



VSD03L

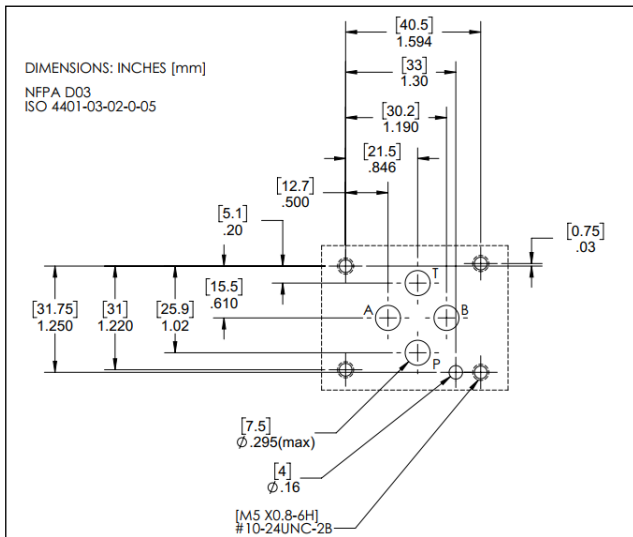
SOLENOID OPERATED DIRECTIONAL VALVE WITH DIGITAL INTERFACE

**SUBPLATE MOUNTING
NFPA D03 ISO 4401-03**

P max 5000 PSI (350 bar)

Q max 21 GPM (80 l/min)

MOUNTING INTERFACE

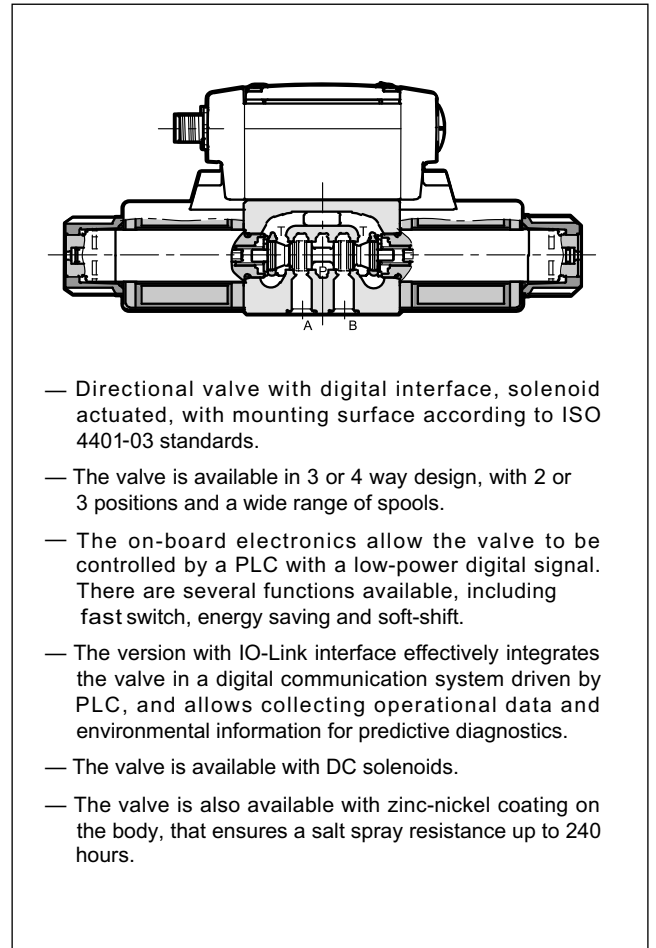


PERFORMANCES

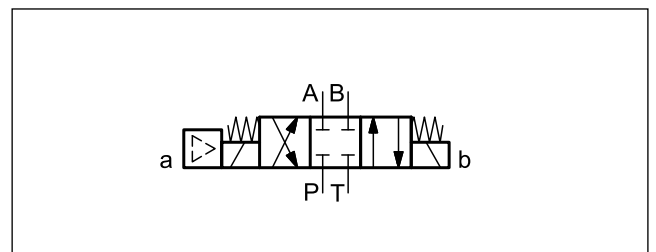
(obtained with mineral oil with viscosity of 36 cSt at 50°C)

Maximum pressure:	P - A - B ports T port	PSI (bar)	5000 (350) 3000 (210)
Maximum flowrate		GPM (l/min)	21 (80)
Pressure drops Δp -Q			see paragraph 5
Operating limits			see paragraph 7
Electrical features			see paragraph 8
Electrical connection			M12 5 pin male A
Ambient temperature range		°C	-20 to +50
Fluid temperature range		°C	-20 to +80
Fluid viscosity range		cSt	10 - 400
Fluid contamination degree			according to ISO 4406:1999 class 20/18/15
Recommended viscosity		cSt	25
Mass:	single solenoid valve double solenoid valve	lbs (kg)	3.3 (1,5) 4.4 (2)

OPERATING PRINCIPLE

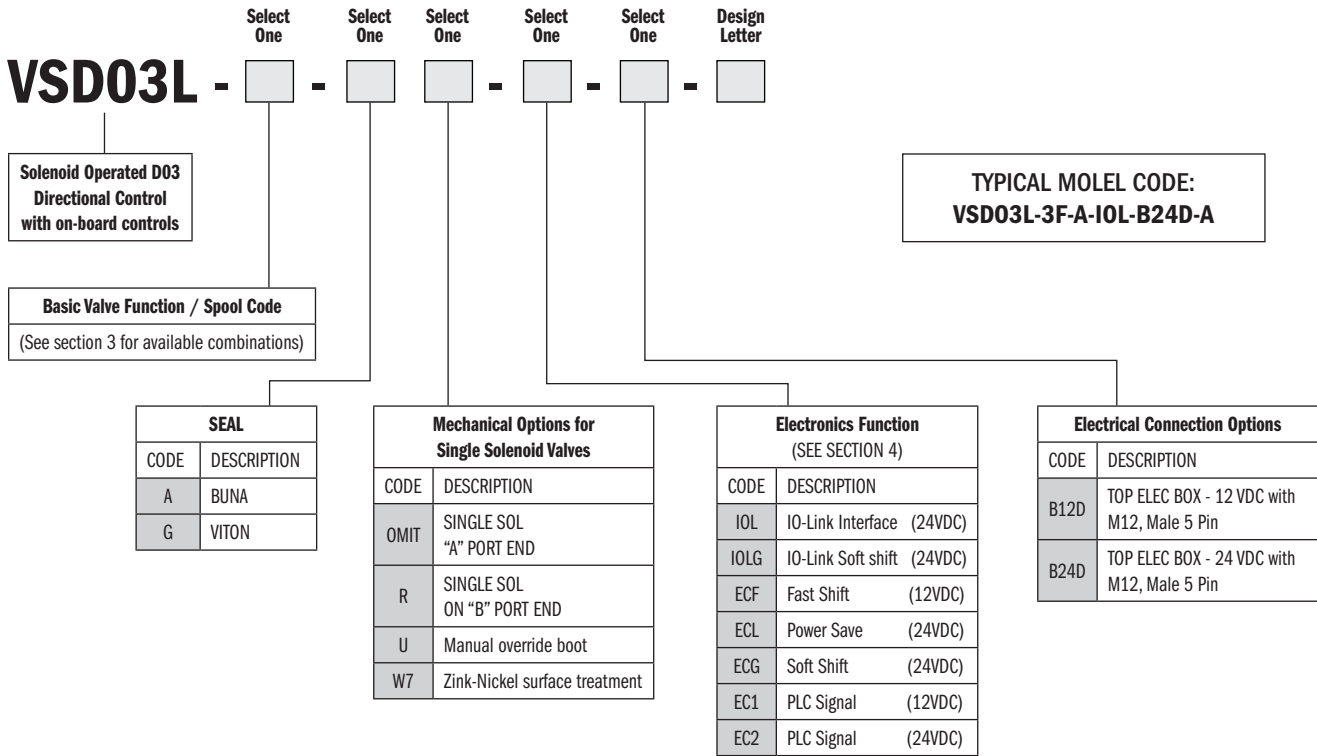


HYDRAULIC SYMBOL (typical)



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).

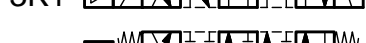
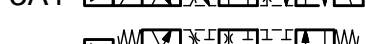
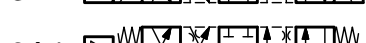
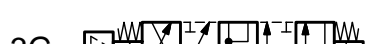
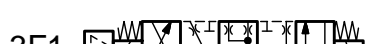
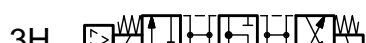
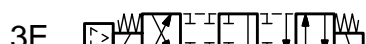
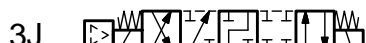
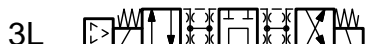
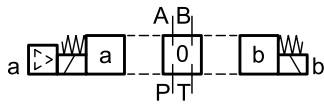
2 - HYDRAULIC FLUIDS:

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.

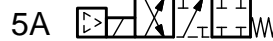
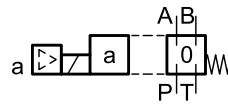
Using fluids at temperatures higher than 80 °C causes a faster degradation of the fluid and of the seals characteristics. The fluid must be preserved in its physical and chemical characteristics.

3 - FUNCTION / SPOOL TYPE

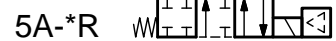
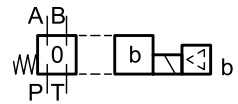
2 solenoids - 3 positions
with spring centering



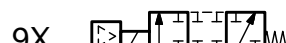
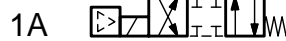
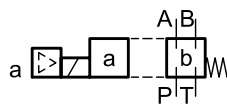
1 solenoid side A
2 positions (central + external)
with spring centering



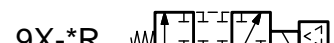
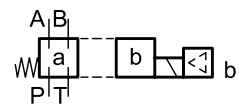
1 solenoid side B
2 positions (central + external)
with spring centering



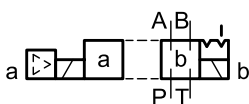
1 solenoid side A
2 external positions
with return spring



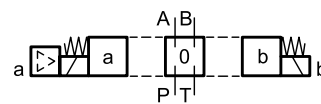
1 solenoid side B
2 external positions
with return spring



2 solenoids - 2 positions
with mechanical retention



Proportional spools
for ECG 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

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Below are the Control and Function / Spool possible combinations

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

4 - ELECTRONIC FUNCTIONS

4.1 - IOL

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

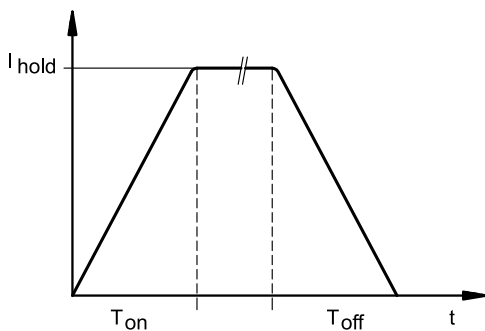
The IO-Link version is able to apply all the behaviours showed for ECG, ECL, ECF and EC* because the function behaviour is set via bus.

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

4.2 - ECG

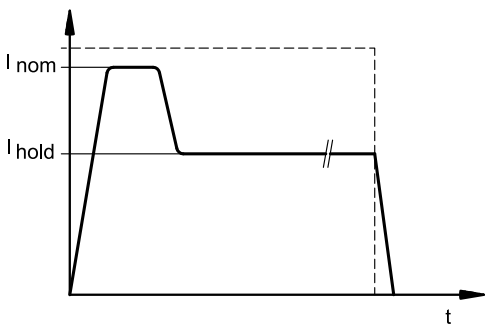
This version enables hydraulic actuators to perform a smooth start and stop by setting times values (200 ÷ 600 ms) for ramp up and ramp down.

See available spools page 4. 1. Performance limits at par. 7.



4.3 - 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%).

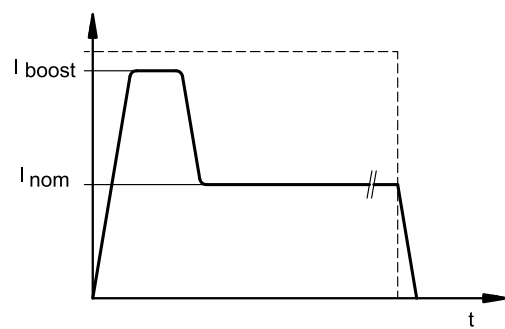


4.4 - ECF

This version allows a fast switching, overboosting the 12 V solenoid just for the time needed to energize it. Then, the voltage will be lowered at the nominal value.

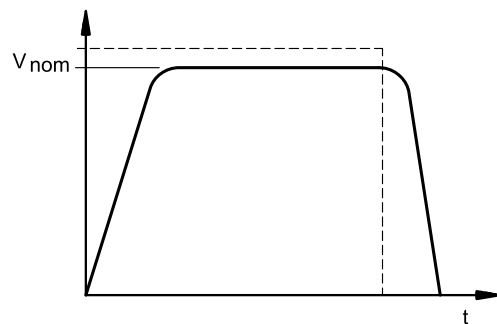
The de-energizing is fast, around 10 ms.

During overboosting, the power-supply unit must be able to provide a 6 A current with 24 V supply voltage.



4.5 - EC1 / EC2

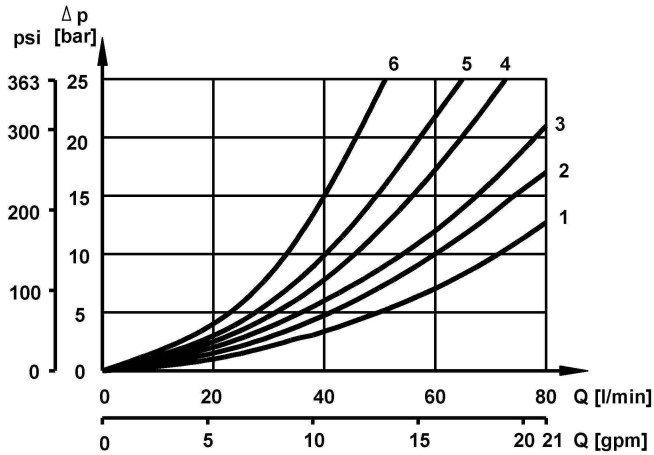
This version allows to control the solenoid with a low power signal coming from the PLC.



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5 - PRESSURE DROPS Δp -Q

(obtained with viscosity 36 cSt at 50 °C)



ENERGIZED POSITION

SPOOL TYPE	FLOW DIRECTION			
	P→A	P→B	A→T	B→T
	CURVES ON GRAPH			
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
3K	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

SPOOL TYPE	FLOW DIRECTION				
	P→A	P→B	A→T	B→T	P→T
	CURVES ON GRAPH				
3B, 5B					2
3F, 5F			3	3	
3L, 5L					3
3J		4			
3E				3	
3H, 3Q			6	6	3
3G	3	3			
3K			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.

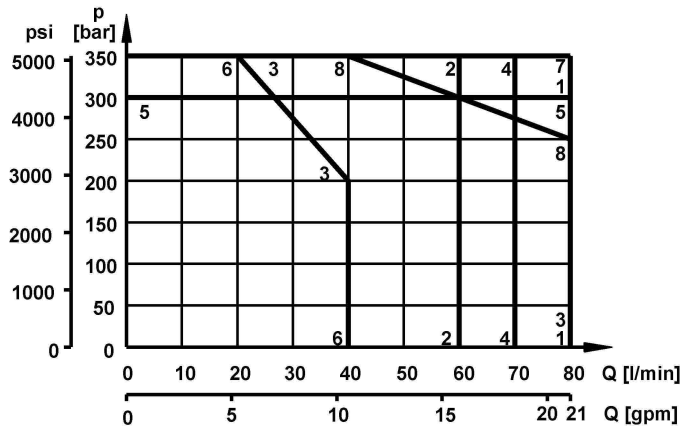
versions	TIMES [ms]	
	ENERGIZING	DE-ENERGIZING
IOL	set via bus	set via bus
EC*, ECL, ECF	25 - 75	15 - 25
ECG	200 to 600	200 to 600

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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 °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.

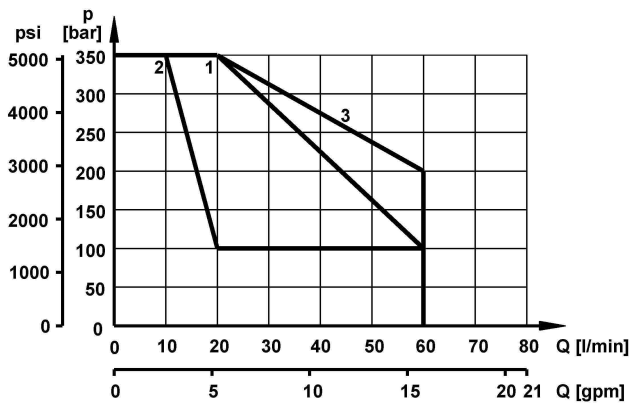


SPOOL	CURVE	
	P→A	P→B
3A, 5A	1	1
3B, 5B	2	2
3F, 5F	3	3
3L, 5L	4	4
3J	5	5
3E	4	6
3H	4	4
3Q	4	4
3F1	7	7
3G	7	7
3K	4	6
3A1	1	1
3K1	4	4
3N	5	5

SPOOL	CURVE	
	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

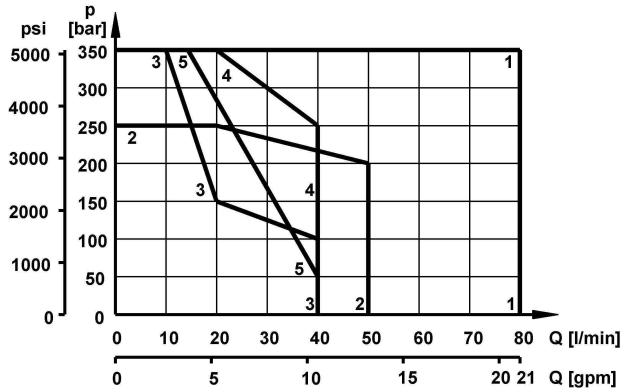
Operating limits of a 4-way valve in 3-way operation or with port A or B plugged or without flow.



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 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

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 [V]	Power consumpt [W]		Current consumpt. [A]		Coil nominal voltage [V]	Resistance at 20°C [Ω]	Coil code
		pulse	continuous	pulse	continuous			
IOL	24	-	24	-	1.9	12	4.5	M1903800
ECG	24	-	24	-	1.9	12		
ECF	24	100	24	4.0	1.9	12		
ECL	24	28	14	2.7	1.5	12		
EC1	12	-	32	-	2.67	12		
EC2	24	-	31	-	1.29	24	18.6	M1903801

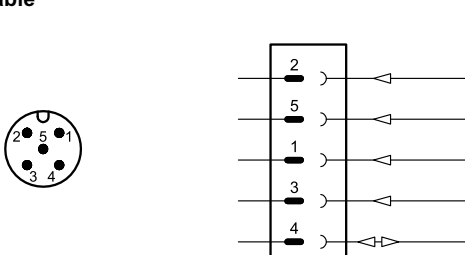
8.3 - IOL function: IO-Link communication

2L- and 1L- are galvanic isolated up to 100 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

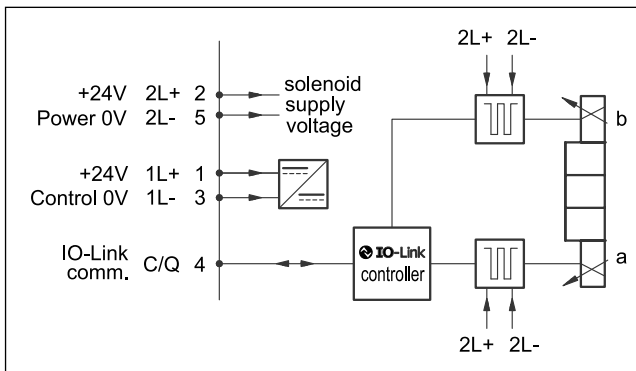
8.4 - IOL Pin table

Pin	Values		Function
	2L+	2L-	
2	+24 V DC		Solenoid voltage supply
5	0 V (GND)		
1	+24 V DC		IO-Link voltage supply
3	0 V (GND)		
4	C/Q		IO-Link Communication



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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
L1	green	-	device linked to Master
	red	device disconnected	device powered, not connected to Master
L2	green	valve ready	-
	red	error	-

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

Supply voltage: ECG, ECF, 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 ECF	A	3 5
Managed breakdowns		Overload and electronics overheating, supply voltage failures

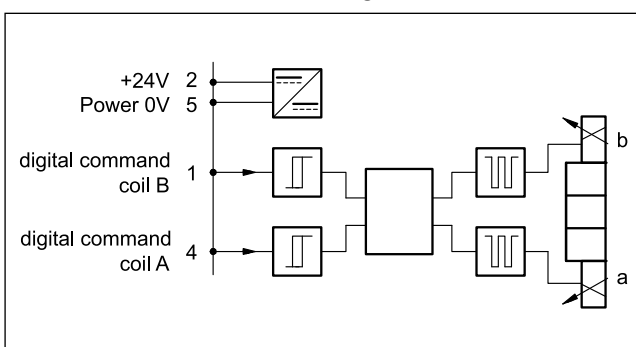
8.8 - ECG, ECF, ECL and EC2 pin table

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
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* functions: led

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

led	colour	on
L1	green	coil A energized
	red	coil A error
L2	green	coil B energized
	red	coil B error

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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.

