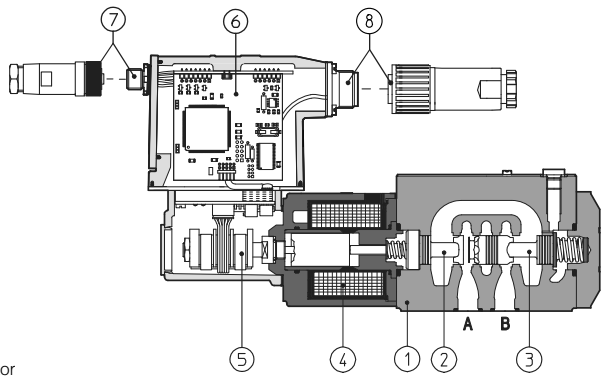
Proportional flow valves type QVHZO-T*, QVKZOR-T*

pressure compensated, direct operated, with position transducer, ISO 4401 size 06 and 10



① Valve body
② Throttle
③ Compensator
④ Proportional solenoid
⑤ Position transducer
⑥ Integral electronics
⑦ Communication connector
⑧ Main connector

QVKZOR-TES

QVHZO and QVKZOR are 2 or 3 way flow proportional valves, direct operated, with position transducer which provide compensated flow control according to the electronic reference signal.

They operate in association with electronic drivers, see section [2] which supply the proportional valves with correct current signal to align valve regulation to the reference signal supplied to the electronic driver.

They are available in different executions:
- -T, with integral position transducer;
- -TE, -TES, as -T plus analogue (TE) or digital (TES) integral electronics;

The flow is controlled by a throttle ②, directly operated by the proportional solenoid ④. The mechanical pressure compensator ③ keeps a constant Δp across the throttle ②, thus the regulated flow is indipendent to the load conditions.

The integral electronics ⑥ ensures factory presetting, fine functionality plus valve-to-valve interchangeability and simplified wiring and installation.
The electronic main connector ⑧ is fully interchangeable for –AE and –AES executions.

Standard 7 pin connector is used for power supply, analog input reference and monitor signals.
12 pin connector is used for option /Z (TES).

Following communication interfaces ⑦ are available for the digital -TES execution:
- -PS, Serial communication interface. The valve reference signal is provided with analogue commands
- -BC, CANopen interface
- -BP, PROFIBUS DP interface

The valves with -BC and -BP interfaces can be integrated into a fieldbus communication network and thus digitally operated by the machine control unit.

The coils are fully plastic encapsulated (insulation class H) and valves have anti-vibration, antishock and weather-proof features.

Surface mounting: ISO 4401, size 06 and 10.

Max flow respectively up to:
QVHZO = 45 l/min
QVKZOR = 90 l/min.
Max pressure = 210 bar.

1 MODEL CODE

QVKZOR - TES - PS - 10 / 65 / * ** / *

Pressure compensated flow control valves
QVHZO = size 06
QVKZOR = size 10

T = with position transducer
TE = as T plus integral analog electronics
TES = as T plus integral digital electronics

Communication interfaces (only for TES)
PS = RS232 serial
BC = CANbus
BP = PROFIBUS-DP

Valve size
06 = ISO 4401, size 06 **10** = ISO 4401, size 10

Max regulated flow:
for **QVHZO**:
3 = 3,5 l/min
12 = 12 l/min
18 = 18 l/min
36 = 35 l/min
45 = 45 l/min
for **QVKZOR**:
65 = 65 l/min
90 = 90 l/min

Electronics options for -TE execution
see section [6]:
F = fault signal
I = current reference (4÷20 mA)
Q = enable signal
Z = enable, fault and monitor signals (12 pin connector)

Electronics options for -TES execution
see section [8]:
I = current reference (4÷20 mA)
Z = double power supply, enable, fault and monitor signals (12 pin connector)

Series number

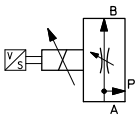
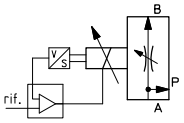
Synthetic fluids
WG = water-glycol
PE = phosphate ester

2 ELECTRONIC DRIVERS FOR QVHZO AND QVKZOR

Valve model	-T	-TE	-TES
Drivers model	E-ME-T	E-RI-TE	E-RI-TES
Data sheet	G140	G200	G210

Note: For power supply and communication connector see section [14]

3 HYDRAULIC CHARACTERISTICS (based on mineral oil ISO VG 46 at 50 °C)

Hydraulic symbols **Note:** **In three-way versions port P is open.** **In two-way versions port P must be plugged.** **Port T must always be plugged.**		 **QVHZO-T** **QVKZOR-T**			 **QVHZO-TE, QVHZO-TES** **QVKZOR-TE, QVKZOR-TES**			
Valve model		**QVHZO-T*-06**					**QVKZOR-T*-10**	
Max regulated flow	[l/min]	3,5	12	18	35	45	65	90
Min regulated flow (1)	[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	[l/min]	50				60	70	100
Max pressure	[bar]	210					210	
Response time 0÷100% step signal (2)	[ms]	25					35	
Hysteresis	[% of the regulated max flow]	≤ 0,5					≤ 0,5	
Linearity	[% of the regulated max flow]	≤ 0,5					≤ 0,5	
Repeatability	[% of the regulated max flow]	≤ 0,1					≤ 0,1	
Thermal drift		zero point displacement < 1% at ΔT = 40°C						

Notes: Above performance data refer to valves coupled with Atos electronic drivers, see sections 2.
(1) Values are referred to 3-way configuration. In the 2-way configuration, the values of min regulated flow are higher.
(2) Response times at step signal (0%→100%) are measured from 10% to 90% of step value and are strictly referred to the valve regulation.

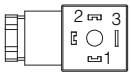
4 GENERAL NOTES

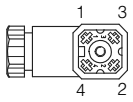
QVHZO and QVKZOR proportional valves are CE marked according to the applicable Directives (e.g. Immunity/Emission EMC Directive).

Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in table F003 and in the installation notes supplied with relevant components.

The electrical signals of the valve (e.g. 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).

5 CONNECTION FOR -T EXECUTION

SOLENOID POWER SUPPLY CONNECTOR		
PIN	Signal description	
1	SUPPLY	
2	SUPPLY	
3	GND	

POSITION TRANSDUCER CONNECTOR		
PIN	Signal description	
1	OUTPUT SIGNAL	
2	SUPPLY -15 VDC	
3	SUPPLY +15 VDC	
4	GND	

6 ANALOG INTEGRAL DRIVERS -TE - OPTIONS

Standard driver execution provides on the 7 pin main connector:

Power supply - 24VDC must be appropriately stabilized or rectified and filtered; a 2,5 A safety fuse is required in series to the driver power supply Apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers
Reference input signal - analog differential input with ±10 VDC nominal range (pin D,E), proportional to desired valve spool position
Monitor output signal - analog output signal proportional to the actual valve's spool position with ±10 VDC nominal range

Following options are available to adapt standard execution to special application requirements:

6.1 Option /F
It provides a Fault output signal in place of the Monitor output signal, to indicate fault conditions of the driver (cable interruption of spool transducers or reference signal - for /I option): Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.

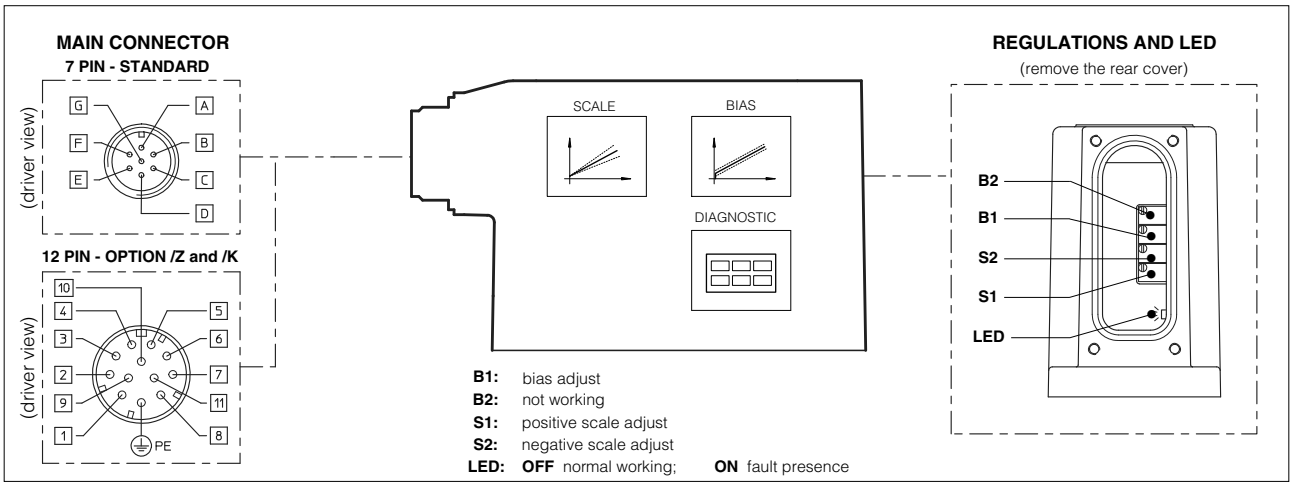
6.2 Option /I
It provides the 4÷20 mA current reference and monitor signals instead of the standard 0 ÷ +10VDC.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

6.3 Option /Q
It provides the possibility to enable or disable the valve functioning without cutting the power supply (the valve functioning is disabled but the driver current output stage is still active). To enable the driver supply a 24VDC on the enable input signal.

6.4 Option /Z
This option includes **/F** and **/Q** features, plus the Monitor output signal.
When the driver is disabled (0 VDC on Enable signal) Fault output is forced to 0 VDC.

6.5 Possible combined options: /FI and /IZ

7 ANALOG INTEGRAL DRIVERS -TE - MAIN FUNCTIONS AND ELECTRONIC CONNECTIONS



7.1 ELECTRONIC CONNECTIONS - 7 & 12 PIN MAIN CONNECTORS

Standard 7pin	/Z,/K option 12pin	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	V+	Power supply 24 VDC for solenoid power stage and driver logic	Input - power supply
B	2	V0	Power supply 0 VDC for solenoid power stage and driver logic	Gnd - power supply
C (1)	7	AGND	Ground - signal zero for MONITOR signal (for standard and /Z options)	Gnd - analog signal
	3	ENABLE	Enable (24 VDC) or disable (0 VDC) the driver (for /Q, /Z and /K options)	Input - on/off signal
D	4	INPUT+	Reference analog differential input: ±10 VDC maximum range (4 ÷ 20 mA for /I option) Normal working range 0 ÷ +10VDC (4 ÷ 20 mA for /I option)	Input - analog signal
E	5	INPUT -		
F (2)	6	MONITOR	Monitor analog output: ±10 VDC maximum range (4 ÷ 20 mA for /I option)	Output - analog signal
	11	FAULT	Fault (0V) or normal working (24V) (for F and /Z options)	Output - on/off signal
-	8	R_ENABLE	Repeat Enable - output repetition of Enable input	Output - on/off signal
-	9	NC	do not connect	Output - on/off signal
-	10	NC	do not connect	Output - on/off signal
G	PE	EARTH	Internally connected to the driver housing	

Notes (1) with /Q option ENABLE signal replaces AGND on pin C; MONITOR signal is reffered to pin B

(2) with /F option FAULT signal replaces MONITOR on pin F.

A minimum time of 50ms to 100ms 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.

8 DIGITAL INTEGRAL DRIVERS -TES - OPTIONS

Standard driver execution provides on the 7 pin main connector:

Power supply - 24VDC must be appropriately stabilized or rectified and filtered; a 2,5 A safety fuse is required in series to each driver power supply Apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers

Reference input signal - analog differential input with ±10VDC nominal range (pin D,E), proportional to desired valve spool position

Monitor output signal - analog output signal proportional to the actual valve's spool position with ±10VDC nominal range

Following options are available to adapt standard execution to special application requirements:

8.1 Option /I

It provides 4÷20 mA current reference and monitor signals instead of the standard 0 ÷ +10VDC.

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.

8.2 Option /Z

It provides on a 12 pin main connector the above standard features plus:

Logic power supply

Option /Z provides separate power supply for the solenoid (pin 1, 2) and for the digital electronic circuits (pin 9, 10).
Cutting solenoid power supply allows to interrupt the valve functioning but keeping energized the digital electronics thus avoiding fault conditions of the machine fieldbus controller. This condition allows to realize safety systems in compliance with European Norms EN13849-1 (ex EN954-1).

Enable Input Signal

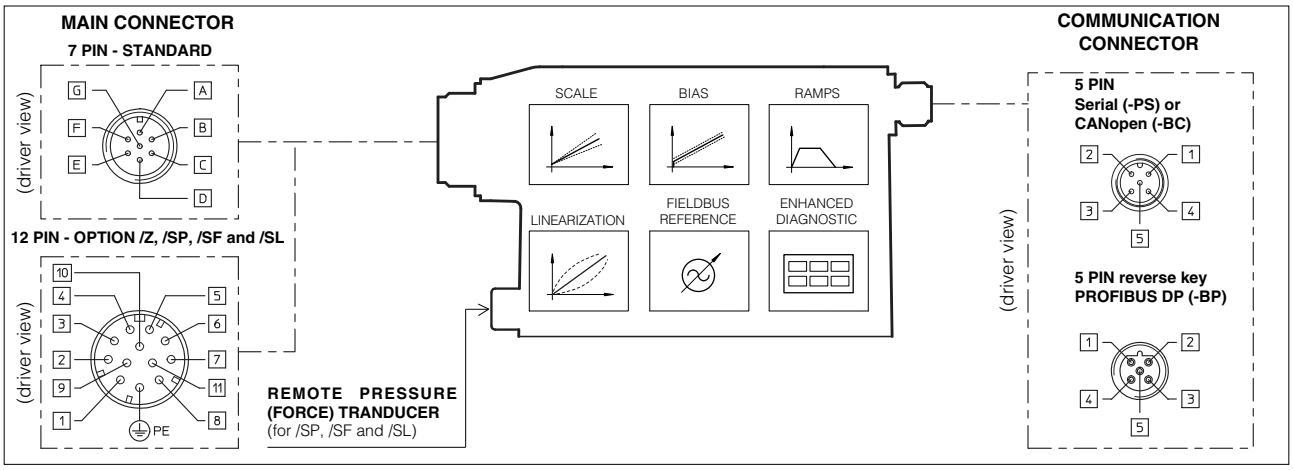
To enable the driver, supply a 24VDC on pin 3 referred to pin 2: when the Enable signal is set to zero the valve functioning is disabled (zero current to the solenoid) but the driver current output stage is still active. This condition does not comply with European Norms EN13849-1 (ex EN954-1).

Fault Output Signal

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4÷20mA input, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24VDC (pin 11 referred to pin 2): Fault status is not affected by the Enable input signal

8.3 Possible combined options: /IZ

9 DIGITAL INTEGRAL DRIVERS -TES - MAIN FUNCTIONS AND ELECTRONIC CONNECTIONS



9.1 ELECTRONIC CONNECTIONS - 7 & 12 PIN MAIN CONNECTORS

Standard 7pin	/Z option 12pin	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	V+	Power supply 24 VDC for solenoid power stage (and for driver logic on 7 pin connection)	Input - power supply
B	2	V0	Power supply 0 VDC for solenoid power stage (and for driver logic on 7 pin connection)	Gnd - power supply
-	3	ENABLE	Enable (24 VDC) or disable (0 VDC) the driver	Input - on/off signal
D	4	INPUT+	Reference analog input: ±10 VDC maximum range (4 ÷ 20 mA for /I option) standard: differential input; /Z option: common mode INPUT+ referred to AGND	Input - analog signal
E	-	INPUT -		
C	5	AGND	Ground - signal zero for MONITOR signal signal zero for INPUT+ signal (only for /Z option)	Gnd - analog signal
F	6	MONITOR	Monitor analog output: ±10 VDC maximum range (4 ÷ 20 mA for /I option)	Output - analog signal
-	7	NC	do not connect	
-	8	NC	do not connect	
-	9	VL+	Power supply 24 VDC for driver logic	Input - power supply
-	10	VL0	Power supply 0 VDC for driver logic	Gnd - power supply
-	11	FAULT	Fault (0V) or normal working (24V)	Output - on/off signal
G	PE	EARTH	Internally connected to the driver housing	

Note: A minimum time of 300 to 500 ms 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.

9.2 ELECTRONIC CONNECTIONS - 5 PIN COMMUNICATION CONNECTORS

	-PS Serial		-BC CANopen		-BP PROFIBUS DP	
PIN	SIGNAL	TECHNICAL SPECIFICATION	SIGNAL	TECHNICAL SPECIFICATION	SIGNAL	TECHNICAL SPECIFICATION
1	NC	do not connect	CAN_SHLD	Shield	+5V	for termination
2	NC	do not connect	NC	do not connect	LINE-A	Bus line (high)
3	RS_GND	Signal zero data line	CAN_GND	Signal zero data line	DGND	data line and termination Signal zero
4	RS_RX	Valves receiving data line	CAN_H	Bus line (high)	LINE-B	Bus line (low)
5	RS_TX	Valves transmitting data line	CAN_L	Bus line (low)	SHIELD	

10 SOFTWARE TOOLS

The functional parameters of digital valves, as the bias, scale ramp and linearization of the regulation characteristic, can be easily set and optimized with the Atos E-SW programming software, available in three different versions according to the driver's communication interfacing: E-SW-PS (Serial), E-SW-BC (CANopen) and E-SW-BP (PROFIBUS DP).
A proper connection is required between the PC and the electronic driver communication port: for a more detailed description of software interface, PC requirements, adapters, cables and terminators, please **see table G500.**
Proportional valves with fieldbus communication interface (-BC and -BP) can be directly managed by the machine control unit; it is required to implement in the machine control the standard communication as described in the user manuals supplied with the relevant programming software. For detailed description of available fieldbus feature, **see table G510.**

On first supply of the E-SW software, it is required to apply for the registration in the Atos download area: www.download.atos.com
Once the registration is completed, the password will be sent by email.
The software remains active for 10 days from the installation date and then it stops until the user inputs his password.
With the password you can also download, in your personal area, the latest releases of the Atos software, manuals, drivers and configuration files.

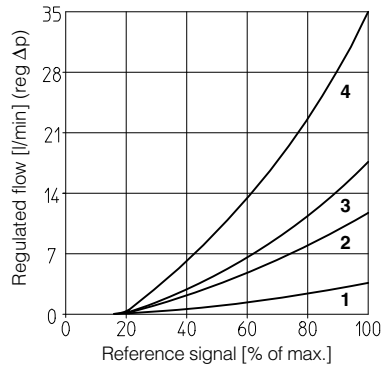
11 MAIN CHARACTERISTICS OF PROPORTIONAL FLOW VALVES TYPE QVHZO-T* AND QVKZOR-T*

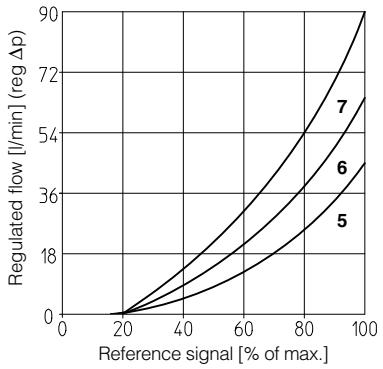
Assembly position	Any position	
Subplate surface finishing	Roughness index, $\sqrt{}^{0.4}$ flatness ratio 0,01/100 (ISO 1101)	
Ambient temperature	-20°C ÷ +70°C for -T executions; -20°C ÷ +60°C for -TE and -TES	
Fluid	Hydraulic oil as per DIN 51524 ... 535 for other fluids see section 1	
Recommended viscosity	15 ÷100 mm²/s at 40°C (ISO VG 15÷100)	
Fluid contamination class	ISO 18/15 achieved with in line filters of 10 μm and $\beta_{10} \geq 75$ (recommended)	
Fluid temperature	-20°C +60°C (standard and /WG seals) -20°C +80°C (/PE seals)	
Valve model	QVHZO-T*	QVKZOR-T*
Coil resistance R at 20°C	3 ÷ 3,3 Ω	3,8 ÷ 4,1 Ω
Max. solenoid current	2,6 A	2 A
Max. power	30 Watt	35 Watt
Protection degree (CEI EN-60529)	IP65 for -T executions; IP65÷67 for -TE and -TES, depending to the connector type (see sect. 14)	
Duty factor	Continuous rating (ED=100%)	

12 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

12.1 Regulation diagrams

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

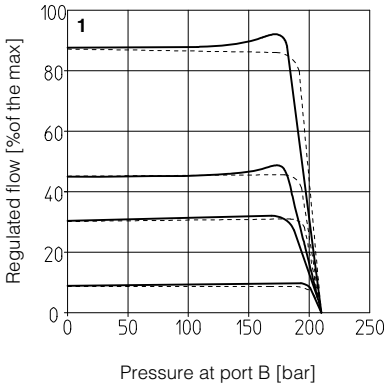


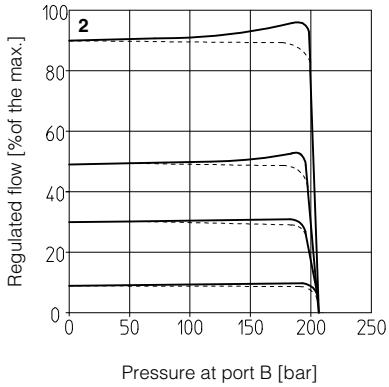


12.2 Regulated flow/outlet pressure diagrams
with inlet pressure = 210 bar

1 = QVHZO-*
2 = QVKZOR-*

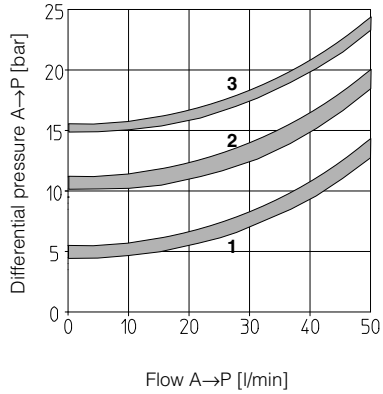
Dotted line for 3-way versions

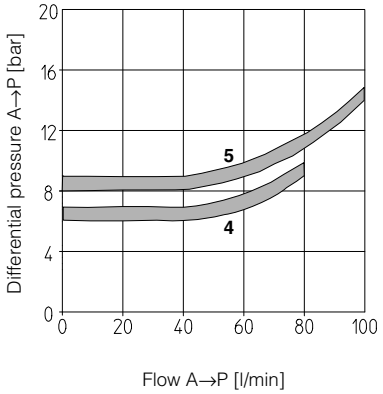




12.3 Flow A→P/Δp diagrams
3-way configuration

1 = QVHZO-*-06/3,
QVHZO-*-06/12
2 = QVHZO-*-06/18,
QVHZO-*-06/36,
3 = QVHZO-*-06/45
4 = QVKZOR-*-10/65
5 = QVKZOR-*-10/90





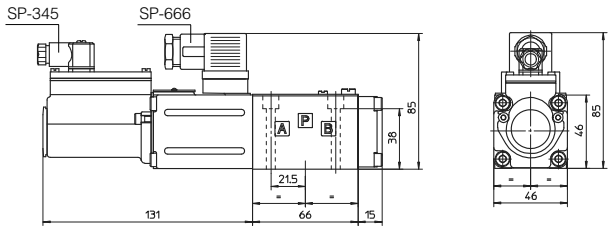
12.4 Dynamic response

The response times in section 3 have to be considered as average values.
For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.

13 **INSTALLATION DIMENSIONS [mm]**

QVHZO-T*

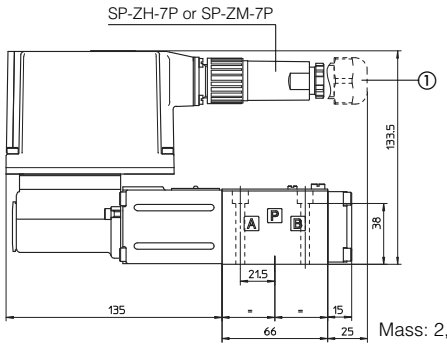
QVHZO-T



Mass: 2,3 kg

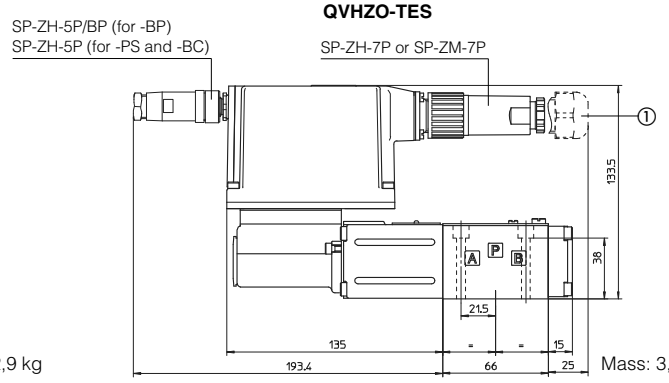
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see tab. P005)
Fastening bolts: 4 socket head screws M5x50 class 12.9
Tightening torque = 8 Nm
Seals: 4 OR 108;
Diameter of ports A, B, P, T:
Ø 7,5 mm (max)

QVHZO-TE



Mass: 2,9 kg

QVHZO-TES

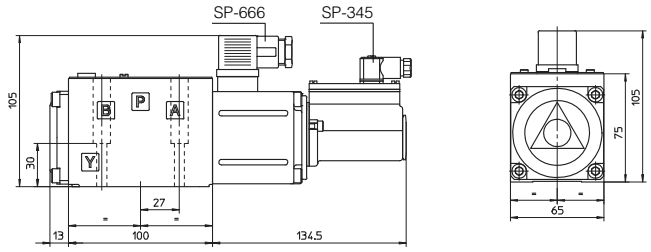


Mass: 3,1 kg

① Dotted line =12 poles connector SP-ZH-12P for option /Z

QVKZOR-T*

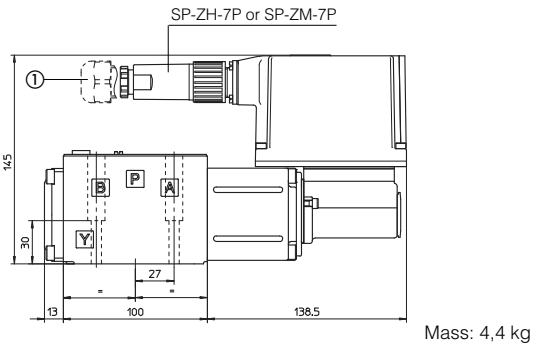
QVKZOR-T



Mass: 3,8 kg

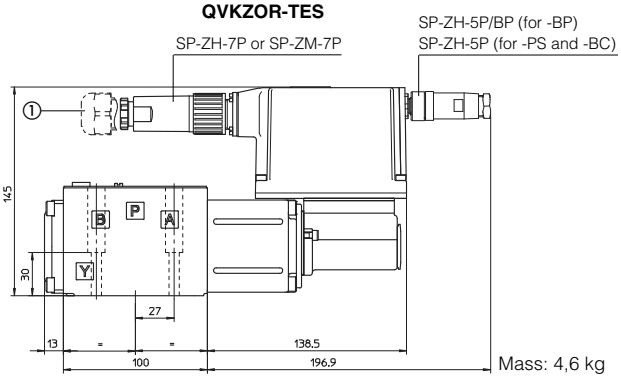
ISO 4401: 2005
Mounting surface: 4401-05-04-0-05 (see tab. P005)
Fastening bolts: 4 socket head screws M6x40 class 12.9
Tightening torque = 15 Nm
Seals: 5 OR 2050;
Diameter of ports A, B, P, T:
Ø 11,2 mm (max)

QVKZOR-TE



Mass: 4,4 kg

QVKZOR-TES



Mass: 4,6 kg

① Dotted line =12 poles connector SP-ZH-12P for option /Z

14 **MODEL CODES OF POWER SUPPLY AND COMMUNICATION CONNECTORS (to be ordered separately)**

VALVE VERSION	-T		-TE, -TES		-TE, /Z -TES /Z, /SF, /SL, /SP	TES -PS, -BC	TES -BP
	Power supply	Transducer					
CONNECTOR CODE	SP-666	SP-345	SP-ZH-7P	SP-ZM-7P	SP-ZH-12P	SP-ZH-5P	SP-ZH-5P/BP
PROTECTION DEGREE	IP65	IP65	IP67	IP67	IP65	IP67	IP67
DATA SHEET	K500		G200, G210, K500			G210, K500	

connectors supplied with the valve