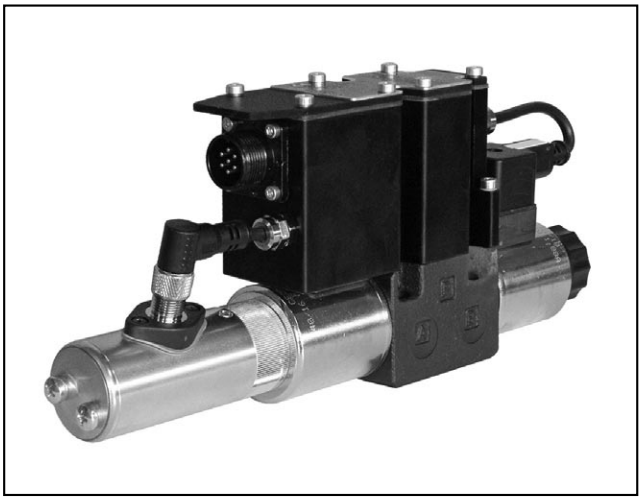


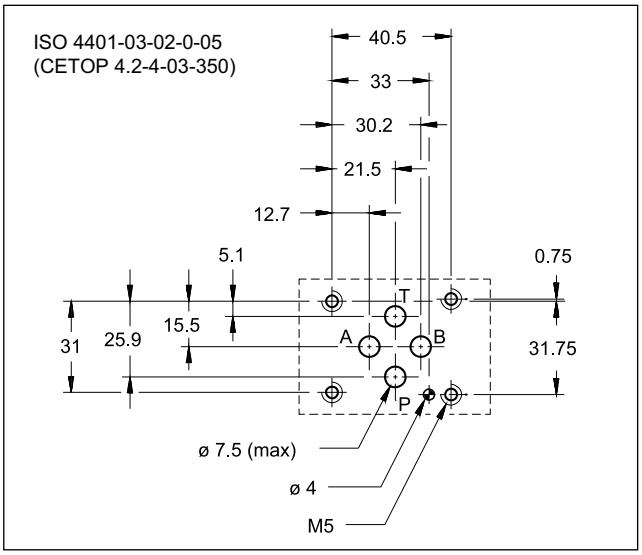
DSE3J*

DIRECTIONAL VALVE WITH PROPORTIONAL CONTROL, FEEDBACK AND INTEGRATED ELECTRONICS

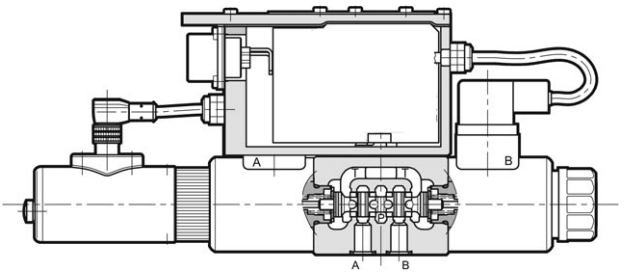
SUBPLATE MOUNTING ISO 4401-03

p max **350** bar
Q max **80** l/min

MOUNTING INTERFACE



OPERATING PRINCIPLE



— The DSE3J* are proportional directional valves, direct operated, with closed loop position control. The mounting interface is in compliance with ISO 4401 standards.

— The valve opening and hence flow rate can be modulated continuously in proportion to the reference signal. Transducer and digital card allow a fine control of the spool position, reducing both hysteresis and response times and optimizing the valve performance.

— The valves are available with different types of electronics, with analogue or fieldbus interfaces.

— The fail safe function is available for spools type Z.

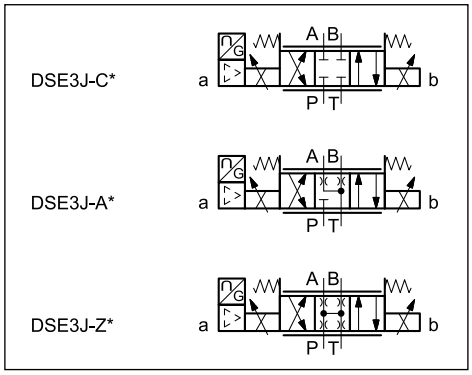
— Valves are easy to install. The driver manages digital settings directly.

PERFORMANCES

(Mineral oil with viscosity of 36 cSt at 50°C and p = 140 bar)

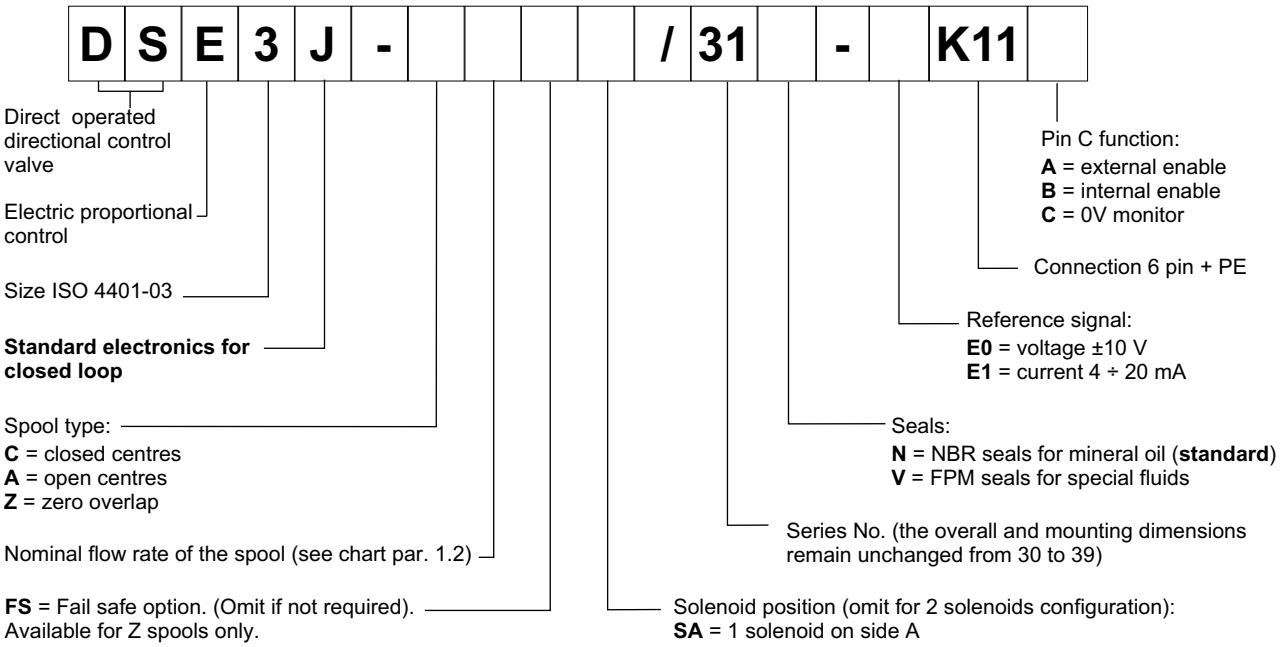
Max operating pressure: P - A - B ports T port	bar	350 210
Nominal flow with Δp 10 bar P-T	l/min	1 - 4 - 12 -18 - 30
Response times	see paragraph 7	
Hysteresis	% of Q_{max}	< 0.2%
Repeatability	% of Q_{max}	< 0.2%
Threshold		< 0.1%
Valve reproducibility		≤ 5%
Electrical characteristics	see paragraph 3	
Ambient temperature range	°C	-20 / +60
Fluid temperature range	°C	-20 / +80
Fluid viscosity range	cSt	10 ÷ 400
Fluid contamination degree	according to ISO 4406:1999 class 18/16/13	
Recommended viscosity	cSt	25
Mass: single solenoid valve double solenoid valve	kg	2.2 2.7

HYDRAULIC SYMBOLS (typical)



1 - IDENTIFICATION CODE

1.1 - Standard electronics



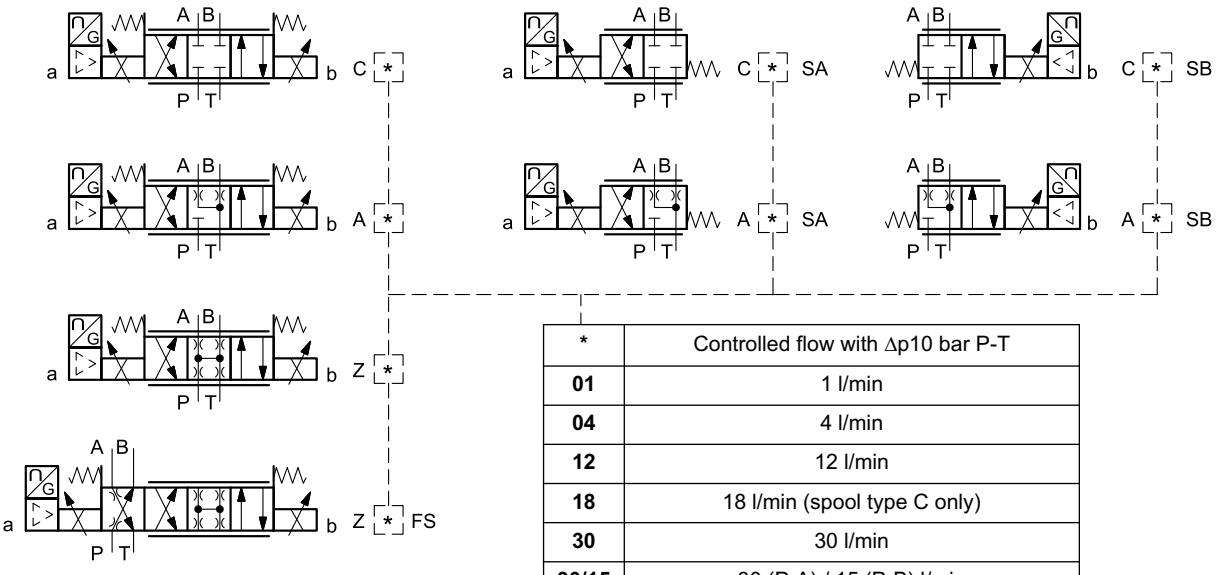
1.2 - Configurations

Valve configuration depends on the combination of the following elements: number of proportional solenoids, spool type, rated flow.

Configuration 2 solenoids :
3 positions with spring centering

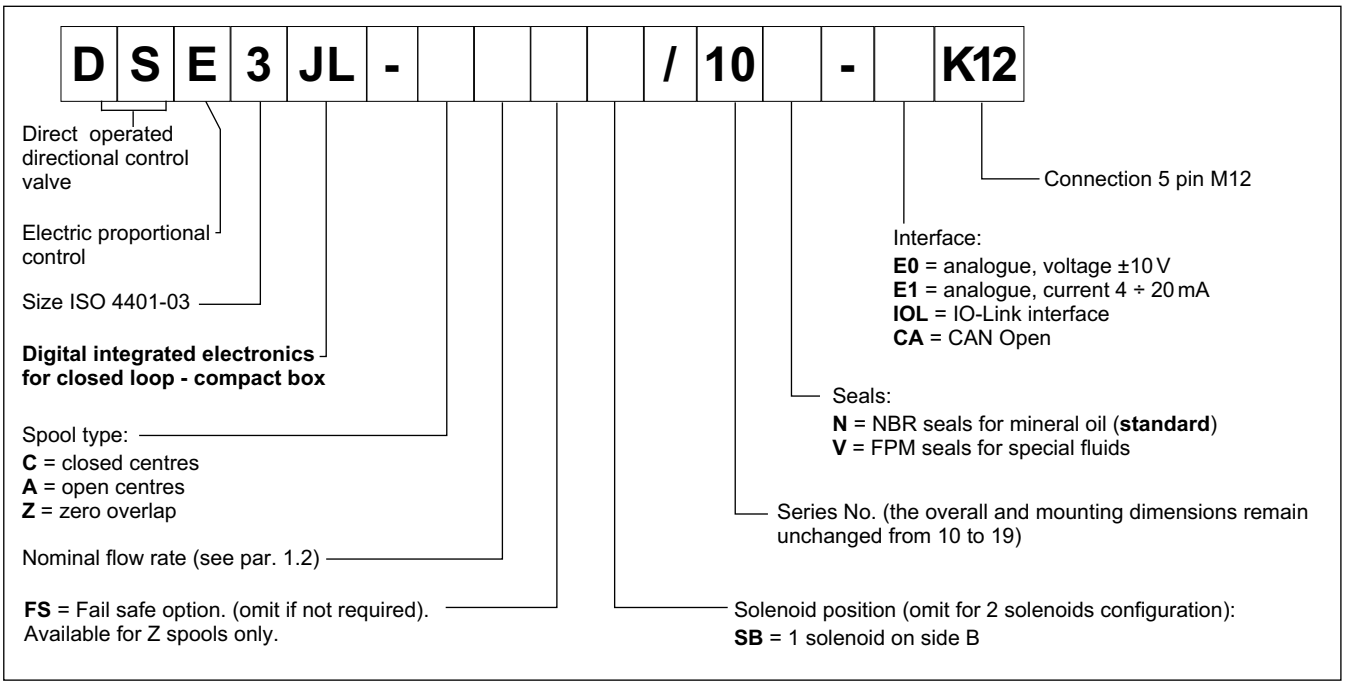
Configuration 1 solenoid on side A "**SA**":
2 positions (central + external)
with spring centering
(for DSE3J and DSE3JH only)

Configuration 1 solenoid on side B "**SB**":
2 positions (central + external)
with spring centering
(for DSE3JL only)

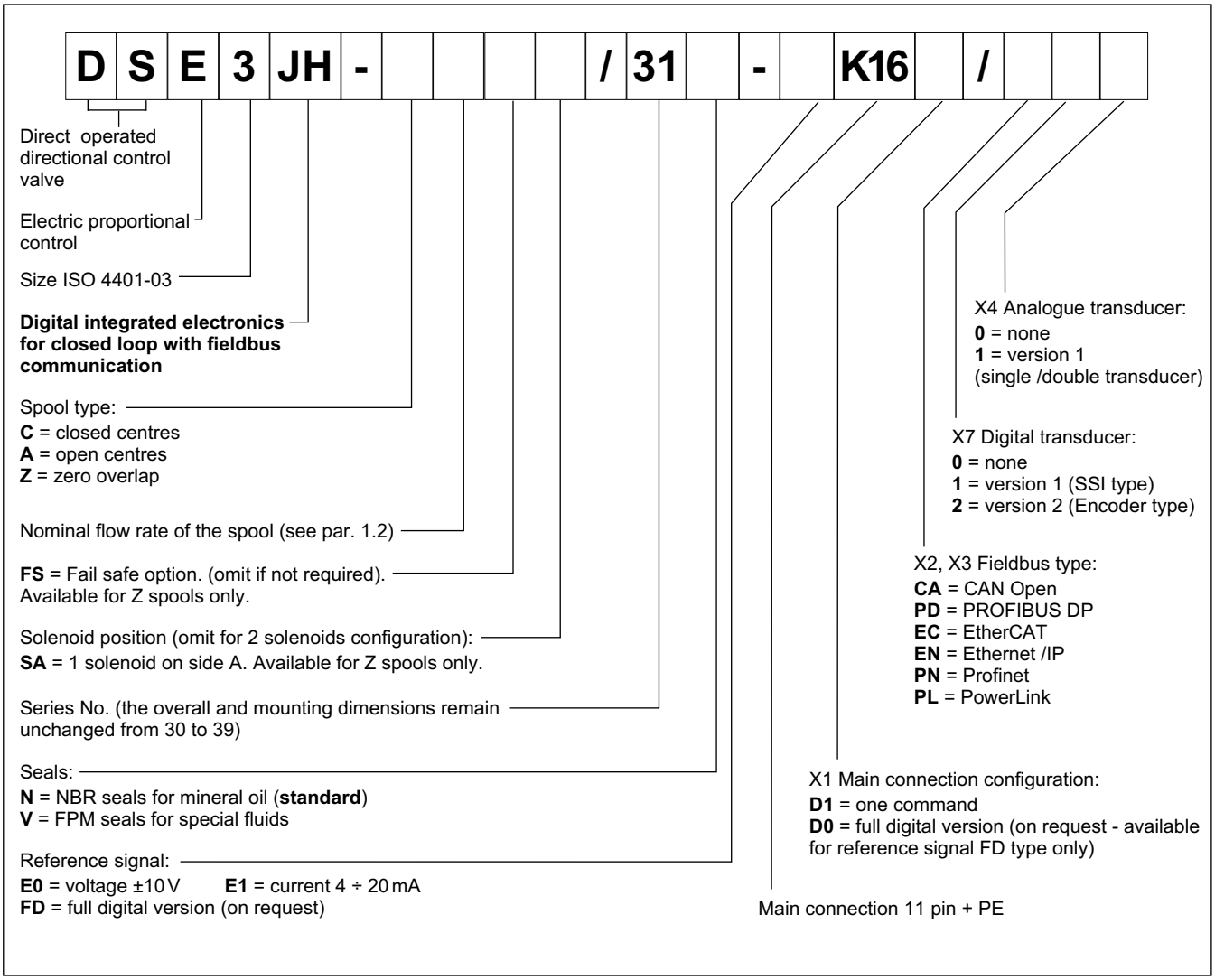


*	Controlled flow with Δp10 bar P-T
01	1 l/min
04	4 l/min
12	12 l/min
18	18 l/min (spool type C only)
30	30 l/min
30/15	30 (P-A) / 15 (P-B) l/min

1.3 - Compact electronics



1.4 - Electronics with fieldbus communication



2 - ELECTRONICS COMMON DATA

Duty cycle		100% (continuous operation)
Protection class according to EN 60529		IP65 / IP67
Supply voltage	V DC	24 (from 19 to 30 VDC), ripple max 3 Vpp
Power consumption	VA	25
Maximum solenoid current	A	1.88
Fuse protection, external	A	3
Managed breakdowns		Overload and electronics overheating, LVDT sensor error, cable breakdown, supply voltage failure
Electromagnetic compatibility (EMC) emissions EN 61000-6-4, immunity EN 61000-6-2		According to 2014/30/EU standards

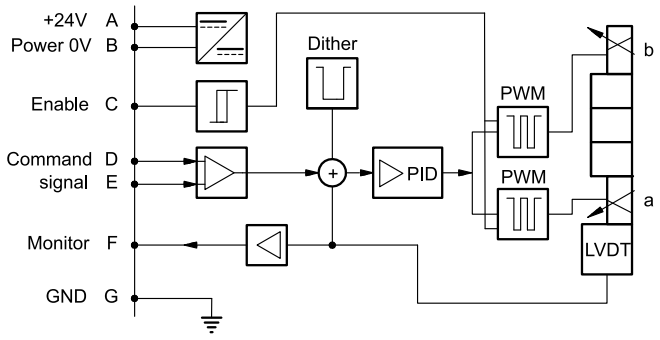
3 - DSE3J - STANDARD ELECTRONICS

3.1 - Electrical characteristics

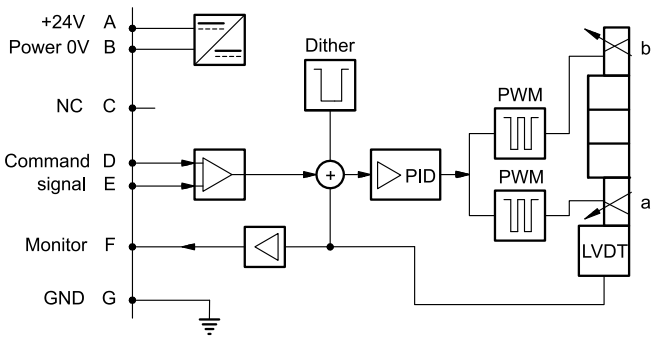
Command signal:	voltage (E0) current (E1)	V DC mA	±10 (Impedance Ri = 11 kOhm) 4 ÷ 20 (Impedance Ri = 58 Ohm)
Monitor signal:	voltage (E0) current (E1)	V DC mA	±10 (Impedance Ro > 1 kOhm) 4 ÷ 20 (Impedance Ro = 500 Ohm)
Communication for diagnostic			LIN-bus Interface (by means of the optional kit)
Connection			6 pin + PE (MIL-C-5015-G - DIN EN 175201-804)

3.2 - On-board electronics diagrams

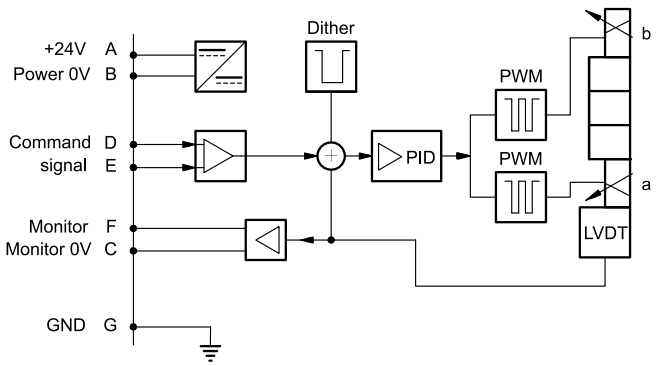
VERSION A - External Enable



VERSION B - Internal Enable

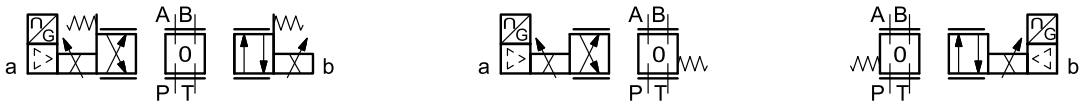


VERSION C - 0V Monitor

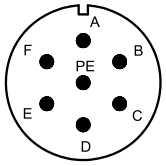


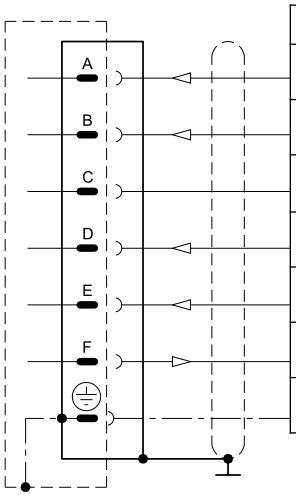
3.3 - Versions with voltage command (E0)

The reference signal is between -10V and +10V on double solenoid valve, and 0 ÷ 10V on single solenoid valve SA. The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.



COMMAND	**-10V**	**0V**	**+10V**		**+10V**	**0V**	**0V**	**+10V**
MONITOR	**-10V**	**0V**	**+10V**		**+10V**	**0V**	**0V**	**+10V**



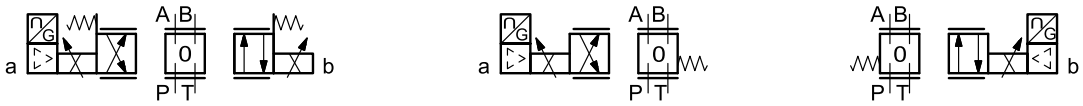


Pin	Values	version A	version B	version C
A	24 V DC	Supply voltage		
B	0 V			
C		Enable 24 V DC	do not connect -	PIN F reference 0 V
D	± 10 V	Command		
E	0 V	Command reference		
F	± 10 V	Monitor (0V reference: pin B)		Monitor
PE	GND	Ground (Earth)		

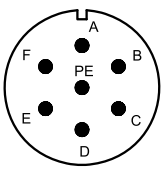
3.4 - Versions with current command (E1)

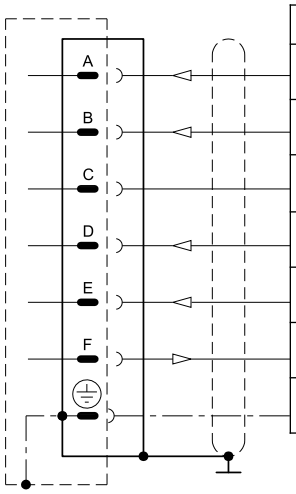
The reference signal is supplied in current 4 ÷ 20 mA. If the current for command is lower, the card shows a breakdown cable error. To reset the error is sufficient to restore the signal.

The monitor feature of versions B and C becomes available with a delay of 0,5 sec from the power-on of the card.



COMMAND	**4 mA**	**12 mA**	**20 mA**		**20 mA**	**4 mA**	**4 mA**	**12 mA**
MONITOR	**4 mA**	**12 mA**	**20 mA**		**20 mA**	**4 mA**	**4 mA**	**12 mA**





Pin	Values	version A	version B	version C
A	24 V DC	Supply voltage		
B	0 V			
C		Enable 24 V DC	do not connect -	PIN F reference 0 V
D	4 ÷ 20 mA	Command		
E	0 V	Command reference		
F	4 ÷ 20 mA	Monitor (0V reference: pin B)		Monitor
PE	GND	Ground (Earth)		

4 - DSE3JL - COMPACT ELECTRONICS

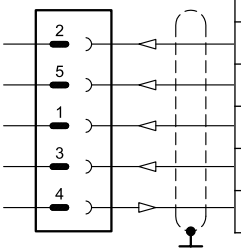
In versions 'IOL' and 'CA' pin 3 and pin 5 are galvanic isolated up to100 V to avoid earth loops. In IO-Link networks, the length of the connecting cable is limited to 20 metres.

4.1 - Electrical characteristics

Command signal:	voltage (E0) current (E1)	V DC mA	±10 (Impedance Ri = 11 kOhm) 4 ÷ 20 (Impedance Ri = 58 Ohm)
Monitor signal:	voltage (E0) current (E1)	V DC mA	0 ÷ 5 (Impedance Ro > 1 kOhm) 4 ÷ 20 (Impedance Ro = 500 Ohm)
IO-Link communication (IOL): Data rate		kBaud	IO-Link Port Class B 230,4
Can Open communication (CA): Data rate		kbit	10 ÷ 1000
Data register (IOL and CA versions only)			solenoid voltage supply, solenoid faults (shortcircuit, bad config, internal), box temperature, switch-on time, vibrations
Connection			5-pin M12 code A (IEC 61076-2-101)

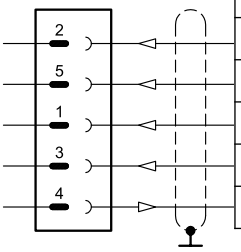
4.2 - Pin tables

'E0' connection



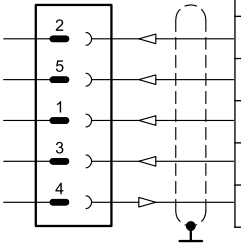
Pin	Values	Function
2	24 V DC	Supply voltage (solenoid and logic)
5	0 V	
1	± 10 V	Command
3	0V	Command reference
4	0 ÷ 5V	Monitor (0V reference: pin 5)

'E1' connection



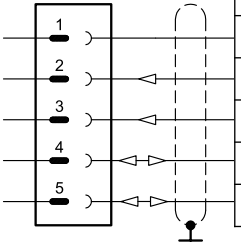
Pin	Values	Function
2	24 V DC	Supply voltage (solenoid and logic)
5	0 V	
1	4 ÷ 20 mA	Command
3	0V	Command reference
4	4 ÷ 20 mA	Monitor (0V reference: pin 5)

'IOL' connection



Pin	Values	Function
2	2L+ 24 V DC	Supply of the power stage
5	2L- 0 V (GND)	Internal galvanic isolation from PIN 3
1	1L+ +24 V DC	IO-Link supply voltage
3	1L- 0V (GND)	
4	C/Q	IO-Link Communication

'CA' connection



Pin	Values	Function
1	CAN_SH	Shield
2	24 V DC	Supply voltage
3	0 V (GND)	
4	CAN H	Bus line (high)
5	CAN_L	Bus line (low)

5 - DSE3JH - FIELDBUS ELECTRONICS

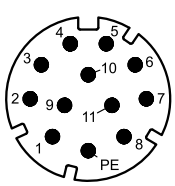
The 11+ PE pin connection allows separate supply voltage for electronics and solenoids.

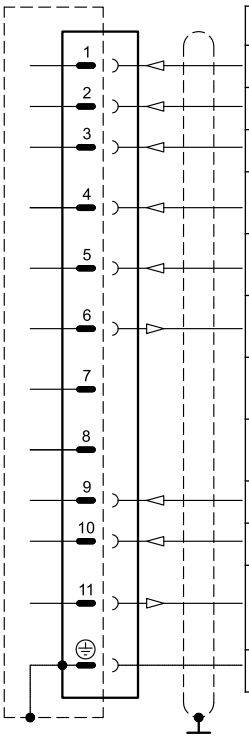
Command - valve position schemes as for the standard electronics. Please refer to pictures in par. 3.3 and 3.4.

5.1 - Electrical characteristics

Command signal:	voltage (E0) current (E1) digital (FD)	V DC mA	±10 (Impedance Ri = 11 kOhm) 4 ÷ 20 (Impedance Ri = 58 Ohm) via fieldbus
Monitor signal:	voltage (E0) current (E1)	V DC mA	±10 (Impedance Ro > 1 kOhm) 4 ÷ 20 (Impedance Ro = 500 Ohm)
Communication / diagnostic			via Bus register
Communication interface standards CAN Open PROFIBUS DP EtherCAT, Ethernet /IP, Profinet, PowerLink			 EN 50325-4 + DS408 EN 50170-2 / IEC 61158 IEC 61158
Communication physical layer CAN Open PROFIBUS DP EtherCAT, Ethernet /IP, Profinet, PowerLink			 optical insulated CAN ISO 11898 optical insulated RS485 fast ethernet, insulated 100 Base TX
Power connection			11 pin + PE (DIN 43651)

5.2 - X1 Main connection pin table





D1: one command

Pin	Values	Function
1	24 V DC	Main supply voltage
2	0 V	
3	24V DC	Enable
4	± 10 V (E0) 4 ÷ 20 (E1)	Command
5	0 V	Command reference signal
6	± 10 V (E0) 4 ÷ 20 (E1)	Monitor (0V reference pin 10)
7	NC	do not connect
8	NC	do not connect
9	24 V DC	Logic and control supply
10	0 V	
11	24 V DC	Fault (0V DC) or normal working (24V DC) (0V reference pin 2)
12	GND	Ground (Earth)

D0: full digital

Pin	Values	Function
1	24 V DC	Main supply voltage
2	0 V	
3	24V DC	Enable
4	NC	do not connect
5	NC	do not connect
6	NC	do not connect
7	NC	do not connect
8	NC	do not connect
9	24 V DC	Logic and control supply
10	0 V	
11	24 V DC	Fault (0V DC) or normal working (24V DC) (0V reference pin 2)
12	GND	Ground (Earth)

5.3 - FIELDBUS connections

Please wire following guidelines provided by the relative standards communication protocol.

5.3.1 - Communication connection CA (CAN Open)

X2 (IN) connection: M12 A 5 pin female

Pin	Values	Function
1	CAN_SH	Shield
2	NC	Do not connect
3	GND	Signal zero data line
4	CAN_H	Bus line (high)
5	CAN_L	Bus line (low)

X3 (OUT) connection: M12 A 5 pin male

Pin	Values	Function
1	CAN_SH	Shield
2	NC	Do not connect
3	GND	Signal zero data line
4	CAN_H	Bus line (high)
5	CAN_L	Bus line (low)

5.3.2 - Communication connection PD (PROFIBUS DP)

X2 (IN) connection: M12 B 5 pin male (IN)

Pin	Values	Function
1	+5 V	Termination supply signal
2	PB_A	Bus line (high)
3	0 V	Data line and termination signal 0
4	PB_B	Bus line (low)
5	SHIELD	

X3 (OUT) connection: M12 B 5 pin female

Pin	Values	Function
1	+5 V	Termination supply signal
2	PB_A	Bus line (high)
3	0 V	Data line and termination signal 0
4	PB_B	Bus line (low)
5	SHIELD	

5.3.3 - Communication connections: EC (EtherCat), EN (Ethernet/IP), PN (PROFINET), PL (POWERLINK)

X2 (IN) connection M12 D 4 pin female

Pin	Values	Function
1	TX+	Transmitter
2	RX+	Receiver
3	TX-	Transmitter
4	RX-	Receiver
HOUSING	shield	

NOTE: Shield connection on connector housing is recommended.

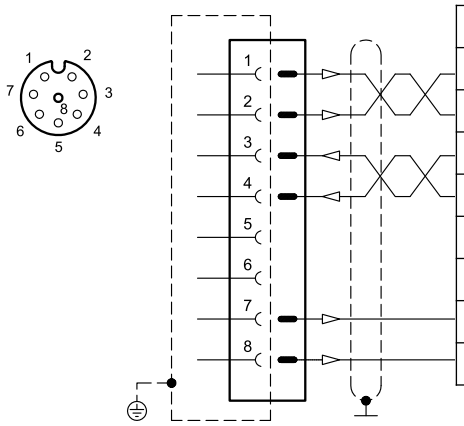
X3 (OUT) connection: M12 D 4 pin female

Pin	Values	Function
1	TX+	Transmitter
2	RX+	Receiver
3	TX-	Transmitter
4	RX-	Receiver
HOUSING	shield	

5.4 - Digital transducer connection

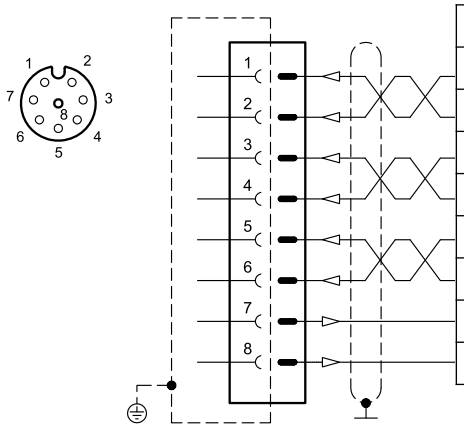
X7 connection: M12 A 8 pin female

VERSION 1: SSI type



Pin	SSI Values	Function	Notes
1	CLK+	Serial synchronous clock (+)	Input - digital signal
2	CLK-	Serial synchronous clock (-)	
3	MIS0+	Serial position data (+)	
4	MIS0-	Serial position data (-)	
5	NC	-	do not connect
6	NC	-	
7	+24 V	transducer power supply	Output power supply
8	0 V	-	Common GND

VERSION 2: ENCODER type



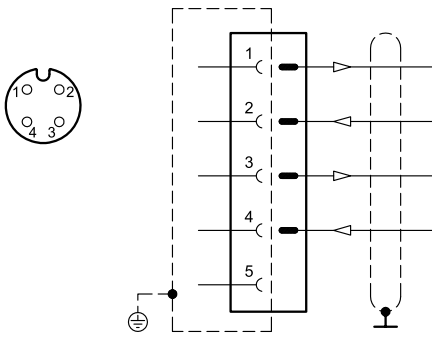
Pin	Values	Function	Notes
1	ENC_Z+	input channel Z+	Input - digital signal
2	ENC_Z-	input channel Z-	
3	ENC_A+	input channel A+	
4	ENC_A-	input channel A+	
5	ENC_B+	input channel B+	
6	ENC_B-	input channel B+	
7	+5 V	transducer power supply	Output power supply
8	0 V	-	Common GND

5.5 - Analogue transducer connection

X4 connection: M12 A 4 pin female

VERSION 1: single / double transducer

(single or double is a software-selectable option)

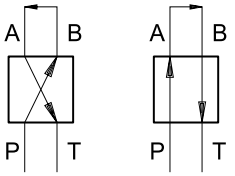


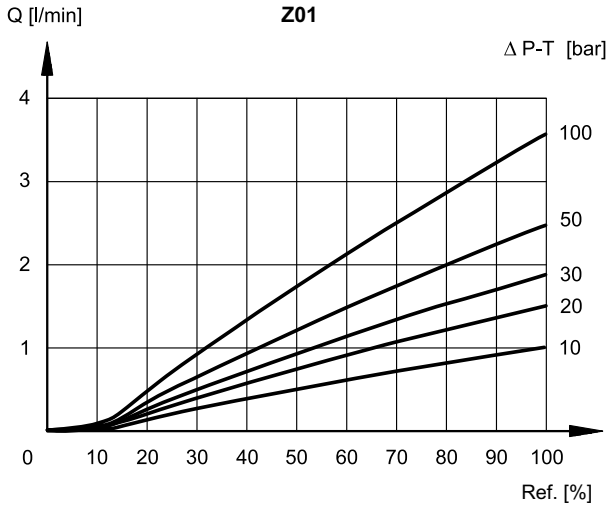
Pin	Values	Notes
1	+24 V	Remote transducer power supply (out) 100 mA
2	±10 V 4 ÷20 mA	Input signal of transducer 1 (range software selectable)
3	0 V	Common reference signal for transducer power and signals
4	±10 V 4 ÷20 mA	Input signal of transducer 2 (range software selectable)
5	-	

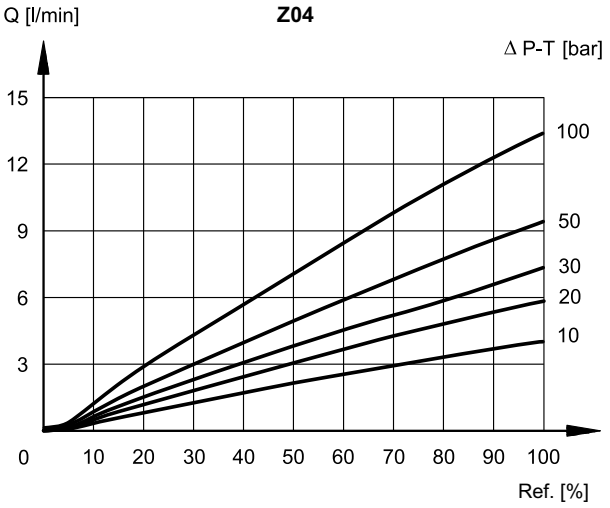
6 - CHARACTERISTIC CURVES

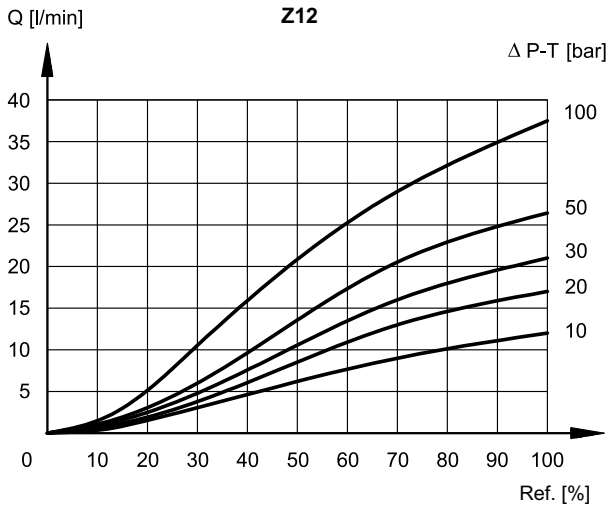
(obtained with mineral oil with viscosity of 36 cSt at 50°C and with digital integrated electronics)

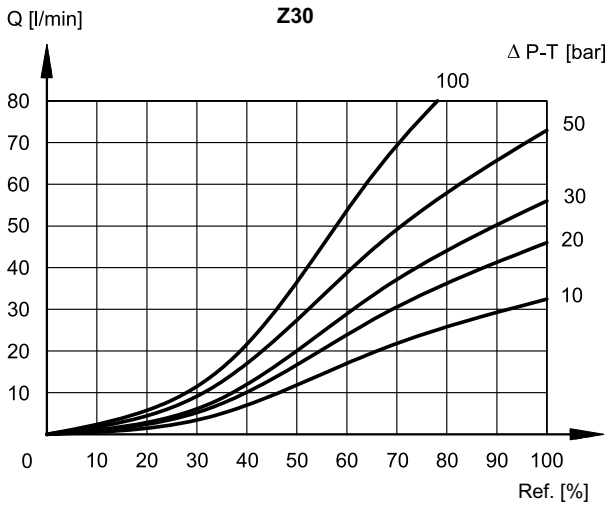
Typical flow rate curves related to the reference signal and measured for the available spools. The Δp values are measured between P and T valve ports.

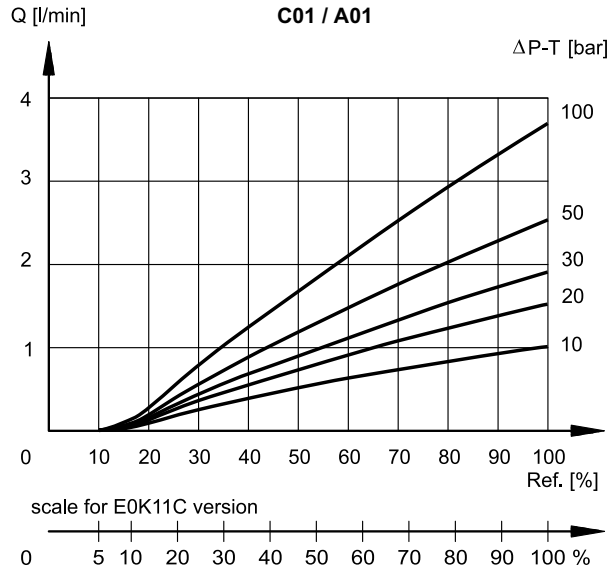


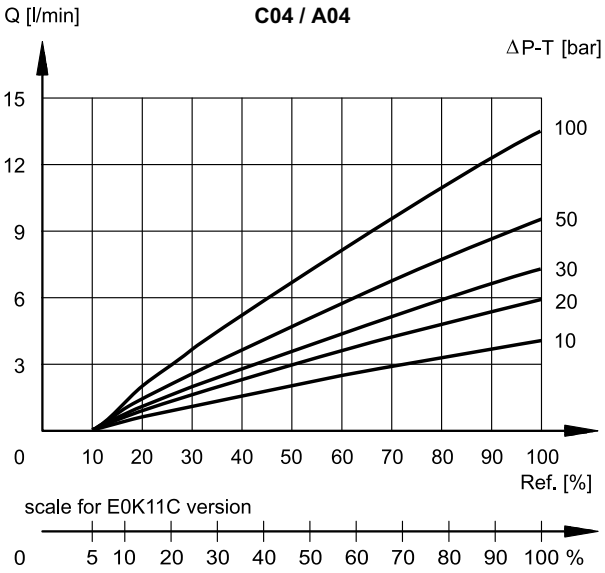


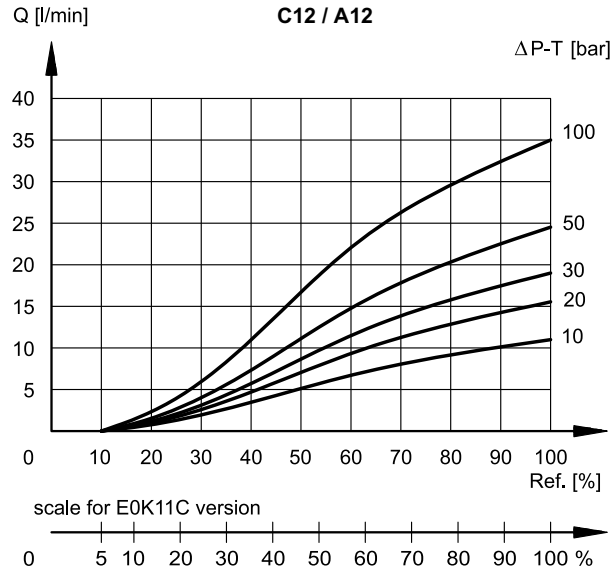


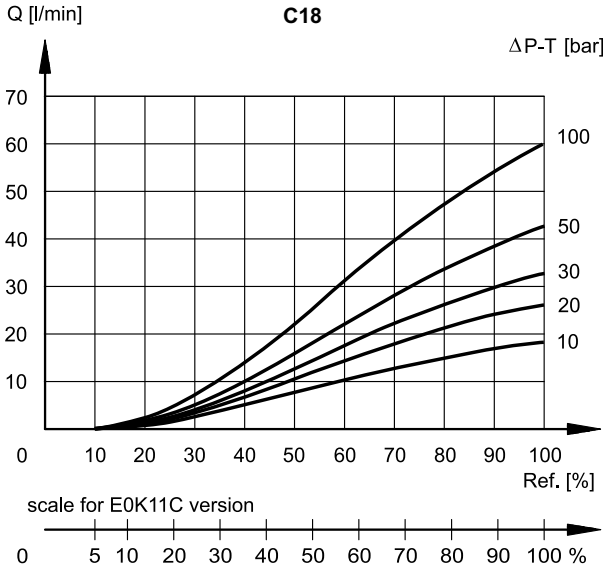


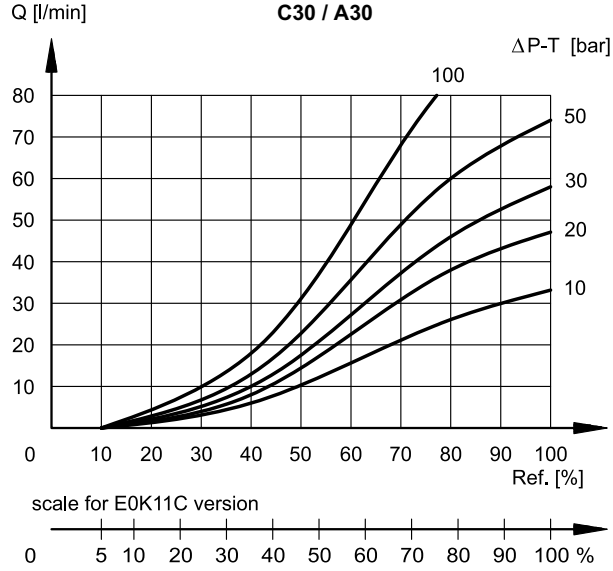



Q [l/min]
C01 / A01
ΔP-T [bar]
4
3
2
1
0
10 20 30 40 50 60 70 80 90 100
Ref. [%]
100
50
30
20
10
scale for E0K11C version
0 5 10 20 30 40 50 60 70 80 90 100 %

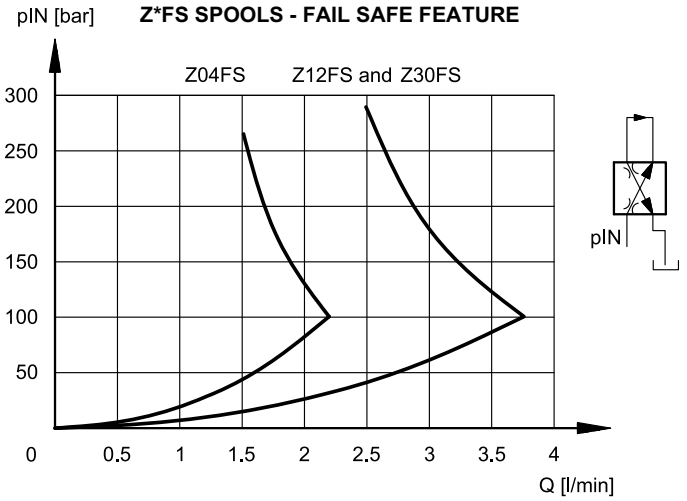

Q [l/min]
C04 / A04
ΔP-T [bar]
15
12
9
6
3
0
10 20 30 40 50 60 70 80 90 100
Ref. [%]
100
50
30
20
10
scale for E0K11C version
0 5 10 20 30 40 50 60 70 80 90 100 %


Q [l/min]
C12 / A12
ΔP-T [bar]
40
35
30
25
20
15
10
5
0
10 20 30 40 50 60 70 80 90 100
Ref. [%]
100
50
30
20
10
scale for E0K11C version
0 5 10 20 30 40 50 60 70 80 90 100 %


Q [l/min]
C18
ΔP-T [bar]
70
60
50
40
30
20
10
0
10 20 30 40 50 60 70 80 90 100
Ref. [%]
100
50
30
20
10
scale for E0K11C version
0 5 10 20 30 40 50 60 70 80 90 100 %


Q [l/min]
C30 / A30
ΔP-T [bar]
80
70
60
50
40
30
20
10
0
10 20 30 40 50 60 70 80 90 100
Ref. [%]
100
50
30
20
10
scale for E0K11C version
0 5 10 20 30 40 50 60 70 80 90 100 %

Z*FS SPOOLS - FAIL SAFE FEATURE

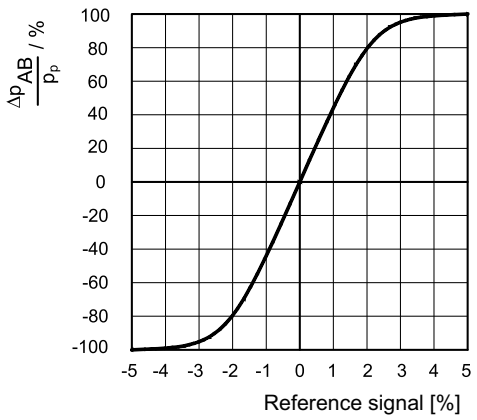


Flow P→B / A→T with valve in fail safe position, depending on the inlet pressure.

When a power failure (enabling OFF) occurs, the valve moves in 'fail safe' position, maintaining a minimum flow that allows the actuator to return slowly to a safe position.

During the black-out the centering springs retain the spool in fail safe-position.

Z SPOOLS - PRESSURE GAIN



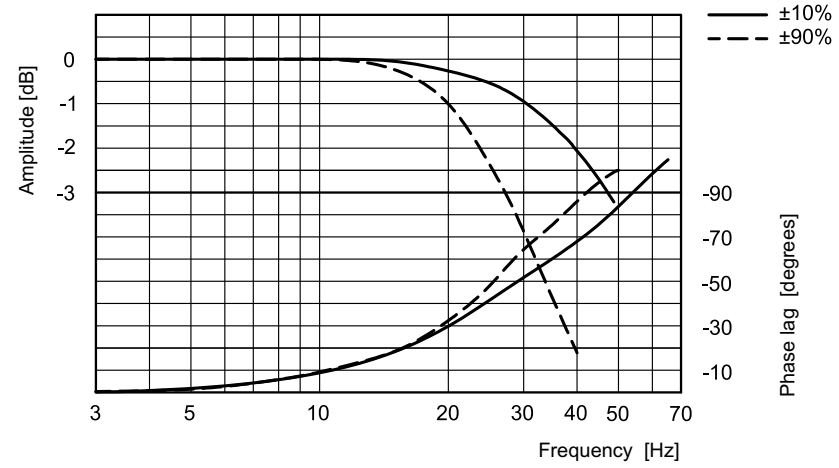
The diagram shows the valve pressure gain, expressed as % of the ratio between the port pressure variation in A or B (Δp AB) and the P system pressure, according to the reference signal.

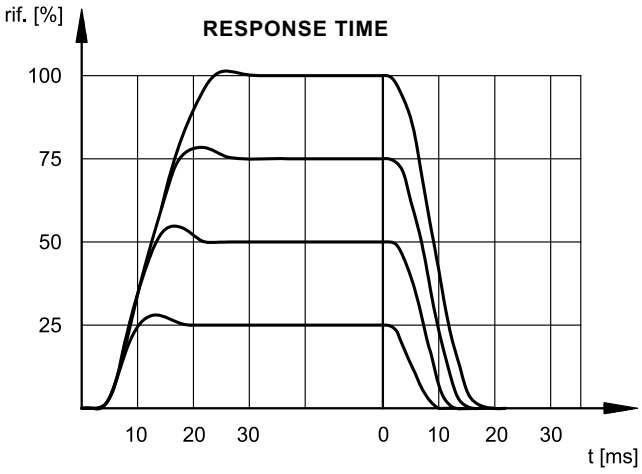
In practice, the pressure gain states the valve reaction towards external disturbances aimed at changing the actuator position.

7 - RESPONSE TIMES

(obtained with mineral oil with viscosity of 36 cSt at 50°C and 140 bar Δp P→T)

FREQUENCY RESPONSE (Z SPOOLS)

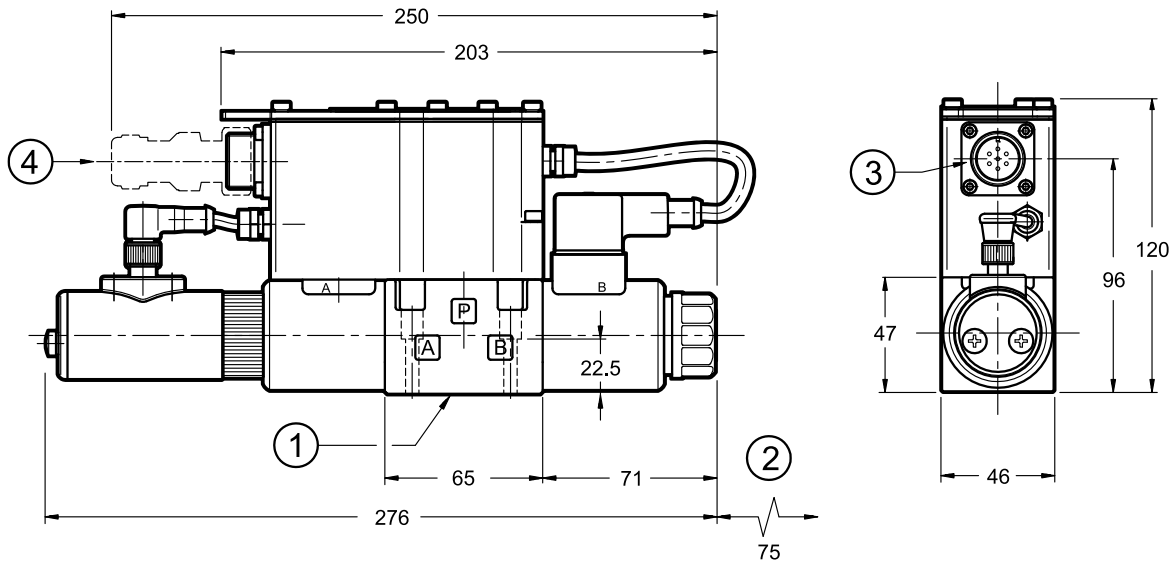


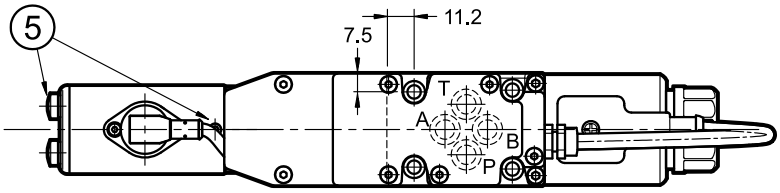


8 - DSE3J - OVERALL AND MOUNTING DIMENSIONS

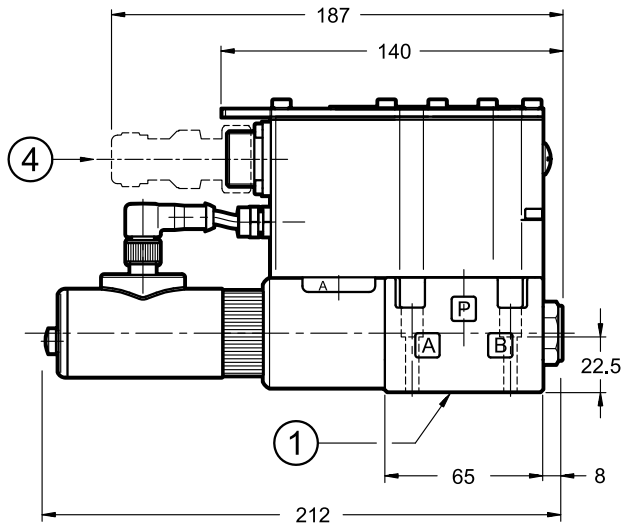
dimensions in mm

DSE3J-/K11**





DSE3J-*SA/K11



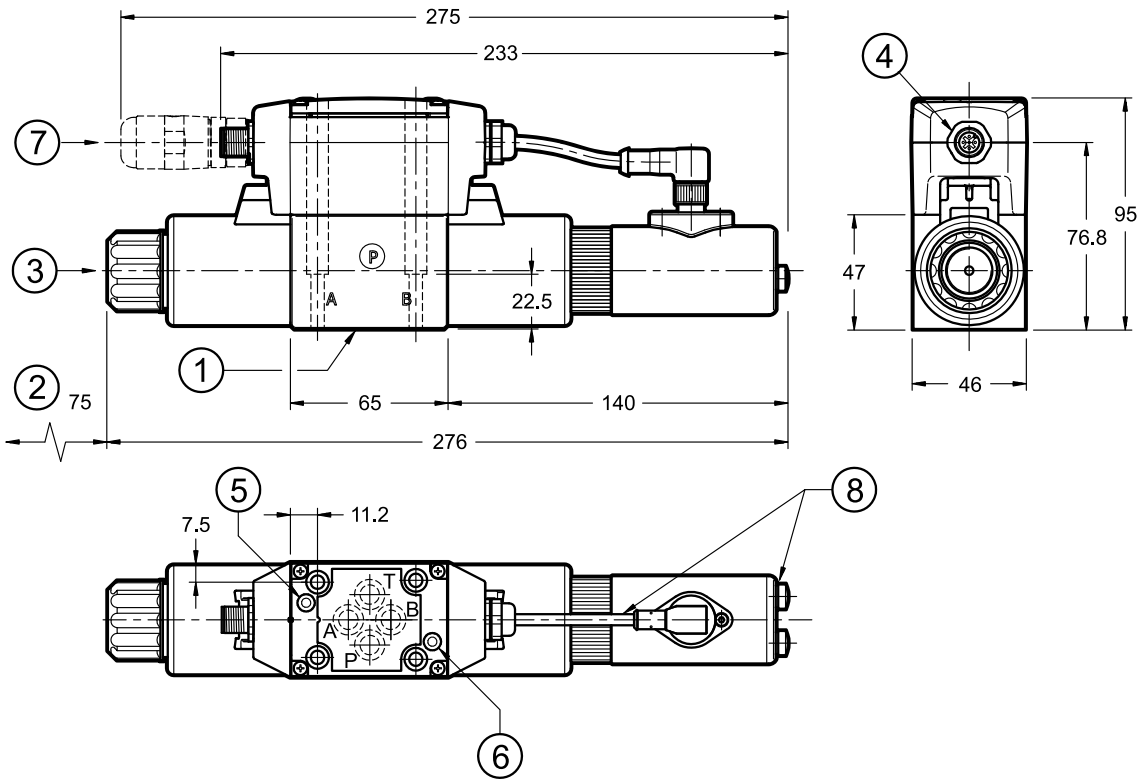
Valve fastening: 4 SHC screws M5x30 - ISO 4762	
Torque: 5 Nm (A8.8)	
Threads of mounting holes: M5x10	

1	Mounting surface with sealing rings: N. 4 OR type 2037 (9.25x1.78) 90 Shore
2	Coil removal space (solenoid B only)
3	Main connection 6 pin + PE
4	Mating connector 6 poles + PE, female type MIL-5015-G **To be ordered separately.** See catalogue 89 000
5	Adjustment sealing performed at factory. Do not disassemble the transducer.

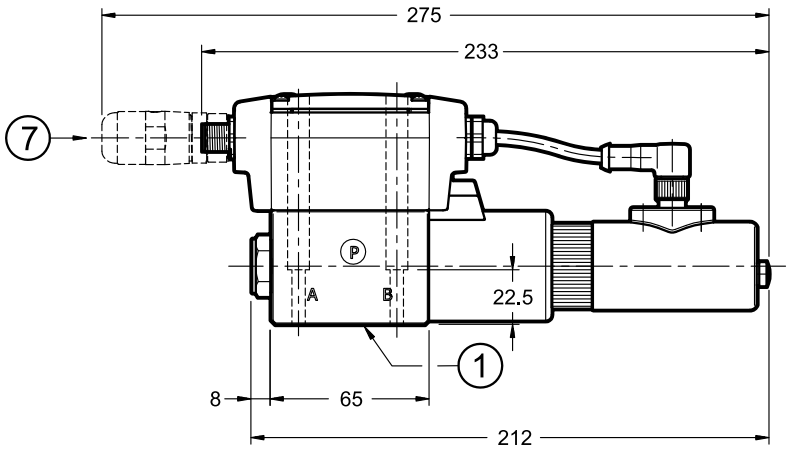
9 - DSE3JL - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

DSE3JL-/K12**



DSE3JL-*SB/K12



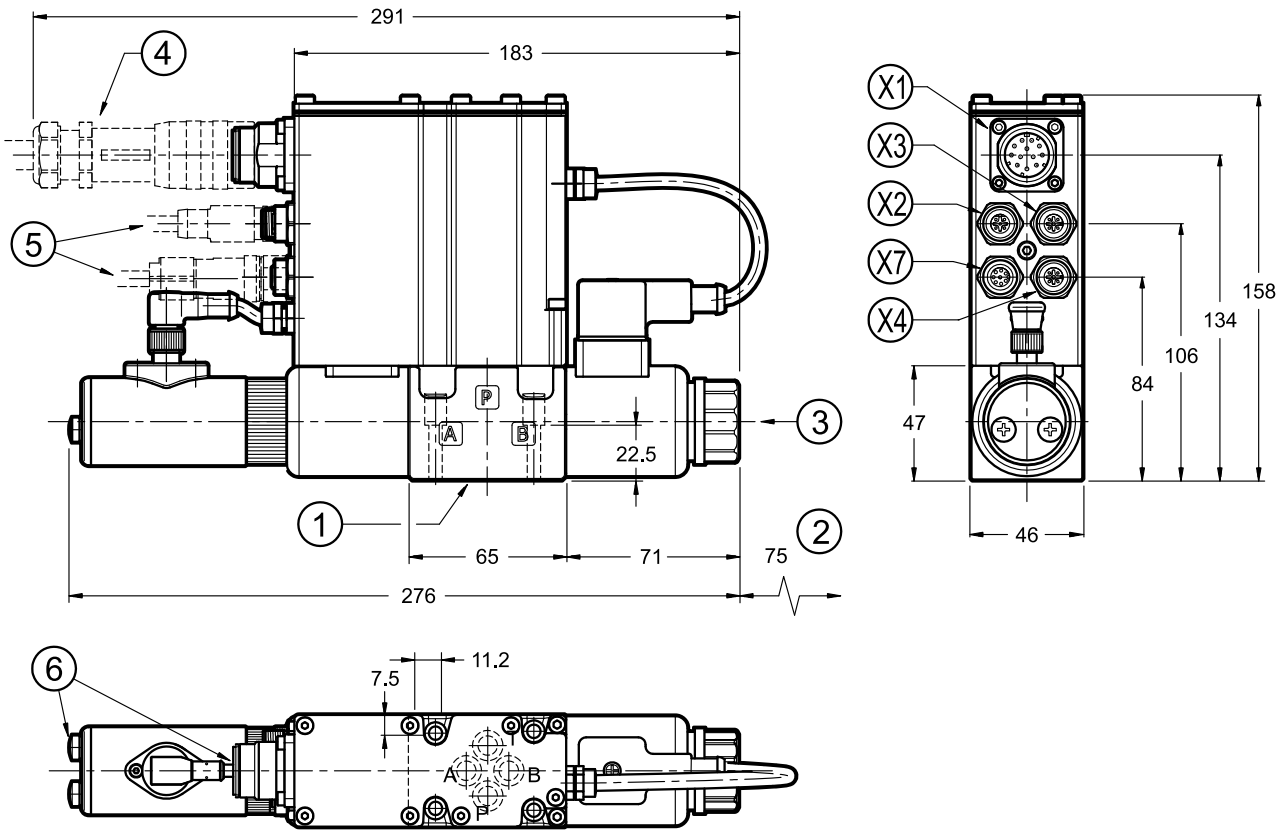
1	Mounting surface with sealing rings: N. 4 OR type 2037 (9.25x1.78) 90 Shore
2	Coil removal space
3	Manual override by pin integrated in the solenoid tube
4	Connection M12 A 5 pin
5	L1 LED
6	L2 LED
7	Mating connector M12 5 poles - code A, female. **To be ordered separately.** See catalogue 89 000
8	Adjustment sealing performed at factory. Do not disassemble the transducer.

Valve fastening: 4 SHC screws M5x30 - ISO 4762
Torque: 5 Nm (A8.8)
Threads of mounting holes: M5x10

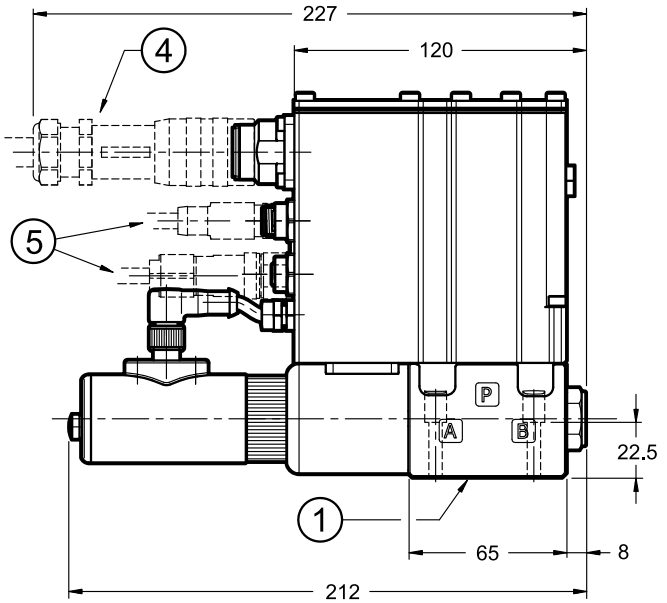
10 - DSE3JH - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

DSE3JH-/K16**



DSE3JH-*SA/K16



X1	Main connection 11 pin + PE
X2	Fieldbus communication (IN)
X3	Fieldbus communication (OUT)
X4	X4 connection for analogue transducer
X7	X7 connection for digital transducer

1	Mounting surface with sealing rings: N. 4 OR type 2037 (9.25x1.78) 90 Shore
2	Coil removal space (solenoid B only)
3	Manual override by pin integrated in the solenoid tube
4	Mating connector 11 poles + PE **To be ordered separately.** See catalogue 89 000
5	Mating connectors for fieldbus communication and signals **To be ordered separately.** See catalogue 89 000

Valve fastening: 4 SHC screws M5x30 ISO 4762
Torque: 5 Nm (A8.8)
Threads of mounting holes: M5x10

NOTE: Depending on the chosen version, X4 and X7 connections may not be present.
Please refer to section 5 for connection descriptions and pinout.

11 - HYDRAULIC FLUIDS

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals. For fluids HFDR type (phosphate esters) use FPM seals (code V). For the use of other kinds of fluid such as HFA, HFB, HFC, please consult our technical department.

Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics.

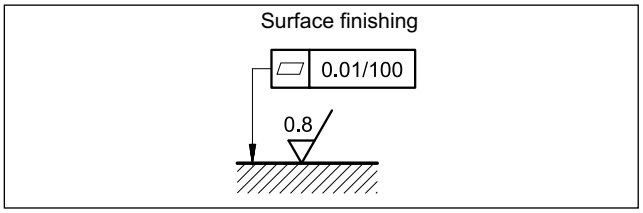
The fluid must be preserved in its physical and chemical characteristics.

12 - INSTALLATION

DSE3J valves can be installed in any position without impairing correct operation.

Ensure that there is no air in the hydraulic circuit.

Valves are fixed by means of screws or tie rods on a flat surface with planarity and roughness equal to or better than those indicated in the relative symbols. If minimum values are not observed, fluid can easily leak between the valve and support surface.



13 - ACCESSORIES

(to be ordered separately)

13.1 - Mating connectors

Mating connectors must be ordered separately. See catalogue 89 000.

For K11 and K16 versions we recommend the choice of a metal connector to avoid electromagnetic disturbances and to comply with EMC regulations on electromagnetic compatibility. If you opt for a plastic connector, make sure that it guarantees and maintains the IP and EMC protection characteristics of the valve.

13.2 - Mating connectors for fieldbus communication and for sensors.

Duplomatic offers spare parts to be wired and also ready-to-use cord sets. Please refer to cat. 89 000.

13.3 - Connection cable

The optimal wiring provides for 7 isolated conductors, with separate screen for the signal wires (command, monitor) and an overall screen.

Cross section for power supply:
- up to 20 m cable length : 1,0 mm^2
- up to 40 m cable length : 1,5 mm^2 (IO-Link excluded)

Cross section for signals (command, monitor):
- 0,50 mm^2

13.4 - Kit for start-up LINPC-USB

Device for service start-up and diagnostic, available for valves with K11 and K16 connections. See catalogue 89 850.

14 - SUBPLATES

(see catalogue 51 000)

PMMD-AI3G rear ports
PMMD-AL3G side ports
Ports dimensions: P, T, A, B: 3/8” BSP

DUPLOMATIC MOTION SOLUTIONS

DUPLOMATIC MS S.p.A.
via M. Re Depaolini 24 ▪ 20015 PARABIAGO (MI) ▪ ITALY
tel. +39 0331.895.111 ▪ www.duplomatic.com ▪ e-mail: sales.exp@duplomatic.com