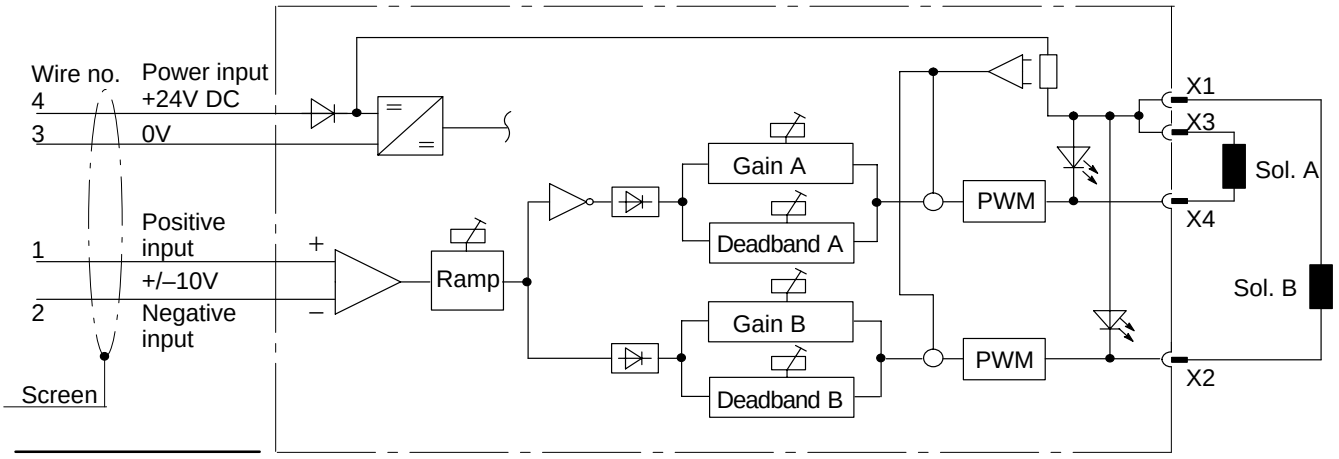
Plug with proportional amplifiers with independent adjustable gain and deadband for each of two solenoid outputs, plus a common adjustable ramp.
LEDs show status of output.

Connections (coded to DIN VDE 0293): wire no. 1 wire no. 2 wire no. 3 wire no. 4 screen	 Positive command signal Negative command signal 0V (power and signal) 24V power supply Connect to a suitable ground point
Power supply (to VDE 0160) Max. permissible voltage	24V DC (20.4V to 30.4V incl. ±10% ripple) 36V DC *for less than 100 ms*
Protection	Reverse polarity protected Short circuit protected
Differential command signal max. command-current Input resistance Protected against overvoltage	–10V to +10V. See “Command Signal” table on next page 1 mA 10 kΩ ±50 volts
Output current per solenoid: rated max.	 1.6A 1.8A
Output voltage at 1.6A output current	Typically 1.5V below supply voltage
Max. power consumption with one solenoid energized	35W
Ramp adjustment ■ range	50 ms to 5 sec
Deadband compensation ■, independent for each solenoid Trigger level for deadband	 200 to 700 mA +/– 100 mV
Gain adjustment ■ range, independent for each solenoid	 0.04 to 0.14 A/V
PWM frequency	240 Hz (optimum for KD/TG4V-3(S) valves)
Installation and start-up guidelines	GB/D-9144

■ *Vibration can cause potentiometer setting to change by up to approx. 5%. To avoid this effect, it is recommended to seal the adjusting screws (e.g. Loctite Screwlock 222).*

Electrical Block Diagram

EHH-AMP-724-**D****-1*

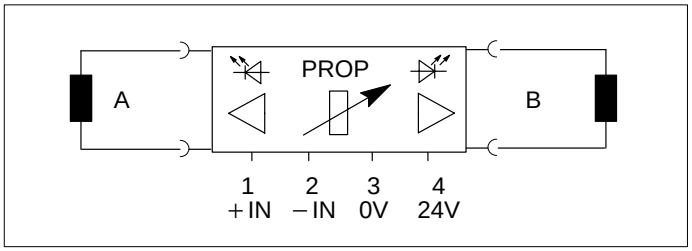


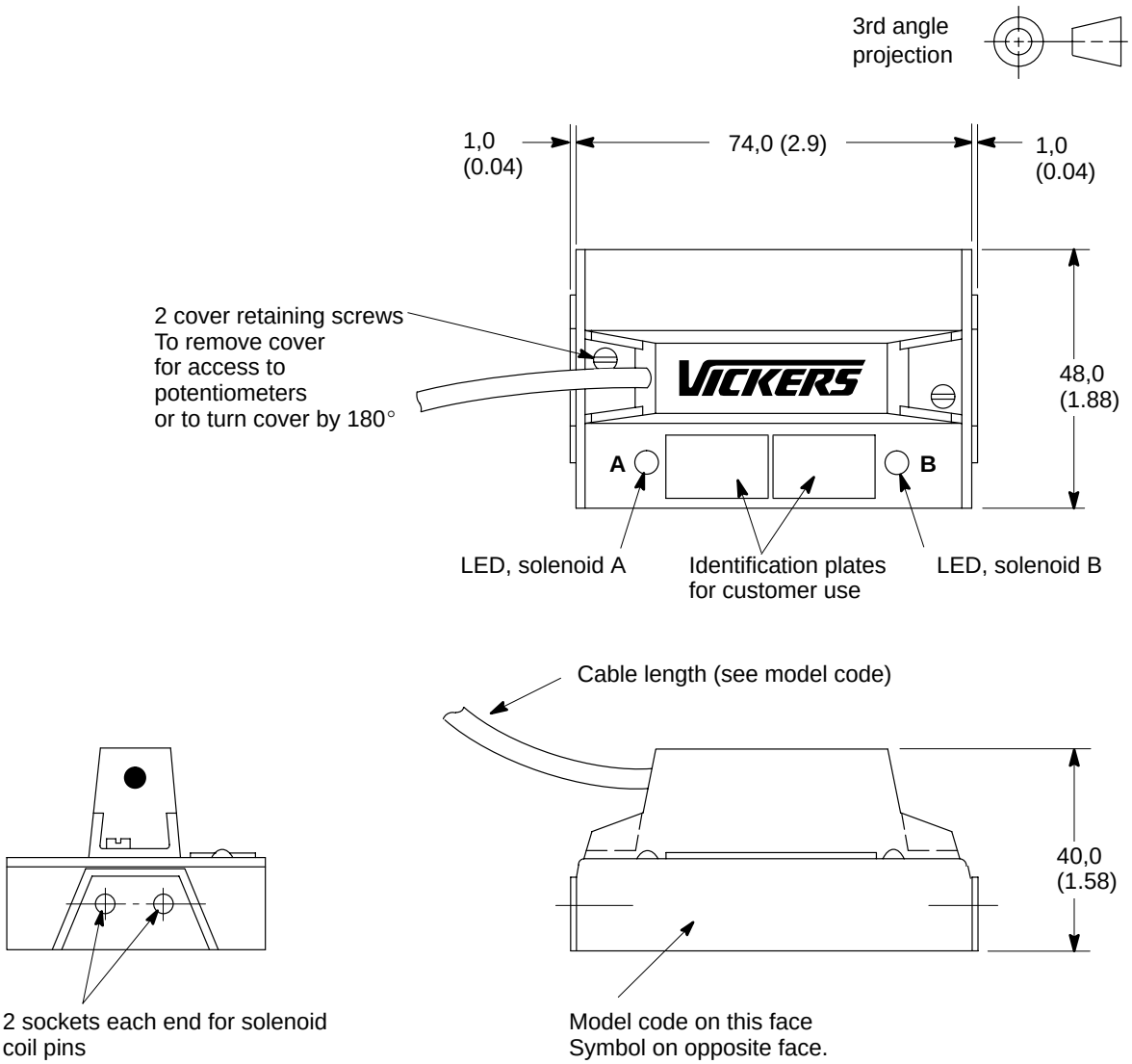
Command Signals

Input	Wire 1	Wire 2	Output
Differential	Positive	Negative	A
	Negative	Positive	B
Non-inverting	Positive	OV	A
	OV	Positive	B
Inverting	OV	Negative	A
	Negative	OV	B

Identification Symbols

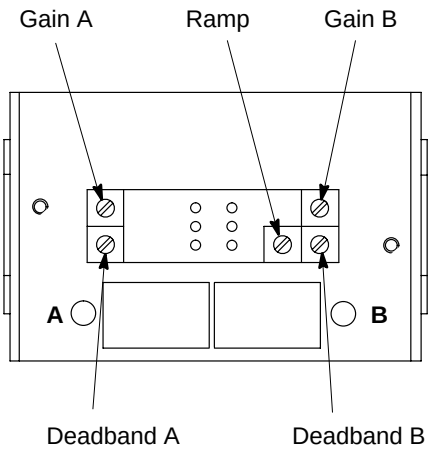
EHH-AMP-724-**D****-1*





Type D
Shown with cover removed for access to potentiometers

Potentiometer Adjustments
Ramp: Turn clockwise to increase ramp time
Deadband: Turn clockwise to increase deadband compensation
Gain: Turn clockwise to increase gain



Installation Data

Installation Data

Mounting Interfaces **KDG5V-5** ISO 4401, size 05 with additional pilot ports. Refer to page B.12 for dimensional data.
KDG5V-7 ISO 4401, size 07. Refer to page B.12 for dimensional data.
KDG5V-8 ISO 4401, size 08. Refer to page B.12 for dimensional data.
KDG5V-10 ISO 4401, size 10. Refer to page B.14 for dimensional data.

Subplates For KDG5V-5, see page B.17.
For KDG5V-7, see see page B.18.
For KDG5V-8, see see page B.18.

DGAM-5 Pilot Ports Adaptor Module for KDG5V-5 Models Provides for external connections to pilot ports if ports X and Y are not present in valve subplate/manifold block. For mounting bolts for valve plus adaptor, see below.

Max. pressure: 210 bar (3000 psi)

Model types:
DGAM-5-1*-R: G$^1/_4''$ ($^1/_4''$ BSPF) port tappings
DGAM-5-1*-S: $^9/_{16}''$-18 UNF-2B port tappings

Mounting Bolt Kits

For KDG5V-5
BK02-156493M (metric)
BK590720 (inch)
For KDG5V-7
BKDG7M (metric)
BK590724 (inch)

For KDG5V-8
BKDGH8658M (metric)
BKDGH06618 (inch)
For KDG5V-8
BK98613M (metric)
BK306 (inch)
For KDG5V-10
BKDG10636M (metric)
BKDG10636 (inch)
If not using Vickers recommended bolt kits, bolts used should be to ISO 898, 12.9 or better.

Mounting Bolt Torques

Recommended torques with threads lubricated
For KDG5V-5
M6 or $^1/_4''$-20 UNC bolts:
To 210 bar (3000 psi) 14 Nm (10.3 lbf ft)
To 315 bar (4500 psi) 20 Nm (14.75 lbf ft)
For KDG5V-7
M10 or $^3/_8''$-16 UNC bolts:
49 to 59 Nm (36 to 43 lbf ft)
plus
M6 or $^1/_4''$-20 UNC bolts
9 to 14 Nm (6.6 to 10.3 lbf ft)
For KDG5V-8
M12 or $^1/_2''$-13 UNC bolts
103 to 127 Nm (76 to 93 lbf ft)
For KDG5V-10
M20 or $^3/_4''$-10 UNC-2B bolts
185-220 Nm (250-300 lbf ft)

Mass (Weight)

Approx. for models with integral pilot pressure reducing module (“X” or “EX”see mode code).
KDG5V-5 9,5 kg (21 lb)
KDG5V-7 11,5 kg (25.3 lb)
KDG5V-8 20,2 kg (44.5 lb)
KDG5V10 54,5 kg (120.0 lb)
For models without integral pressure reducing module (No symbol, or “E”, see model code), deduct 1,2 kg (2.6 lb).

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.

Essential information on the correct methods for treating hydraulic fluid is included in Vickers publication 561;"Vickers Guide to Systemic Contamination Control," available from your local Vickers distributor or by contacting Vickers, Incorporated. Recommendations on filtration and the selection of products to control fluid condition are included in 561.

Recommended cleanliness levels, using petroleum oil under common conditions, are based on the highest fluid pressure levels in the system and are coded in the chart below. Fluids other than petroleum, severe service cycles or temperature extremes are cause for adjustment of these cleanliness codes. See Vickers publication 561 for exact details.

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 below. These codes have been proven to provide a long trouble-free service life for the products shown, regardless of the manufacturer.

	System Pressure Level bar (psi)		
Product	**<70 (<1000)**	**70-210 (1000-3000)**	**210+ (3000+)**
Vane Pumps – Fixed	20/18/15	19/17/14	18/16/13
Vane Pumps – Variable	18/16/14	17/15/13	
Piston Pumps – Fixed	19/17/15	18/16/14	17/15/13
Piston Pumps – Variable	18/16/14	17/15/13	16/14/12
Directional Valves	**20/18/15**	**20/18/15**	**19/17/14**
Pressure/Flow Control Valves	19/17/14	19/17/14	19/17/14
CMX Valves	18/16/14	18/16/14	17/15/13
Servo Valves	16/14/11	16/14/11	15/13/10
Proportional Valves	17/15/12	17/15/12	15/13/11
Cylinders	20/18/15	20/18/15	20/18/15
Vane Motors	20/18/15	19/17/14	18/16/13
Axial Piston Motors	19/17/14	18/16/13	17/15/12
Radial Piston Motors	20/18/14	19/17/13	18/16/13

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).

Fluid Temperatures

For mineral oil:
Min. . . . . –20°C (–4°F)
Max. * . . . . . +70°C (+158°F)

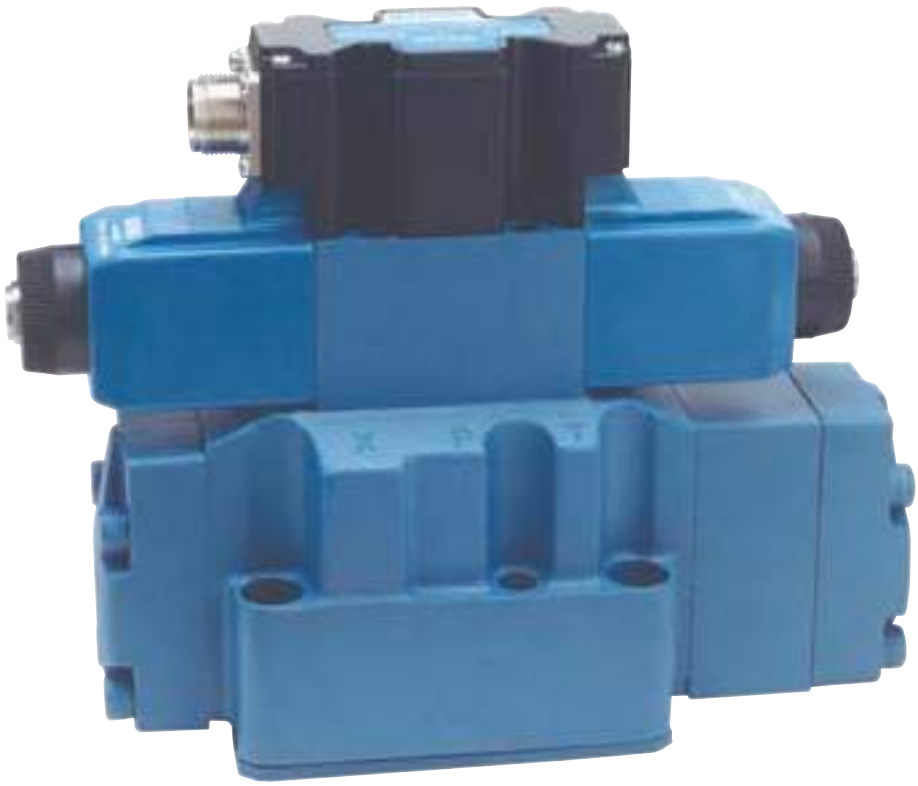
* *To obtain optimum service life from both fluid and hydraulic system, 65°C (150°F) normally is the maximum temperature.*

Whatever the actual temperature range, ensure that viscosities stay within viscosities specified in the "Hydraulic Fluids" section.

EATON | Vickers

Proportional Directional Control Valves Two-Stage Models Without Electrical Feedback

KBDG5V-5-1*
KBDG5V-7-1*
KBDG5V-8-1*
KBDG5V-10-1*



Contents

General Description	Page 3
Typical Section	Page 3
Model Codes	Page 4
Spool Data	Page 5
Functional Symbols	Page 6
Operating Data	Page 7
Performance Characteristics	Page 8
Power Capacity Envelopes	Page 9
Flow Characteristics	
KBDG5V-7/8	Page 10
KBDG5V-10	Page 11
Step Response	Page 12
Installation Dimensions	
KBDG5V-5/7/10	Page 13
Pilot Supply and Drain Plugs	Page 14
Mounting Faces	Page 15
Electrical Information	
Block Diagram	Page 16
Typical Connection Arrangements	Page 17
Application Data	Page 18

CE *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).*

General Description

Vickers™ KBDG5V-5/7/8/10 are solenoid operated directional control, non-feedback type proportional valves.

These are two-stage proportional directional control valves in which the main-stage spool is positioned according to the output from an integrally mounted proportional, solenoid-operated, pressure-reducing valve. Direction of main-spool travel depends upon which of the two solenoids of the pilot valve is energized and the amount of travel is dependent upon the current input to the solenoid.

At any intermediate position of the main spool, a force balance exists between the controlled, reduced pilot pressure acting on the spool end and the opposing centering spring, plus the action of flow forces. There is no electrical feedback of the main-stage spool position.

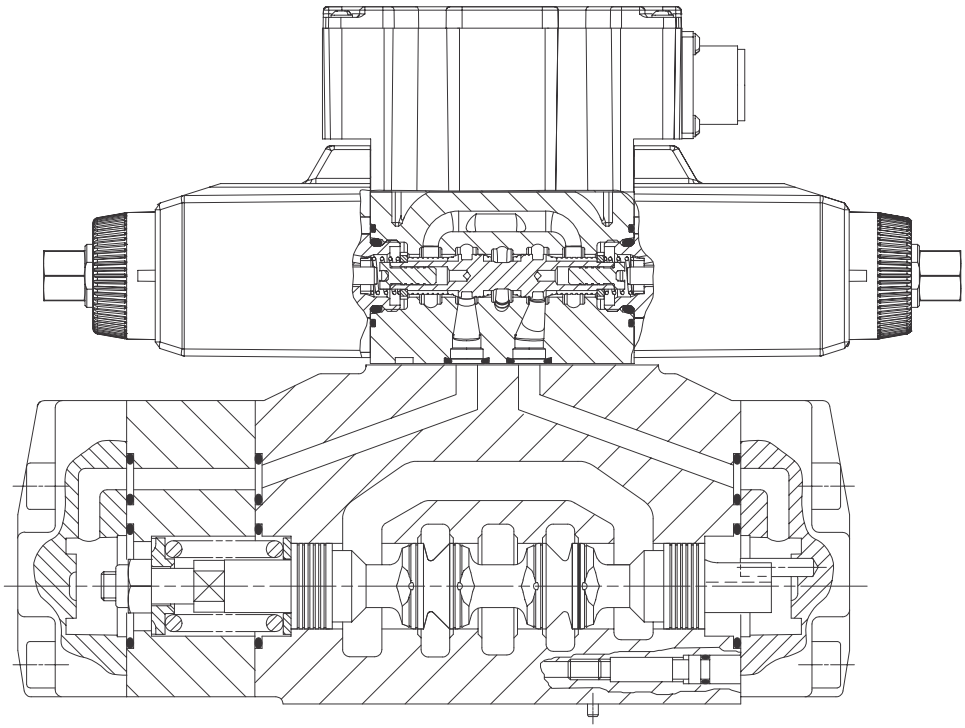
This range of valves offers effective and economic solutions for applications having repetitive load conditions throughout each operating cycle, e.g. mold closure /opening in plastics molding machinery.

Standard Features and Benefits

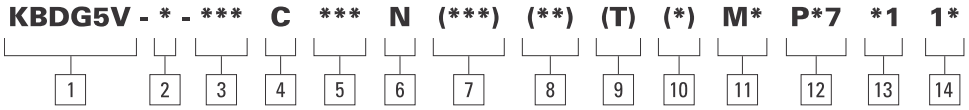
- These global products, manufactured to world-class quality standards, are sold and serviced throughout the world.
- These valves open up expanded application opportunities as a cost effective alternative to feedback-type proportional and servo valves.
- Auxiliary DIN-rail mounted function modules available.

Typical Section

KBDG5V-7
Without Integral Pilot Pressure Reducer



Model Codes



1 Model Series

KB – Proportional valve with integral amplifier, B series

D – Directional valve

G – Subplate mounted

5 – Solenoid controlled/pilot operated

V – Pressure rating on P, A & B ports
Sizes 7, 8 and 10: 350 bar (5000 psi)
Size 5: 315 bar (4500 psi)

2 Mounting Interface Size (ISO 4401)

5 – NFPA D05, CETOP 5

7 – NFPA D07, CETOP 7

8 – NFPA D08, CETOP 8

10 – NFPA D10, CETOP 10

3 Spool Type

See "Spool Data", page 5

2 – All ports blocked when spool centered

7 – Open P to A&B

12 – All ports blocked when spool centered, regenerative function when spool energized

33/133 – Bleed A and B to T when spool centered

4 Spool / Spring Arrangement

C – Spool spring centered

5 Flow Rating

See "Spool Data", page 5

Flow rating (L/min) for symmetric spools
"A" port flow rating (L/min) for asymmetric spools

6 Spool Metering Type

N – Meter-in and meter-out

7 Flow Rating

See "Spool Data", page 5

"B" port flow rating (L/min) for asymmetric spools

8 Pilot Supply

Models without integral, fixed pilot pressure reducer module

E – External pilot supply
Blank – Internal pilot supply

Models with integral, fixed pilot pressure reducer module

X – Internal pilot supply
EX – External pilot supply

For system pressures less than 200 bar (2900 psi) the pilot pressure reducing module is optional.

For system pressures above 200 bar (2900 psi) the pilot pressure reducing module must be fitted.

9 Pilot Drain

T – Internal pilot drain

Blank – External pilot drain

10 Manual Override

Blank – Plain overrides

H – Water-resistant overrides

Z – No overrides

11 Electrical Command Option

1 – +/- 10V control signal

2 – 4-20 mA control signal

12 Electrical Connection

PC7 – 7 pin connector without plug supplied

PE7 – 7 pin connector with plug supplied

PH7 – As PE7 but with pin "C" used for enable signal

PR7 – As PC7 but with pin "C" used for enable signal

13 Coil Identification

H – 24V

14 Design Number, 10 Series

Subject to change. Installation dimensions unaltered for design numbers 10 to 19 respectively

Warning

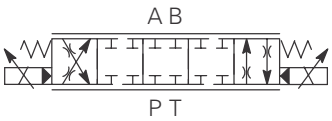
Valves with integral amplifiers are supplied with or without the metal 7-pin plug. The Vickers™ plug, part no. 934939, must be correctly fitted to ensure that the EMC rating and IP67 rating are achieved. The plug retaining nut must be tightened to 2-2,5 Nm (1.5-2.0 lbf ft) to effect a proper seal.

Spool Data

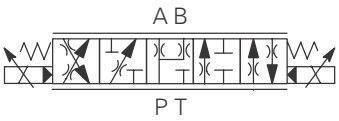
Spool Symbols

Simplified symbols including transient flow conditions (dotted line).

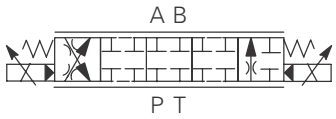
Spool type 2C



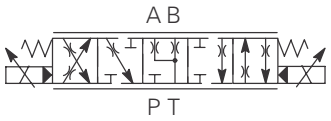
Spool type 7C



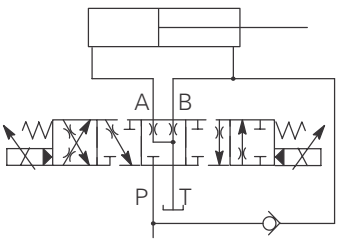
Spool type 12C



Spool type 33C



Spool type 133C
with typical regenerative circuit



Spool Types and Flow Ratings

Symmetric Spools

Flow ratings for flow through P-A-B-T at Δp = 5 bar (72 psi) per flow path, e.g. P-A, or B-T. For other pressure drop values see "Flow Gain" curves on pages 10 and 11.

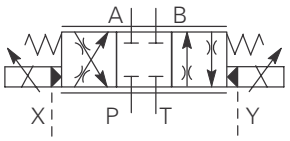
SPOOL CODE	MAIN STAGE SPOOL SYMBOL	FLOW RATING
For KBDG5V-5 valves:		
2C90N	2C	90 L/min (24 USgpm)
33C80	33C	80 L/min (21 USgpm)
For KBDG5V-7 valves:		
2C180N	2C	180 L/min (48 USgpm)
33C85N	33C	85 L/min (22.6 USgpm)
33C170N	33C	170 L/min (45 USgpm)
For KBDG5V-8 valves:		
2C330N	2C	330 L/min (88 USgpm)
33C330N	33C	330 L/min (88 USgpm)
For KBDG5V-10 valves:		
2C550N	2C	550 L/min (145 USgpm)
7C550N	7C	550 L/min (145 USgpm)
12C550N	12C	550 L/min (145 USgpm)
33C550N	33C	550 L/min (145 USgpm)

Asymmetric Spools

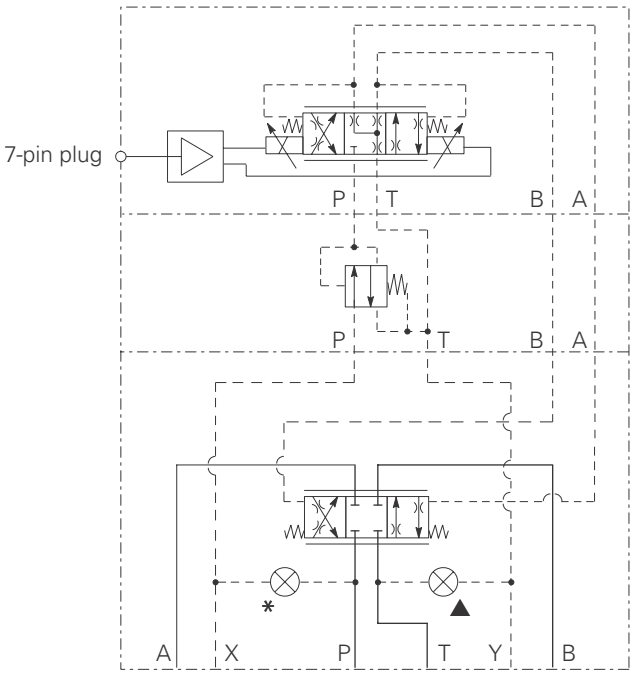
Figure preceding metering type designator, "N" (e.g. 2C***N) is flow rating P-A, or A-T ("A" port flow); figure after "N" (N***) is flow rating P-B, or B-T ("B" port flow).

SPOOL CODE	MAIN STAGE SPOOL SYMBOL	FLOW RATING
For KBDG5V-5 valves:		
2C70N45	2C	70 L/min (18.6 USgpm), "A" port flow
		45 L/min (12.0 USgpm), "B" port flow
33C60N40	33C	60 L/min (16.0 USgpm), "A" port flow
		40 L/min (10.6 USgpm), "B" port flow
For KBDG5V-7 valves:		
2C180N100	2C	180 L/min (48.0 USgpm), "A" port flow
		100 L/min (26.6 USgpm), "B" port flow
33C130N65	33C	130 L/min (34.6 USgpm), "A" port flow
		65 L/min (17.3 USgpm), "B" port flow
For KBDG5V-8 valves:		
2C330N200	2C	330 L/min (88.0 USgpm),"A" port flow
		250 L/min (66.6 USgpm), "B" port flow
33C330N200	33C	330 L/min (88.0 USgpm), "A" port flow
		250 L/min (66.6 USgpm), "B" port flow
133C330N200	133C	330 L/min (88.0 USgpm), "A" port flow
		250 L/min (66.6 USgpm), "B" port flow
12C330N200	12C	330 L/min (88.0 USgpm), "A" port flow
		250 L/min (66.6 USgpm), "B" port flow
For KBDG5V-10 valves:		
2C310N550	2C	310 L/min (82.6 USgpm), "A" port flow
		550 L/min (145 USgpm), "B" port flow
2C550N310	2C	550 L/min (145 USgpm), "A" port flow
		310 L/min (82.6 USgpm), "B" port flow
33C310N550	33C	310 L/min (82.6 USgpm), "A" port flow
		550 L/min (145 USgpm), "B" port flow
33C550N310	33C	550 L/min (145 USgpm), "A" port flow
		310 L/min (82.6 USgpm), "B" port flow

Functional Symbols



Simplified symbol
KBDG5V models
(Spool type "2" shown)



Typical schematic symbol

Pilot stage with integral amplifier.

Pressure reducer module, see "Model Code".

Main-stage.
Spool type "2C" shown.

* Internal plug shown, for external pilot supply (via port X). For internal pilot supply (from port P) plug is not fitted. Port X should be blocked at mounting interface, or otherwise plugged at subplate or manifold block. See "Model Code".

▲ Internal plug shown, for external pilot drain (via port Y). For internal pilot drain (via port T) plug is not fitted. Port Y should be blocked at mounting interface, or otherwise plugged at subplate or manifold block. See "Model Code".

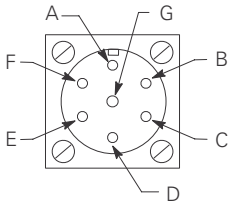
See also "Pilot Drain Application" notes.

Operating Data

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

Power supply (24V)	(Model code 13 H)	24V DC (21V to 36V including 10% peak-to-peak ripple) maximum current - 1.2A
Command signal (Volts)		0 to +10V DC, or 0 to -10V DC, or -10V to +10V DC
Input impedance		47 kΩ
Common mode voltage to pin B	(Model code 11 1)	4V
Command signal (Current)		4 to 20 mA
Input impedance	(Model code 11 2)	100Ω
Valve enable signal:		
Enable		>9.0V (36V max)
Disable		<2.0V
Input impedance		36 kΩ

7-pin plug connector



View of pins of fixed half

Pin	Description
A	Power supply positive (+)
B	Power supply 0V and current command return
C	Valve enable (PH7 & PR7)
D	Command signal (+V or current in)
E	Command signal (-V or current GND)
F	Output monitor
G	Protective ground

Electromagnetic compatibility (EMC):	
Emission (10 V/m)	EN 50081-2
Immunity (10 V/m)	EN 50082-2
Monitor signal (pin F)	0 to +5V (0.39 V/A)
Output impedance	10 kΩ
Reproducibility, valve-to-valve (at factory settings):	
Flow at 100% command signal	≤5%
Protection:	
Electrical	Reverse polarity protected
Environmental	IEC 529, Class IP67
Ambient air temperature range for full performance	0°C to 70°C (32°F to 158°F)
Oil temperature range for full performance	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)
Mass:	
Valves with integral pressure reducing module	
KBDG5V-5	9,8 kg (21.2 lb)
KBDG5V-7	11,9 kg (25.8 lb)
KBDG5V-8	20,6 kg (44.6 lb)
KBDG5V-10	54,9 kg (118.9 lb)
For models without reducing module, deduct 1,2 kg (2.6 lb)	
Supporting products:	
Auxiliary electronic modules (DIN-rail mounting):	
EHA-CON-201-A-2* Signal converter	See catalog 2410A
EHD-DSG-201-A-1* Command signal generator	See catalog 2470
EHA-RMP-201-A-2* Ramp generator	See catalog 2410A
EHA-PID-201-A-2* PID controller	See catalog 2427
EHA-PSU-201-A-10 Power supply	See catalog 2410A
Ramp time	0-12 sec for full step input (0-100%)
Relative duty factor	Continuous rating (ED = 100%)
Hysteresis with flow through P-A-B-T	<8% of rated flow

Performance Characteristics

Data is typical with fluid at 36 cSt (168 SUS) and 50˚C (122˚F).

Minimum Pressure

KBDG5V-5/7/8
For full flow performance, pilot pressure ≥45 bar (650 psi).

KBDG5V-10
For full flow performance, pilot pressure ≥28 bar (405 psi).

i.e.

Pressure at port P for internal pilot supply.

or

Pressure at port X for external pilot supply.

Pilot Drain Application Notes

External pilot drain is the recommended configuration.

Internal pilot drain is possible where a stable "T" port pressure, not exceeding 8 bar (116 psi), can be guaranteed.

Any pressure surges at the "T" port (drain) will cause the main spool to move and change the valve output. This possibility is eliminated by the use of an external drain.

Maximum Pressures, bar (psi)

For models without integral pilot pressure reducer

MODEL	PILOT PRESSURE SOURCE	MODEL CODE 7	PORTS P, A, B	T	X	Y †
KBDG5V-**5**	External	E	315 (4500)	210 (3000)	200 (2900)	8 (116)
	Internal	Omit	200§ (2900)	210 (3000)	■	8 (116)
KBDG5V-**7/8**	External	E	350 (5000)	350 (5000)	200 (2900)	8 (116)
	Internal	Omit	200§ (2900)	350 (5000)	■	8 (116)
KBDG5V-**10**	External	E	350 (5000)	350 (5000)	40 (580)	8 (116)
	Internal	Omit	40 (580)	350◆ (5000)	■	8 (116)

For models with integral pilot pressure reducer

KBDG5V-**5**	External	EX	315 (4500)	210 (3000)	315 (4500)	8 (116)
	Internal	X	315 (4500)	210 (3000)	■	8 (116)
KBDG5V-**7/8**	External	EX	350 (5000)	350♣ (5000)	315 (4500)	8 (116)
	Internal	X	350 (5000)	350♣ (5000)	■	8 (116)
KBDG5V-**10**	External	EX	350 (5000)	350◆ (5000)	315 (4500)	8 (116)
	Internal	X	350 (5000)	350◆ (5000)	■	8 (116)

■ When using internal pilot pressure, port X should be plugged at the subplate or manifold face (e.g. manifold not drilled for connection to port X).

§ The maximum pressure for ports A and B is: 310 bar (4500 psi) for size 5; 350 bar (5000 psi) for sizes 7 and 8.

† See "Pilot Drain Application" note.

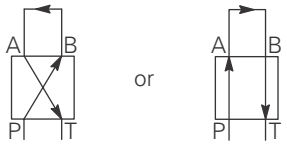
◆ Pilot must be externally drained, otherwise "Y" port pressure applies.

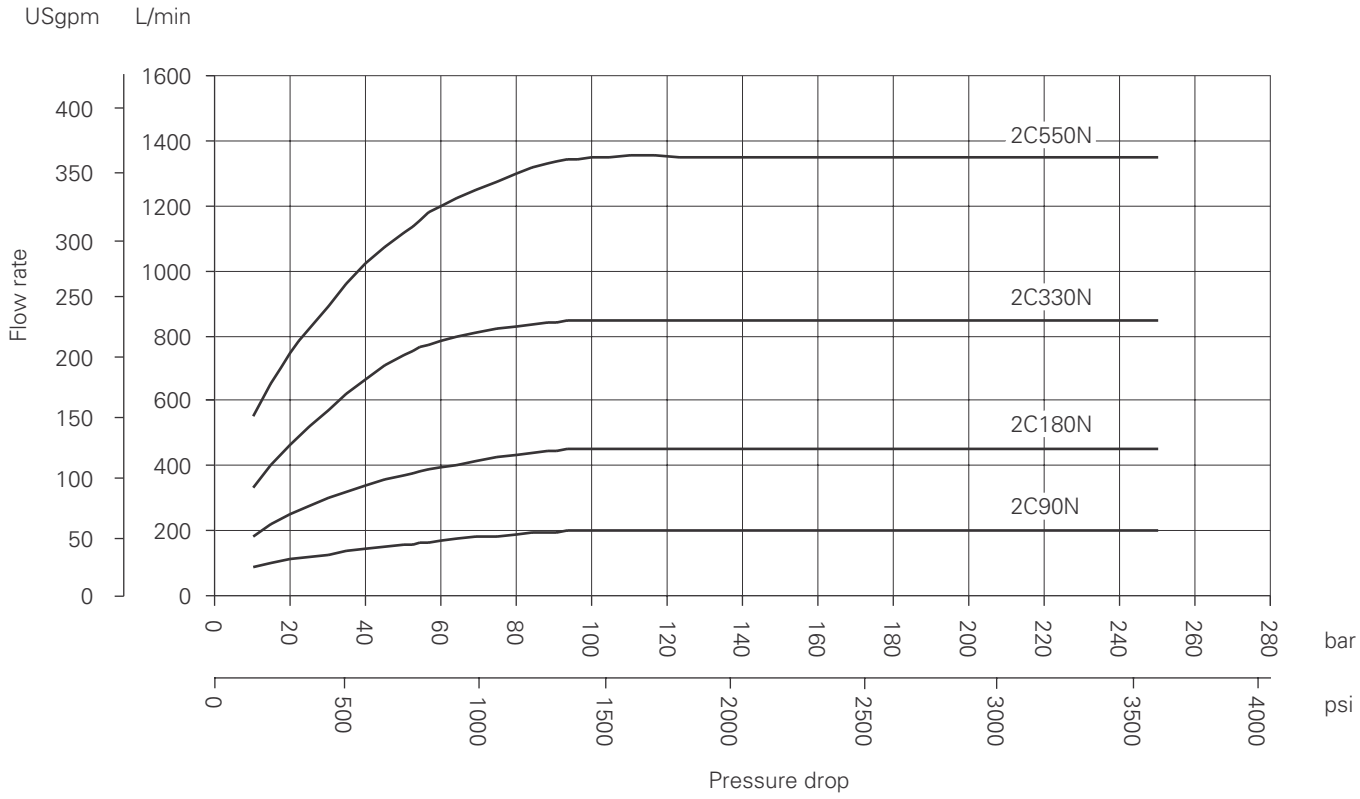
♣ Pilot must be externally drained, otherwise "T" port pressure limited to 210 bar (3000 psi).

Power Capacity Envelopes

Flow through P-A-B-T or P-B-A-T

Power Capacity Looped Flow

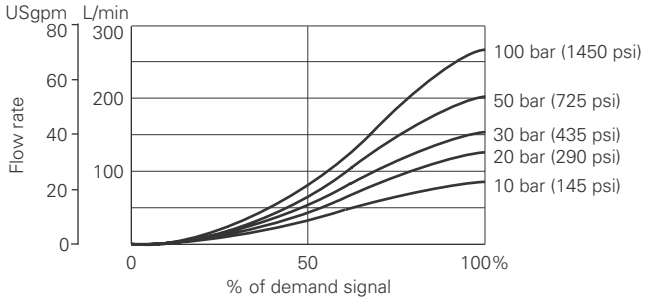




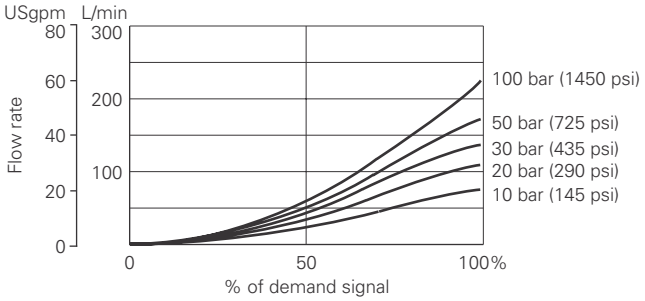
Flow Characteristics

Flow gain curves at stated values of total valve pressure drop, for flow P-A-B-T, or P-B-A-T.

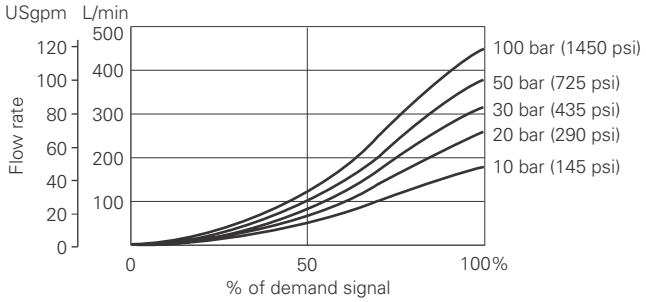
KBDG5V-5-**2C90N**



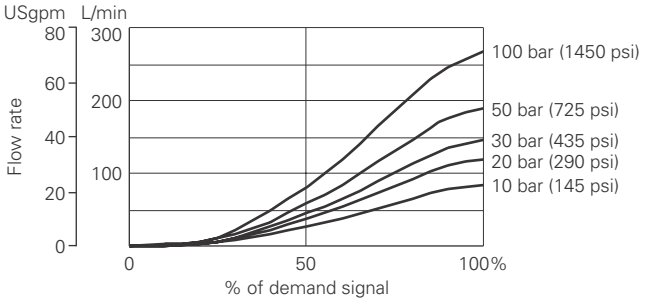
KBDG5V-5-**33C80N**



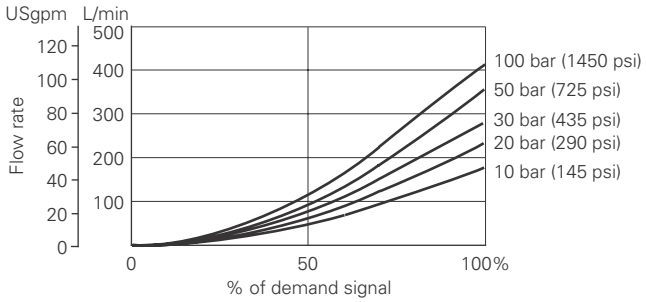
KBDG5V-7-**2C180N**



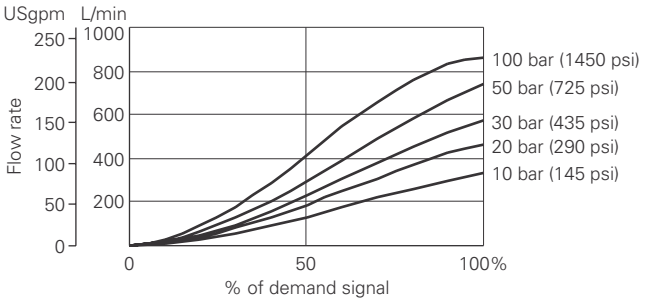
KBDG5V-7-**33C85N**



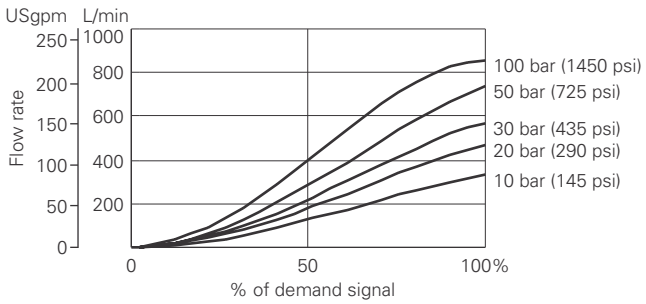
KBDG5V-7-**33C170N**



KBDG5V-8-**2C330N**



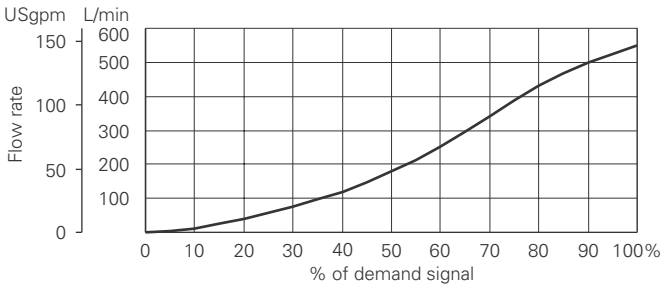
KBDG5V-8-**33C330N**



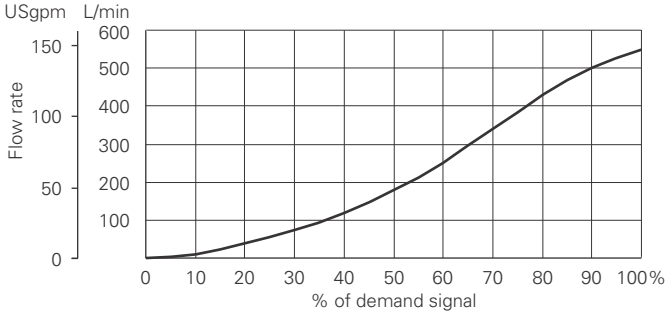
Flow Characteristics (continued)

Flow gain curves at 10 bar (145) psi valve pressure drop, for flow P-A-B-T, or P-B-A-T.

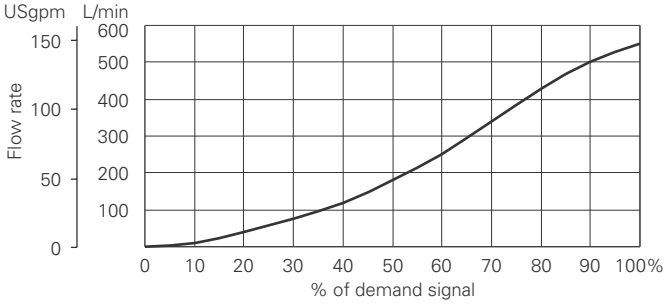
KBDG5V-10-**2C550N**



KBDG5V-10-**7C550N**
KBDG5V-10-**12C550N**



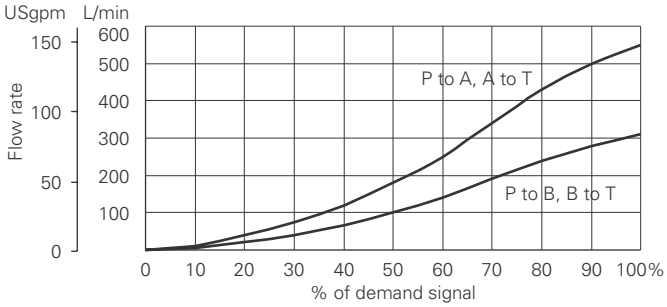
KBDG5V-10-**33C550N**



Asymmetric Spools

At 5 bar (72 psi) valve pressure drop

KBDG5V-10-**33C550N310**



Step Response (Typical)

Test conditions:

No pressure reducer module

Flow P-A-B-T

Total valve Δp = 10 bar (145 psi)

External pilot pressure = 50 bar (725 psi)

"Response" = Time, from step response signal, until output reaches 90% of step change value

INPUT SIGNAL STEP CHANGE	SPOOL RESPONSE TIMES (ms) KBDG5V-5	KBDG5V-7	KBDG5V-8	KBDG5V-10
0 to 100%	42	45	85	110
100% to 0	33	47	55	110
10% to 90%	43	58	75	100
90% to 10%	40	50	54	100
25% to 75%	34	50	70	95
75% to 25%	30	48	45	95
90% to 90%	78	78	144	200

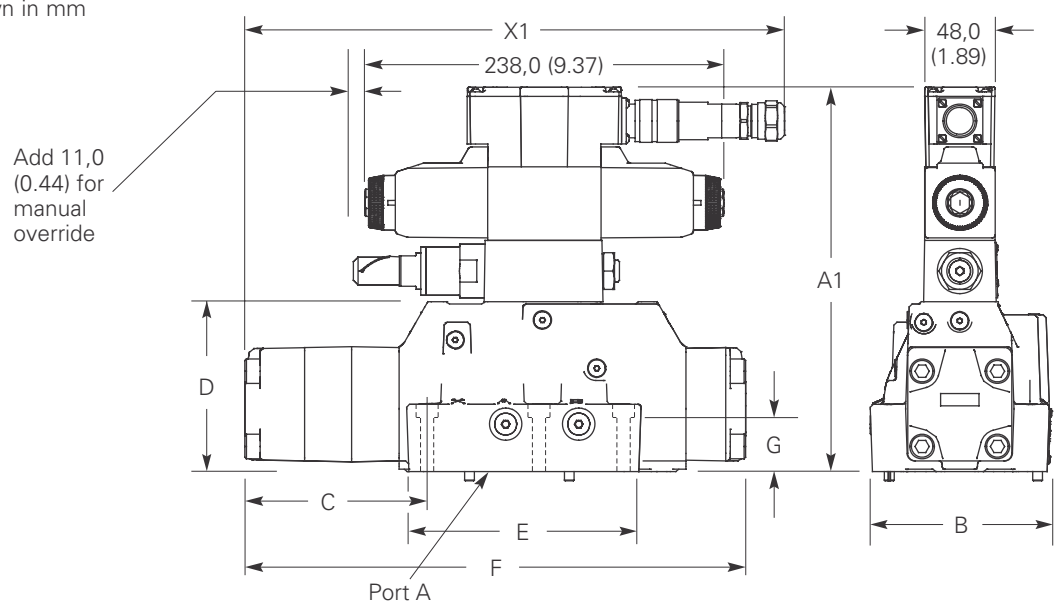
Pilot flow required to achieve above response times:

	KBDG5V-5	KBDG5V-7	KBDG5V-8	KBDG5V-10
	3,8 L/min	6,2 L/min	6,2 L/min	23,0 L/min
	(0.98 USgpm)	(1.6 USgpm)	(1.6 USgpm)	(5.96 USgpm)

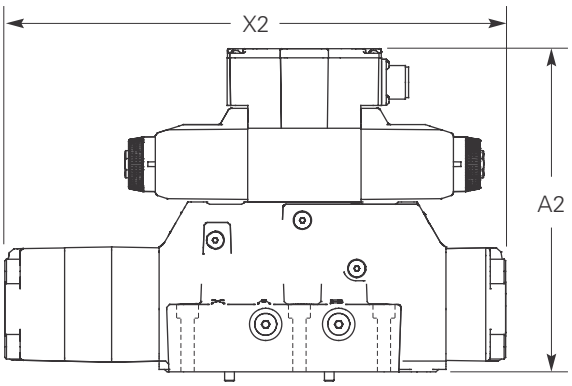
Installation Dimensions

KBDG5V Models with "EX" or "X"
(With integral pilot pressure reducer)
The illustration is correct for KBDG5V-8 valves
Dimensions are shown in mm (inches)

3rd angle projection



KBDG5V Models with "E" or No Symbol
(Without integral pilot pressure reducer)

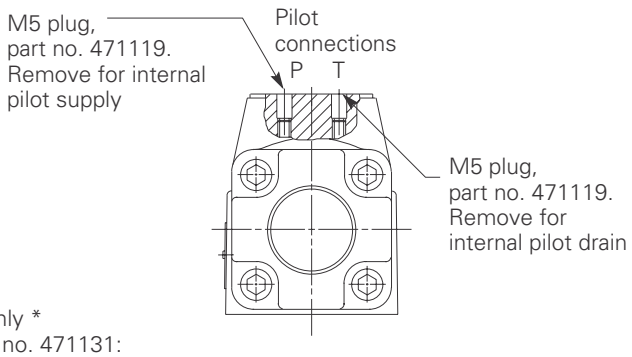


MODEL	A1	A2	B	C	D	E	F	G	X1▲	X2▲
KBDG5V-5	233,6 (9.20)	187,6 (7.39)	70,4 (2.77)	94,4 (3.72)	87,3 (3.4)	98,0 (3.86)	217,0 (8.54)	30,0 (1.18)	277,0 (10.9)	238,0 (9.37)
KBDG5V-7	241,4 (9.50)	195,4 (7.69)	92,8 (3.65)	83,3 (3.3)	95,1 (3.7)	124,0 (4.88)	232,0 (9.14)	33,0 (1.3)	297,0 (11.69)	258,0 (10.15)
KBDG5V-8	257,3 (10.13)	211,3 (8.32)	117,0 (4.60)	117,3 (4.62)	111,0 (4.37)	175,5 (6.91)	327,0 (12.87)	42,5 (1.67)	352,0 (13.86)	327,0 (12.87)
KBDG5V-10	339,8 (13.38)	293,8 (11.57)	196,8 (7.75)	194,3 (7.65)	193,5 (7.62)	226,8 (8.93)	516,9 (20.35)	35,0 (1.38)	516,9 (20.35)	516,9 (20.35)

▲ Overall installed length of KBD valves is X1 with connector fitted, and X2 without.

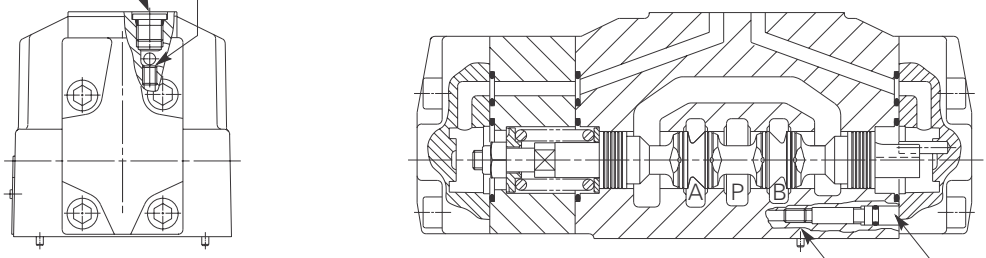
Pilot Supply and Drain Plugs

KBDG5V-5 models
Viewed from port B end of main-stage



KBDG5V-7 models only *
Remove this plug for access to pilot drain plug

KBDG5V-7 models only *
M6 x 8 mm plug, part no. 471131:
fitted for external pilot drain.
Not fitted for internal pilot drain.

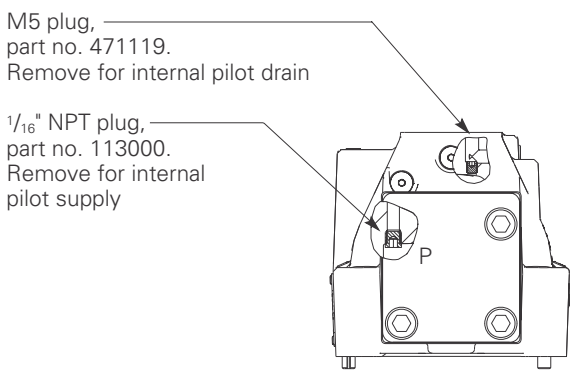


KBDG5V-7 models only *
M6 x 8 mm plug, part no. 471131:
fitted for external pilot supply models; not fitted for internal pilot supply models. See "Model Code" .

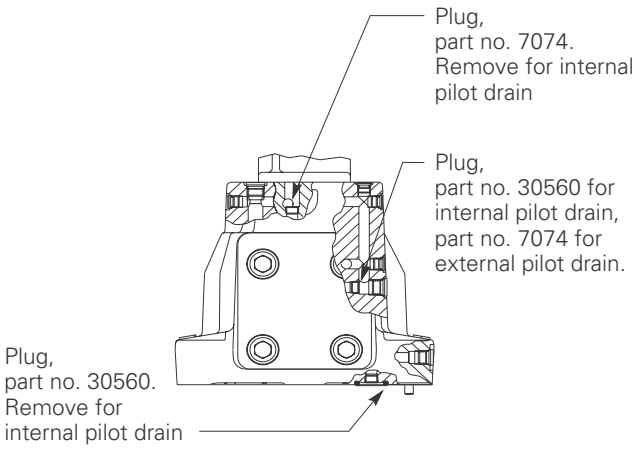
Size 7 only *
M5 internal thread for removal of closure plug

* Internal plug shown, for external pilot supply (via port X).
For internal pilot supply (from port P) plug is not fitted. Port X should be blocked at mounting interface, or otherwise plugged at subplate of manifold block. See "Model Code".

KBDG5V-8 models
Section through port P of main-stage



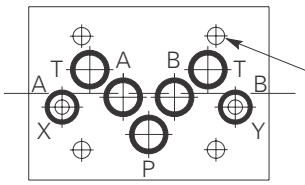
KBDG5V-10 models



Views on Mounting Faces

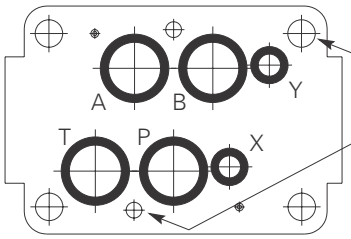
All O-seals supplied

KBDG5V-5



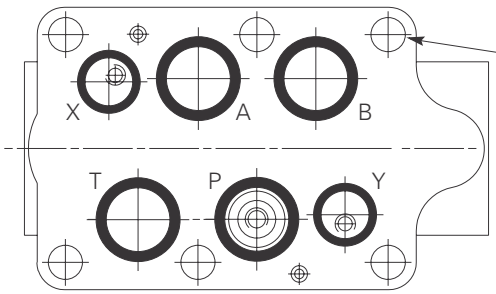
4 holes for mounting bolts
Ø 7,02 (0.27 Ø) spotfaced to
Ø 11,0 (0.43 Ø)

KBDG5V-7



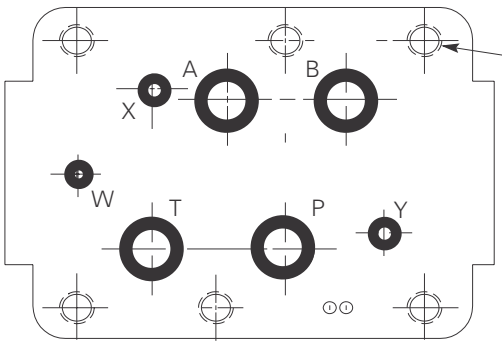
6 holes for mounting bolts
4 x Ø 11,0 (0.43 Ø) c'bored
Ø 17,5 (0.68 Ø)
2 x Ø 6,4 (0.25 Ø) c'bored
Ø 11,0 (0.43 Ø)

KBDG5V-8



6 holes for mounting bolts
Ø 13,5 (0.53 Ø)
spotfaced to
Ø 20,0 (0.78 Ø)

KBDG5V-10



6 holes for mounting bolts

Block Diagram
KBDG5V-*

COMMAND SIGNALS AND OUTPUTS

7-pin plug			Flow direction
Command = Volts (±10V)	**Pin D**	**Pin E**	
	Positive	0V	P to A
	0V	Negative	
	V_D - V_E = Positive		
	Negative	0V	P to B
	0V	Positive	
	V_D - V_E = Negative		

Command =	Pin D	Pin E	Pin B	Flow direction
Current (4-20 mA)	More than 12 mA	Current GND	Current return	P to A
	Less than 12 mA	Current GND	Current return	P to B

Wiring

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

Power Cables

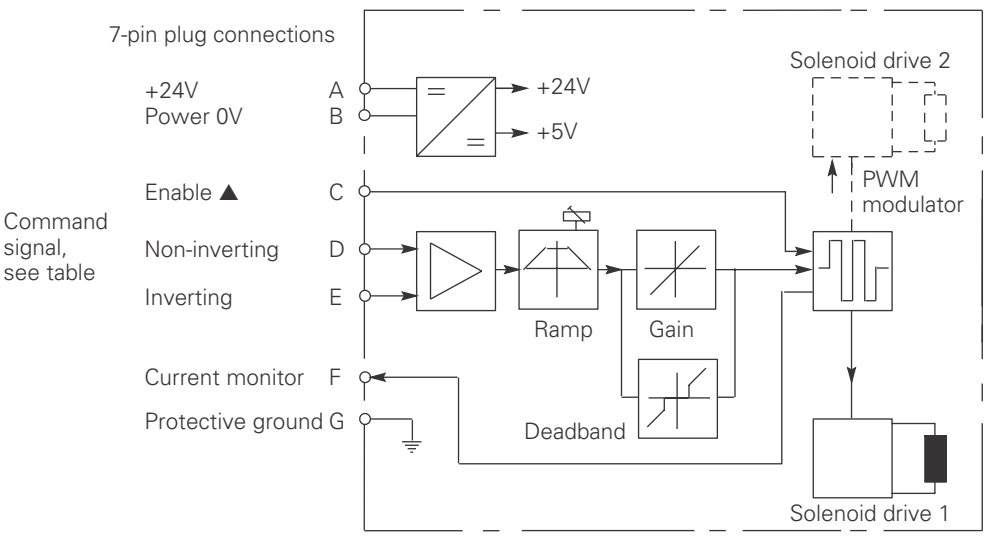
For 24V supply:
0,75 mm² (18 AWG) up to 20m (65 ft)
1,00 mm² (16 AWG) up to 40m (130 ft)

Signal Cables

0,50 mm² (20 AWG)

Screen (Shield)

A suitable cable would have 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 diagrams on next page.

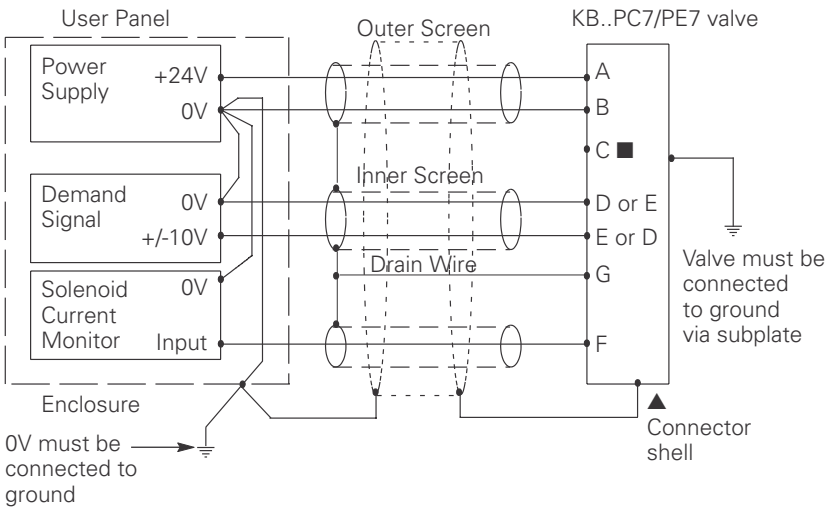


▲ In valves with PH7 or PR7 type electrical connection.

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

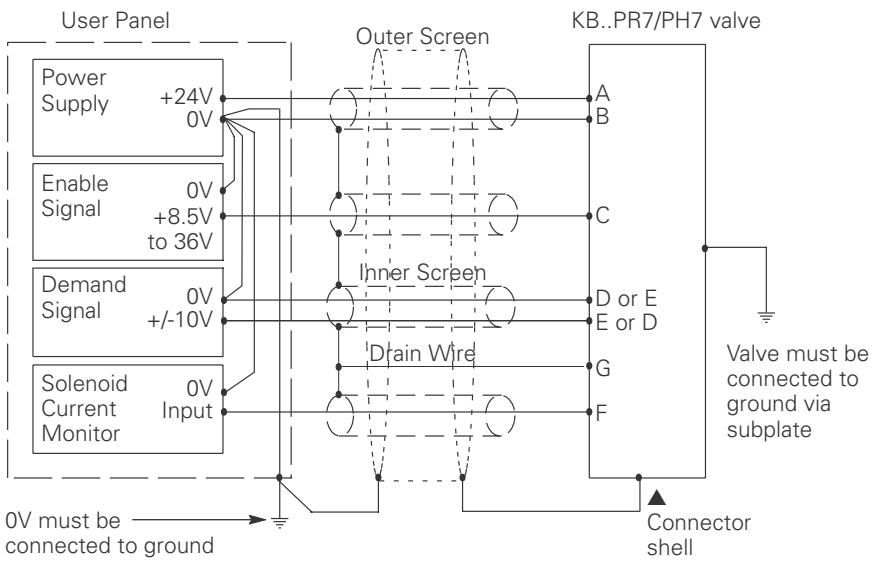
Typical Connection Arrangements

Wiring Connections



■ Pin C may be connected to ground or left unconnected.

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 these valves are compatible with antiwear hydraulic oils, and with 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 KBDG5V-5
BK02-156493M (metric)
BK590720 (inch)

For KBDG5V-7
BKDG7M (metric)
BK590724 (inch)

For KBDG5V-8
BKDG8-655M (metric)
BKDG06-635 (inch)

For KBDG5V-10
BKDG10636M (metric)
BKDG10636 (inch)

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

Mounting Bolt Torques

Recommended torques with threads lubricated

For KBDG5V-5
M6 or 1/4"-20 UNC bolts:
To 210 bar (3000 psi) 14 Nm (10.3 lbf ft)
To 310 bar (4500 psi) 20 Nm (14.75 lbf ft)

For KBDG5V-7
M10 or 3/8"-16 UNC bolts:
49 to 59 Nm (36 to 43 lbf ft)
plus
M6 or 1/4"-20 UNC bolts
9 to 14 Nm (6.6 to 10.3 lbf ft)

For KBDG5V-8
M12 or 1/2"-13 UNC bolts
103 to 127 Nm (76 to 93 lbf ft)

For KBDG5V-10
M20 or 3/4"-10 UNC-2B bolts
185-220 Nm (250-300 lbf ft)

Seal Kits (Mainstage Only)

KBDG5V-5.....565143
KBDG5V-7.....02-351175
KBDG5V-8.....02-352520
KBDG5V-10.....02-329888

Plugs

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-P.

Service Information

The products from this range are preset at the factory for optimum performance; disassembling critical items would destroy these settings. It is recommended that if any mechanical or electronic repair is necessary, valves should be returned to the nearest Eaton Hydraulics 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.

Eaton
14615 Lone Oak Road
Eden Prairie, MN 55344-2287
USA
Tel: (+1) 952 937-9800
Fax: (+1) 952 974-7722
www.hydraulics.eaton.com

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Fax: (+61) 3 9318 5714

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Vickers

Printed in USA
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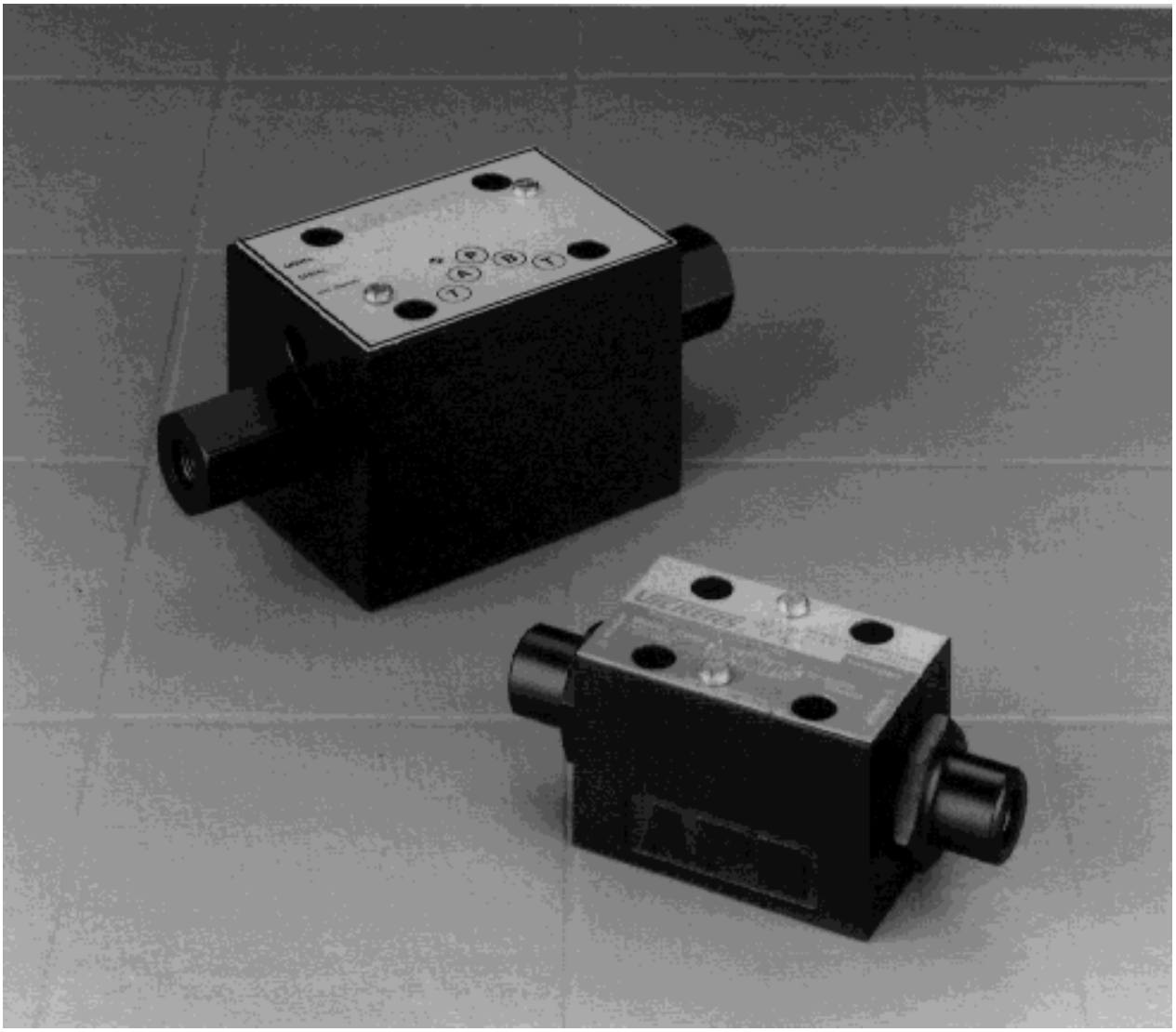
January 2003

Proportional Directional Valves

Hydraulic Pilot Operated KDG3V-3 and KDG3V-5 Series
ISO 4401-03 and -05 (NFPA D03 and D05) Interfaces



Introduction

Vickers KDG3V-3 and -5 valves are used in open loop hydraulic circuits to direct and meter flow in proportion to pilot pressure commands. The resulting controlled flow is used to determine the direction, velocity and acceleration/deceleration of hydraulic cylinders or motors.

The KDG3V is controlled by applying pilot pressure, through an operator mechanism, to either end of the valve's normally spring-centered spool. The resulting force causes spool travel when it is greater than the opposing spring force.

Optional pressure feedback models have a small pin inside the ends of the spool. Load pressure acts on the area of the pin and opposes the pilot pressure, thus closing the spool. For a given pilot pressure, flow decreases as load pressure increases, until maximum pressure is reached at zero flow. Maximum load pressure can be changed by changing the pilot pressure.

Pressure, actuator and tank port connections are made by mounting the valve on a subplate or manifold. Vickers hydraulic remote controls (catalog GB-MC-2032A) are an ideal means of providing pilot pressure for the KDG3Vs, and ultimately providing precise low-effort control of actuator functions.

Features and Benefits

- KDG3V valves, manufactured to world-class quality standards, are sold and serviced throughout the world.
- Standard ISO 4401-03 and -05 mountings are interchangeable with NFPA D03 and D05 interfaces, respectively.
- Load-pressure feedback option available.
- NFPA fatigue rated at 350 bar (5075 psi) for KDG3V-3, and 315 bar (4568 psi) for KDG3V-5.
- The use of fluorocarbon seals throughout provides multi-fluid capability.

Contents

General Information

Typical Applications 4
Metering 4
Valve Spool Position 4
Pressure Feedback 4
Graphical Symbols 4
Flow Rate 4
Recommended Fluids 4
Mounting 4
Seal Kits 4

KDG3V-3 Model Series

Model Code 5
Ratings and Specifications 5
Performance Curves 6
Installation Dimensions 7
Cross Section Drawing 7

KDG3V-5 Model Series

Model Code 8
Ratings and Specifications 8
Performance Curves 9
Installation Dimensions 10
Cross Section Drawing 10

Subplates & Bolt Kits 11

Fluid Cleanliness 12

General Information

Typical Applications

KDG3V valves are often used in mobile and industrial “line of sight” applications where speed and position are controlled by an operator. Typical applications include aerial work platforms, railway maintenance equipment, and snow groomers.

Metering

The spools of KDG3V valves have metering notches positioned between the pressure port and actuator port, creating a throttle in the hydraulic actuator’s inlet line. These meter-in spools are commonly used with hydrostat modules for pressure compensation in applications having no overrunning load, as well as in load sensing pump circuits. (See catalog GB-C-2007A for information on hydrostat modules.)

Valve Spool Position

The spool will be spring centered until adequate pilot pressure is applied, unless it’s a pressure feedback spool.

NOTE

Due to silting, the spool of any sliding-spool valve may stick and not spring return if held shifted under pressure for long periods. Such valves should be cycled periodically to prevent this from occurring.

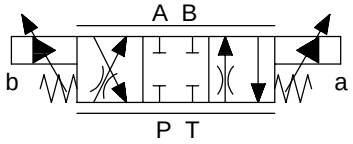
Pressure Feedback

Optional pressure feedback models have a small pin inside the ends of the spool. See pressure feedback pin page 7.

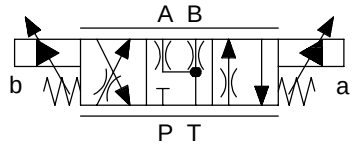
Load pressure acts on the area of the pin and opposes the pilot pressure, thus closing the spool. For a given pilot pressure, flow decreases as load pressure increases, until maximum pressure is reached at zero flow. Maximum load pressure can be changed by changing the pilot pressure.

Graphical Symbols

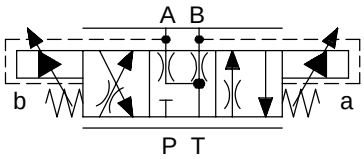
KDG3V-3-2C**A-S-60
KDG3V-5-2C**A-S-10



KDG3V-3-33C**A-S-60
KDG3V-5-33C**A-S-10



KDG3V-3-33C**A-3-S-60
KDG3V-5-33C**A-4-S-10



Flow Rates

Flow through the valve depends on spool position and valve pressure differential. As the valve is opened, the rate of flow increases, and if the pressure differential across the valve changes due to load pressure changes, the flow will vary. Therefore, “rated flow” is an arbitrary term, dependent on the above parameters.

The valve exhibits an inherent degree of load compensation whereby increasing valve pressure drop has progressively less effect on flow rate. See power capacity curves page 6.

To eliminate the effects of pressure changes, a hydrostat module can be installed under the valve to achieve pressure compensation. (See catalog GB-C-2007A for information on hydrostat modules.)

Recommended Fluids

Petroleum oils are recommended. Fluorocarbon seals are standard and are suitable for use with phosphate ester fluids or blends, water glycol, water-in-oil emulsion fluids, and petroleum oils. HWBF (95% water) is not recommended.

See back cover for recommended fluid cleanliness levels. See 694 for additional fluid, and temperature, recommendations.

Mounting

The surface to which the valve mounts must be flat within 0,013 mm (.0005 inch) and smooth within 1,1 micrometer (45 microinch). Mounting bolts should be grade 12.9 (SAE grade 7) or better.

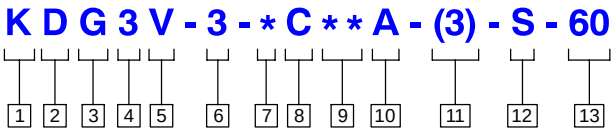
Subplates, and bolts for joining valves and subplates, are available. See page 11.

Seal Kits

Replacement seals for KDG3V-3 and -5 valves are available in kits 02-110959 and 02-310114, respectively.

KDG3V-3 Model Series

Model Code



1 Valve Type

K – Proportional

2 Valve Function

D – Directional control

3 Mounting

G – Manifold or subplate

4 Operation

3 – Hydraulic pilot operated

5 Pressure Rating

V – 350 bar (5075 psi)

6 Interface

3 – ISO 4401-03 (NFPA D03)

7 Spool Type (center condition)

2 – Closed center (all ports)
33 – Closed center (bleed A and B ports)

8 Spool/Spring Arrangement

C – Spring centered, double operator

9 Flow Rating @ 10 bar (145 psid)

23 – 23 Lpm (6 USgpm)
34 – 34 Lpm (9 USgpm)

10 Metering Configuration

A – Meter-in only

11 Pressure Feedback Option

3 – Feedback (available with type 33 spool only)
Blank – No feedback required

12 Thread for Pilot/Drain Connection

S – SAE internal straight thread

13 Design Number

Subject to change. Installation dimensions remain unchanged for designs 60 through 69.

Ratings and Specifications

Rated Flow	**Maximum Flow**	**Max. Operating Pressure**	**Rated Fatigue Pressure** (Ports A, B & P)	**Maximum Tank Line Pressure**
Per spool type	See curves Page 6	350 bar (5075 psi)	350 bar (5075 psi)	210 bar (3045 psi)

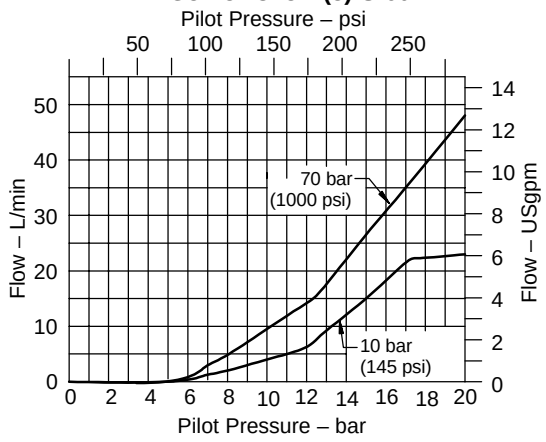
Pilot Pressure	**Hysteresis**	**Repeatability**	**Pilot Pressure Required To Begin Flow** (Cracking Point)	**Approximate Weight** (All Models)
0-17 bar (0-250 psi)	±4 %	±1 %	3,3-6,7 bar (50-100 psi)	1,2 kg (2.5 lbs)

KDG3V-3 Model Series

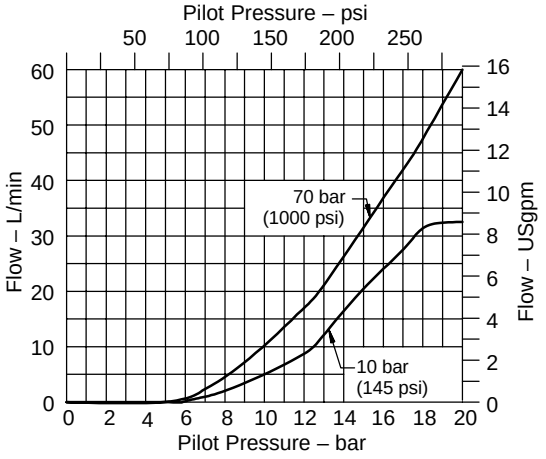
Flow Gain

At stated valve pressure drop.
Single flow path, P→A or P→B.

KDG3V-3-*C23A-(3)-S-60

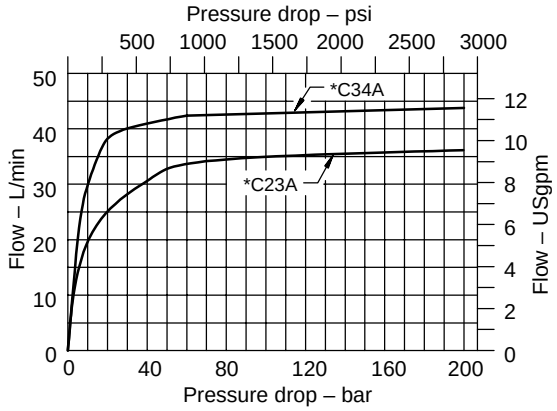


KDG3V-3-*C34A-(3)-S-60



Power Capacity

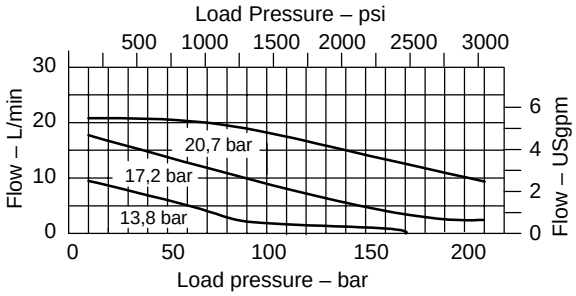
At rated pilot pressure of 17 (250 psi).
Flow thru P→A or P→B.
Single flow path.



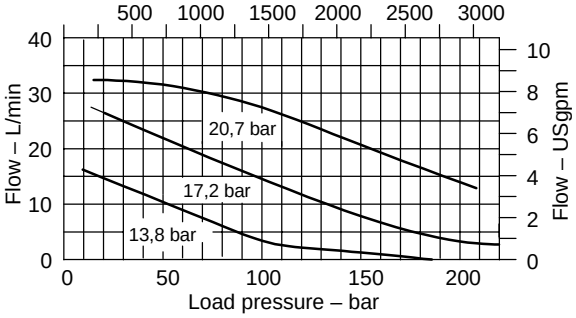
Load Compensation

Pressure feedback for load sense or hydrostat systems.
10 bar (145 psid) constant pressure drop P.
Service at various pilot pressures.

KDG3V-3-33C23A-3-S-60



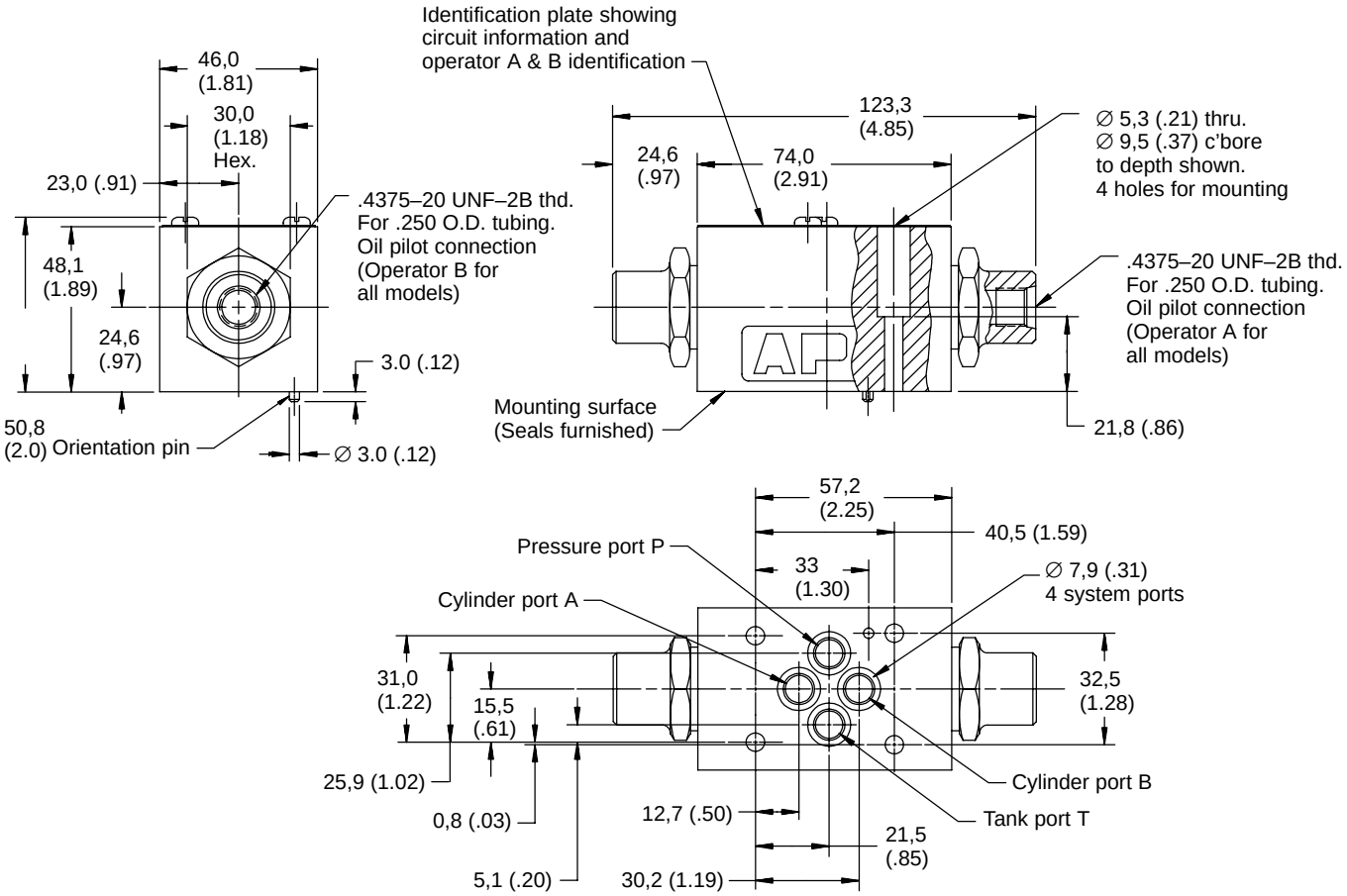
KDG3V-3-33C34A-3-S-60



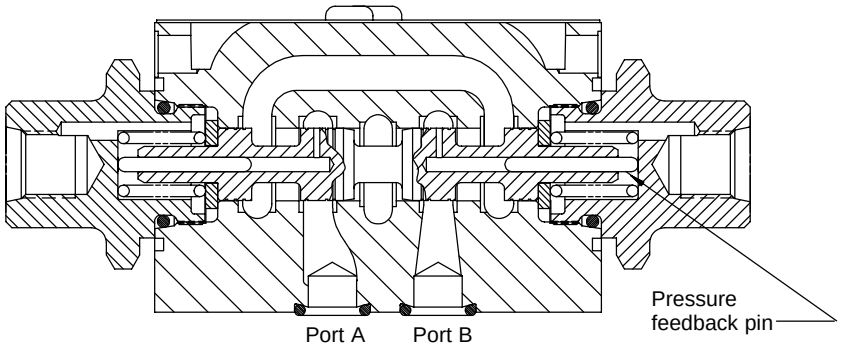
KDG3V-3 Model Series

Installation Dimensions

Millimeters (Inches)

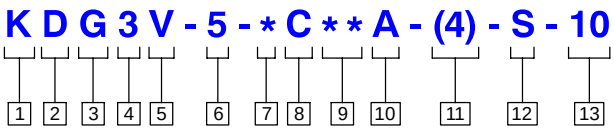


Cross Section of Pressure Feedback Model



KDG3V-5 Model Series

Model Code



1 Valve Type

K – Proportional

2 Valve Function

D – Directional control

3 Mounting

G – Manifold or subplate

4 Operation

3 – Hydraulic pilot operated

5 Pressure Rating

V – 315 bar (4568 psi)

6 Interface

5 – ISO 4401-05 (NFPA D05)

7 Spool Type (center condition)

2 – Closed center (all ports)
33 – Closed center (bleed A and B ports)

8 Spool/Spring Arrangement

C – Spring centered, double operator

9 Flow Rating @ 10 bar (145 psid)

63 – 63 Lpm (17 USgpm)
95 – 95 Lpm (25 USgpm)

10 Metering Configuration

A – Meter-in only

11 Pressure Feedback Option

4 – Feedback (available with type 33 spool only)
Blank – No feedback required

12 Thread for Pilot/Drain Connection

S – SAE internal straight thread

13 Design Number

Subject to change. Installation dimensions remain unchanged for designs 10 through 19.

Ratings and Specifications

Rated Flow	**Maximum Flow**	**Max. Operating Pressure**	**Rated Fatigue Pressure** (Ports A, B & P)	**Maximum Tank Line Pressure**
Per spool type	See curves page 9	315 bar (4568 psi)	315 bar (4568 psi)	70 bar (1015 psi)

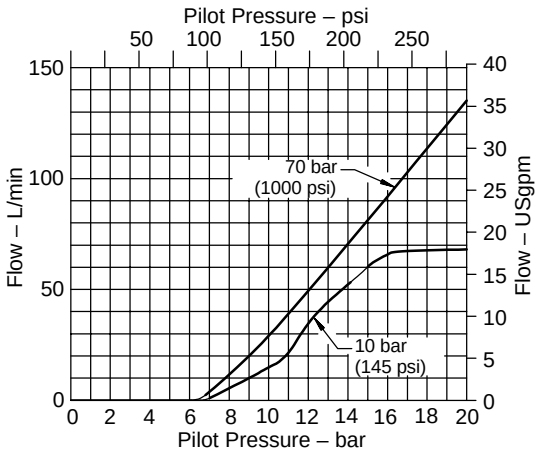
Pilot Pressure	**Hysteresis**	**Repeatability**	**Pilot Pressure Required To Begin Flow** (Cracking Point)	**Approximate Weight** (All Models)
0-17 bar (0-250 psi)	±4 %	±1 %	3-7 bar (45-105 psi)	3,3 kg (7,2 lbs)

KDG3V-5 Model Series

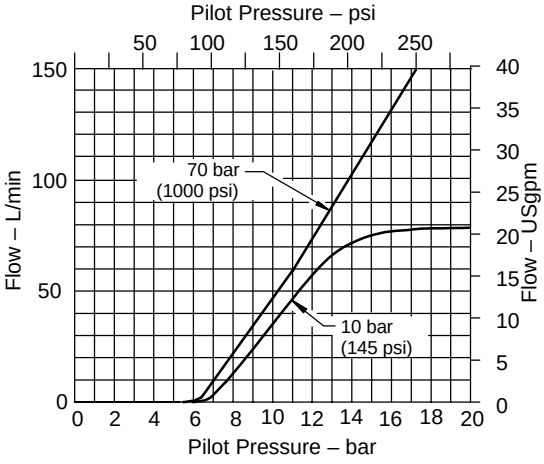
Flow Gain

At stated valve pressure drop.
Single flow path, P→A or P→B.

KDG3V-5-*C63A-(4)-S-10

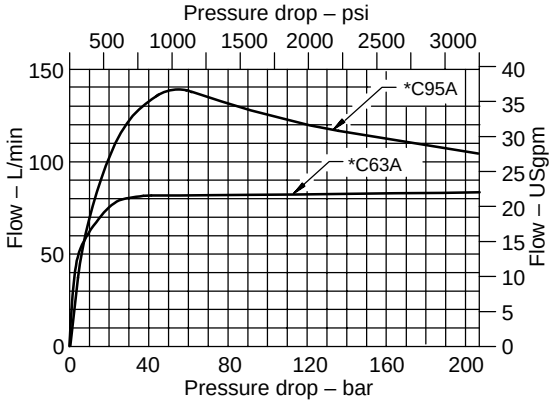


KDG3V-5-*C95A-(4)-S-10



Power Capacity

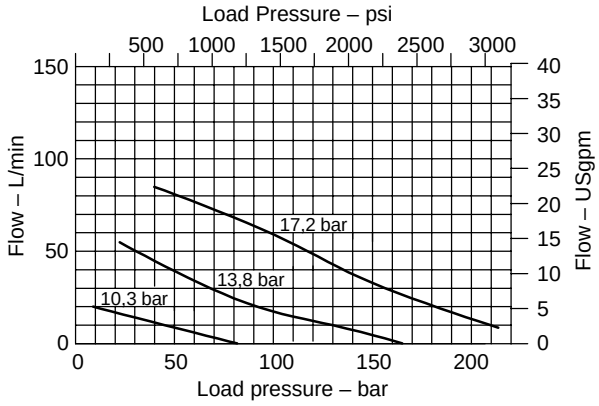
At rated pilot pressure of 15,5 (225 psi).
Flow thru P→A or P→B.
Single flow path.



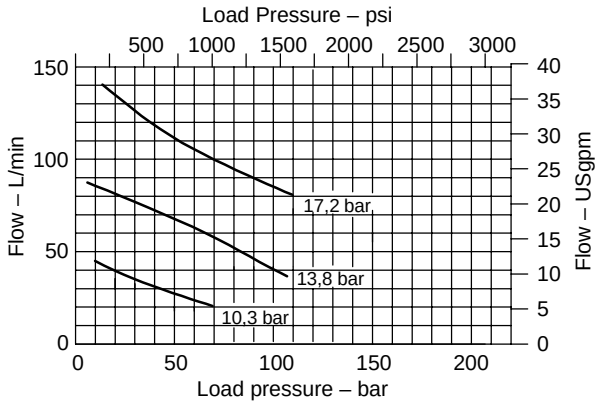
Load Compensation

Pressure feedback for load sense or hydrostat systems.
20 bar (240 psid) constant pressure drop P.
Service at various pilot pressures.

KDG3V-5-33C63A-4-S-10

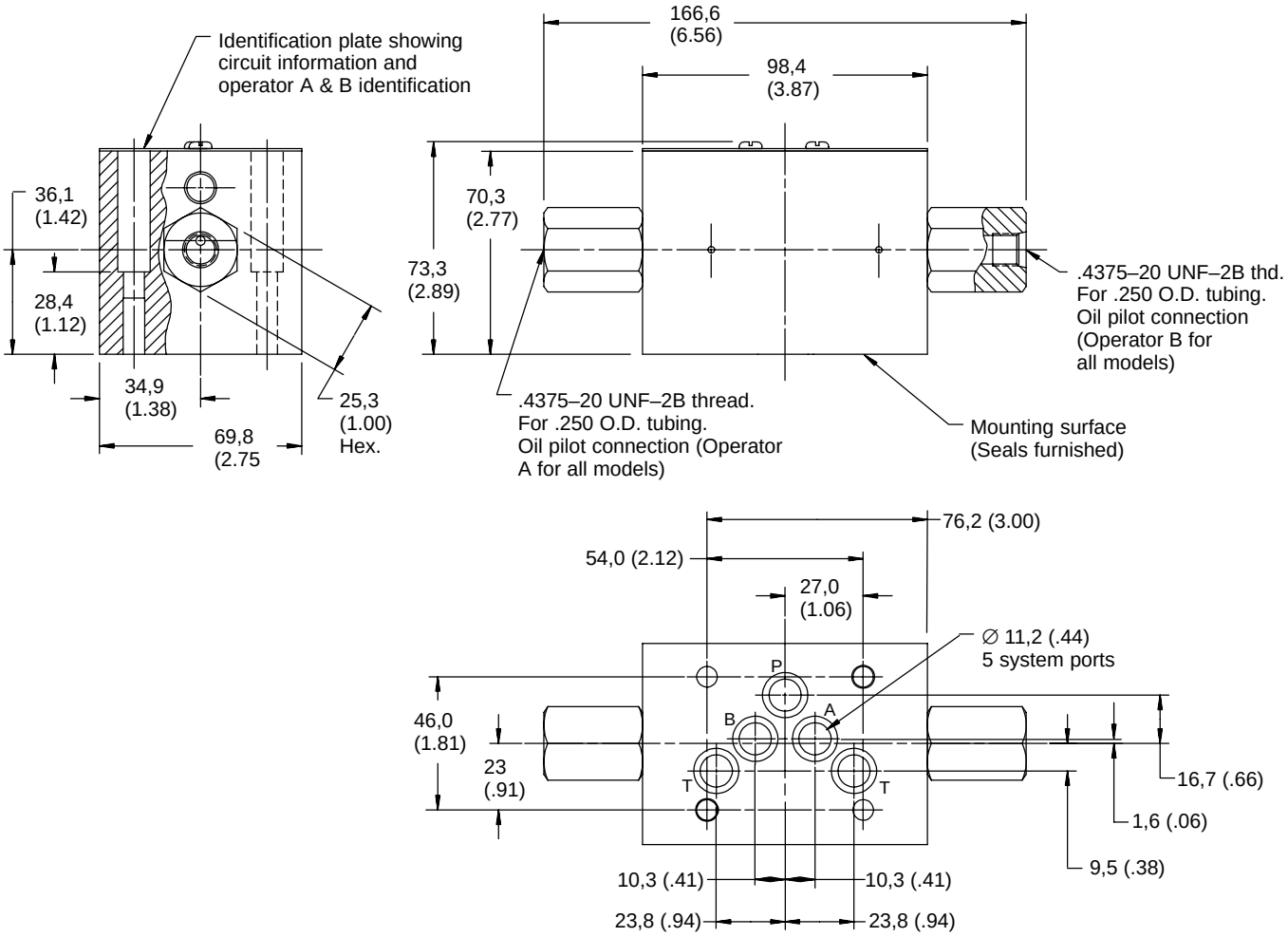


KDG3V-5-33C95A-4-S-10

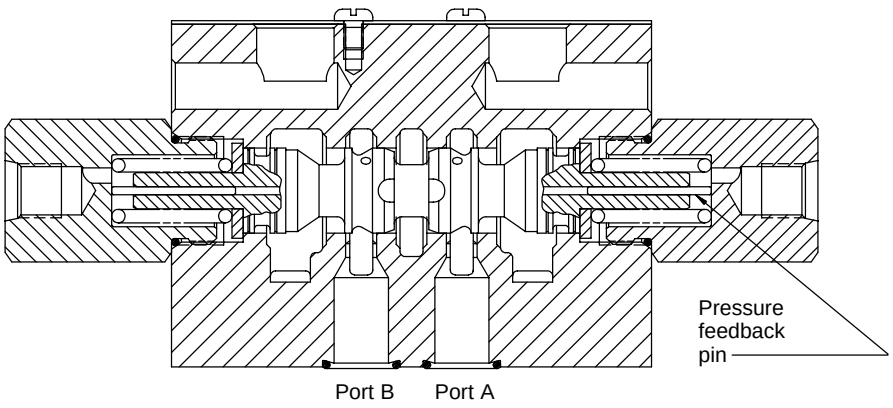


KDG3V-5 Model Series

Installation Dimensions
Millimeters (Inches)



Cross Section of Pressure Feedback Model



Subplates & Bolt Kits

Valves, subplates, and bolts for joining the two must be ordered separately per the following examples.

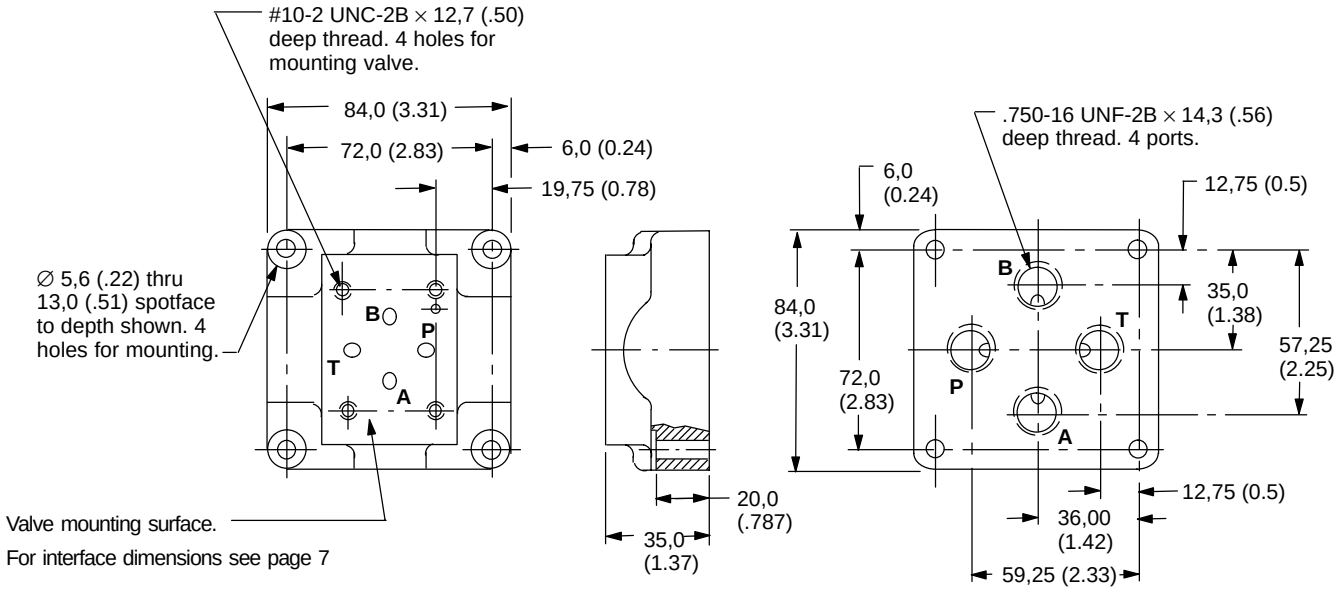
Note: Subplates are rated at 207 bar (3000 psi) only.

Example A:
(1) KDG3V-3-2C23A-S-60 valve
(1) DGVM-3-10-S subplate
(1) BK590716 mounting bolt kit (inch)
Maximum recommended mounting bolt torque is 6 Nm (53 lb. in.).

Example B:
(1) KDG3V-5-2C63A-S-10 valve
(1) DGSM-01-20-T8 subplate
(1) BK4-06 mounting bolt kit (inch)
Maximum recommended mounting bolt torque is 15 Nm (130 lb. in.).

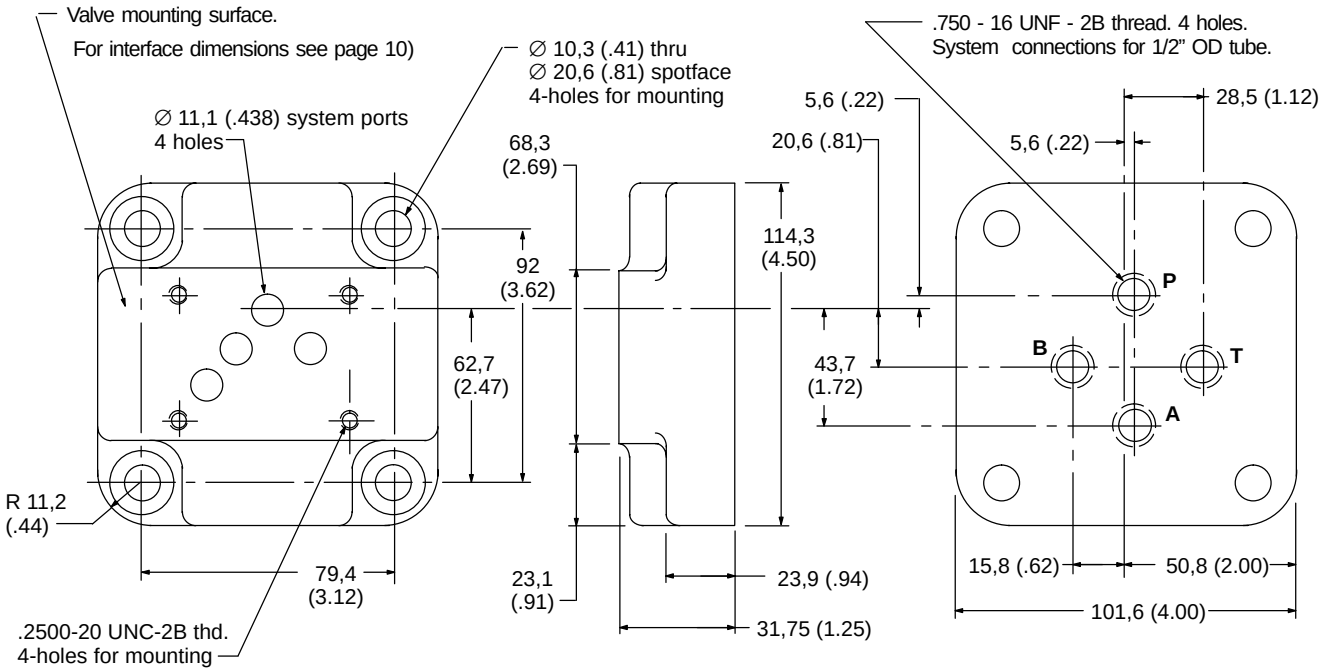
DGVM-3-10-S Subplate

Millimeters (Inches)



DGSM-01-20-T8 Subplate

Millimeters (Inches)



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.

Essential information on the correct methods for treating hydraulic fluid is included in Vickers publication 561 “Vickers Guide to Systemic Contamination Control,” available from your local Vickers distributor or by contacting Vickers, Incorporated. Recommendations on filtration and the selection of products to control fluid condition are included in 561.

Recommended cleanliness levels, using petroleum oil under common conditions, are based on the highest fluid pressure levels in the system and are coded in the chart below. Fluids other than petroleum, severe service cycles, or temperature extremes are cause for adjustment of these cleanliness codes. See Vickers publication 561 for exact details.

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 component is shortened in fluids with higher cleanliness codes than those listed below. These codes have been proven to provide a long, trouble-free service life for the products shown, regardless of the manufacturer.

	System Pressure Level bar (psi)		
Product	**<138 (<2000)**	**138–207 (2000–3000)**	**210+ (3000+)**
Vane pumps, fixed	20/18/15	19/17/14	18/16/13
Vane pumps, variable	18/16/14	17/15/13	
Piston pumps, fixed	19/17/15	18/16/14	17/15/13
Piston pumps, variable	18/16/14	17/15/13	16/14/12
Directional valves	20/18/15	20/18/15	19/17/14
Proportional directional valves	**17/15/12**	**17/15/12**	**15/13/11**
Servo valves	16/14/11	16/14/11	15/13/10
Pressure/Flow controls	19/17/14	19/17/14	19/17/14
Cylinders	20/18/15	20/18/15	20/18/15
Vane motors	20/18/15	19/17/14	18/16/13
Axial piston motors	19/17/14	18/16/13	17/15/12
Radial piston motors	20/18/14	19/17/13	18/16/13

Eaton Servo-Performance Proportional Directional Valve

AxisPro™

KBS*-3 10 Series

Powering Business Worldwide

Contents

Introduction

General Description 3

Typical Section View 3

Model Code 4

Spool Sleeve Details 6

Spool Data 8

Spool/Sleeve Combinations 9

Performance Curves 10

Operating Data 12

Software Information 15

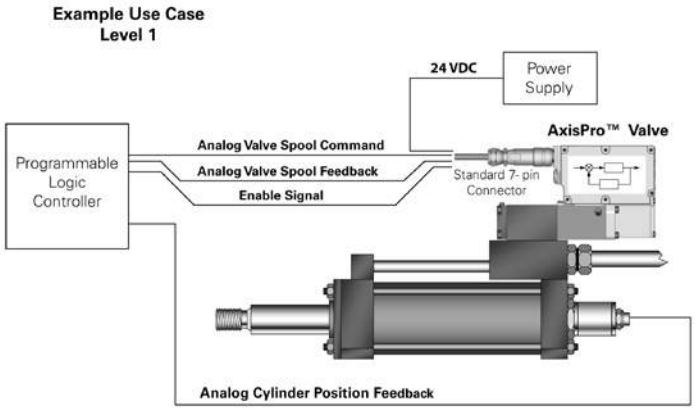
Electrical Information 16

Installation Dimensions 20

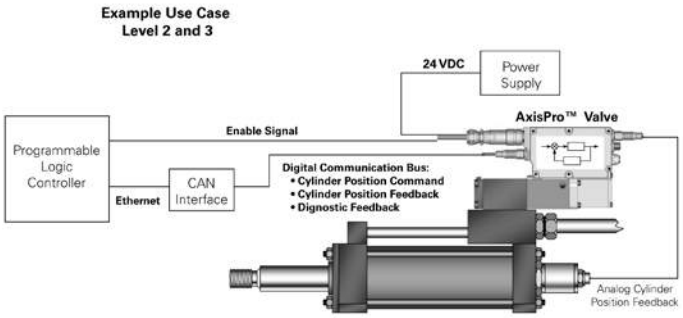
Mounting Surfaces 22

Application Data 23

AxisPro is a game changing machine control valve. Its embedded intelligence simplifies traditionally complex control practices. Plug and play design reduces machine build time, and its ability to predict potential maintenance issues increases machine reliability.



AxisPro level 1 valves,such as KBS1-3 (ISO size 3),can be used to control machine motions in open loop or closed loop control applications.The valve receives its analog command input on the 7-pin,main,connector from an external axis control device.



AxisPro level 2 or level 3 valves, such as KBS2-3(or KBS3-3 with sensors),can be used to control machine motion in open or closed loop control applications.The valve can receive its analog command input on the 7-pin connector from an external axis control device or,with the available on-board motion control feature activated (via Eaton Pro-FX Configure), can close the external control loop around the actuator on the valve (taking feedback signal from cylinder or motor) – eliminating the separate motion controller.In this case the AxisPro valve receives a position,speed or force command and will create its own valve command needed to comply with the requested machine motion.In addition,digital communications over the CANopen bus is available for machine control or monitoring purposes.

Introduction

General Description

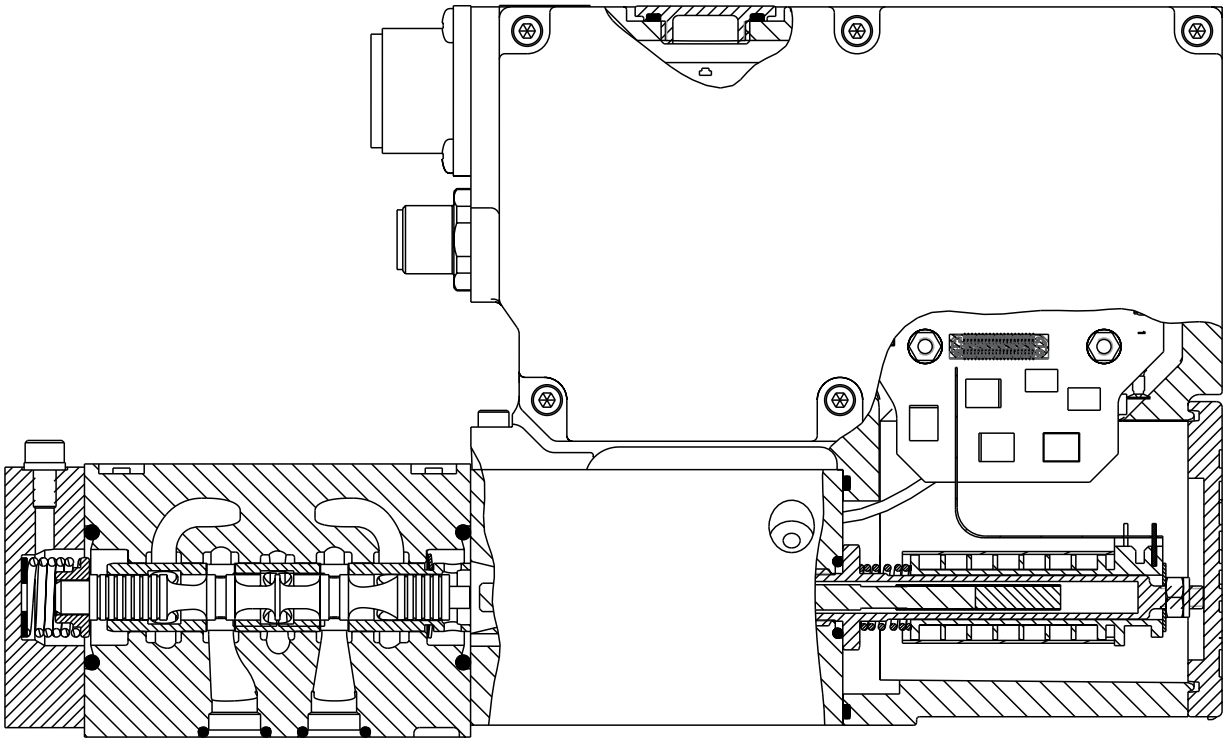
Built on the proven KBS servo Proportional Valve technology, Eaton' s new AxisPro™ Proportional Valve provides a range of controls capability in a modular design. These four-way solenoid operated proportional valves offer high dynamic performance which enables them to be used in closed-loop control applications previously only possible using servo valves. Best-in-class ingression protection rated to IP65 and IP 67, combined with up to 85C (185F) ambient temperature allows operation in demanding environments.

Unique benefits from AxisPro

Reliable, extended uptime is enabled by valve and systems diagnostics capability. LED lens provides on-valve diagnostics information for level-1, 2 and 3 valves. Access to systems and machine health data can be made available via CANopen networked valves and systems data collected from external sensors input to level-2 valves, or from integrated sensors on level-3 valves featuring pressure sensors in A, B, P and T ports along with temperature data sensed from the T-port.

Leverage inventory of AxisPro valves by configuration through software. One valve SKU can serve multiple needs: Level-1 valves can be configured via Eaton's Pro-FX™ Configure software tool for optional command signal: Voltage or current, as well as activating the "enable"-pin. Level-2 and 3 valves can also have CAN bus activated and control modes selected and configured: VSC for valve-spool control, or for axis-control drive modes: DPC Cylinder position control, DSC Speed control, DFP Force/Pressure control, DPQ Pressure/Flow control. User applications can be developed in Eaton's Pro-FX Control software tool, which is based on the popular CODESYS development environment. This feature is available option on level-2 and 3 valves allowing the use of pre-developed motion control blocks from Eaton's Pro-FX Control library or custom developed solutions that can be loaded into a "white space" reserved in the on-board controller memory.

Typical Section View



KBS1-3

Model Code

KBS1 - 3 - ** - NS - ** - * - NS - 001 - 10

1 2 3 4 5 6 7 8 13 14 15

1 **Valve Type**

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

2 **Control Level**

Level 1

3 **Interface**

3 – ISO 4401, size 03-02-0-94 ANSI/B93.7M-D03

4 **Spool/Sleeve**

1 – Symmetric -40ℓ/min - At Failsafe -all ports blocked (legacy 92L40)
2 – Symmetric -24ℓ/min - At Failsafe -all ports blocked (legacy 92L24)
3 – Symmetric -12ℓ/min - At Failsafe -all ports blocked (legacy 92L12)
4 – Symmetric -05ℓ/min - At Failsafe -all ports blocked (legacy 92L05)
5 – Symmetric -40ℓ/min - At Failsafe -P port blocked, A,B,T connected (legacy 96L40)
6 – Symmetric -24ℓ/min - At Failsafe -P port blocked, A,B,T connected (legacy 96L24)
7 – Symmetric -12ℓ/min - At Failsafe -P port blocked, A,B,T connected (legacy 96L12)
8 – Symmetric -05ℓ/min - At Failsafe -P port blocked, A,B,T connected (legacy 96L05)
9 – Symmetric -40ℓ/min - At Failsafe reduced flow A connected to T and B connected to P(legacy 94L40)
13 – Symmetric -40ℓ/min – reduced pressure at null - At Failsafe -P port blocked, A,B,T connected (legacy 86L40)
17 – Asymmetric -40ℓ/min A; 20ℓ/min B - At Failsafe -all ports blocked (legacy 92L40N20)
18 – Asymmetric -40ℓ/min A; 10ℓ/min B - At Failsafe -all ports blocked (legacy 92L40N10)
19 – Asymmetric -24ℓ/min A; 12ℓ/min B - At Failsafe -all ports blocked (legacy 92L24N12)
20 – Asymmetric -40ℓ/min A; 20ℓ/min B - At Failsafe -P port blocked, A,B,T connected (legacy 96L40N20)
21 – Asymmetric -40ℓ/min A; 10ℓ/min B - At Failsafe -P port blocked, A,B,T connected (legacy 96L40N10)
22 – Asymmetric -24ℓ/min A; 12ℓ/min B - At Failsafe -P port blocked, A,B,T connected (legacy 96L24N12)
23 – 2-gain Symmetric – 4ℓ/min @ 40% - 40ℓ/min @100% - At Failsafe -all ports blocked (legacy 92L04T40)
24 – 2-gain Symmetric – 2.4ℓ/min @ 60% -24ℓ/min @100% - At Failsafe -all ports blocked (legacy 92L02T24)
25 – 2-gain Symmetric – 1.5ℓ/min @ 60% -15ℓ/min @100% - At Failsafe -all ports blocked (legacy 92L01T15)
26 – 2-gain Symmetric – 4.0ℓ/min @ 40% -40ℓ/min @100% - @Failsafe -P port blocked, A,B,T connected (legacy 96L04T40)
27 – 2-gain Symmetric – 2.4ℓ/min @ 60% -24ℓ/min @100% - @Failsafe -P port blocked, A,B,T connected (legacy 96L02T24)
28 – 2-gain Symmetric – 1.5ℓ/min @ 60% -15ℓ/min @100% - @Failsafe -P port blocked, A,B,T connected (legacy 96L01T15)
29 – 2-gain Symmetric – 2.4ℓ/min @ 40% -24ℓ/min @100% - @Failsafe -P port blocked, A,B,T connected
30 – 2-gain Symmetric – 1.5ℓ/min @ 40% -15ℓ/min @100% - @Failsafe -P port blocked, A,B,T connected

5 **Valve Special Feature**

NS – Not Selected

6 **Command Signal**

1 – +/- 10V voltage command signal
2 – +/- 4-20mA current command signal
3 – +/- 10mA current command signal
4 – +/- 15mA current command signal
5 – +/- 20mA current command signal

7 **Monitor Output**

1 – ±10V voltage feedback signal
2 – 4-20mA current feedback signal

8 **Electrical Connection**

C – 7 pin connector without plug
E – 7 pin connector with plug
H – As E but with pin "C" used for enable signal
R – As C but with pin "C" used for enable signal

13 **Electrical Special Feature**

NS – Not Selected

14 **Software Revision**

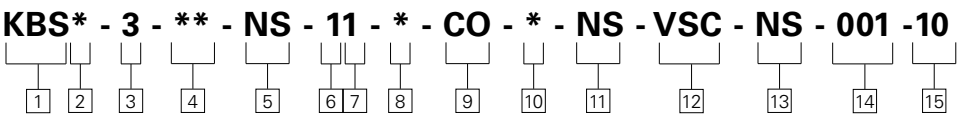
XXX – Software Revision

15 **Design Number**

10 series

To find available product configurations go to www.eaton.com/AxisPro

Model Code



2 **Control Level**

2 – Level 1 plus Network enabled and DS408 control modes

3 – Level 2 plus Integrated pressure and temperature sensors

6 **Command Signal**

1 – +/- 10V voltage command signal

Note: Command signal is shipped with 1 configuration. You may configure to other command signal options using Pro-FX: Configure software.

2 – 4-20mA current command signal

3 – +/- 10mA current command signal

4 – +/- 15mA current command signal

9 – Command over Fieldbus

7 **Monitor Output**

1 – ±10V voltage feedback signal

Note: Monitor Output is shipped with 1 setting. You may configure to other monitor signal options using Pro-FX: Configure software.

2 – 4-20mA current feedback signal

9 – Feedback over Fieldbus

8 **Electrical Connection**

C – 7 pin connector without plug

E – 7 pin connector with plug

Note: You may reconfigure pin "C" as the enable signal using Pro-FX configure software.

9 **Digital Communication Interface**

CO – CANOpen

10 **External Sensor**

A – 4 4-20mA external sensor analog inputs and 2 discrete inputs

D – 1 SSI external digital sensor input

11 **Customer Application Programming Space**

NS – Not Selected

CW – CODESYS White Space

12 **Control Mode**

VSC - Valve spool position control

Note: Control Mode is shipped in valve spool closed loop position control (VSC) configuration. You may reconfigure to other control mode options using Pro-FX: Configure software.

DPC - DS408 Drive Position Control Mode Enabled

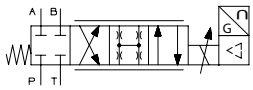
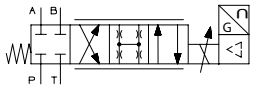
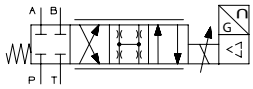
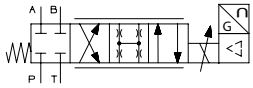
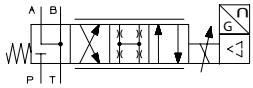
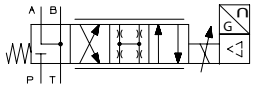
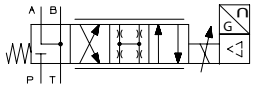
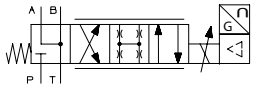
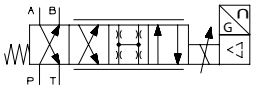
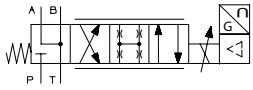
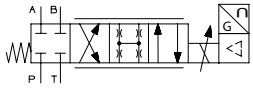
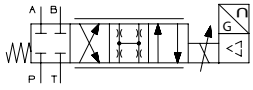
DSC – DS408 Drive Speed Control Mode Enabled

DFP – DS408 Drive Force/Pressure Control Mode Enabled

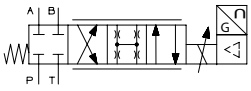
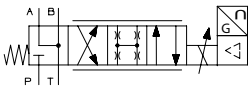
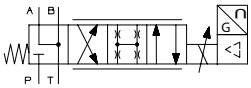
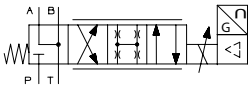
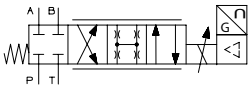
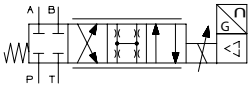
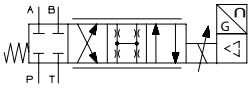
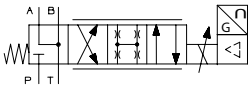
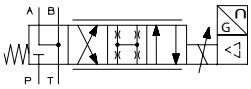
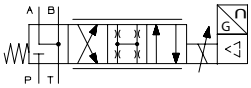
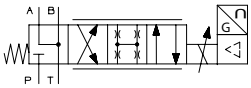
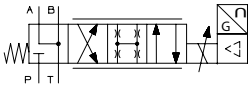
DPQ – Eaton Custom Drive Pressure / Flow Control Mode Enabled

To find available product configurations go to www.eaton.com/AxisPro

Spool Sleeve Details

Spool/Sleeve #	Symbol	Failsafe behavior	Flow ℓ/min@ Δ70 bar	Symmetric	Asymmetric	Single gain	Dual gain	Notes
1		All Ports blocked	40	√		√		
2		All Ports blocked	24	√		√		
3		All Ports blocked	12	√		√		
4		All Ports blocked	5	√		√		
5		P - Blocked A,B,T connected	40	√		√		
6		P - Blocked A,B,T connected	24	√		√		
7		P - Blocked A,B,T connected	12	√		√		
8		P - Blocked A,B,T connected	5	√		√		
9		Reduced flow, A Conncted to T B connected to P	40	√		√		
13		P - Blocked A,B,T connected	40	√		√		Reduced pressure at null
17		All Ports blocked	40/20		√	√		
18		All Ports blocked	40/10		√	√		

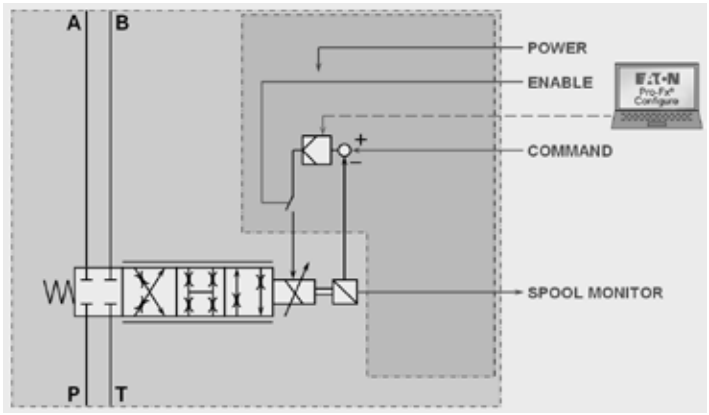
Spool Sleeve Details

Spool/Sleeve #	Symbol	Failsafe behavior	Flow ℓ/min@ Δ70 bar	Symmetric	Asymmetric	Single gain	Dual gain	Notes
19		All Ports blocked	24/12		√	√		
20		P - Blocked A,B,T connected	40/20		√	√		
21		P - Blocked A,B,T connected	40/10		√	√		
22		P - Blocked A,B,T connected	24/12		√	√		
23		All Ports blocked 40 @ 100%	4 @ 40%	√			√	
24		All Ports blocked 24 @ 100%	2.4 @ 60%	√			√	
25		All Ports blocked 15 @ 100%	1.5 @ 60%	√			√	
26		P - Blocked A,B,T connected	4 @ 40% 40 @ 100%	√			√	
27		P - Blocked A,B,T connected	2.4 @ 60% 24 @ 100%	√			√	
28		P - Blocked A,B,T connected	1.5 @ 60% 15 @ 100%	√			√	
29		P - Blocked A,B,T connected	2.4 @ 40% 24 @ 100%	√			√	
30		P - Blocked A,B,T connected	1.5 @ 40% 15 @ 100%	√			√	

Spool Data
Spool Symbols

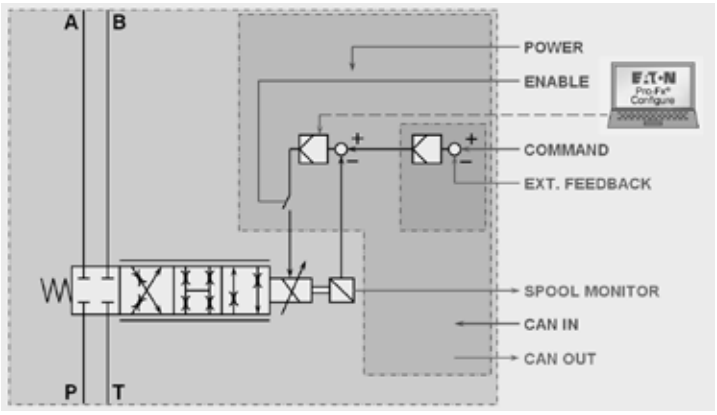
Functional Symbol

Model Type KBS1-3



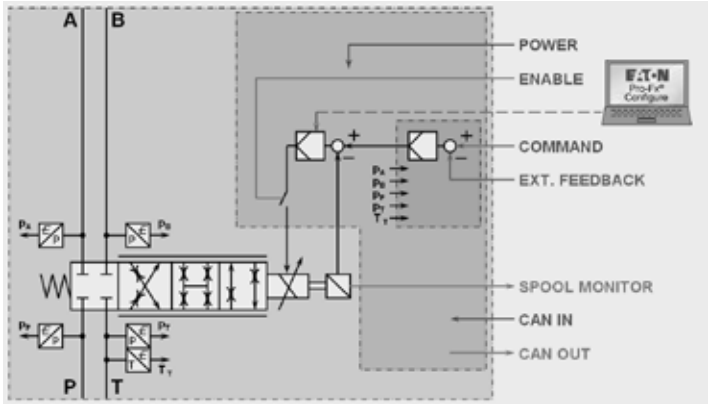
Centralized motion control, relying on external motion controller, not shown in the diagram

Model Type KBS2-3 w/Field 11 = NS



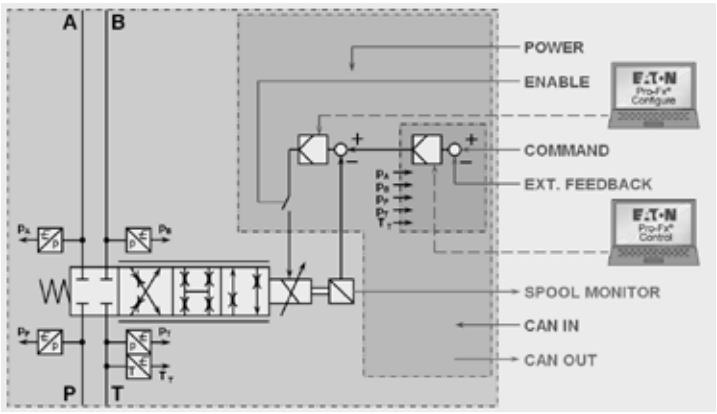
Distributed motion control, taking advantage of the available axis-control function embedded in the valve controller for AxisPro level 2 and 3.Command can be analog via the 7-pin connector or via CANopen using the M12 connections illustrated on page 12.

Model Type KBS3-3 w Field 11 = NS



Level 3 valve integrated pressure sensors can be used for machine health monitoring with data broadcast over the CANopen bus or employed for pressure control in addition to the external motion control illustrated for the level 2 valve.

Model Type KBS3-3 w/Field 11 = CW



Selecting the CW-option allows user specific applications to be developed in Eaton's Pro-FX Control software tool, which is based on the popular CODESYS development environment.

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.

Pressures and Flow Rates

Operating Pressure:
bar (psi)

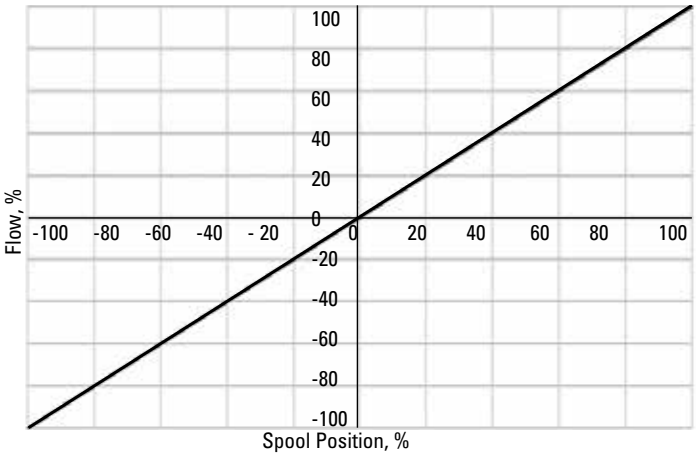
Ports

P,A,B : 350 (5075)
T : 250 (3625)

Spool/Sleeve Combinations
Functional Representation

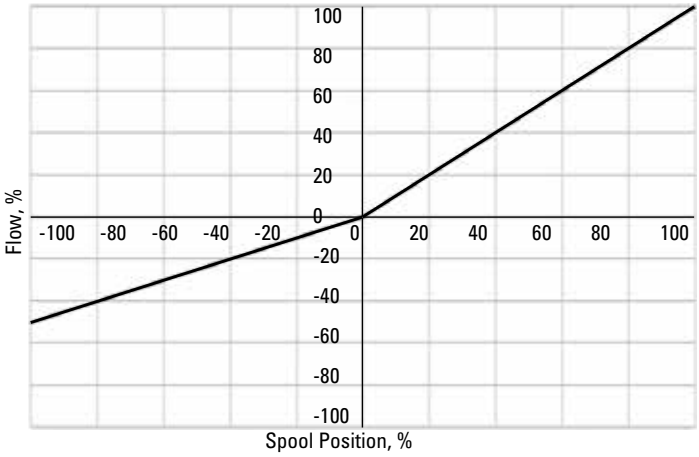
Spool/Sleeve#: 1, 2,3,4,5,6,7,8,9,13

Symmetric



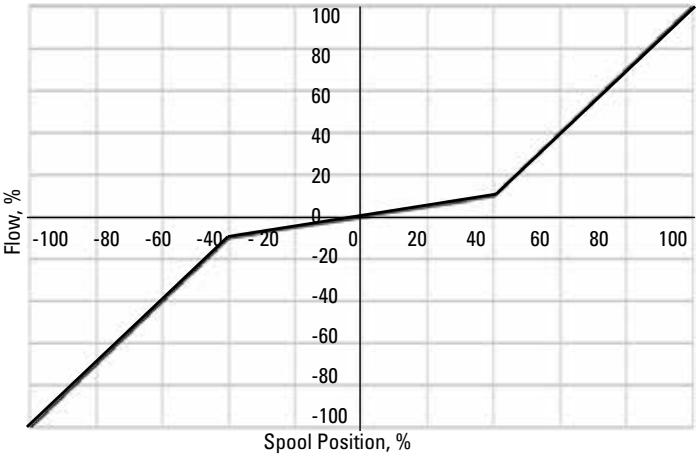
Spool/Sleeve#: 17,18,19,20,21,22

2:1 Asymmetric



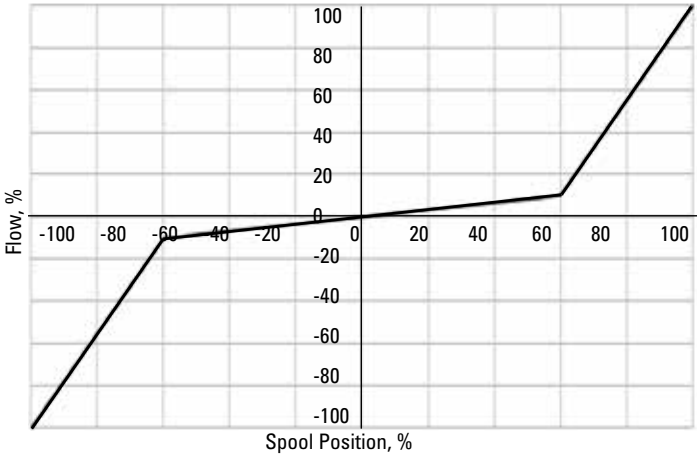
Spool/Sleeve#: 23,24, 26,29,30

Kink at 40%



Spool/Sleeve#: 25,27,28

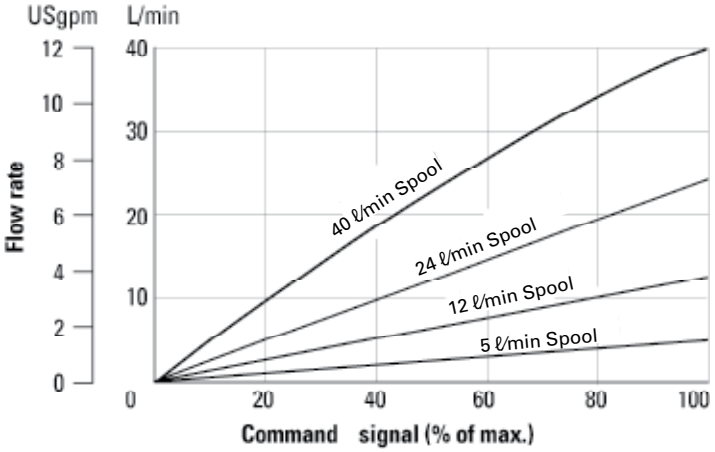
Kink at 60%



Performance Curves

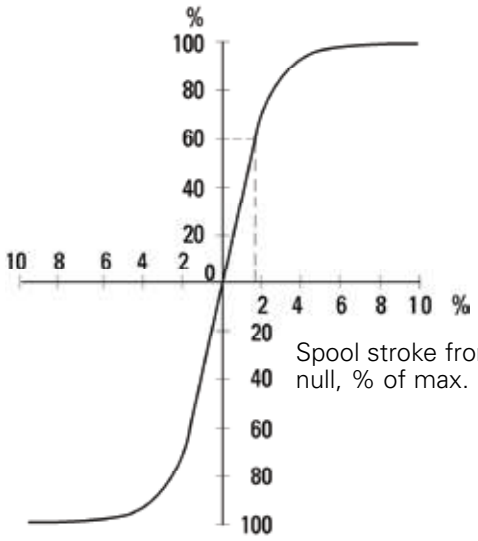
Flow Gain

Flow from port P-A-B-T or P-B-A-T at 70 bar (1000 psi) total valve Δp, 35 bar (500 psi) per metering edge



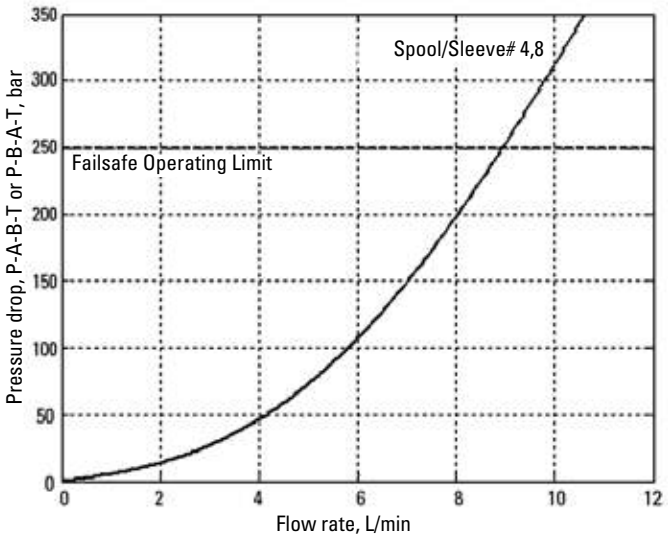
Pressure Gain

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

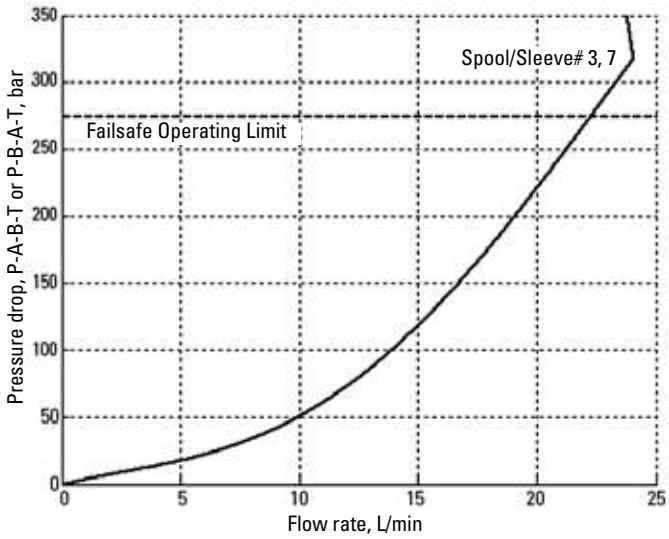


Power Capacity Envelopes

5 ℓ/min

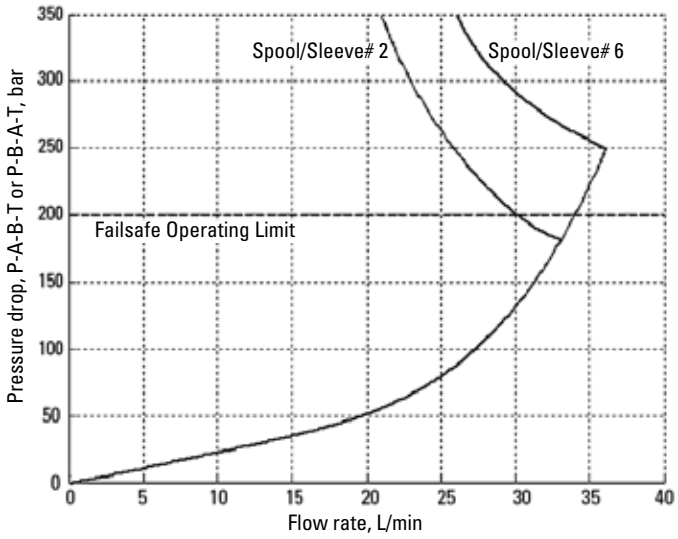


12 ℓ/min

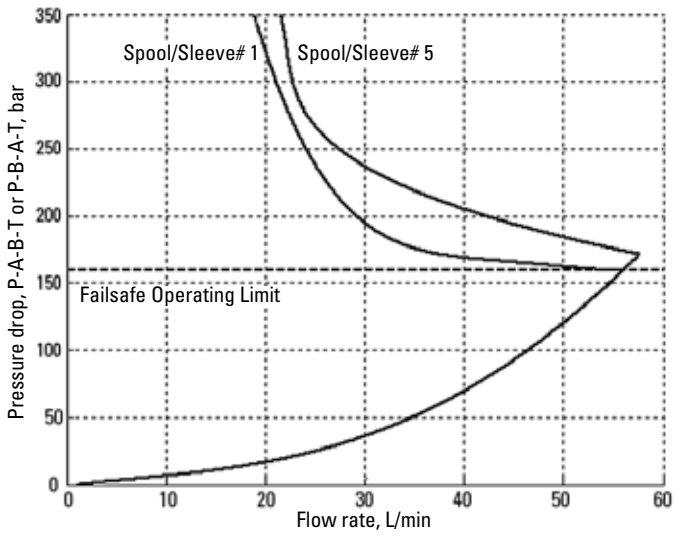


Performance Curves

24 ℓ/min

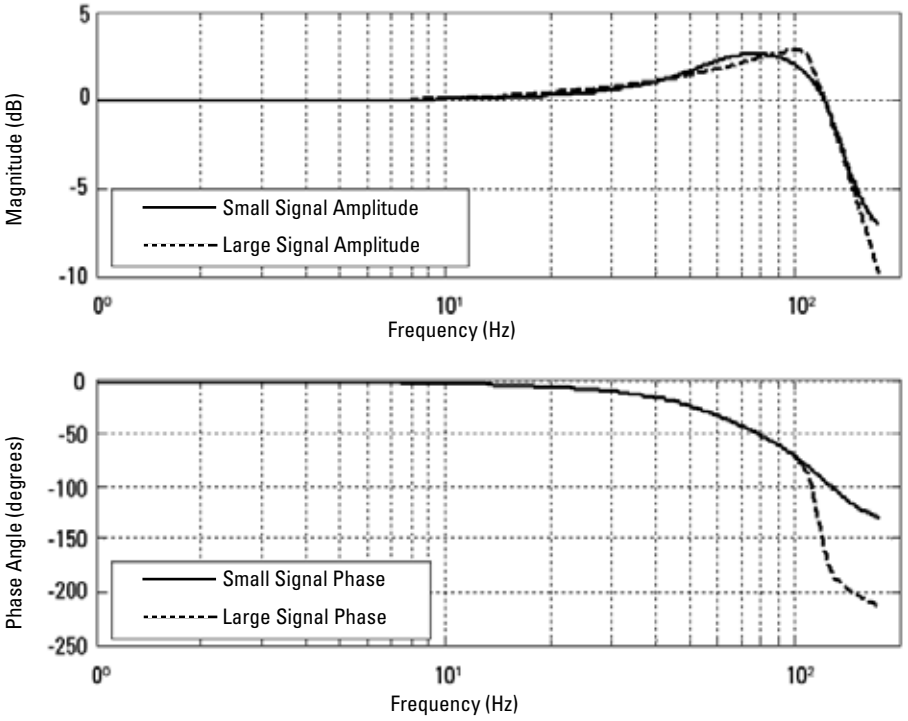


40 ℓ/min



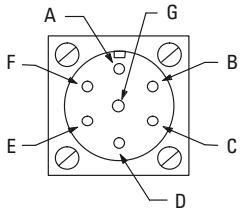
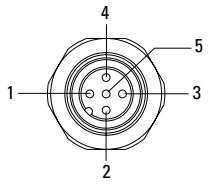
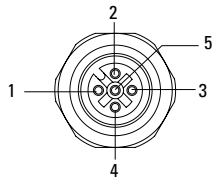
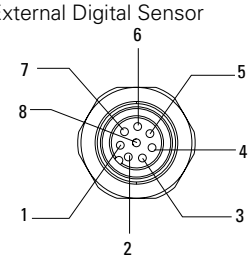
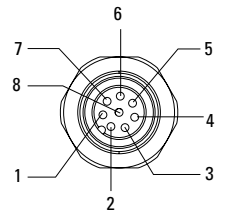
Operating Limit: When operating the valve beyond the operating pressure limit,spool may not return to failsafe when power is removed

Frequency Response, typical
For amplitudes of +/- 5% with zero offset, +/- 25% with +/- 50% offsets.
Δp (P to T) = 70 bar (1000 psi)



Operating Data

Connector Details

7-pin plug connector 	Pin A B C C D E F G	Description Power supply positive (+) Power supply 0V and current command return Not connected (Field 8 = C,E) Valve enable (Field 8 = H,R) Command signal (+V or current in) Command signal (-V or current GND) Output monitor Protective earth	Note: Present at location 1 of the electronics enclosure (see figure 1 below). To ensure EMI protection use only metal shielded mating connectors. Mating 7-pin (connector) is Eaton part number 934939
M12 5-pin CAN Connector (Male) 	Pin 1 2 3 4 5	Description CAN shield Not Connected Power supply 0V CAN High CAN Low	Note: Present at location 2 and 4 of the electronics enclosure (see figure 1 below). Selection based on model code field number 9, present when CO option enabled. To ensure EMI protection use only metal shielded mating connectors Use only shielded twisted pair (STP) cables for mating connection.
M12 5-pin CAN Connector (Female) 	Pin 1 2 3 4 5	Description CAN shield Not Connected Power supply 0V CAN High CAN Low	Note: Present at location 5 of the electronics enclosure (see figure 1 below). Selection based on model code field number 9, present when CO option enabled. To ensure EMI protection use only metal shielded mating connectors Use only shielded twisted pair (STP) cables for mating connection.
M12 8-pin External Digital Sensor 	Pin 1 2 3 4 5 6 7 8	Description Power supply 0V +24V Supply CLK- DATA- DATA+ Not Connected CLK+ Not Connected	Note: Present at location 3 of the electronics enclosure (see figure 1 below). Selection based on model code field number 10, present when D option enabled. To ensure EMI protection use only metal shielded mating connectors 24V to Power supply 0V (pin 2, 1) short circuit protected (max current 1.5 A). Use only shielded twisted pair (STP) cables for mating connection.
M12 8-pin External Analog Sensor Port 	Pin 1 2 3 4 5 6 7 8	Description Speed Sensor Input1 Speed Sensor Input2 4-20mA External Sensor Signal1 +15V Supply 4-20mA External Sensor Signal2 Power supply 0V 4-20mA External Sensor Signal3 4-20mA External Sensor Signal4	Note: Present at location 3 of the electronics enclosure (see figure 1 below). Selection based on model code field number 10, present when A option enabled. To ensure EMI protection use only metal shielded mating connectors 15V to Power supply 0V (pin 4, 6) short circuit protected (max current 500 mA).

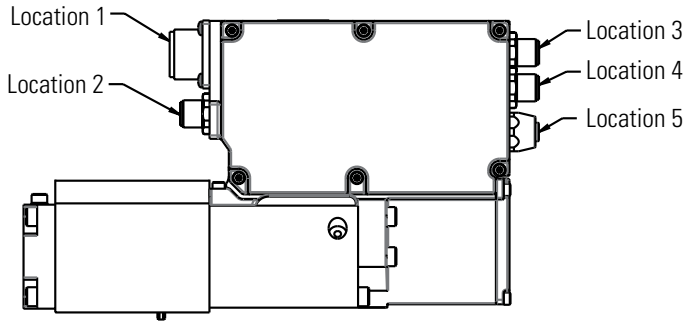
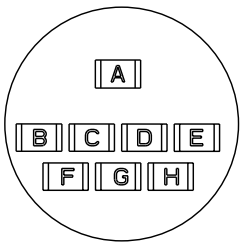


Figure 1

Note: See above for connector plugs specifications.

Operating Data

Data is typical, with fluid at 32 cST (150 SUS) and 40°C (104°F)

Diagnostic		Color A [Green] B [Red] C [Green] D [Red] E [Green]	Description Power CAN Error CAN Run Diagnostic Status
		Note: 1. Figure to the left references the clear plastic window on the top of the valve. 2. LED F will glow as part of general operation.	
Electromagnetic compatibility (EMC):		IEC61326-2-1	
Monitor Points Signal: Voltage mode Current mode Output impedance		 ±10V DC 4 to 20 mA 10 kΩ	
Power stage PWM frequency		20 kHz nominal	
Reproducibility, valve-to-valve (at factory settings): Flow gain at 100% command signal		 ≤5%	
Protection: Electrical		 Reverse polarity protected between pin A and B of the 7 pin plug connector	
Ambient air temperature range for full performance Oil temperature range for full performance		–25°C to +85°C (–13°F to +185°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)	
Power supply		24V DC (18V to 36V including 10% peak-to-peak max ripple) max current 3,7A	
Command Signal: Voltage mode Input impedance Voltage between Pin D and B Voltage between Pin E and B Current mode Max differential voltage to pin E to pin B		 –10V to +10V DC 13 bit resolution, ± 1% Field 6 = 1: 47kΩ, Field 6 = 2,3,4,5: 100Ω Field 6 = 1:18v (max) Field 6 = 1:18v (max) Field 6 = 2,3,4,5: 13 bit resolution based on ±20mA, ±1% Field 6 = 2,3,4,5: 100 mV	
Valve enable signal for model code field 8 = H or R Enable Disable Input impedance		 Disable <6.5V Enable Signal >8.5V (max 36V) 10 kΩ	
Sensor Resolution: External Sensor Port		 4-20 mA: 0-20mA 12 bit resolution ± 1%, 3mA cable break detect, 22mA overcurrent detect. Speed, independent frequency mode: 10Hz to 100 kHz. Speed, incremental count and direction + frequency mode: signed 32bit count, 0 to 100 kHz. Speed, quadrature phase A&B + frequency mode: signed 32 bit count, 0 to 100 kHz. SSI: binary or gray code, 32bits max, adjustable resolution and zero offset.	
Integrated Pressure and Temperature Sensors		Integrated PCB temperature sensor accuracy: ± 2°C For Level 3 valves: Integrated Pressure sensors on all ports Pressure sensors rated to 400bar Integrated Pressure sensors accuracy: ± 0.5% of full scale Bandwidth: >100 Hz Integrated temperature sensor on tank port Accuracy: ± 5°C Bandwidth: ~1 Hz	
Amplifier Temperature Sensing		1°C (1.8°F) resolution, -25°C (-13°F) undertemp detect, 125°C (257°F) overtemp detect	
Power Supply Detect		18-36Vdc, 0.01 V resolution ± 1%, 19V under voltage detect, 36V overvoltage	

Operating Data

KBS*-3 Valves (all valves)	
Relative duty factor	Continuous rating (ED = 100%)
Hysteresis	<0.1%
Mass	2.49 kg (5.5 lb) approx.
Environmental	IP65 and IP67 rated when using a similarly rated connector Location 2, 3, 4 and 5 connectors have IP65 and IP67 rated shipping covers
Step response:	
Step, % Flow	ms
0% to 100%, 100% to 0%	8.0
10% to 90%, 90% to 10%	8.0
-10% to 10%, 10% to -10%	7.0
25% to 75%, 75% to 25%	7.0
Parts Information:	
Interface Seal Kits	02-147573
Mating Electrical 7-pin Connector	934939

Software Information

KBS1

- Analog commanded spool control.
- Analog command source configuration options.
- Monitor output signal configuration options.
- Enable input signal enable/disable option.

KBS2/KBS3

- KBS1capability.
- Sensor port configuration options. Configurable position, Speed, Pressure, Force and SSI Sensors.
- CANopen DS408 compliant control modes (device options vary per available hardware options).
  - valve spool position control (VPOC/VSC).
  - drive speed control (DSC).
  - drive force/pressure control (DFPC/DFP).
  - drive position control (DPC).
  - drive pressure/flow control (Eaton DPQ).
- CANopen DSP306 compliant electronic data sheet (EDS).
- Diagnostic configuration options.

All levels and models are compatible with the Eaton Pro-FX:
For the latest revision, please visit www.eaton.com/AxisPro

Download Pro-Fx™, Technical Information and Support Materials from Eaton's Website:

http://www.eaton.com/AxisPro

Install the Eaton Pro-Fx™ Configure PC application tool. Installation is supported on a wide range of Windows based operating systems including Windows 7 32 bit and 64 bit.

The Pro-Fx™ configure installation provides several options for PC USB peripheral CANbus adapters supported by the software. During installation the user can choose to install drivers for an available CANbus adapter.

The adapters supported by Pro-Fx™: Configure are:

- PCAN-USB* PEAK-System Technik GmbH (http://www.peak-system.com)
- ValueCAN Intrepid Control Systems, Inc. (http://www.intrepidcs.com)
- Leaf-Light Kvaser AB (http://www.kvaser.com)

* The PCAN-USB adapter is recommended for compatibility with Eaton Pro-Fx: Control development environment used with KBS4DGV-xxx and other Eaton Pro-Fx products.

Block Diagram Voltage Input (Field 6 = 1)

Wiring connections must be made via the 7-pin plug mounted on the amplifier. See page 18 of this leaflet and Eaton's Installation Wiring Practices for Vickers™ Electronic Products, leaflet 2468. Recommended cable sizes are:

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:

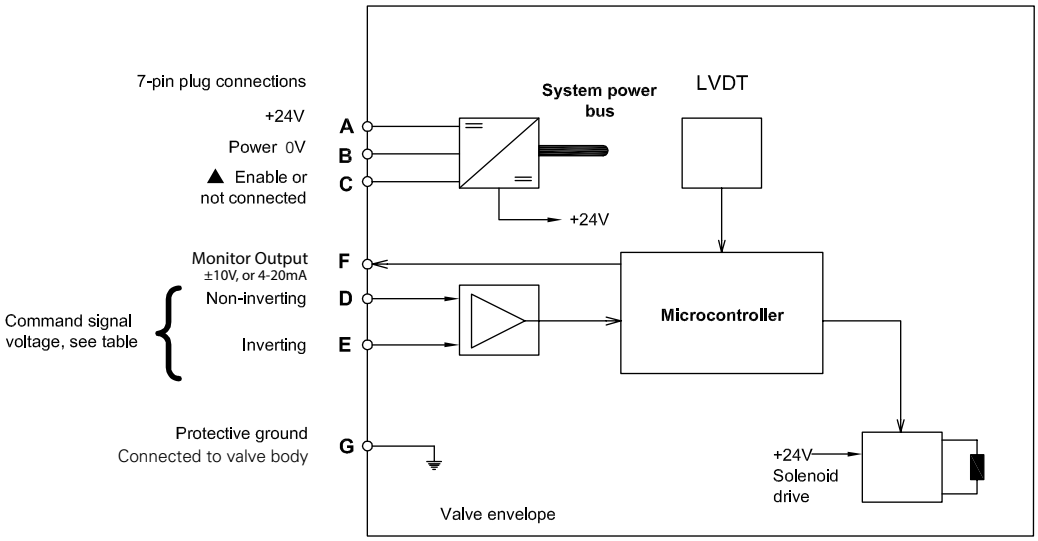
0.50 mm² (20 AWG)

Screen (shield):

A suitable cable would have 7 cores, a separate screen for the signal wires and an overall screen.

Cable outside diameter 8.0 - 10.5 mm (0.31 - 0.41inches)

See connection diagram on page 18.



▲ Pin C is used for a valve enable signal with electrical connections Field 8 = H or R.

Command Signals and Outputs, Field 6 = 1

7-pin plug		Flow direction
Pin D	**Pin E**	
Positive OV $U_D - U_E$ = Positive	OV Negative	P to A
Negative OV $U_D - U_E$ = Negative	OV Positive	P to B

Warning

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

Block Diagram Current Input (Field 6 = 2, 3, 4,5)

Wiring connections must be made via the 7-pin plug mounted on the amplifier. See page 19 of this leaflet and Eaton's Installation Wiring Practices for Vickers™ Electronic Products, leaflet 2468. Recommended cable sizes are:

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:

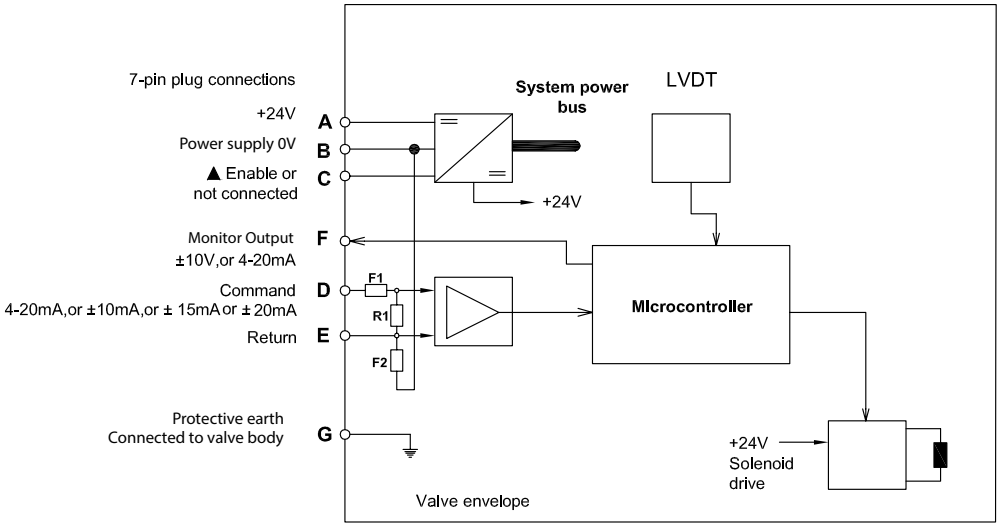
0.50 mm² (20 AWG)

Screen (shield):

A suitable cable would have 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 page 19.



▲ Pin C is used for a valve enable signal with electrical connections Field = H or R

R1 shunt resistor 100R
F1, F2 resettable fuse

Command Signals and Outputs, Field 6 = 2

7-pin plug			
Pin D	**Pin E**	**Pin B**	**Flow direction**
More than 12 mA	Current return	Power ground	P to A
Less than 12 mA	Current return	Power ground	P to B

Command Signals and Outputs, Field 6 = 3,4,5

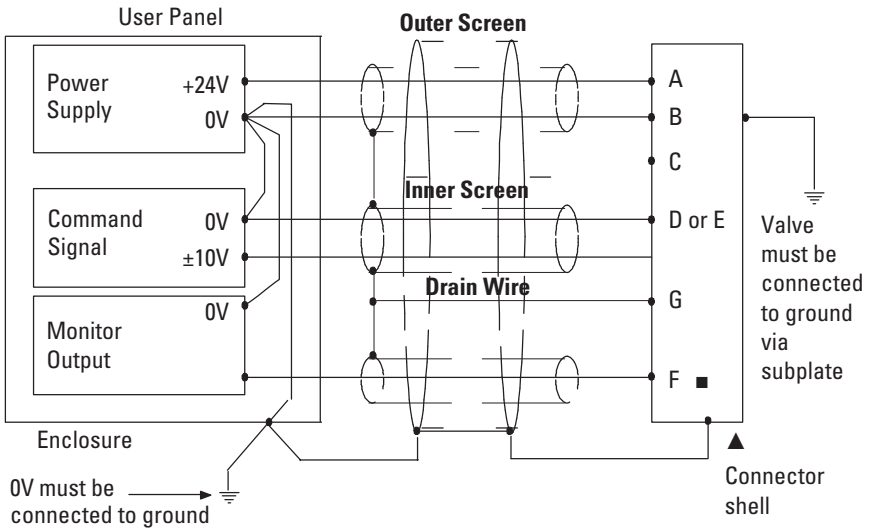
7-pin plug			
Pin D	**Pin E**	**Pin B**	**Flow direction**
More than 0 mA	Current return	Power ground	P to A
Less than 0 mA	Current return	Power ground	P to B

Warning

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

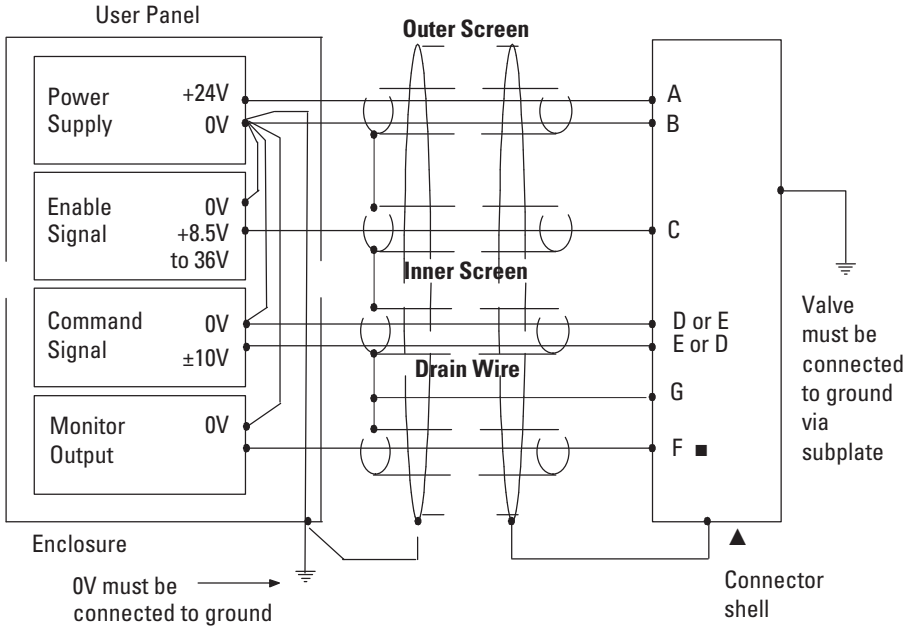
Wiring Connections Voltage Input (Field 6 = 1)

■ Spool position monitor voltage (pin F) will be referenced to the KB valve local ground (pin B).



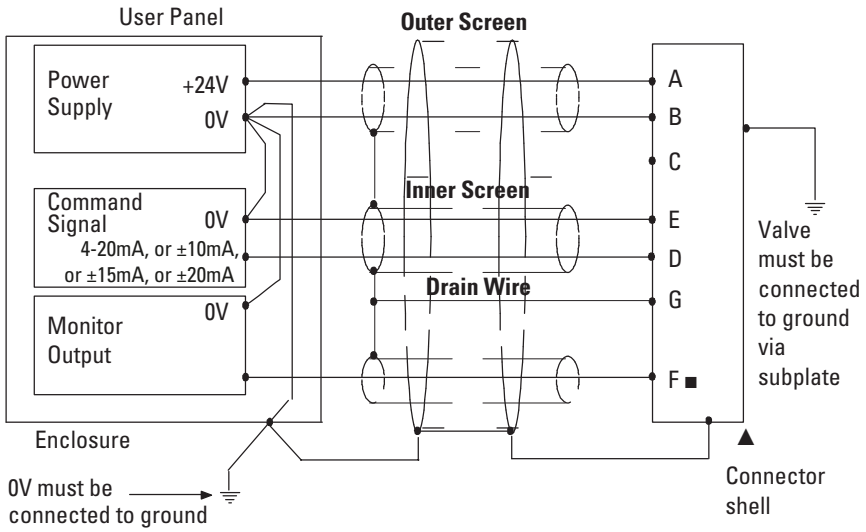
Wiring Connections for Voltage Mode (Field 6 = 1) Valves with Enable Feature

▲ 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.



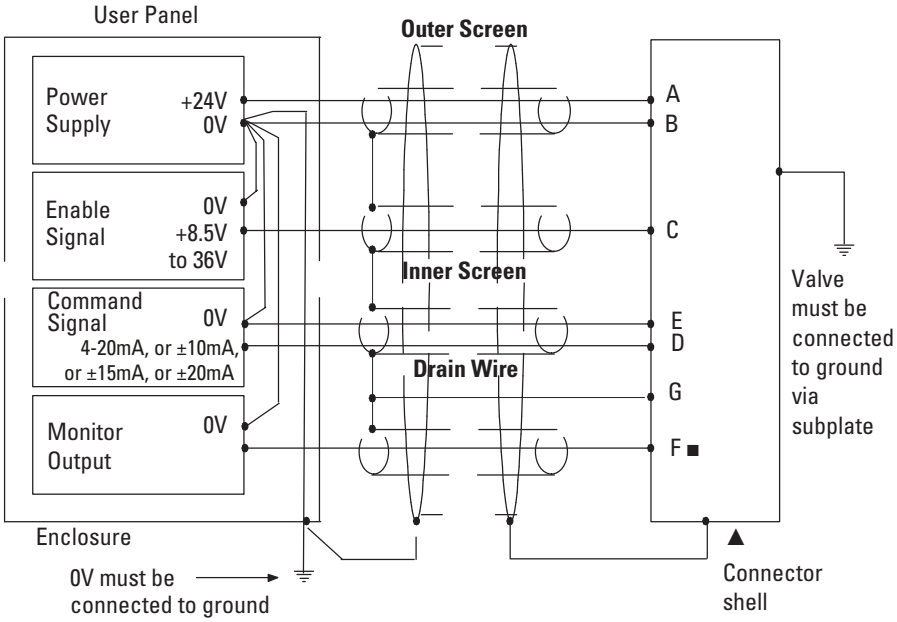
Wiring Connections Current Input (Field 6 = 2, 3, 4, 5)

■ Spool position monitor voltage (pin F) will be referenced to the KB valve local ground (pin B).



Wiring Connections for Current Input (Field 6 = 2, 3, 4, 5) 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 of 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.

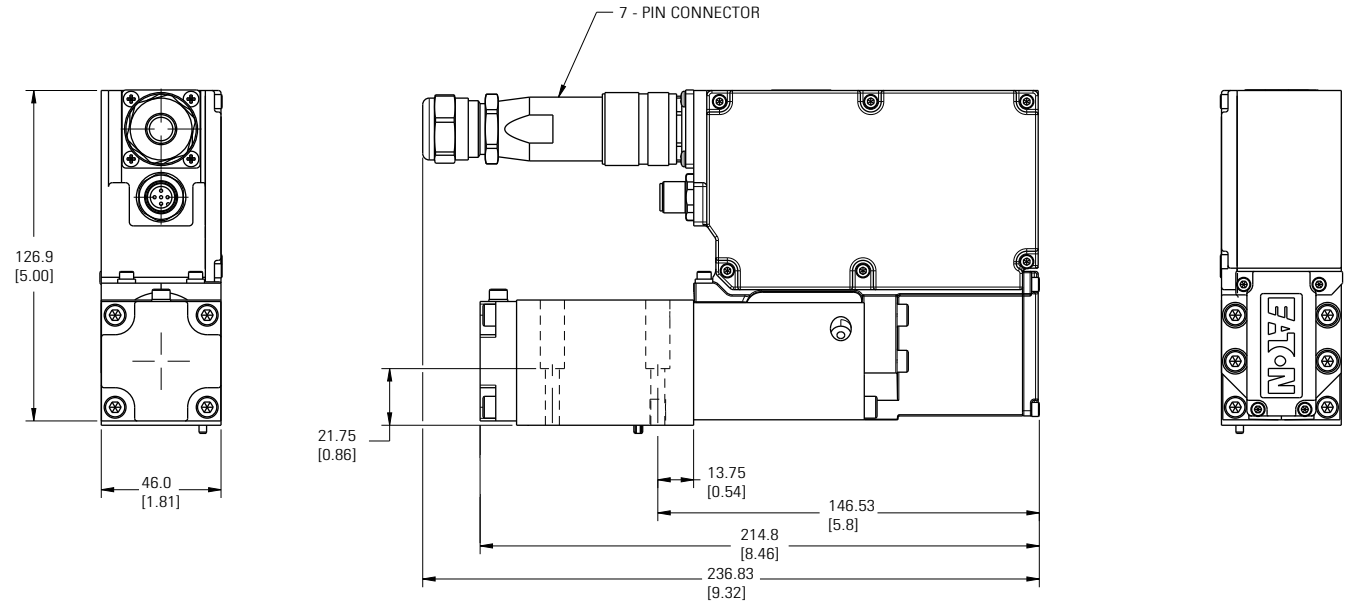
The enable line to pin C should be outside the screen which contains the demand signal cables.

To ensure EMI protection use only metal shielded mating connectors.

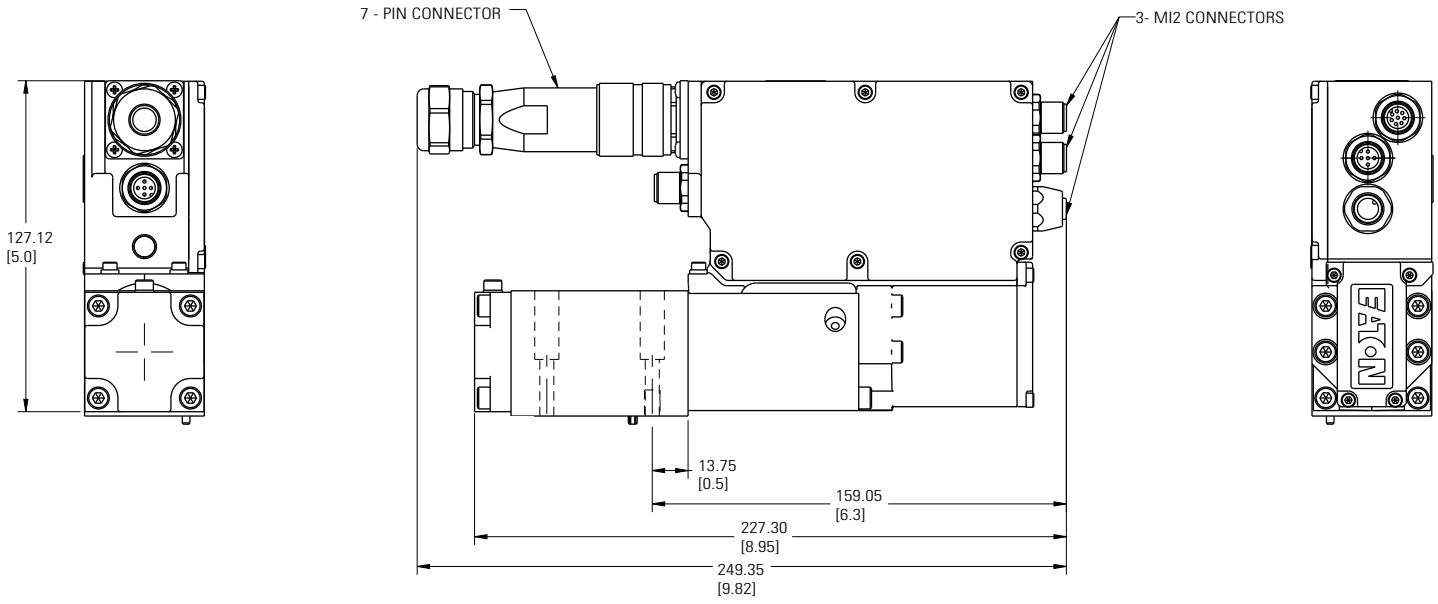
Installation Dimensions

mm (inch)

KBS1-3

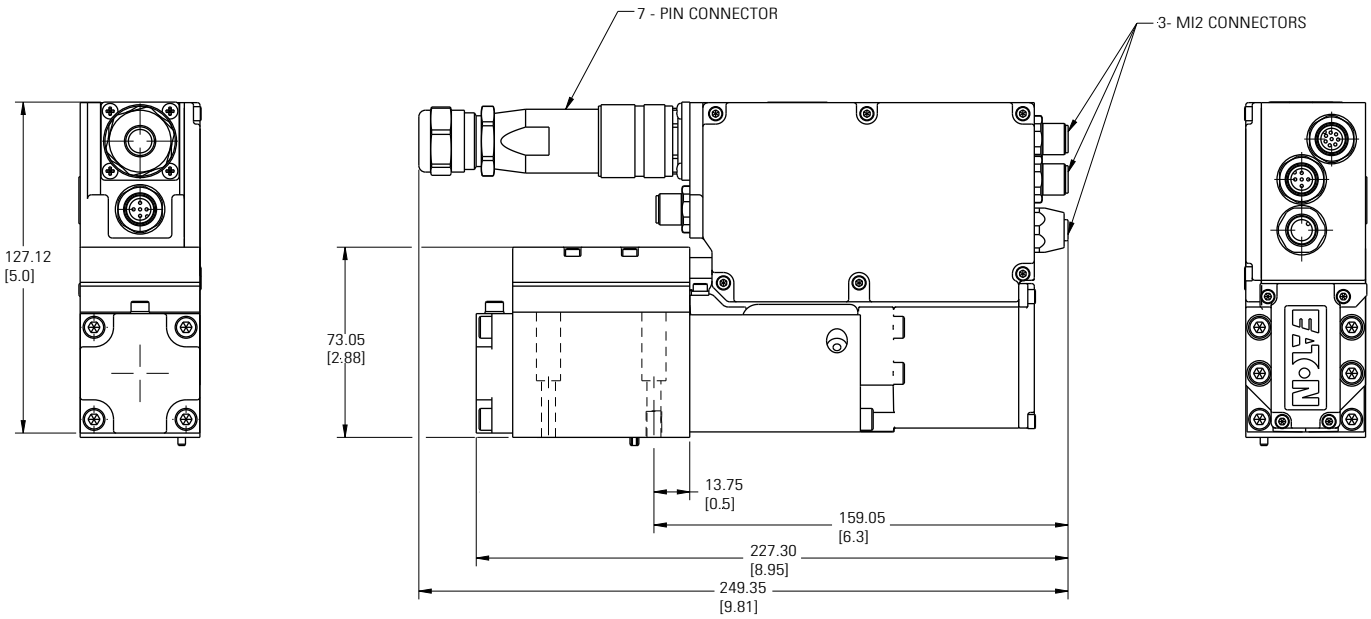


KBS2-3



Installation Dimensions
mm (inch)

KBS3-3



Mounting Surfaces

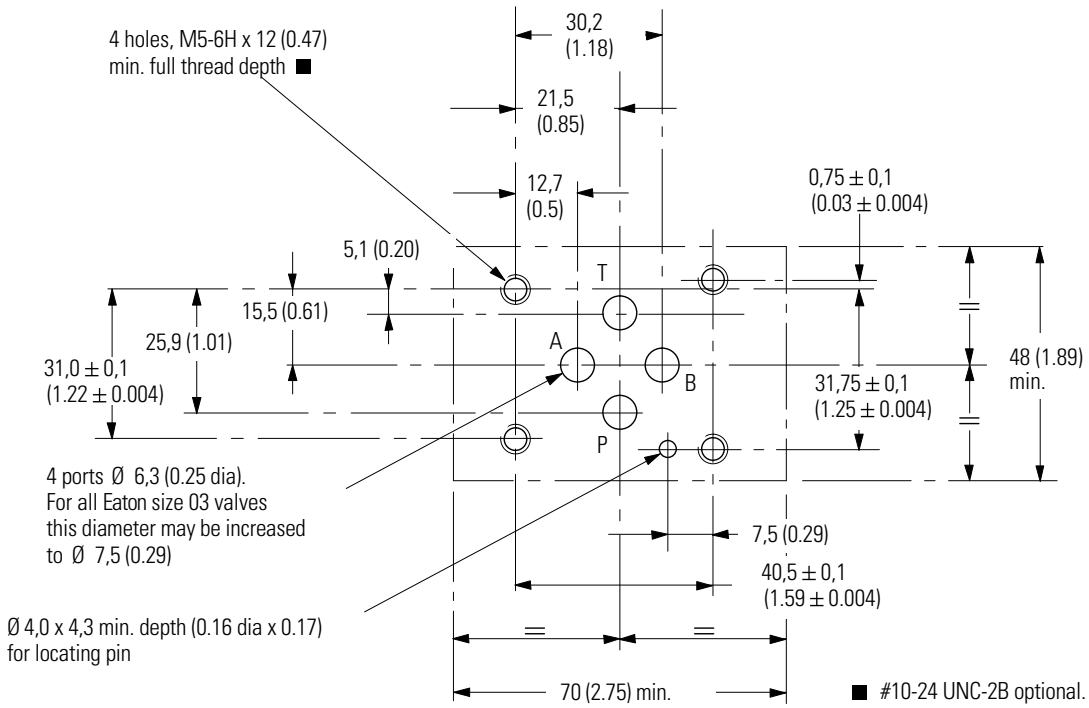
Mounting Surfaces to ISO 4401 (Size 03)

This interface conforms to:
ISO 4401-03-02-0-94
plus location pin hole

ANSI/B93.7M (and NFPA)
size 03

CETOP R35H4.2-4-03, plus
location pin hole

DIN 24340 Form A6 plus
location pin hole



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.

The following recommendations are based on ISO cleanliness levels at 2 µm, 5 µm and 15 µm. For products in this catalog the recommended level is:

17/15/12

Eaton 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 aryl phosphate ester. 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.

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 Eaton repair center.

The products will be refurbished as necessary and retested to specification before return. Field repair is restricted to the replacement of the interface seals.

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