

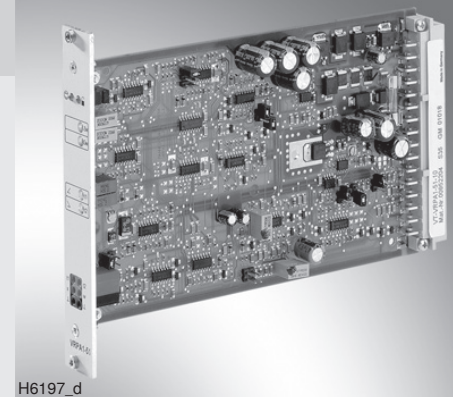
# Analog amplifier

**RE 30217/09.11**  
Replaces: 29957

1/8

## Type VT-VRPA1-400-1X/V0

Component series 1X



H6197\_d

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## Features

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1	– Suitable for the flow rate adjustment of an axial piston variable displacement pump A10VSO with electric flow controller FE
2	– Plug-in connections compatible with amplifier VT 5036-1X
2	– Command value signal inputs: 0 to +6 V; 0 to +9 V; 0 to +10 V
4	– Potentiometer setting on the front plate for zero point and amplitude attenuation
5	– Measurement sockets for the ramp time
6	– "Ramp off" input
7	– Outputs for command value (0 to +6 V) and actual value (0 to –6 V)
8	– LED display "Ready for operation"
	– Reverse polarity protection for the operating voltage

## Ordering code

VT-VRPA1-1X/V0

Amplifier for proportional valves with electric position feedback, analog, with one output stage

Standard

For axial piston variable displacement pumps A10VSO = 400

1X = Component series 10 to 19  
(10 to 19: Unchanged technical data and pinout)

### Suitable card holder:

- Type VT3002-1-2X/32D, see data sheet 29928, Material no.: R900020153

When replacing amplifier VT 5036, the blanking plate 4TE/3HE must be ordered separately for the rack mounting. Material no.: R900021004

## Functional description

The VT-VRPA1-400-1X/V0 is used for the flow adjustment of an axial piston pump A10VSO with electric flow controller FE. The amplifier controls a proportional valve. The latter controls the swivel angle of the pump. For that purpose, actual swivel angle value is read in from the card.

### Power supply unit

After application of the operating voltage, the internal power supply unit [6] creates a voltage of  $\pm 9$  V as compared to measurement zero (M0). Measured against load zero (L0), it is raised by +9 V. The voltages +9 V and -9 V (-9 V corresponds to L0) are fed to the connector strip X1 and can be used externally (e. g. for a command value potentiometer). The maximum load capacity is 25 mA.

### Ready for operation

The amplifier card is ready for operation if the following conditions are satisfied:

- Operating voltage > 22 V
- No asymmetry of the internal supply voltages
- No cable break in the position transducer lines
- No short circuit in the solenoid lines

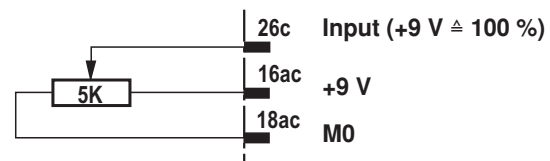
Readiness for operation is displayed by the green LED on the front plate.

### Command value

The command value voltage is either specified directly, by the regulated voltage +9 V of the power supply unit [6] or via an external command value potentiometer. For the "Command value 1" input, +9 V  $\hat{=}$  +100 % and for the "Command value 2" input, +6 V  $\hat{=}$  +100 %. The reference point for the command value inputs 1 and 2 is always M0 (18ac). The command value input 3 is a differential input [1] (0 to +10 V). If the command value is specified by external electronics with a different reference potential, the differential input has to be used.

When disconnecting or connecting the command value voltage, it has to be ensured that both signal lines are in each case separated from or connected with the input. All command values will - before they are forwarded - be added up according to their absolute value and their sign [2]. Using the "Zw" potentiometer, offset voltages in the command value branch can be compensated.

### External command value potentiometer (with 9 V command value input)



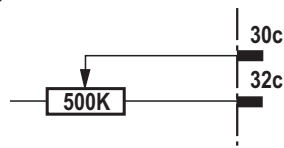
### Ramp function

The down-stream ramp generator [3] generates a ramp-shaped output signal from a given step-shaped input signal. The time constants of the output signal (ramp times) can be adjusted using the "t1" (upward ramp) and "t2" (downward ramp) potentiometers accessible through the front plate. The specified maximum ramp time refers to a command value step of 100 % and is approx. 5 s. If a command value step of less than 100 % is switched to the ramp generator input [3], the ramp time will be correspondingly shorter. The current ramp time can be checked at the "t1" (upward ramp) and "t2" (downward ramp) measurement sockets.

Detailed information see "Technical data"

## Functional description (continued)

### External time potentiometer



Notice:

When using an external time potentiometer, the internal potentiometers for the ramp times must be set to maximum (voltages at the "t1" and "t2" measurement sockets approx. 20 mV). The maximum ramp time is reduced as the resistance value of the external potentiometer is switched in parallel to that of the internal potentiometer (approx. 500 kΩ). In this case, the ramp times for upward and downward ramp cannot be set separately.

By applying a voltage > 10 V to the "Ramp off" switching input or setting the plug-in bridge X4, the ramp time is set to its minimum value (approx. 15 ms). The switching input will then be ineffective. The minimum value is then valid for both directions.

### Calculation of the ramp times

$$t_{\text{up}} = \frac{0,1}{U_{t1}} \text{ (in s)}$$

$$t_{\text{down}} = \frac{0,1}{U_{t2}} \text{ (in s)}$$

$U_{t1}$ ;  $U_{t2}$  ... Voltage at the measurement socket "t<sub>1</sub>" or "t<sub>2</sub>" (in V)

### Swivel angle controller

From the output of the ramp generator [3], the command value voltage reaches the "Gw" potentiometer which is accessible through the front plate and serves as attenuator. You can also use it to set the maximum swivel angle of the pump. The output signal of the "Gw" potentiometer is the swivel angle command value which is supplied to the PD controller [8] and via an output stage [17] also to the "w" measurement socket on the front plate of the card as well as to port 28c at the connector strip X1 (command value after ramp). A voltage of +6 V at the "w" measurement socket corresponds to a command value of +100 %. In the controller, the swivel angle command value and the actual swivel angle value are compared; in case of a difference, a corresponding actuating variable is output and forwarded to the power output stage [13] the output signal of which controls the proportional solenoid of the pump's pilot control valve.

### Swivel angle acquisition

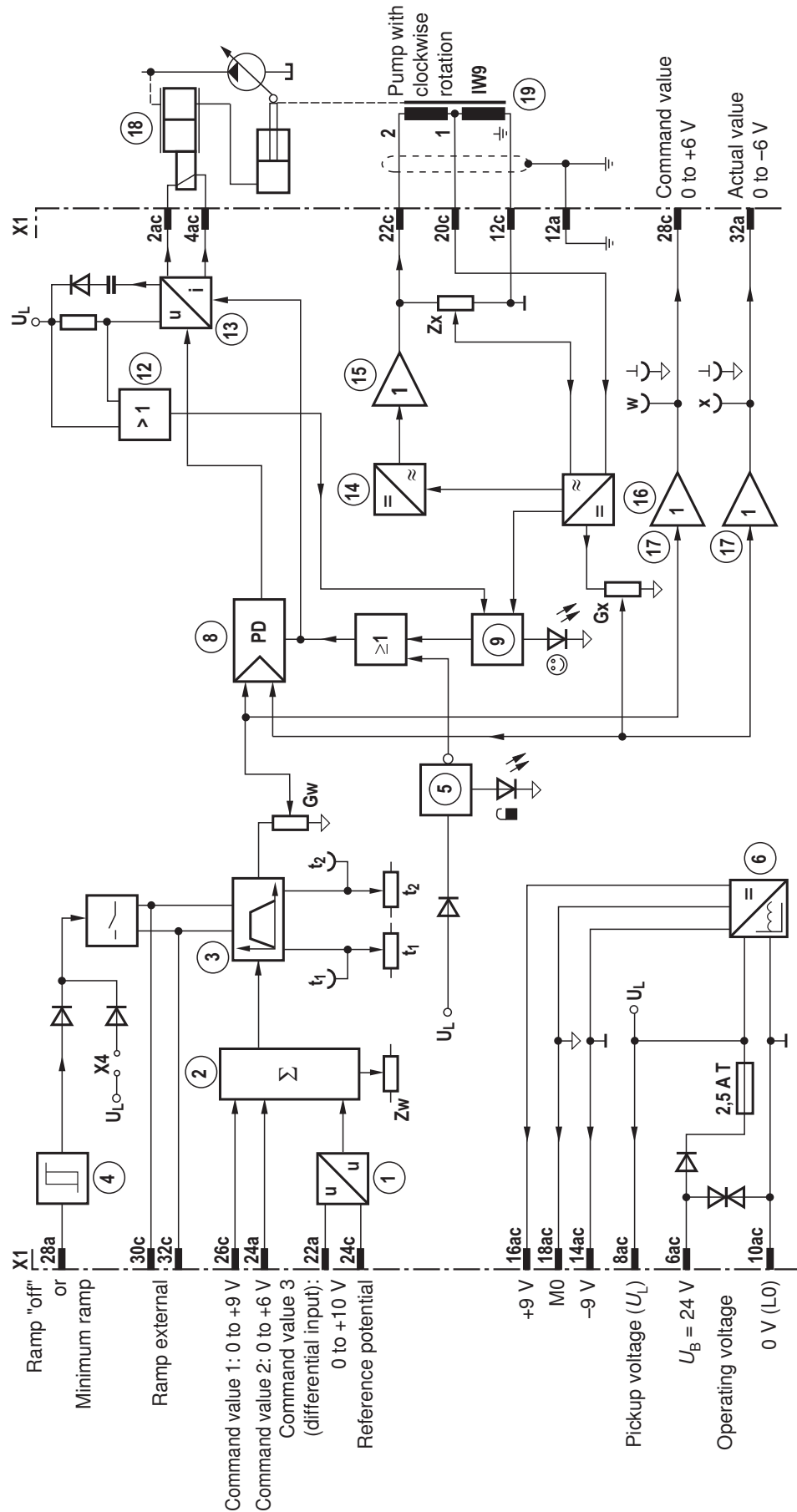
The position transducer electronics consist of an oscillator [14] with downstream driver [15] for controlling the inductive position transducer and a demodulator [16] for analyzing the position transducer signal (actual value). The oscillator frequency is approx. 2.5 kHz. The inductive position transducer must be connected as throttle circuit with mid sensing. The position transducer electronics have been adjusted in the factory. Due to very long or capacitive position transducer lines, the delay resulting from signal runtime and line attenuation might make readjustment of the zero point (via "Zx" potentiometer) and the amplification (via "Gx" potentiometer) necessary. The actual value (corresponds to the swivel angle position) can be measured at the actual value measurement socket.

Notice:

The actual value signal is output in inverted form as compared to the command value. A path of 100 % corresponds to -6 V at the actual value measurement socket and at port 32a of the connector strip X1.

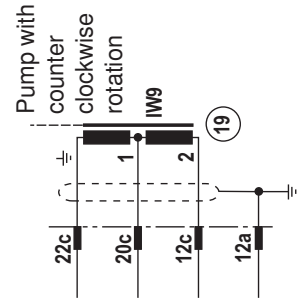
[ ] = Assignment to the block diagram page 4

# Block diagram / pinout



Explanations on the bridges (from X2) as well as position of the display and adjustment elements see page 6

- Zw** = Zero point command value
- Gw** = Command value attenuator
- Zx** = Zero point actual value
- Gx** = Actual value
- ☺ = Ready for operation
- 🔒 = Enable
- t1** = Ramp time "up"
- t2** = Ramp time "down"
- 1** = Differential amplifier
- 2** = Command value summing device
- 3** = Ramp generator
- 4** = Threshold value switch
- 5** = Enable circuit
- 6** = Power supply unit
- 8** = PD controller
- 9** = Error detection
- 12** = Overcurrent identification
- 13** = Clocked output stage
- 14** = Oscillator
- 15** = Driver position transducer
- 16** = Demodulator
- 17** = Output stage
- 18** = Proportional valve
- 19** = Swivel angle sensor



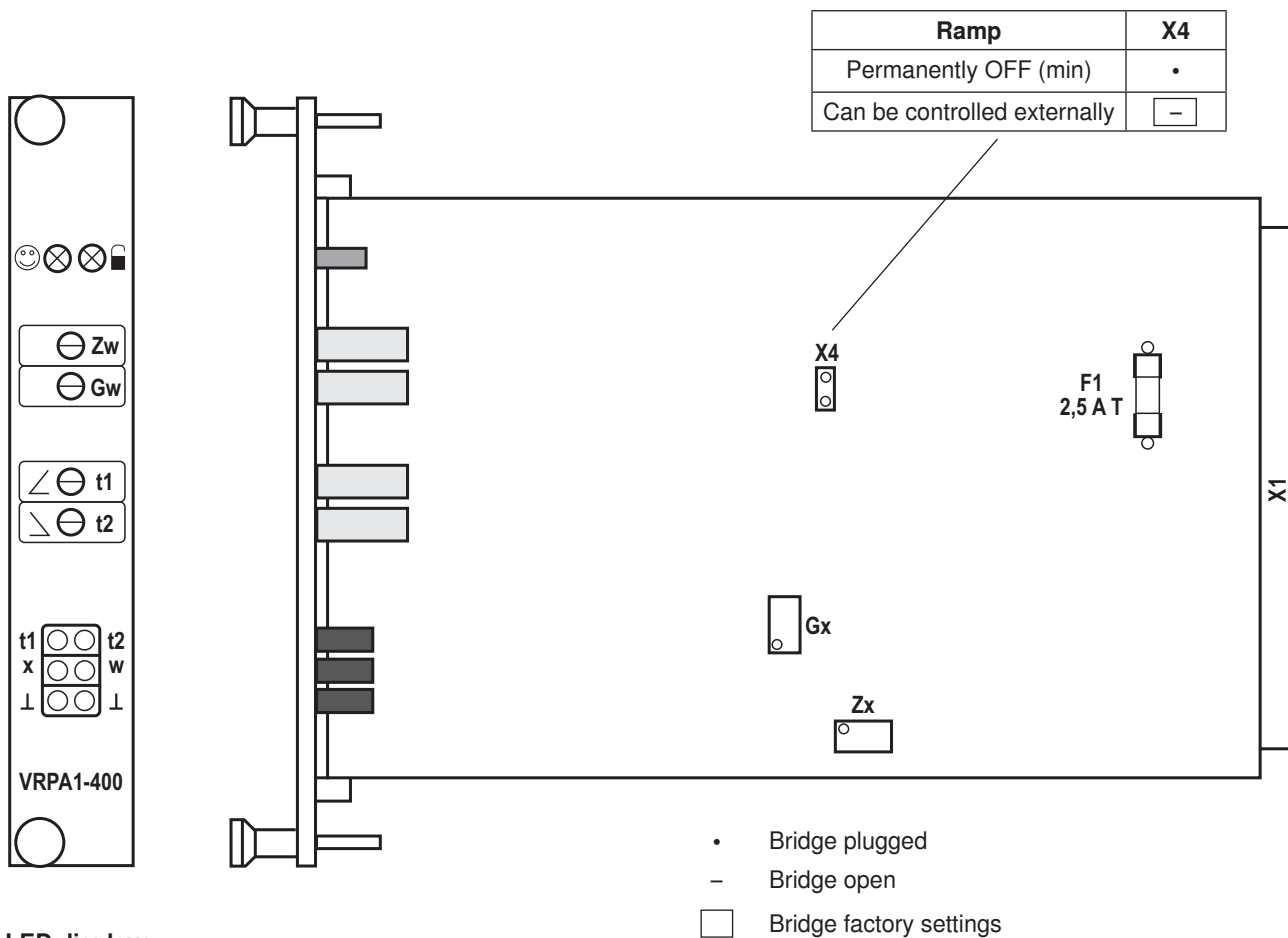
**Technical data** (For applications outside these parameters, please consult us)

Operating voltage	$U_B$	24 VDC +40 % /-5 %
Operating range:		
– Upper limit value	$u_B(t)_{\max}$	35 V
– Lower limit value	$u_B(t)_{\min}$	22 V
Power consumption	$P_S$	< 30 W
Current consumption	$I$	< 1.3 A
Fuse	$I_S$	2.5 A slow-blow
Inputs:		
– Command value 1	$U_e$	0 V to +9 V (reference potential is M0)
– Command value 2	$U_e$	0 V to +6 V (reference potential is M0)
– Command value 3 (differential input)	$U_e$	0 V to +10 V
– External ramp switch-off		
• Without ramp	$U_R$	> 10 V
• With ramp	$U_R$	< 9 V
Setting ranges:		
– Zero point "Zw"		-5 % to max. +30 %
– Command value attenuator "Gw"		0 % to 105 %
– Ramp time "up"	$t_{\text{up}}$	< 20 ms to 5 s $\pm 20$ % ( $U_{t1}$ : -0.02 V $\triangleq$ approx. 5 s; -5 V $\triangleq$ approx. 20 ms)
– Ramp time "down"	$t_{\text{down}}$	< 20 ms to 5 s $\pm 20$ % ( $U_{t2}$ : 0.02 V $\triangleq$ approx. 5 s; 5 V $\triangleq$ approx. 20 ms)
Outputs:		
– Output stage		
• Solenoid current/resistance	$I_{\max}$	700 mA / $R_{20} = 12 \Omega$
• Pilot current	$I_V$	400 mA
• Clock frequency	$f$	Freely clocking (approx. 250 Hz)
– Driver for inductive position transducer		
• Oscillator frequency	$f$	2.5 kHz $\pm 10$ %
– Regulated voltage	$U$	$\pm 9$ V $\pm 1$ % (with raised zero point); $\pm 25$ mA externally loadable
– Measurement sockets		
• Command value "w"	$U_w$	0 V to +6 V ( $R_i = 1 \text{ k}\Omega$ )
• Actual value "x"	$U_x$	0 V to -6 V ( $R_i = 1 \text{ k}\Omega$ )
• Upward ramp "t1"	$U_{t1}$	-0.02 V to approx. -5 V
• Downward ramp "t2"	$U_{t2}$	0.02 V to approx. 5 V
Type of connection		32-pole male multipoint connector, DIN 41612, design D
Card dimensions		European card 100 x 160 mm, DIN 41494
Front plate dimensions:		
– Height		3 HE (128.4 mm)
– Width soldering side		1 TE (5.08 mm)
– Width component side		3 TE
Admissible operating temperature range	$\vartheta$	0 to 50 °C
Storage temperature range	$\vartheta$	-25 °C to +70 °C
Weight	$m$	0.15 kg

**Notice:**

For information on the **environment simulation testing** for the areas EMC (electromagnetic compatibility), climate and mechanical load, see data sheet 30117-U.

## Display / setting elements



### LED displays:

- ☺ Ready for operation (green)
- ☑ Enable (yellow)

### Potentiometer:

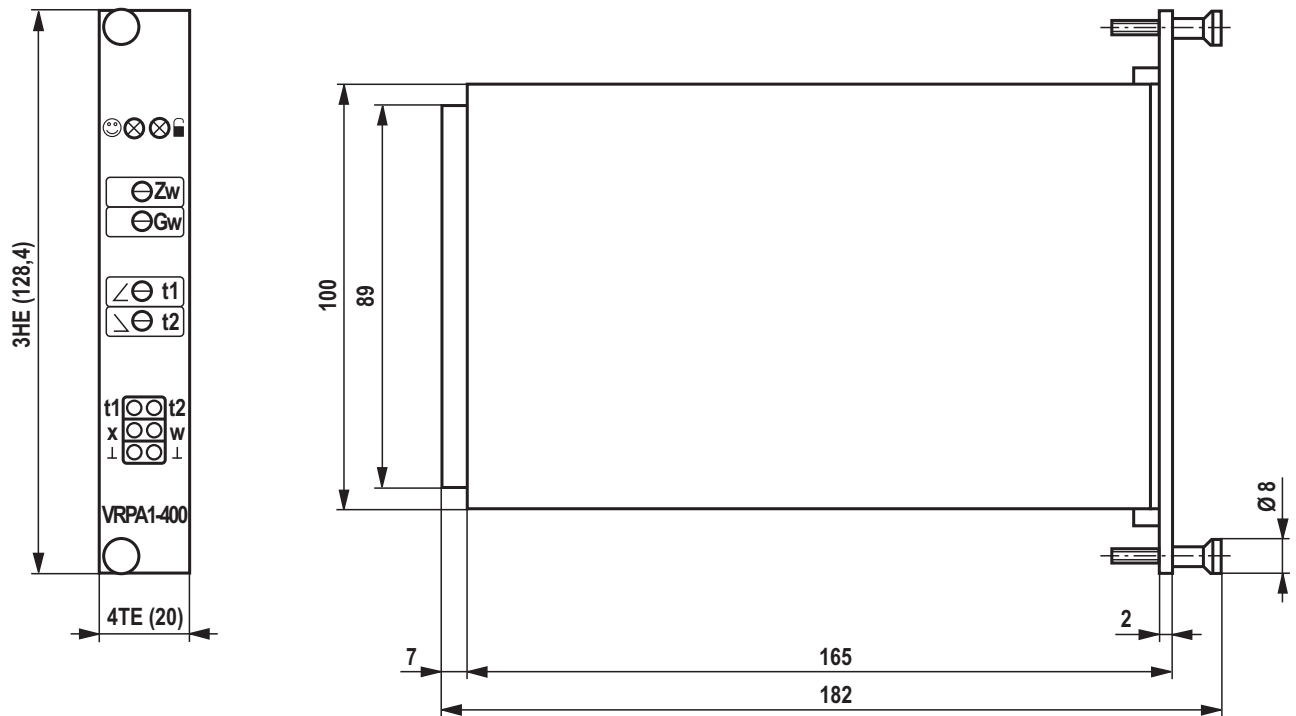
- Zw** Zero point command value
- Gw** Command value attenuator
- t1** Ramp time "up"
- t2** Ramp time "down"

Cannot be set via front plate:

- Zx** Zero point actual value
- Gx** Actual value

### Measurement sockets:

- t1** Ramp time "up"
- t2** Ramp time "down"
- x** Actual value
- w** Command value
- ⊥** Measurement null

**Unit dimensions** (dimensions in mm)

## Project planning / maintenance instructions

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- The amplifier card may only be unplugged and plugged when de-energized.
- No plug-in connectors with free-wheeling diodes or LED displays must be used for solenoid connection.
- Only carry out measurements at the card using instruments  $R_i > 100 \text{ k}\Omega$ .
- Measurement zero (M0) is increased by +9 V as compared to the 0 V operating voltage and not potentially isolated, i.e. –9 V regulated voltage = 0 V operating voltage. Thus, do not connect measurement zero (M0) to 0 V operating voltage.
- For switching command values, relays with gold-plated contacts have to be used (small voltages, low currents).
- Always shield command value lines; connect shielding to 0 V operating voltage on the card-side, other side open (risk of ground loops).  
Recommendation: Also shield the solenoid conductors.  
For solenoid conductors up to 50 m in length, use cables with a wire cross-section of 1.5 mm<sup>2</sup>.  
With greater lengths, please contact us.
- The distance to aerial lines, radios, and radar systems has to be 1 m at least.
- Do not lay solenoid and signal lines near power cables.
- The charging current of the smoothing capacitors on the card requires the pre-fuses to be of a slow-blowing nature.
- If the differential input is used, both inputs must always be connected or disconnected at the same time.
- Do not connect the port of the inductive position transducer marked with the ground sign with the ground (prerequisite for the compatibility with amplifier type VT 5036).
- When replacing an amplifier VT 5036 by VT-VRPA1-400-1X/V0, no re-wiring is necessary. The electrical connection in the position transducer branch (12c and 14c) are bridged internally.

### Notice:

Electric signals taken out via control electronics (e. g. actual value) must not be used for switching safety-relevant machine functions (also see the European standard "Safety requirements on fluid-powered systems and components - Hydraulics", EN ISO 13849).