

The Drive & Control Company

Rexroth
Bosch Group

Valve amplifier for proportional valves

Type VT-MSPA2-1

RE 30228

Edition: 2014-01

Replaces: 2011-04



- ▶ Component series 1X
- ▶ Suitable for controlling direct operated proportional directional valves without electric position feedback (type 4WRA, size 6 and 10, component series 2X)

Features

- ▶ Command value input ± 10 V (differential input)
- ▶ Ramp generator with separately adjustable ramp time "up/down"
- ▶ Characteristic curve correction by means of separately adjustable step levels and separately adjustable maximum values
- ▶ Enable input
- ▶ Reverse polarity protection for voltage supply
- ▶ Power supply unit with DC/DC converter
- ▶ LED displays:
 - Ready for operation (green)
 - Enable (yellow)
- ▶ Operating mode selector switch "S"

Contents

Features	1
Ordering code	2
Functional description	3
Block diagram	4
Technical data	5
Terminal assignment	6
Dimensions	6
Project planning/maintenance instructions/ additional information	7
Setting recommendation	7

Bosch Rexroth AG, RE 30228, edition: 2014-01

2/8 **VT-MSPA2-1** | Valve amplifier

Ordering code

01	02	03	04	05	06				
VT-MSPA2	-	1	-	1X	/	V0	/	0	*

01	Valve amplifier for proportional valves, analog, modular design	VT-MSPA2
02	For controlling the valves 4WRA6 (component series 2X) and 4WRA10 (component series 2X)	1
03	Component series 10 to 19 (10 to 19: Unchanged technical data and connections)	1X
04	Version: Standard	V0
05	Option: Standard	0
06	Further details in the plain text	*

Bosch Rexroth AG, RE 30228, edition: 2014-01

Functional description

General

The amplifier modules are snapped onto top hat rails. The electrical connection is established via screw terminals. The modules are operated with 24 V direct voltage.

Power supply unit [1]

The amplifier modules have a power supply unit with making current limiter. This unit supplies all internally required positive and negative supply voltages. The making current limiter prevents high making current peaks.

Command value presetting

The internal command value signal is calculated from the total [3] of the external command value signal available at the differential input [2] and the zero point offset (zero point potentiometer "Zw").

A positive command value results in a current increase in the "b" solenoid and thus a flow in the valve from P to A and from B to T.

A negative command value results in a current increase in the "a" solenoid and thus a flow in the valve from P to B and from A to T.

Enable function [11]

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

Ramp generator [4]

The ramp generator limits the incline of the control output. The downstream step functions and amplitude attenuators do not extend or shorten the ramp time.

Notes for setting and measuring the ramp time:

Value at measuring socket "t <" or "t >"	U_t in V	5	3	2
Current ramp time ($\pm 20\%$)	t in ms	20	33	50

U_t in V	1	0.5	0.3	0.2	0.1	0.05	0.03	0.02
t in ms	100	200	333	500	1000	2000	3333	5000

The following applies: $t = \frac{100 \text{ V ms}}{U_t}$

Example: Measured $U_t = 5 \text{ V}$
Results in $t = \frac{100 \text{ V ms}}{5 \text{ V}} = 20 \text{ ms}$

Characteristic curve generator [5]

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

Amplitude limiter [6]

The internal command value is limited to approx. $\pm 110\%$ of the nominal range.

Current controller [7]

The solenoid current is recorded, in the current controller compared with the control output and the difference is compensated.

Power output stage [8]

The power output stage creates the clocked solenoid current for the proportional valve. The solenoid current is limited to 2.7 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 the release is missing.

Clock generator [9]

The clock generator creates the clock frequency "f" of the output stages. Using the operating mode selector switch, three basic frequencies can be set:

S = 1: $f = 150 \text{ Hz} \dots 400 \text{ Hz}$ adjustable
S = 2: $f = 380 \text{ Hz} \dots 180 \text{ Hz} \pm 15\%$ (WRA 10)
S = 3: $f = 350 \text{ Hz} \dots 240 \text{ Hz} \pm 15\%$ (WRA 6)

When setting the WRA valves, the frequency changes depending on the command value and on the operating voltage.

Fault recognition [11]

The solenoid conductor is monitored for cable break as well as over-current of the output stage.

Command value inversion [12]

The command value created internally from the input signal and the zero point offset signal can be inverted by an external signal.

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	S	< 48 VA
Current consumption	I	< 2 A
Fuse		Thermal overload protection (with restart if the value falls below the temperature threshold)
Inputs:		
Analog		
• Command value (differential input)	U_e	0 to ± 10 V; $R_e > 50$ k Ω
Digital		
• Enable ON	U	8.5 V to U_B
OFF	U	0 to 6.5 V
	R_e	> 100 k Ω
Setting ranges:		
Clock frequency "f"	S = 1	150 Hz ... 400 Hz adjustable
	S = 2	380 Hz ... 180 Hz ± 15 % (WRA 10)
	S = 3	350 Hz ... 240 Hz ± 15 % (WRA 6)
Zero point command value (potentiometer "Zw")		± 30 %
Ramp times (potentiometer "t <" and "t >")		20 ms to 5 s
Step level (potentiometer "Sw+" and "Sw-")		0 to 50 %
Amplitude attenuator (potentiometer "G+" and "G-")		0 to 110 % (applies to the step level setting of 0 %)
Outputs:		
Power output stages	I	0 to 2.5 A; short-circuit-proof; clocked
Measuring sockets		
• Ramp time "t <"	U	20 mV to 5 V
• Ramp time "t >"	U	20 mV to 5 V
• Actual value "I"	U	0 to ± 2.5 V (mV \triangleq mA)
• Command value "w"	U	0 to ± 10 V
• Command value after ramp "wR"	U	0 to ± 10 V
Type of connection		12 screw terminals
Type of mounting		Top hat rail TH 35-7.5 according to EN 60715
Protection class according to EN 60529		IP 20
Dimensions (W x H x D)		40 mm x 79 mm x 85.5 mm
Admissible operating temperature range	ϑ	0 to +50 °C
Storage temperature range	ϑ	-25 °C to +70 °C
Weight	m	0.14 kg

Notice:

For information on the environment simulation testing for the areas EMC (electro-magnetic compatibility), climate and mechanical load, see data sheet 30228-U.



6/8 VT-MSPA2-1 | Valve amplifier

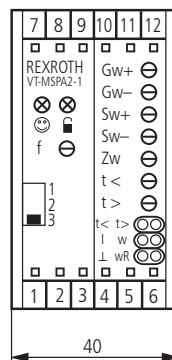
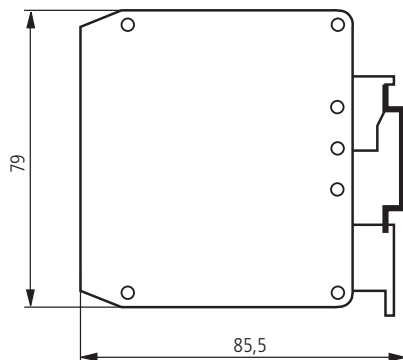
Terminal assignment

Operating voltage	$+U_B$	1	7	Solenoid "b"
	0 V	2	8	
Enable	U_F	3	9	Solenoid "a"
	-IN	4	10	
Differential input	+IN	5	11	n.c.
	INV	6	12	n.c.

Dimensions (dimensions in mm)

LED indicators:

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



Potentiometers:

- GW+** Amplitude attenuator for positive command values
- GW-** Amplitude attenuator for negative command values
- Sw+** Step level for positive direction
- Sw-** Step level for negative direction
- Zw** Zero point command value
- t <** Ramp time for increasing command values
- t >** Ramp time for decreasing command values
- f** Frequency setting

Measuring sockets:

- t <** Ramp time "up"
- t >** Ramp time "down"
- I** Actual current value
- w** Command value
- wR** Command value after ramp
- ⊥** Measurement zero

Operating mode selector switch

- 1: Gen. application with $I_{max} = 2.5$ A;
 $f = 150$ Hz ... 400 Hz
- 2: Frequency optimized for WRA 10
- 3: Frequency optimized for WRA 6

Bosch Rexroth AG, RE 30228, edition: 2014-01

Project planning/maintenance instructions/additional information

- ▶ The amplifier module may only be wired when de-energized.
- ▶ Do not lay lines close to power cables.
- ▶ Do not use free-wheeling diodes in the solenoid conductors.
- ▶ The distance to aerial lines, radios, and radar systems has to be 1 m at least.
- ▶ Always shield command value lines; connect shielding to protective earthing (PE) on the module side.
Recommendation: Also shield solenoid conductors.
For solenoid lines up to a length of 50 m, use cable type LiYCY 1.5 mm².
For longer lines, please consult us.
- ▶ For switching command values, relays with gold-plated contacts have to be used (low voltages, low currents).
- ▶ Only carry out measurements at the module using instruments with $R_i > 100 \text{ k}\Omega$.
- ▶ For setting the potentiometers, use a screwdriver with a blade width of 4 mm.
- ▶ With a strongly fluctuating operating voltage, it may in individual cases be necessary to use an external smoothing capacitor with a capacity of at least 2200 μF .
Recommendation: Capacitor module VT 11110 (see data sheet 30750); sufficient for up to 3 amplifier modules
- ▶ In the condition as supplied, the setting of the clock frequency corresponds to the requirements of the WRA 6 and WRA 10 valves. Rotating the "f" potentiometer changes the valve hysteresis and may lead to disturbing noise developments.

Setting recommendation

The system-specific circuitry must have been completed.

Signal	Setting
Command value zero point	<ul style="list-style-type: none"> ▶ Set the external command value presetting to zero ▶ Set the internal command value to zero using the "Zw" zero point potentiometer and carry out a check at the "wR" measuring socket
Ramp times	<ul style="list-style-type: none"> ▶ Set ramp time according to formula or table (see functional description "Ramp generator") and check it at the "t >" and "t <" measuring sockets
Step level	<ul style="list-style-type: none"> ▶ Apply enable signal ▶ Using the "Zw" zero point potentiometer, set the measurement signal at "wR" to +0,3 V ▶ Using the "Sw+" potentiometer, set the necessary positive step level ▶ Using the "Zw" zero point potentiometer, set the measurement signal at "wR" to -0,3 V ▶ Using the "Sw-" potentiometer, set the necessary negative step level ▶ Set the zero point <p>Notice: With an external command value presetting, it must at least result in +0.3 V / -0.3 V at the "wR" measuring socket.</p>
Maximum values	<p>Notice: Before adjusting the maximum values, zero point and step levels must be set correctly. The maximum current must not exceed the rated solenoid current!</p> <ul style="list-style-type: none"> ▶ Set the step levels first; create the command value $\pm 100 \%$ externally ▶ Using the "Gw+/"Gw-" potentiometers, set the required maximum control output and carry out a check at the "wR" and "w" measuring sockets
Clock frequency:	<p>Condition as supplied:</p> <p>S = 1: $f = 170 \text{ Hz}$ S = 2 and "w" = 0: $f = 380 \text{ Hz}$ S = 3 and "w" = 0: $f = 350 \text{ Hz}$</p>

Notice:

The new setting of the frequency can be carried out with a digital multimeter that is able to measure frequencies. Measure at solenoid terminals 7 against ground 2 and/ or 9 against 2.

8/8 **VT-MSPA2-1** | Valve amplifier

Notes

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