D40X Datasheet

Proportional servo valve with integrated digital axis controller.

Features D40X

The D40X axis controller offers new on the market-features. This benefits are packed into a userfriendly, intuitive user interface, using the latest approved technologies to upgrade your application.

Software functions are pre-loaded so if the hardware allows a feature, you can activate it on site directly.

The D40X with on-board electronics is an axis controller, performing position closed loop of any hydraulic actuator using analogue LVDT-, SSI-, or digital incremental encoder position transducer. Analogue sin/cos encoders are supported by hardware option.

4 configurable analogue sensor inputs (V/A) with flexible scaling on two seperate M12 connectors (see page 7, connector 7,8), each input supports also PT100/PT500/ PT1000 temperature, sensors in a 2 wire configuration.

Digital fieldbus protocol PROFINET, EtherCAT or EtherNet /IP availabe and field selectable. Select your protocol post purchase.

HTML-Browser-based service interface via USB-C port on device or over the fieldbus Ethernet-Connection using standard TCP/IP interface (with dedicated MAC and IP-adress for increased independency). No specific software on your external device for parameter settings is required. Just connect your laptop or other device by use of a standard USB-cable connector to the D40X, no internet is required, as the webserver is fully self contained. The browser based Web interface will allow you to have access to set all parameters depending on your access level.

Updates of parameter software can be recived by email and get installed on site by cutomer. Software update is limited to USB-C based access.

On-desk configuration without 24V power supply – the web browser and Ethernet/fieldbus are alive as soon as the USB-C is connected allowing all pre-site configuration and fieldbus checking to be done connecting the main 24V supply.

No undesired hydraulic function on the way to the failsafe position.

Double power supply to coil and electronics. Electronics remains active for fieldbus communication and monitoring functions while coil is power off (SIL2).

Content

Function D40X

Working principle of the D40X

The D40X is a control valve for 2-, 2x2-, 3- and 4-way applications and is suitable for electrohydraulic control of pressure and flow with high dynamic characteristics.

Design and Application

A permanent magnet linear force motor is used to drive the spool. The linear force motor drives the spool in both working directions from the spring-centered middle position. The strong actuating force of the spool, provides the D40X with excellent static and dynamic characteristics.

Function

The D40X is a digital directional control valve with integrated axis controller with the following functionalities:

- Position control
- Pressure/force control
- Horse Power control
- Alternating control (position - pressure/force)
- Alternating control (flow - pressure/force)
- P/Q function (flow-controlled)

Fieldbus Interface

The built-in fieldbus interface (PROFINET RT or EtherCAT or EtherNet/IP) enable operating parameters to be set, activates the valve and monitors its performance. To reduce wiring, the fieldbus interface is provided with internal switch with two M12-connectors. The D40X is also available without a fieldbus interface. In this case, the valve is controlled using analogue interface. All parameters are set using the web based USB-C service interface.

Axis Control

External position sensors like LVDT (3-wire and 4-wire), SSI, digital incremental encodersignal are attached to the D40X M12 connector for closing the axis controller loop. Analogue Inputs within the range of +/-20mA and +/-10V are accepted and operator set in the parameter settings.

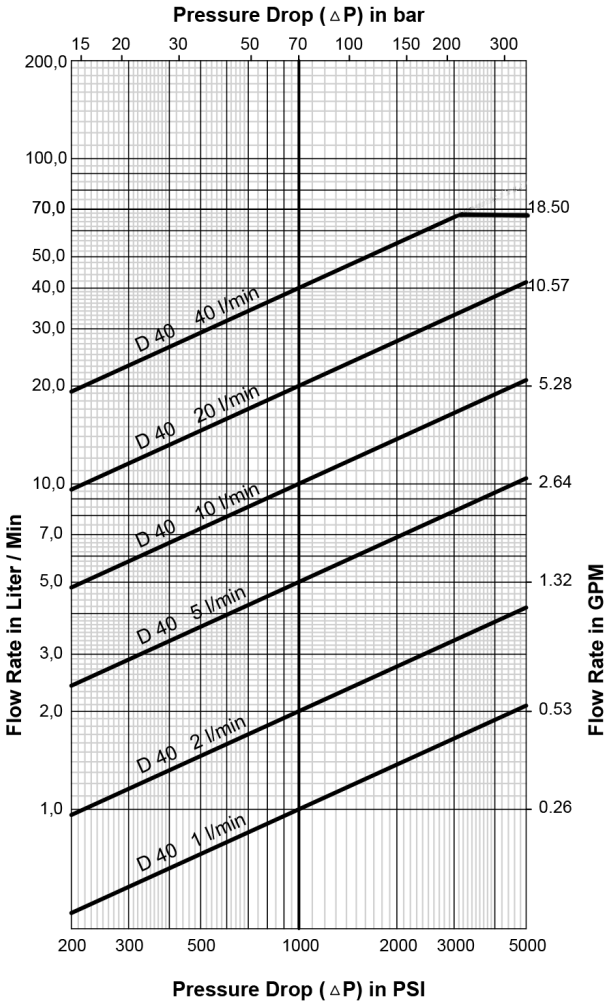
Software Features

- Webbrowser based parameter software. No software is required on your programming device. No Internet access is requested, for parameterization.
- grafical user interface organized in pages and levels.
- Customer can set up to 3 different authorisation access levels for internal access right management.
- Look of the grafical user interface changes according the choosen authorization access level
- real time monitoring of internal signals by internal oscilloscope function.
- advanced diagnostics
- Parameter settings can be sent by email and be installed on site by user (parameter up/download)
- D40X firmware can be received by email and be installed on site by user (software update in the field)

Technical data D40X

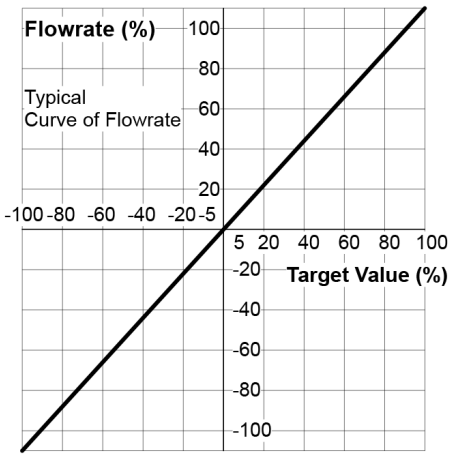
Function	Directly actuated 4/3-way valve						
Piston drive	Bidirectional proportional solenoid						
Connection diagram	ISO 440103 / Cetop 03 / NG6						
Nominal flow rate at 70 bar ΔP	1 L/min	2 L/min	5 L/min	10 L/min	20 L/min	30 L/min	40 L/min
Frequency response at 90° phase shift at 40% amplitude	120 Hz						
Leakage at 100 bar, 40 cSt	<0,1 L/min	<0,1 L/min	<0,2 L/min	<0,3 L/min	<0,5 L/min	<0,6 L/min	<0,8 L/min
Step response for 100% amplitude	8ms						
Maximum pressure in P, B, A	350 bar						
Maximum pressure in T without Y	250 bar						
Maximum pressure in T with Y	350 bar						
Temperature range	-20 to +85C°						
Oil viscosity	5 to 360 cSt.						
Required purity class of the fluid	NAS 1638: < class 7 ISO 4406 :16/13, 1 liter version: NAS 1638: < class 6 ISO 4406 :14/12						
Sensitivity	0.1% of the rated current						
Hysteresis	<0,2%						
Zero displacement with 20% pressure change	<0,2%						
Zero displacement with temperature change of 40C°	<1%						
Possible customer signals	Field selectable standard/customised analogue signals V/A within the range of +/- 10V and +/- 20mA fieldbus I/O link						
Possible feedback signals	LVDT, analogue signals V/A, SSI, quadrature signals						
Fail-safe piston position	Center position, or P→B/ A→T or P→A/ B→T (more options with intermediate plate valve see page 7)						
Supply voltage	24VDC, Min. 22 VDC, Max. 27 VDC						
Maximum current consumption	2.0 Amp						
Type of protection	IP67						
Installation position	any						
Weight	2 kg						

Valve Flow Diagram

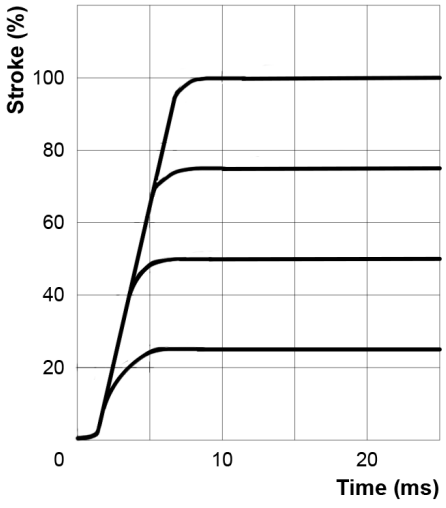


Volume-Signal

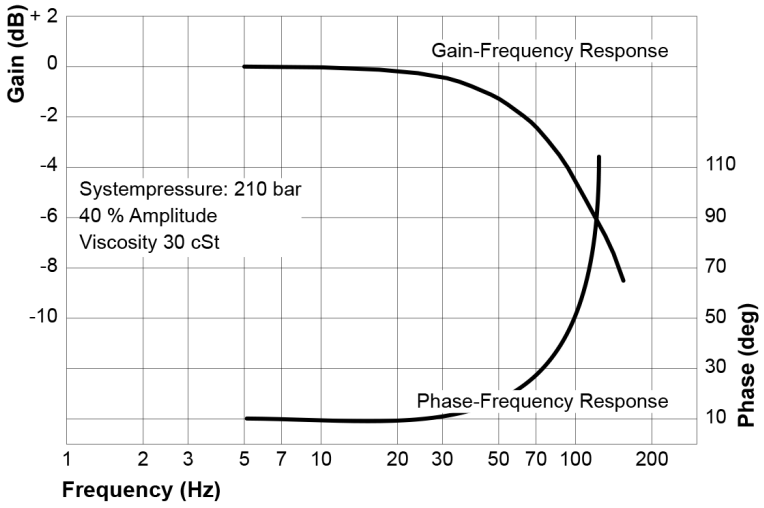
at constant pressure difference



Step Response

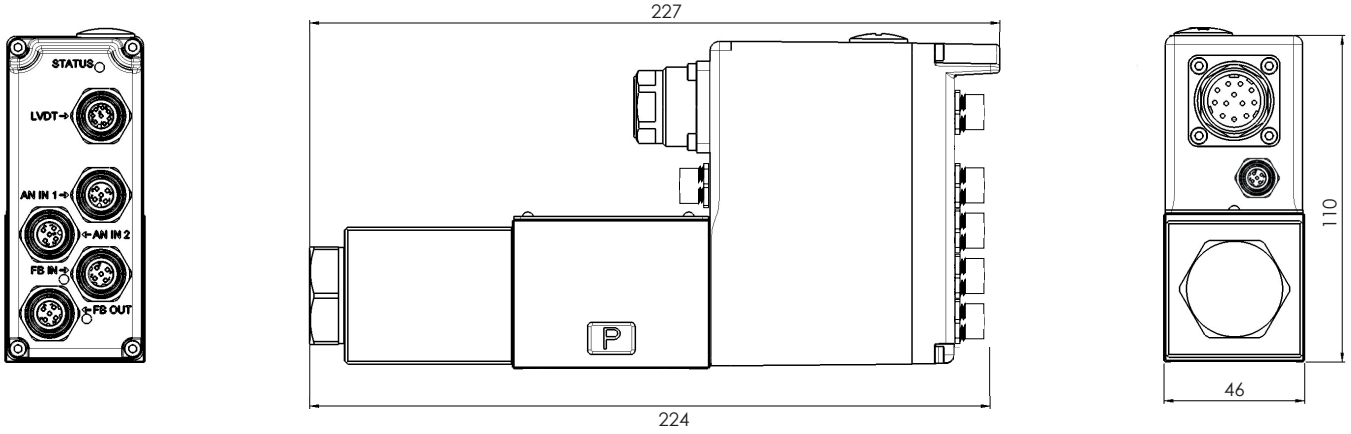


Frequency Response

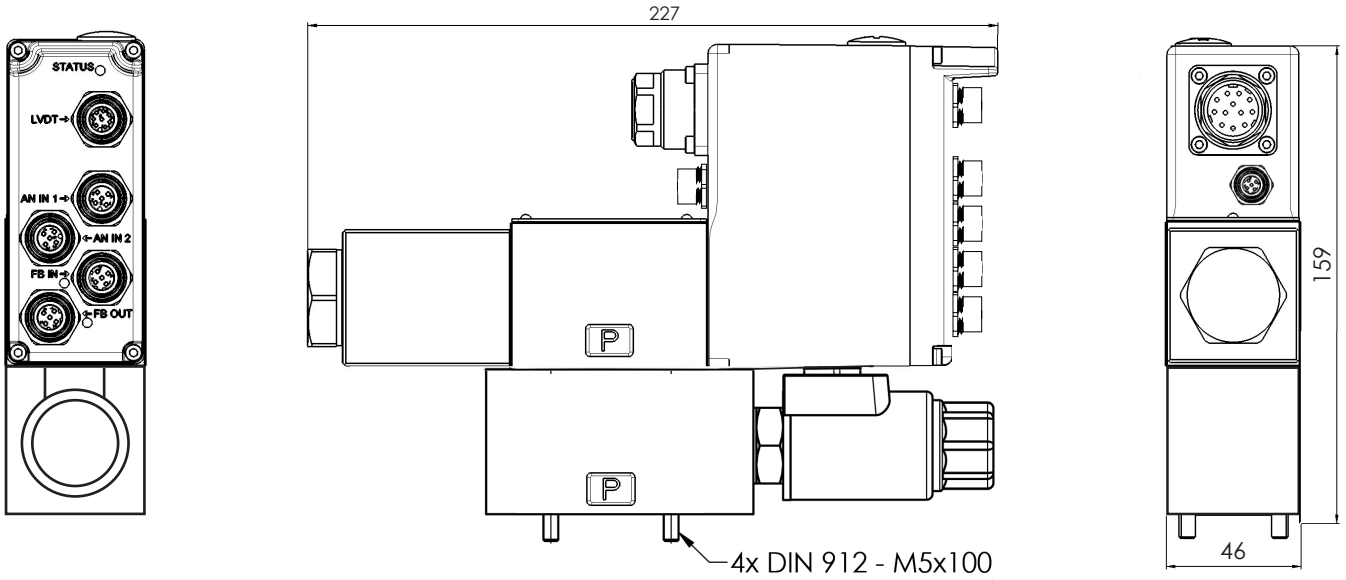


Measurement and hydraulical connection

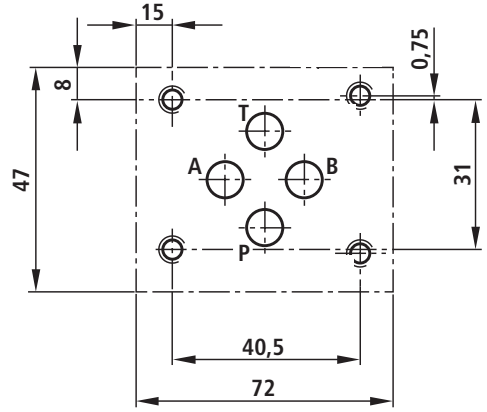
Configuration with full amount of connectors



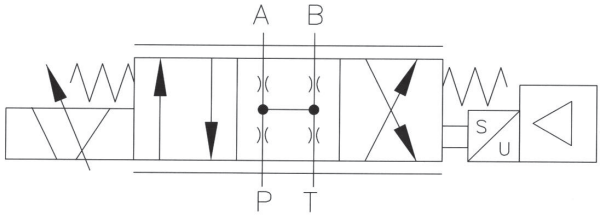
Layout Fail safe position code 3+4



Connection (View application) NG6 / Cetop03

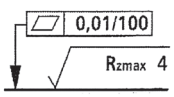


Hydraulic schema

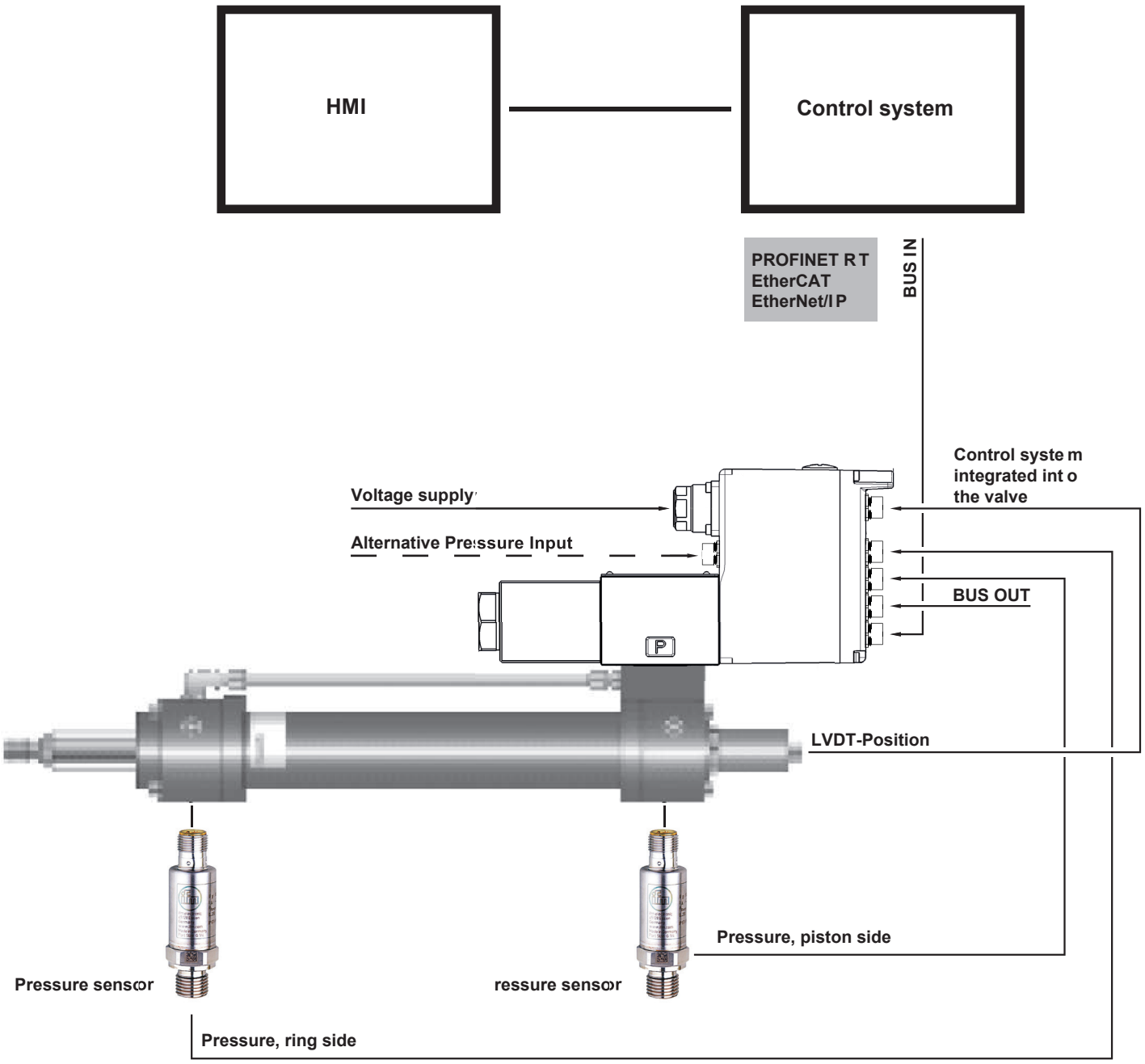


Valve attachmentt-surface

Please assure the following valve attachment surface quality:

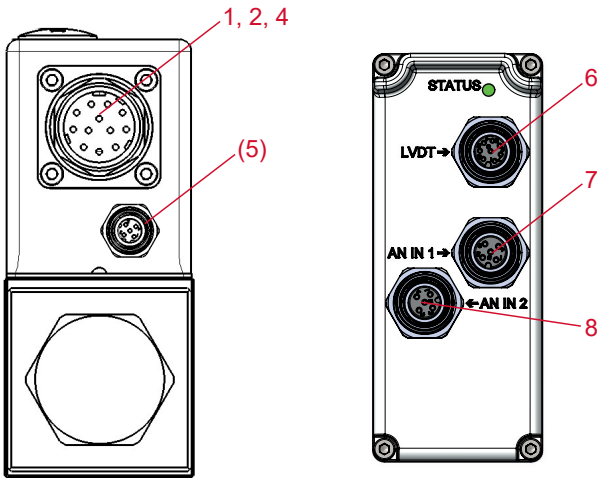


D40X in a system network

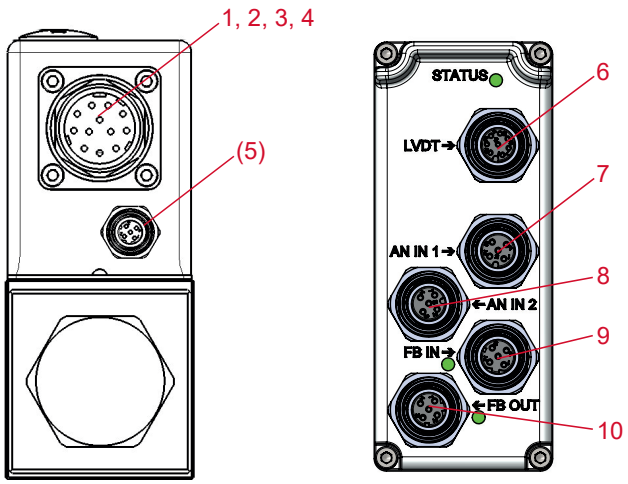


Electrical connections / Pin-assignment

D40X connector layout without fieldbus function



D40X connector layout with fieldbus function



1 6+PE, M23 connector, power 24VDC, analogue input signal, flow or pressure, monitor signal, position valve spool

2 11+PE, M26 connector, power 24VDC, analogue input signal, flow and/or pressure, monitor signal, position valve spool and pressure

3 Power 24VDC, M12 connector, push/pull, 4-pin, T-coded, male

4 IO-Link slave for digital input signals flow and/or pressure, M12 connector, push/pull, 5-pin, A-coded

(5) Optional: External analogue pressure input current/ voltage, M12 connector, push/pull, 5-pin, A-coded, female (alternative position for connector 7 or 8)

6 Feedback signal LVDT, SSI, digital quadrature, sin/ cos, analogue signals as hardware option. Current / voltage, M12 connector, push/pull connection, 8-pin, A-coded, female

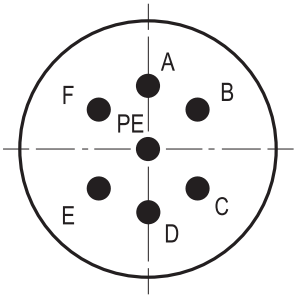
7 Analogue input current/voltage (maximum 2 signals) M12 connector, push/pull, 5-pin, A-coded, female

8 Analogue input current/voltage (additional maximum 2 signals) M12 connector, push/pull, 5-pin, A-coded, female

9 Fieldbus input, PROFINET Rt or EtherNet IP or EtherCAT M12 connector, push/pull, 4-pin, D-coded, female

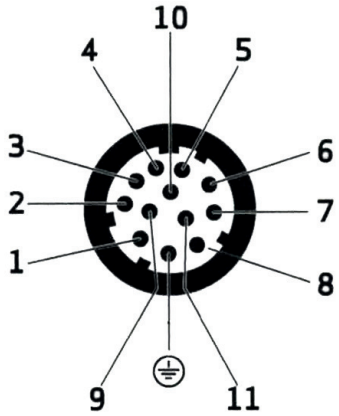
10 Fieldbus output, PROFINET Rt or EtherNet IP or EtherCAT M12 connector, push/pull, 4-pin, D-coded, female

Connector 6 + PE



Pin	Signal +/- 10V	Signal 4...20mA (6 + PE)	Signal +/- 20mA (6 + PE)
A	Supply voltage	Supply voltage	Supply voltage
B	GND	GND	GND, reference potential actual value/enable (current loop / F.B feedback)
C	Reference potential actual value	Reference potential actual value (Current loop / F.C Repatriation)	Enable input
D	Setpoint	Setpoint	Setpoint
E	Reference potential setpoint	Reference potential setpoint (Current loop D.E Repatriation)	Reference potential setpoint (Current loop D.E Repatriation)
F	Monitor output	Monitor output	Monitor output
⏚	Functional earth (directly connected to the valve body)		

Connector 11 + PE



Pin	Usage (Analogue and Fieldbus)	Comment
1	24V Supply	Main supply: Coil power stage and electronics
2	GND	GND for power supply
3	Digital input	24V
4	Analogue input volume flow, referenced to pin 5	+/- 10V, +/- 20mA
5	Common for analogue inputs	Used for pin 4 and pin 7
6	Analogue output Q	+/- 20mA or +/- 10V (selectable)
7	Analogue input pressure, referenced to pin 5	+/- 10V, +/- 20mA
8	Analogue output p	0/4 .. 20mA or 0 .. 10V (selectable)
9	Optional: +24V supply	Supply for Coil power stage
10	Optional: GND	Signal GND
11	Digital output 1	Digital output: 24V / 20mA
PE	Protective Earth	Connected with valve body

11 + PE signal usage for D40 et. al. (Pin C will be used for digital input, see below)

Pin 1: Power supply 24V (electronics and coil power stage)

Pin 2: GND for power and signal

Pin 3: Digital input with selectable function / enable

Pin 4: Analogue input signal, positive terminal

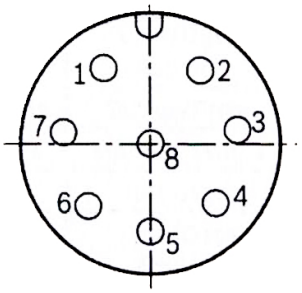
Pin 5: Analogue input signal volume flow/position, negativ terminal for 4/5 and 7/5

Pin 6: Monior signal +/- 20mA / +/- 10V software selectable, preferred for flow/position

Pin 7: Analogue input signal pressure, positive terminal

Pin 8: Monior signal 4 ... 20mA / 0 ... 10V software selectable, preferred pressure

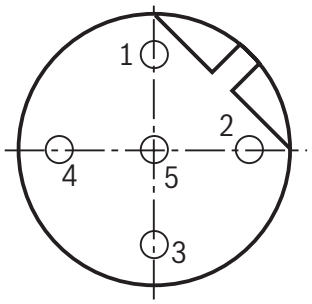
Device connector, Axis-interface: M12 (A-coding), 8-pin, female



Pin	SSI usage	Analogue usage	LVDT usage	Quadrature usage	Remark
1	Clock positive	Unused	Excitation positive	Phase A positive	5 V Level
2	Clock negative	Unused	Excitation negative	Phase A negative	5 V Level
3	Data positive	Unused	Signal positive	Phase B positive	5 V Level
4	Data negative	Unused	Signal negative	Phase B negative	5 V Level
5	Unused	Unused	Center signal	Index I positive	5 V Level
6	Unused	Analogue In	Unused	Index I negative	24 V Level
7	Supply 24V	Supply 24V	Switches off	Supply 24V	24 V Level
8	GND	GND	GND	GND	GND fix

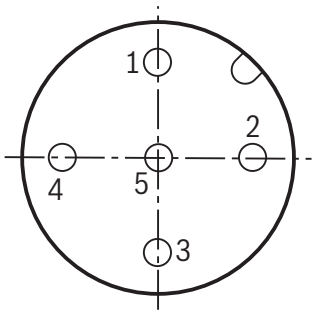
A 4 wire LVDT is connected to pin 1, pin 2, pin 3 and pin 4
A 3 wire LVDT is connected to pin 1, pin 2, and pin 5

Device connector assignment for PROFINET / EtherCAT / EtherNet IP interface (coding D), M12, 4-pin, socket



Pin	Function
1	1 TxD +
2	2 RxD +
3	3 TxD –
4	RxD –
5	not used

Device connector analogue configurable sensor interfaces, (A-coding), M12, 5-pin, female



Pin	Function
1	24V power max. 50mA
2	Analogue input 2 or 4: V/ mA / PT1000 / PT500 PT100 (additional signal) [1) 2)]
3	GND and reference for pin 2 / pin 4
4	Analogue input 1 or 3: V/ mA / PT1000 / PT500 PT100 (standard) [1)]
5	not used

1) V = Signals in the range of -10V to +10V possible
A = Signals in the range of -20mA to +20mA possible

2) Pin 4 is used for main function. If parallel usage of pin 4 and pin 2 is intended, costomermade cable or y-splitter is required.

Ordering code D40X

1	2	3	4	5	6	7	8	9	10
D40X									

1	**Valve model**	D40X

2	**Overlap (1*)**	
	Zero overlap	Z
	2% overlap	Y
	4% overlap	T
	10% overlap	X
	25% overlap	W
	3-way	V
	10% overlap P, 3% underlap T	U

3	**Flow rate (1*)**	at 70bar pressure difference at 35bar / control edge			
		Linear	Kink at 40%	Kink at 60%	
	1 L/min	✓			1
	2 L/min	✓			2
	5 L/min	✓			5
	10 L/min	✓			10
	20 L/min	✓		✓	20
	30 L/min		✓		30
	40 L/min	✓			40

4	**Flow characteristics**	
	Linear characteristic curve (standard)	L
	Characteristic curve kinked at 40% amplitude	K
	Characteristic curve kinked at 60% amplitude	P

5	**Failsafe position**	
	Center position, no flow	M
	P to B / A to T	1
	P to A / B to T	2
	P closed, A + B to T (2*)	3
	A, B, P, T closed (2*)	4
	A to B, P+T closed (2*)	5

6	**Sealing material**	
	NBR	N
	Viton (FPM, FKM)	V
	EPDM	E
	PFE	P

7	**Pressure control**		
	No pressure / force control		X
	Pressure control 1 external pressure transducer	using connector 5 (see page 5)	m
		using connector 7 or 8 (see page 5)	n
	Pressure control 1 pressure transduce integrated in D40X port A	max pressure 25bar	o
		max pressure 160bar	p
		max pressure 250bar	q
		max pressure 350bar	r
	Force control (2 external pressure transducer) using connector 7 and 8, or 7 or 8 with Y-connector (see page 5)		s
	Force control 1 load cell	using connector 5 (see page 5)	t
		using connector 7 or 8 (see page 5)	u

8	**Signal interface**					
		Command signal Input Q	Monitor signal output Q	Command signal Input P	Monitor signal output P	
	Analogue signal	range +/- 10V or +/- 20mA customer field selected		range 0...10V or 0...20mA costumer field selected		A
	Default settings	+/- 10V	4...20mA	0...10V	4...20mA	
	Digital signal	PROFINET/Rt (fixed)				PN
		EtherCAT (fixed)				EC
		EtherNet/IP (fixed)				EN
		Fieldbus PN, EC, EN, (customer field selectable)				FX
		I/O-link (4*)				IO

9	**Connector frontside**	
	6 + PE, M23 connector (1) when P or Q control	1
	11 + PE, M26 connector (2) when PQ control	2
	M12 connector (3), alternative to 6 + PE (no monitor signal)	3

10	**Mounting side of the coil**	
	Coil on A-side (standard)	A
	Coil on B-side	B

11	**Selec specific**	

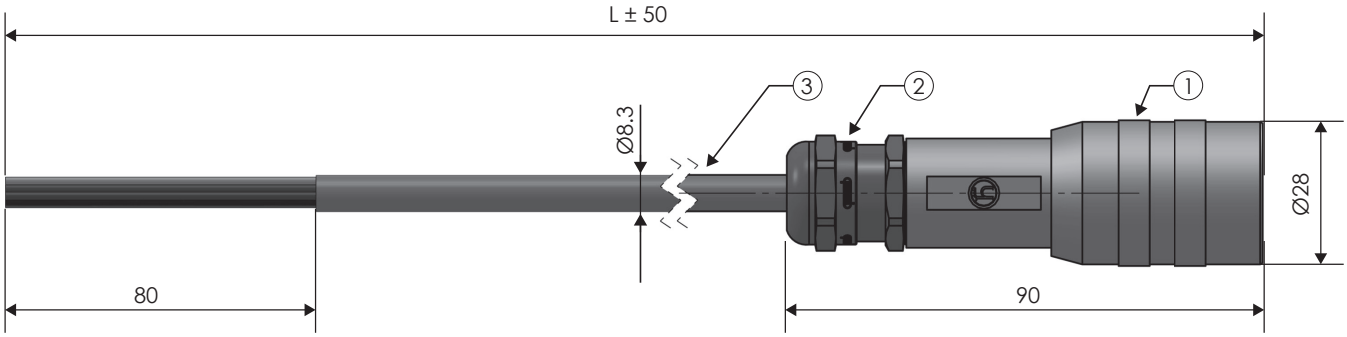
(1*) Customer-specific requirements are possible on request
(area ratios, special flow rates, progressive characteristic curve)

(2*) With intermediate plate valve (see page 4)

(3*) The customer can freely define signals via the browser-based parameterization interface in the voltage range +/-20V and current range +/-50mA. Default +/-10V or inform us of the desired signal with the order. We will parameterize accordingly.

(4*) 6+PE connector is replaced by M12 connector

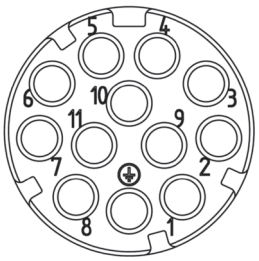
Connector M26, 11+PE assembled with cable



	Selec part Nr.
① Metal Connector M26, 11+PE Hirschmann, N11-EFS	261125-C
② Metal Connector gland, PG13, S	–
③ Shielded cable, Lapp Oelflex Servo FD798CP	–

Assembly of ①, ②, ③, 2 Meter overall length	261125-2
Assembly of ①, ②, ③, 5 Meter overall length	261125-5
Assembly of ①, ②, ③, 10 Meter overall length	261125-10
Assembly of ①, ②, ③, 15 Meter overall length	261125-15
Assembly of ①, ②, ③, 20 Meter overall length	261125-20
Assembly of ①, ②, ③, 25 Meter overall length	261125-25

Pin assignment for 11-pin cable connector



Pin Nr. 11+PE (M26)	Conductor cross-section	Wire color	Name	Function
8	0.14mm²	red	Analogue out 2 (Pressure)	4…20mA monitor output for pressure
5	0.14mm²	grey	Common in	Common input pin for the 2 analogue input signals on pin 3 and 6
4	0.14mm²	yellow	Analogue in 1 / Position (Q)	Input for the analogue position (Q) input signal, +/-10V, +/-20mA
3	0.14mm²	green	Digital in	Digital input, defined by software, used for non critical enable functions or switch operations
6	0.14mm²	pink	Analogue out 1	4…20mA monitor output or +/-10V monitor output for position (Q)
7	0.14mm²	blue	Analogue in 2 (Pressure)	Input for the analogue pressure (P) input signal, +/-10V, +/-20mA
11	0.14mm²	violet	Digital Output 1	Status output 24V, 20mA, current limited, controlled by software
GND	Shield		PE	Protective Earth connection
1	0.5mm²	white	Electronic supply	Power input, 24V used for electronic
2	0.5mm²	black	GND	Ground connection for coil supply
9	0.5mm²	brown	Coil supply	Power input 24V for coil power stage
10	0.5mm²	blue	GND	Signal GND