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IO-Link



MOUNTING INTERFACE



PERFORMANCES

(obtained with mineral oil with viscosity of 36 cSt at 50°C)

Maximum pre	essure: P - A - B ports T port	PSI (bar)	5000 (350) 3000 (210)	
Maximum flo	wrate	GPM (l/min)	21 (80)	
Pressure dro	ps ∆p-Q	see para	graph 5	
Operating lim	nits	see para	graph 7	
Electrical fea	tures	see para	graph 8	
Electrical cor	nection	M12 5 pin male A		
Ambient tem	perature range	°C	-20 to +50	
Fluid tempera	ature range	°C	-20 to +80	
Fluid viscosit	y range	cSt	10 - 400	
Fluid contam	ination degree	accord ISO 440 class 20	ing to 6:1999)/18/15	
Recommend	ed viscosity	cSt	25	
Mass:	Mass: single solenoid valve double solenoid valve		3.3 (1,5) 4.4 (2)	

VSD03L SOLENOID OPERATED DIRECTIONAL VALVE WITH DIGITAL INTERFACE

SUBPLATE MOUNTING NFPA D03 ISO 4401-03

P max 5000 PSI (350 bar) Q max 21 GPM (80 l/min)

OPERATING PRINCIPLE



- Directional valve with digital interface, solenoid actuated, with mounting surface according to ISO 4401-03 standards.
- The valve is available in 3 or 4 way design, with 2 or 3 positions and a wide range of spools.
- The on-board electronics allow the valve to be controlled by a PLC with a low-power digital signal.
 There are several functions available, including energy saving and soft-shift.
- The version with IO-Link interface effectively integrates the valve in a digital communication system driven by PLC, and allows collecting operational data and environmental information for predictive diagnostics.
- The valve is available with DC solenoids.
- The valve is also available with zinc-nickel coating on the body, that ensures a salt spray resistance up to 240 hours.

HYDRAULIC SYMBOL (typical)





SOLENOID OPERATED DIRECTIONAL VALVE WITH DIGITAL INTERFACE

1 - IDENTIFICATION CODE:



NOTE: The standard valve is supplied with surface treatment of phosphating black.

The [W7] zinc-nickel finishing on the valve body makes the valve suitable to ensure a salt spray resistance up to 240 hours. (test operated according to UNI EN ISO 9227 standards and test evaluation operated according to UNI EN ISO 10289 standards).

2 - HYDRAULIC FLUIDS:

Use mineral oil-based hydraulic fluids HL or HM type, according to ISO 6743-4. For these fluids, use NBR seals (code A). For fluids HFDR type (phosphate esters) use FPM seals (code G). For the use of other fluid types 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.



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3 - FUNCTION / SPOOL TYPE



2 solenoids - 2 positions with mechanical retention











1 solenoid side A 2 external positions with return spring





1 solenoid side B

Proportional spools for ECG/IOLG function



NOTE 1: Hydraulic symbols for 3B1 and 3L1 are identical to those of 3B and 3L spools. Please refer to page 4/11 for possible function / spool and control function combinations



Below are the Control and Function / Spool possible combinations

	Control Function Code							
Function / Spool Code	IOL	EC1	EC2	ECL	ECG/IOLG			
1A	x	х	x	х				
1B	х	х	х	х				
1B1					х			
2A	х	х	х	х				
2B	Х	х	х	Х				
3A	х	х	х	х				
3A1					х			
3AC					Х			
3B	х	х	х	х				
3B1					Х			
3E	х	х	х	х				
3F	Х	х	Х	Х				
3F1					х			
3FC					Х			
3G	х	х	Х	Х				
3H	х	х	х	х				
3J	х	х	х	х				
3K	х	х	х	х				
3K1	х	х	х	х				
3L	х	х	х	х				
3L1					Х			
3N	х	х	х	Х				
3Q	х	х	х	Х				
5A	х	х	х	х				
5B	х	х	х	х				
5F	х	х	х	х				
5L	х	х	х	х				
9X	Х	х	Х	Х	Х			



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4 - ELECTRONIC FUNCTIONS

IOL

This version take advantages from IO-Link communication, providing different methods for feeding the power supply to the solenoid. The IOL version is fed 24V DC only.

The IO-Link version is able to apply all the behaviors showed for ECG, ECL, and EC* because the function behaviors is set via bus.

A data register feature is implemented for on / off time for both solenoid A and solenoid B, and for the functions mentioned above

ECG/IOLG

This version enables hydraulic actuators to perform a smooth start and stop by setting times values for ramp up and ramp down.

ECG code is 200 ms IOLG code is adjustable from 200 ms to 600 ms.

See available spools page 4. Performance limits at par. 7.



ECL

This version allows to feed the solenoid at the nominal current value for a time sufficient to guarantee the complete valve energizing (200 ms). The current is therefore automatically reduced at holding (approx 60%).



EC1 / EC2

This version allows to control the solenoid with a low power signal coming from the PLC.





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ENERGIZED POSITION

5 - PRESSURE DROPS Δp -Q

(obtained with viscosity 36 cSt at 50 °C)



	FLOW DIRECTION			
SPOOL TYPE	P→A	Р→В	A→T	B→T
	CI	JRVES (ON GRAF	РН
3A, 5A	2	2	3	3
3B, 5B	1	1	3	3
3F, 5F	3	3	1	1
3L, 5L	5	5	5	5
3J	2	1	3	3
3E	2	2	3	1
3H, 3Q	4	5	5	5
3F1	2	2	3	3
3G	1	3	1	3
ЗК	2	2	1	3
3A1, 3K1	2	2	3	3
3N	1	2	3	3
1A	3	3	3	3
1B	2	2	2	2
9X	3	3		
2A, 2B	2	2	2	2

For pressure drops between A and B lines of 3G spools used in regenerative diagrams, refer to curve 5.

DE-ENERGIZED POSITION

		FLOW DIRECTION				
SPOOL TYPE	P→A	P→B	A→T	B→T	P→T	
		CURVI	ES ON C	GRAPH		
3B, 5B					2	
3F, 5F			3	3		
3L, 5L					3	
3J		4				
3E				3		
3H, 3Q			6	6	3	
3G	3	3				
ЗК			3			
3N	4					

6 - SWITCHING TIMES

The values indicated are obtained according to ISO 6403 standard, with mineral oil viscosity 36 cSt at 50°C.

TIMES [ms]					
versions	ENERGIZING	DE-ENERGIZING			
IOL	set via bus	set via bus			
EC*, ECL	25 - 75	15 - 25			
ECG	200 to 600	200 to 600			



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7 - OPERATING LIMITS

The curves define the flow rate operating fields according to the valve pressure of the different versions. The values have been obtained according to ISO 6403 norm with solenoids at rated temperature and supplied with voltage equal to 90% of the nominal voltage. The value have been obtained with mineral oil, viscosity 36 cSt, temperature 50 $^{\circ}$ C and filtration according to ISO 4406:1999 class 18/16/13.

The limits for 1B and 1A spools refer to the 4-way operation. The operating limits of a 4-way valve in 3-way operation or with port A or B plugged or without flow are shown in the related chart.



SBOOL	CUI	RVE
SFOOL	P→A	P→B
3A, 5A	1	1
3B, 5B	2	2
3F, 5F	3	3
3L, 5L	4	4
3J	5	5
3E	4	6
3H	4	4
3Q	4	4
3F1	7	7
3G	7	7
ЗK	4	6
3A1	1	1
3K1	4	4
3N	5	5

SPOOL	CURVE		
SPOOL	P→A	P→B	
1A	7	7	
1B	8	8	
9X	2	2	
2A	7	7	
2B	8	8	

4-WAY VALVE IN 3-WAY OPERATION

Operating limits of a 4-way valve in 3-way operation or with port A or B plugged or without flow.



SPOOL	CURVE
1A backpr. A; 1A-*R backpr. B	1
1B backpr. A; 1B-*R backpr. B	1
1A backpr. B; 1A-*R backpr. A	2
1B backpr. B; 1B-*R backpr. A	3

SPOOLS FOR ECG/IOLG FUNCTION

Limits of spools type 3A, 3A1, 3B1,3L1,3F1, 1B1, AC and FC specific for soft-shift valves.



SPOOL	CURVE
3A, 3A1	1
3B, 3B1	2
3L1	4
3F1	1
1B1	3
AC, FC	5



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8 - ELECTRICAL FEATURES

8.1 - Solenoids

These are essentially made up of two parts: tube and coil. The tube is threaded into the valve body and includes the armature that moves immersed in oil, without wear. The inner part, in contact with the oil in the return line, ensures heat dissipation. The coil is fastened to the tube by a threaded ring, and can be easily replaced.

Protection from atmospheric agents IEC 60529

The IP protection degree is guaranteed only with both valve and connectors of an equivalent IP degree, correctly connected and installed.

electric connection	electric connection protection	whole valve protection
B**D - 2 pins for junction box	IP65	IP65

SUPPLY VOLTAGE FLUCTUATION	± 10% Vnom
MAX SWITCH ON FREQUENCY	18.000 ins/hr
DUTY CYCLE	100%
ELECTROMAGNETIC COMPATIBILITY (EMC)	In compliance with 2014/30/EU
LOW VOLTAGE	In compliance with 2014/35/EU
CLASS OF PROTECTION Coil insulation (VDE 0580) ImpregnatioN	class H class F

8.2 - Current and absorbed power

The table shows current and power consumption values for each function (values ±10%).

Function	Power supply	Powe	r consumpt [W]	Currer	nt consumpt. [A]	Coil nominal voltage	Resistance at 20°C	Coil code	
	[v]	pulse	continuous	pulse	continuous	[V] [12]	[V] [12]	[V]	
IOL	24	-	24	-	1.9	12			
ECG	24	-	24	-	1.9	12	4.5	M4002000	
ECL	24	28	14	2.7	1.5	12	4.5	W1903800	
EC1	12	-	32	-	2.67	12			
EC2	24	-	31	-	1.29	24	18.6	M1903801	

8.3 - IOL function: IO-Link communication

2L- and 1L- are galvanic isolated up to100 V to avoid earth loops. In IO-Link networks, the length of the connecting cables is limited to 20 metres.

Supply voltage	V DC	24 (from 19 to 30 VDC), ripple max 3 Vpp
IO-Link communication (IOL): Data rate	kBaud	IO-Link Port Class B 230.4
Managed breakdowns		Overload and electronics overheating, cable breakdown, supply voltage failures
Connection		5-pin M12 code A (IEC 61076-2-101), male

Pin

8.4 - IOL/IOLG Pin table

	Pin		Values	Function
	2	2L+	+24 V DC	Colonaid voltage europy
	5	2L-	0 V (GND)	Solenoid voltage supply
	1	1L+	+24 V DC	IO Link voltage gupply
	3	1L-	0 V (GND)	
	4	C/Q		IO-Link Communication
$ \begin{array}{c} 5 \\ 1 \\ 3 \\ 4 \\ 4 \\ 4 \\ 4 \\ 4 \\ 4 \\ 4 \\ 4 \\ 4 \\ 4$	5 1 3 4	2L- 1L+ 1L- C/Q	0 V (GND) +24 V DC 0 V (GND)	IO-Link voltage supply



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8.5 - IOL on-board electronics diagram



8.6 - IOL function: Led

The valve has 2 two-color LEDs visible from the top cover. They work alternatively.

led	colour	on	flashing
	green	-	device linked to Master
L1	red	device disconnected	device powered, not connected to Master
1.2	green	valve ready	-
	red	error	-

8.7 - ECG, ECL, EC1 and EC2 functions: electrical characteristics

Supply voltage: ECG, ECL, EC2 EC1	V DC	24, ripple max 3 Vpp 12, ripple max 3 Vpp
Power consumption	W	1 + solenoid consumption (see par. 8.2)
Fuse protection, external: ECG, ECL, EC1, EC2	А	3 5
Managed breakdowns		Overload and electronics overheating, supply voltage failures

8.8 - ECG, ECL and EC2 pin table

Pin	Values	Function
- 1	8 ÷ 24 V DC	Digital command coil B
2	+24 V DC	Solenoid supply voltage
 3	NC	-
- 4	8 ÷ 24 V DC	Digital command coil A
5	0V GND	Supply voltage reference

8.9 - EC1 pin table

		Pin	Values	Function
		⊲1	8 ÷ 12 V DC	Digital command coil B
		⊲2	+12 V DC	Solenoid supply voltage
1	<u>3</u>)	3	NC	-
		⊲4	8 ÷ 12 V DC	Digital command coil A
		⊲5	0V GND	Supply voltage reference

8.10 - EC* on-board electronics diagram



8.11 - EC* fuctions: led

The valve has 2 two-color LEDs on the top cover. They work alternatively.

led	colour	on
1.1	green	coil A energized
	red	coil A error
1.2	green	coil B energized
	red	coil B error



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9 - ELECTRIC CONNECTORS

A 5-poles M12 code A female connector is required. It can be ordered separately with code M3491001001.

10 - OVERALL AND MOUNTING DIMENSIONS





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11 - INSTALLATION

Configurations with centering and return springs can be mounted in any position; type 2A valves - without springs and with mechanical detent - must be mounted with the longitudinal axis horizontal.

Valve fixing takes place by means of screws or tie rods, with the valve mounted on a lapped surface, with values of planarity and smoothness that are equal to or better than those indicated in the drawing. If the minimum values of planarity and/or smoothness are not met, fluid leakages between valve and mounting surface can easily occur.

Surface finishing		
	.0004/4.0	
	 	

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