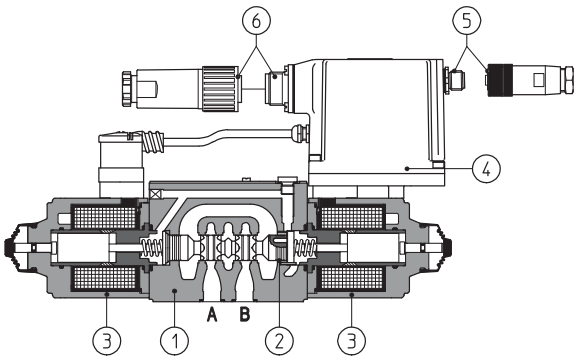
Proportional directional valves type DHZO-A* and DKZOR-A*

direct operated, without position transducer, ISO 4401 size 06 and 10



DKZOR-AES-PS-171

① Valve body
② Spool
③ Proportional solenoid
④ Integral electronics
⑤ Communication connector
⑥ Main connector

DHZO-A* and DKZOR-A* are proportional valves, direct operated without position transducer, which provide both directional and non-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 proper current to align valve regulation to the reference signal supplied to the electronic driver.

They are available in different executions:
- -A, without position transducer;
- -AE, -AES as -A plus analogue (AE) or digital (AES) integral electronics ④;
- -AEG, as A plus integral digital cycle generator (see table G120).

The 4-way spool ②, sliding into a 5-chambers body ①, is directly operated by proportional solenoids ③.
The integral electronics ④ ensures factory presetting, fine functionality plus valve-to-valve interchangeability and simplified wiring and installation.
The electronic main connector ⑥ is fully interchangeable for –AE and –AES executions.
Standard 7 pin main connector is used for power supply, analog input reference and monitor signals.
12 pin connector is used for AEG version and for option /Z (AES).

Following communication interfaces ⑤ are available for the digital -AES and -AEG execution:
- -PS, Serial communication interface. The valve reference signal is provided with analogue commands via the 7 (or 12) pins connector ⑥.
- -BC, CANopen interface (only for -AES)
- -BP, PROFIBUS DP interface (only for -AES)

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 the valves have antivibration, antishock and weather-proof features.

Mounting surface: ISO 4401 sizes 06 and 10.

Max flow respectively up to 50 l/min and 105 l/min with valve differential pressure Δp = 30 bar, see table [3].

Max pressure = 350 bar for DHZO;
315 bar for DKZOR.

1 MODEL CODE

DHZO - AES - PS - 0 7 1 - S 5 / * / * ** / * *

DHZO = size 06
DKZOR = size 10

A = without position transducer
AE = as A plus integral electronics
AES = as A plus integral digital electronics
AEG = as A plus integral digital cycle generator (1)

Communication interfaces (only for AES and AEG)
PS = Serial
BC = CANopen (only AES)
BP = PROFIBUS DP (only AES)

Valve size
0 = ISO 4401 size 06
1 = ISO 4401 size 10

Configuration, see section [3]
5 = external plus central position, spring centered
7 = 3 position, spring centered

Spool overlapping in central position, see section [3]
1 = P, A, B, T positive overlapping (20% of spool stroke)
3 = P positive overlapping; (20% of spool stroke) A, B, T, negative overlapping

Spool type (regulating characteristics)
L = linear;
S = progressive;
D = differential-progressive (as **S**, but with P-A= Q, P-B= Q/2)

Spool size: **14, 1, 3, 5** = see section [3]

Hydraulic options, see section [4]:
B = solenoid and integral electronics at side of port A
Y = external drain

Options for -A execution see section [6]:
MO = horizontal hand lever
MV = vertical hand lever
BMO = horizontal hand lever installed at side of port B
BMV = vertical hand lever installed at side of port B
N = manual micrometric adjustment
NV = as N plus handwheel and graduated scale

Electronics options for -AE execution see section [8]:
I = current reference input (4÷20 mA)
Q = enable signal

Electronics options for -AES execution see section [10]:
I = current reference input (4÷20 mA)
Z = double power supply, enable fault and monitor (12 pin connector)

Coils voltage (only for -A execution): see section [6]:
- = standard 12 Vdc coil
6 = with 6 Vdc coil
18 = with 18 Vdc

Synthetic fluids
WG = water-glycol
PE = phosphate ester

Series number

Note:
(1) For detailed description of AEG integral cycle generator, see table G120

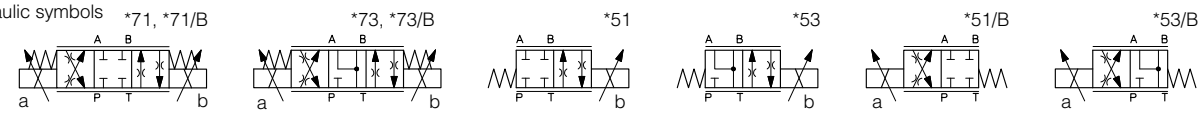
2 ELECTRONIC DRIVERS FOR DHZO-A*

Valve model	-A						-AE	-AES	-AEG
Drivers model	E-MI-AC-0*F	E-MI-AS-IR	E-BM-AC-0*F	E-BM-AS-PS	E-ME-AC-0*F	E-RP-AC-0*F	E-RI-AE	E-RI-AES	E-RI-AEG
Data sheet	G010	G020	G025	G030	G035	G100	G110	G115	G120

Note: For power supply and communication connector see section [17] and [19]

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

Hydraulic symbols



Valve model	DHZO					DKZOR	
		-A	-AE	-AES	-AEG	-A	-AE -AES -AEG
Spool overlapping	1, 3	1, 3	1, 3	1, 3	1, 3	1, 3	1, 3
Spool type and size	L14	L1	S2	S3, L3, D3	S5, L5, D5	S3, L3, D3	S5, L5, D5
Pressure limits [bar]	ports P, A, B = 350; T = 210 (250 with external drain /Y)					ports P, A, B = 315; T = 210 (250 /Y)	
Max flow (1) [l/min]							
at Δp = 10 bar (P-T)	1	4,5	8	17	28	45	60
at Δp = 30 bar (P-T)	2	8	14	30	50	80	105
at Δp = 70 bar (P-T)	3	12	21	45	74	120	160
Response time (2) [ms]	< 30					< 40	
Hysteresis [%]	≤ 5%					≤ 5%	
Repeatability	± 1%					± 1%	

Notes:
- Above performance data refer to valves coupled with Atos electronic drivers, see section 2.
- The flow regulated by the directional proportional valves is not pressure compensated, thus it is affected by the load variations.To keep costant the regulated flow under different load conditions, modular pressure compensators are available (see tab. D150).

(1) For different Δp, the max flow is in accordance to the diagrams in sections 14.2 and 15.2

4 HYDRAULIC OPTIONS

4.1 Option /B Solenoid (for valve configuration *5*), and integral electronics at side of port A.

4.2 Option /Y External drain advisable when the valve is used in double flow path, see section 14.5 and 15.5. Option /Y is mandatary if the pressure in port T exceeds 160 bar.

5 GENERAL NOTES

DHZO and DKZOR proportional valves are CE marked according to the applicable Directives (e.g. Immunity/Emission EMC Directive and Low Voltage 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).

6 OPTIONS FOR -A EXECUTION

6.1 Option /6 6 VDC coil instead of standard 12 VDC, to be used in case of power supply 12 VDC

6.2 Option /18 18 VDC coil instead of standard 12 VDC, to be used with electronic drivers not supplied by Atos

6.3 Auxiliary hand lever

this option is available only for DHZO-A with spool type S3, S5, D3, D5, L3, L5.
It allows to operate the valve in absence of electrical power supply. For detailed description of DHZO-A with hand lever option see table E138

- **Option /MO** horizontal hand lever
- **Option /MV** vertical hand lever
- **Option /BMO** horizontal hand lever installed at side of port B
- **Option /BMV** vertical hand lever installed at side of port B

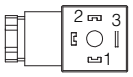
The following options allow to operate the valve in absence of electrical power supply by means of a micrometric screw replacing the standard solenoid manual override, see table K500

6.4 Option /N manual micrometric adjustment

6.5 Option /NV as N plus handwheel and graduated scale

7 CONNECTIONS FOR -A EXECUTION

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



8 ANALOG INTEGRAL DRIVERS -AE - 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 coil current

Monitor output signal - analog output signal proportional to the actual valve's coil current (1V monitor = 1A coil current)

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

8.1 Option /I

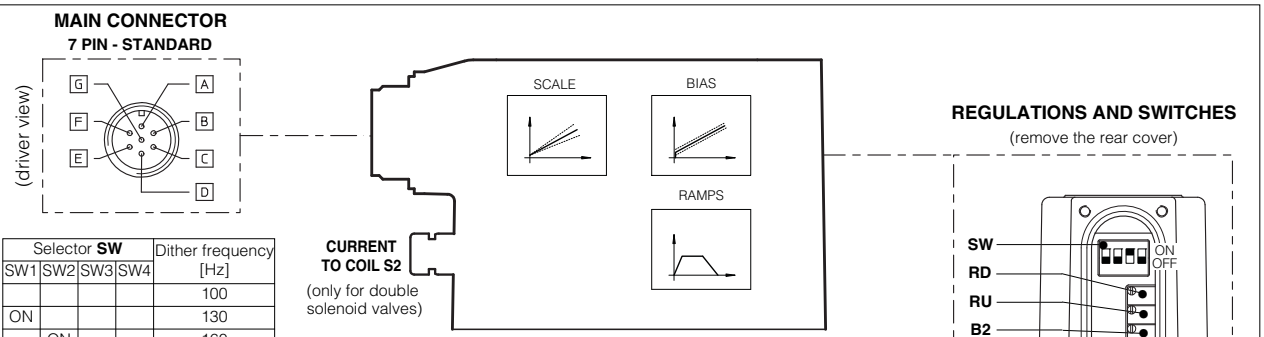
It provides the 4÷20 mA current reference signal instead of the standard ±10 VDC. Monitor output signal is still the standard ±10 VDC
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

8.2 Option /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.

8.2 Possible combined option: /IQ

9 ANALOG INTEGRAL DRIVERS -AE - MAIN FUNCTIONS AND ELECTRONIC CONNECTIONS



Selector **SW**				Dither frequency
SW1	SW2	SW3	SW4	[Hz]
				100
ON				130
	ON			160
		ON		**200 (Standard)**
ON		ON		230
	ON	ON		270
ON	ON	ON		300
ON	ON		ON	380
ON		ON	ON	430
	ON	ON	ON	470
ON	ON	ON	ON	500

The dither frequency is factory pre-set at 200 Hz and its regulation may be adjusted after contact with Atos technical department

B1: positive bias adjust
B2: negative bias adjust (only for double solenoid valves)
S1: positive scale adjust
S2: negative scale adjust (only for double solenoid valves)
RU: ramp for increasing reference signal
RD: ramp for decreasing reference signal
SW: dither frequency selector (see table beside)

9.1 ELECTRONIC CONNECTIONS - 7 PIN MAIN CONNECTORS

PIN	SIGNAL	TECHNICAL SPECIFICATIONS		NOTES
A	V+	Power supply 24 VDC for solenoid power stage and driver logic		Input - power supply
B	V0	Power supply 0 VDC for solenoid power stage and driver logic		Gnd - power supply
C (1)	AGND	Ground - signal zero for MONITOR signal		Gnd - analog signal
	ENABLE	Enable (24 VDC) or disable (0 VDC) the driver	(for /Q option)	Input - on/off signal
D	INPUT+	Reference analog differential input: ±10 VDC maximum range For single solenoid valves the reference input is 0÷+10 VDC	(4 ÷ 20 mA for /I option) (4 ÷ 20 mA for /I option)	Input - analog signal
E	INPUT -	For double solenoid valves the reference input is ±10 VDC	(4 ÷ 20 mA for /I option)	
F	MONITOR	Monitor analog output: ±10 VDC maximum range		Output - analog signal
G	EARTH	Internally connected to the driver housing		

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

A minimum time of 60ms to 160ms 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

10 DIGITAL INTEGRAL DRIVERS -AES - 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 coil current
Monitor output signal - analog output signal proportional to the actual valve's coil current (1V monitor = 1A coil current)

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

10.1 Option /I

It provides 4÷20 mA current reference signal instead of the standard ±10 VDC. Monitor output signal is still the standard 0÷10 VDC
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.

10.2 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

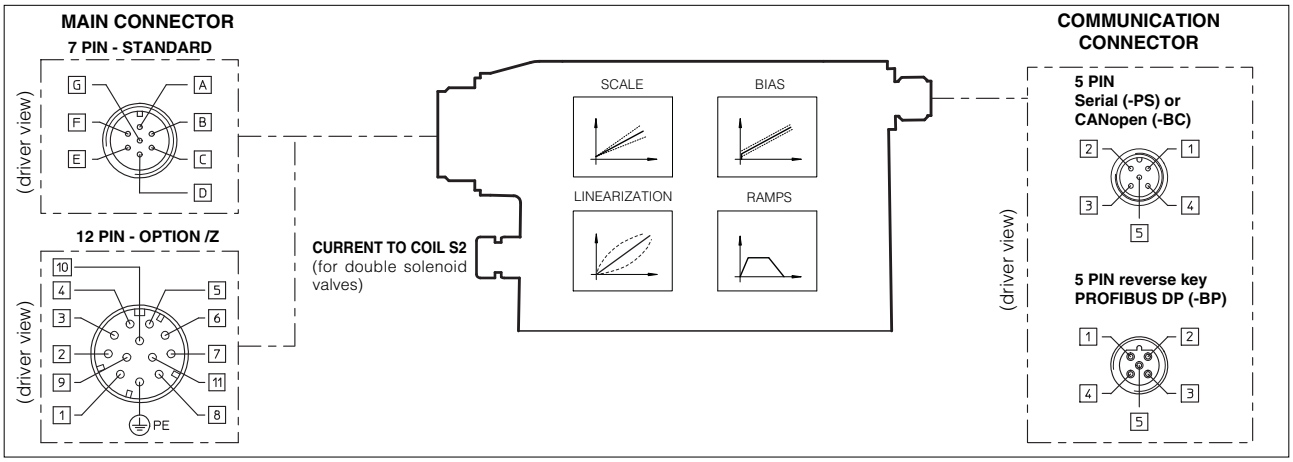
To enable the driver, supply a 24VDC on pin 3 referred to pin 2: when the Enable signal is set to zero the valve functioning is disabled (zero current to the solenoid) but the driver current output stage is still active. This condition does not comply with European Norms EN13849-1 (ex EN954-1).

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

10.3 Possible combined option: /IZ

11 DIGITAL INTEGRAL DRIVERS -AES - MAIN FUNCTIONS AND ELECTRONIC CONNECTIONS



11.1 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) For single solenoid valves the reference input is 0÷+10 VDC (4 ÷ 20 mA for /I option) For double solenoid valves the reference input is ±10 VDC (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	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 (0 VDC) or normal working (24 VDC)	Output - on/off signal
G	PE	EARTH	Internally connected to the driver housing	

Note: A minimum time of 270 to 340 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.

11.2 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	

12 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.

13 MAIN CHARACTERISTICS OF PROPORTIONAL DIRECTIONAL VALVES

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 -A execution; -20°C ÷ +60°C for -AE and -AES executions					
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)					
Coil Voltage	DHZO-A*			DKZOR-A*		
	with 12 VDC coil	with 6 VDC coil	with 18 VDC coil	with 12 VDC coil	with 6 VDC coil	with 18 VDC coil
Coil resistance R at 20°C	3 ÷ 3,3 Ω	2 ÷ 2,2 Ω	13 ÷ 13,4 Ω	3,8 ÷ 4,1 Ω	2,2 ÷ 2,4 Ω	12 ÷ 12,5 Ω
Max. solenoid current	2,2 A	2,75 A	1 A	2,6 A	3,25 A	1,2 A
Max. power	30 Watt			35 Watt		
Protection degree (CEI EN-60529)	IP65 for -A execution; IP65÷67 for -AE and -AES executions, depending to the connector type (see sect. 17, 19)					
Duty factor	Continuous rating (ED=100%)					

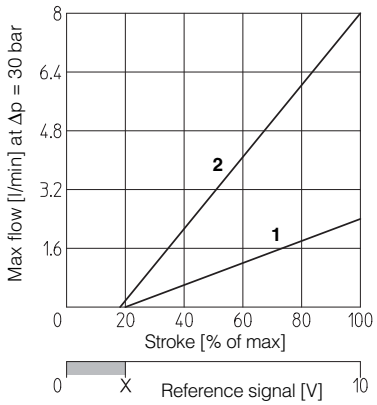
14 DIAGRAMS FOR DHZO (based on mineral oil ISO VG 46 at 50 °C)

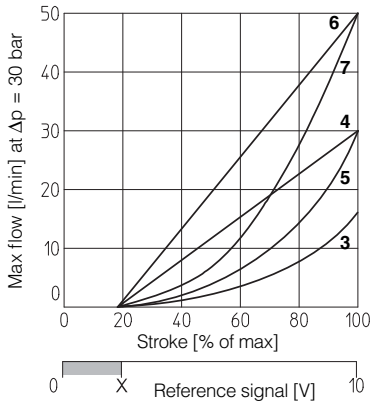
14.1 Regulation diagrams

1 = linear spool L14
2 = linear spool L1
3 = progressive spool S2
4 = linear spool L3
5 = progressive spool S3, D3
6 = linear spool L5
7 = progressive spool S5, D5

Note:
Hydraulic configuration vs reference signal for double solenoid valves (also for option /B):

Reference signal	0 ÷+10 V 12÷20 mA	P → A / B → T
Reference signal	0 ÷-10 V 4÷12 mA	P → B / A → T



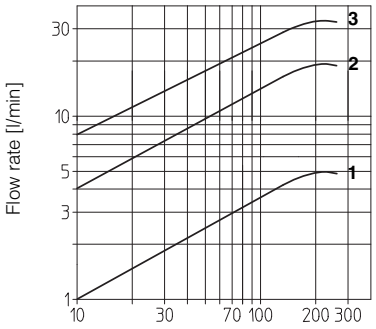


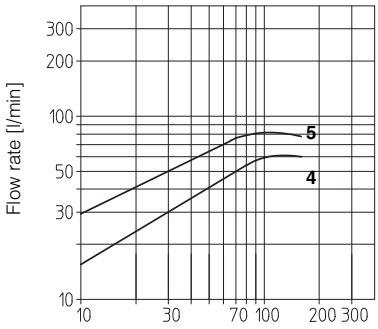
X = Threshold for bias activation depending to the valve type and amplifier type

14.2 Flow /Δp diagrams

stated at 100% of valve stroke

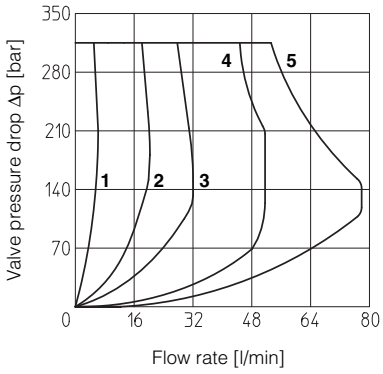
1 = spool L14
2 = spool L1
3 = spool S2
4 = spool S3, L3, D3
5 = spool S5, L5, D5





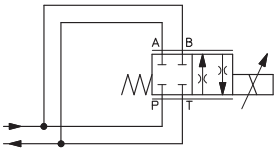
14.3 Operating limits

1 = spool L14
2 = spool L1
3 = spool S2
4 = spool L3, S3, D3
5 = spool L5, S5, D5



14.4 Operation as throttle valve

Single solenoid valves (DHZO-*-051) can be used as simple throttle valves:
Pmax = 250 bar (option /Y advisable)



	SPOOL TYPE						
	L14	**L1**	**S2**	**L3**	**S3**	**L5**	**S5**
Max flow Δp= 70bar [l/min]	6	20	40	80		100	

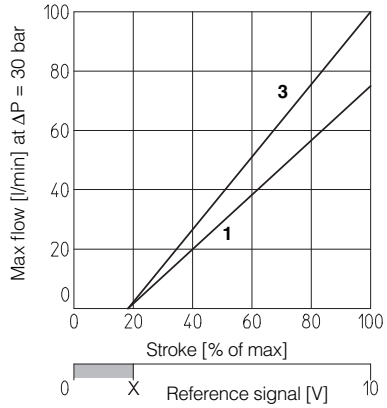
15 DIAGRAMS FOR DKZOR (based on mineral oil ISO VG 46 at 50 °C)

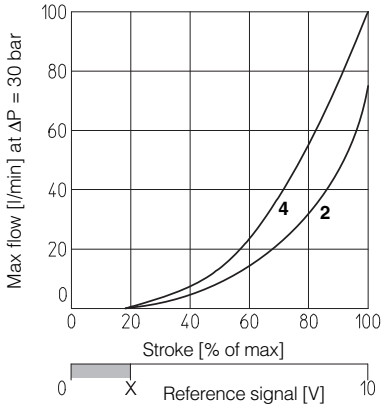
15.1 Regulation diagrams

1 = linear spool L3
2 = progressive spool S3, D3
3 = linear spool L5
4 = progressive spool S5, D5

Note:
Hydraulic configuration vs reference signal
for double solenoid valves (also for option /B):

Reference signal	0 ÷+10 V 12÷20 mA	P → A / B → T
Reference signal	0 ÷-10 V 4÷12 mA	P → B / A → T



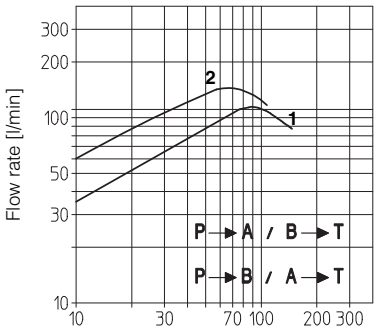


X = Threshold for bias activation depending to the valve type and amplifier type

15.2 Flow /Δp diagrams

stated at 100% of valve stroke

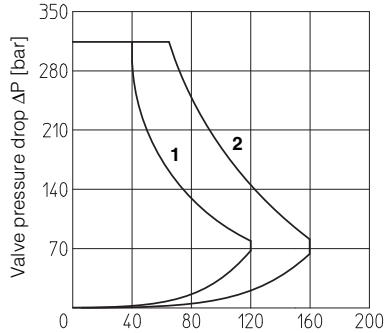
1 = spool S3, L3, D3
2 = spool S5, L5, D5



Valve pressure drop Δp [bar]

15.3 Operating limits

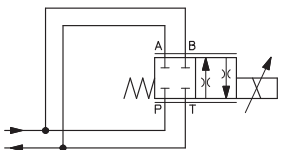
1 = spool L3, S3, D3
2 = spool L5, S5, D5



Flow rate [l/min]

15.4 Operation as throttle valve

Single solenoid valves (DKZOR-*-151)
can be used as simple throttle valves:
Pmax = 250 bar (option /Y advisable)

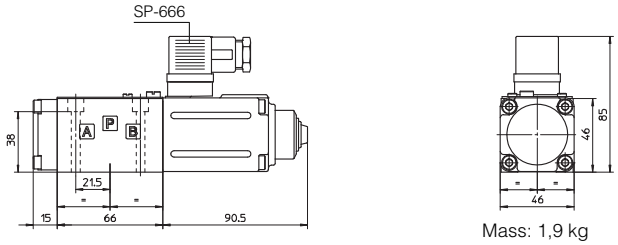


	SPOOL TYPE			
	L3	**S3**	**L5**	**S5**
Max flow Δp= 30 bar [l/min]	100		160	

16 INSTALLATION DIMENSIONS FOR DHZO [mm]

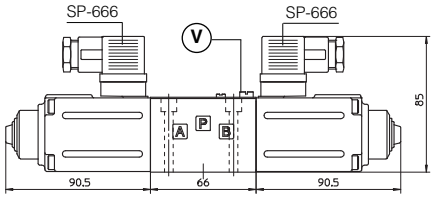
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(for /Y version, surface 4401-03-03-0-05 without X port)
Fastening bolts: 4 socket head screws M5x50 class 12.9
Tightening torque = 8 Nm
Seals: 4 OR 108; 1 OR 2025
Diameter of ports A, B, P, T: Ø 7,5 mm (max)
Diameter of port Y: Ø = 3,2 mm (only for /Y option)

DHZO-A-05



Mass: 1,9 kg

DHZO-A-07

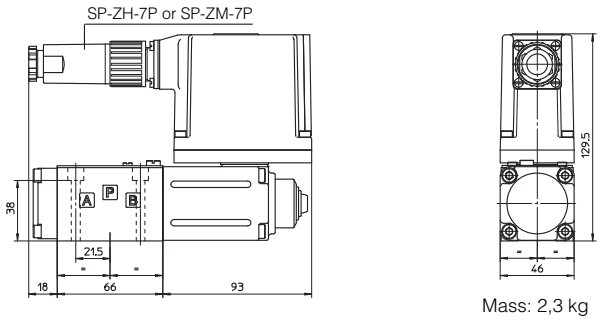


Mass: 2,6 kg

Note: for option /B the solenoid is at side of port A

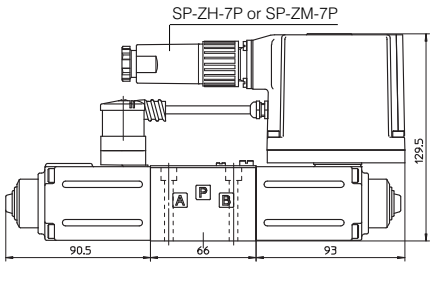
-AE EXECUTION

DHZO-AE-05



Mass: 2,3 kg

DHZO-AE-07

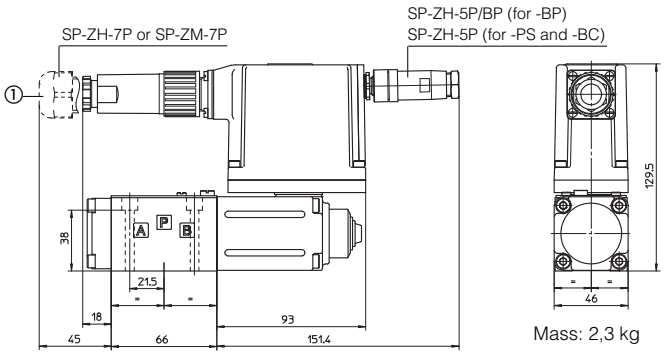


Mass: 3,1 kg

-AES EXECUTION

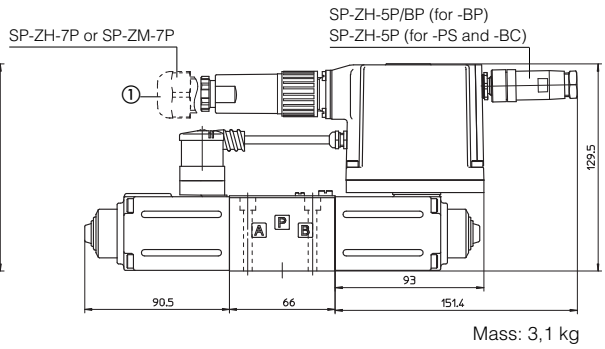
① Dotted line =12 poles connector SP-ZH-12P for option /Z

DHZO-AES-*-05
DHZO-AEG-*-05



Mass: 2,3 kg

DHZO-AES-*-07
DHZO-AEG-*-07



Mass: 3,1 kg

Note: for option /B the solenoid and the integral electronics are at side of port A

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

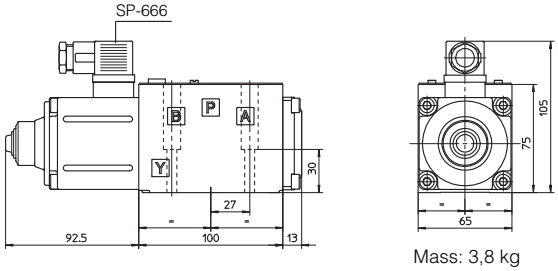
VALVE VERSION	-A	-AE, -AES		-AES/Z -AEG	-Serial (-PS) or CANopen (-BC)	PROFIBUS DP (-BP)
CONNECTOR CODE	SP-666	SP-ZH-7P	SP-ZM-7P	SP-ZH-12P	SP-ZH-5P	SP-ZH-5P/BP
PROTECTION DEGREE	IP65	IP67	IP67	IP65	IP67	IP67
DATA SHEET	K500	G110, G115, K500			G115, K500	

connectors supplyed with the valve

18 INSTALLATION DIMENSIONS FOR DKZOR [mm]

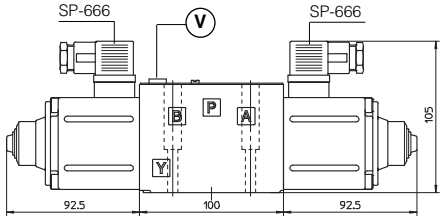
ISO 4401: 2005
Mounting surface: 4401-05-04-0-05 (see table P005)
(for /Y version, surface 4401-05-05-0-05 without X port)
Fastening bolts: 4 socket head screws M6x40 class 12.9
Tightening torque = 15 Nm
Seals: 5 OR 2050; 1 OR 108
Diameter of ports A, B, P, T: Ø 11,2 mm (max)
Diameter of port Y: Ø = 5 mm (only for /Y option)

DKZOR-A-15



Mass: 3,8 kg

DKZOR-A-17

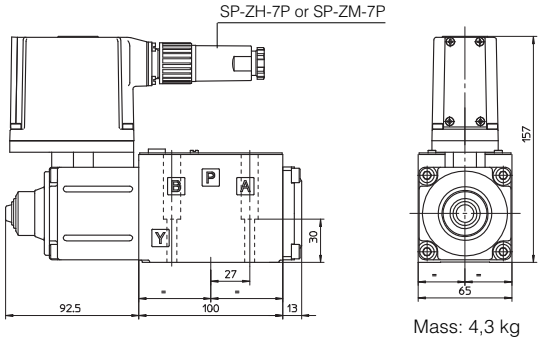


Mass: 4,5 kg

Note: for option /B the solenoid is at side of port A

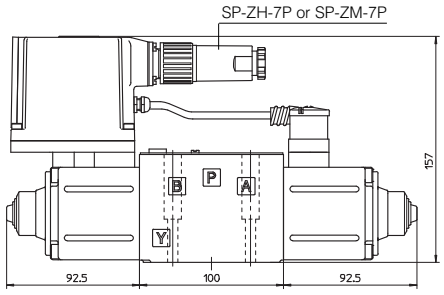
-AE EXECUTION

DKZOR-AE-15



Mass: 4,3 kg

DKZOR-AE-17

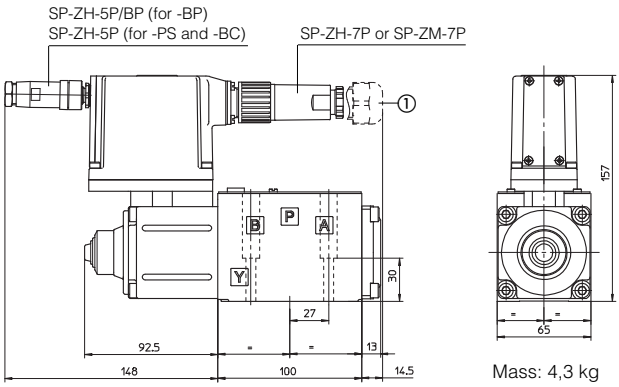


Mass: 5,0 kg

-TES EXECUTION

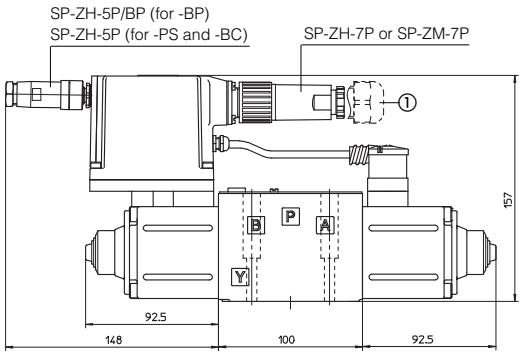
① Dotted line =12 poles connector SP-ZH-12P for option /Z

DKZOR-AES-*-15
DKZOR-AEG-*-15



Mass: 4,3 kg

DKZOR-AES-*-17
DKZOR-AEG-*-17



Mass: 5,0 kg

Note: for option /B the solenoid, the position transducer and the integral electronics are at side of port A

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

VALVE VERSION	-A	-AE, -AES		-AES/Z -AEG	-Serial (-PS) or CANopen (-BC)	PROFIBUS DP (-BP)
CONNECTOR CODE	SP-666	SP-ZH-7P	SP-ZM-7P	SP-ZH-12P	SP-ZH-5P	SP-ZH-5P/BP
PROTECTION DEGREE	IP65	IP67	IP67	IP65	IP67	IP67
DATA SHEET	K500	G200, G210, K500			G210	

connectors supplyed with the valve