

**VED03M X Series**

# VED03M X Series

## Servo-Proportional Directional Control Valves with Feedback and Integrated Digital Electronics

### DESCRIPTION

Continental Hydraulics VED03 X Series, High Response 4-way servo-proportional valve with precision lapped Spool / Sleeve, position sensing LVDT and Enhanced On-Board Digital Amplifier. These valves conform to NFPA D03 and ISO 4401 mounting standards.

The VED03 X series valve is a 4-way (3 position + Fail-Safe Position) Servo-Proportional valve.

Spring offset and precision line to line Spool/Sleeve for no delay when crossing “null”, resulting in high dynamic performance and increased control when used in precision Positioning and Pressure control applications.

- 160 Hz high frequency response operation
- On-Board Digital Control resulting in extremely low Phase Lag and high frequency operation
- 3 position with Fail-Safe 4th Position
- High Precision Lap Spool in Sleeve design provides zero crossing delay at Null
- Spool position feedback

**VED03MX** style uses the industry standard common 7 Pin connection and Analog inputs. See pages 3-7 for more details.

**VED03XH** style provides for a variety of Fieldbus communication types. See pages 8-11 for more details.

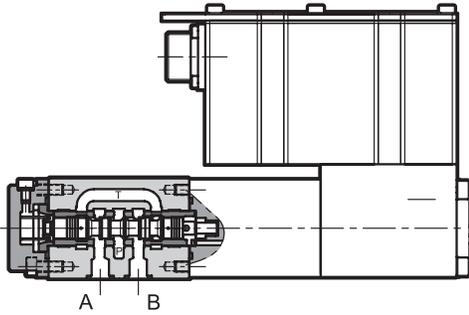
For all other performance data and accessories. See pages 2,12,13



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

Max operating pressure: P - A - B ports T port	PSI (bar)	5000 (350) 3600 (250)
Nominal flow with Δp 70 bar P-T	l/min	5 - 10 - 20 - 40 lpm
Response times	see page x	
Hysteresis	% of Q max	< 0.2%
Threshold		< 0.1%
Electrical characteristics	see data under each style	
Step Response	8 ms	
Frequency Response	160 Hz at ±5% signal	
CONTAMINATION LEVEL (ISO class)	preferred	16/14/11
	maximum	17/15/12
Viscosity	25 cSt recommended (5-400 cSt viscosity range)	
Ambient temperature range	°F (°C)	-4 / 140 (-20 / +60)
Fluid temperature range	°F (°C)	-4 / 180 (-20 / +80)
Fluid viscosity range	cSt	5 - 400
Fluid contamination degree	according to ISO 4406:1999 class 16/14/11	
Recommended viscosity	cSt	25
Vibration on the three axes	g	30
Weight	lbs (kg)	5.7 (2.6)

## VED03M X Series

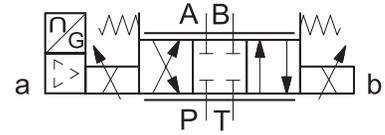


### OPERATING PRINCIPLE

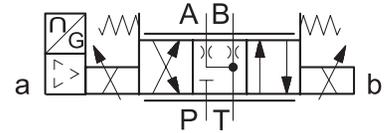
- It is available in six different flow ranges up to 40 l/min, with spools with zero overlap.
- A version for potentially explosive atmospheres according to ATEX 2014/34/EU II 3GD is available see page 7.
- Two types of integrated electronics are available, with analogue or fieldbus interfaces.

### HYDRAULIC SYMBOLS (typical)

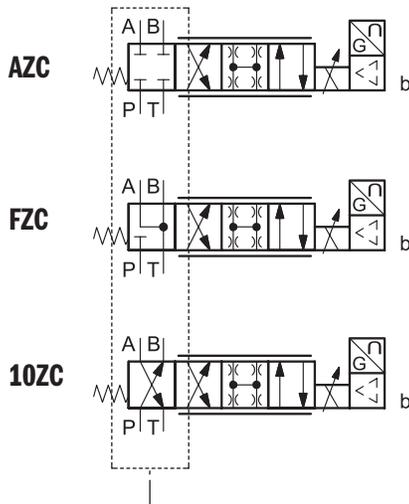
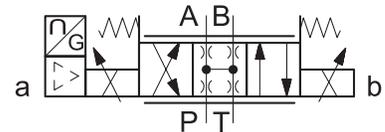
VED03\*-3AC



VED03\*-3FC



VED03\*-3ZC



### FAIL SAFE POSITION

When a power failure occurs, the electronics de-energizes the solenoid and the spool will take the fail safe position by spring return.

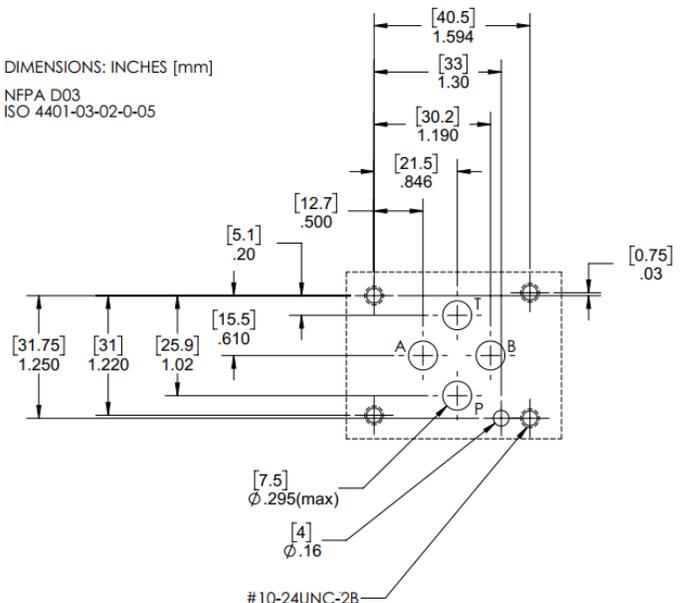
FLOW RATE	FAIL SAFE TYPE		
	AZC	FZC	10ZC
01	x	-	-
02	x	-	-
05	x	x	x
10	x	x	x
20	x	x	x
40	x	x	x

(x) Available (-) Not Available

LEAKAGE FLOW IN FAIL SAFE POSITION AT 100 BAR (CM <sup>3</sup> /MIN) CU.IN	
CODE	DESCRIPTION
AZC	P → A (20) 1.22
	P → B (30) 1.83
	A → T (30) 1.83
	B → T (30) 1.83
FZC	P → A (20) 1.22
	P → B (30) 1.83

### MOUNTING INTERFACE

DIMENSIONS: INCHES [mm]  
 NFPA D03  
 ISO 4401-03-02-0-05



## VED03M X Series

### IDENTIFICATION CODE: Analog Electronics

**VED03MX** -  -  -   -   **D** -  \_\_\_\_\_ DESIGN LETTER

**D03 Size**  
**High Response Spool in Sleeve**

FUNCTION	
<b>AZC</b>	
<b>FZC</b>	
<b>10ZC</b>	
<p><b>FAIL SAFE POSITION</b> When a power failure occurs, the electronics de-energize the solenoid and the spool will take the fail safe position by means of the centering spring.</p>	

SEALS	
CODE	DESCRIPTION
<b>A</b>	BUNA (STD)
<b>G</b>	VITON

HAZARDOUS LOCATIONS	
CODE	DESCRIPTION
<b>OMIT</b>	OMIT if not required
<b>K3</b>	ATEX 2014/34/EU 11 3GD see page 7

REFERENCE SIGNAL	
CODE	DESCRIPTION
<b>E0</b>	Voltage ± 10 V (STD)
<b>E1</b>	Current 4-20 mA

NOMINAL FLOW (with ΔP 35 Bar/Land)	
CODE	FLOW RATE
<b>01</b>	1 l/min (0.26 gpm) AZC Function ONLY
<b>02</b>	2 l/min (0.52 gpm) AZC Function ONLY
<b>05</b>	5 l/min (1.3 gpm)
<b>10</b>	10 l/min (2.6 gpm)
<b>20</b>	20 l/min (5.3 gpm)
<b>40</b>	40 l/min (10.6 gpm)

CONNECTIONS	
CODE	DESCRIPTION
<b>OBW</b>	On board electronics - Internal Enable Monitor signal PIN F to PIN B
<b>OBC</b>	On board electronics - PIN C Enable Monitor signal PIN F to PIN B
<b>OBM</b>	On board electronics - Internal Enable Monitor signal PIN F to PIN C

TYPICAL ORDERING CODE:  
**VED03MX-AZC-20-A-OBMEOD.\***

## VED03M X Series

### VED03MX ELECTRONICS COMMON DATA

Duty cycle		100% (continuous operation)
Protection class according to EN 60529		IP66 / IP68
Supply voltage	V DC	24 (from 19 to 30 VDC), ripple max 3 Vpp
Power consumption	VA	35
Maximum solenoid current	A	2.6
Fuse protection, external	A	(fast), max current 4A
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

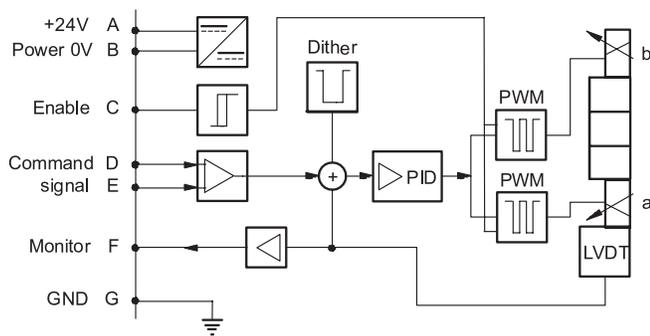
### VED03MX- STANDARD ELECTRONICS

#### Electrical characteristics

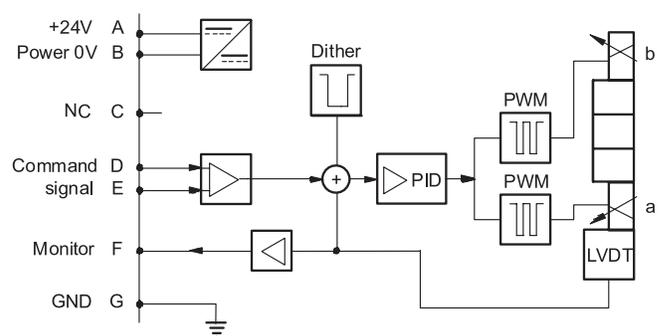
Command signal: voltage (E0) current (E1)	V DC mA	±10 (Impedance Ri = 11 kOhm) 4 - 20 (Impedance Ri = 58 Ohm)
Monitor signal: voltage (E0) current (E1)	V DC mA	±10 (Impedance Ro = 1 kOhm) 4 - 20 (Impedance Ro = 500 Ohm)
Communication for diagnostic		LIN-bus Interface (by means of the optical kit)
Connection		5-pin M12 code A (IEC 61076-2-101)

#### On-board electronics diagrams

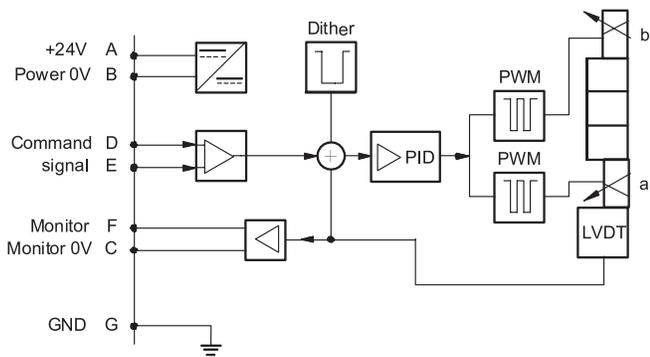
**VERSION OBC - External Enable**



**VERSION OBW - Internal Enable**



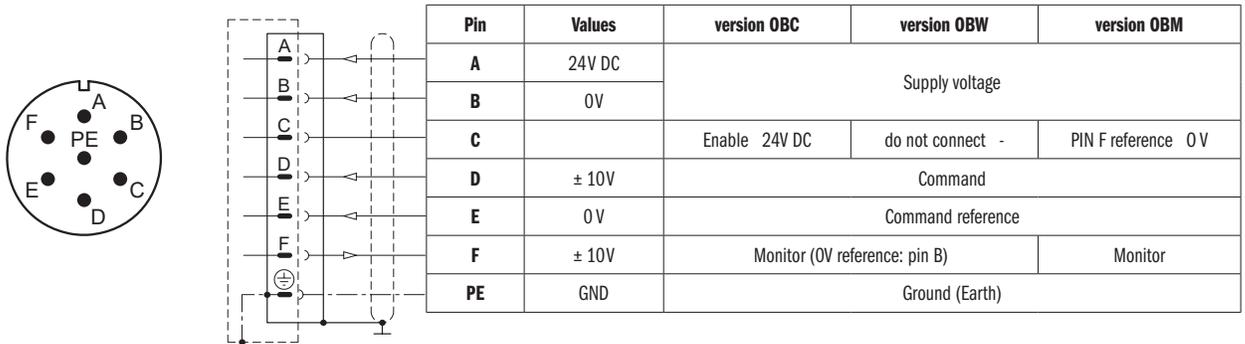
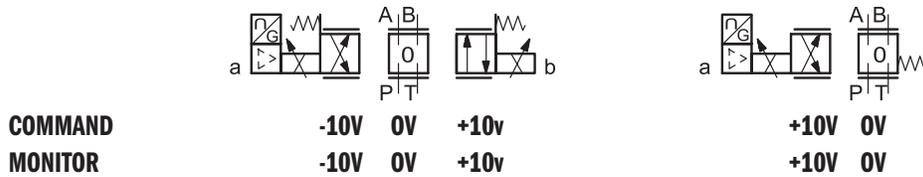
**VERSION OBM - 0V Monitor**



## VED03M X Series

### VED03MX Versions with voltage command (E0)

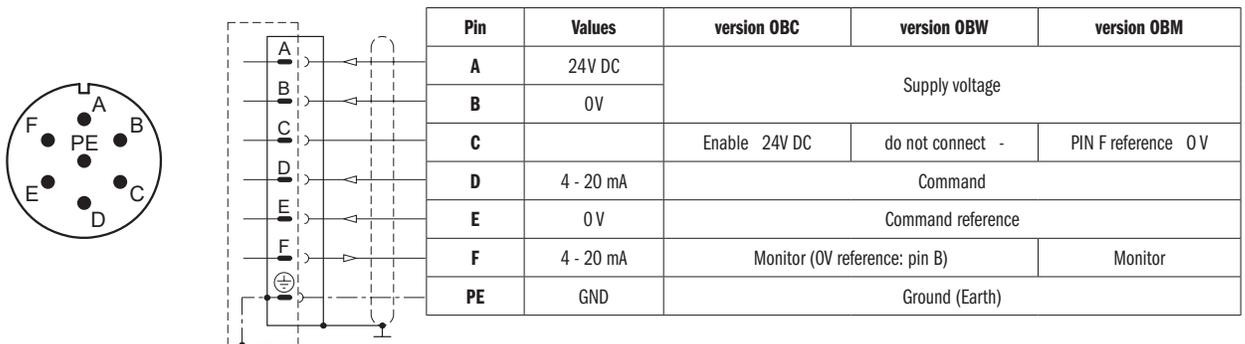
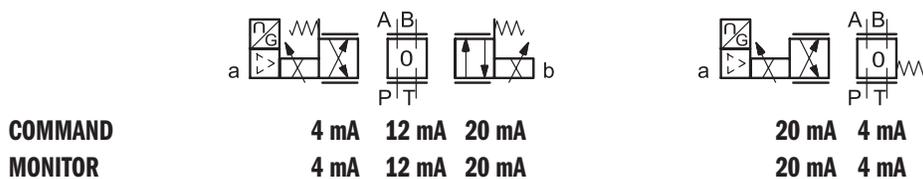
The reference signal is between -10V and +10V on double solenoid valve, and 0 - 10V on single solenoid valve.  
The monitor feature of versions OBW and OBM becomes available with a delay of 0.5 sec from the power-on of the card.



### VDD03MX 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.

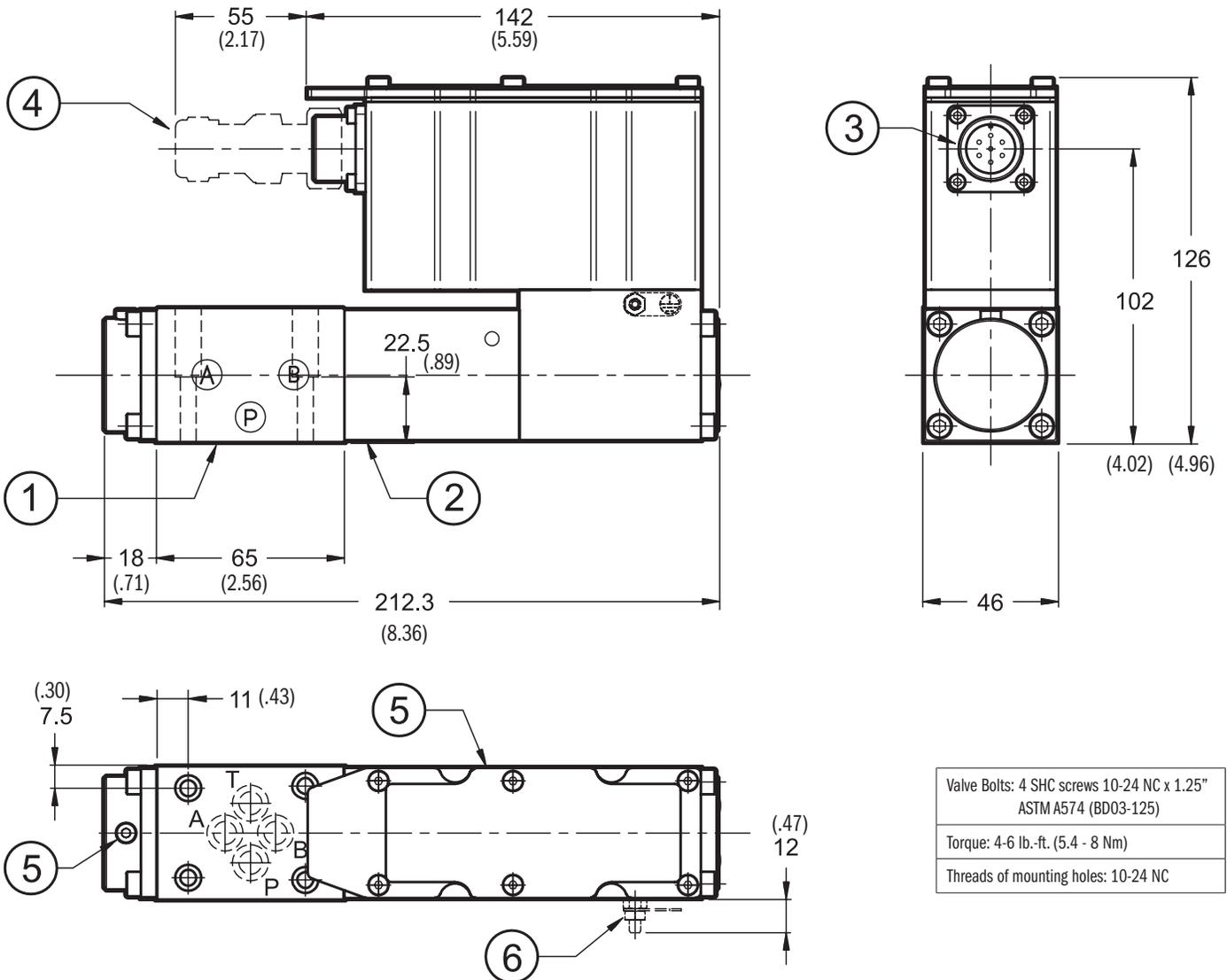
The monitor feature of versions OBW and OBM becomes available with a delay of 0.5 sec from the power-on of the card.



## VED03M X Series

### VED03MX - OVERALL AND MOUNTING DIMENSIONS

Dimensions mm (inches)



1	Valve body with mounting surface sealing rings: AS568-012 90 Shore A
2	Control solenoid with built-in position transducer
3	Main connection
4	Mating connector 6 poles + PE, female type MIL-5015-G To be ordered separately.
5	Air breather. Sealed at the factory (NOTE)
6	K3 option only: grounding point see page 7

NOTE: The valve is filled with mineral oil during testing, therefore the breather should not be used without specific authorization. Breaking the seals can cause the loss of the guarantee.

## VED03M X Series

### ATEX 2014/34/EU RATED VERSION

Valves suitable for use in potentially explosive atmospheres certified according to ATEX 2014/34/EU classified under ATEX II 3GD are now available.

The electrical and technical characteristics and dimensions of ATEX certified valves are identical to those of standard valves.

**The supply is always delivered together with the ATEX declaration of conformity and the operating and maintenance user manual, where are described all the information for the proper use of valves in potentially explosive atmospheres.**

TYPE EXAMINATION CERTIFICATE N°: **AR20ATEX046**

#### Identification code

To order the ATEX-rated version, simply insert letters K3 in the identification code. Please use the identification code shown on page 3.

Example: VED03MX-AZC-20-AK3-0BWCOD-\*

#### Classification

The valves VED03MX-K3 are ATEX marked as below:

#### MARKING FOR GASES, VAPOURS AND MISTS:

 II 3G Ex ec IIC T4 Gc

EX: Specific marking of explosion protection as ATEX 2014/34/EU directive and related technical specification requests

II: Group II for surface plants

3: Category 3 normal protection, eligible for zone 2

G: for use in areas in which explosive atmospheres caused by gases, vapors, mists

Ex ec: "ec" protection type, increased safety

IIC: Gas group (automatically eligible for group IIA and IIB)

T4: Temperature class (max surface temperature)

Gc: Protection level for electrical devices (EPL) Equipment for explosive gas atmospheres, having an "enhanced" level of protection, which is not a source of ignition in normal operation and which may have some additional protection to ensure that it remains inactive as an ignition source in the case of regular expected occurrences.

#### MARKING FOR DUSTS:

 II 3D Ex tc IIC T135°C Dc

EX: Specific marking of explosion protection as ATEX 2014/34/EU directive and related technical specification requests

II: Group II for surface plants

3: Category 3 normal protection, eligible for zone 22

D: for use in areas in which explosive atmospheres are caused by explosive dusts

Ex tc: "tc" protection type, protected by enclosures

IIC: Dusts group (automatically eligible for group IIIA and IIIB)

T135°C: Temperature class (max surface temperature)

Dc: Protection level for electrical devices (EPL) Equipment for explosive dust atmospheres, having an "enhanced" level of protection, which is not a source of ignition in normal operation and which may have some additional protection to ensure that it remains inactive as an ignition source in the case of regular expected occurrences.

#### IP protection degree

The IP protection degree of the valve is IP66/IP68 according to IEC EN 60529.

NOTE: the test carried out to reach IP68 is: duration 1 h, depth 1 m.

The IP degree is guaranteed only with mating connector of equivalent IP degree, installed and tightened correctly.

#### Operating temperatures

The operating ambient temperature must be between - 20 °C and +60 °C.

The fluid temperature must be between - 20 °C and +80 °C.

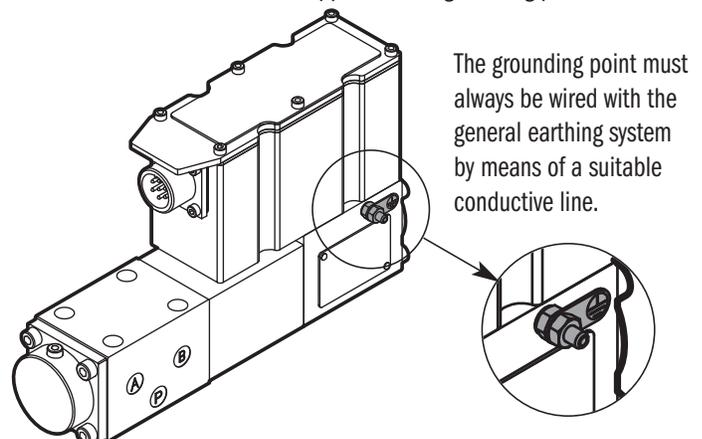
The valves are T4 (T135 °C) class temperature classified, so they are eligible for operation also at higher class temperature (T3, T2, T1 (T200 °C)).

#### Connectors

The connector is not supplied with the valve, but can be ordered separately. The connector must be suitable for the intended conditions of use.

#### Ground points

The ATEX certified valves are supplied with a grounding point with M4 screw.



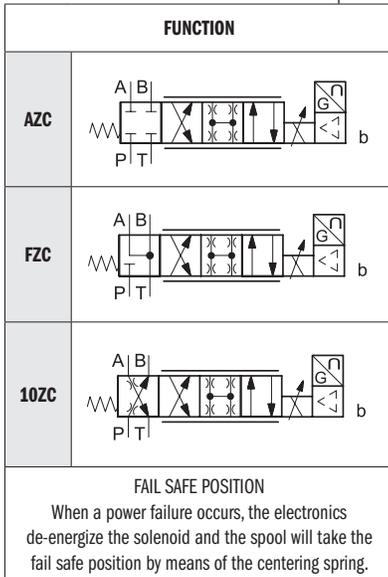
## VED03M X Series

### IDENTIFICATION CODE: Fieldbus Electronics

**VED03XH** -  -  -  -  **D** -

DESIGN LETTER

**D03 Size**  
**High Response Spool in Sleeve Field Bus Options**



SEALS	
CODE	DESCRIPTION
<b>A</b>	BUNA (STD)
<b>G</b>	VITON

CONTROL INTERFACE	
CODE	DESCRIPTION
<b>E0</b>	Analog Voltage (±10V)
<b>E1</b>	Analog current (4-20mA)
<b>FD</b>	Full Digital Version (on Request)

NOMINAL FLOW (with ΔP 35 Bar/Land)	
CODE	FLOW RATE
<b>01</b>	1 l/min (0.26 gpm) AZC Function ONLY
<b>02</b>	2 l/min (0.52 gpm) AZC Function ONLY
<b>05</b>	5 l/min (1.3 gpm)
<b>10</b>	10 l/min (2.6 gpm)
<b>20</b>	20 l/min (5.3 gpm)
<b>40</b>	40 l/min (10.6 gpm)

CONNECTIONS (Select one for each X connection)		
	CODE	DESCRIPTION
<b>X1 Main Connector Configuration (Select One)</b>	<b>D1</b>	One Command
	<b>D0</b>	Full Digital (on request - available for reference signal FD type Only)
<b>X2, X3 Fieldbus type (Select One)</b>	<b>EC</b>	EtherCAT
	<b>EN</b>	Ethernet / IP
	<b>PN</b>	Profinet
	<b>PL</b>	PowerLink
<b>X7 Digital Transducer (Select One)</b>	<b>0</b>	None
	<b>1</b>	SSI Type
	<b>2</b>	Encoder Type
<b>X4 Analog transducer (Select One)</b>	<b>0</b>	None
	<b>1</b>	Single / Double Transducer

TYPICAL ORDERING CODE:  
**VED03XH-AZC-20-A-OBMEOD-D**

## VED03M X Series

### VED03XH - FIELDBUS ELECTRONICS

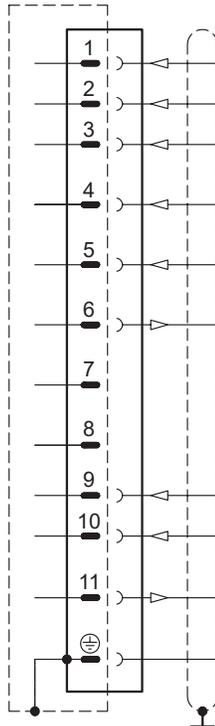
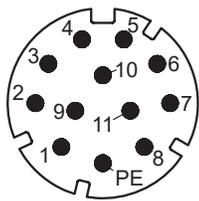
The 11+ PE pin connection allows separate supply voltage for electronics and solenoids.

Command - valve position schemes as for the standard electronics. Please refer to pictures in par. 4.3 and 4.4.

### VED03XH Electrical characteristics

Command signal: voltage (E0) current (E1) digital (FD)	V DC mA	$\pm 10$ (Impedance Ri = 11 kOhm) 4 - 20 (Impedance Ri = 58 Ohm) via fieldbus
Monitor signal: voltage (E0) current (E1)	V DC mA	$\pm 10$ (Impedance Ro > 1 kOhm) 4 - 20 (Impedance Ro = 500 Ohm)
Communication / diagnostic		via Bus register
Communication interface standards		IEC 61158
Communication physical layer		fast ethernet, insulated 100 Base TX
Power connection		11 pin + PE (DIN 43651)

### X1 Main connection pin table



#### D1: one command

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

#### D0: full digital

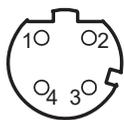
Pin	Values	Function
1	24V DC	Main supply voltage
2	0 V	
3	24V DC	Enable
4	NC	do not connect
5	NC	do not connect
6	NC	do not connect
7	NC	do not connect
8	NC	do not connect
9	24V DC	Logic and control supply
10	0 V	
11	24V DC	Fault (0V DC) or normal working (24V DC) (0V reference pin 2)
12	GND	Ground (Earth)

### VED03JH FIELDBUS connections

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

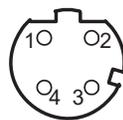
**Communication connections: EC (EtherCat), EN (Ethernet/IP), PN (PROFINET), PL (POWERLINK)**

#### 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	

#### 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	

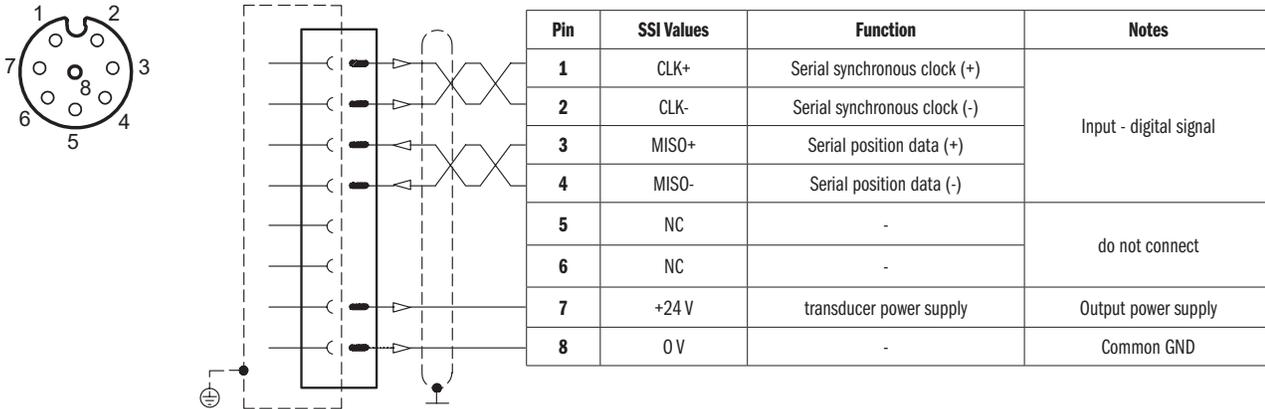
Note: Shield connection on connector housing is recommended.

## VED03M X Series

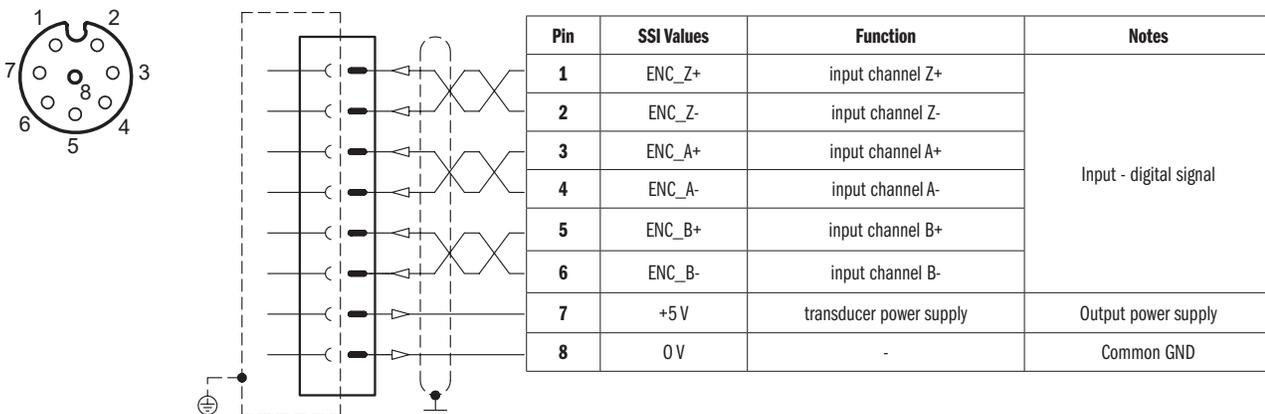
### Digital transducer connection

X7 connection: M12 A 8 pin female)

VERSION 1: SSI type

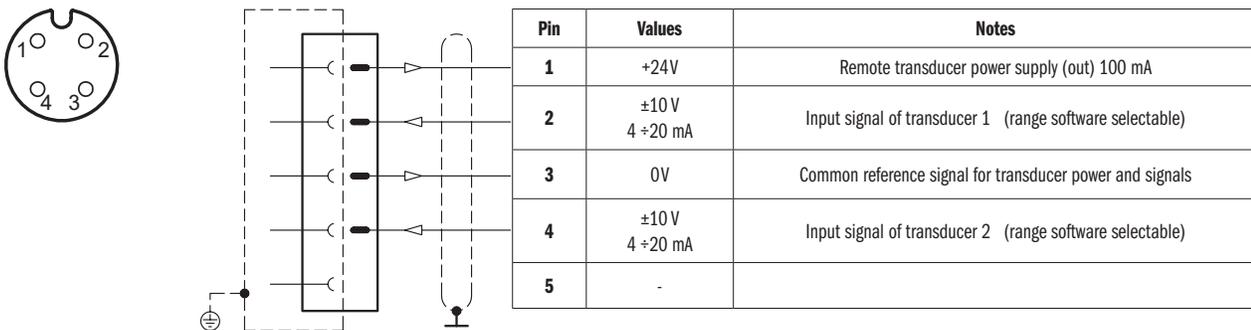


VERSION 2: ENCODER type



Analogue transducer connection X4 connection: M12 A 4 pin female

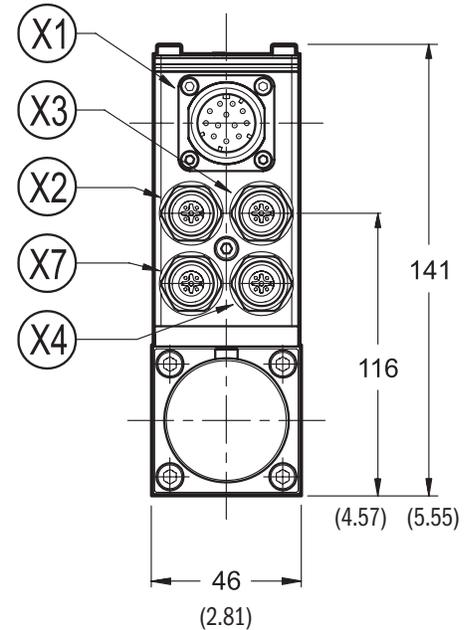
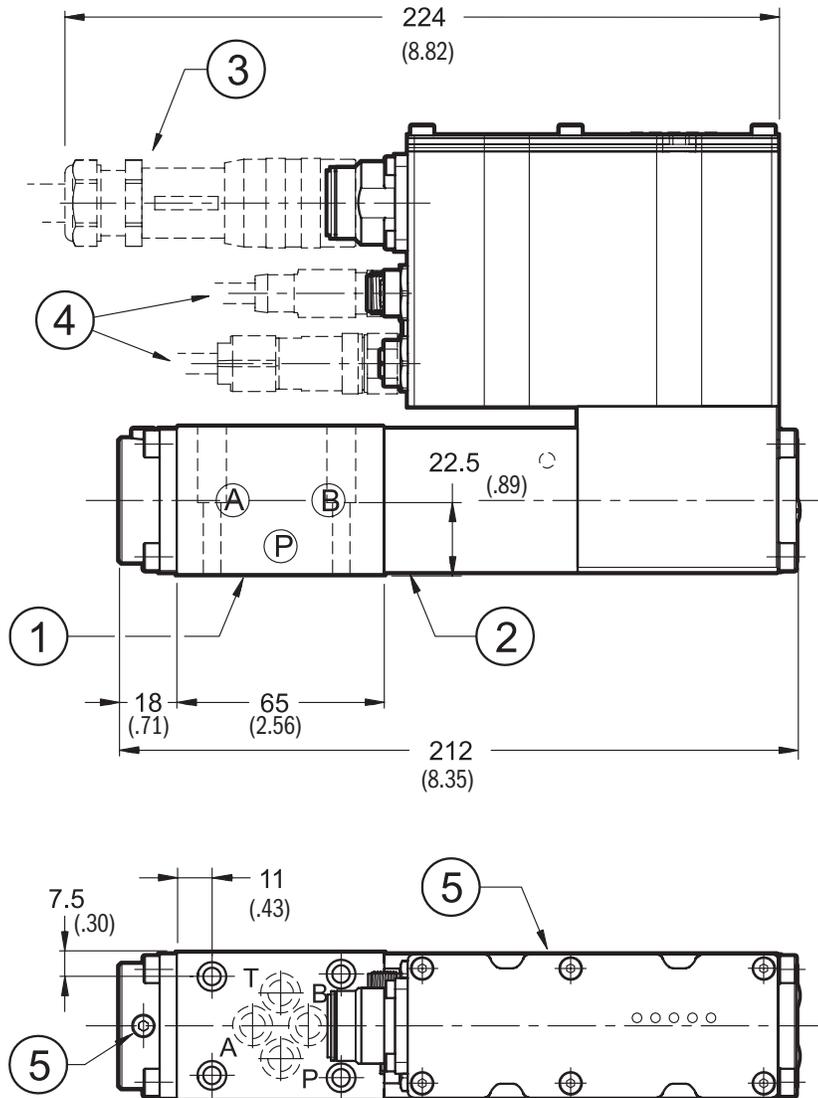
VERSION 1: single / double transducer (single or double is a software-selectable option)



## VED03M X Series

### VED03XH - OVERALL AND MOUNTING DIMENSIONS

Dimensions mm (inches)



Valve Bolts: 4 SHC screws 10-24 NC x 1.25" ASTM A574 (BD03-125)
Torque: 4-6 lb.-ft. (5.4 - 8 Nm)
Threads of mounting holes: 10-24 NC

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

Note 1: Depending on the chosen version, X4 and X7 connections may not be present. Please refer to page 10-12 for connection descriptions and pinout.

Note 2: The valve is filled with mineral oil during testing, therefore the breather should not be used without specific authorization. Breaking the seals can cause the loss of the guarantee.

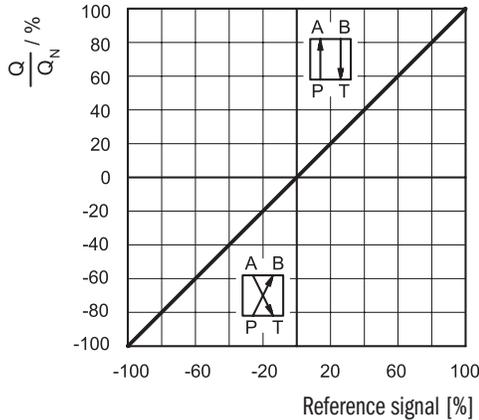
<b>1</b>	Mounting surface with sealing rings: AS568-012 90 Shore A
<b>2</b>	Control solenoid with built-in position transducer
<b>3</b>	Mating connector 11 poles + PE To be ordered separately.
<b>4</b>	Mating connectors for fieldbus communication and signals To be ordered separately.
<b>5</b>	Air breather. Sealed at the factory (NOTE 2)

## VED03M X Series

### PERFORMANCE CURVES

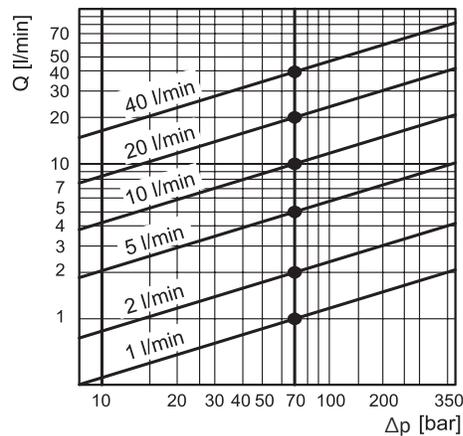
Curves obtained with mineral oil viscosity of 170 sus (36 cSt) at 122°F (50°C) and dedicated OBE.

**REFERENCE / FLOW RATE CURVE**



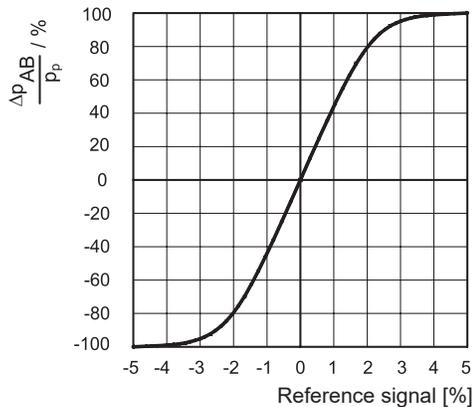
Typical flow rate curves at constant  $\Delta p = 70$  bar P-T according to the reference signal. NOTE: with positive reference signal connected to pin D the valve regulates P - A / B - T.

**FLOW RATE CURVE ACCORDING TO  $\Delta p$**



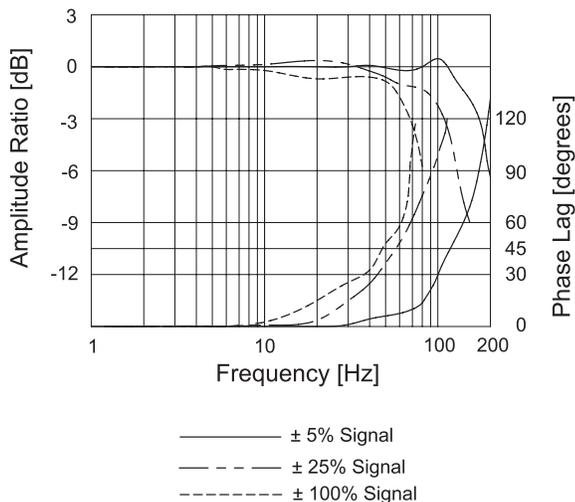
The diagram states the maximum valve controlled flow rate according to the pressure drop between the P and T ports.

**PRESSURE GAIN (LZ)**

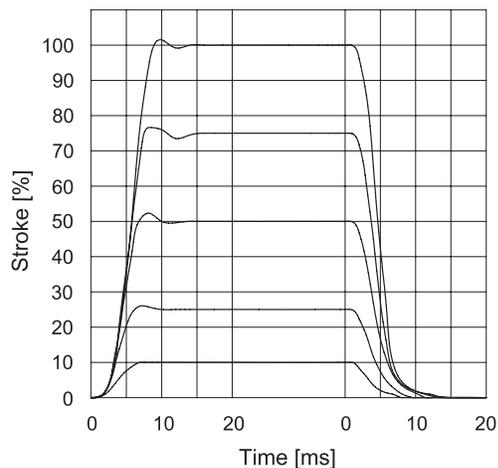


The diagram shows the valve pressure gain, expressed as % of the ratio between the port pressure variation in A or B ( $\Delta p_{AB}$ ) and the P system pressure, according to the reference signal. In practice, the pressure gain states the valve reaction towards external disturbances aimed at changing the actuator position.

**FREQUENCY RESPONSE**



**STEP RESPONSE TIME**



Due to inherent phase lag characteristics of the overall system and machine, common industrial control practices recommends, as rule of thumb, to utilize the 45°, or less phase lag frequency ratings, when applying Servo and Proportional valves to any position control loop for stable, repeatable and consistent control.

