MANNESMANN REXROTH

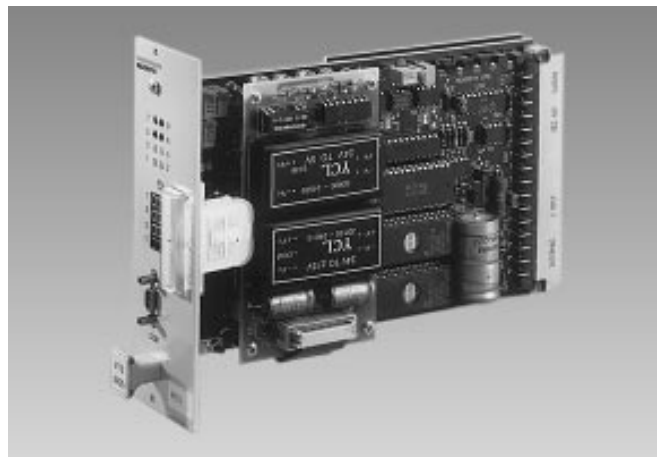|	Secondary control with A10VS - axial piston units	RE 92 715/09.95
Size 28 to 140	Nom. pressure 250 bar	Max. pressure 315 bar	Replaces: 07.87
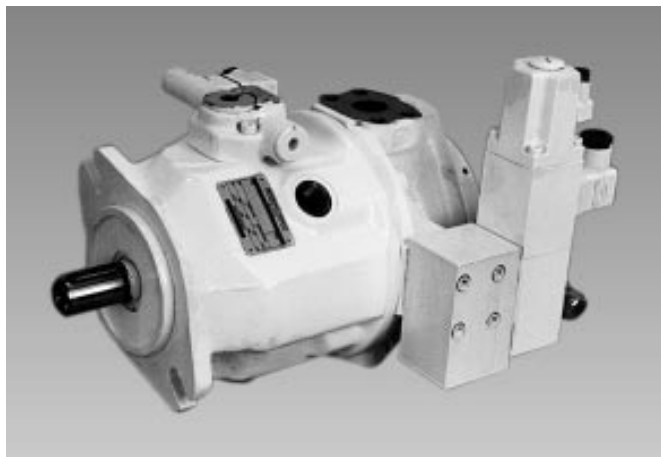
Secondary unit type A10VSO ... DSE with proportional valve fitted

H/A 3131/92
MCS digital controller card, type VTS 0235-1X/1...
(version with DC/DC converter VTS 0015)

Characteristics

- Highly dynamic rotary drive
- Reversing operation in open or closed circuit (four quadrant operation)
- With energy recovery and energy storage
- With closed loop control of speed, position or torque of high control quality and dynamics
- Throttle-free coupling and power transmission for as many independently operating machines (motor or generator mode) as required, which are connected to a common supply line with quasi-constant operating pressure
- Low losses
- Compact closed loop control elelectronics in Euro-card format

Functional description

Secondary controlled hydrostatic machines connected to a supply network with quasi-constant operating pressure provide an energy-saving drive concept with high dynamics for establishing closed loop controls of speed, position or torque with energy recovery.

The take-up or feedback of energy into the supply network takes place without throttling and in line with demand by adjusting the displacement of the unit to the actual load, with any number of units, operating as motors or pumps, being connected in parallel. Four quadrant operation is even possible in the open circuit, with the units being swivelled "over center" for speed or torque reversal. This also reverses the direction of flow.

If required, an energy accumulator may be fitted between the primary and the secondary units.

The accumulator covers peak flow requirements. Moreover, it is used for storing energy which is fed back by the secondary unit into the hydraulic mains during pump operation, if there is no further consumer requirement. The pre-load pressure and loading condition of the accumulator, together with the pressure-compensated primary unit and the operating condition of the secondary unit, determine the quasi-constant high pressure of the system.

The specific characteristics of secondary controls such as reducing the amount of equipment required on the primary side, combined with the possibility of energy recovery, storage of braking energy and the virtually load-independent speed and positioning accuracy open up a wide range of applications.

For further information, see "The Hydraulic Trainer Volume 6" (RE 00 293).
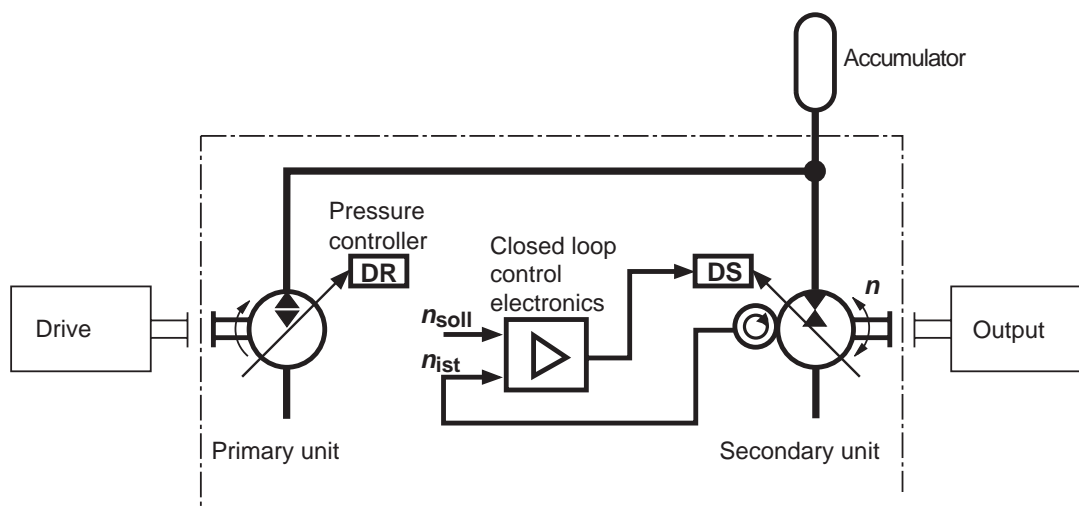
Speed controller

With a closed loop speed control, the DSE control device changes the swivel angle and thus the displacement of the hydraulic unit at a quasi-constant pressure until the torque required to maintain the preselected speed has built up.

In a supply network with a quasi-constant operating pressure, the torque is proportional to the swivel angle or the displacement of the axial piston unit. The swivel angle of the machine is acquired by an inductive position transducer, the actual speed value is acquired by an incremental rotary encoder with internal frequency/current converter.

VTS 0235 controller and monitoring electronics to RE 29 789 are not included in the scope of supply. The system is electronically protected against excessive speeds. The electrically pilot operated check valve (sequencing valve - hydraulic isolator, which has to be integrated into the pipework) is returned to the closed position in the case of an emergency . Thus, the power

supply to the secondary unit is interrupted; now, only braking in the generator mode with energy recovery and supply to the hydraulic mains is possible.

In order to prevent caviation while the machine is running on or coming to a stop after an emergency stop signal, anti-cavitation valves must be provided and installed in the pipework. These valves, check valves without spring, have to be installed vertically and must be ordered separately.

Projecting note:

With the drive mechanism under high pressure and $n = 0$, swivelling to the left (start-up in anti-clockwise rotation) is restricted. Please consult us.

Ordering code for the complete system

1 The complete secondary unit is to be ordered according to this parts list:

1.0 Axial piston unit for the secondary control completely assembled, consisting of items 1.1 to 1.3

1.1 Axial piston unit without proportional valve and without rotary encoder
For the ordering code, see page 3
Technical data of the axial piston unit, see page 4 to 9
Technical data of the swivel angle encoder, see page 11

1.2 Rotary encoder
For the ordering code, see page 12

1.3 STW 0063 proportional valve
Order no. 521141
For the technical data, see page 10 and 11

2 Anti-cavitation valve
(loose supply, separate order)
(se page 13)

3 Sequencing valve (pilot operated check valve)
for pipe installation
(loose supply, separate order)
(see page 13)

4 Closed loop control electronics
(loose supply, separate order)
see page 14
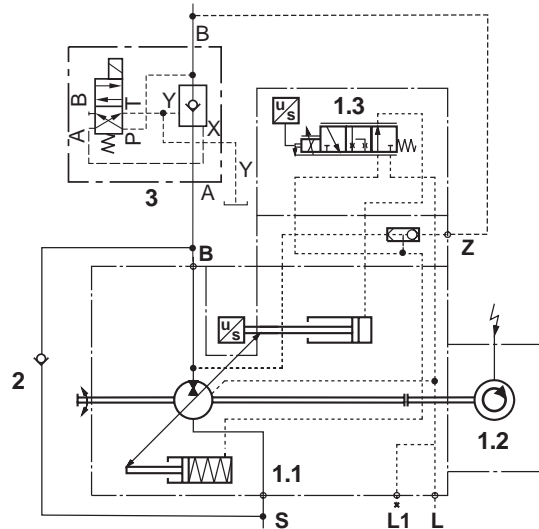
Should you have further questions, please contact our department VT6 in Lohr (fax no.18 -12 93)

Ordering code: axial piston unit (page 2, item 1.1)

| A10VS | O | | DSE/ | 3X | W – | P | | 12 | |

Hydraulic fluid
Mineral oil   **= no code**

Axial piston unit
Swashplate design, variable, stationary operation **= A10VS**
Nominal pressure 250 bar, peak pressure 315 bar

Operating mode
Motor/pump   **= O**

Size
= Displacement $V_{g\,max}$ (cm^3)   **28 45 71 100 140**

Control devices
Speed control, secondary-controlled, without proportional valve
and rotary encoder   **= DSE**

Series 30 to 39   **= 3X**

Direction of rotation
Bi-directional (viewed on shaft end)   **= W**

Seals
NBR seals (shaft sealing ring in FPM)   **= P**
FPM seals to ISO 1629   **= V**

Shaft end
Cylindrical with key   DIN 6885   **= P**

Mounting flange

	28	45	71	100	140	
ISO 2-hole	●	●	●	●	–	**= A**
ISO 4-hole	–	–	–	–	●	**= B**

Connection for working lines
Pressure port   B ⎫ SAE on opposite sides   **= 12**
Suction port   S ⎭ Metric fixing thread

Through drive for the retorary encoder
Standard: Incremental encoder can be fitted through drive Ø 16 mm   **= T10**
Tacho-generator, can be fitted, through drive Ø 16 mm (see foot note [1], page 12)   **= T20**

Technical data: A10VSO ... DSE axial piston unit

Operating pressure range inlet

Absolute pressure at port S

$p_{abs\ min}$ —————————————————— 0,8 bar
$p_{abs\ max}$ ————————————————— 30 bar

Pressure at port B
Nominal pressure p_N ——————————— 250 bar
Peak pressure p_{max} ———————————— 315 bar
(Pressure data to DIN 24 312)

Leak-oil pressure

Max. permissible pressure at port L, L1:
Max. 0,5 bar higher than the pressure at port S, however, not
higher than 2 bar absolute.

Size	Size		**28**	**45**	**71**	**100**	**140**
Displacement	$V_{g\ max}$	cm³	28	45	71	100	140
Max. speed							
$V_g \leq 1,0\ V_{g\ max}$, $p_E \geq 12$ bar ⎤ closed	n_{max}	min⁻¹	4600	4000	3400	3100	2700
$V_g \leq 0,8\ V_{g\ max}$, $p_E \geq 12$ bar ⎦ circuit	n_{max}	min⁻¹	4600	4000	3500	3100	2800
$V_g \leq 0,8\ V_{g\ max}$, $p_E \geq 1$ bar ⎤ open	$n_{o\ max\ zul}$	min⁻¹	3400	2900	2450	2250	2000
$V_g \leq 1,0\ V_{g\ max}$, $p_E \geq 1$ bar ⎦ circuit	$n_{o\ max}$	min⁻¹	3000	2600	2200	2000	1800
Control flow max.	$V_{S\ max}$	cm³	7,18	10,02	13,72	16,85	25,45
Control time $p_{St} = p_{HD} = 200$ bar	t_S	s	0,040	0,045	0,060	0,080	0,110
Internal moment of inertia		kgm²	0,0017	0,0033	0,0083	0,0167	0,0242
Minimum total moment of inertia required [1]		kgm²	0,02	0,03	0,092	0,2	0,3
Weight (without rotary encoder and oil fill)		kg	15	21	33	45	60
Permissible axial force at case pressure p_{max} 1 bar abs.	$\pm F_{ax\ max}$	N	1000	1500	2400	4000	4800
Permissible radial force	$F_{q\ max}$	N	1200	1500	1900	2300	2800

[1] For an overshoot-free closed speed control loop.
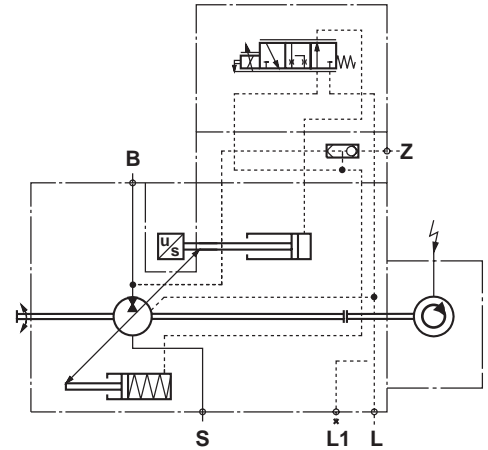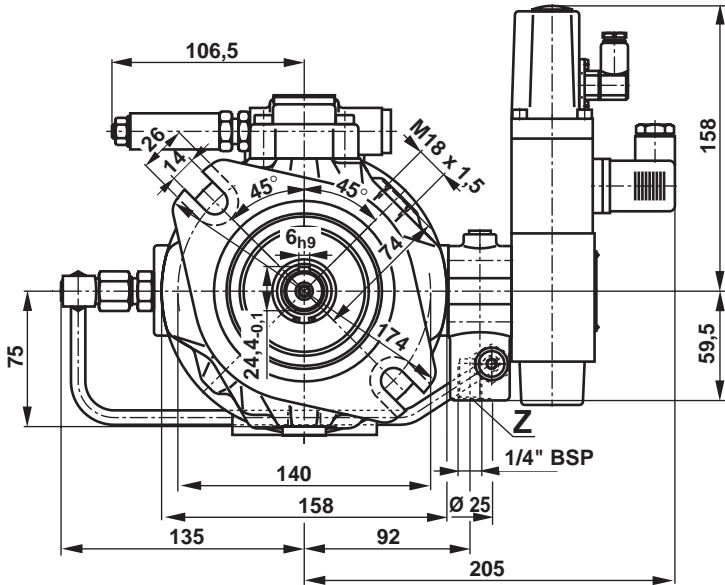For lower values, please consult us !

Application of force

F_q

$+F_{ax}$ $-F_{ax}$

X/2 | X/2
X
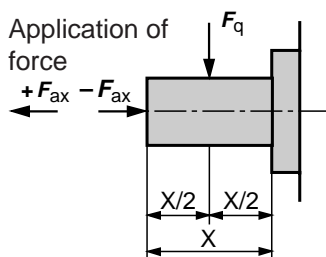
Direction of flow

Swivel range [2]	Direction of rotation [3]		Pressure in	Operating mode
	clockwise	anti-clockwise		
right	B ⇒ S/	–	B	motor
right	–	S/ ⇒ B	B	pump
left	–	B ⇒ S/	B	motor
left	S/ ⇒ B	–	B	Pump

[2] See swivel angle indicator
[3] Viewed on shaft

right

left

15° 0° 15°

MANNESMANN REXROTH

www.khadathydraulic.com
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fax : 021- 33488105
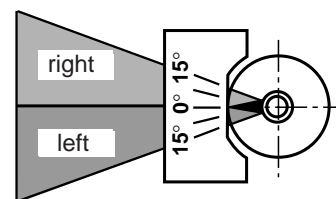
Unit dimensions: A10VSO28DSE/3XW–. PA12T.. with proportional valve   (Dimensions in mm)
and rotary encoder fitted

106,5

158

M18 x 1,5

26

14

45°   45°

6h9

74

59,5

75

24,4-0,1

174

Z

1/4" BSP

140

158

Ø 25

135

92

205

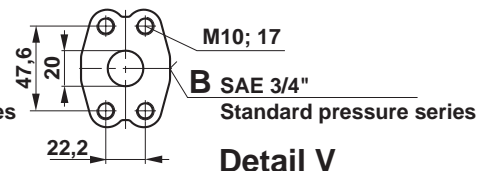**Designation of ports:**

B	= Pressure port (standard pressure series)	SAE 3/4"
S	= Suction port (standard pressure series)	SAE 1 1/4"
L, L1	= Leak-oil port	M18x1,5
Z	= Pilot pressure port	1/4" BSP

S   V

9   90

6,3

ISO 3019/2
2-hole flange

2   32

Ø 100h8
Ø 22j6
M6

16

L

80

59,5

80

13   L1

40

36

46

158

164

270

W

B   Z

U/S

S   L1 L

Detail S

L
R

15° 0 15°

M10; 17

50,7

32

S SAE 1 1/4"
Standard pressure series

30,2

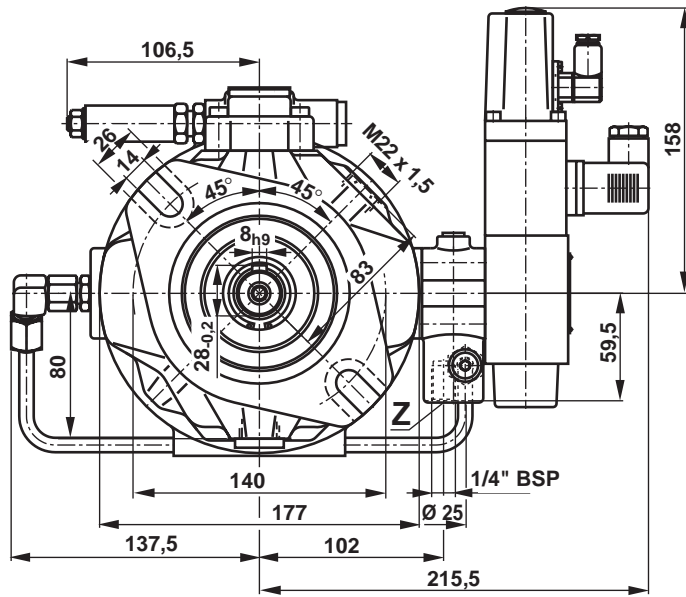**Detail W**

M10; 17

47,6

20
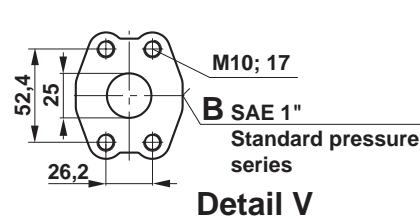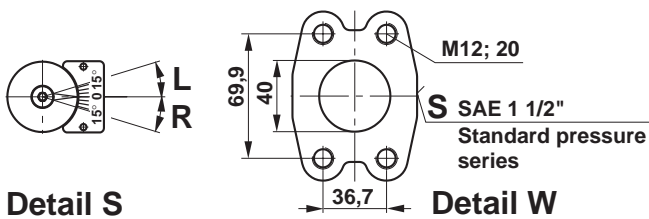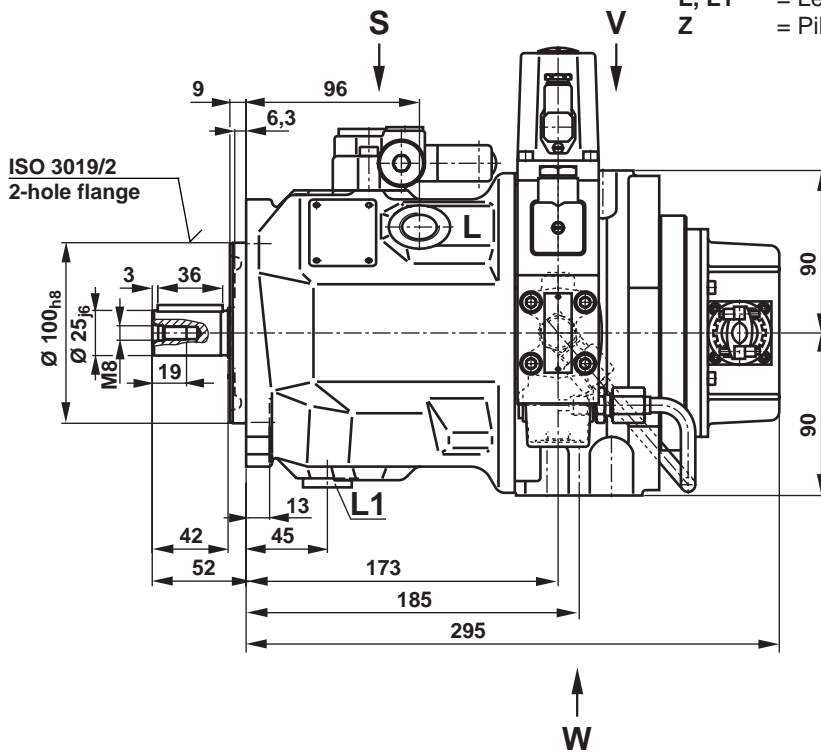
B SAE 3/4"
Standard pressure series

22,2
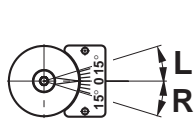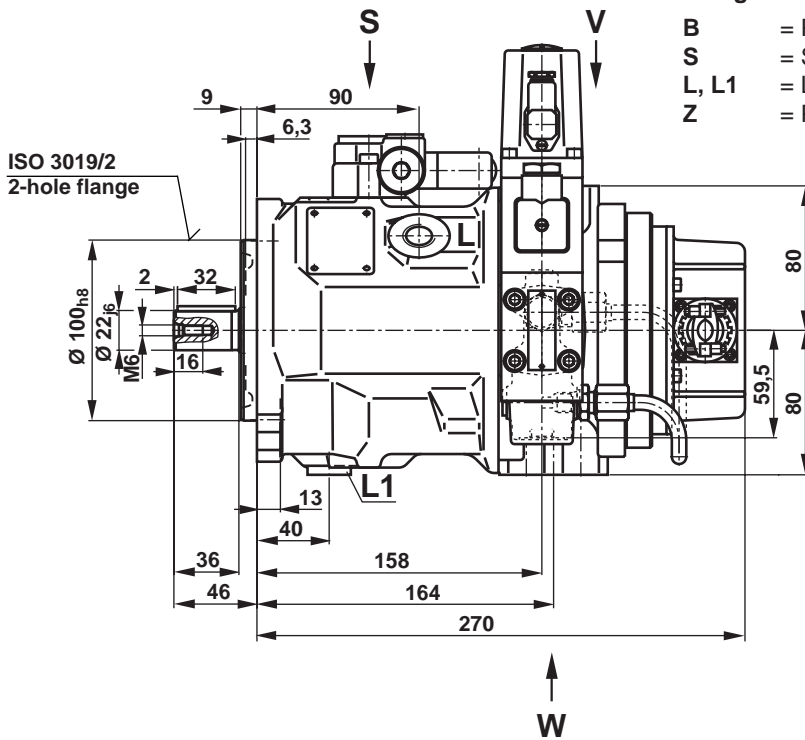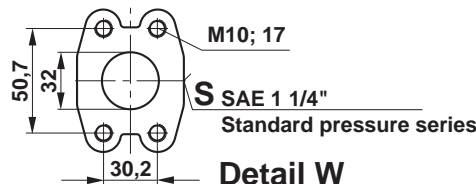
Detail V

Unit dimensions: A10VSO45DSE/3XW–. PA12T.. with proportional valve and rotary encoder fitted   (Dimensions in mm)


106,5

26

14

45°   45°

M22 x 1,5

8_{h9}

83

$28_{-0,2}$

Z

80

158

59,5

140

1/4" BSP

177

Ø 25

137,5

102

215,5

B

Z

S   L1   L
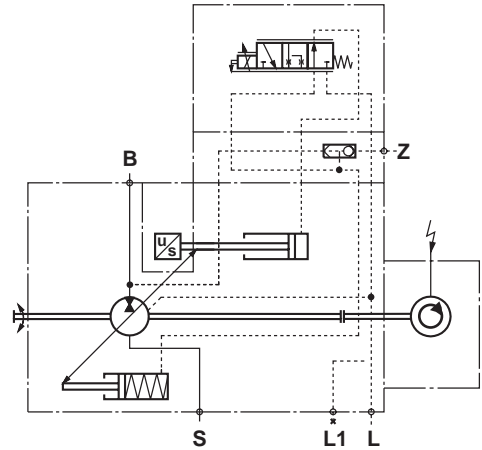
Designation of ports:

B	= Pressure port (standard pressure series)	SAE 1"
S	= Suction port (standard pressure series)	SAE 1 1/2"
L, L1	= Leak-oil port	M22x1,5
Z	= Pilot pressure port	1/4" BSP

S   V

9   96

6,3

**ISO 3019/2
2-hole flange**

L

3   36

$Ø 100_{h8}$

$Ø 25_{j6}$

M8   19

13   L1

42   45

52

173

185

295

90

90

W

L
R

Detail S

M12; 20

69,9   40

S SAE 1 1/2"
**Standard pressure
series**

36,7   **Detail W**

M10; 17

52,4   25

B SAE 1"
**Standard pressure
series**
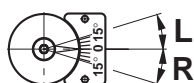
26,2   **Detail V**

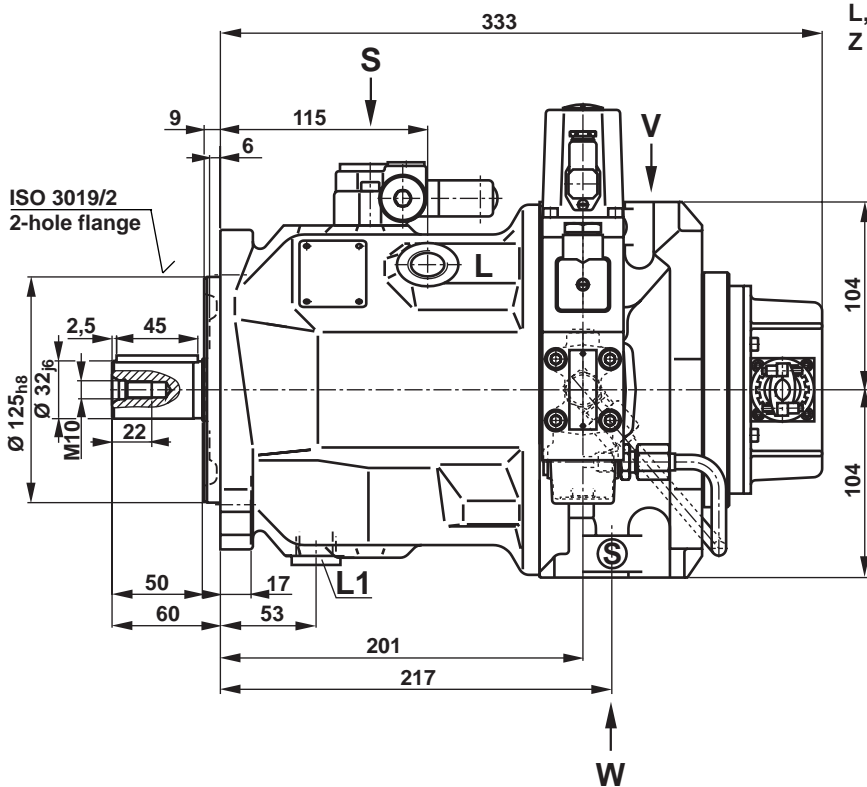**MANNESMANN
REXROTH**

Unit dimensions: A10VSO71DSE/3XW–. PA12T.. with proportional valve and rotary encoder fitted   (Dimensions in mm)
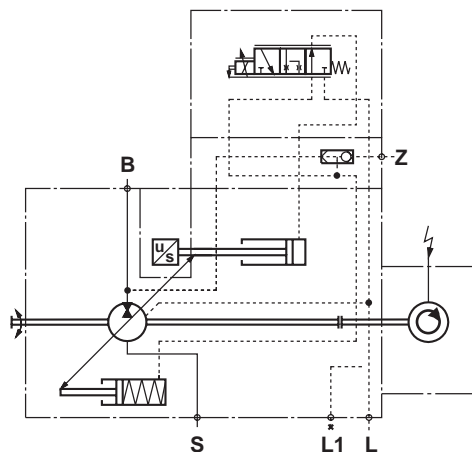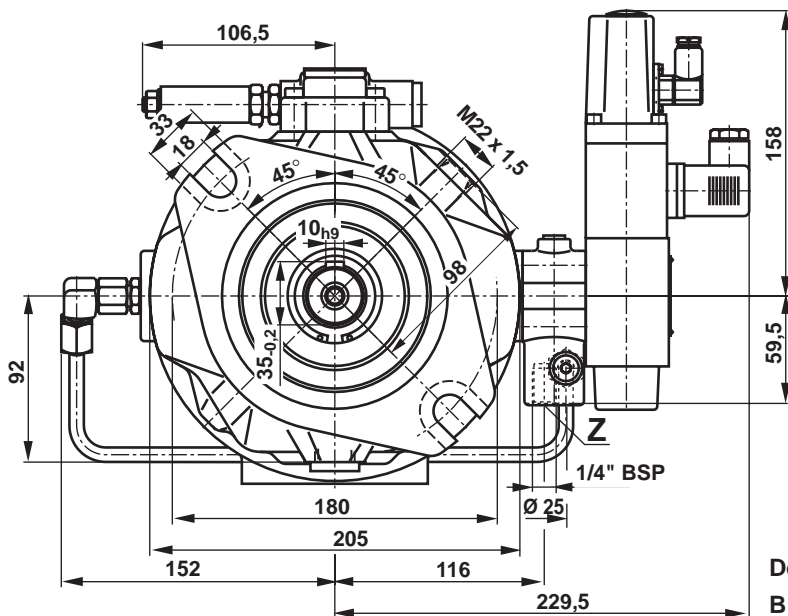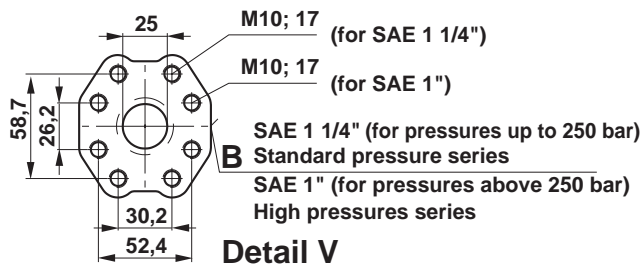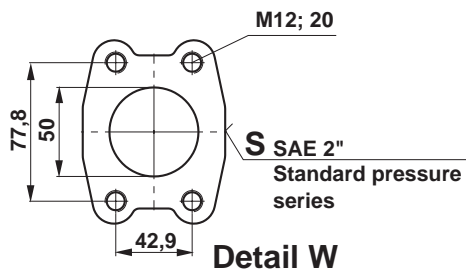

Designation of ports:

B = Pressure port
  – for pressures up to 250 bar   SAE 1 1/4"
    (standard pressure series)
  – for pressures above 250 bar SAE 1"
    (high pressures series)
S = Suction port
    (standard pressure series)   SAE 2"
L, L1 = Leak-oil port   M22x1,5
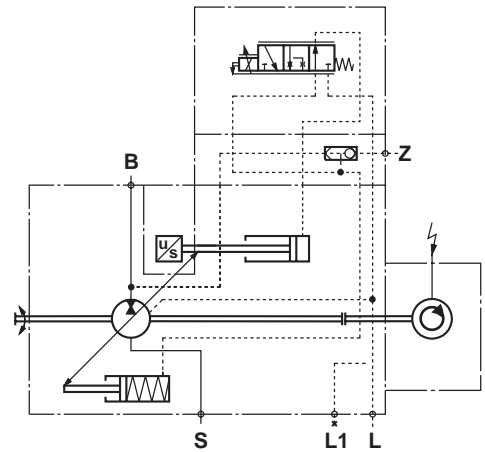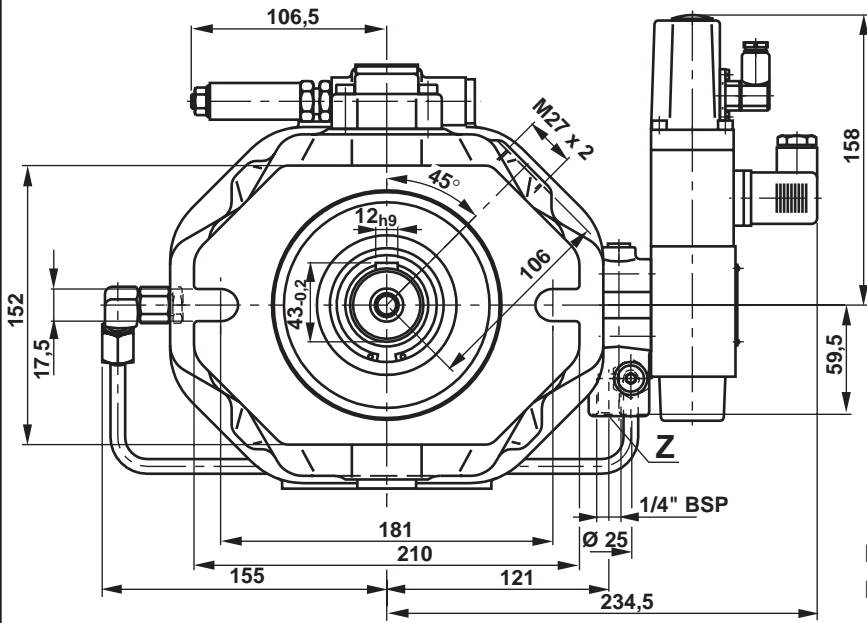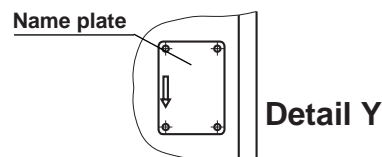**Z** = Pilot pressure port   1/4" BSP

ISO 3019/2
2-hole flange

Detail S

M10; 17 (for SAE 1 1/4")
M10; 17 (for SAE 1")
SAE 1 1/4" (for pressures up to 250 bar)
B Standard pressure series
SAE 1" (for pressures above 250 bar)
High pressures series

Detail V

M12; 20
S SAE 2"
Standard pressure series

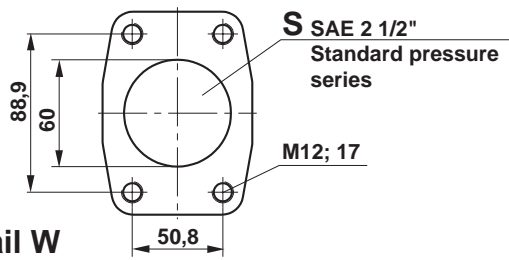**Detail W**

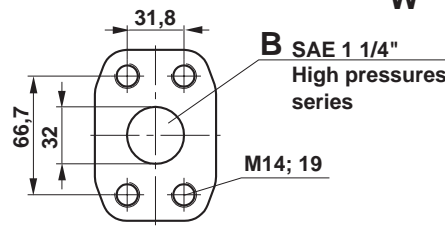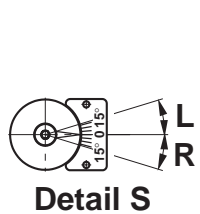www.khadathydraulic.com
tell : 021- 33488178
fax : 021- 33488105

Unit dimensions: A10VSO100DSE/3XW–. PA12T.. with proportional valve (Dimensions in mm)
and rotary encoder fitted

106,5

M27 x 2

45°

12_{h9}

$43_{-0.2}$

106

158

152

17,5

59,5

Z

1/4" BSP

Ø 25

181

210

155

121

234,5

B

Z

$\boxed{\frac{u}{s}}$

S **L1** **L**

Designation of ports:

B	= Pressure port (high pressure series)	SAE 1 1/4"
S	= Suction port (standard pressure series)	SAE 2 1/2"
L, L1	= Leak-oil port	M27x2
Z	= Pilot pressure port	1/4" BSP

S **Y** **V**

175

9

**ISO 3019/2
2-hole flange**

1,5   68

Ø 125_{h8}

Ø 40_{k6}

M12

28

L

66

70

80

20

95

L1

268

275

404

100

100

W

31,8

B SAE 1 1/4"
**High pressures
series**

66,7

32

M14; 19

Detail V

S SAE 2 1/2"
**Standard pressure
series**

88,9

60

M12; 17

50,8

Detail W

15° 0 15'

L
R

Detail S

Name plate

Detail Y

MANNESMANN
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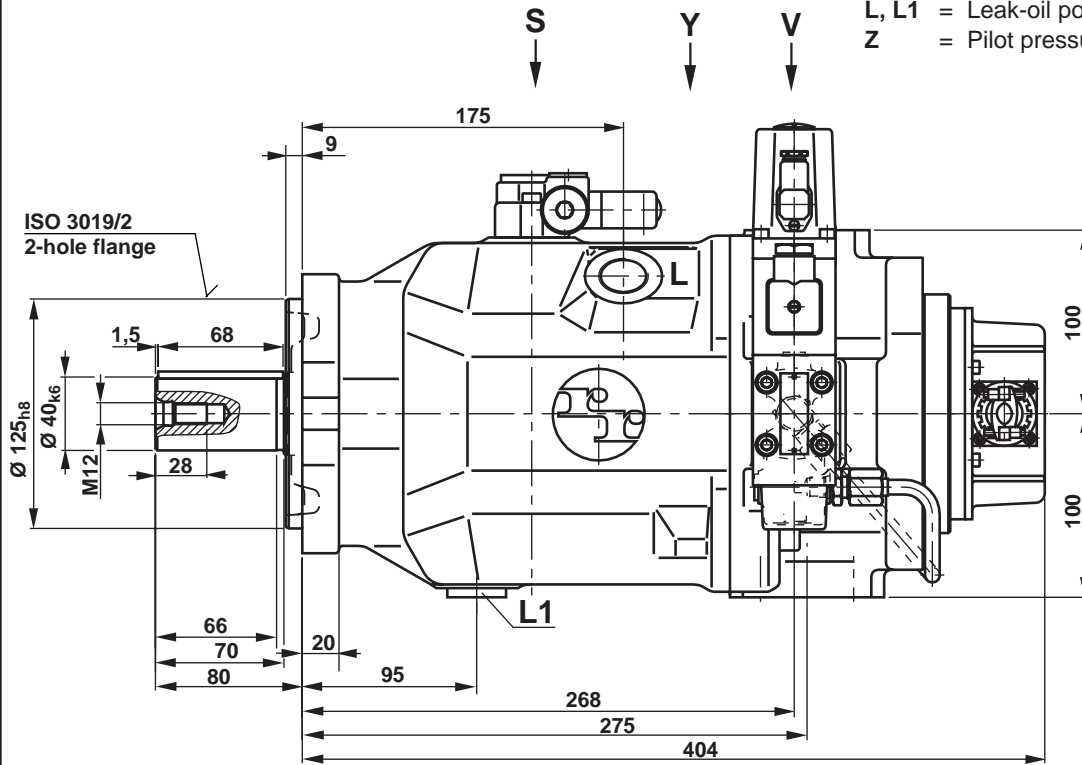**Unit dimensions:** A10VSO140DSE/3XW–. PB12T.. with proportional valve (Dimensions in mm)
and rotary encoder fitted
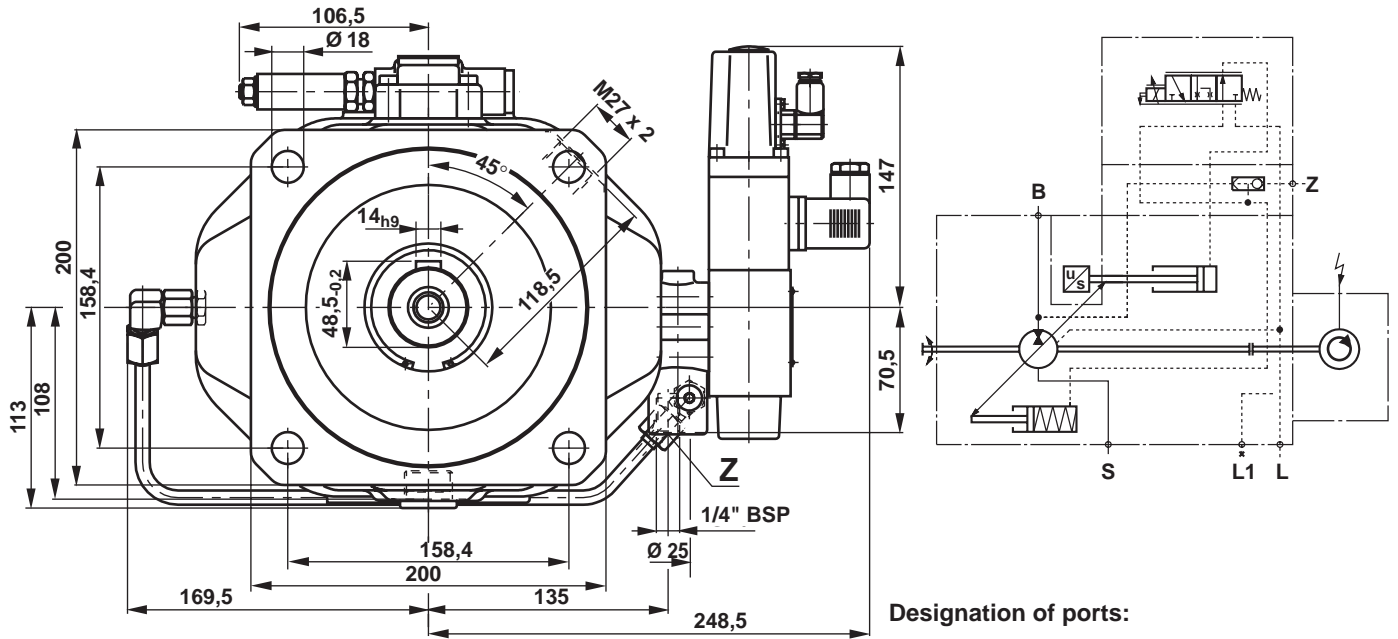
106,5
Ø 18
M27 x 2
45°
14h9
48,5-0,2
118,5
200
158,4
113
108
147
70,5
Z
1/4" BSP
Ø 25
158,4
200
169,5
135
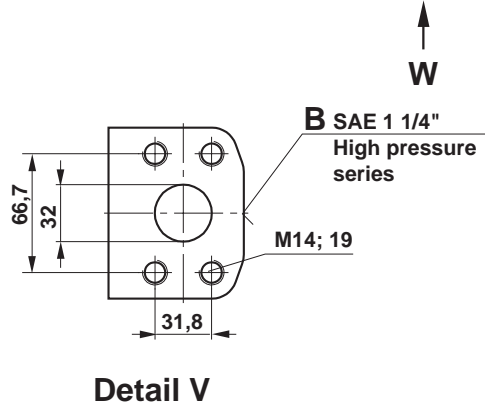248,5

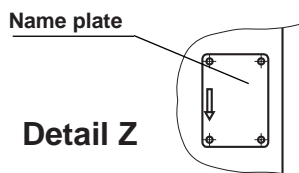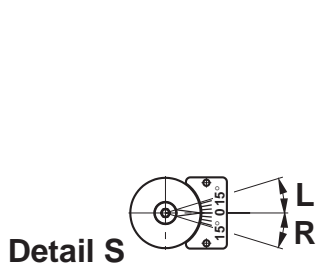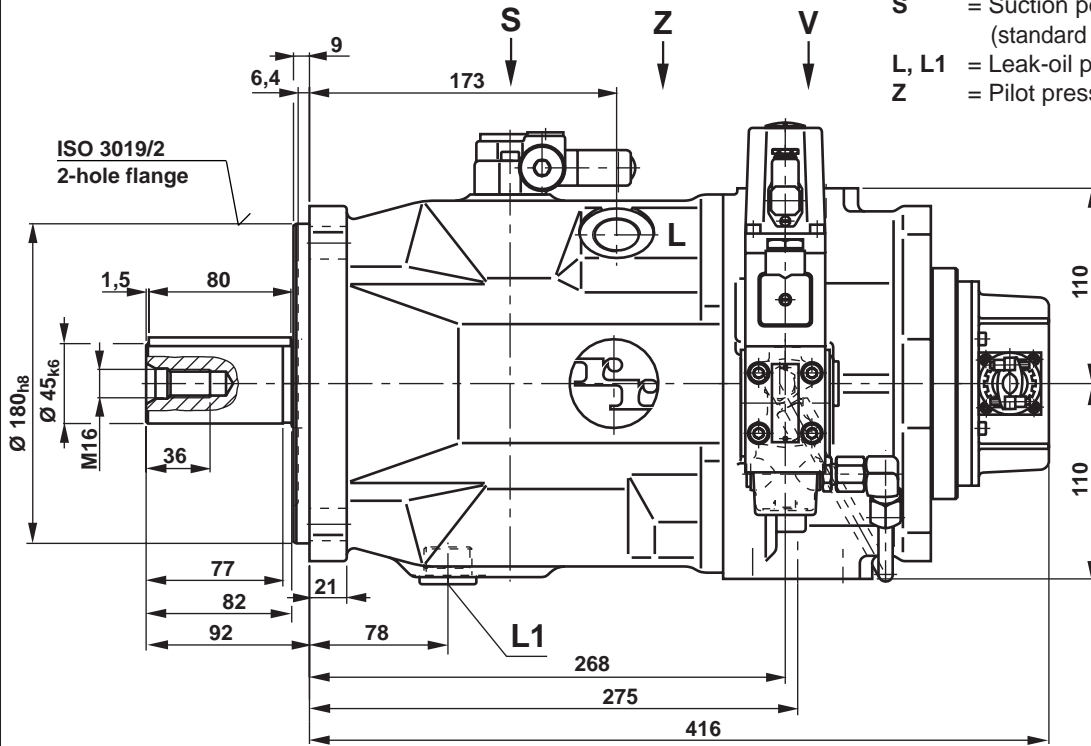**B**
Z
S
L1 **L**

Designation of ports:

B = Pressure port
(high pressure series) SAE 1 1/4"
S = Suction port
(standard pressure series) SAE 2 1/2"
L, L1 = Leak-oil port M27x2
Z = Pilot pressure port 1/4" BSP

S **Z** **V**

9
6,4
173

ISO 3019/2
2-hole flange

L

110

1,5 80
Ø 180h8
Ø 45k6
M16
36
77
82
92
21
78
L1
268
275
416

110

W

S SAE 2 1/2"
Standard
pressure
series

Detail S

L
R

15° 0 15°

B SAE 1 1/4"
High pressure
series

66,7
32
M14; 19
31,8

Detail V

88,9
63
M12; 17
50,8

Detail W

Name plate

Detail Z

Technical data: STW 0063 proportional valve (see page 2, item 1.3)   (Dimensions in mm)
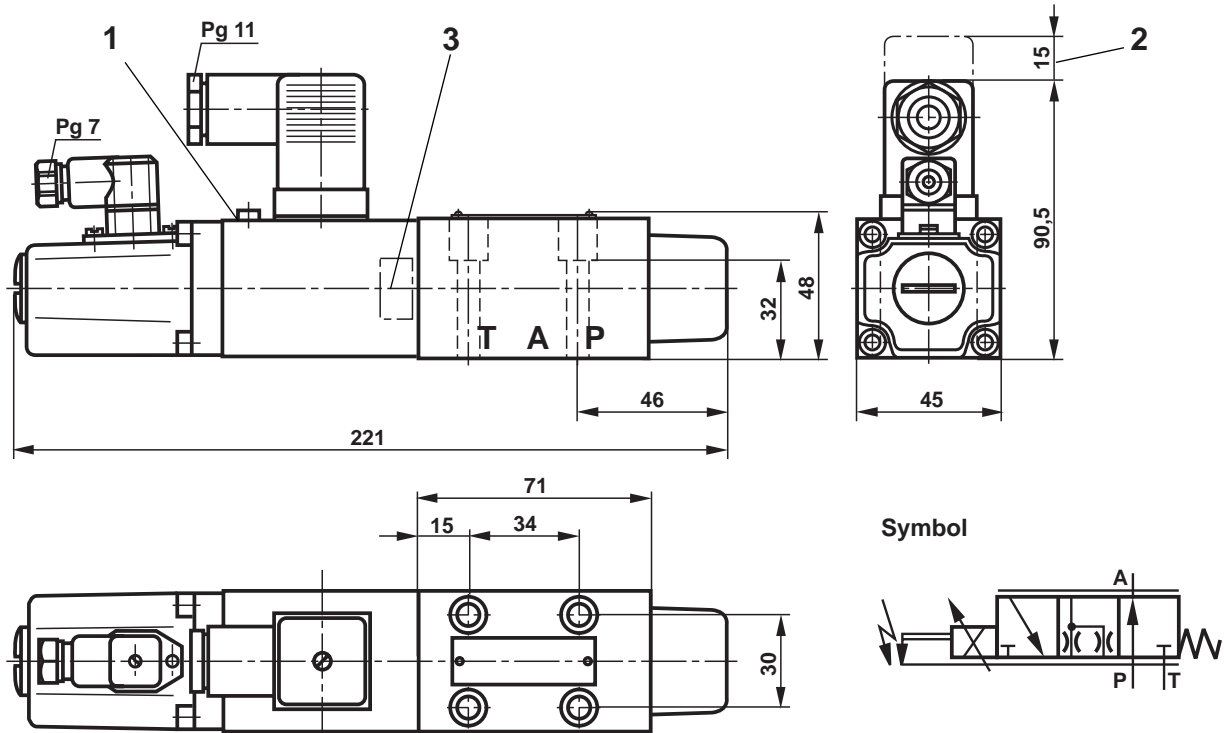
Inductive position transducer DK2
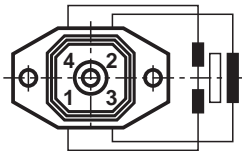
1 Supply
2 M0
3 Signal
4 M0

1 Bleed screw
2 Space required to remove plug
3 Solenoid dimensions

Symbol

Hydraulic

Valve flow at Δp = 10 bar and v = 41 mm^2/s	L/min	26
Operating pressure	bar	315
Frequency response– 3dB signal $\pm$ 5 %	Hz	125
Switching time 0 $\rightarrow$ 100 %	ms	10
Hysteresis	%	< 1
Repetitive accuracy	%	< 1
Viscosity range	mm^2/s	20 to 380
Ambient temperature range	°C	– 20 to + 50
Cleanliness		NAS 1638 class 7 to 9
Filter		β_{10} > 75 %
Hydraulic fluid		Mineral oil (HL, HLP) DIN 51 524 Phospate ester (HFD-R)
Fluid temperature range	°C	10 to 70
Weight	kg	2,0

Electrical

Max. valve current		A	2,8
Control current		A	approx. 1 to 1,5
Nominal power, proportional solenoid		W	19
Coil resistance	cold value	Ω	2,1
	warm value	Ω	3,2
Duty cycle			Continuous
Coil temperature		°C	up to 150
Electrical connection			Plug-in connection to DIN 43 650-AF2-Pg 11
Type of protection to DIN 40 050			IP 65

Technical data: Proportional valve STW 0063 (see page 2, item 1.3)

DK2 inductive position transducer, spool position acquisition (see page 2, item 1.3)

Measuring system		Differential transfer
Nominal stroke		± 0,6 mm
Linearity tolerance		≤ 1 %
Carrier frequency	f	5 kHz
Coil resistance	– between connection 1 and 2	113 Ω
(at 20 °C)	– between connection 3 und 4	101 Ω
Electrical connection		GM 209 connector
Type of protection of plug-in connection to DIN 40 050		IP 65

Technical data: IW9-03-DT inductive position transducer (see page 2, item 1.1),
Swivel angle acquisition the secondary unit

Measuring system		Differential throttle
Nominal stroke		± 4 mm
Linearity tolerance		≤ 1,5 %
Carrier frequency	f	5 kHz
Coil resistance	– between connection 1 and 2	32 Ω
(at 20 °C)	– between connection 2 and ⏚	46 Ω
	– between connection 1 and ⏚	32 Ω
Electrical connection		Plug-in connection to DIN 43 650 - BFZ-Pg 9
Type of protection of plug-in connection to DIN 40 050		IP 65

Technical data: GEL 291 incremental encoder [1] (see page 2, item 1.2)   (Dimensions in mm)
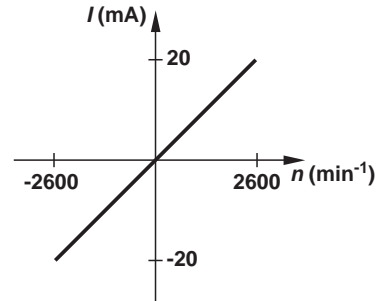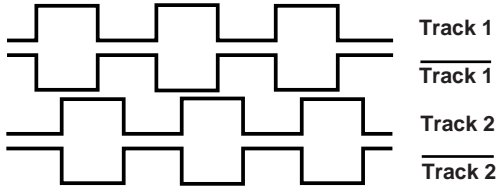
Incremental transmitter can only be fitted with through drive T10 (page 3)

Resolution	750 increments/rotation analog output $\pm$ 2600 min^{-1} $\triangleq$ $\pm$ 20 mA
Type of protection	IP 65
Working temperature range to DIN 32 876	$-$ 20 to $+$ 80 °C

Signal pattern AX
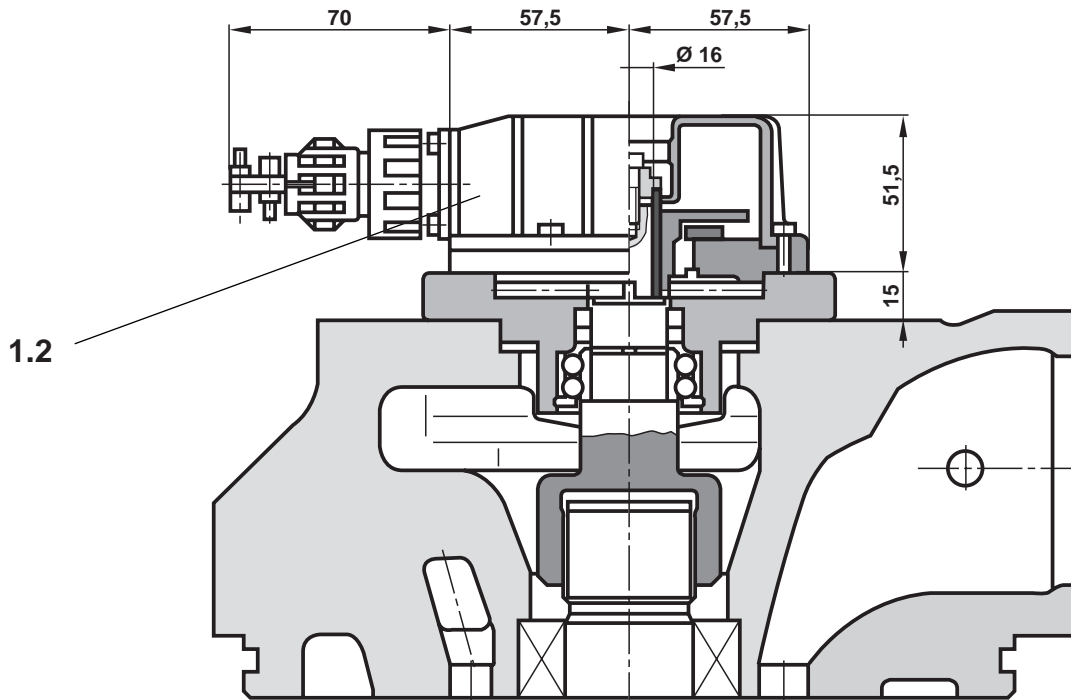Supply voltage U_S = 24 V, current requirement 130 mA

Analog current output

Track 1
$\overline{\text{Track 1}}$
Track 2
$\overline{\text{Track 2}}$

Clockwise rotation, viewed on the axis

I (mA)
20
-2600
2600 n (min^{-1})
-20

Pin allocation (10-pin plug)

Ground reference
$\oplus$
$\ominus$ T

	T
1st track	⊓_⊓
$\overline{\text{1st track}}$	⊔‾⊔
2nd track	⊓_⊓
$\overline{\text{2nd track}}$	⊔‾⊔

H A
G B
F C
E D
I J

+ U_S
Analog signal

Clockwise
I
n
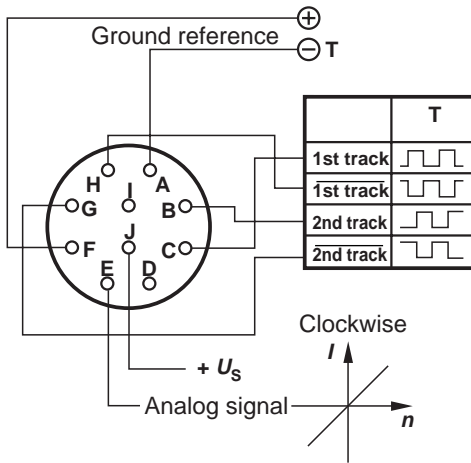
The incremental encoder is independent of the component size.

70   57,5   57,5
Ø 16
51,5
15

1.2

[1] If requested, the DC tacho-generator type KTD3-2A4 can also be used for speed acquisition
(ordering code for through drive T20).
In this case, please consult our department VT6 in Lohr (fax no. 18-12 93).

Technical data: Anti-cavitation valve (see page 2 , item 2), separate order

Anti-cavitation valve (RE 20 375)

Size	Type
28	S 10 A 0.0
45	S 15 A 0.0
71	S 15 A 0.0
100	S 20 A 0.0
140	S 20 A 0.0

Sequencing valve (pilot operated check valve) (item 2.0), separate order

SL 20 AGA1-4X/6EG24N9Z4
optional (flow-dependent)
SL 30 AGA1-4X/6EG24N9Z4

We recommend
SL 20 for A10VSO 28 and 45
SL 30 for A10VSO 71, 100 and 140
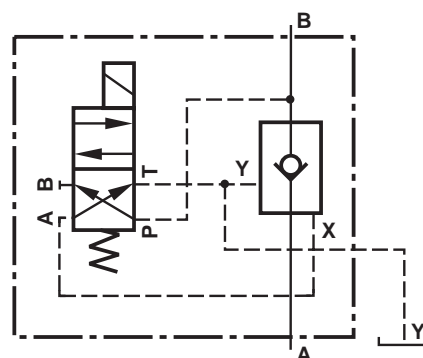
Electrical data

DC	V	24
Power requirement	W	27
Duty cycle		Continuous
Type of procetion to DIN 40 050		IP 65

Technical data: MCS VTS 0235-1X digital controller card, separate order (see page 2, item 4)

MCS controller cards to VTS 0235 RE 29 789 are used for the secondary control of A10VS axial piston units with proportional control by means of an STW 0063.

They contain all of the functional groups required for the acquisition of the valve spool and swivel angle positions as well as for the analog speed feedback of the unit.

Depending on the version (card with or without DC/DC converter VTS 0015), the card is designed for a voltage supply of 24 VDC or $+5$ V, ± 15 V, and $+24$ V.

The card version with a VTS 0016 provides an additional 16 opto-decoupled, digital inputs and 16 corresponding outputs (24 V-level).
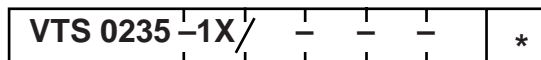
Characteristics:

– Efficient micro-controller with 16/32-bit processor

– Non-volatile storage of all system parameters in an EEPROM

– Parameterization and process visualisation via commercially available PC or hand-held operating box type BB-3 (VT 12 321)

– Two analog differential amplifier inputs ± 10 V or 0 to 20 mA (with 12-bit ADC)

– One analog differential amplifier input with voltage divider and matching amplifier for analog tachometer (with 12-bit ADC)

– Two oscillator/demodulator modules with 12-bit ADC connected downstream for inductive position measuring

– Pulsed, current-coupled valve output stage

– Switching output for isolator valve

– Opto-decoupled control inputs and signalling outputs

– Displays and measuring ouputs for diagnosis on the front panel

– Comprehensive monitoring functions

The standard software for the digital secondary control consists of the following functional blocks:

– Speed controller with command value ramp including preselection for acceleration and deceleration

– Controller cascade with :
  - PID - speed controller
  - PD - swivel angle controller
  - PD - valve spool position controller

– Swivel angle limitation (optional) via free analog input or settable parameter; this enables a torque control with speed limitation

– Sequence program for cutting in and cutting out; this provides simple operation via start/stop signal without requiring e.g. an additional PLC

– Processing of two opto-decoupled inputs on the mother board ("start / stop" and "external emergency override/fault reset") and two outputs ("summation error" and "controller active")

– Safety function by means of software monitoring of :
  - Maximum speed
  - Speed difference
  - Angular acceleration
  - Swivel angle difference
  - Valve position difference

The software can be extended with additional functions such as external preselection of the power limit or customer-specific functions. For this, a free analog input is available. If the controller board is fitted with a VTS 0016, 16 additional inputs and outputs can be processed.

| VTS 0235 –1X/ | – | – | – | | * |

MCS digital controller card

Series 10 to 19 = 1X
Unchanged data and pin allocation

Without DC / DC - converter VTS 0015 = 0
With DC / DC - converter VTS 0015 = 1

Without I/O - board VTS 0016 / SPS IIC = 3
With I/O - board VTS 0016 / SPS IIC = 5

Further details in clear text

Actual speed value input:
0 = Voltage ± 10 V, $R_i \geq 10$ kΩ
1 = Current 0 to ± 20 mA, $R_i = 500$ Ω
Division ratio N = Voltage up to ± 40 V
$R_i = $ N $\bullet$ 500 Ω
$1 < N \leq 4$

2 = With RS 232 interface
4 = With RS 485 interface