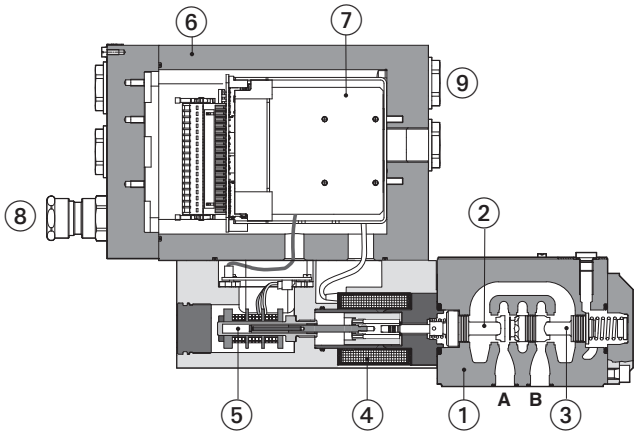
Ex-proof digital proportional flow valves high performance

pressure compensated, with on-board driver and LVDT transducer - **ATEX, IECEx, CCC**



QVKZA-TES-SN-NP-10

① valve body
② throttle
③ compensator
④ ex-proof solenoid
⑤ ex-proof LVDT transducer
⑥ ex-proof electronics housing
⑦ on-board digital drivers
⑧ ex-proof cable glands (to be ordered separately)
⑨ USB port always present (factory plugged)

QVHZA-TES, QVKZA-TES

Ex-proof digital high performance proportional flow valves, with LVDT position transducer for pressure compensated flow regulations.

They are equipped with ex-proof on-board digital driver, LVDT transducer and solenoid certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX**, **IECEx**, **CCC** for gas group **II 2G** and dust category **II 2D**

The flameproof enclosure of on-board digital driver, solenoid and transducer, prevents the propagation of accidental internal sparks or fire to the external environment.

The driver and solenoid are also designed to limit the surface temperature within the classified limits.

QVHZA:	**QVKZA**:
Size: **06** - ISO4401	Size: **10** - ISO4401
Max flow: **45 l/min**	Max flow: **90 l/min**
Max pressure: **210 bar**	Max pressure: **210 bar**

1 MODEL CODE

QVKZA	- TES	- SN	- NP	- 10	/ 65	/ M	*	*	/ *

QVKZA Ex-proof pressure compensated proportional flow valves, direct
QVHZA = size 06
QVKZA = size 10

TES = on-board driver and LVDT transducer

Alternated P/Q controls:
SN = none

Fieldbus interface, USB port always present:
NP = Not Present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT
EW = POWERLINK
EI = EtherNet/IP
EP = PROFINET RT/IRT

Valve size ISO 4401:
06 = size 06
10 = size 10

Max regulated flow:
QVHZA:
3 = 3,5 l/min
12 = 12 l/min
18 = 18 l/min
36 = 35 l/min
45 = 45 l/min
QVKZA:
65 = 65 l/min
90 = 90 l/min

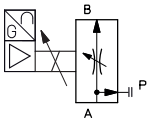
Cable entrance threaded connection:
M = M20x1,5

Electronic options:
I = current reference input and monitor 4 ÷ 20 mA (omit for std voltage 0 ÷ 10 VDC)

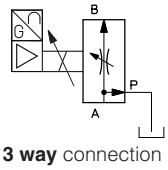
Series number

Seals material, see section 9 :
- = NBR
PE = FKM
BT = HNBR

2 HYDRAULIC SYMBOLS



2 way connection



3 way connection

The valves can be used in 2 or 3 way connection, depending to the application requirements.

In **2 way** the P port must not be connected (blocked)
In **3 way** the P port has to be connected to tank or to other user lines

The port T must be always not connected (blocked)

3 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FX900** and in the user manuals included in the E-SW-* programming software.

4 VALVE SETTINGS AND PROGRAMMING TOOLS

WARNING: the below operation must be performed in a safety area

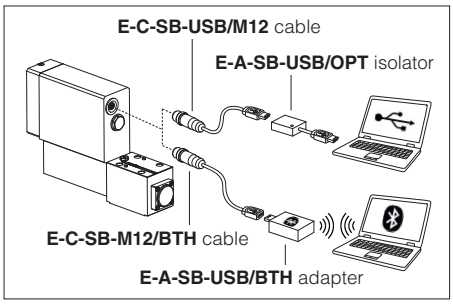
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

5 FIELDBUS - see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These executions allow to operate the valves through fieldbus or analog signals available on the terminal board.

6 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 10 -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” RoHs Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006

7 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		QVHZA					QVKZA	
Max regulated flow	[l/min]	3,5	12	18	35	45	65	90
Min regulated flow	[cm³/min]	15	20	30	50	60	85	100
Regulating Δp	[bar]	4 - 6		10 - 12		15	6 - 8	10 - 12
Max flow on port A **(1)**	[l/min]	40			50	55	70	100
Max pressure	[bar]	210						
Response time 0÷100% step signal	[ms]	≤ 30					≤ 45	
Hysteresis		≤ 0,5 [% of the regulated max flow]						
Linearity		≤ 0,5 [% of the regulated max flow]						
Repeatability		≤ 0,1 [% of the regulated max flow]						

(1) for different Δp, the max flow is in accordance to diagrams in section 14.3

8 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	35 W			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Monitor outputs	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions			
Protection degree to DIN EN60529	IP66/67 with relevant cable gland			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid current supply; spool position control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX

Note: a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero

9 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity		20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		
Hydraulic fluid		**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water **(1)**		NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

10 CERTIFICATION DATA

Valve type	QVHZA, QVKZA			
Certifications	Multicertification Group II **ATEX IECEx CCC**			
Solenoid certified code	**OZA-TES**			
Type examination certificate **(1)**	• ATEX: TUV IT 18 ATEX 068 X • IECEx: IECEx TPS 19.0004X • CCC: 2021322307004057			
Method of protection	• ATEX 2014/34/EU Ex II 2G Ex db IIC T6/T5/T4 Gb; Ex II 2D Ex tb IIIC T85°C/T100°C/T135°C Db • IECEx Ex db IIC T6/T5/T4 Gb; Ex tb IIIC T85°C/T100°C/T135°C Db • CCC Ex d IIC T6/T5/T4 Gb; Ex tD A21 IP66/IP67 T85°C/T100°C/T135°C			
Temperature class	**T6**	**T5**	**T4**	
Surface temperature	≤ 85 °C	≤ 100 °C	≤ 135 °C	
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +55 °C	-40 ÷ +70 °C	
Applicable Standards	EN 60079-0: 2012+A11:2013 EN 60079-1:2014	EN 60079-31:2014	IEC 60079-0:2017 IEC 60079-1:2014	IEC 60079-31:2013
Cable entrance: threaded connection	**M** = M20x1,5			

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The driver and solenoids are certified for minimum ambient temperature -40°C.
In case the complete valve must withstand with minimum ambient temperature -40°C, select **/BT** in the model code.

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

11 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Power supply and signals: section of wire = 1,0 mm²	**Grounding:** section of external ground wire = 4 mm²

11.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
40 °C	T6	85 °C	80 °C
55 °C	T5	100 °C	90 °C
70 °C	T4	135 °C	110 °C

12 CABLE GLANDS

Cable glands with threaded connections M20x1,5 for standard or armoured cables have to be ordered separately, see tech table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

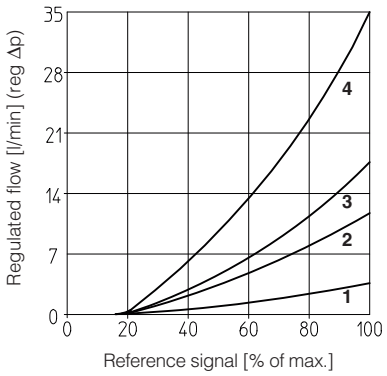
13 ELECTRONIC OPTIONS

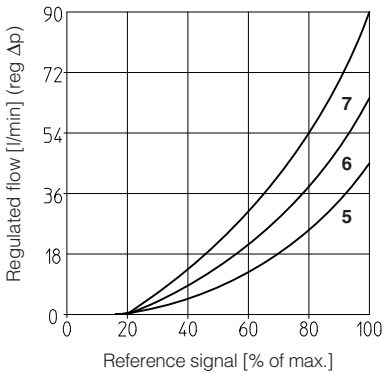
I = It provides 4 ÷ 20 mA current reference signal, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA. It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

14 DIAGRAMS - based on mineral oil ISO VG 46 at 50 °C

14.1 Regulation diagrams

1 = QVHZA-*-06**/3**
2 = QVHZA-*-06**/12**
3 = QVHZA-*-06**/18**
4 = QVHZA-*-06**/36**
5 = QVHZA-*-06**/45**
6 = QVKZA-*-10**/65**
7 = QVKZA-*-10**/90**



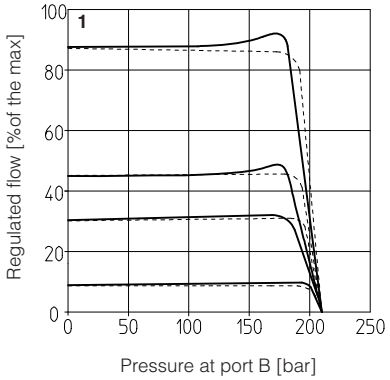


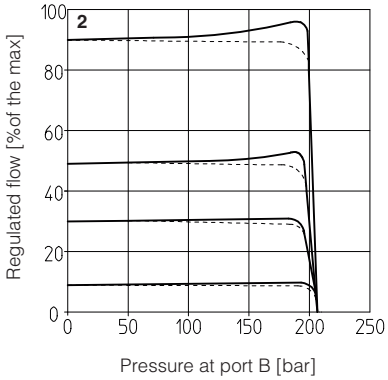
14.2 Regulated flow/outlet pressure diagrams

with inlet pressure = 210 bar

1 = QVHZA
2 = QVKZA

Dotted line for 3-way versions

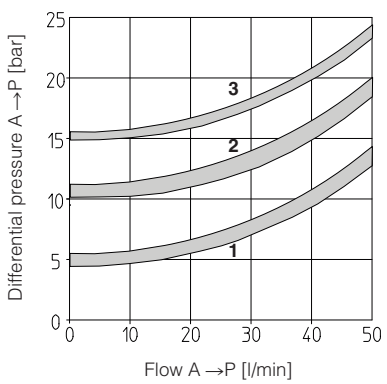


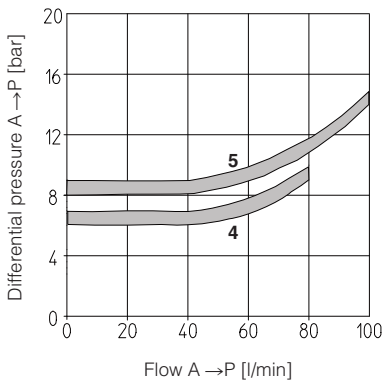


14.3 Flow A → P/Δp diagrams

3-way configuration

1 = QVHZA-*-06**/3**
QVHZA-*-06**/12**
2 = QVHZA-*-06**/18**
QVHZA-*-06**/36**
3 = QVHZA-*-06**/45**
4 = QVKZA-*-10**/65**
5 = QVKZA-*-10**/90**





15 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, EN-982).

15.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

15.2 Power supply for driver's logic and communication (VL+ and VL0)

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 3 and 4, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

15.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

15.4 Flow monitor output signal (Q_MONITOR)

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position).
Monitor output signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

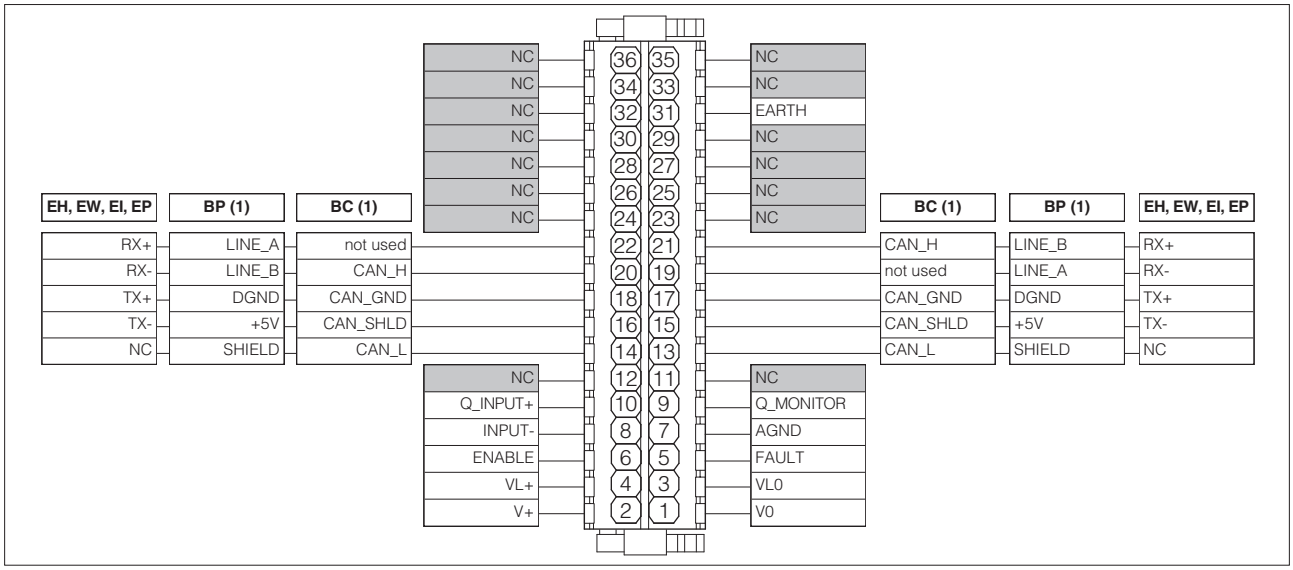
15.5 Enable input signal (ENABLE)

To enable the driver, supply a 24 VDC on pin 5: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

15.6 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

16 TERMINAL BOARD OVERVIEW



(1) For BC and BP executions the fieldbus connections have an internal pass-through connection

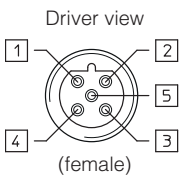
17 ELECTRONIC CONNECTIONS

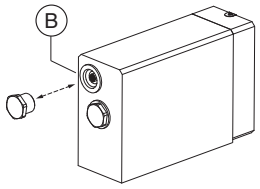
17.1 Main connections signals

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	**V0**	Power supply 0 VDC	Gnd - power supply
	2	**V+**	Power supply 24 VDC	Input - power supply
	3	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
	4	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
	5	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
	6	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
	7	**AGND**	Analog ground	Gnd - analog signal
	8	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
	9	**Q_MONITOR**	Flow monitor output signal: ±10 VDC / ±20 mA maximum range, referred to AGND Defaults are: 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
	10	**Q_INPUT+**	Flow reference input signal: ±10 VDC / ±20 mA maximum range, referred to AGND Defaults are: 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	31	**EARTH**	Internally connected to driver housing	

17.2 USB connector - M12 - 5 pin always present

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
B	1	**+5V_USB**	Power supply
	2	**ID**	Identification
	3	**GND_USB**	Signal zero data line
	4	**D-**	Data line -
	5	**D+**	Data line +





17.3 BC fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**CAN_L**	Bus line (low)
	16	**CAN_SHLD**	Shield
	18	**CAN_GND**	Signal zero data line
	20	**CAN_H**	Bus line (high)
	22	**not used**	Pass-through connection **(1)**

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**CAN_L**	Bus line (low)
	15	**CAN_SHLD**	Shield
	17	**CAN_GND**	Signal zero data line
	19	**not used**	Pass-through connection **(1)**
	21	**CAN_H**	Bus line (high)

(1) Pin 19 and 22 can be fed with external +5V supply of CAN interface

17.4 BP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**SHIELD**	
	16	**+5V**	Power supply
	18	**DGND**	Data line and termination signal zero
	20	**LINE_B**	Bus line (low)
	22	**LINE_A**	Bus line (high)

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**SHIELD**	
	15	**+5V**	Power supply
	17	**DGND**	Data line and termination signal zero
	19	**LINE_A**	Bus line (high)
	21	**LINE_B**	Bus line (low)

17.5 EH fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1 (input)	14	**NC**	do not connect
	16	**TX-**	Transmitter
	18	**TX+**	Transmitter
	20	**RX-**	Receiver
	22	**RX+**	Receiver

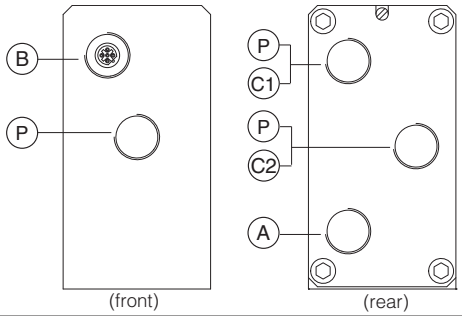
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2 (output)	13	**NC**	do not connect
	15	**TX-**	Transmitter
	17	**TX+**	Transmitter
	19	**RX-**	Receiver
	21	**RX+**	Receiver

18 CONNECTIONS LAYOUT

CABLE ENTRANCE OVERVIEW

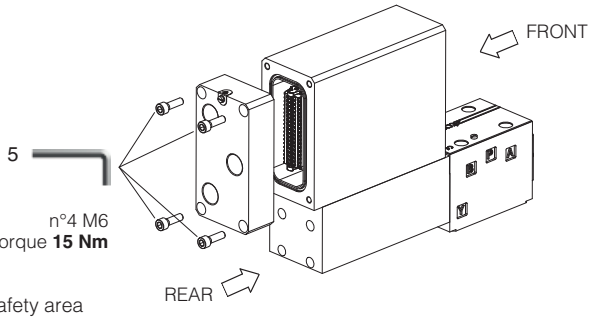
Cables entrance description:

- (A) main connections
- (B) USB connector always present (factory plugged)
- (C1) fieldbus (input)
- (C2) fieldbus (output)
- (D1) pressure transducer 1
- (D2) pressure transducer 2
- (P) threaded plug



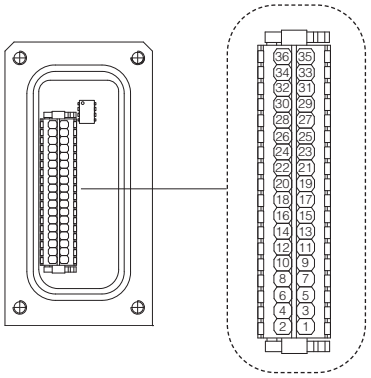
TERMINAL BOARD AND FIELDBUS TERMINATOR

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator

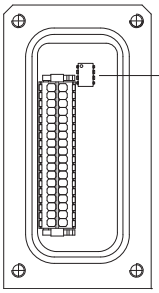


⚠ **WARNING:** the above operation must be performed in a safety area

Terminal board - see section 16

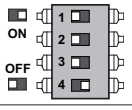


Fieldbus terminator only for BC and BP executions **(1)**



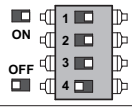
BC - CANopen setting:

Switch	Termination enabled
1	OFF
2	OFF
3	OFF
4	ON

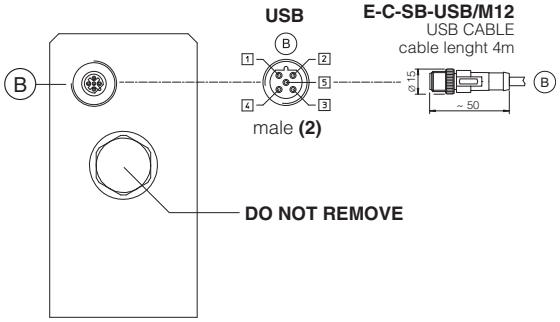


BP - PROFIBUS DP setting:

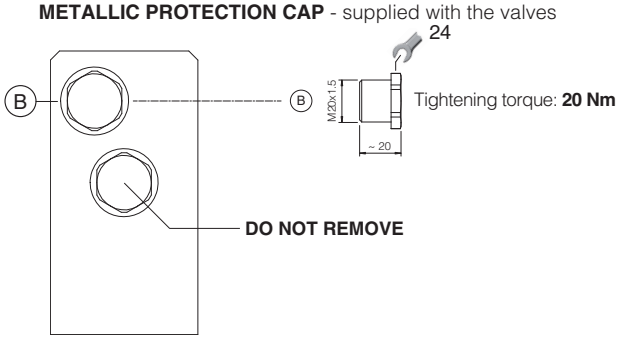
Switch	Termination enabled
1	ON
2	ON
3	ON
4	OFF



USB CONNECTOR

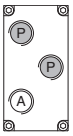
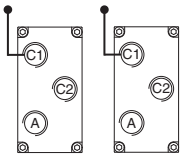
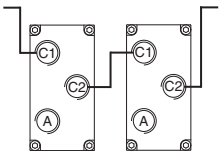


METALLIC PROTECTION CAP - supplied with the valves

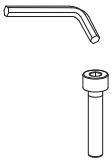


(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF
(2) Pin layout always referred to driver's view

18.1 Cable glands and threaded plug - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland quantity	entrance	Threaded plug quantity	entrance		
NP	1	A	none	none		Cable entrance A is open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "via stub" connection	2	C1 A	1	C2		Cable entrance A, C1, C2 are open for costumers
BC, BP, EH, EW, EI, EP "daisy chain" connection	3	C1 C2 A	none	none		Cable entrance A, C1, C2 are open for costumers

19 FASTENING BOLTS AND SEALS

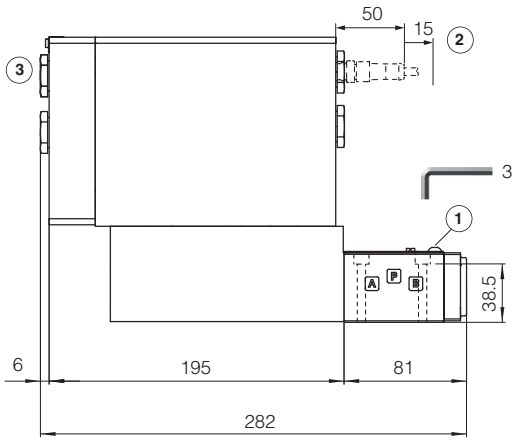
	QVHZA	QVKZA
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max)	**Seals:** 5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max)

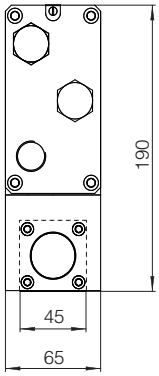
20 INSTALLATION DIMENSIONS [mm]

QVHZA-TES

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see tab. P005)

Mass [kg]	
QVHZA-TES	7,2

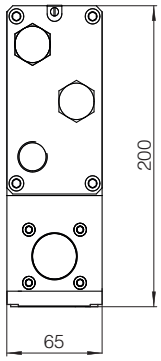


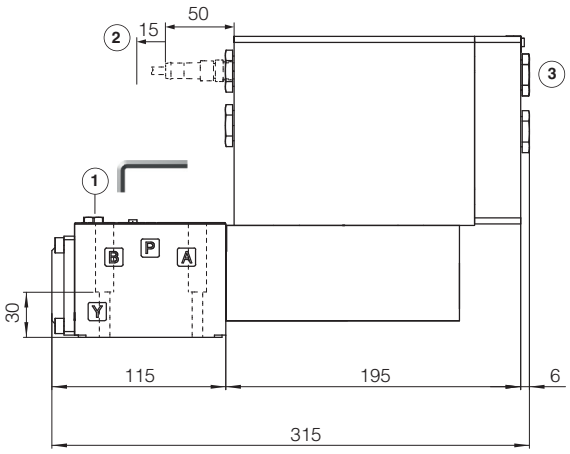


QVKZA-TES

ISO 4401: 2005
Mounting surface: 4401-05-04-0-05 (see tab. P005)

Mass [kg]	
QVKZA	9





(1) = Air bleed off
(2) = Space to remove the USB connector
(3) = The dimensions of cable glands must be considered (see tech table **KX800**)

21 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments	**GS500**	Programming tools
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, CCC, PESO	**GS510**	Fieldbus
		KX800	Cable glands for ex-proof valves
FX900	Operating and manintenance information for ex-proof proportional valves	**P005**	Mounting surfaces for electrohydraulic valves