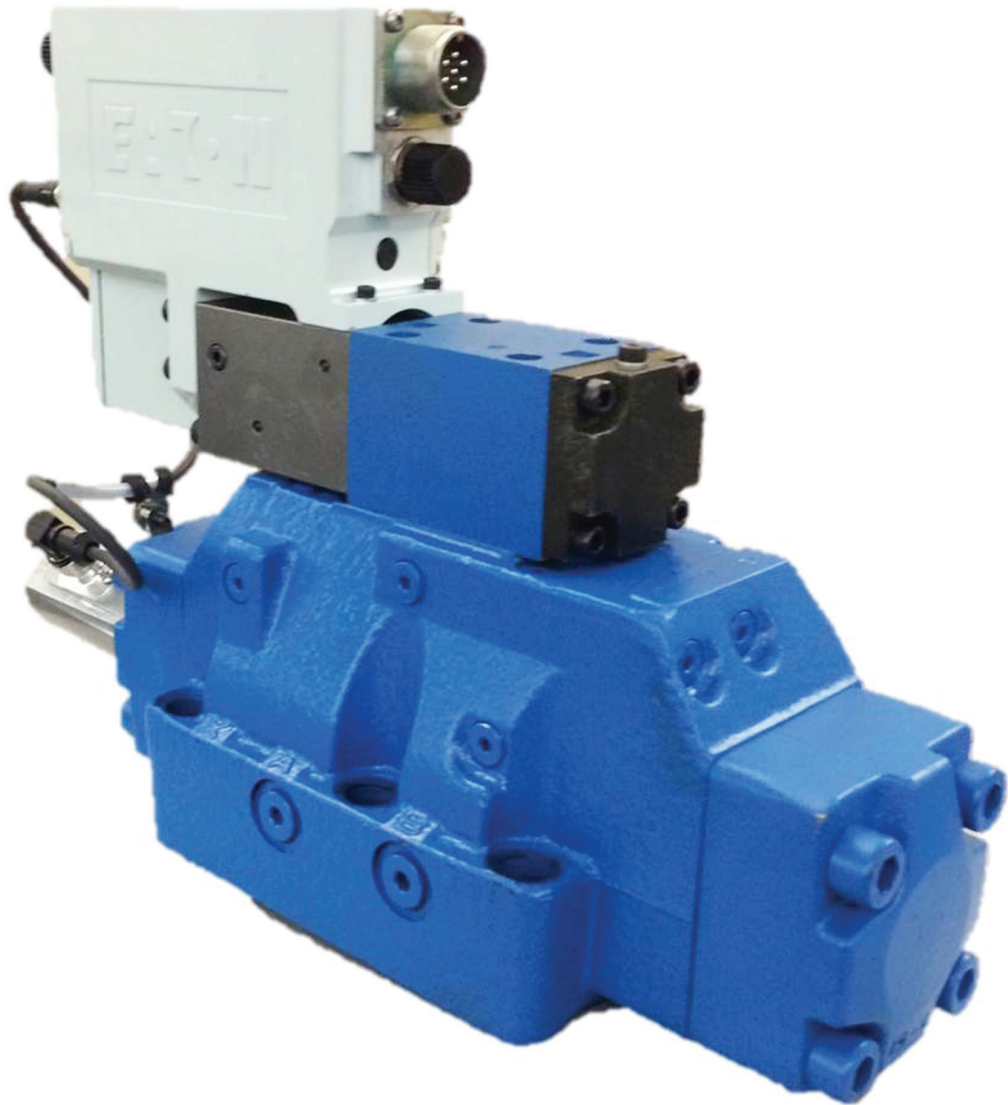


Eaton Servo-Performance Proportional Directional Valve AxisPro™

KBH*-8
10 Series



EATON

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
-------------------------------------	----

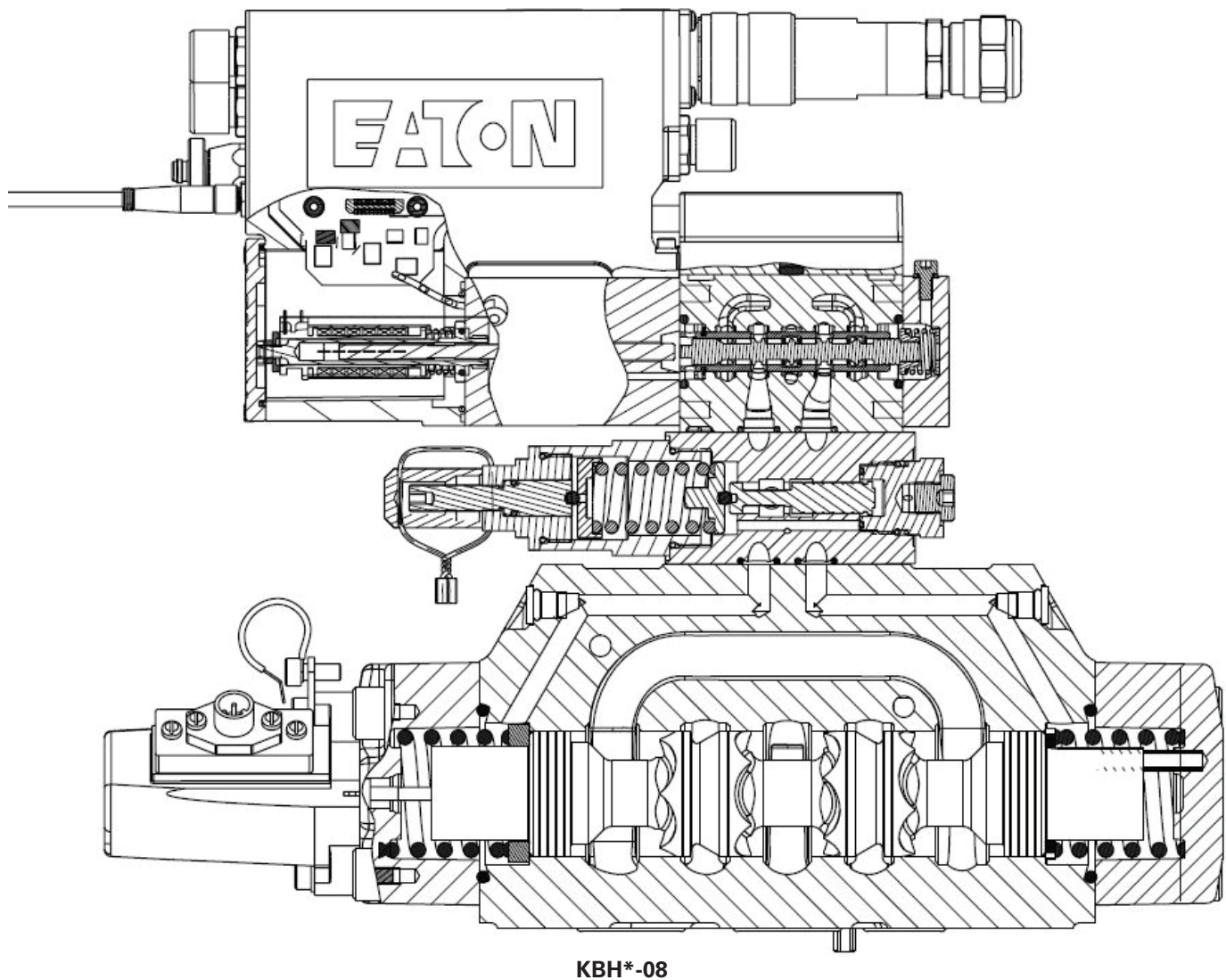
Software Information	16
-----------------------------------	----

Application Data	17
-------------------------------	----

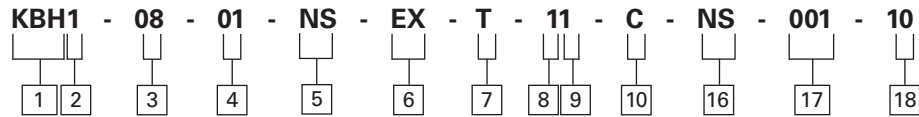
Introduction

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.



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

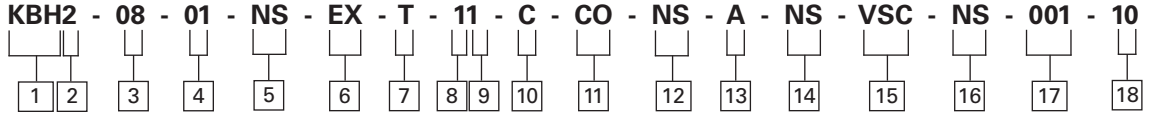
17 Software Revision

XXX – Software revision

18 Design Number

10 series.

Model Code



2 – 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

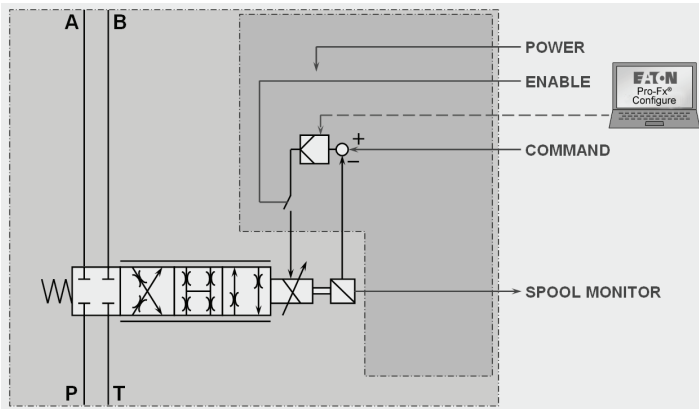
DPQ - Eaton Custom Drive Pressure / Flow Control Mode Enabled

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

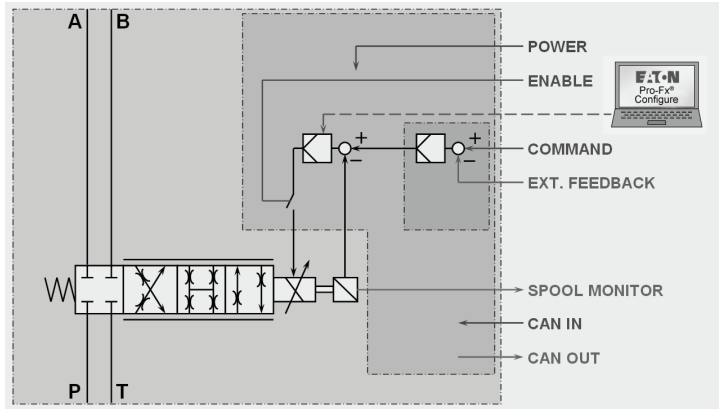
Spool Data

Spool Symbols

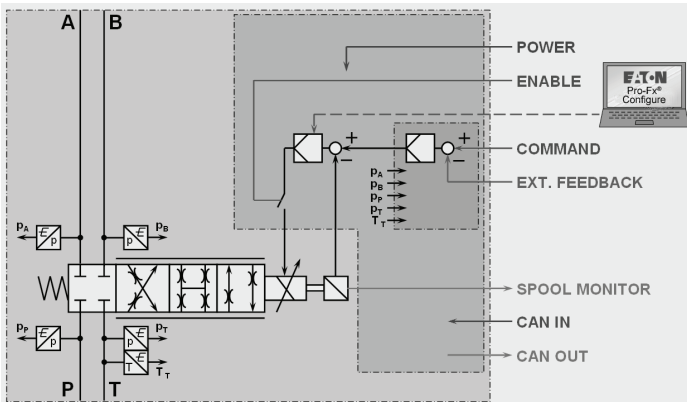
Model Type KBH1



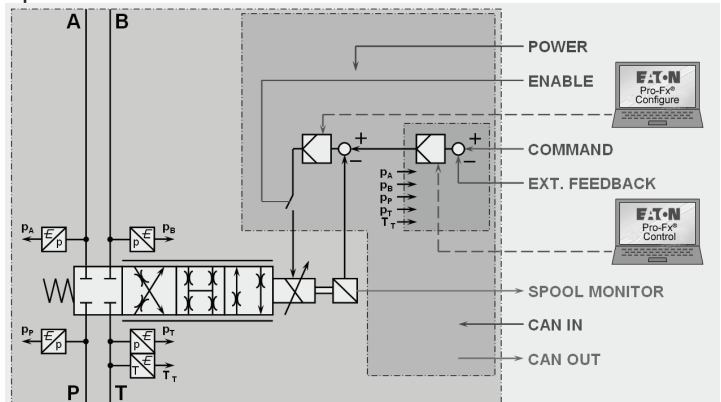
Model Type KBH2



Model Type KBH2 with Pilot Valve Sensor Option



Model Type KBH2 with Pilot Sensor Option and White Space



Application Notes

1. Main-Spool Options

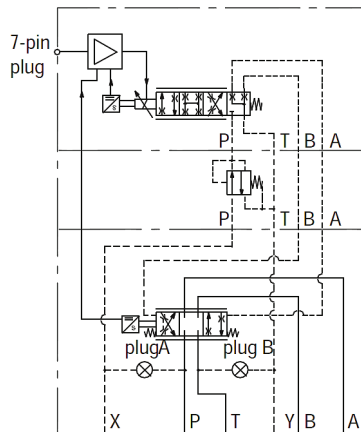
Spools shown are meter-in/ meter-out types. Center-condition options are type 5C.

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.



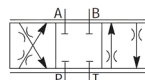
Spool Types and Flow Ratings

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

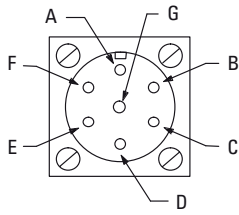
Minimum Recommended Flow Rates

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

Operating Data

Connector Details

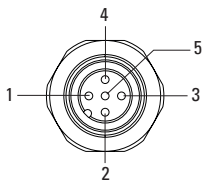
7-pin plug connector



Pin	Description
A	Power supply positive (+)
B	Power supply 0V and current command return
C	Not connected (PE7 & PC7)
D	Valve enable (PH7 & PR7)
E	Command signal (+V or current in)
F	Command signal (-V or current GND)
G	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

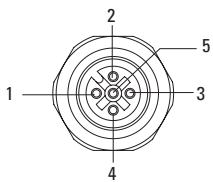
M12 5-pin CAN Connector (Male)



Pin	Description
1	GND
2	Not Connected
3	GND
4	CAN High
5	CAN Low

Note:
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.
To ensure EMI protection use only metal shielded mating connectors
Use only shielded twisted pair (STP) cables for mating connection.

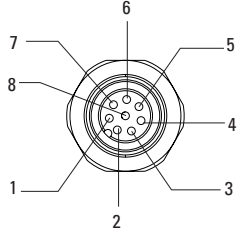
M12 5-pin CAN Connector (Female)



Pin	Description
1	GND
2	Not Connected
3	GND
4	CAN High
5	CAN Low

Note:
Present at location 5 of the electronics enclosure (see figure 1 below).
To ensure EMI protection use only metal shielded mating connectors
Use only shielded twisted pair (STP) cables for mating connection.

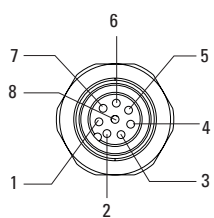
M12 8-pin External Digital Sensor



Pin	Description
1	Power supply 0V
2	+24V Supply
3	CLK-
4	DATA-
5	DATA+
6	Not Connected
7	CLK+
8	Not Connected

Note:
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.
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	Description
1	Speed Sensor Input1
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

Note:
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.
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).

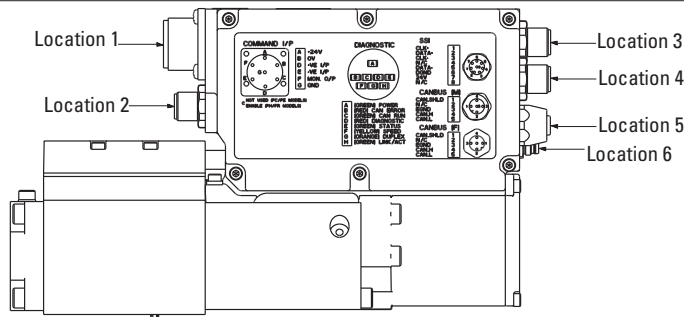


Figure 1: Pilot Stage

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
<p>Note:</p> <ol style="list-style-type: none"> Figure to the left references the clear plastic window on the top of the valve. LED F (amber) will glow as a part of normal operation. 		
Electromagnetic compatibility (EMC):	IEC61326-2-1	
Monitor Points Signal:		
Voltage mode	±10V DC	
Current mode	4 to 20 mA	
Output impedance	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	-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)	
Power supply	24V DC (18V to 36V including 10% peak-to-peak max ripple) max current 3,7A	
Command Signal:		
Voltage mode	-10V to +10V DC 13 bit resolution, ± 1%	
Input impedance	M1: 47 kΩ - M2, M3, M4: 100Ω	
Voltage between Pin D and B	M1: 18V (max)	
Voltage between Pin E and B	M1: 18V (max)	
Current mode	M2: 4-20 mA , M3: ±10mA, M4: ±15mA (± 20 mA, 13 bit resolution, ± 1%)	
Max differential voltage to pin E to pin B	M2, M3, M4: 100 mV	
Valve enable signal for model code H & R		
Enable Disable	Disable <6.5V; Enable Signal >8.5V (max 36V)	
Input impedance	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	17.1 kg (37.5 lb) approx.
KBH*-08 without reducer	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 $\varnothing_p = 5$ 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 \varnothing_p values, flow rates approximate to: $Q_x = Q_D \sqrt{\frac{\varnothing_{pX}}{\varnothing_{pD}}}$

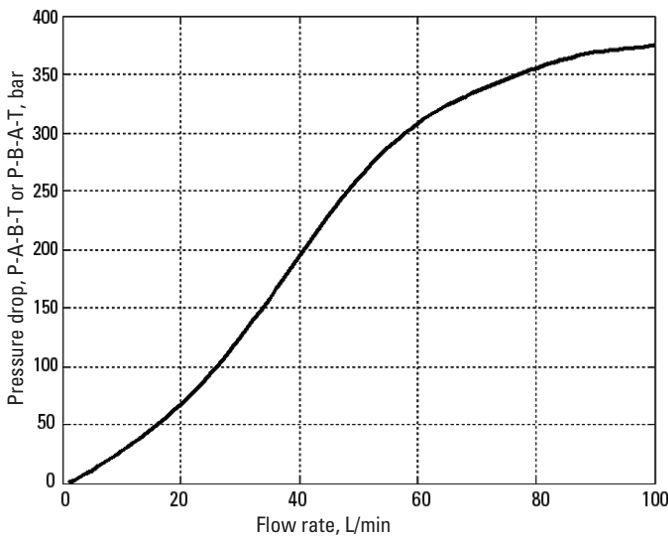
where Q_D = Datum flow rate

\varnothing_{pD} = Pressure drop at datum flow rate

\varnothing_{pX} = Required p

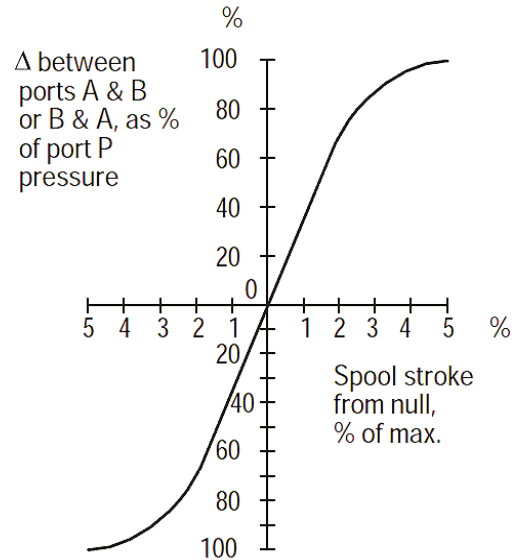
Limited by valve power capacity.

Refer to curves on page 8.

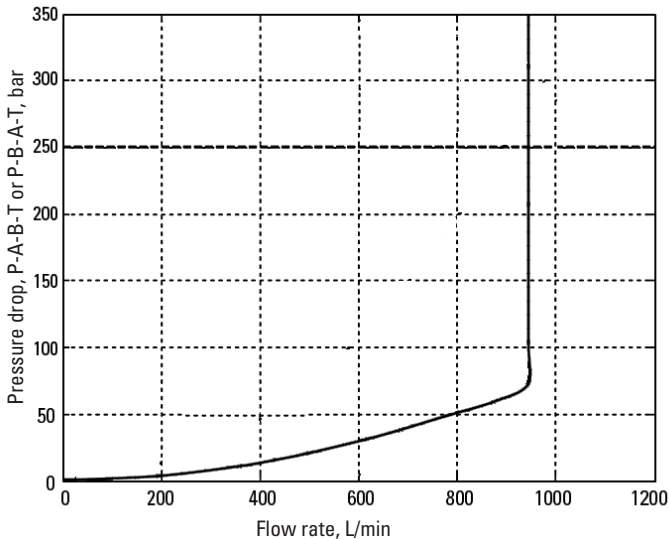


Pressure Gain

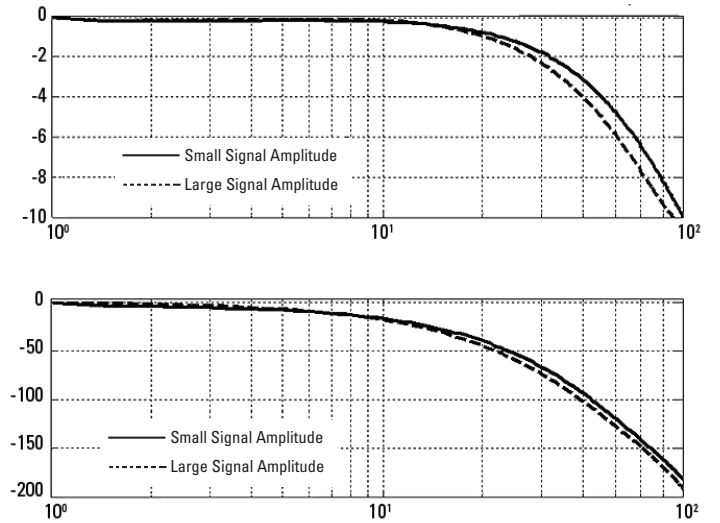
("5C" spools only)



Power Capacity Envelopes



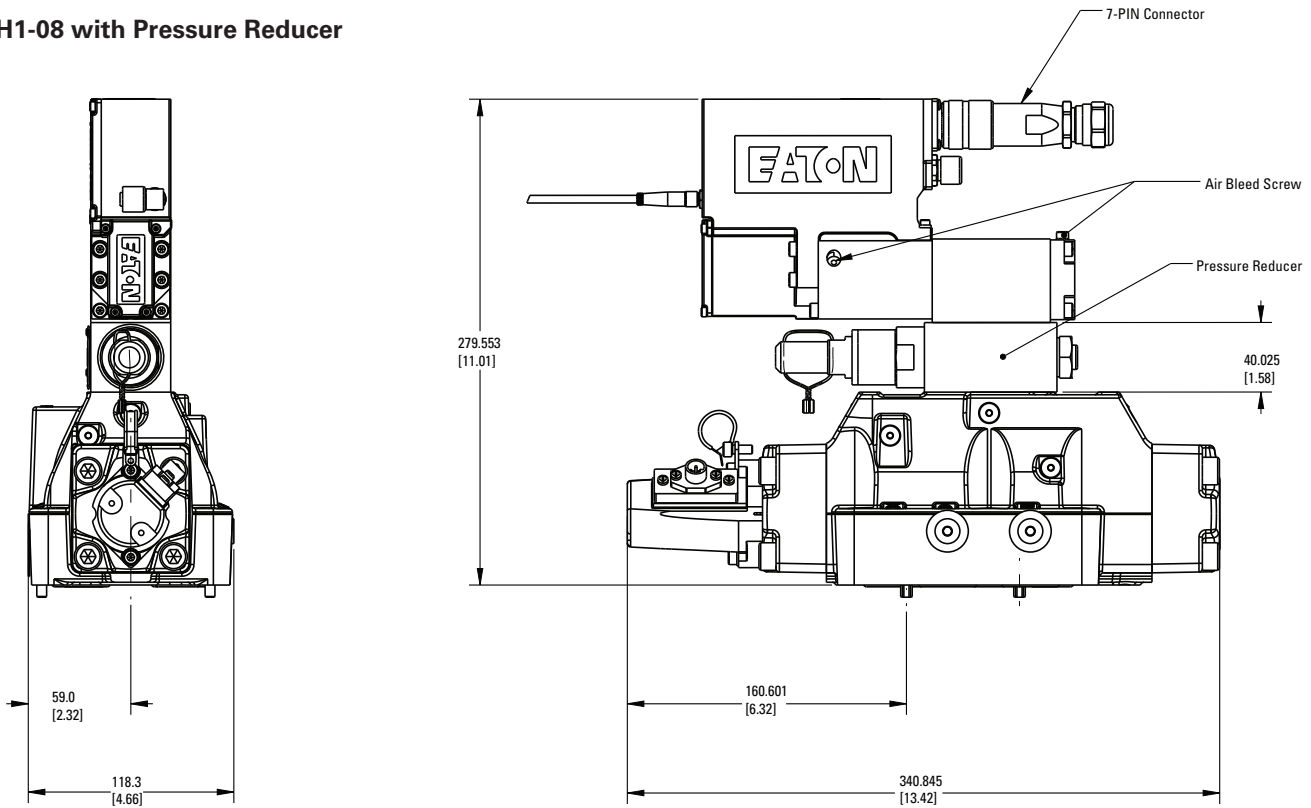
Frequency Response, typical



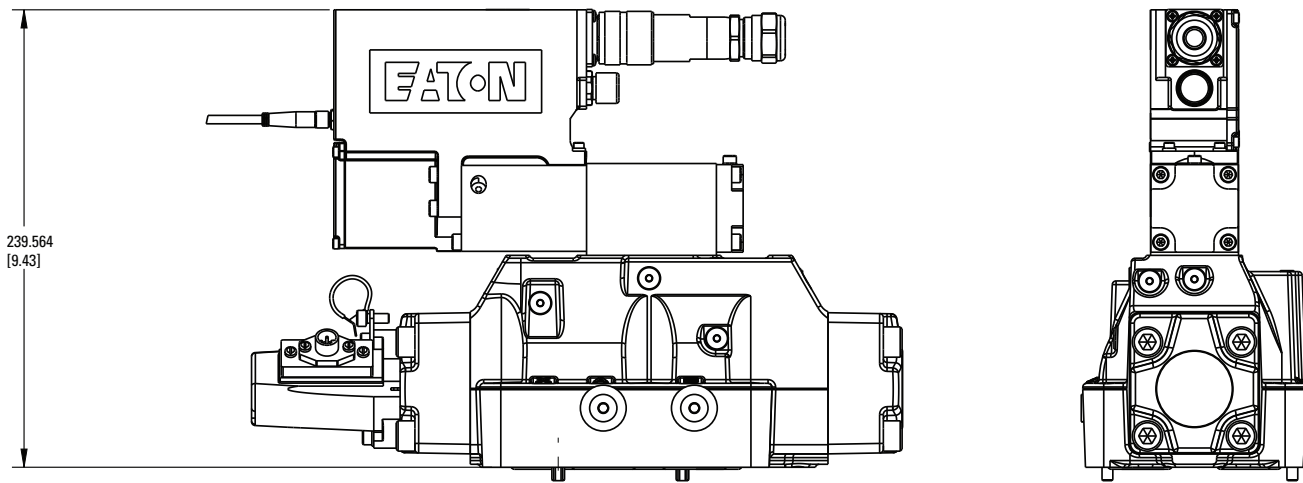
Installation Dimensions

mm (inch)

KBH1-08 with Pressure Reducer



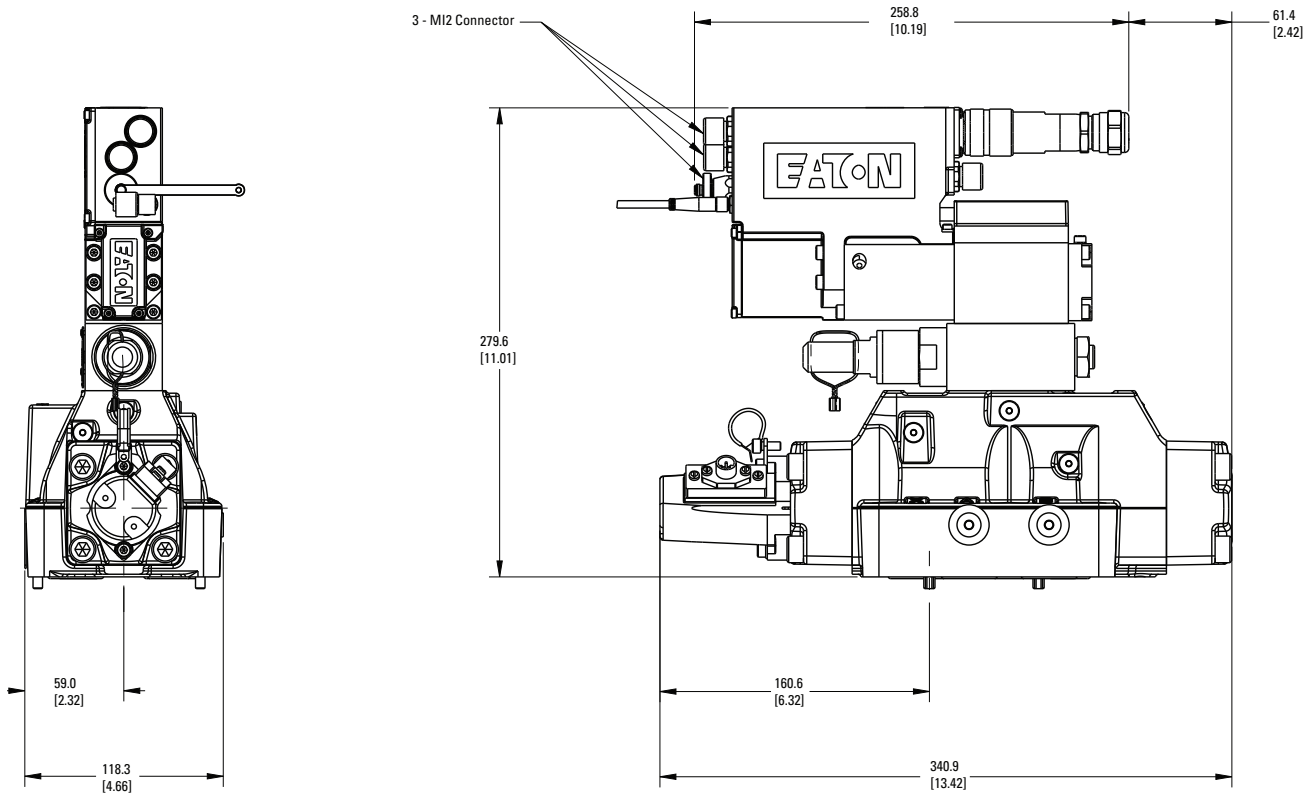
KBH1-08 without Pressure Reducer



Installation Dimensions

mm (inch)

KBH2-08 with Reducer and Pilot Sensors



Electrical Information

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:

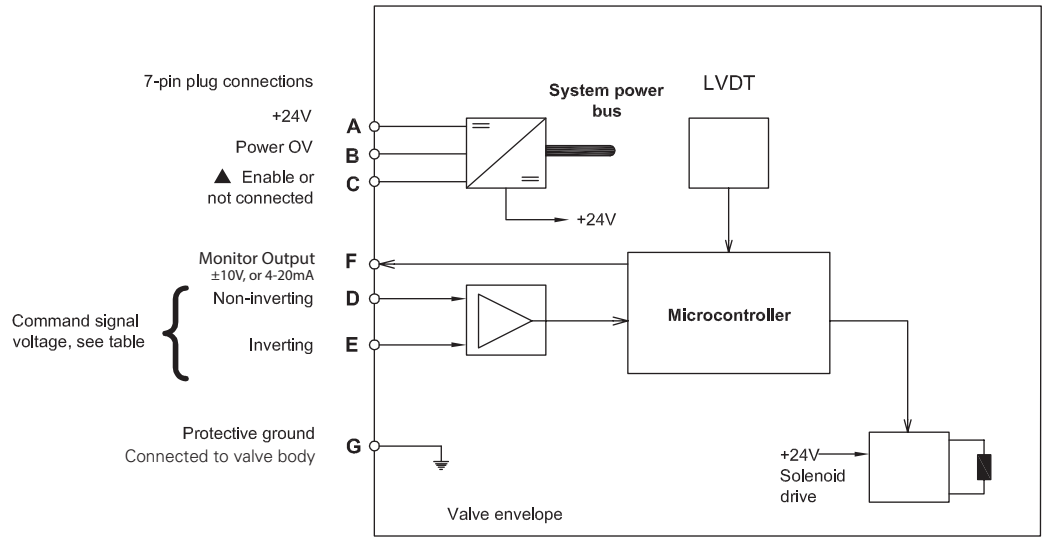
0.50 mm² (20 AWG)

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 - 0.41 inches)

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	P to A
OV	Negative	
$U_D - U_E = \text{Positive}$		
Negative	OV	P to B
OV	Positive	
$U_D - U_E = \text{Negative}$		

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
 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)

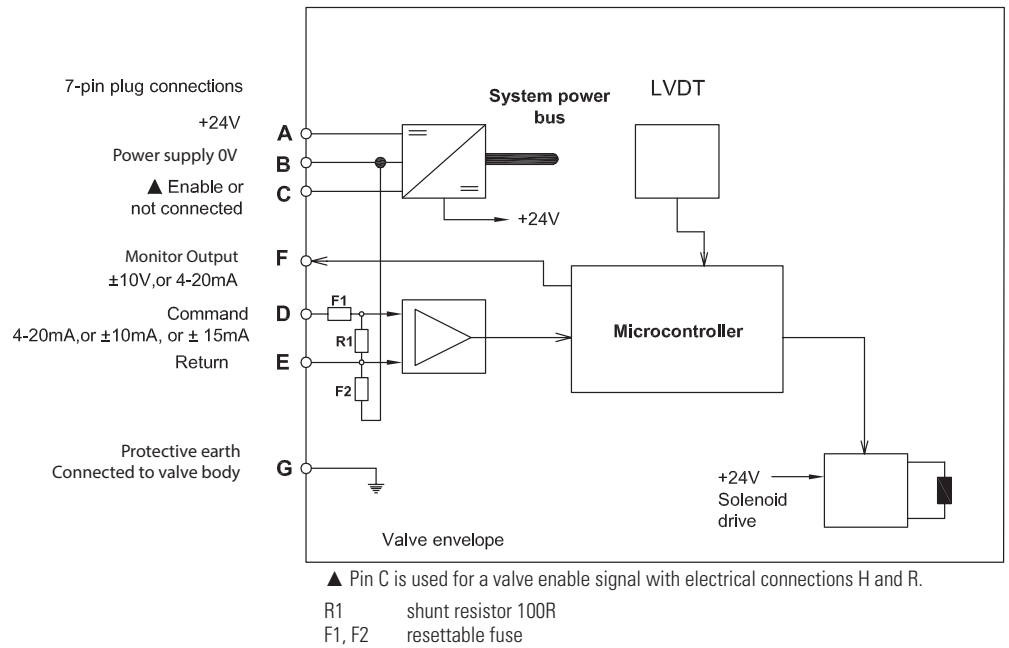
Screen (shield):

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



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



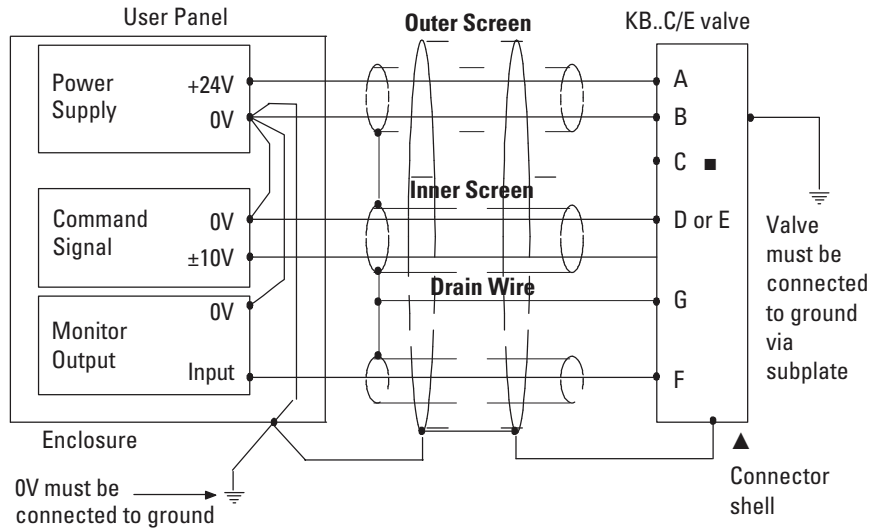
WARNING

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

Electrical Information

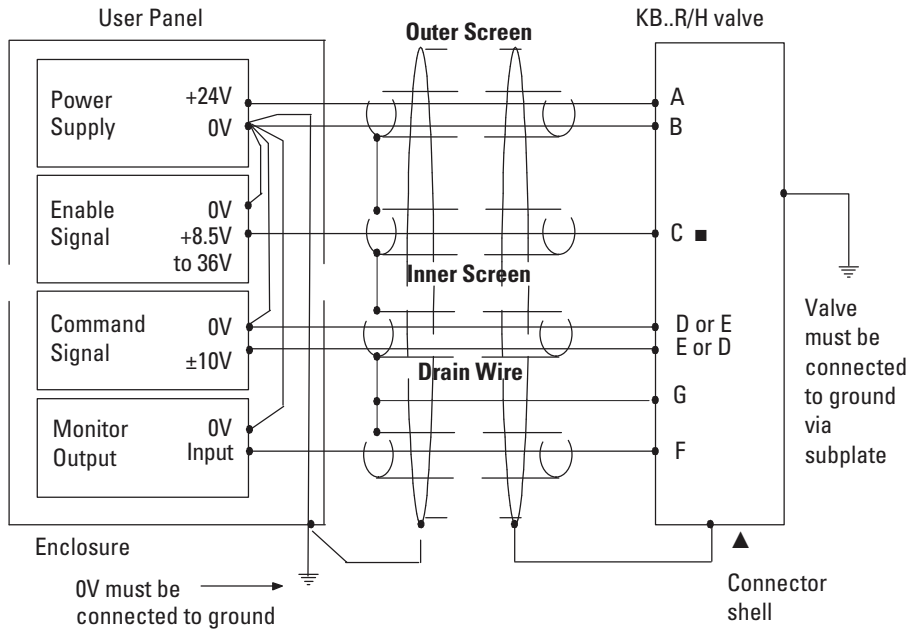
Wiring Connections Voltage Input (Command Signal 1)

■ 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

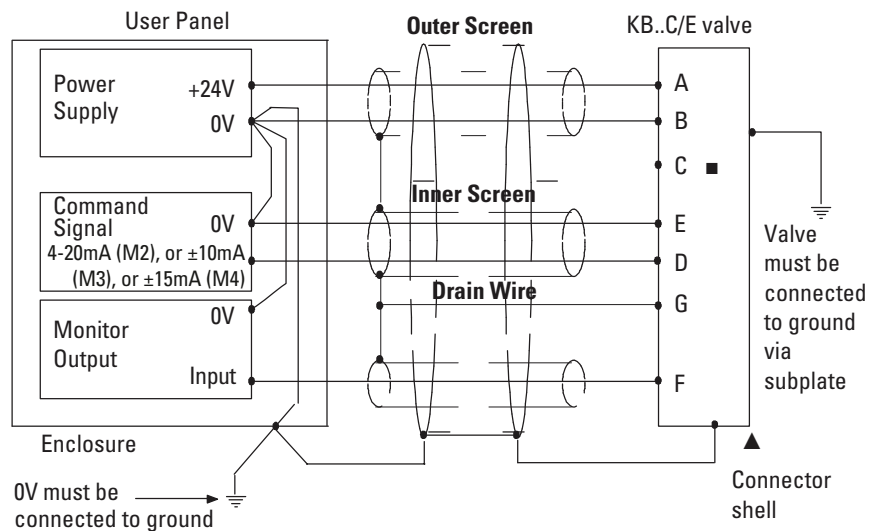
▲ Note: In applications where the valve must conform to European RFI/EMC regulations, the outer screen (shield) must be connected to the outer shell of the 7 pin connector, and the valve body must be fastened to the earth ground. Proper earth grounding practices must be observed in this case, as any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



Electrical Information

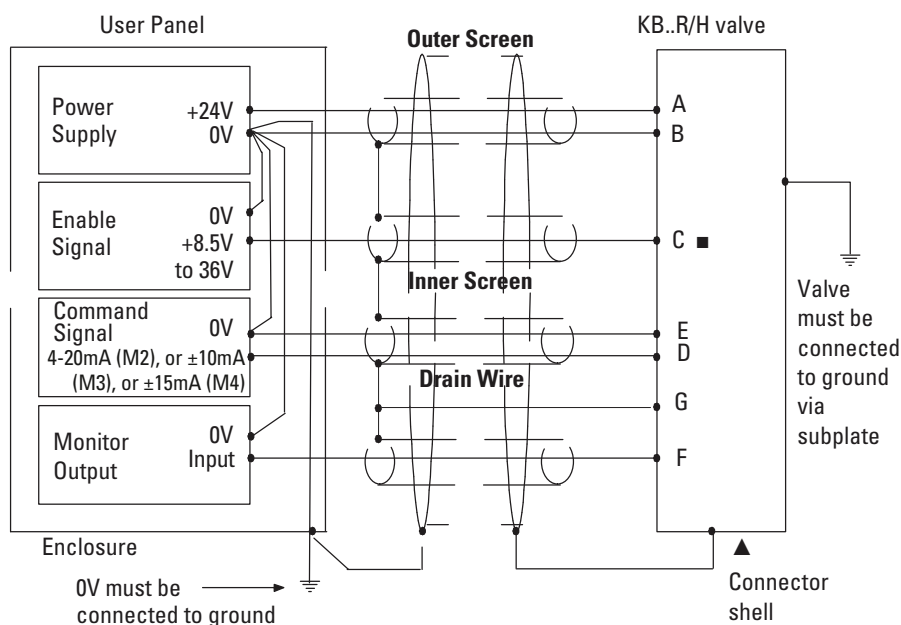
Wiring Connections Current Input (Command Signal 2, 3 and 4)

■ 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.

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.

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.

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

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

Eaton
Hydraulics Group Asia Pacific
Eaton Building
No.7 Lane 280 Linhong Road
Changning District,
Shanghai 200335
China
Tel: (+86 21) 5200 0099
Fax: (+86 21) 2230 7240