

Valve amplifier for proportional directional valves

RE 30119

Edition: 2013-04

Replaces: 07.05

Type VT-VRPA2



H6641

- ▶ Component series 1X
- ▶ Analog, Euro-card format
- ▶ Suitable for controlling 4/3 proportional directional valves with electrical position feedback:
 - 4WRE 6...-2X,
 - 4WRE 10...-2X

Features

- ▶ Differential input (± 10 V)
- ▶ Four callable command value inputs (± 10 V)
- ▶ Current input (4 ... 20 mA)
- ▶ Inversion of the internal command value signal via 24 V input or jumper
- ▶ Selection of ramp time via quadrant recognition (24 V input) or ramp time call-ups (24 V inputs) with option T5
- ▶ Selection of the ramp time range via jumper
- ▶ Characteristic curve correction by means of separately adjustable step levels and maximum values
- ▶ Enable input
- ▶ "Ready for operation" output signal
- ▶ Switchable measuring socket with option T5
- ▶ Reverse polarity protection for the voltage supply
- ▶ Power supply with DC/DC converter without raised zero point

Contents

Features	1
Ordering code	2
Function	2
Block diagram/pin assignment, option T1	4
Block diagram/pin assignment, option T5	5
Technical data	6
Display/adjustment elements, option T1	7
Display/adjustment elements, option T5	8
Dimensions	10
Project planning / maintenance instructions / additional information	10

Ordering code

01	02	03	04	05	06
VT-VRPA2	-	-	1X	/	V0

01	Valve amplifier for proportional directional valves and proportional pressure valves, analog, euro-card format	VT-VRPA2
02	For controlling 4/3 proportional directional valves 4WRE 6...-2X	1
	For controlling 4/3 proportional directional valves 4WRE 10...-2X	2
03	Component series 10 to 19 (10 to 19: Unchanged technical data and pin assignment)	1X
04	Version: Standard	V0
05	Option: With one ramp time	T1
	Option: With five ramp times	T5
06	Further details in the plain text	*

Accessories

- Open card holder VT 3002-1-2X/48F (see data sheet 29928)

Function

Power supply unit [1]

The amplifier card has a power supply unit with making current limiter. This unit supplies all internally required positive and negative supply voltages.

Command value specification

The internal command value signal is calculated from the total (summation [6]) of the external command value signal available at the differential input [2] and at the current input [3], the called-up signal [4] and the zero point offset [5] (zero point potentiometer "Zw").

The following applies:

Standard values	Current input	Differential input	Command value measuring socket	Flow direction
-100 %	4 mA	-10 V	-10 V	P to B, A to T
0 %	12 mA	0 V	0 V	
100 %	20 mA	10 V	10 V	P to A, B to T
0 %	< 1 mA ¹⁾		0 V	

¹⁾ If the current input is not wired-up or if the cable of the current command value is broken, the resulting internal command value signal is 0 %.

There is no switch-over between current and voltage input. The inputs are permanently available (see block diagram).

Command value call-ups [4]

Four command value signals "w1" to "w4" can be called up. The external command value voltages (command values 1 to 4) are either defined directly by the regulated voltage outputs +10 V and -10 V or via external potentiometers. If these command value inputs are directly connected to the regulated voltages, the command values are set at the potentiometers "w1" to "w4". When using external potentiometers, the internal potentiometers will function as attenuators or limiters.

Only one call-up can be operated at the same time. If several call-ups are operated simultaneously, call-up "1" has the lowest priority and call-up "4" has the highest priority. The respective active call-up is indicated via a yellow LED on the front plate.

Command value inversion [7]

The command value created internally from the input signals, the command value call-ups and the zero point offset signal can be inverted by an external signal or jumper J1. The inversion is indicated by an LED ("-1") on the front plate.

Enable function [8]

The enable function enables the power output stages and forwards the internal command value signal to the ramp generator. The enable signal is indicated by an LED on the front plate. If enable is connected, the internal command value is changed (with any kind of command value specification) by the set ramp time. Thus, a controlled valve does not open abruptly.

Ramp generator [9]

The ramp generator limits the rise of the control output. The downstream step functions and amplitude attenuators do not extend or shorten the ramp time. Using jumper J2, the ramp time is set to a minimum (< 2 ms) (ramp off).

External ramp time setting:

Using an external potentiometer, the internally set ramp time can be extended. The setting can be verified by means of the measuring socket. In case of a cable break, the internal default setting will be valid automatically.

Note for setting and measuring the ramp time:

Value at measuring socket "t" (T1) / "v" (T5)						U_i / V	5	3	2
Current ramp time (± 20 %)						t / ms	20	33	50
U_i / V	1	0.5	0.3	0.2	0.1	0.05	0.03	0.02	
t / ms	100	200	333	500	1000	2000	3333	5000	

By closing the jumper J3, the ramp times specified above can be increased tenfold.

Characteristic curve generator [11]

Using the adjustable characteristic curve generator, the step level and maximum values for positive and negative signals can be set separately according to the hydraulic requirements. The actual development of the characteristic curve through the zero point is not stepped but linear.

Amplitude limiter [12]

The internal command value is limited to approx. ± 110 % of the nominal range.

Oscillator [14]

The oscillator creates the control signal for the inductive position transducer.

Demodulator [15]

The demodulator supplies the actual value signal of the valve spool position from the position transducer signal.
100 % $\triangleq$ 10 V

Position controller [17]

The position controller is optimized in a valve-specific manner.

Power output stage [18]

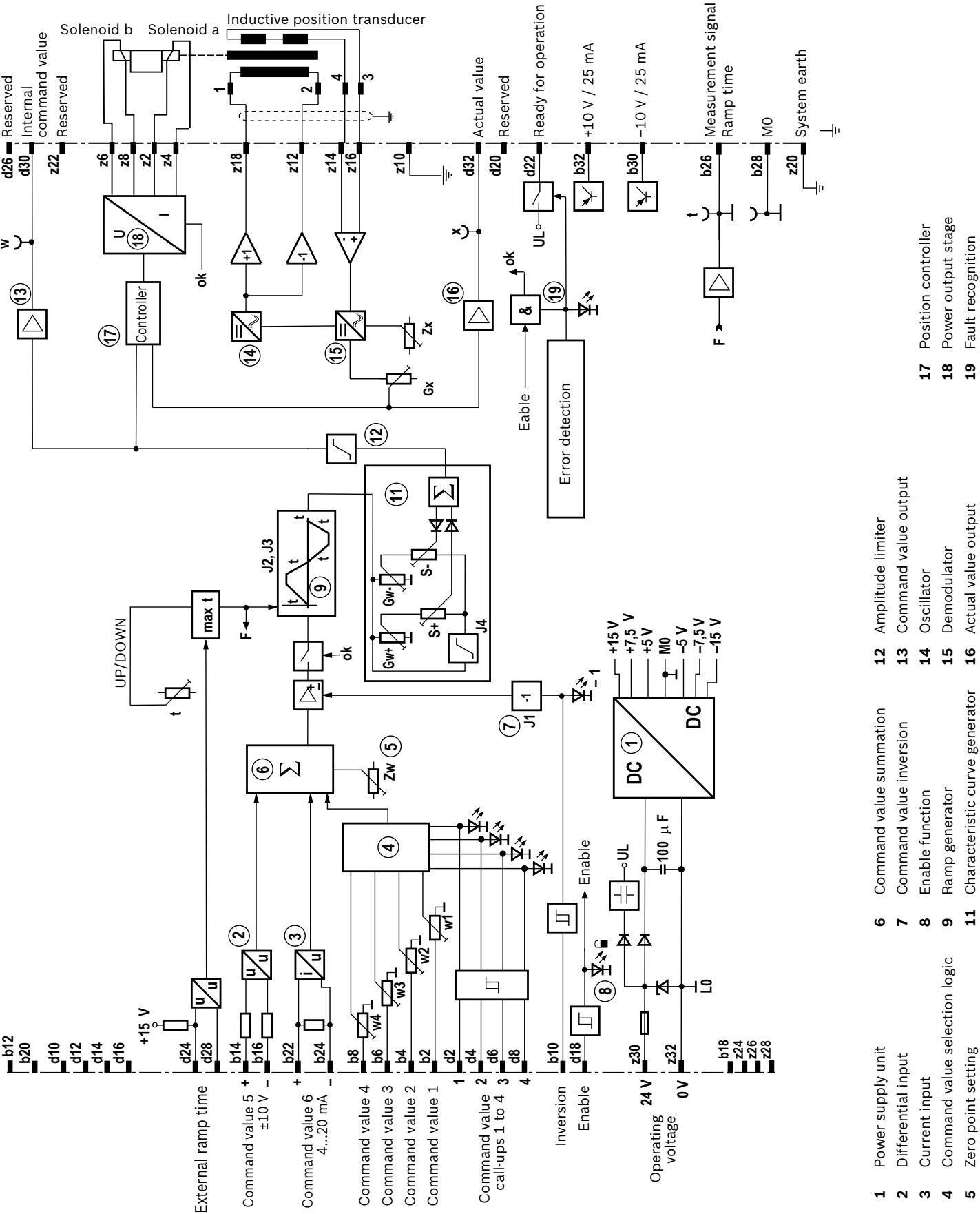
The power output stage creates the clocked solenoid current for the proportional valve. The solenoid current is limited to 2.5 A to 2.8 A per output. The output stage outputs are short-circuit-proof. The output stages are de-energized in case of an internal fault signal or if they have not been enabled..

Fault recognition [19]

The position transducer cable is monitored for cable break and short-circuits on the primary side as well as for over-currents at the output stage.

[] = Attribution to the block diagrams on pages 4 and 5

Block diagram/pin assignment, option T1



The diagram illustrates a closed-loop control system for a 4-quadrant motor drive. The system is composed of several interconnected blocks and components:

- Power Supply Unit:** Provides a 24V operating voltage and a 0V reference. It includes a DC power supply (DC 1) and a current feedback loop (J1, J2, J3).
- Command Inputs:** Includes a 4-quadrant operation input (b12, b20) and ramp call-ups (d10, d12, d14, d16). These inputs are processed by a 4-quadrant motor (10) and a ramp generator (11).
- Control Loop:** The system uses a feedback loop to control the motor's position. The feedback signal is processed by a current feedback loop (J1, J2, J3) and a speed feedback loop (J4, J5). The control signal is then processed by a position feedback loop (J6, J7) and a current feedback loop (J8, J9).
- Motor and Feedback:** The motor (10) is driven by the control signal. The feedback signal is provided by a current feedback loop (J1, J2, J3) and a speed feedback loop (J4, J5).
- Output and Status:** The system outputs a command value (b13) and a command value inversion (b7). It also provides a status signal (b12) and a command value output (b13).

The diagram is a detailed schematic showing the internal components and signal flow of the control system. It includes various blocks such as summing junctions, integrators, comparators, and feedback loops. The components are labeled with numbers and letters, and the signal flow is indicated by arrows.

- | | | | | | |
|----------|-------------------------------|-----------|--------------------------------|-----------|----------------------|
| 1 | Power supply unit | 7 | Command value inversion | 13 | Command value output |
| 2 | Differential input | 8 | Enable function | 14 | Oscillator |
| 3 | Current input | 9 | Ramp generator | 15 | Demodulator |
| 4 | Command value selection logic | 10 | Ramp time selection logic | 16 | Actual value output |
| 5 | Zero point setting | 11 | Characteristic curve generator | 17 | Position controller |
| 6 | Command value summation | 12 | Amplitude limiter | 18 | Power output stage |

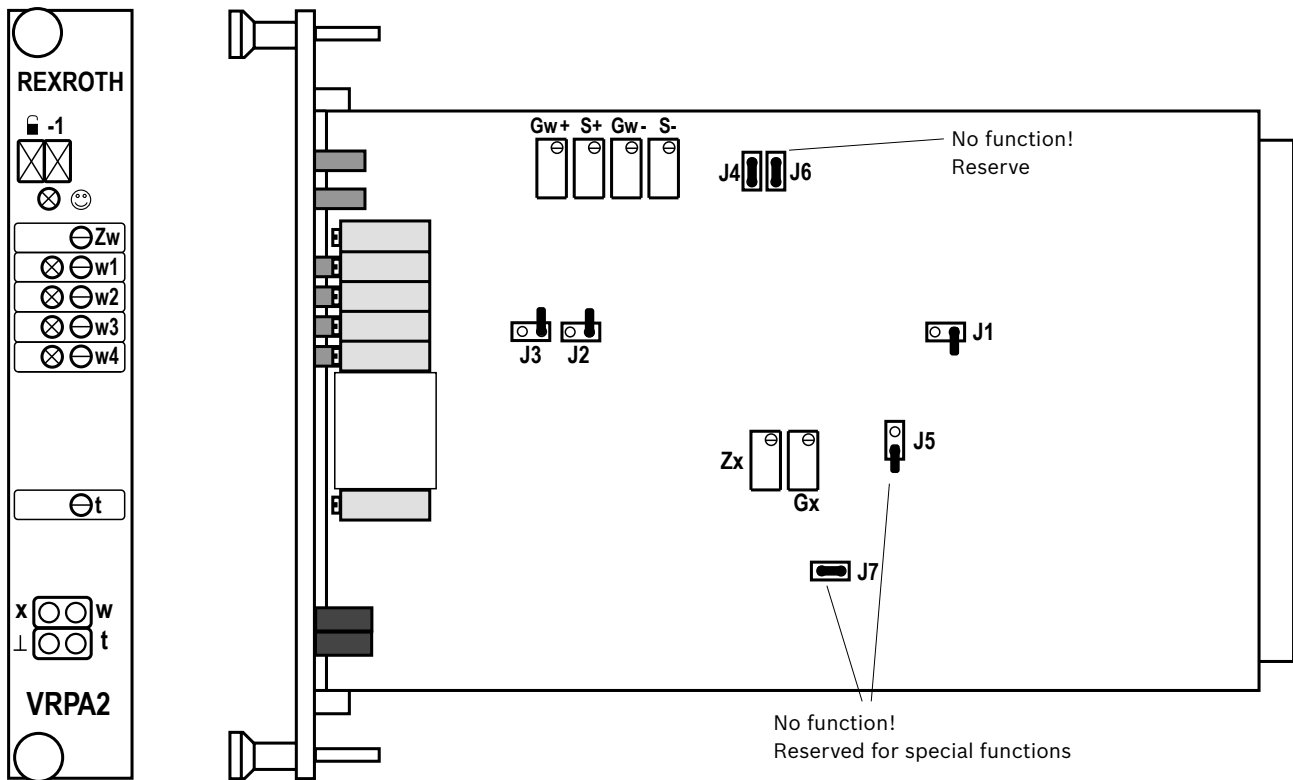
Technical data (for applications outside these parameters, please consult us!)

Operating voltage	U_B	24 VDC + 40 % – 20 %
Operating range:		
Upper limit value	$U_B(t)_{\max}$	35 V
Lower limit value	$U_B(t)_{\min}$	18 V
Power consumption	P_S	< 24 VA
Current consumption	I	< 2 A
Fuse	I_S	2 A medium time-lag, exchangeable
Inputs, analog		
Command values 1 to 4 (potentiometer inputs)	U_e	0 ... ± 10 V, $R_e > 100$ k Ω (M0 is reference)
Command value 5 (differential input)	U_e	0 ... ± 10 V, $R_e > 50$ k Ω
Command value 6 (current input)	I_e	4 ... 20 mA, load $R_B = 100$ Ω
External ramp time	U_e	0 ... +10 V, $R_e = 10$ k Ω (internally increased to +15 V, M0 is reference)
Inputs, digital		
Command value call-ups, Command value inversion, Enable, Ramp call-ups (option T5), 4-quadrant operation (option T5)	U U	8.5 V ... $U_B \rightarrow$ ON, $R_e > 100$ k Ω 0 ... 6.5 V $\rightarrow$ OFF, $R_e > 100$ k Ω
Setting ranges		
Zero adjustment (potentiometer "Zw")		± 30 %
Command values (potentiometers "w1" to "w4")		0 ... 110 %
Ramp times (potentiometer "t1" to "t5")		20 ms ... 5 s, switchable to 0.2 ... 50 s
Step level (potentiometer "S+" and "S–")		0 ... 50 %
Amplitude attenuator (potentiometer "G+" and "G–")		0 ... 110 % (applies to the step level setting of 0 %)
Outputs		
Command value signal	U	± 10 V ± 2 %, $I_{\max} = 2$ mA
Actual value signal	U	$\pm 2,5$ V ± 2 %, $I_{\max} = 2$ mA
Measurement signal (option 5)	U	± 10 V ± 2 %, $I_{\max} = 2$ mA
Ready for operation	U	> 16 V, 50 mA (in case of a fault: $U < 1$ V, $R_i = 10$ k Ω)
Regulated voltages	U	± 10 V ± 2 %, 25 mA, short-circuit-proof
Power output stage	I	0 ... 2.5 A, short-circuit-proof, clocked with approx. 5 kHz
Oscillator	U f	± 5 V _{SS} per output, 10 mA 5.6 kHz ± 10 %
Measuring sockets		
Command value "w"		± 10 V ± 2 %, $I_{\max} = 2$ mA
Actual value signal "x"		± 10 V ± 2 %, $I_{\max} = 2$ mA
Ramp time "t"		See description on page 3
Socket "v" (option T5)		See description on page 3 and table on page 9
Type of connection		48-pin male multipoint connector, DIN 41612, design F
Card dimensions		Euro card 100 x 160 mm, DIN 41494
Admissible operating temperature range	9	0 ... 50 °C
Storage temperature range	9	–25 °C ... +85 °C
Weight	m	0.17 kg (net)

Notice:

For information on the environment simulation testing for the areas EMC (electromagnetic compatibility), climate and mechanical load, see data sheet 30119-U.

Display/adjustment elements, option T1



Inversion	J1
Inverting	
Not inverting	•

Ramp function	J2
Off	
On	•

Ramp time	J3
0.2 ... 50 sec.	
0.02 ... 5 sec.	•

Step function	J4
Off	•
On	

LED displays:

- Ready for operation (green)
- Enable (yellow)
- 1** External inverting

Measuring sockets:

- x, w, t** Measurement signal (see page 6)
- ⊥** Measurement zero

Potentiometers (some with LED display):

- Zw Zero point calibration
- w1 Command value 1
- w2 Command value 2
- w3 Command value 3
- w4 Command value 4
- t Ramp time

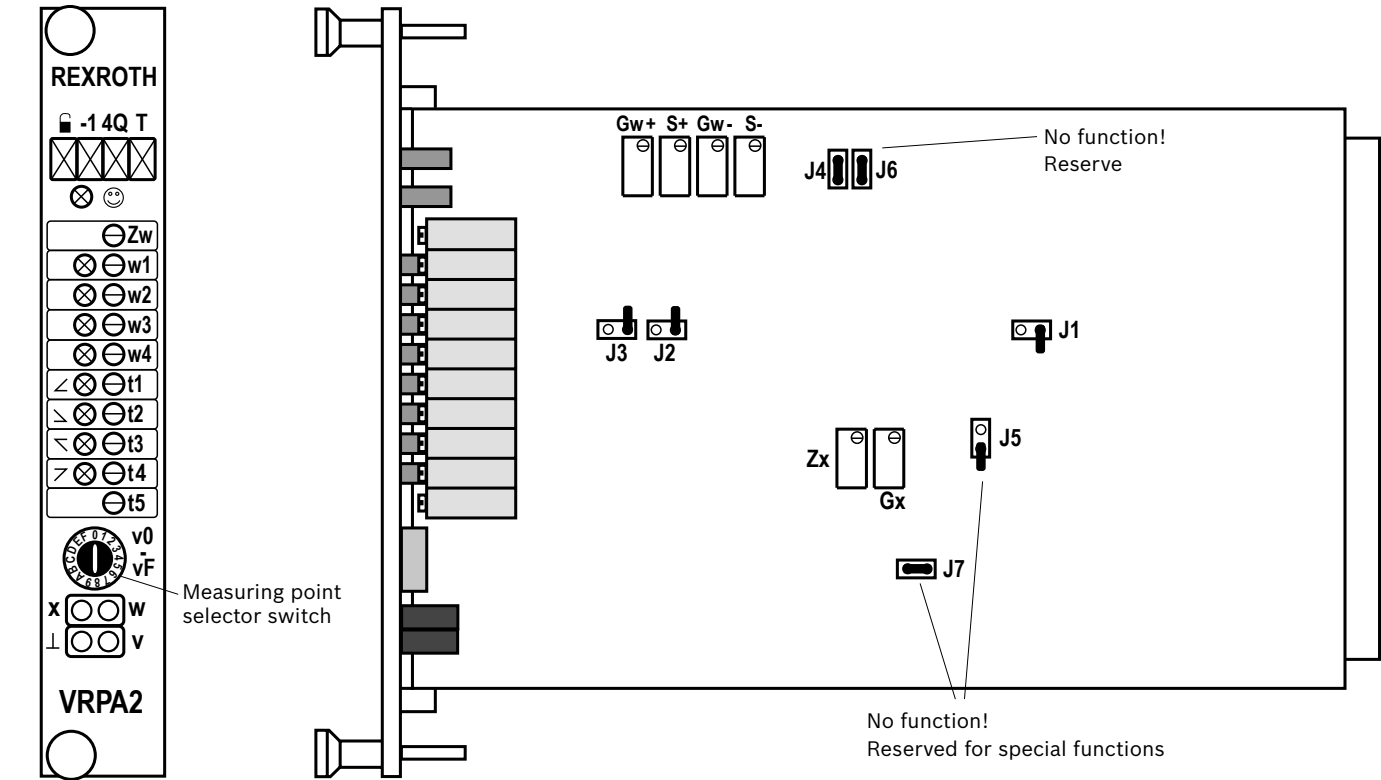
Adjustable on the board:

- Gw+ Amplitude attenuator for positive command values
- Gw- Amplitude attenuator for negative command values
- S+ Step level for positive direction
- S- Step level for negative direction

•	= Factory setting of the jumpers
	= Jumper closed
	= Jumper open

The warranty expires if the sealed potentiometer is adjusted.

Display/adjustment elements, option T5



Inversion	J1
Inverting	
Not inverting	•

Ramp function	J2
Off	
On	•

Ramp time	J3
0.2 ... 50 sec.	
0.02 ... 5 sec.	•

Step function	J4
Off	
On	•

LED displays:

- Ready for operation (green)
- Enable (yellow)
- 1** External inverting
- 4Q** 4-quadrant operation
- T** Reserved

Measuring sockets:

- x, w, v** Measurement signal (see page 6)
- ⊥** Measurement zero

Potentiometers (some with LED display):

- Zw** Zero point calibration
- w1** Command value 1
- w2** Command value 2
- w3** Command value 3
- w4** Command value 4
- t** Ramp time

Adjustable on the board:

- Gw+** Amplitude attenuator for positive command values
- Gw-** Amplitude attenuator for negative command values
- S+** Step level for positive direction
- S-** Step level for negative direction

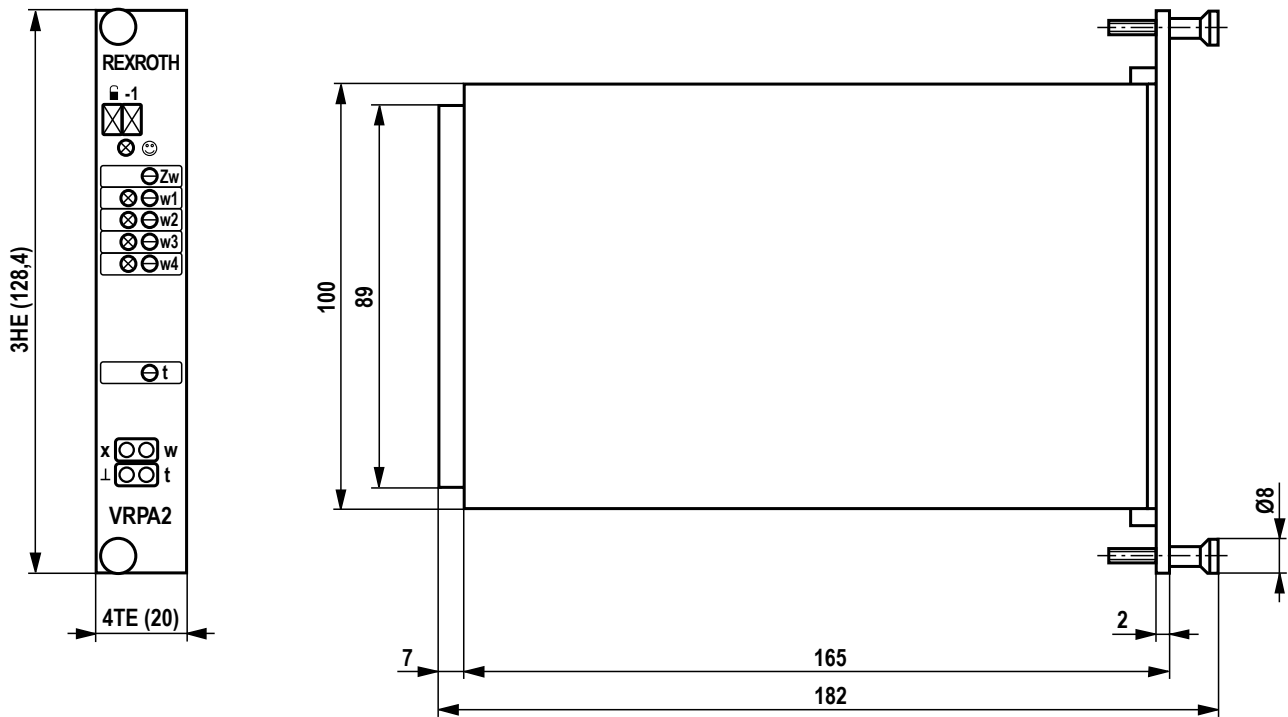
The warranty expires if the sealed potentiometer is adjusted.

Display/adjustment elements, option T5 (continued)**Measuring socket "v"**

Signal designation	Measuring point selector switch	Measurement signal "v"
Internal command value	0	$\pm 100\% \triangleq \pm 10\text{ V}$
Command value call-up 1	1	$\pm 100\% \triangleq \pm 10\text{ V}$
Command value call-up 2	2	$\pm 100\% \triangleq \pm 10\text{ V}$
Command value call-up 3	3	$\pm 100\% \triangleq \pm 10\text{ V}$
Command value call-up 4	4	$\pm 100\% \triangleq \pm 10\text{ V}$
Zero point offset "Zw"	5	$\pm 30\% \triangleq \pm 3\text{ V}$
Composite signal of the command values	6	$\pm 100\% \triangleq \pm 10\text{ V}$
Ramp output signal	7	$\pm 100\% \triangleq \pm 10\text{ V}$
Zero point offset "Zx"	8	$\pm 30\% \triangleq \pm 10\text{ V}$
Not connected	9	
Ramp time "t1"	A	10 mV ... 10 V ¹⁾
Ramp time "t2"	B	10 mV ... 10 V ¹⁾
Ramp time "t3"	C	10 mV ... 10 V ¹⁾
Ramp time "t4"	D	10 mV ... 10 V ¹⁾
Ramp time "t5"	E	10 mV ... 10 V ¹⁾
Current ramp time "t"	F	10 mV ... 10 V ¹⁾

¹⁾ The allocations of voltage and ramp time specified in the table on page 3 shall apply.

Dimensions (dimensions in mm)



Project planning / maintenance instructions / additional information

- For more information, refer to document 30119-B.