ENGINEERING TOMORROW

User Guide

Proportional Pressure Reducing Valves

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



VICKERS by Danfoss

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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 by Danfoss™ 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.

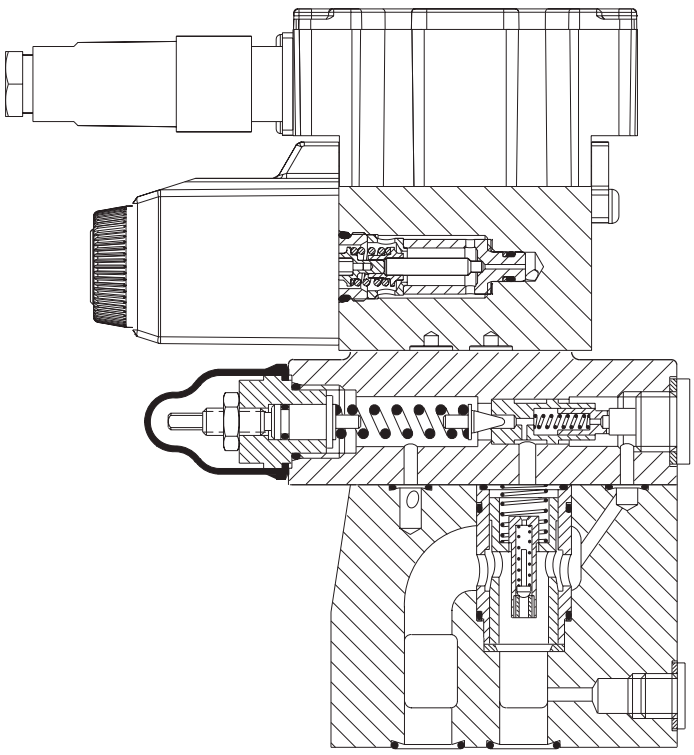
High valve response ensures that the reduced outlet pressure is unaffected by inlet pressure peaks. Excess build-up of outlet pressure (during long holding periods, or flow back from an actuator reacting to an overload) is prevented by the small check valve in the mainstage spool, allowing fluid to bleed-off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



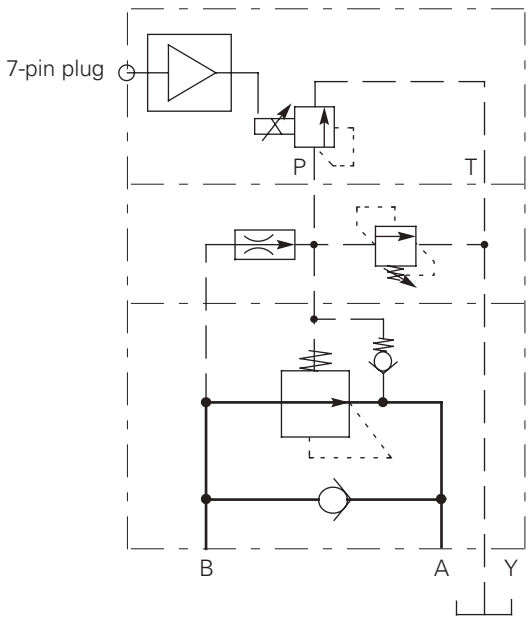
Functional Symbols

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.

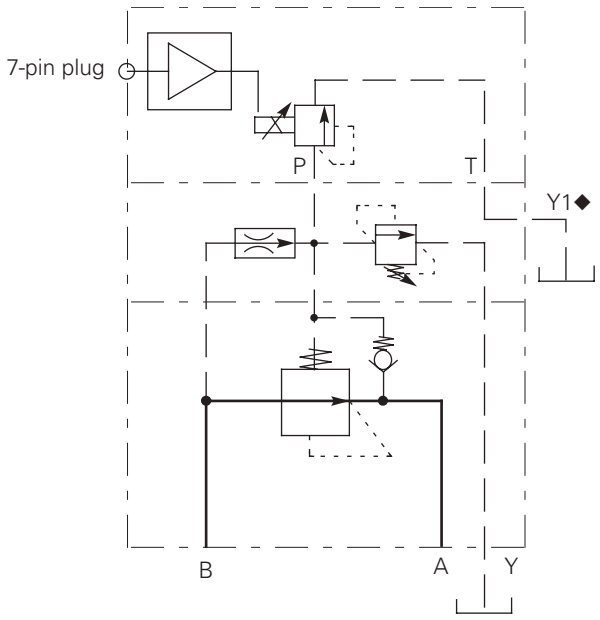


Manual Pilot Drained to Port Y; Electrical Pilot Drained to Port Y1◆:

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

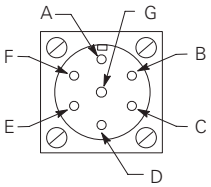
15 Design Number, 1* Series

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 Danfoss, 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 by Danfoss™ 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 AX456378196795en-000101
EHD-DSG-201-A-1* Command signal generator	See catalog AI456959968999en-000101
EHA-RMP-201-A-2* Ramp generator	See catalog AX456378196795en-000101
EHA-PID-201-A-2* PID controller	See catalog AN456873394966en-000101
EHA-PSU-201-A-10 Power supply	See catalog AX456378196795en-000101
Subplates, size 03	See catalog 2425
Mounting bolts ■	See catalog 2314A
■ Note: If not using Vickers by Danfoss™ 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.

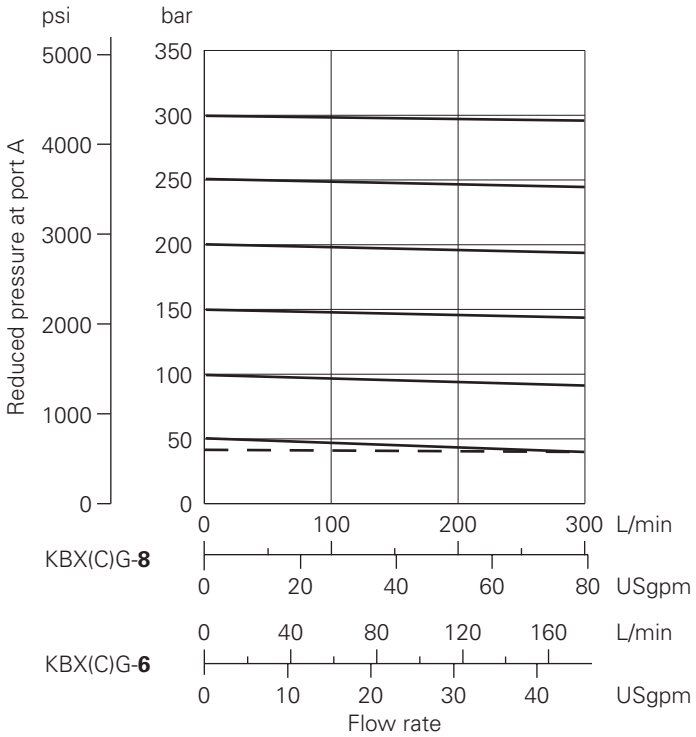
Performance Data

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)



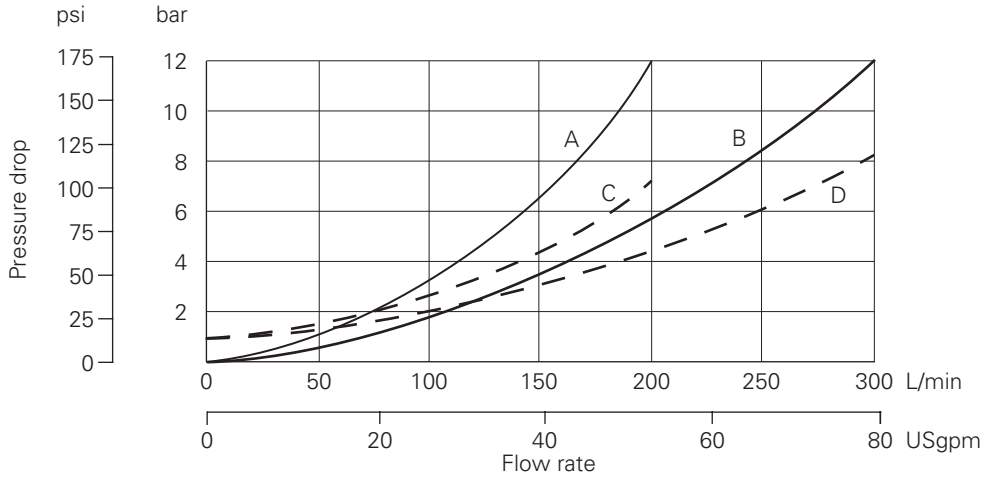
Pressure Drop

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

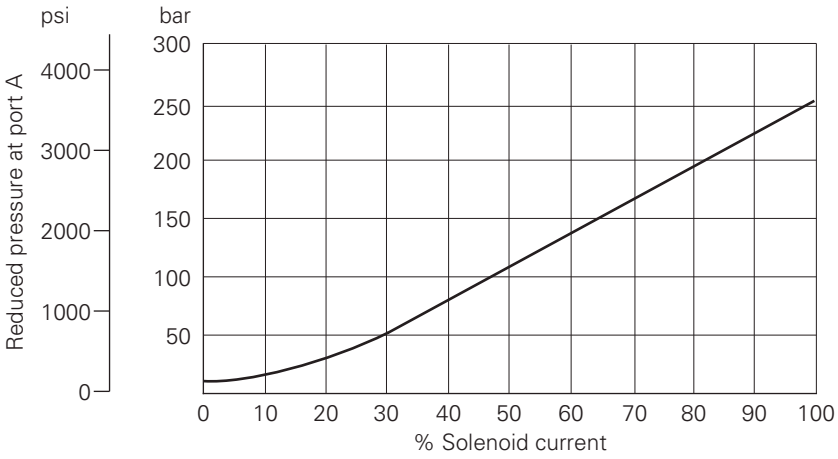
From port A to B through check valve (mainstage assumed closed).

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

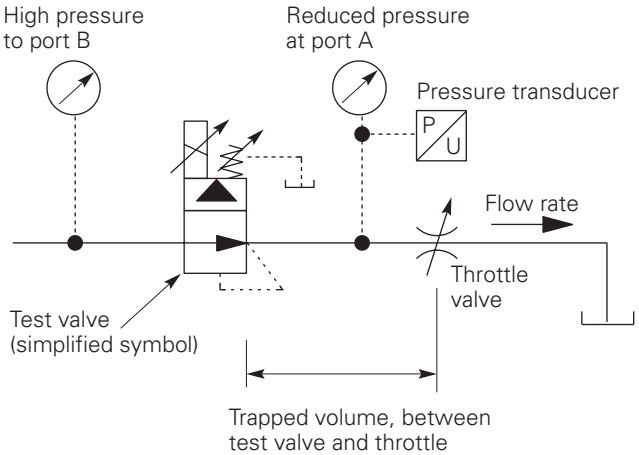
Typical data for KBX(C)G-*-*-250 model.

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

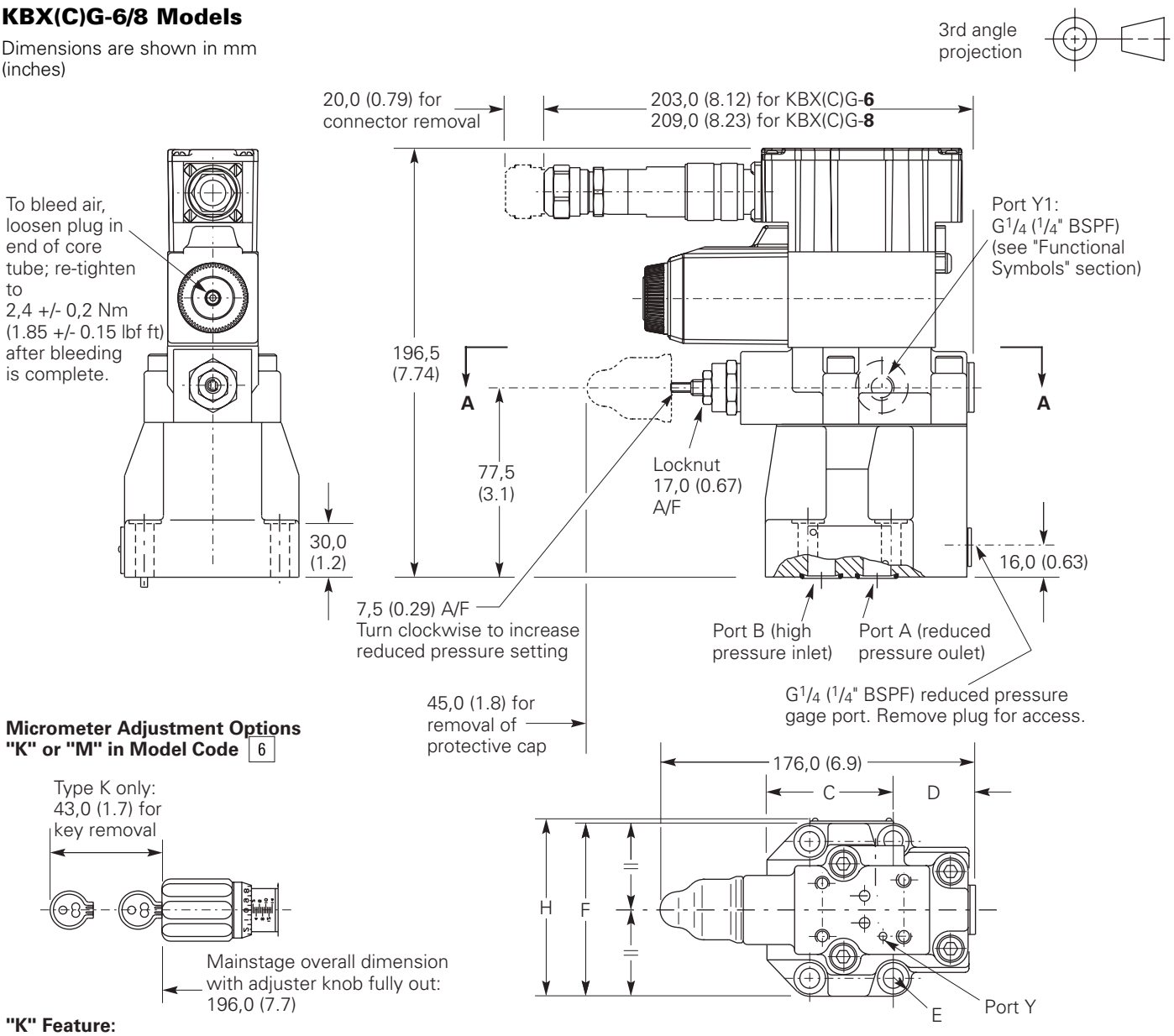
1. Inlet pressure set 300 bar (4350 psi)
2. Trapped volume as in table
3. Steady state flow rate adjusted by downstream throttle valve with Δp = 250 bar (3600 psi)
4. Response = time from step input signal until reduced output pressure reaches 90% of step change, as measured by transducer

Test Circuit



KBX(C)G-6/8 Models

Dimensions are shown in mm (inches)



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

"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 Danfoss, 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.

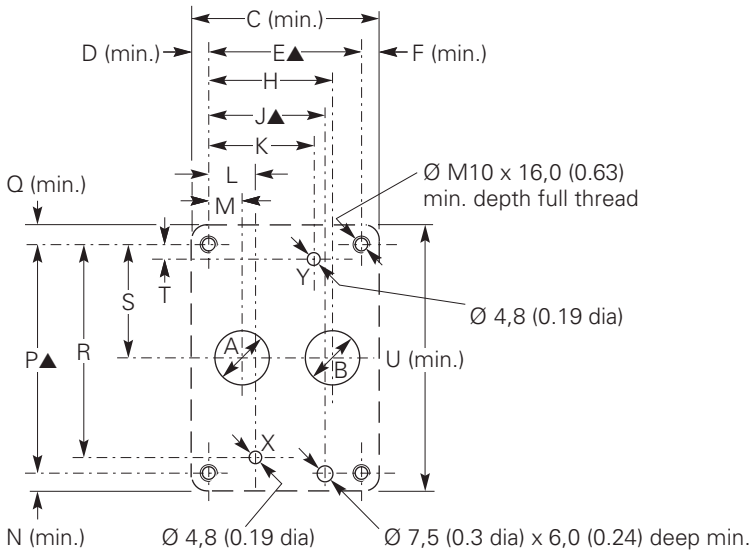
Port functions

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

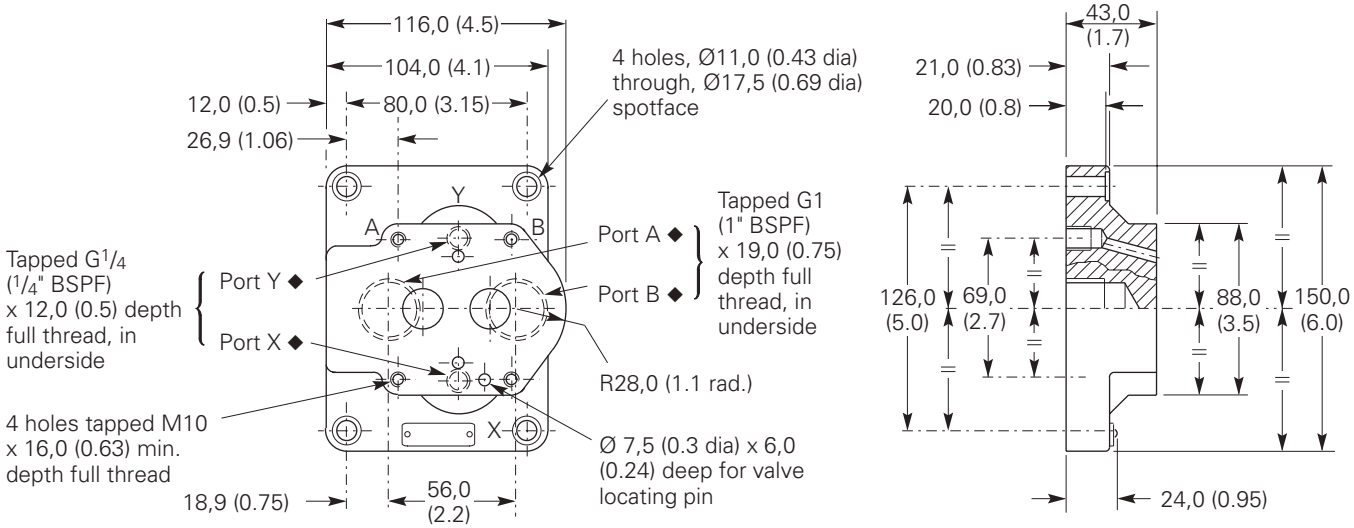
Y = Drain port



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)

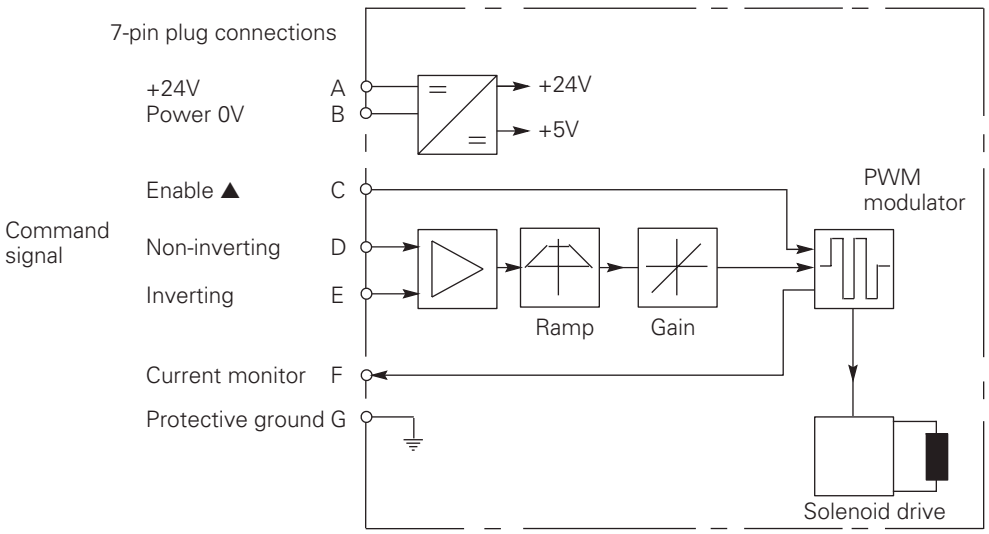
▲ Tolerance on bolt and pin locations ±0,1 mm (±0.004").

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 by Danfoss™ 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)

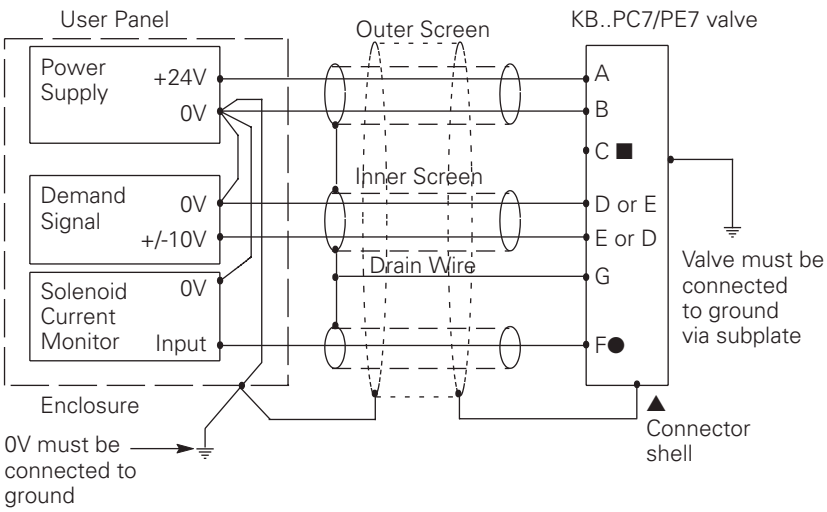
Screen (Shield)

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

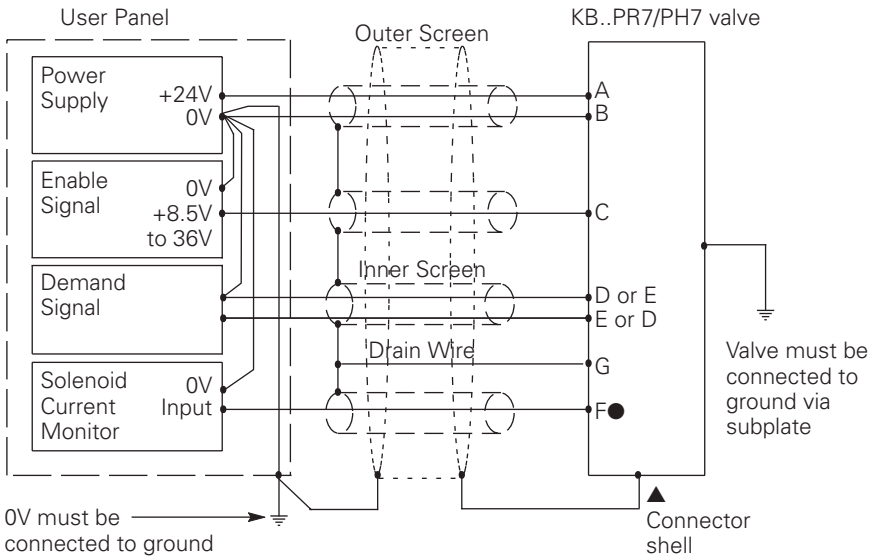
Wiring Connections



■ 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 Danfoss 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

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