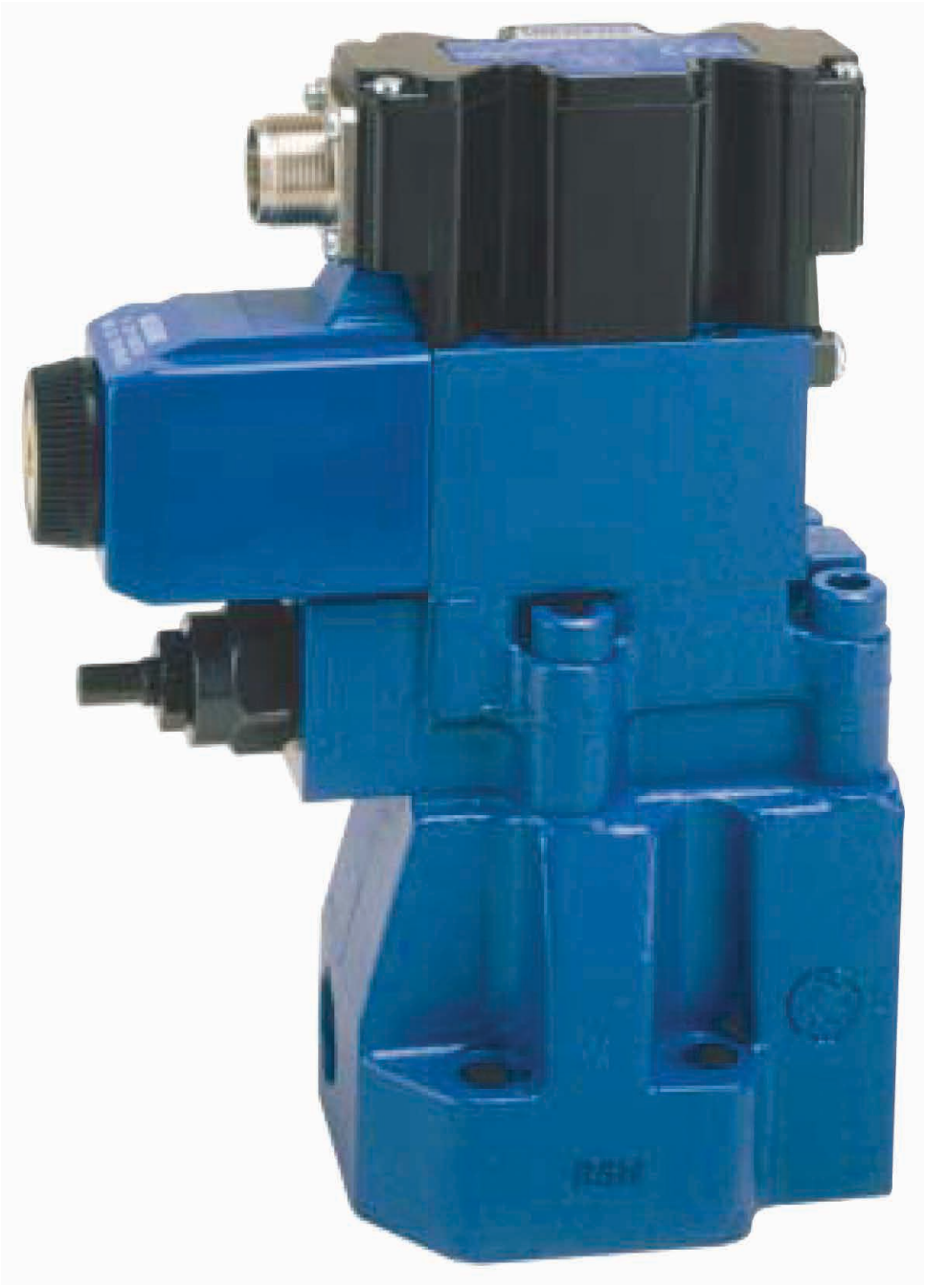
Proportional pressure reducing valves

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



Powering Business Worldwide

Contents

CE

This product has been designed and tested to meet specific standards outlined in the European Electromagnetic Compatibility Directive (EMC) 2014/30/EU which repealed Directive 2004/108/EC. For Restriction of Hazardous Substances, complies to (RoHS) Directive 2011/65/EU. For instructions on installation requirements to achieve effective protection levels, see the Installation Wiring Practices for Eaton's Electronic Products. 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.

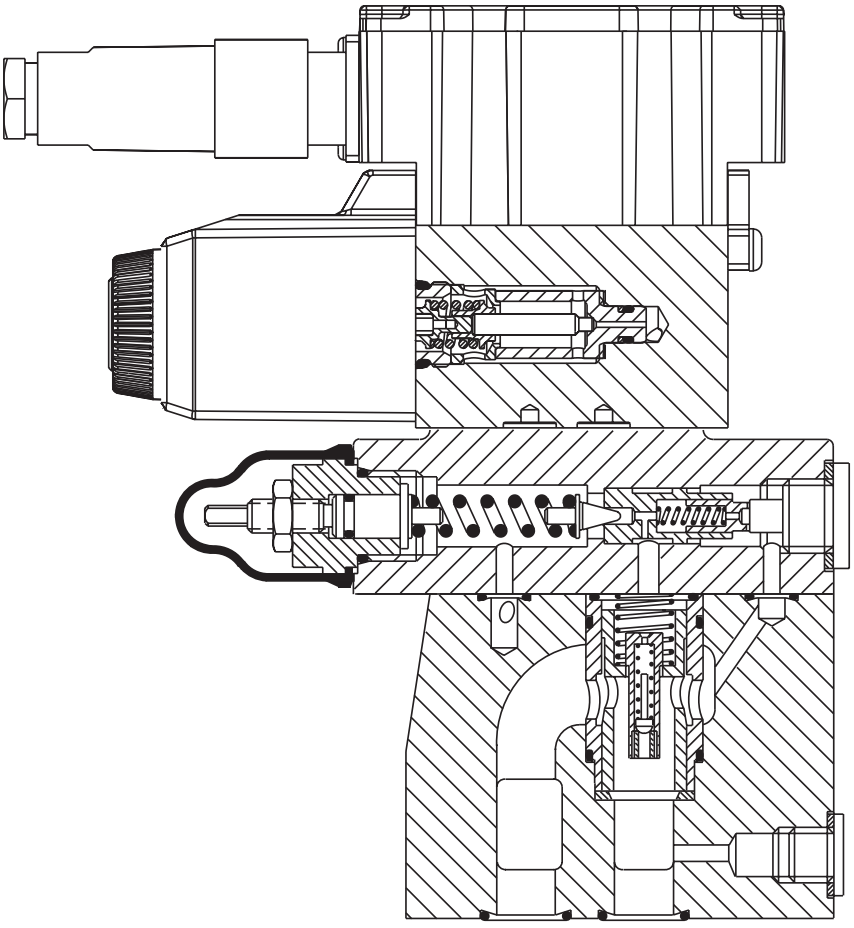
High valve response ensures that the reduced outlet pressure is unaffected by inlet pressure peaks. Excess buildup of outlet pressure (during long holding periods, or flow back from an actuator reacting to an overload) is prevented by the small check valve in the mainstage spool, allowing fluid to bleed-off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



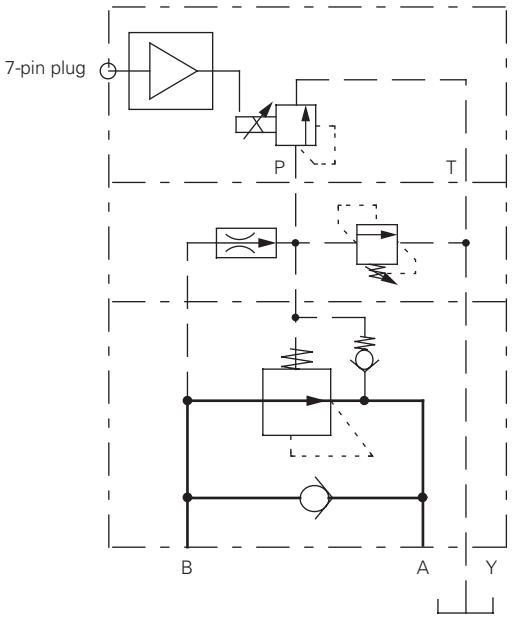
Functional symbols

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.

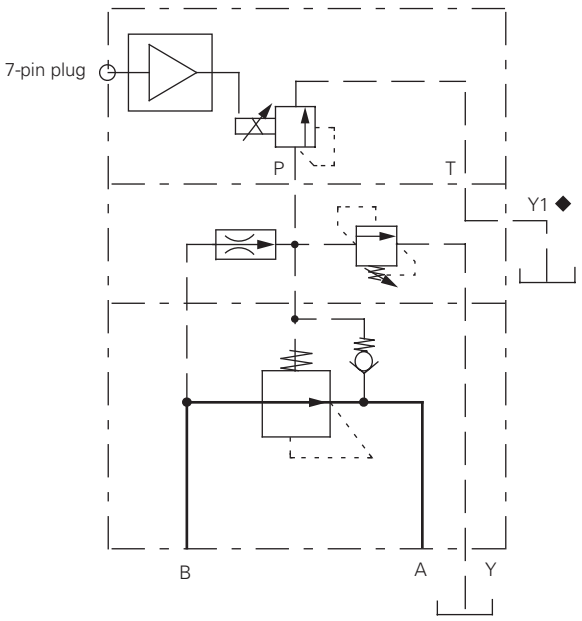


Manual pilot drained to Port Y; electrical pilot drained to Port Y1 ◆:

Model code 8 = 3

Symbol for KBXG.

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



Model codes

KB	*	*	G	*	*	***	*	Z	*	3	A	P*7	*	11
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

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 Manual overrides

Z	No overrides

10 Electrical command options

M1	+/- 10 volts control signal
M2	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

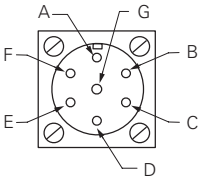
11	Subject to change. Installation dimensions unaltered for design numbers 10 to 19 respectively

⚠ 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.
Amplifier rating	24V x 40W (18V-32V 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	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)	IEC 61326-2-1 (Electrical equipment for measurement, control and laboratory use)
	Conducted Emissions CISPR11 -2015-06 Ed 6.0/EN55011 - Class A, 150kHz to 30MHz
	Radiated Emissions CISPR11 -2015-06 Ed 6.0 /EN55011 - Class A, 30MHz – 1GHz
	RF Continuous Conducted disturbances IEC 61000-4-6, 3Vrms Class A 150 KHz to 80 MHz
	RF Electromagnetic Field, 80MHz to 1GHZ, 10V/m; 1.4GHz to 2.7GHz, 3V/m; Meets Criterion A
	Surge: IEC 61000-4-5
	• DC Power Port : ±1kV • Signal/Control Port : ±1kV
	Electrical Fast Transients IEC 61000-4-4, Class B
	• DC Power Port : ±1kV • Signal/Control Port : ±0.5kV
	Electrostatic discharges (ESD) IEC 61000-4-2, Class B
	• Air ±8kV • Contact ±4kV
ROHS Compliance:	Complies with: Restriction of Hazardous Substances (RoHS) Directive 2011/65/EU
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 underride	See graph
Hysteresis, using Vickers™ drive amplifier	<7%

Operating data

Linearity at conditions:	<6% of rated pressure
1. "Dead-head" (no flow from reduced pressure outlet port) 2. Between 10% and 100% rated pressure	
Repeatability	<±1.3% of rated pressure
Protection:	
Electrical	Reverse polarity protected
Environmental	IEC 529, Class IP67
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.

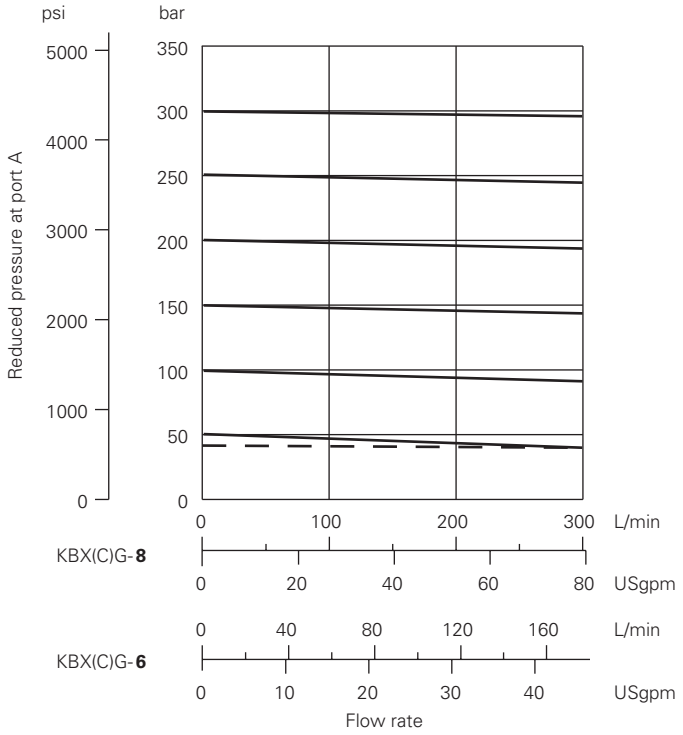
Performance data

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

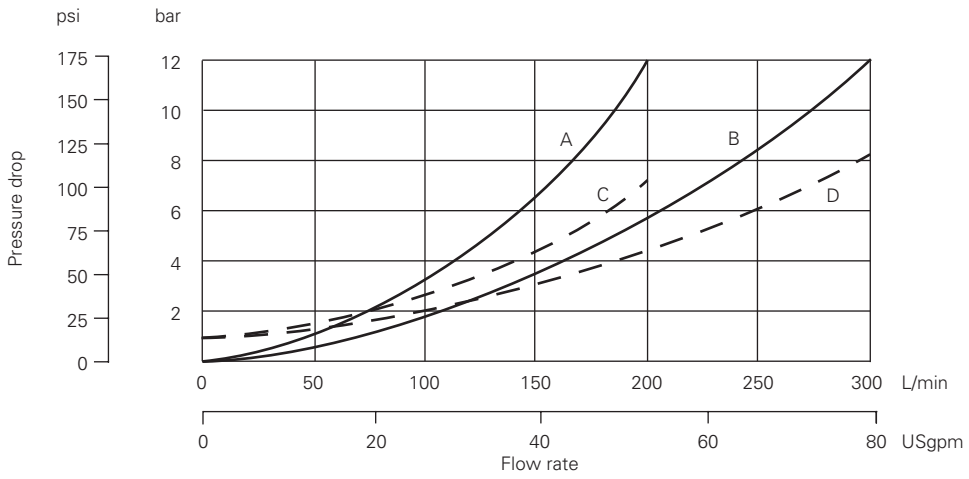
KBX(C)G-**8** valves.....Curve B

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

Types KBXCG only:

KBXCG-**6** valves.....Curve C

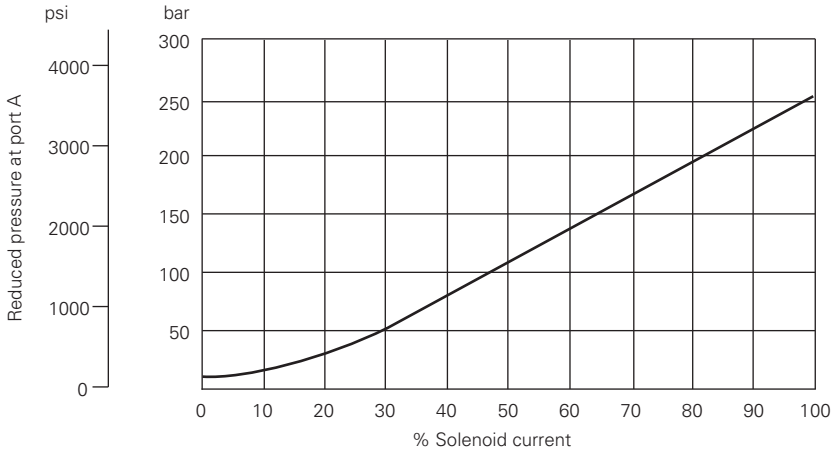
KBXCG-**8** valves.....Curve D



Performance data

Pressure gain

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



Step response

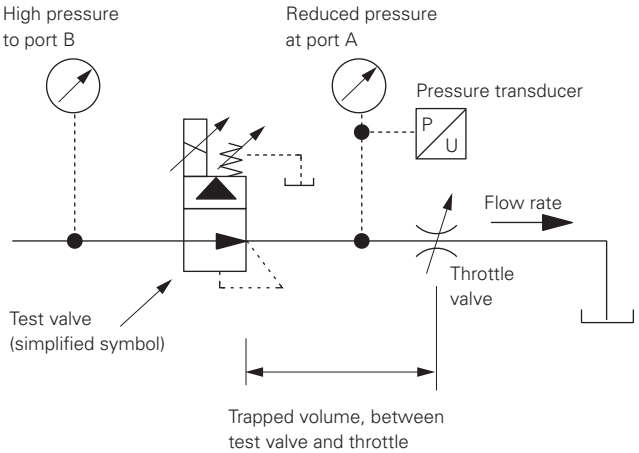
Typical data for KBX(C)G-*-*- 250 model.

Valve size	Test conditions: trapped volume	Flow rate	Step size: pressure demand	Response time (ms)
6	1,5 liters (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

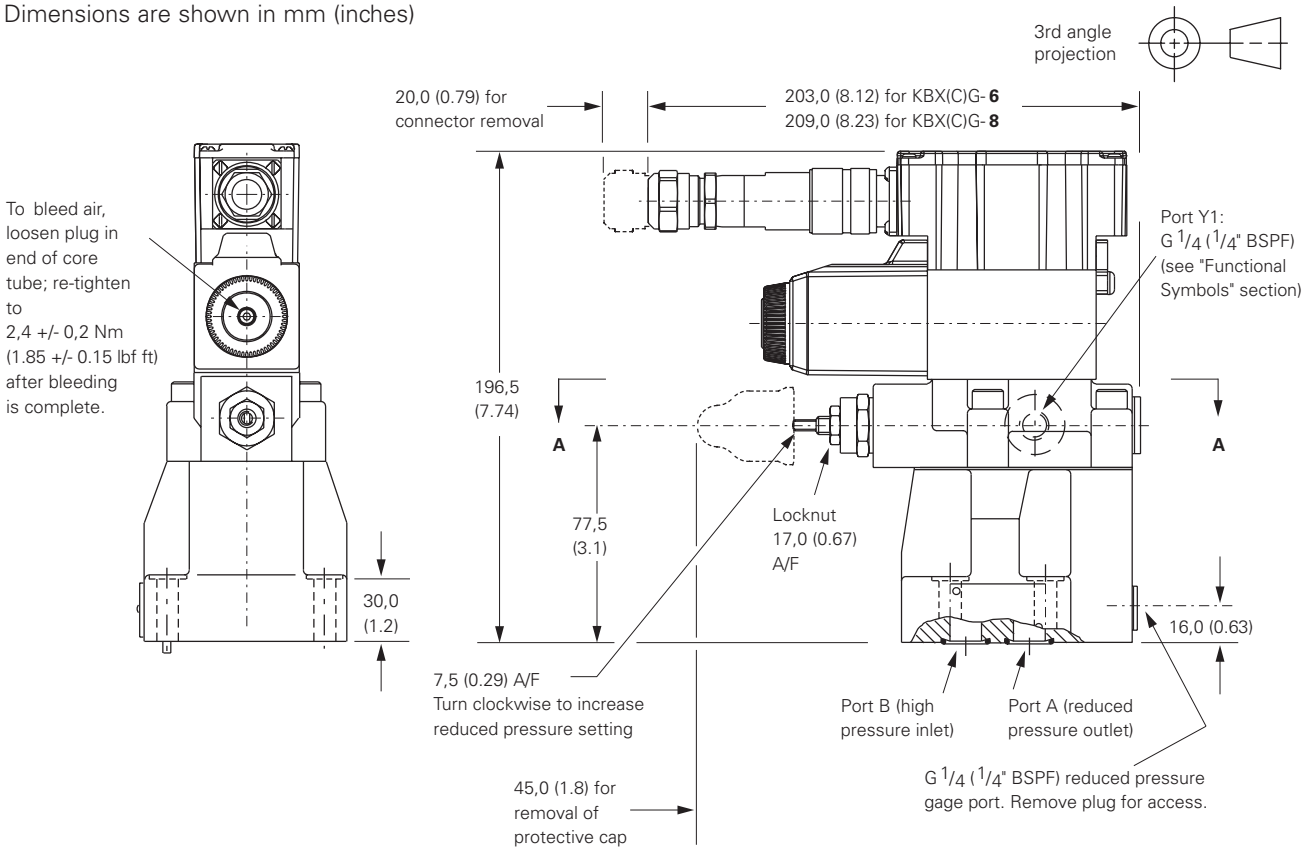
1. Inlet pressure set 300 bar (4350 psi)
2. Trapped volume as in table
3. Steady state flow rate adjusted by downstream throttle valve with Δp = 250 bar (3600 psi)
4. Response = time from step input signal until reduced output pressure reaches 90% of step change, as measured by transducer

Test circuit

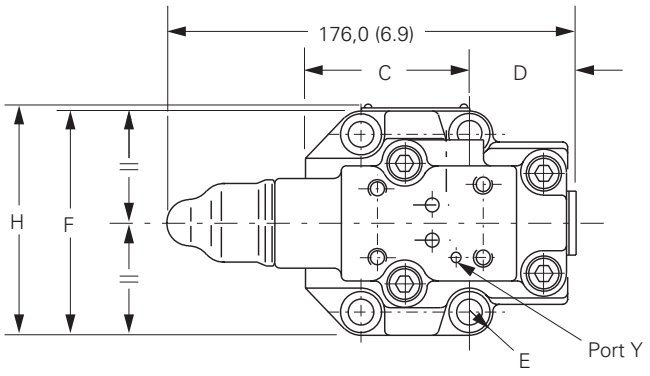


KBX(C)G-6/8 models

Dimensions are shown in mm (inches)



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)



View "A-A"

⚠ WARNING

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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.

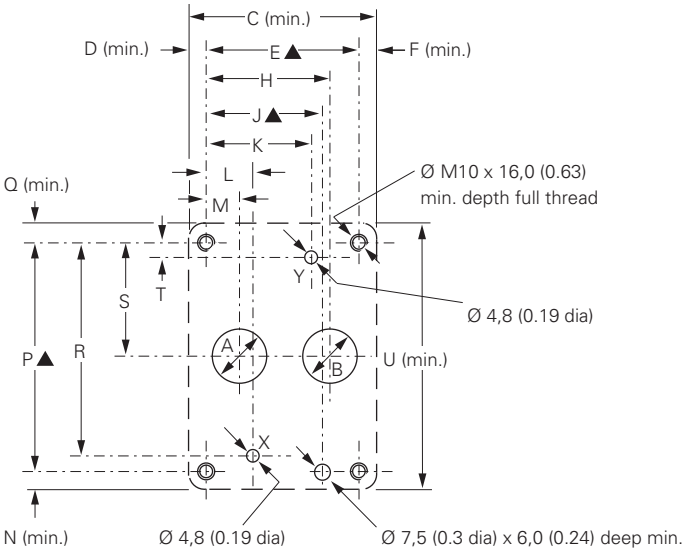
Port functions

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

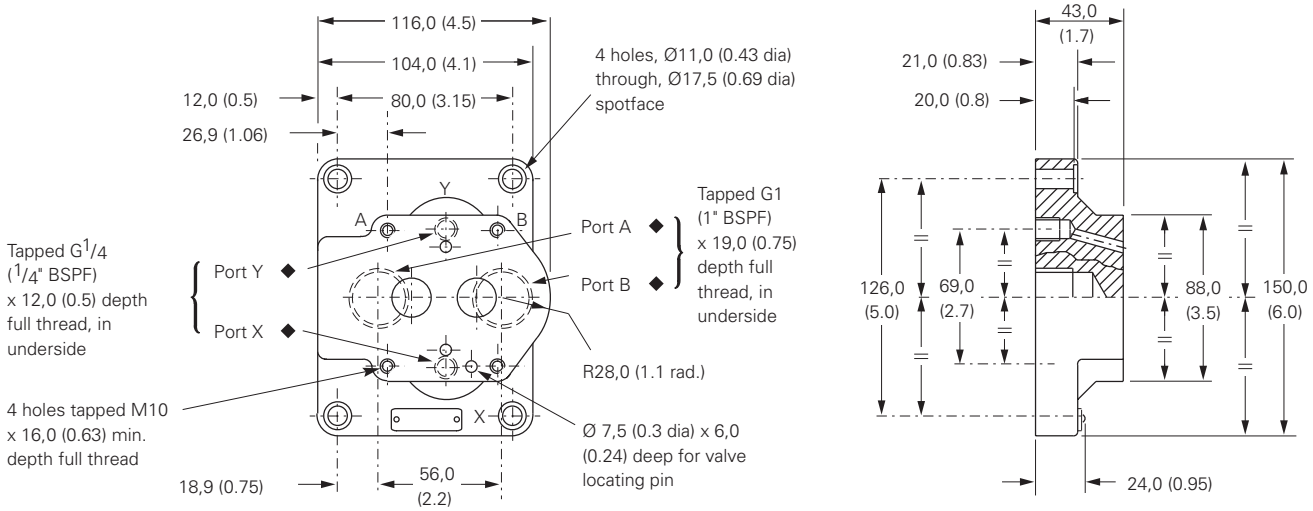
Y = Drain port



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

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 mm² (18 AWG) up to 20m (65 ft)

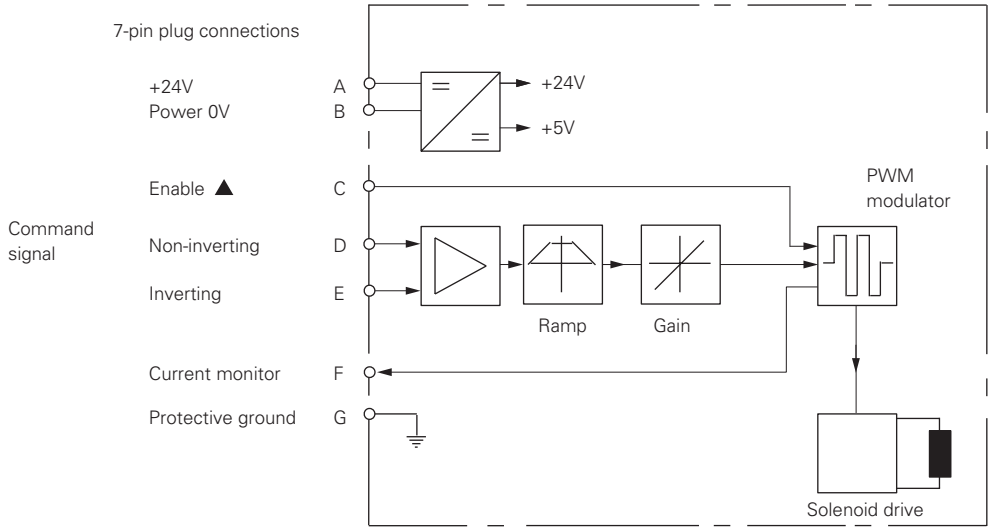
1,00 mm² (16 AWG) up to 40m (130 ft)

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.

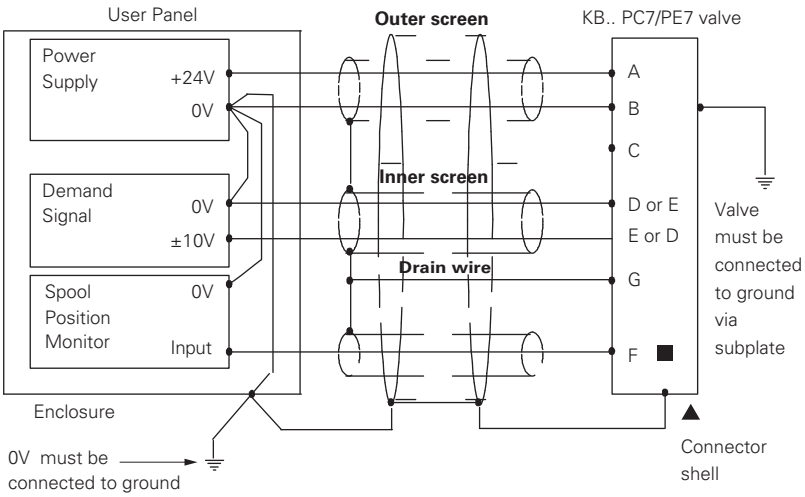
⚠ WARNING

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

Block diagram

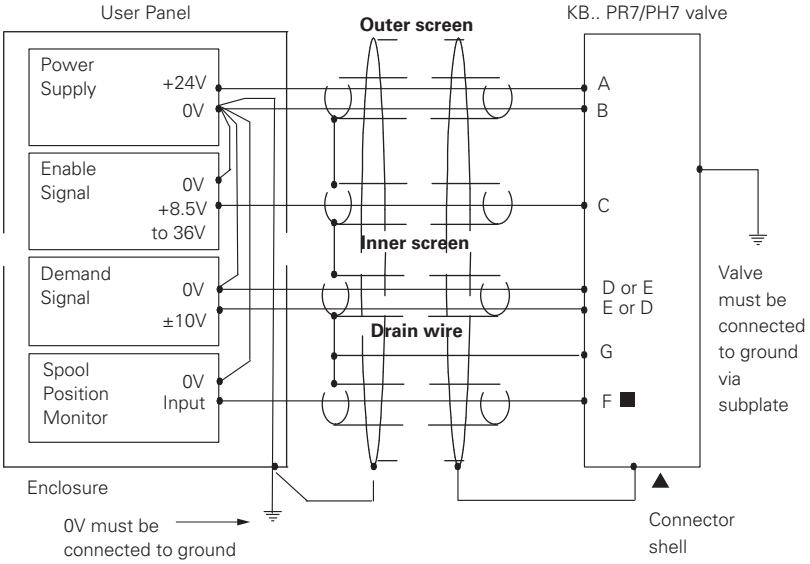
Voltage input (M1) wiring

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



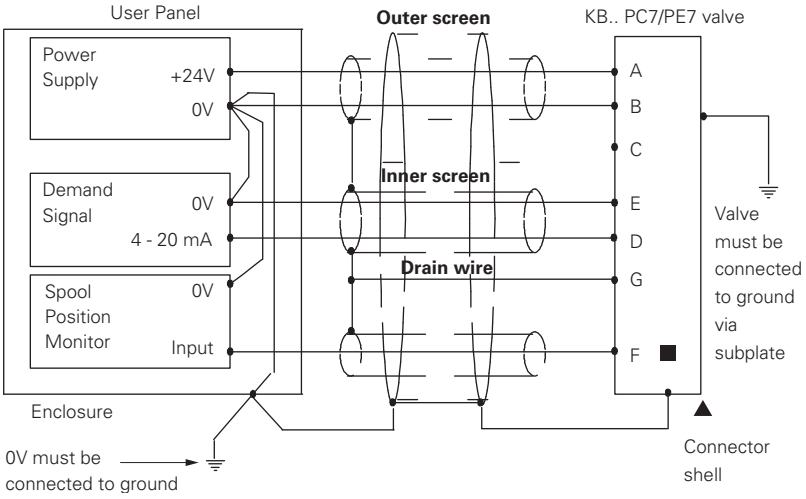
Wiring connections for M1 valves with enable feature

▲ **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.



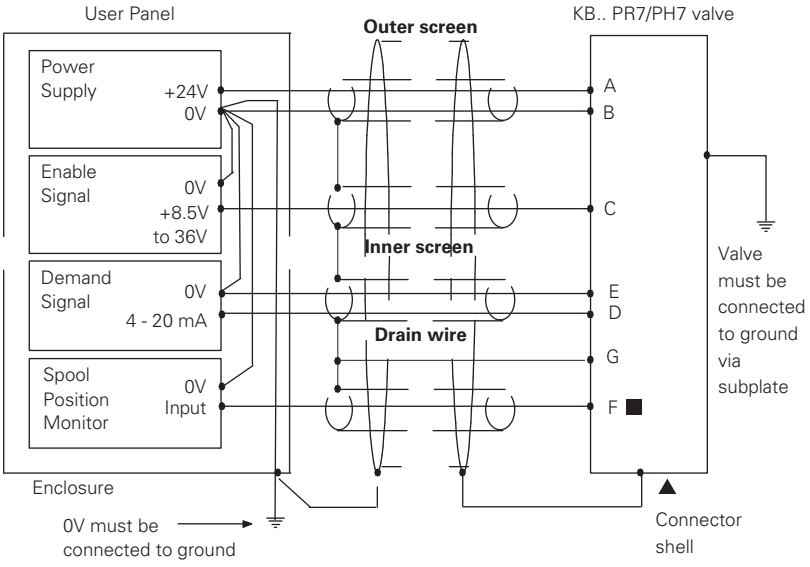
Current input (M2) wiring

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



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.

Hydraulic fluids and fluid cleanliness

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 Eaton Hydraulic Fluid Recommendation 03-401-2010 rev 1.

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..... 02-145869

Mainstage valves:

KBX(C)G-6..... 614824

KBX(C)G-8..... 614826

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