Control of secondary units with A4VS axial piston units

Size 40 to 1000¹

Nom. press. 315 bar
Max. press. 400 bar

RE 92 055/10.97
Replaces: 04.96

Secondary unit Type A4VSO250DS1

Characteristics:
- High response rotary drive
- Reversing open or closed loop operation (four quadrant operation)
- Power feedback and storage
- Speed, position and torque control with excellent and responsive control characteristics
- Throttle-free coupling and energy transmission from as many independently working motor or generator driven machines as required, to a common supply line with quasi-constant operating pressure
- Low losses, especially with partial-load operation
- Compact closed loop electronics (digital or analogue) in Euro-card format

¹ Size 1000 on request!

Functional description
Secondary controlled hydrostatic machines connected to a power network with quasi-constant operating pressure mean high response, energy saving drives for speed, position and torque control with power feedback.

No throttling is required for either power take up or feedback, the displacement of the machine adjusting itself to the relevant loading. This means that any number of units, operating as motors or pumps, may be connected in parallel. Four quadrant operation is even possible in open loop operation, the units used for speed and torque reversal being swivelled over the “Zero”. This also reverses the direction of flow.

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

This accumulator is used to cover rapid flow peaks and also to store energy returned by pump from the secondary unit to the hydraulic circuit, where this energy is not required by any other actuators. The pre-load pressure and loading condition of the accumulator, together with the pressure compensated primary unit and degree of loading on the secondary unit, determine the quasi-constant high pressure in the system.

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

For further information see “Hydraulic Trainer Vol. 6” (RE 00 293).

Control and monitoring electronics VT 12000 with frequency/voltage converter VTS 0102

1) Size 1000 on request!
**Technical data:** Axial piston unit A4VSO (open loop control)

**Operating pressure inlet**
Absolute pressure at suction port S - generator operation

- $P_{\text{abs\ min}} = 0.8$ bar
- $P_{\text{abs\ max}} = 30$ bar

**Determination of inlet pressure $P_{\text{abs}}$ at suction port S with an increase of speed**

**Note:**
As the high and low pressure sides do not change, a feed pump may be fitted to port S (see closed loop control). For operating pressure output see closed loop control.

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**Technical data:** Axial piston unit A4VSG (closed loop control)

**Operating pressure inlet**
Recommended boost pressure $P_{\text{Spr}}$ = 15 bar

- Aux. pump inlet pressure $P_{S \text{ min}}$ ($v = 10$ to $300$ mm$^2$/s) $\geq 0.7$ bar abs.

**Operating pressure outlet**
Pressure at port A or B
- Nominal pressure $P_{n} = 315$ bar
- Peak pressure $P_{\text{max}} = 400$ bar
- Peak pressure of aux. pump $P_{H \text{ max}} = 30$ bar

**Pilot circuit, with identical pressure circuit**

**Positioning pressure range**
- Maximum permissible positioning pressure $p_{\text{max}} = 315$ bar
- Minimum positioning pressure required $p_{\text{min}} = \text{operating pressure or 150 bar (see diagram)}$

**Installation position**
Optional. The pump housing must be filled on commissioning and remain full during operation.

**Case drain pressure**
Max. pressure of leakage fluid (housing pressure)

- $P_{\text{max}} = 4$ bar abs.

**Note:**
Shaft seals are of FPM to ISO 1629. All other seals are Perbunan. The values in the table are guide values and under certain operating conditions may have to be reduced.

1) from permissible data of servo valve and other system components
### Technical data: Secondary units A4VSO/A4VSG

<table>
<thead>
<tr>
<th>Size</th>
<th>40</th>
<th>71</th>
<th>125</th>
<th>180</th>
<th>250</th>
<th>355</th>
<th>500</th>
<th>750</th>
<th>1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displacement</td>
<td>$V_g^{\text{max}}$ cm³</td>
<td>40</td>
<td>71</td>
<td>125</td>
<td>180</td>
<td>250</td>
<td>355</td>
<td>500</td>
<td>750</td>
</tr>
<tr>
<td>Max. speed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$V_g \leq 1.0$</td>
<td>$V_g^{\text{max}}$, $p_E \geq 15$ bar</td>
<td>closed</td>
<td>$n_{\text{max}}$ r.p.m.</td>
<td>3700</td>
<td>3200</td>
<td>2600</td>
<td>2400</td>
<td>2000</td>
<td>1800</td>
</tr>
<tr>
<td>$V_g &lt; 0.8$</td>
<td>$V_g^{\text{max}}$, $p_E \geq 15$ bar</td>
<td>circuit</td>
<td>$n_{\text{max}}$ r.p.m.</td>
<td>4900</td>
<td>4100</td>
<td>3400</td>
<td>2900</td>
<td>2600</td>
<td>2200</td>
</tr>
<tr>
<td>$V_g &lt; 0.8$</td>
<td>$V_g^{\text{max}}$, $p_E \geq 1$ bar</td>
<td>open</td>
<td>$n_{\text{max}}$ per r.p.m.</td>
<td>3200</td>
<td>2700</td>
<td>2200</td>
<td>2100</td>
<td>1800</td>
<td>1700</td>
</tr>
<tr>
<td>$V_g \leq 1.0$</td>
<td>$V_g^{\text{max}}$, $p_E \geq 1$ bar</td>
<td>circuit</td>
<td>$n_{\text{max}}$ r.p.m.</td>
<td>2600</td>
<td>2200</td>
<td>1800</td>
<td>1800</td>
<td>1500</td>
<td>1500</td>
</tr>
<tr>
<td>Positioning flow (from 0 to $V_g^{\text{max}}$)</td>
<td>$V_g^{\text{max}}$ cm³</td>
<td>5.9</td>
<td>10.5</td>
<td>18.8</td>
<td>18.8</td>
<td>35.9</td>
<td>35.9</td>
<td>63.8</td>
<td>105</td>
</tr>
<tr>
<td>Positioning time (from 0 to $V_g^{\text{max}}$)</td>
<td>$t_s$ s</td>
<td>0.030</td>
<td>0.040</td>
<td>0.050</td>
<td>0.050</td>
<td>0.060</td>
<td>0.060</td>
<td>0.080</td>
<td>0.090</td>
</tr>
<tr>
<td>Internal moment of inertia</td>
<td>kgm²</td>
<td>0.0049</td>
<td>0.0121</td>
<td>0.0300</td>
<td>0.055</td>
<td>0.0959</td>
<td>0.19</td>
<td>0.3325</td>
<td>0.66</td>
</tr>
<tr>
<td>Minimum total moment of inertia required ²)</td>
<td>kgm²</td>
<td>0.05</td>
<td>0.12</td>
<td>0.30</td>
<td>0.55</td>
<td>0.96</td>
<td>1.90</td>
<td>3.33</td>
<td>6.66</td>
</tr>
<tr>
<td>Approx. weight (with RVE and tacho) A4VSO-DS1</td>
<td>kg</td>
<td>65</td>
<td>79</td>
<td>122</td>
<td>136</td>
<td>218</td>
<td>241</td>
<td>373</td>
<td>513</td>
</tr>
<tr>
<td>Approx. weight (with RVE and tacho) A4VSG-DS1</td>
<td>kg</td>
<td>67</td>
<td>83</td>
<td>126</td>
<td>140</td>
<td>225</td>
<td>248</td>
<td>381</td>
<td>523</td>
</tr>
<tr>
<td>Max. axial force at a case pressure of $p_{\text{max}}$, 1 bar abs.</td>
<td>± $F_{\text{ax max}}$ N</td>
<td>1000</td>
<td>1400</td>
<td>1900</td>
<td>2250</td>
<td>3000</td>
<td>3600</td>
<td>4000</td>
<td>5450</td>
</tr>
<tr>
<td>Max. axial force at a case pressure of $p_{\text{max}}$, 4 bar abs.</td>
<td>± $F_{\text{ax max}}$ N</td>
<td>620</td>
<td>810</td>
<td>1050</td>
<td>1400</td>
<td>1850</td>
<td>2100</td>
<td>2500</td>
<td>3150</td>
</tr>
<tr>
<td>Max. radial force</td>
<td>$F_q^{\text{max}}$ N</td>
<td>1200</td>
<td>1700</td>
<td>2500</td>
<td>3100</td>
<td>4000</td>
<td>4400</td>
<td>5000</td>
<td>6000</td>
</tr>
</tbody>
</table>

1) High speed version (15% higher speed) available on request
2) For an overshoot-free speed closed loop control circuit. For lower values please enquire (see also page 26)

### Application of force

- Application of force: $F_q$
- $F_{\text{ax}}^{+}$: Positive axial force
- $F_{\text{ax}}^{-}$: Negative axial force
- $X/2$: Distance from center of rotation

### Direction of flow

<table>
<thead>
<tr>
<th>Swivel angle range ³)</th>
<th>Direction of rotation ⁴)</th>
<th>Pressure in</th>
<th>Mode of operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>right right</td>
<td>B ⇒ S/A</td>
<td>–</td>
<td>B</td>
</tr>
<tr>
<td>left left</td>
<td>S/A ⇒ B</td>
<td>–</td>
<td>B</td>
</tr>
<tr>
<td>right left</td>
<td>B ⇒ A</td>
<td>–</td>
<td>A</td>
</tr>
<tr>
<td>left left</td>
<td>A ⇒ B</td>
<td>–</td>
<td>A</td>
</tr>
</tbody>
</table>

³) compared with swivel angle indicator
⁴) Viewed on shaft end
### Ordering code

<table>
<thead>
<tr>
<th>Fluid</th>
<th>Mineral oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Axial piston unit</td>
<td>Industrial swashplate variable unit</td>
</tr>
<tr>
<td>$p_N$</td>
<td>350 bar, $p_{\text{max}}$</td>
</tr>
<tr>
<td>Mode of operation</td>
<td>Secondary unit for open circuits $= O^{1}$</td>
</tr>
<tr>
<td>Size</td>
<td>Displacement $V_g$ max (cm$^3$)</td>
</tr>
<tr>
<td>Control device</td>
<td>Speed control, secondary unit, with built-on servo valve $= DS1$</td>
</tr>
<tr>
<td>Series</td>
<td>Sizes 40, 71</td>
</tr>
<tr>
<td>Direction of rotation</td>
<td>Bi-directional $= W$</td>
</tr>
<tr>
<td>Seals</td>
<td>Perbunan (shaft sealing ring in FPM) $= P$</td>
</tr>
<tr>
<td>Shaft end</td>
<td>Parallel with key DIN 6886 $= P$</td>
</tr>
<tr>
<td>Mounting flange</td>
<td>ISO 4 hole $= B$</td>
</tr>
<tr>
<td>Service line connections</td>
<td>Pressure port $B$ SAE at side, 90° offset</td>
</tr>
<tr>
<td>Through drive</td>
<td>ISO 125, 4 hole Splined shaft 32x2x14x9g A4VSO/G 40 $= K31$</td>
</tr>
<tr>
<td>Valve</td>
<td>Without valve block $= 0$</td>
</tr>
<tr>
<td>Filtration</td>
<td>Without filter $= N$</td>
</tr>
</tbody>
</table>

1) not available for size 1000.
Speed controller DS1

The DS1 speed controller is used to control the swivel angle and displacement of a secondary unit at quasi-constant operating pressure so that the correct torque is made available to maintain the required speed.

In a quasi-constant pressure system the torque is proportional to the swivel angle or displacement of the axial piston unit. The swivel angle is fed back by means of an inductive positional transducer and the rotational speed by means of a tacho-generator.

The unit is supplied complete with a servo valve and flushing plate. Please note the commissioning instructions in RE 07 700 and RE 29 586. For less demanding applications the servo valve may be replaced by a proportional valve.

The control and monitoring electronics VT12000 to RE 29 775 and the frequency/voltage converter and monitoring electronics to RE 29 761 are not included. The system is electronically protected against excessive speeds.

Component parts of a secondary unit

1.1 Hydraulic positioning device (see technical data)

1.2 4 way servo valve (see RE 29 586)

<table>
<thead>
<tr>
<th>Size</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>40, 71</td>
<td>4WS2EM10-4X/20B2ET315Z8DM</td>
</tr>
<tr>
<td>125, 180</td>
<td>4WS2EM10-4X/30B2ET315Z8DM</td>
</tr>
<tr>
<td>250, 355, 500</td>
<td>4WS2EM10-4X/45B2ET315Z8DM</td>
</tr>
<tr>
<td>750, 1000</td>
<td>4WS2EM10-4X/60B2ET315Z8DM</td>
</tr>
</tbody>
</table>

1.3 Inductive positional transducer IW9-03-DT (see page 24)
Alternative: integral piston positional transducer

2 Sandwich plate filter (Ordering code: Z)
not required with proportional valve

<table>
<thead>
<tr>
<th>Size</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>40, 71</td>
<td>DFBH/HC 60Z10D2.0/L24-V</td>
</tr>
<tr>
<td>125, 180, 250, 355, 500, 750, 1000</td>
<td>DFBH/HC 110Z10D2.0/L24-V</td>
</tr>
</tbody>
</table>

3 Incremental encoder GEL 293 (Ordering code: T03 or T04) (see page 23)
Alternative: AC tacho generator, with or without centrifugal switch

4 Electrically operated check valve RVE (Ordering code: 1) (see page 24)

5 Anti-cavitation valve, to be ordered separately (see page 24)

Associated electronics:
- Control and monitoring device VT 12000 (see page 25 and RE 29 775)
- Frequency/voltage converter and monitoring electronics VTS0102 (see page 25 and RE 29 761)
- Torque controller card MD1, VTS 0229 (see page 26 and RE 29 797)
- Power limiting card LB1 (see page 26 and RE 29 796)

Pilot operated check valve RVE (hydraulic isolator), mounted on the high pressure port, is returned to the closed position in the event of an emergency. The secondary unit is then separated from the pressure line to effect braking with power feedback.

In order to prevent cavitation due to the motor running on (or backwards) during an emergency stop, anti-cavitation valves must be used and mounted onto port B1. These valves, check valves without spring, must be mounted vertically and are to be ordered separately.
Unit dimensions: A4VSO40DS1/1XW...B13T031Z

Connections:
- B = Pressure port (high pressure series) SAE 3/4"
- B1 = Additional port M22x1,5
- S = Suction port \( p_{\text{max}} = 30 \text{ bar} \) SAE 1 1/2"
- K1, K2 = Housing flushing port M22x1,5
- MB = Test port for operating pressure M14x1,5
- MS = Pilot oil return M18x1,5
- M1, M2 = Test port for operating pressure 1/4"BSP
- Sp, P = Positioning pressure port M22x1,5
- PST = Positioning pressure port 1/2"BSP
- R(L) = Oil filling/air bleed port M22x1,5
- T = Oil drain M22x1,5
- T1 = Leakage/air bleed port 1/4"BSP
- T2 = Leakage/air bleed port 1/8"BSP
- U = Flushing port (bearings) M14x1,5
- RKv = External pilot oil return M22x1,5

Pipe threads “BSP” to ISO 228/1
Unit dimensions: A4VSG40DS1/1XW–..B10T031Z

Connections:

- **B** = Pressure port (high pressure series) SAE 3/4"
- **A** = Pressure port (high pressure series) SAE 3/4"
- **K2, K3** = Housing flushing port M22x1,5
- **MA, MB** = Test port for operating pressure M14x1,5
- **M1, M2** = Test port for operating pressure 1/4"BSP
- **Sp, P** = Positioning pressure port M22x1,5
- **P5t** = Positioning pressure port 1/2"BSP
- **R(L)** = Oil filling/air bleed port M22x1,5
- **T** = Oil drain M22x1,5
- **T1** = Leakage/air bleed port 1/4"BSP
- **T2** = Leakage/air bleed port 1/8"BSP
- **U** = Flushing port (bearings) M14x1,5
- **RKv** = External pilot oil return M22x1,5
- **E** = Pilot oil return (feed) M18x1,5

Pipe threads “BSP” to ISO 228/1
Connections:

- **B** = Pressure port (high pressure series) SAE 1"
- **B1** = Additional port M27x2
- **S** = Suction port \( \rho_{\text{max}} = 30 \text{ bar} \) SAE 2"
- **K1, K2** = Housing flushing port M27x2
- **MB** = Test port for operating pressure M14x1,5
- **MS** = Pilot oil return M18x1,5
- **M1, M2** = Test port for operating pressure 1/4"BSP
- **Sp, P** = Positioning pressure port M22x1,5
- **PSt** = Positioning pressure port 1/2"BSP
- **R(L)** = Oil filling/air bleed port M27x2
- **T** = Oil drain M27x2
- **T1** = Leakage/air bleed port 1/4"BSP
- **T2** = Leakage/air bleed port 1/8"BSP
- **U** = Flushing port (bearings) M14x1,5
- **RKv** = External pilot oil return M22x1,5

Unit dimensions: A4VSO71DS1/1XW–..B13T031Z
**Unit dimensions:** A4VSO125DS1/2XW--B13T031Z

**Connections:**
- **B** = Pressure port (high pressure series) SAE 1 1/4"
- **B1** = Additional port M33x2
- **S** = Suction port ($p_{max} = 30$ bar) SAE 2 1/2"
- **K1, K2** = Housing flushing port M33x2
- **MB** = Test port for operating pressure M14x1,5
- **MS** = Test port for suction pressure M14x1,5
- **MS2** = Pilot oil return 1/2"BSP
- **M1, M2** = Test port for operating pressure 1/4"BSP
- **Sp, P** = Positioning pressure port M22x1,5
- **PSt** = Positioning pressure port 1/2"BSP
- **R(L)** = Oil filling/air bleed port M33x2
- **T** = Oil drain M33x2
- **T1** = Leakage/air bleed port 1/4"BSP
- **T2** = Leakage/air bleed port 1/4"BSP
- **U** = Flushing port (bearings) M14x1,5
- **RKv** = External pilot oil return M22x1,5

So observe flushing regulations to RE 92 055/10.97 and remove flushing plate after flushing.
Connections:

- **B** = Pressure port (high pressure series) SAE 1 1/4"
- **A** = Pressure port (high pressure series) SAE 1 1/4"
- **K2, K3** = Housing flushing port M33x2
- **MA, MB** = Test port for operating pressure M14x1.5
- **M1, M2** = Test port for operating pressure 1/4"BSP
- **Sp, P** = Positioning pressure port M22x1.5
- **PSt** = Positioning pressure port 1/2"BSP
- **R(L)** = Oil filling/air bleed port M33x2
- **T** = Oil drain M33x2
- **T1** = Leakage/air bleed port 1/4"BSP
- **T2** = Leakage/air bleed port 1/4"BSP
- **U** = Flushing port (bearings) M14x1.5
- **RKv** = External pilot oil return M22x1.5
- **E** = Pilot oil return (feed) M22x1.5

Flushing plate

Observe flushing regulations to RE 29.96

Remove flushing plate after flushing

Pipe threads “BSP” to ISO 228/1
Connections:

- **B** = Pressure port (high pressure series) SAE 1 1/4"  
- **B1** = Additional port M33x2  
- **S** = Suction port (p_{max} = 30 bar) SAE 3"  
- **K1, K2** = Housing flushing port M33x2  
- **MB** = Test port for operating pressure M14x1,5  
- **MS** = Test port for suction pressure M14x1,5  
- **MS2** = Pilot oil return 1/2"BSP  
- **M1, M2** = Test port for operating pressure 1/4"BSP  
- **Sp, P** = Positioning pressure port M22x1,5  
- **PSt** = Positioning pressure port 1/2"BSP  
- **R(L)** = Oil filling/air bleed port M33x2  
- **T** = Oil drain M33x2  
- **T1, T2** = Leakage/air bleed port 1/4"BSP  
- **U** = Flushing port (bearings) M14x1,5  
- **RKv** = External pilot oil return M22x1,5

Unit dimensions: A4VSO180DS1/2XW–..B13T031Z
Connections:

- **B** = Pressure port (high pressure series) SAE 1 1/4".
- **A** = Pressure port (high pressure series) SAE 1 1/4".
- **K2, K3** = Housing flushing port M33x2.
- **MA, MB** = Test port for operating pressure M14x1,5.
- **M1, M2** = Test port for operating pressure 1/4"BSP.
- **Sp, P** = Positioning pressure port M22x1,5.
- **PSt** = Positioning pressure port 1/2"BSP.
- **R(L)** = Oil filling/air bleed port M33x2.
- **T** = Oil drain M33x2.
- **T1** = Leakage/air bleed port 1/4"BSP.
- **T2** = Leakage/air bleed port 1/4"BSP.
- **U** = Flushing port (bearings) M14x1,5.
- **RKv** = External pilot oil return M22x1,5.
- **E** = Pilot oil return (feed) M22x1,5.

Pipe threads “BSP” to ISO 228/1.
Unit dimensions: A4VSO250DS1/2XW..B13T031Z

Connections:

- **B** = Pressure port (high pressure series) SAE 1 1/2"
- **B1** = Additional port M42x2
- **S** = Suction port (p_{max} = 30 bar) SAE 3"
- **K1, K2** = Housing flushing port M42x2
- **M1, M2** = Test port for operating pressure 1/4"BSP
- **Sp, P** = Positioning pressure port M22x1,5
- **M20**
- **MS1, MB** = Test port for operating pressure M14x1,5
- **MS2** = Pilot oil return 1/2"BSP
- **R(L)** = Oil filling/air bleed port M42x2
- **T** = Oil drain M42x2
- **T1, T2** = Leakage/air bleed port 1/4"BSP
- **U** = Flushing port (bearings) M14x1,5
- **RKv** = External pilot oil return M22x1,5

Pipe threads “BSP” to ISO 228/1

Flushing plate

Remove flushing plate after flushing

Observe flushing regulations to RE 29 586
Connections:

- **B** = Pressure port (high pressure series) SAE 1 1/2"
- **A** = Pressure port (high pressure series) SAE 1 1/2"
- **K2, K3** = Housing flushing port M42x2
- **MA, MB** = Test port for operating pressure M14x1.5
- **M1, M2** = Test port for operating pressure 1/4"BSP
- **Sp, P** = Positioning pressure port M22x1.5
- **PSt** = Positioning pressure port 1/2"BSP
- **R(L)** = Oil filling/air bleed port M42x2
- **T** = Oil drain M42x2
- **T1** = Leakage/air bleed port 1/4"BSP
- **T2** = Leakage/air bleed port 1/4"BSP
- **U** = Flushing port (bearings) M14x1.5
- **RKv** = External pilot oil return M22x1.5
- **E** = Pilot oil return (feed) M22x1.5

Pipes threads “BSP” to ISO 228/1

Unit dimensions: A4VSG250DS1/2XW–..B10T031Z
Connections:
B = Pressure port (high pressure series) SAE 1 1/2"
B1 = Additional port M42x2
S = Suction port (p_{max} = 30 bar) SAE 4"
K1, K2 = Housing flushing port M42x2
MB = Test port for operating pressure M14x1,5
MS = Test port for suction pressure M14x1,5
MS2 = Pilot oil return 1/2"BSP
M1, M2 = Test port for operating pressure 1/4"BSP
Sp, P = Positioning pressure port M22x1,5
PSt = Positioning pressure port 1/2"BSP
R(L) = Oil filling/air bleed port M42x2
T = Oil drain M42x2
T1, T2 = Leakage/air bleed port 1/4"BSP
U = Flushing port (bearings) M18x1,5
RKv = External pilot oil return M22x1,5
Connections:

- **B** = Pressure port (high pressure series) SAE 1 1/2"
- **A** = Pressure port (high pressure series) SAE 1 1/2"
- **K2, K3** = Housing flushing port M42x2
- **MA, MB** = Test port for operating pressure M14x1,5
- **M1, M2** = Test port for operating pressure 1/4"BSP
- **Sp, P** = Positioning pressure port M22x1,5
- **PSt** = Positioning pressure port 1/2"BSP
- **T** = Oil drain M42x2
- **R(L)** = Oil filling/air bleed port M42x2
- **T1** = Leakage/air bleed port 1/4"BSP
- **T2** = Leakage/air bleed port 1/4"BSP
- **U** = Flushing port (bearings) M18x1,5
- **RKv** = External pilot oil return M22x1,5
- **E** = Pilot oil return (feed) M22x1,5

Pipe threads “BSP” to ISO 228/1

Unit dimensions: A4VSG355DS1/2XW–..B10T031Z
Connections:

- **B** = Pressure port (high press. series) SAE 2"
- **B1** = Additional port M48x2
- **S** = Suction port ($p_{\text{max}} = 30$ bar) SAE 5"
- **K1, K2** = Housing flushing port M48x2
- **MB** = Test port for operating pressure M18x1,5
- **MS** = Test port for suction pressure M18x1,5
- **MS2** = Pilot oil return M27x2
- **M1, M2** = Test port for operating pressure 1/4"BSP
- **P** = Positioning pressure port M27x2
- **PSt** = Positioning pressure port 3/4"BSP
- **R(L)** = Oil filling/air bleed port M48x2
- **T** = Oil drain M48x2
- **T1, T2** = Leakage/air bleed port 1/4"BSP
- **U** = Flushing port (bearings) M18x1,5
- **RKv** = External pilot oil return M27x2
- **MA2, MB2, MP** = Test port for positioning press. M14x1,5
- **R2 to R7** = Air bleed adjustment M14x1,5

Pipe threads "BSP" to ISO 228/1

Observe flushing regulations to RE 29 586
Remove flushing plate after flushing

Unit dimensions: A4VSO500DS1/2XW--H13T031Z
Connections:

- **B**: Pressure port (high pressure series) SAE 2"
- **A**: Pressure port (high pressure series) SAE 2"
- **K2, K3**: Housing flushing port M48x2
- **MA1, MB1**: Test port for operating pressure M18x1,5
- **M1, M2**: Test port for operating pressure 1/4"BSP
- **P**: Positioning pressure port M27x2
- **PSt**: Positioning pressure port 3/4"BSP
- **R(L)**: Oil filling/air bleed port M48x2
- **T**: Oil drain M48x2
- **T1, T2**: Leakage/air bleed port 1/4"BSP
- **U**: Flushing port (bearings) M18x1,5
- **RKv**: External pilot oil return M27x2
- **E**: Pilot oil return (feed) M27x2
- **MA2, MB2, MP**: Test port for positioning press. M14x1,5
- **R2 to R7**: Air bleed adjustment M14x1,5

**Pipe threads** “BSP” to ISO 228/1

**Connections:**
- **B**: Pressure port (high pressure series) SAE 2"
- **A**: Pressure port (high pressure series) SAE 2"
- **K2, K3**: Housing flushing port M48x2
- **MA1, MB1**: Test port for operating pressure M18x1,5
- **M1, M2**: Test port for operating pressure 1/4"BSP
- **P**: Positioning pressure port M27x2
- **PSt**: Positioning pressure port 3/4"BSP
- **R(L)**: Oil filling/air bleed port M48x2
- **T**: Oil drain M48x2
- **T1, T2**: Leakage/air bleed port 1/4"BSP
- **U**: Flushing port (bearings) M18x1,5
- **RKv**: External pilot oil return M27x2
- **E**: Pilot oil return (feed) M27x2
- **MA2, MB2, MP**: Test port for positioning press. M14x1,5
- **R2 to R7**: Air bleed adjustment M14x1,5

**Unit dimensions:** A4VSG500DS1/2XW-..H10T031Z
Unit dimensions: A4VSO750DS1/2XW...H13T031Z

Connections:
- **B** = Pressure port (high press. series) SAE 2" 
- **B1** = Additional port M48x2 
- **S** = Suction port (p_max = 30 bar) SAE 5" 
- **K1, K2** = Housing flushing port M48x2 
- **MB** = Test port for operating pressure M18x1,5 
- **MS** = Test port for suction pressure M18x1,5 
- **MS2** = Pilot oil return M27x2 
- **M1, M2** = Test port for operating pressure 1/4"BSP 
- **P** = Positioning pressure port M27x2 
- **PS1** = Positioning pressure port 3/4"BSP 
- **R(L)** = Oil filling/air bleed port M48x2 
- **T** = Oil drain M48x2 
- **T1, T2** = Leakage/air bleed port 1/4"BSP 
- **U** = Flushing port (bearings) M18x1,5 
- **RKv** = External pilot oil return M27x2 
- **MA2, MB2, MP** = Test port for positioning press. M14x1,5 
- **R2 to R7** = Air bleed adjustment M14x1,5

Pipe threads "BSP" to ISO 228/1
Connections:

- **B** = Pressure port (high press. series) SAE 2"
- **A** = Pressure port (high press. series) SAE 2"
- **K2, K3** = Housing flushing port M48x2
- **MA1, MB1** = Test port for operating pressure M18x1,5
- **M1, M2** = Test port for operating pressure 1/4"BSP
- **P** = Positioning pressure port M27x2
- **PS** = Positioning pressure port 3/4"BSP
- **R(L)** = Oil filling/air bleed port M48x2
- **T** = Oil drain M48x2
- **T1, T2** = Leakage/air bleed port 1/4"BSP
- **U** = Flushing port (bearings) M18x1,5
- **RKv** = External pilot oil return M27x2
- **MA2, MB2, MP** = Test port for positioning press. M14x1,5
- **R2 to R7** = Air bleed adjustment M14x1,5

Pipe threads “BSP” to ISO 228/1
**Unit dimensions**: A4 VSG1000... on request!
**Technical data:** Incremental encoder GEL 293 (Item 3); Ordering code T03 or T04

<table>
<thead>
<tr>
<th>Resolution:</th>
<th>Ordering code T03</th>
<th>1000 increments/revolutions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ordering code T04</td>
<td>2500 increments/revolutions</td>
</tr>
</tbody>
</table>

**Insulation:** IP 65

**Power consumption:** $R_L = \infty$; $U_B = 5 \, \text{V}$; $\leq 1.0 \, \text{W}$

**Operating temperature range to DIN 32 876:** $-20 \, \text{to} \, +80 \, ^\circ\text{C}$

### Signal pattern T

Feed voltage $U_S = 5 \, \text{V} \pm 5 \%$; Signal voltage $U_{Si} = 5 \, \text{V}$

![Signal pattern T diagram]

Turn clockwise when facing the axis

### Cabling (10-pin plug)

![Cabling diagram]

Signal evaluation by means of FUW1 (see page 25)

Optional extras:
- integral analogue output (T05); ... ± 20 mA at $n = 2600 \, \text{r.p.m.}$ (standard)
- separate centrifugal switch (T99 necessary)

The incremental encoder may be of any size. When using an optional extra or when evaluating by means of the FUW1 the nominal speed must be given.

### Maximum cable lengths

between encoder and interface electronics.

Earth cable shield on one side to receiver. The given data are standard values and depend on the cable type

<table>
<thead>
<tr>
<th>$U_S = 5 , \text{V}$ (T)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$f$ (kHz)</td>
</tr>
<tr>
<td>$L_{max}$ ($I_a \leq 100 , \text{mA}$)</td>
</tr>
</tbody>
</table>

If required both the speed counter and the DC tacho generator TDP 0,7 / 8-3 (30 V / 1000 r.p.m.) may be fitted with a centrifugal switch. In this case please consult our department VT6 in Lohr (fax no. 18 - 12 93).
### Technical data: Inductive positional transducer IW9-03-DT (Item 1.3)

**Data – Swivel angle transducer**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical measuring system</td>
<td>half bridge differential</td>
</tr>
<tr>
<td>Control stroke</td>
<td>± 4 mm</td>
</tr>
<tr>
<td>Tolerance on linearity</td>
<td>≤ 1.5 %</td>
</tr>
<tr>
<td>Frequency</td>
<td>f</td>
</tr>
<tr>
<td></td>
<td>5 kHz</td>
</tr>
<tr>
<td>Coil resistance (at 20 °C)</td>
<td></td>
</tr>
<tr>
<td>– between ports 1 and 2</td>
<td>32 Ω</td>
</tr>
<tr>
<td>– between ports 2 and 3</td>
<td>46 Ω</td>
</tr>
<tr>
<td>– between ports 1 and 4</td>
<td>32 Ω</td>
</tr>
</tbody>
</table>

**Electrical connections**

Plug connections to DIN 43 650 - BFZ-Pg9

**Insulation of plug connections to DIN 40 050**

IP 65

### Technical data: Electrically operated check valve RVE A4VS (Item 4); Ordering code 1

**Electrical data** (see directional poppet valve M–3SEW6, RE 22 057)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC voltage</td>
<td>V 24</td>
</tr>
<tr>
<td>Power required</td>
<td>W 27</td>
</tr>
<tr>
<td>Duty cycle</td>
<td>continuous</td>
</tr>
<tr>
<td>Insulation to DIN 40 050</td>
<td>IP 65</td>
</tr>
</tbody>
</table>

**Hydraulic data** (see logic elements Type LC.., RE 81 010)

<table>
<thead>
<tr>
<th>Size</th>
<th>Logic element (integral)</th>
<th>in housing</th>
<th>max. flow m ( Q_{\text{max}} ) in L/min at pressure drop of 5 bar</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>LC25B40E-6X/</td>
<td>AG 55 27</td>
<td>400</td>
</tr>
<tr>
<td>71</td>
<td>LC25B40E-6X/</td>
<td>AG 55 26</td>
<td>400</td>
</tr>
<tr>
<td>125</td>
<td>LC32B40E-6X/</td>
<td>AG 55 24</td>
<td>600</td>
</tr>
<tr>
<td>180</td>
<td>LC32B40E-6X/</td>
<td>AG 55 24</td>
<td>600</td>
</tr>
<tr>
<td>250</td>
<td>LC32B40E-6X/</td>
<td>AG 55 25</td>
<td>600</td>
</tr>
<tr>
<td>355</td>
<td>LC32B40E-6X/</td>
<td>AG 55 25</td>
<td>600</td>
</tr>
<tr>
<td>500</td>
<td>LC40B40E-6X/</td>
<td>AG 55 29</td>
<td>1000</td>
</tr>
<tr>
<td>750</td>
<td>LC50B40E-6X/</td>
<td>AG 55 79</td>
<td>1600</td>
</tr>
<tr>
<td>1000</td>
<td>LC50B40E-6X/</td>
<td>AG 55 79</td>
<td>1600</td>
</tr>
</tbody>
</table>

### Technical data: Anti-cavitation valve (Item 5), to be ordered separately

**Anti-cavitation valve** (RE 20 375)

<table>
<thead>
<tr>
<th>Size</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>S 10 A 0.0</td>
</tr>
<tr>
<td>71</td>
<td>S 15 A 0.0</td>
</tr>
<tr>
<td>125</td>
<td>S 20 A 0.0</td>
</tr>
<tr>
<td>180</td>
<td>S 20 A 0.0</td>
</tr>
<tr>
<td>250</td>
<td>S 25 A 0.0</td>
</tr>
<tr>
<td>355</td>
<td>S 25 A 0.0</td>
</tr>
<tr>
<td>500</td>
<td>S 30 A 0.0</td>
</tr>
<tr>
<td>750</td>
<td>S 30 A 0.0</td>
</tr>
</tbody>
</table>

**Note:** For A4VSO units these anti-cavitation valves are piped to port B. This is not necessary with the A4VSG for which integral anti-cavitation valves are available.
Technical data: Control and monitoring electronics VT 12000 S 2X, to be ordered separately

The control and monitoring electronics VT 12000 S 2X (RE 29 775) are used to control the speed of secondary units.

Characteristics:
- Time ramp
- PID speed controller
- PD swivel angle controller
- Output stage for servo valve
- Voltage stabiliser
- Monitoring the secondary unit by means of signal outputs such as:
  - Swivel angles ≤ 5 %
  - Speed ≤ 2 %
  - Swivel angle difference ≥ 5 %
  - Speed difference ≥ 5 %
  - Speed ≥ 110 % (max.)
  - Rotary acceleration “too high”
  - Signal outputs “ready for operation”
  - Electrical monitoring of positional transducer
  - Voltage symmetry ± 15 V

Further details in clear text

<table>
<thead>
<tr>
<th>VT 12000</th>
<th>S</th>
<th>2X</th>
<th>*</th>
</tr>
</thead>
<tbody>
<tr>
<td>32-pin edge connector, DIN 41 612, Type D</td>
<td>= S</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Series 20 to 29</td>
<td>= 2X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(20 to 29, externally interchangeable)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Technical data: Frequency/voltage converter and monitoring electronics FUW 1 VTS 0102, RE 29 761

These additional electronics are used in conjunction with speed controller VT 12000 and a digital speed measuring device (incremental encoder) for the speed control of secondary units where very accurate speed control is required.

The card comprises:
- A frequency/voltage converter;
  - Input signals:
    - two input trains with 90° offset pulses
    - voltage level 5 V to 15 V
    - sensing ratio 1:1
    - maximum frequency approx. 150 kHz
  - Output signal:
    - analogue voltage ± 10 V, proportional to frequency
    - TTL signal for directional indication
  - Pre-selectable evaluation ratio with a multiplication factor of 1, 2 or 4
- Cable break monitor for incremental encoder
- Internal monitoring signals linked via opto-couplers to 3 external signals
- Interlock and inverted interlock output signals via both TTL and opto-decoupled outputs

Further details in clear text

<table>
<thead>
<tr>
<th>VTS 0102</th>
<th>S</th>
<th>1X</th>
<th>FUW 1</th>
<th>*</th>
</tr>
</thead>
<tbody>
<tr>
<td>64-pin plug to DIN 41 612 Type C (for building into Euro-card magazine)</td>
<td>= 1X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Series 10 to 19</td>
<td>(10 to 19: externally interchangeable)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evaluation factor 1, 2 or 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

0 = without cable break monitor
1 = with cable break monitor

f_{\text{limit}} in kHz
f_{\text{room}} in kHz
## Technical data: Torque controller card MD 1, RE 29 797

The MD 1 torque controller card is used in conjunction with the VT 12000 amplifier for secondary control drives (see RE 29 775). It makes possible the mainentance of a pre-set torque in open or closed loop operation as well as calculation of the torque for the secondary unit and its output as an analogue voltage.

### Characteristics:
- Analogue pre-setting of the command value by way of differential inputs for voltages of 0 to ±10 V or currents of 0 to ±20 mA or 4 to 20 mA.
- Analogue signal output for calculated torque
- PID torque regulator, optionally as disturbance variable regulator
- Analogue pressure compensation for correcting performance curves taking into account actual pressure value
- Loss compensation through internal pressure compensation or by means of an externally pre-set correction value
- Internal speed limiting when used with VT 12000
- May be connected to a PLC via opto-decoupled and short-circuit protected inputs and outputs
- DIL switch for implementing various types of circuit

### Technical data:

<table>
<thead>
<tr>
<th>Torque controller card MD 1</th>
<th>Series 10 to 19</th>
<th>= 1X</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(10 to 19: externally interchangeable)</td>
<td></td>
</tr>
</tbody>
</table>

Further details in clear text

## Technical data: Power limiting card LB 1, RE 29 796

The LB 1 power limiting card may be used to limit power, speed or, dependent on pressure, the swivel angle of a variable displacement pump in closed loop secondary, pressure or primary control circuits. A primary power unit may be controlled and/or the actual power displayed dependent on various system parameters by means of a 10 V/20 mA second function group (function block). The card may also be universally used as a multiplier or divider.

### Characteristics:
- 4 differential inputs optionally for:
  - ±0 to 10 V
  - ±0 to 20 mA
  - 4 to 20 mA
- 2 opto-decoupled switching inputs, logic switches which may be inverted
- Internal reference voltage sources
- Matching circuit (voltage divider)
- Limiting of swivel angle by means of limiting diodes
- Matching of power limit by means of various input signals
- Power may be limited in all 4 quadrants of operation
- Message “Power limiting active” output

### Technical data:

<table>
<thead>
<tr>
<th>Power limiting card LB 1</th>
<th>Series 10 to 19</th>
<th>= 1X</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(10 to 19: externally interchangeable)</td>
<td></td>
</tr>
</tbody>
</table>

Further details in clear text