ENGINEERING
TOMORROW

User Guide

AxisPro® KBSD14-05 01 Series
Servo-Performance Proportional Directional Valve



https://powersource.danfoss.com/products/hydraulic-valves/industrial-valves

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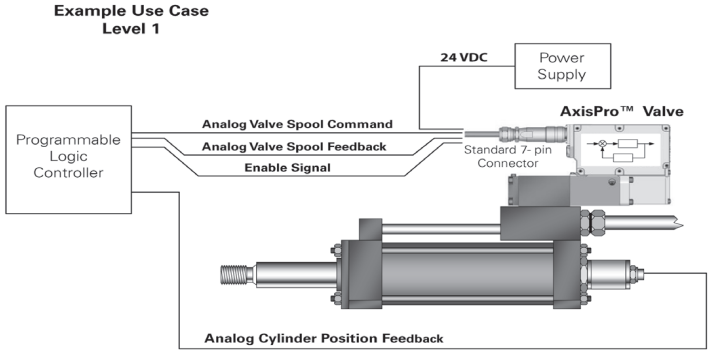
12. Application Data 31

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to meet specific standards outlined in the European Electromagnetic Compatibility Directive (EMC) 2014/30/EU which repealed Directive 2004/108/EC.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 including amendment 2015/863.

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1. Introduction

Axis Pro 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 KBSD14-05 (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 or 12-pin main connector from an external axis control device.

1.1 General Description

Built on the proven KBS servo Proportional Valve technology, the AxisPro™ Proportional Valve provides a range of control capabilities in a modular design.

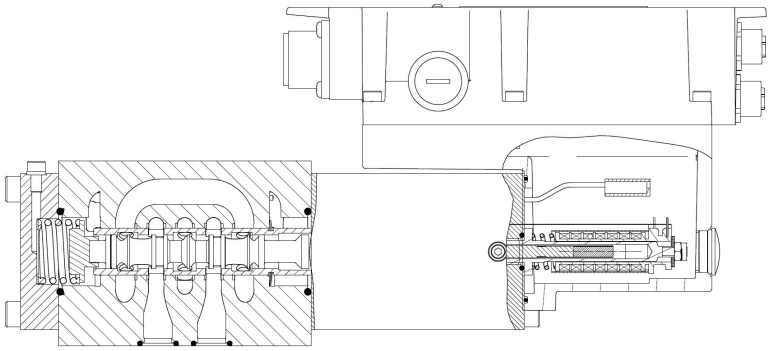
These four-way solenoid operated proportional valves offer high dynamic performance which enables them to be used in closed-loop control applications previously only possible using servo valves. Best-in- class ingression protection rated to IP65 and IP 67, combined with up to 85°C (185°F) ambient temperature allows operation in demanding environments.

1.2 Unique benefits from AxisPro

Reliable, extended uptime is enabled by valve and systems diagnostics capability. LEDs provides on-valve diagnostics information for valves. Access to systems and machine health data can be made available via CANopen and Ethernet networked valves.

Leverage inventory of AxisPro valves by configuration through software. One valve SKU can serve multiple needs: Valves can be configured via Danfoss's Pro-FX™ Configure software tool for optional command signal: Voltage or current, as well as activating the "enable"-pin. Valves can also have CAN and Industrial Ethernet bus activated and control modes selected and configured.

Typical Section View of KBSD14-05



2. Model Code

KBSD14	05	**********	N	*	*	***	**	N	01	H	001	00	*****
1	2	3	4	5	6	7	8	9	10	11	12	13	14

1 Valve Type

KBSD14 – Servo performance proportional valve with integral amplifier and electronic feedback, level 1

2 Interface

05 – ISO 4401, Size 05-04-0-05 ANSI/B93.7M-D05

3 Spool/Sleeve

0000092L100 – Symmetric -100ℓ/min – At Failsafe -all ports Blocked
00000092L80 – Symmetric -80ℓ/min – At Failsafe -all ports blocked
00000092L50 – Symmetric -50ℓ/min – At Failsafe -all ports blocked
00000092L25 – Symmetric -25ℓ/min – At Failsafe -all ports blocked
0000096L100 – Symmetric -100ℓ/min – At Failsafe -P port blocked, A,B,T connected
00000096L80 – Symmetric -80ℓ/min – At Failsafe -P port blocked, A,B,T connected
00000096L50 – Symmetric -50ℓ/min – At Failsafe -P port blocked, A,B,T connected
00000096L25 – Symmetric -25ℓ/min – At Failsafe -P port blocked, A,B,T connected
0000094L100 – Symmetric -100ℓ/min – At Failsafe reduced flow A connected to T and B connected to P
00000094L80 – Symmetric -80LPM - At Failsafe reduced flow A connected to T and B to P
00000094L50 – Symmetric -50LPM - At Failsafe reduced flow A connected to T and B to P
00000094L25 – Symmetric -25LPM - At Failsafe reduced flow A connected to T and B to P
0092L100N70 – Asymmetric -100LPM A; 70LPM B - At Failsafe -all ports blocked
0092L100N50 – Asymmetric -100LPM A; 50LPM B - At Failsafe -all ports blocked
0092L100N25 – Asymmetric -100LPM A; 25LPM B - At Failsafe -all ports blocked
00092L50N25 – Asymmetric -50LPM A; 25LPM B - At Failsafe - all ports blocked
0096L100N70 – Asymmetric -100LPM A; 70LPM B - At Failsafe -P port blocked, A,B,T connected
0096L100N50 – Asymmetric -100LPM A; 50LPM B - At Failsafe -P port blocked, A,B,T connected
0096L100N25 – Asymmetric -100LPM A; 25LPM B - At Failsafe -P port blocked, A,B,T connected
00096L50N25 – Asymmetric -50LPM A; 25LPM B - At Failsafe -P port blocked, A,B,T connected
0092L10T100 – 2-gain Symmetric – 10LPM @ 40% -100LPM @100% - At Failsafe -all ports blocked
00092L05T50 – 2-gain Symmetric – 05LPM @ 40% -50LPM @100% - At Failsafe -all ports blocked
0096L10T100 – 2-gain Symmetric – 10LPM @ 40% -100LPM @100% - @Failsafe -P port blocked, A,B,T connected
00096L05T50 – 2-gain Symmetric – 05LPM @ 40% -50LPM @100% - @Failsafe -P port blocked, A,B,T connected

4 Pilot supply & drain option

N – Not applicable

5 Command Signal

1 +/- 10V voltage command
2 4-20mA current command
3 +/-10mA current command
4 +/- 15mA current command
5 +/- 20mA current command

6 Monitor Output

1 +/- 10V voltage feedback signal
2 4-20mA current feedback signal

7 Electrical connection

C07 – 7 pin connector without plug, no enable
E07 – 7 pin connector with plug, no enable
H07 – 7 pin connector with plug, pin "C" enable
R07 – 7 pin connector without plug, pin "C" enable
C12 – 12 pin connector without plug, no enable
E12 – 12 pin connector with plug, no enable
H12 – 12 pin connector with plug, pin "C" enable
R12 – 12 pin connector without plug, pin "C" enable

8 Digital communication interface

NS – No option
CO – CANopen
PN – Profinet
EI – Ethernet/IP
EC – EtherCAT

9 External sensor

N – No option

10 Design Series

01 – 01 series, subject to change

11 Coil Rating

H – 24V DC Amplifier supply

12 Software revision

001 – Software revision

13 Seal option

00 – FKM Seals
F1 – NBR Seals

14 Special Feature

00000 – Not applicable
CR720 – 720 hours of corrosion protection
VR000 – Standard corrosion protection, high vibration resistance
VR720 – 720 hours of corrosion protection, high vibration resistance

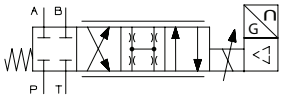
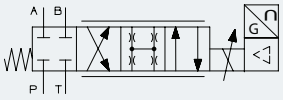
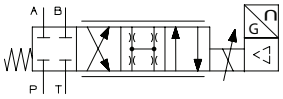
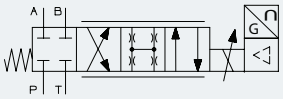
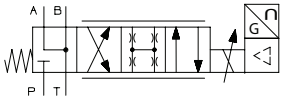
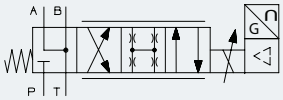
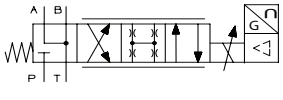
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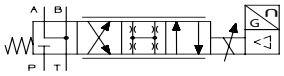
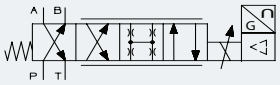
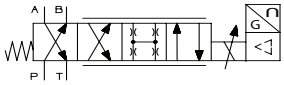
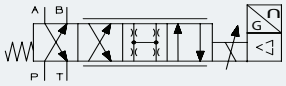
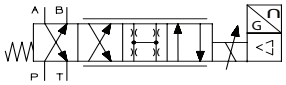
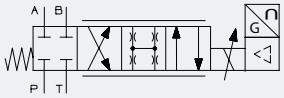
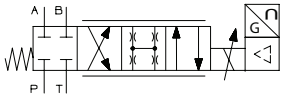
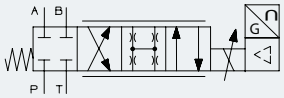
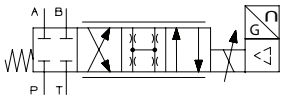
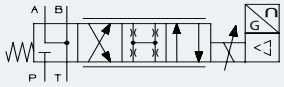
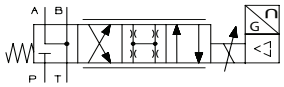
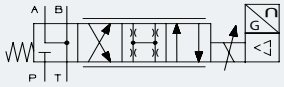
3. Spool Sleeve Details

Spool/Sleeve Code (Symmetric Spools)
Example: **92L100**
92L: Failsafe behavior
100: Flow rating per metering flow path, e.g. 'P – A' or 'P – B' or 'A - T' or 'B - T' in lpm at 70 bar ΔP

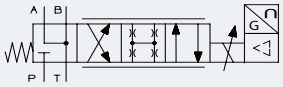
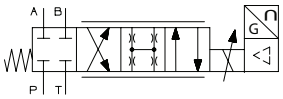
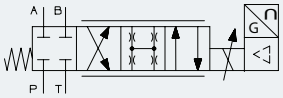
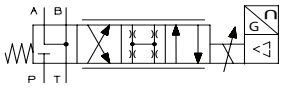
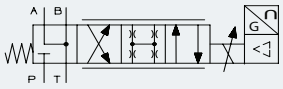
Spool/Sleeve Code (Asymmetric Spools)
Example: **92L100N70**
92L: Failsafe behavior
100: Flow rating 'P – A' or 'A – T' (A port flow)
N: Designator for asymmetric spools
70: Flow rating 'P – B' or 'B – T' (B port flow) in lpm at 70 bar ΔP

Spool/Sleeve Code (Dual Gain Spools)
Example: **92L10T100**
92L: Failsafe behavior
10: Flow rating per metering flow path, for first gain (40% or 60% command)
T: Kink at 40%
100: Flow rating per metering flow path, for second gain (100 % command) in lpm at 70 bar ΔP

Spool/Sleeve	Symbol	Failsafe Behavior	Flow ℓ/min@ ΔP 70 bar	Symmetric	Asymmetric	Single Gain	Dual Gain	Notes
92L100		All Ports blocked	100	√		√		
92L80		All Ports blocked	80	√		√		
92L50		All Ports blocked	50	√		√		
92L25		All Ports blocked	25	√		√		
96L100		P - Blocked A,B,T connected	100	√		√		
96L80		P - Blocked A,B,T connected	80	√		√		
96L50		P - Blocked A,B,T connected	50	√		√		

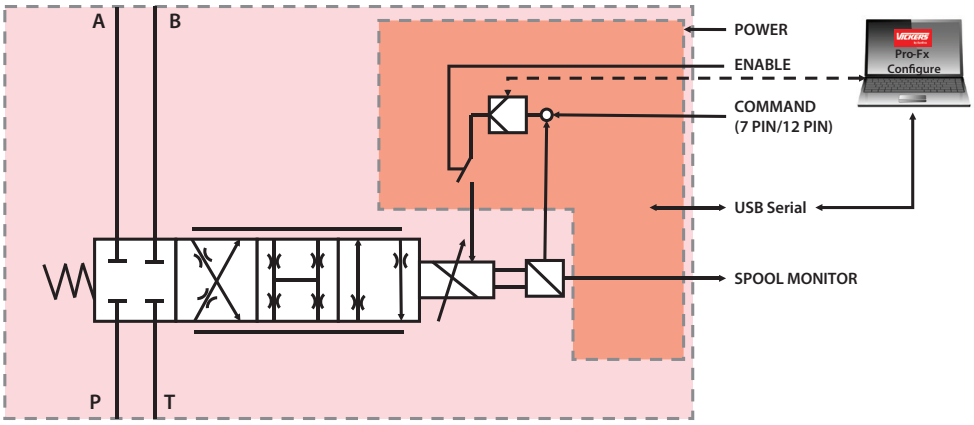
Spool/Sleeve	Symbol	Failsafe Behavior	Flow ℓ/min@ ΔP 70 bar	Symmetric	Asymmetric	Single Gain	Dual Gain	Notes
96L25		P - Blocked A,B,T connected	25	√		√		
94L100		Reduced flow, A Connected to T, B connected to P	100	√		√		
94L80		Reduced flow, A Connected to T, B connected to P	80	√		√		
94L50		Reduced flow, A Connected to T, B connected to P	50	√		√		
94L25		Reduced flow, A Connected to T, B connected to P	25	√		√		
92L100N70		All Ports blocked	100/70		√	√		
92L100N50		All Ports blocked	100/50		√	√		
92L100N25		All Ports blocked	100/25		√	√		
92L50N25		All Ports blocked	50/25		√	√		
96L100N70		P - Blocked A,B,T connected	100/70		√	√		
96L100N50		P - Blocked A,B,T connected	100/50		√	√		
96L100N25		P - Blocked A,B,T connected	100/25		√	√		

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Spool/Sleeve	Symbol	Failsafe Behavior	Flow ℓ/min@ ΔP 70 bar	Symmetric	Asymmetric	Single Gain	Dual Gain	Notes
96L50N25		P - Blocked A,B,T connected	50/25		√	√		
92L10T100		All Ports blocked	10 @ 40% 100 @100%	√			√	
92L05T50		All Ports blocked	5 @ 40% 50 @100%	√			√	
96L10T100		P - Blocked A,B,T connected	10 @ 40% 100 @100%	√			√	
96L05T50		P - Blocked A,B,T connected	5 @ 40% 50@ 100%	√			√	

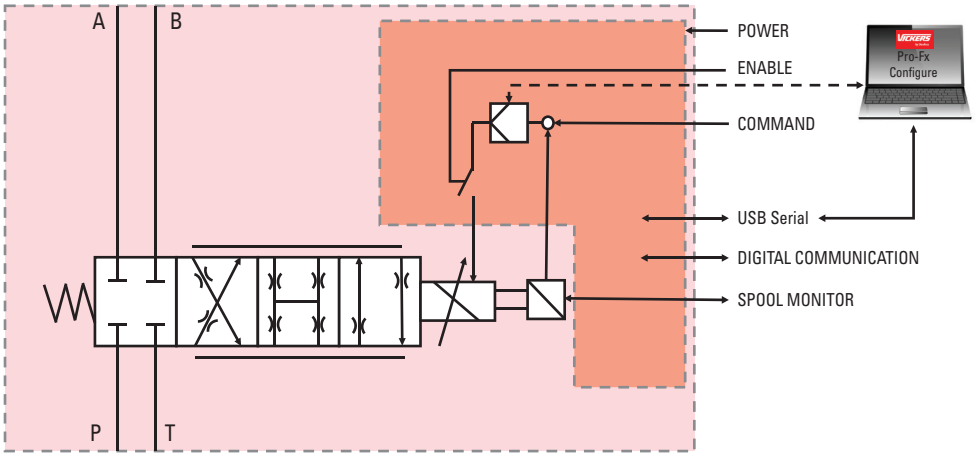
4. Functional Block Diagram

*Model type KBSD14-05-**********-N-*-*-***-**NS**-N-01-H-001-00-*****



Centralized motion control, relying on external motion controller, not shown in the diagram. Command can be analog via the 7-Pin/12-Pin connector.

*Model type KBSD14-05-**********-N-*-*-***-**CO/PN/EI/EC**-N-01-H-001-00-*****



Centralized motion control, relying on external motion controller, not shown in the diagram. Command can be analog via the 7-Pin/12-Pin connector or via Digital Communication options CANopen or Profinet or Ethernet/IP or EtherCAT using the M12 connections illustratedon page 15.

5. Maximum Operating Pressure

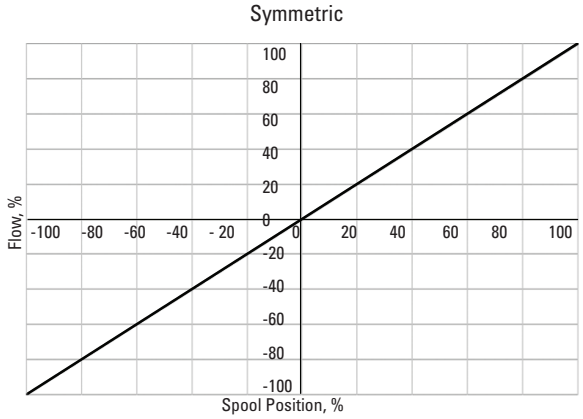
Ports	Operating Pressure	
	bar	psi
P,A,B	350	5075
T	250	3625

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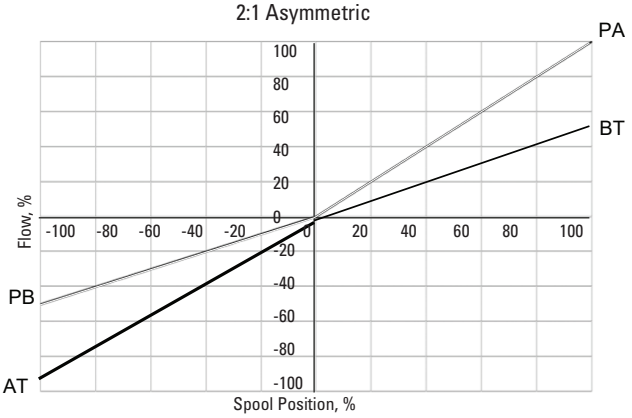
6. Spool/Sleeve Combinations

Functional Representation

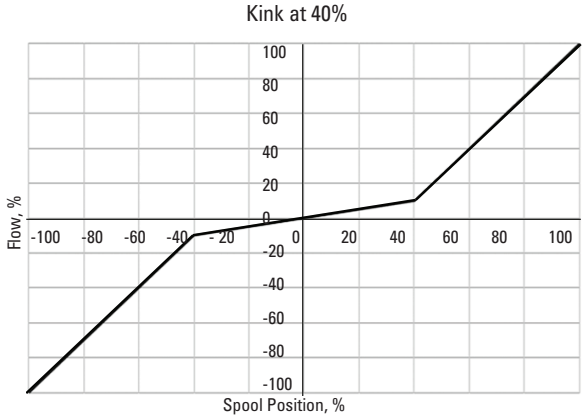
Spool/Sleeve#: 92L**, 96L**, 94L**, 76L**



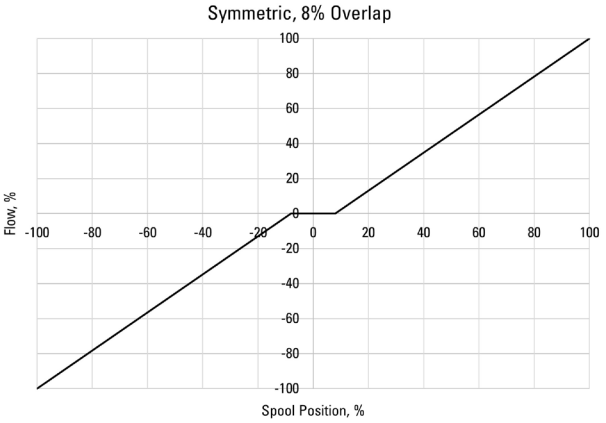
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Spool/Sleeve#: 92L**T**, 96L**T**



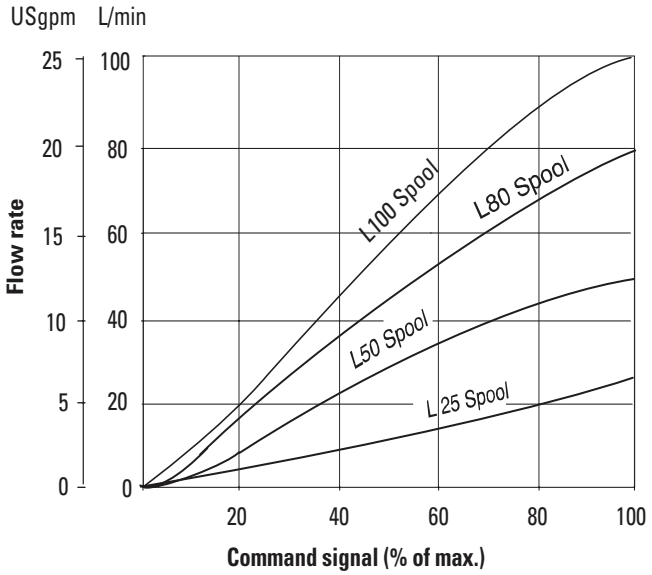
Spool/Sleeve#: 82L**, 86L**



7. Performance Curves

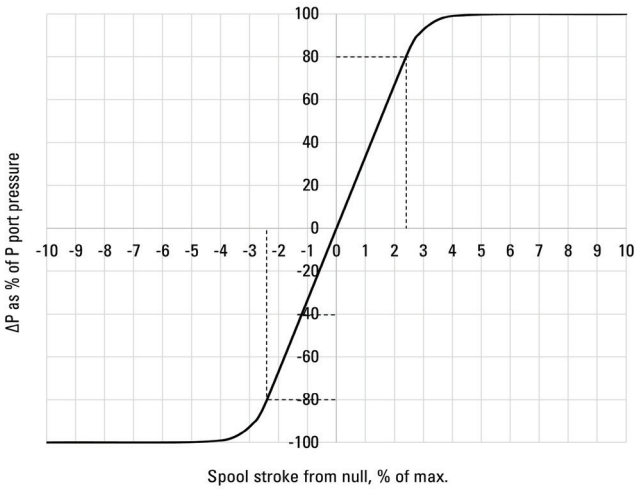
Flow Gain

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



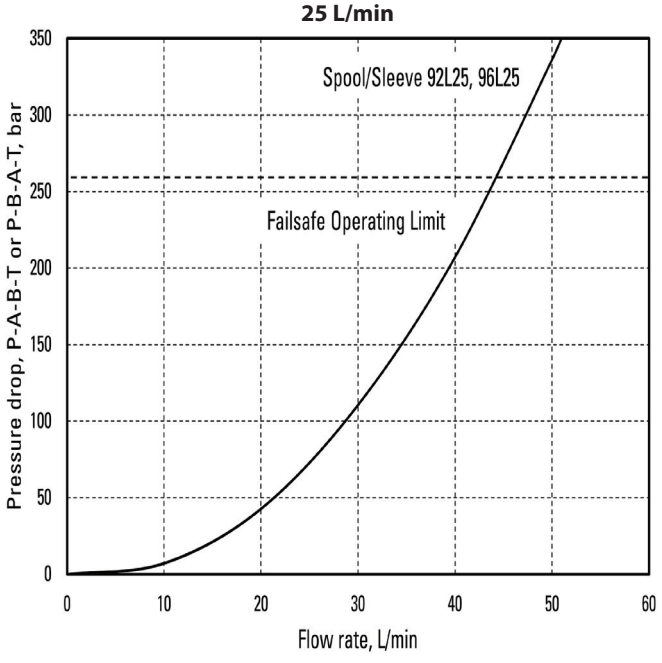
Pressure Gain

Δp between ports A and B or B and A, as % of port P pressure

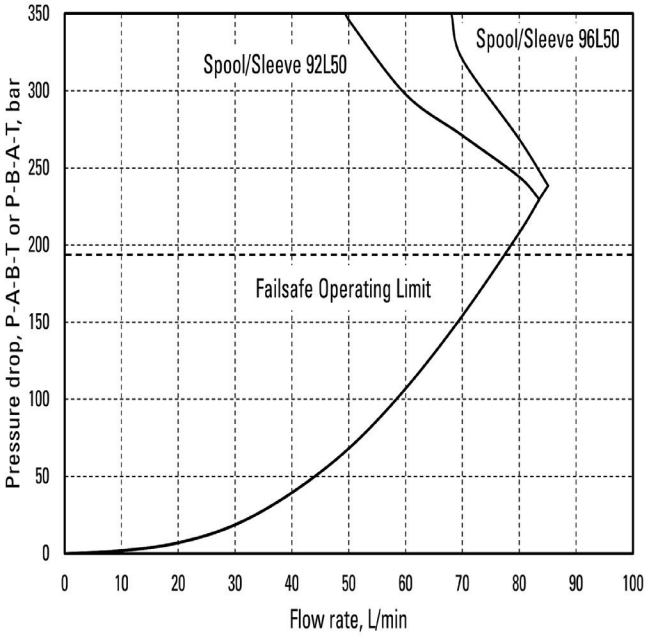


Power Capacity Envelopes

25 L/min



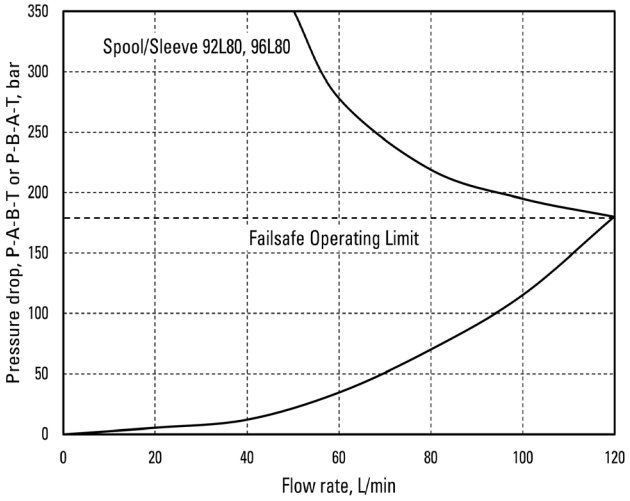
50 L/min



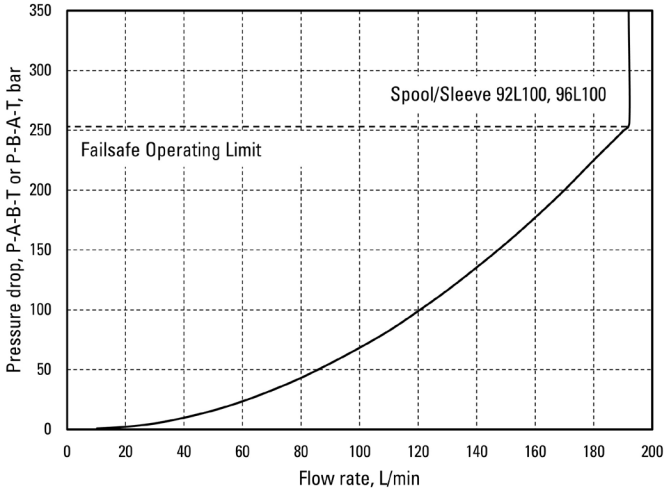
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7. Performance Curves *(Continued)*

80 L/min

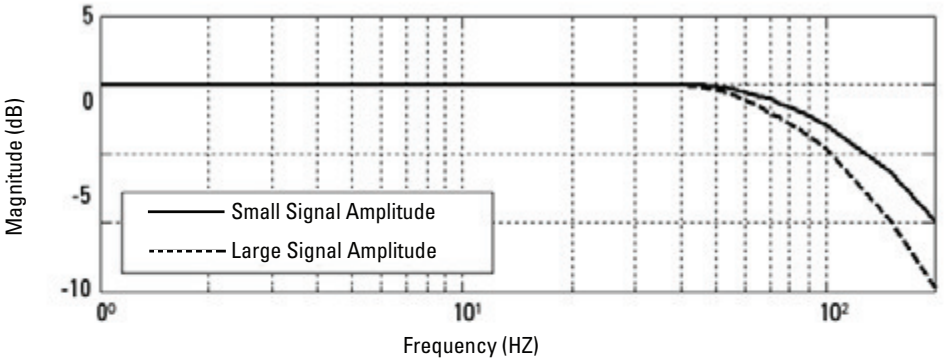


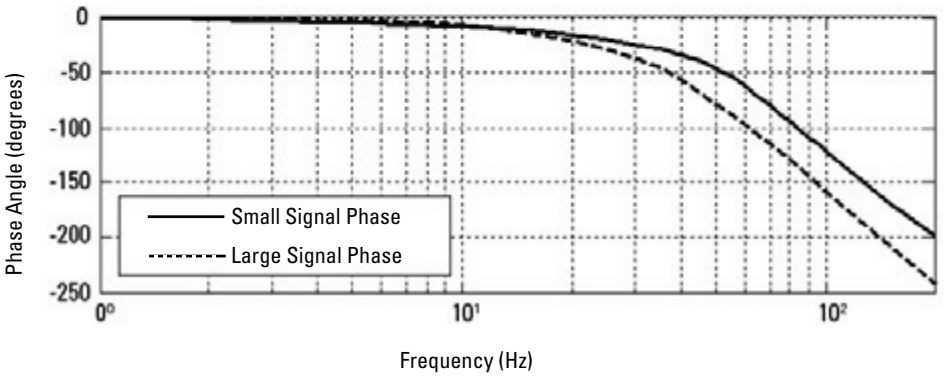
100 L/min



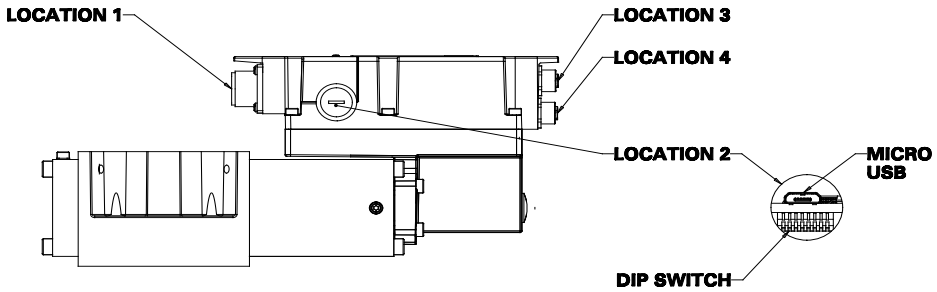
Operating Limit: When operating the valve beyond the operating pressure limit, spool may not return to failsafe when power is removed

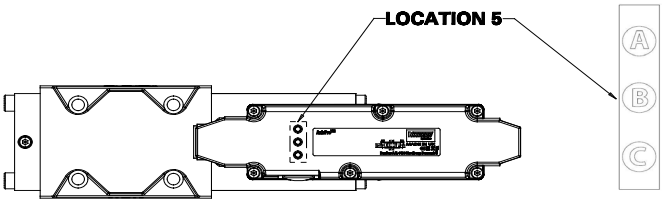
Frequency Response, typical
For amplitudes of +/- 5% with zero offset, +/- 25% with +/- 50% offsets. Δp (P to T) = 70 bar (1000 psi)



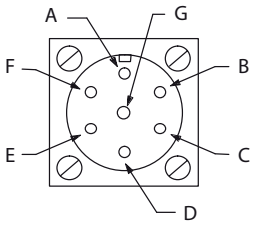
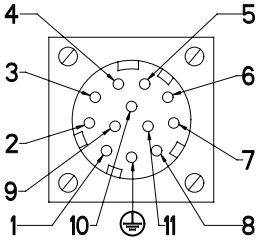


8. Operating Data

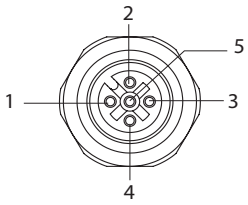
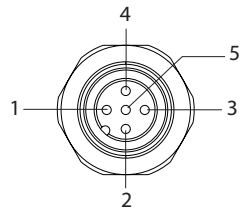
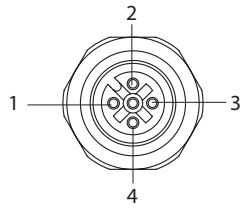




8.1 Connector Details

Connector	Image	Pin	Signal	Technical specification	Note
LOCATION 1 7-pin plug connector		A	Power supply positive (+)	Supply voltage: 18-36 V DC	To ensure EMI protection use only metal shielded mating connectors. Mating 7-pin (connector) is Danfoss part number 934939
		B	Power supply 0V ground return	Power supply ground (0V)	
		C	Not connected / Valve enable	Enable Signal >12V (max 36V)	
		D	Command signal (+V or current in)	Voltage mode: ±10V DC Current mode: 4-20 mA or ±20mA	
		E	Command signal return	Command signal (-V or current GND)	
		F	Monitor output	Voltage mode: ±10V DC, Current mode: 4-20 mA	
		G	Protective earth	Internally connected to housing	
LOCATION 1 12-pin plug connector		1	+24V Drive stage supply	Supply Voltage: 18-36 V DC	To ensure EMI protection use only metal shielded mating connectors. Mating 12-pin (connector) is Danfoss part number 12007132.
		2	Power supply 0V	Power supply ground	
		3	Valve enable	Enable Signal >12V (max 36V)	
		4	Command signal (+V or current in)	Voltage mode: ±10V DC, Current mode: 4-20 mA or ±20mA DC	
		5	Command signal (-V or current GND)	Command signal (-V or current GND)	
		6	Monitor output	Voltage mode: ±10V DC, Current mode: 4-20 mA	
		7	NC		
		8	Enable acknowledgement (24V)	Fault-free operation: 0V Error: 24V (Equivalent to input power supply) max current: 50mA	
		9	+24V Power supply Electronics	Supply Voltage: 18-36 V DC Max. ripple: 10% peak-to-peak (comply with absolute supply voltage limit values)	
		10	GND (0 V)	Power supply ground (0V)	
		11	Error output signal (24 V)	Fault-free operation: 0V Error: 24V (Equivalent to input power supply) max current: 1.5A	
		12	Protective earth	Internally connected to housing	

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Connector	Image	Pin	Description	Note
LOCATION 3 M12 5-pin CAN Connector (Female)		1	CAN shield	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	
LOCATION 4 M12 5-pin CAN Connector (Male)		1	CAN shield	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	
LOCATION 3 - PORT 0 **LOCATION 4 - PORT 1** M12 4-pin Ethernet Connector (Female)		1	TxD+	M12 connector is D-Coded To ensure EMI protection use only premade CAT5 or CAT 6 cable.
		2	RxD+	
		3	TxD-	
		4	RxD-	

8.2 LED Diagnostic Details (Location 5)

Diagnostic	Color	CANopen	Profinet	Ethernet/IP	EtherCAT
	[A]Green	CAN Connection status	Port 0 connection status	Module status	Run
	[A] Red	Not used	System error	Not used	Not used
	[B] Green	Device status	Device status	Device status	Device status
	[B] Red	Fault Manager	Fault Manager	Fault Manager	Fault Manager
	[C] Green	Not used	Port 1 connection status	Not used	Not used
	[C] Red	Communication error	Communication error	Network status	Error

For detailed information on LED Diagnostics, see below table.

CANopen LED Indication details

LED	State	Description
LED A GREEN	Flashing (2.5Hz ON/OFF rate, 200ms ON, 200ms OFF)	Device is in CANopen NMT Pre-Operational state.
	ON	Device is in CANopen NMT operational state.
	Single flashing (Sequence of 200ms ON, 1000ms OFF)	Device is in NMT stop state.
LED A RED	OFF	Not used

CANopen LED Indication details (Continued)

LED	State	Description
LED B GREEN	1Hz frequency (500ms ON and 500ms OFF)	No error
	OFF	Device error or in boot mode
LED B RED	OFF	No error
	Blinking (1Hz, 500ms ON 500ms OFF)	Warning faults
	Fast blinking (2Hz, 250ms ON and 250ms OFF)	Critical faults
LED C GREEN	OFF	Not used
LED C RED	OFF	Not used
	Single flashing (Sequence of 200ms ON, 1000ms OFF)	At least one of the error counters of the CAN controller has reached the maximum errxxxor count
	Double flash (Sequence of 200ms ON, 200ms OFF, 200ms ON, 1000ms OFF)	Node guard or heartbeat error

Profinet LED Indication details

LED	State	Description
LED A GREEN	OFF	The device has no link to the port 0
	Flickering	The device sends/receives frames port 0
LED A RED	OFF	No Error
	Flashing (1Hz,3S)	DCP signal service is initiated via the bus.
	ON	Watchdog timeout; channel, generic or extended diagnosis present; system error
LED B GREEN	1Hz frequency (500ms ON and 500ms OFF)	No error
	OFF	Device error or in boot mode
LED B RED	OFF	No error
	Blinking (1Hz, 500ms ON 500ms OFF)	Warning faults
	Fast blinking (2Hz, 250ms ON and 250ms OFF)	Critical faults
LED C GREEN	OFF	The device has no link to the port 1
	Flickering	The device sends/receives port 1
LED C RED	OFF	No Error
	Flashing(2Hz)	No data exchange
	Single Flash (200ms On and 1000ms Off)	Device is in Boot mode
	ON	No configuration; or low speed physical link; or no physical link

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Ethernet/IP LED Indication details

LED	State	Description
LED A GREEN	OFF	LED Module Status No Power
	Blink with 10 Hz Frequency (100ms ON 100ms OFF)	LED Module Status Self-Test
	Blink with 2.5 Hz (400 ms ON and 400 ms OFF)	LED Module Standby Activated
	Steady ON	LED module Operational
LED A RED	OFF	Not used
LED B GREEN	1Hz frequency (500ms ON and 500ms OFF)	No error
	OFF	Device error or in boot mode
LED B RED	OFF	No error
	Blinking (1Hz, 500ms ON 500ms OFF)	Warning faults
	Fast blinking (2Hz, 250ms ON and 250ms OFF)	Critical faults
LED C GREEN	OFF	Not used
LED C RED	OFF	LED Network Status Indicator Steady OFF or LED Network Status Indicator Connection time out
	Blink 400ms	LED Network Status Indicator No Connection
	ON	LED Network Status Indicator connected

EtherCAT LED Indication details

LED	State	Description
LED A GREEN	OFF	Init
	Blinking	Pre-Operational
	Single Flash	Safe-Operational
	ON	Operational
LED A RED	OFF	Not used
LED B GREEN	1Hz frequency (500ms ON and 500ms OFF)	No error
	OFF	Device error or in boot mode
LED B RED	OFF	No error
	Blinking (1Hz, 500ms ON 500ms OFF)	Warning faults
	Fast blinking (2Hz, 250ms ON and 250ms OFF)	Critical faults
LED C GREEN	OFF	Not used
LED C RED	OFF	No Error
	Blinking	Invalid Configuration
	Single Flash	Unsolicited State Change
	Double Flash	Application Watchdog Timeout
	Flickering	Booting Error
	ON	PDI Watchdog Timeout

8.3 DIP Switch: Baud rate & node ID setting (Location 2)

The baud rate and Node ID can be set by SDO or 8 pin DIP switch. The default baud rate is 125 kbps. Possible baud rate supported are 125 kbps, 250 kbps, 500 kbps and 1000 kbps. The upper two MSB pin B7 & B6 are used for baud rate setting as per the table, while remaining 6 pins B5 to B0 are used for Node ID from 1 to 63.

DIP switch
Setting of node ID & baud rate:
Switch up = 0
Switch down = 1

Example for setting baud rate & node ID

- To set the Node ID use switch B0 (LSB) to B5 that is 6-bit node address; to set Node ID to 3 make switch B0 &B1 to 1 by pulling down and remaining switched B2 to B5 make 0 by pulling up.
- To set the baud rate use switch B6 & B7 (MSB) that is 2-bit baud rate setting; to set baud rate to 500 kbps make only switch B7 to 1 by pulling down and B6 to 0 by pulling up.

DIP8/B7	DIP7/B6	BAUD RATE
0	0	125 kbps
0	1	250 kbps
1	0	500 kbps
1	1	1000 kbps

B7	B6	B5	B4	B3	B2	B1	B0	HEX	Baud rate B7/B6	Node ID B5…B0
0	0	0	0	0	0	0	0	00	125 kbps	Default (Node ID 1) Node ID = 1....63
0	0	0	0	0	1	0	1	05		
0	0	1	1	1	1	1	1	3F		
0	1	0	0	0	0	0	0	40	250 kbps	Default (Node ID 1) Node ID = 1....63
0	1	0	0	0	0	0	1	41		
0	1	1	1	1	1	1	1	7F		
1	0	0	0	0	0	0	0	80	500 kbps	Default (Node ID 1) Node ID = 1....63
1	0	0	0	0	0	0	1	81		
1	0	1	1	1	1	1	1	BF		
1	1	0	0	0	0	0	0	C0	1000 kbps	Default (Node ID 1) Node ID = 1....63
1	1	0	0	0	0	0	1	C1		
1	1	1	1	1	1	1	0	FE		

8.4 Micro USB serial communication (Location 2)

The microUSB 2.0 port is not intended for a permanent installation when the valve body and the computer both have connections to protective earth. The USB ground is not isolated, so either the computer should run on a battery (laptop) or the valve should not be connected to ground. If that cannot be achieved, please use a USB isolator between the computer and the valve. Also consider that the IP67 is compromised when the PG plug is removed and the USB connection used.

Recommended cable type: Standard "A" Male to Micro-B Male.
Note: It is recommended to use a USB isolator to eliminate any ground loops through the serial USB port.

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8.5 Electromagnetic compatibility (EMC)

Electromagnetic compatibility (EMC):	IEC61326-1 2021
Conducted Emissions CISPR 11	2024/EN55011- Class A, 150kHz - 30MHz.
Radiated Emissions CISPR 11	2024/EN55011- Class A, 30MHz – 6GHz.
RF Continuous Conducted Disturbances (Conducted Susceptibility) IEC 61000-4-6	2023, Class A 150KHz to 80MHz • DC Power Port: 10Vrms • Signal Port: 10Vrms
RF Electromagnetic Fields (Radiated Susceptibility) IEC 61000-4-3	2020, Class A 80MHz-1000MHz: (10V/m) 1.4GHz-6GHz: (3V/m)
Surges IEC 61000-4-5	2014+A1: 2017, Class B
DC Power Port	±0.5kV Line to Line, ±1kV Line to Ground
Signal Port	±1kV Line to Ground
Electrical Fast Transients IEC 61000-4-4	2012, Class B • DC Power Port: ±2kV • Signal Port: ±1kV
Electrostatic Discharges (ESD) IEC 61000-4-2	2008, Class B • Air discharges: ±8kV • Contact discharges: ±4kV
Power Frequency Magnetic Fields IEC 61000-4-8	2009, Class A • (30A/m), Continuous field
Voltage Withstand Test	750V DC for 60sec

8.6 Operating Conditions

Monitor Output Signal: Voltage mode Voltage Mode Output Impedance Current Mode Current Mode Output Impedance	 ±10V DC 10 kΩ 4-20mA 0-250Ω (typ 100Ω)
Power stage PWM frequency	21 kHz nominal
Reproducibility, valve-to-valve (at factory settings): Flow gain at 100% command signal	 ≤5%
Protection: Electrical	Reverse polarity protected between pin A-B of the 7 pin plug connector and between pin 1-2 and 9-10 of the 12 pin plug connector
Ambient air temperature range for full performance	–40°C to +85°C (–13°F to +185°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	–40°C (–40°F)
Storage temperature range	–25°C to +85°C (–13°F to +185°F)
Vibration: Random Vibration (5 Hz to 2000 Hz, 10 hours per axis) Mechanical shock	 13.25 Grms 50 G, 6 positive and 6 negative pulses per axis
Power supply	24V DC (18V to 36V including 10% peak-to-peak max ripple) max current 3.2A
Command Signal: Voltage mode Input impedance Current mode	 –10V to +10V DC Field 5 = 1: 47kΩ, Field 5 = 2,3,4,5: 100Ω Field 5 = 2,3,4,5: 100Ω 13 bit resolution based on ±20mA, ±1%Field
Valve Enable Signal for model code field 7 Enable Disable Input impedance	 Disable <5V Enable Signal >12V (max 36V) 10 kΩ
Amplifier Temperature Sensing	1°C (1.8°F) resolution, -25°C (-13°F) undertemp detect, 125°C (257°F) overtemp detect
Power Supply Detect	18-36V DC, 0.01 V resolution ± 1%, 18V under voltage detect, 36V overvoltage

KBS*-05 Valves (all valves) Relative duty factor Hysteresis Mass Environmental	 Continuous rating (ED = 100%) <0.1% 5.9 kg (13 lb) approx. 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 0% to 100%, 100% to 0% 10% to 90%, 90% to 10% -10% to 10%, 10% to -10% 25% to 75%, 75% to 25%	25 ℓ/min 50 ℓ/min 80 ℓ/min 100 ℓ/min ms ms ms ms 16 16 16 22 14 14 14 19 9 9 9 13 11 11 11 18
Parts Information: Seal Kit Mating Electrical 7-pin Connector Mating Electrical 12-pin Connector	 11372782 934939 12007132

Products are compliant and certified for the following specifications. Download conformity certificate DOC00069895	
CE according to EMC directive 2014/30/EU	Tested as per EN IEC 61326-1:2021, EN IEC 61000-4-6:2023, EN IEC 61000-4-5:2014+A1:2017
CE RoHS	According to Directive 2011/65/EU
UKCA according to EMC Regulations 2016	Tested as per BS EN 61326-1:2021, BS EN 61000-4-6:2023 , BS EN 61000-4-5:2014+A1:2017
UKCA RoHS	According to 'The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012, as amended BS EN IEC 63000:2018'

MTTFd, refer EN 13849 data sheet DOC00078462	**Condition**	**MTTFd (Years)**
KBSD14-05-**********-N-*-*-*07-NS/CO-N-01-H-001-**-***** (Valves with 7 Pin connector and Analog or CANopen communication option)	Power removed (Switch off) Power applied	150 years 74.7 years
KBSD14-05-**********-N-*-*-*07-PN/EI/EC-N-01-H-001-**-***** (Valves with 7 Pin connector and Industrial ethernet communication option)	Power removed (Switch off) Power applied	150 years 55.1 years
KBSD14-05-**********-N-*-*-*12-NS/CO-N-01-H-001-**-***** (Valves with 12 Pin connector and Analog or CANopen communication option)	Power removed (Switch off) Power applied	150 years 71.9 years
KBSD14-05-**********-N-*-*-*12-PN/EI/EC-N-01-H-001-**-***** (Valves with 12 Pin connector and Industrial ethernet communication option)	Power removed (Switch off) Power applied	150 years 53.4 years

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9. Software Information

- Analog commanded spool control.
- Analog command source configuration options.
- Monitor output signal configuration options.
- Enable input signal enable/disable option.
- Valve spool position control (VPOC/VSC)
- CANopen DSP306 compliant electronic data sheet (EDS).
- Diagnostic configuration options.
- Ethernet Fieldbus option: Profinet, Ethernet/IP, EtherCAT
- TCP/IP communication for Danfoss Pro-FX™ 2.0 configuration tool - closed loop control modes are available via industrial Ethernet

All levels and models are compatible with the Danfoss Pro-FX™: For the latest revision, please visit www.danfoss.com

Download Pro-FX™, Technical Information and Support Materials from Danfoss's Website: http://www.danfoss.com

Install the Danfoss Pro-FX™ Configure PC application tool. Installation is supported on a wide range of Windows based operating systems including Windows 10/11 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 Danfoss Pro-FX™: Control development environment used with KBSD14- 03 and other Danfoss Pro-FX™ products, it is also included in the TEQ-470-A-10 test box.

The adaptors supported by Pro-FX™ Configure are:
CG150
TCP/IP
USB Serial

CANopen Version:
- CANopen Slave Device
- PDO communication with dynamic mapping support
- Baud rate supported: 125kbps, 250kbps, 500kbps and 1000kbps
- SDO communication
- EDS file available
- Pro-FX™ tool access via CANopen and serial

EtherCAT Version:
- EtherCAT Slave Device
- PDO communication 100µs ring time 5ms refresh rate
- 100/10Mbit data rate
- SDO communication (CoE)
- PDO dynamic mapping support
- ESI file available
- FW download via FoE supported
- Pro-FX™ tool access via serial

Ethernet/IP Version:
- Ethernet/IP Adapter Device
- Assembly package for Process Data 5ms refresh rate
- 100/10Mbit data rate
- two ports supported with daisy chaining, DLR support
- Class 3 explicit message support
- EDS file available
- TCP ports:
  - 80 (webserver)
  - 300 (Pro-FX™ tool)
- Pro-FX™ tool access via TCP/IP and Serial

Profinet Version:
- Protocol IO-Device
- Cyclic 5ms data exchange
- Conformance Class 2
- PROFINET IO specification: V 2.4
- 100/10 Mbit RT compatible
- Acyclic data exchange via Read Write Data
- Records
- Two ports both can be used as access, build in Switch
- GDML file for Level1 and Level2
- TCP ports:
  - 80 (webserver)
  - 300 (Pro-FX™ tool)
- Pro-FX™ tool access via TCP/IP and Serial

10. Electrical Information

10.1 Block Diagram Voltage Input (Field 5=1)

Wiring connections must be made via the 7-pin plug or 12-pin plug mounted on the amplifier. See page 22 & 23 of this user guide.

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

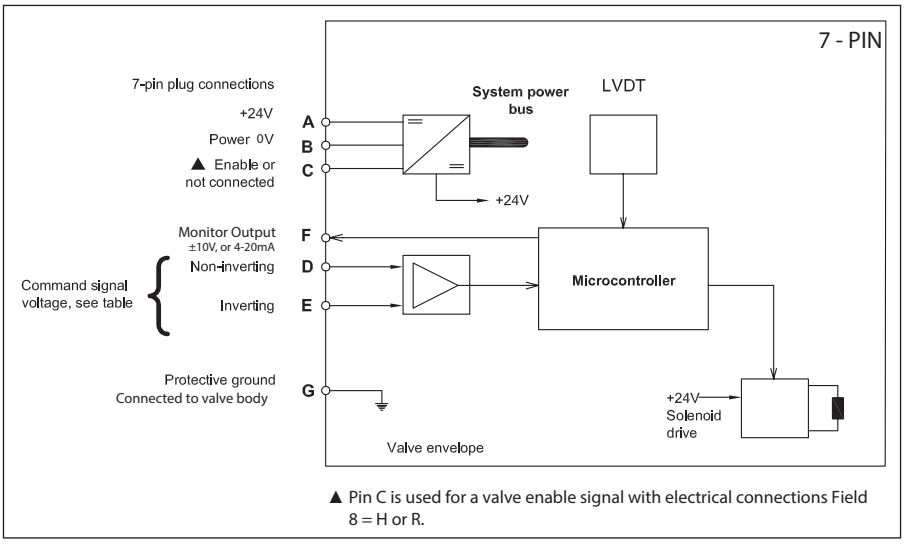
Signal cables:

0.50 mm² (20 AWG)

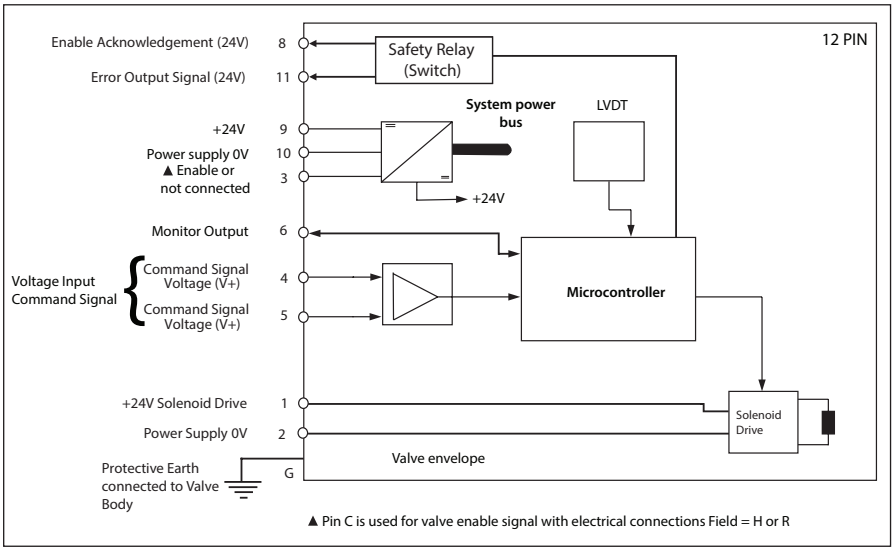
Screen (shield):

A suitable cable would have 7 cores or 10/12 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 22 & 23.

Voltage Input Mode



▲ Pin C is used for a valve enable signal with electrical connections Field 8 = H or R.



▲ Pin C is used for valve enable signal with electrical connections Field = H or R

Command Signals and Outputs, Field 5 = 1

7-pin plug / 12-pin plug		*Flow Direction*
Pin D (7-pin plug)/ Pin 4 (12-pin plug)	*Pin E (7-pin plug)/ Pin 5 (12-pin plug)*	
Positive 0V $U_D - U_E$ = Positive	0V Negative	P to A
Negative 0V $U_D - U_E$ = Negative	0V Positive	P to B

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10.2 Block Diagram Current Input (Field 5= 2,3,4,5)

Wiring connections must be made via the 7-pin plug or 12-pin plug mounted on the amplifier. See page 24 & 25 of this user guide.

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)

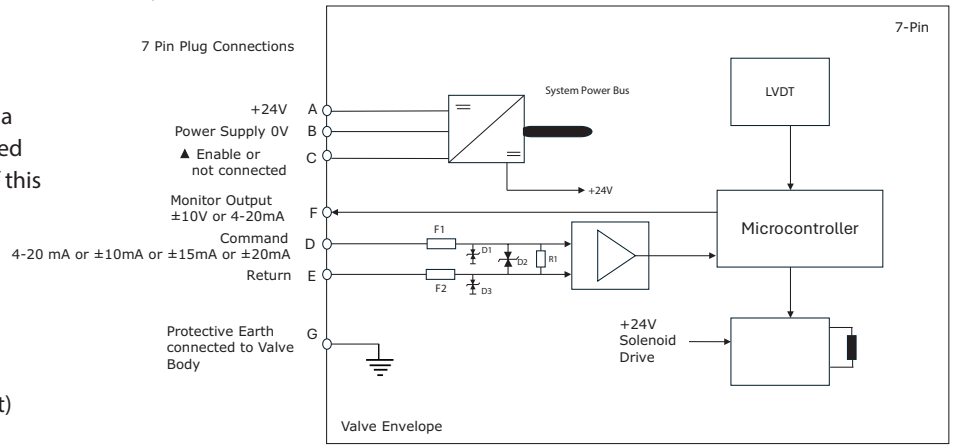
Signal cables:

0.50 mm² (20 AWG)

Screen (shield):

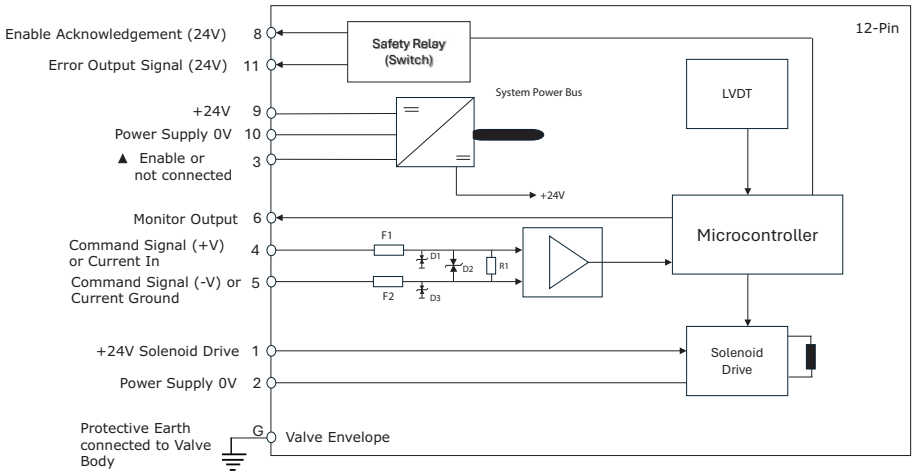
A suitable cable would have 7 cores or 10/12 cores, a separate screen for the signal wires and an overall screen. Cable outside diameter 8.0 - 10.5 mm (0.31 - 0.41 inches) See connection diagram on page 24 & 25.

Current Input Mode



▲ Pin C is used for a valve Enable signal with Electrical connections Field = H or R

R1 Shunt Resistor 100R
F1,F2 Resettable Fuse
Dx TVS Diode rated for 15V



▲ Pin C is used for a valve Enable signal with Electrical connections Field = H or R

R1 Shunt Resistor 100R
F1,F2 Resettable Fuse
Dx TVS Diode rated for 15V

Command Signals and Outputs, Field 5=2

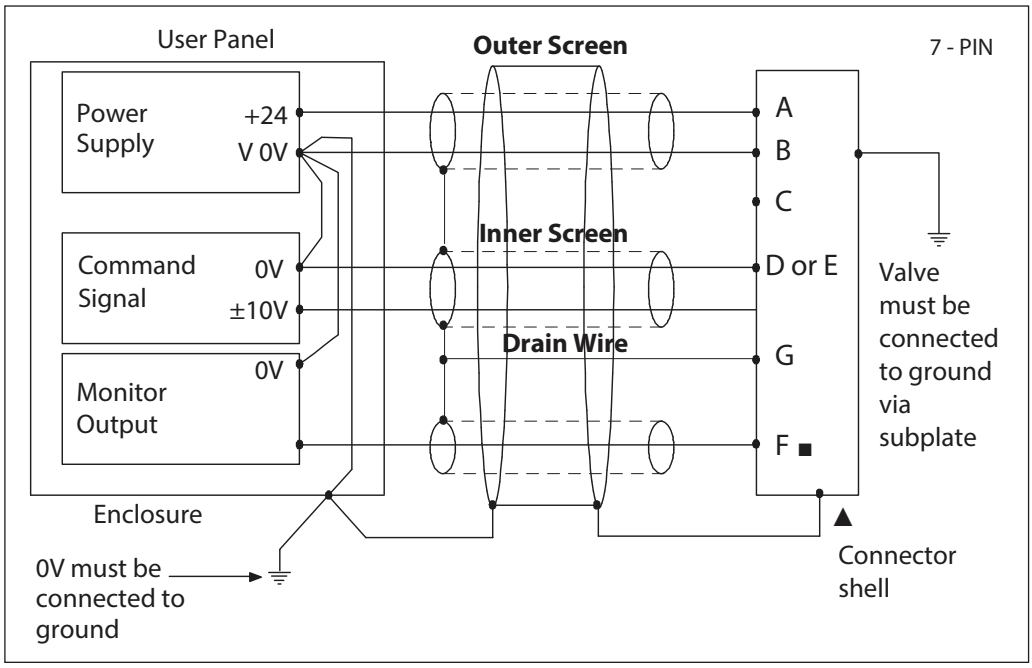
7-pin plug / 12-pin plug			*Flow Direction*
Pin D (7-pin plug)/ Pin 4 (12-pin plug)	*Pin E (7-pin plug)/ Pin 5 (12-pin plug)*	*Pin B (7-pin plug)/ Pin 2 (12-pin plug)*	
More than 12 mA	Current return	Power ground	P to A
Less than 12 mA	Current return	Power ground	P to B

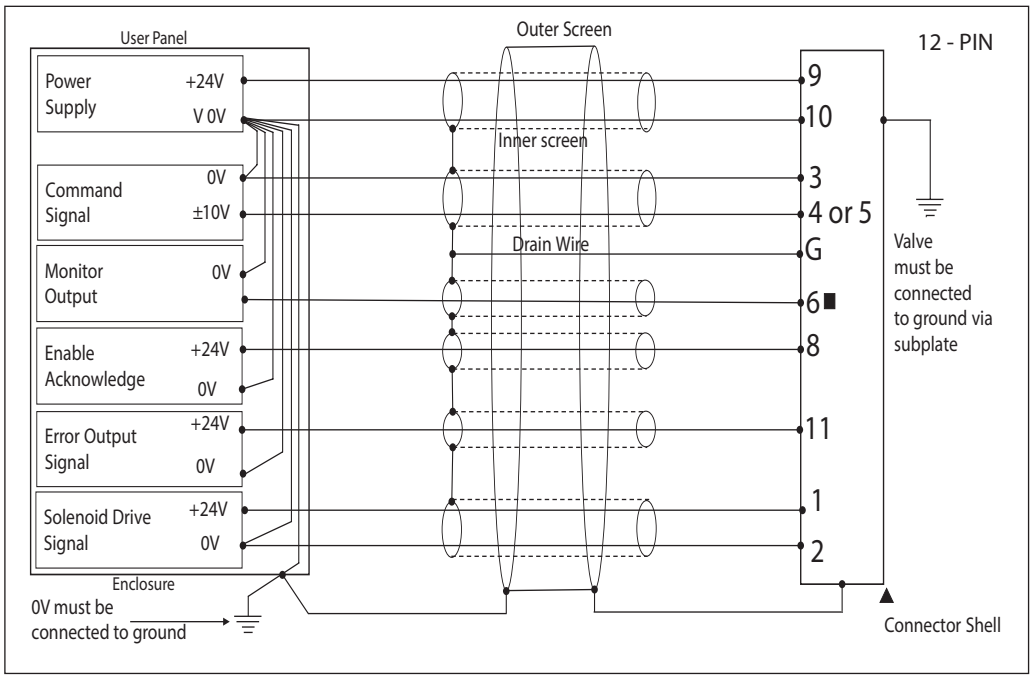
Command Signals and Outputs, Field 5=3,4,5

7-pin plug / 12-pin plug			*Flow Direction*
Pin D (7-pin plug)/ Pin 4 (12-pin plug)	*Pin E (7-pin plug)/ Pin 5 (12-pin plug)*	*Pin B (7-pin plug)/ Pin 2 (12-pin plug)*	
More than 0 mA	Current return	Power ground	P to A
Less than 0 mA	Current return	Power ground	P to B

10.3 Wiring Connections Voltage Input (Field 5 = 1)

- Spool position monitor voltage (pin F/ pin 6) will be referenced to the valve local ground (pin B/ pin 10).

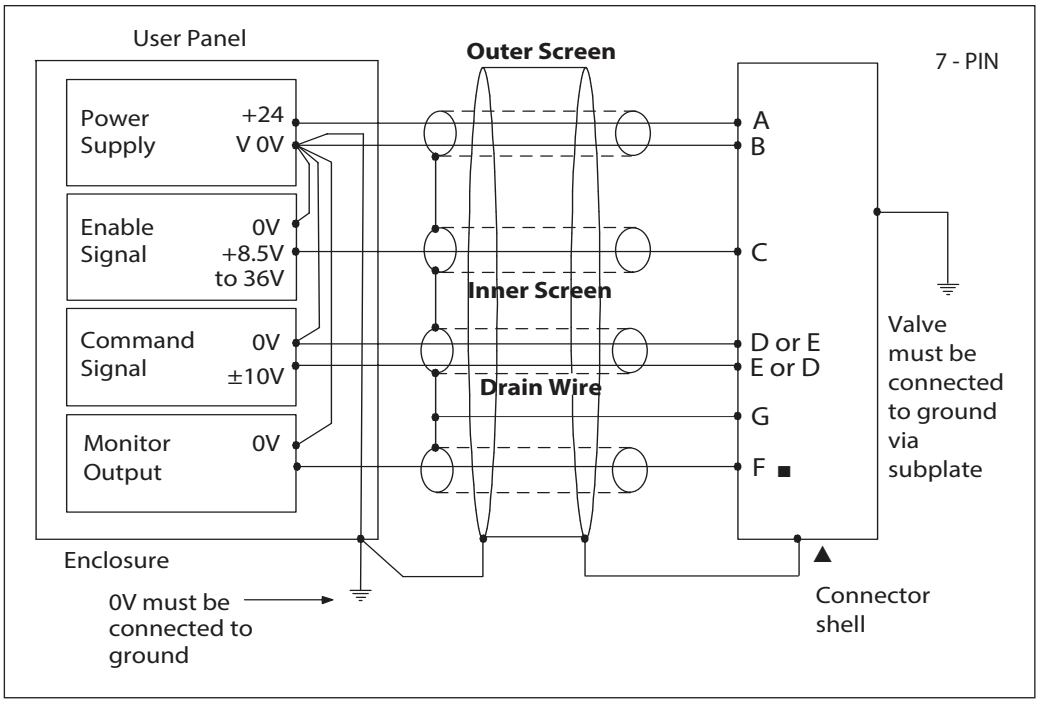


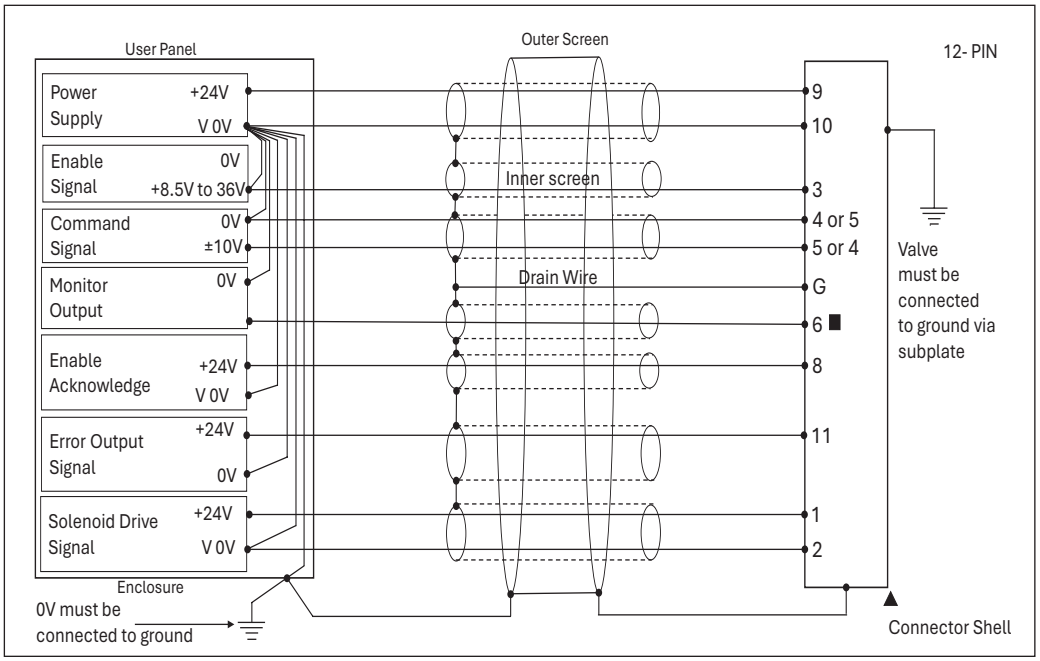


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10.4 Wiring Connections for Voltage Mode (Field 5 = 1)
Valves with Enable Feature

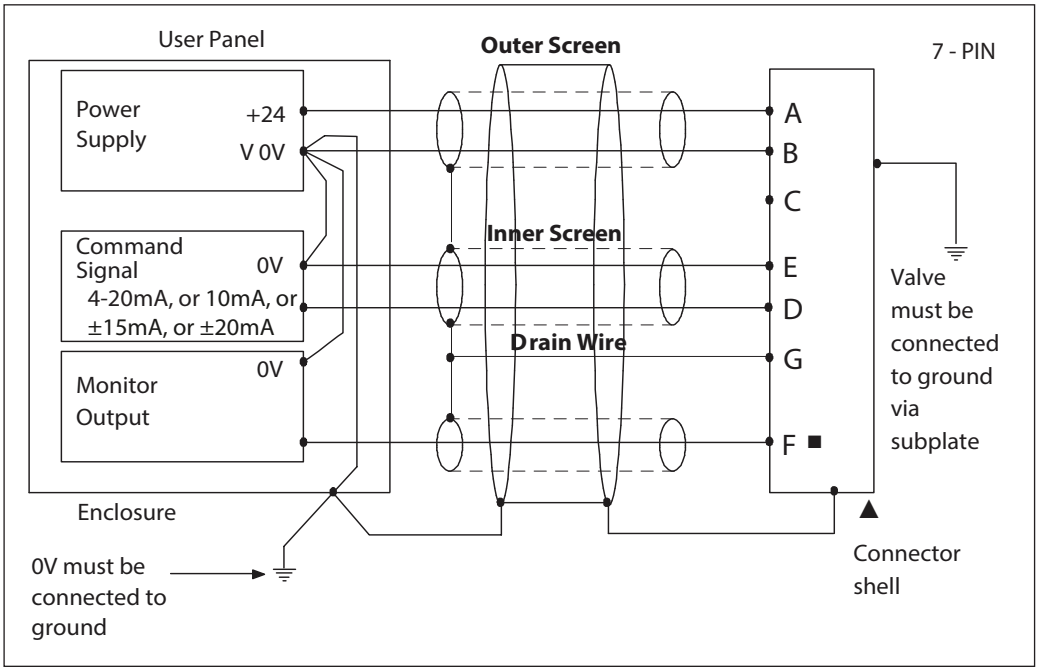
ΔNote: In applications where the valve must conform to European RFI/EMC regulations, the outer screen (shield) must be connected to the outer shell of the 7 pin connector, and the valve body must be fastened to the earth ground. Proper earth grounding practices must be observed in this case, as any differences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

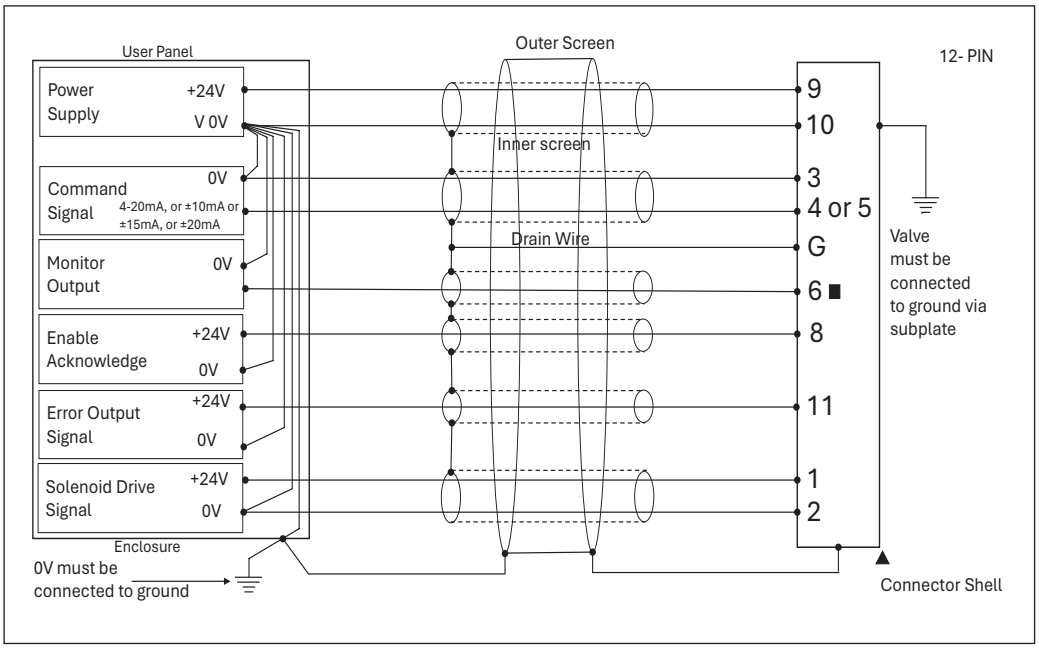




10.5 Wiring Connections Current Input (Field 5 = 2,3,4,5)

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

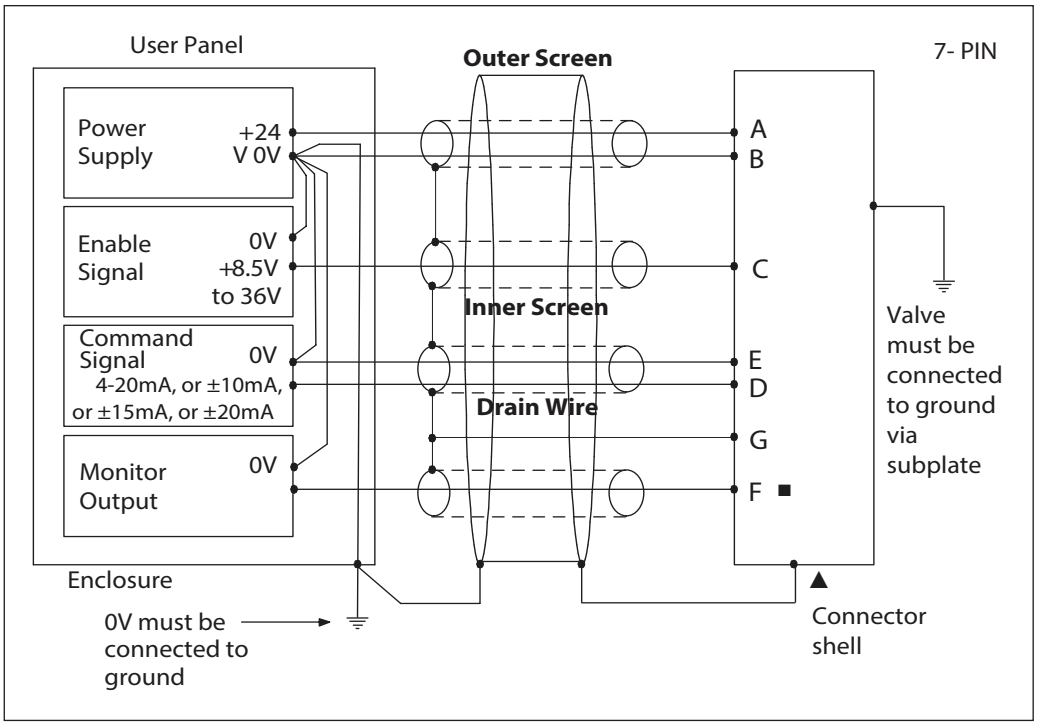


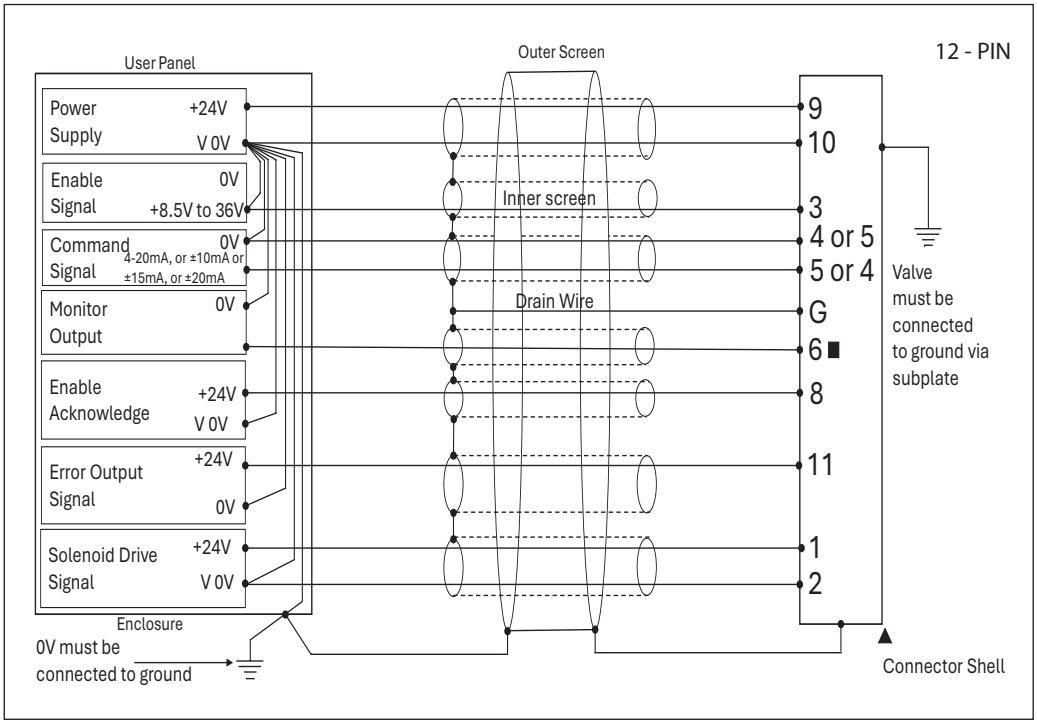


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10.6 Wiring Connections for Current Input (Field Field 5 = 2,3,4,5) Valves with Enable Feature

Δ 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/ 12 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.



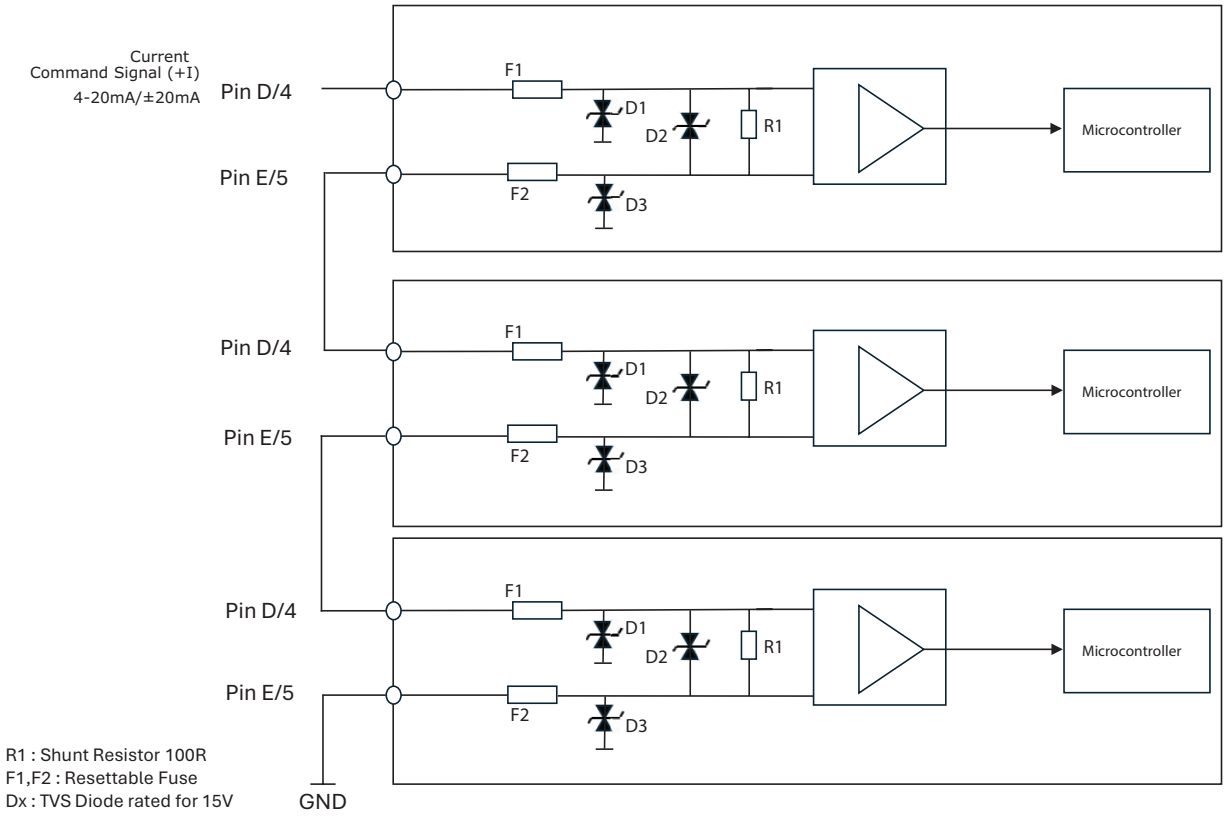


10.7 Wiring Connection of Valve in Current Mode Command with current as input

Daisy Chain Configuration

In applications where valves are connected in a daisy chain configuration, the following wiring method should be used:

- Pin D/4 of the valve serves as the input.
- Pin E/5 acts as the return.
- The E/5 pin of the first valve should be connected to the D/4 pin of the next valve in the series.
- This pattern continues for all valves in the daisy chain.



Note: Detailed wiring connections are outlined in Section 10.5 and 10.6

The daisy chain configuration above is applicable to both 7 Pin and 12 Pin Connector

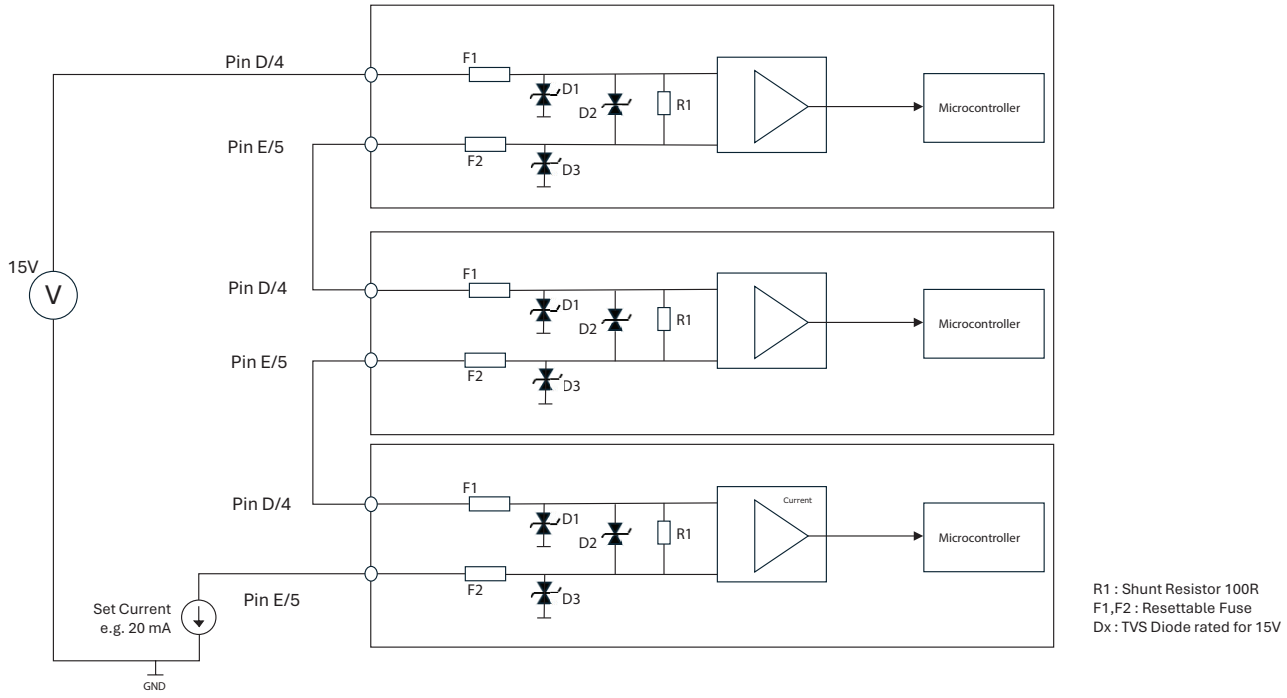
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10.8 Wiring Connection of Valve in Current Mode Command with voltage as input

Daisy Chain Configuration

In applications where valves are connected in a daisy chain configuration, the following wiring method should be used:

- Apply 15V (maximum) input to the valve on Pin D/4.
- Pin E/5 acts as the return.
- This wiring pattern continues for all valves in the daisy chain.
- At the termination point (i.e., Pin E/5), the adjustment of current drawn determines the current flowing through the valves in series.



Note: Detailed wiring connections are outlined in Section 10.5 and 10.6

The daisy chain configuration above is applicable to both 7 Pin and 12 Pin Connector

10.9 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 or 12 pin connector part no. 12007132 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.

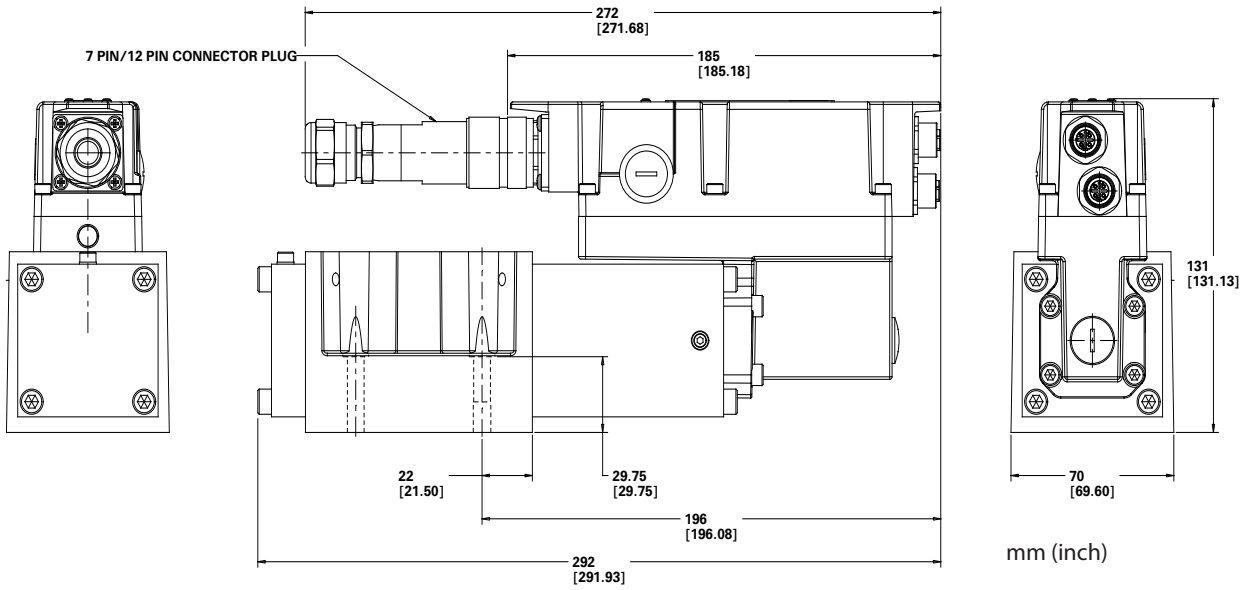
The enable line to pin C should be outside the screen which contains the demand signal cables.

To ensure EMI protection use only metal shielded mating connectors.

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11. Installation Dimensions

KBSD14-05



mm (inch)

A. Mounting bolt

- Refer catalog GB-2314A for mounting bolt kit.
- Metric: M6-16H X 40
- Inch: #1/4"-20 UNC-2B
- Recommended bolts: Class 12.9 (ISO 898)
- Recommended torque: 9.0 to 14.0 Nm (Threads lubricated)

B. The connector plug

- 7 PIN connector: 934939,
- 12 Pin connector: 12007132

Connector plug retaining nut must be tightened with a torque of 2.0 to 2.5 Nm to effect a proper seal. This is necessary to ensure that the EMC rating and IP67 rating are achieved.

12. Mounting Surfaces

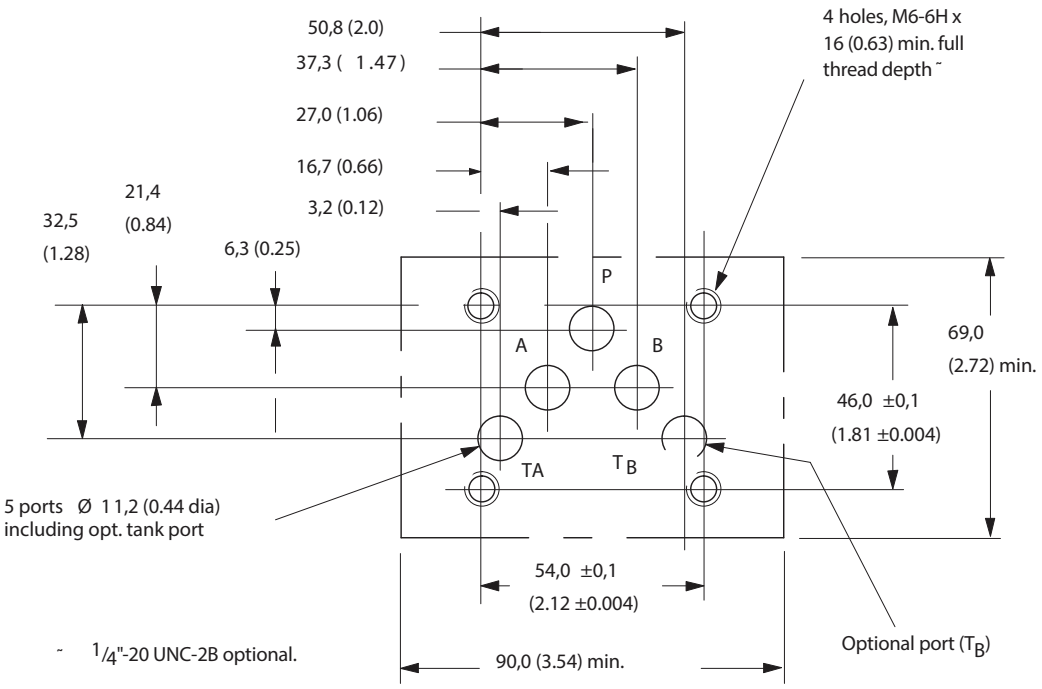
Mounting Surfaces Interface to ISO 4401 (Size 05)

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



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13. Application Data

Hydraulic Fluids
Proper selection of hydraulic fluid and consistent maintenance of its condition are essential for ensuring the long and reliable operation of hydraulic components and systems.

The hydraulic fluid must possess a well-balanced formulation of high-quality base oils and additives to provide robust protection against component wear, as well as deliver essential properties like oxidative and thermal stability and rapid air release.

Materials and seals used in these valves are Fluorocarbon (FKM) and are compatible with following hydraulic fluids.

Mineral/Petroleum oil
- HH, HL, HM, HR, HV, HS & HG (ISO 11158/ISO 6743-4)

Synthetic PAO (Poly Alfa Olefin)
Environment friendly (bio-degradable) hydraulic fluids (ISO 15380/ISO 6743-4)
- HEES (Synthetic ester base))
- HETG (Vegetable oil/triglyceride base)
- HEPR (Polyalphaolefin and related hydrocarbon)

Fire resistant hydraulic fluids (ISO 12922/ISO 6743-4)
Anhydrous/water free
- HFDR (Phosphate ester)
- HFDU (Polyol ester)
- HFDU (Polyether polyol)

Fluid Cleanliness
The hydraulic fluid must maintain an adequate level of cleanliness at all times to ensure trouble-free performance and prevent premature failure of system components.

The following recommendations are based on ISO 4406:1999 cleanliness standards, which classify particle contamination at 4 µm, 6 µm, and 14 µm sizes. For the products featured in this catalogue, the recommended cleanliness level is 17/15/12.

Danfoss products, as any components, will operate with apparent satisfaction in fluids with higher cleanliness codes than those described. Experience has shown, however, that the life of any hydraulic components is shortened in fluids with higher cleanliness codes than the recommended level.

Viscosity Recommendations
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 Danfoss 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.

ENGINEERING
TOMORROW

Cartridge valves
- DCV directional control valves
- Electric converters
- Electric machines
- Electric motors
- Fluid Conveyance
- Gear motors
- Gear pumps
- Hydraulic integrated circuits (HICs)
- Hydrostatic motors
- Hydrostatic pumps
- Industrial hydraulics
- Orbital motors
- PLUS+1® controllers
- PLUS+1® displays
- PLUS+1® joysticks and pedals
- PLUS+1® operator interfaces
- PLUS+1® sensors
- PLUS+1® software
- PLUS+1® software services, support and training
- Position controls and sensors
- PVG proportional valves
- Steering components and systems
- Telematics

Danfoss Power Solutions is a global manufacturer and supplier of high-quality hydraulic and electric components. We specialize in providing state-of-the-art technology and solutions that excel in the harsh operating conditions of the mobile off-highway and industrial markets as well as the marine sector. Building on our extensive applications expertise, we work closely with you to ensure exceptional performance for a broad range of applications. We help you and other customers around the world speed up system development, reduce costs and bring vehicles and vessels to market faster.

Danfoss Power Solutions – your strongest partner in hydraulics and mobile

Go to www.danfoss.com for further product information.

We offer you expert worldwide support for ensuring the best possible solutions for outstanding performance. And with an extensive network of Global Service Partners, we also provide you with comprehensive global service for all of our components.

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