

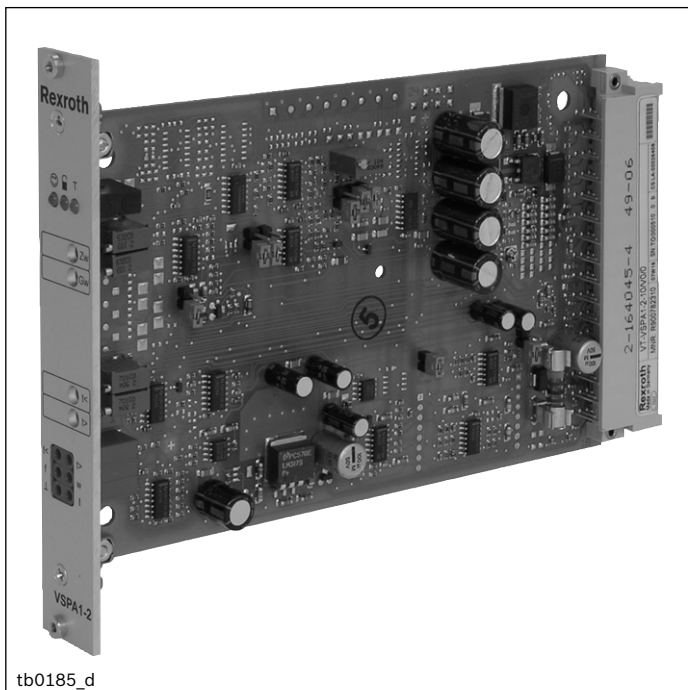
Valve amplifier for proportional pressure valves

Type VT-VSPA1-2

RE 30115

Edition: 2013-09

Replaces: 2013-02



tb0185_d

- ▶ Component series 1X
- ▶ Analog, Euro-card format
- ▶ Suitable for controlling proportional pressure valves:
 - DBET-6X,
 - DBEM...-7X

Features

- ▶ Differential input (0 ... +10 V)
- ▶ Current input (4 ... 20 mA)
- ▶ Ramp generator with separately adjustable ramp times "up/down"
- ▶ External ramp time presetting
- ▶ Enable input
- ▶ Clocked power output stage
- ▶ "Ready for operation" message
- ▶ Reverse polarity protection of the supply voltage
- ▶ Short-circuit protection and cable break detection of the solenoid conductor

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Ordering code

01	02	03	04	05	06				
VT-VSPA1	-	2	-	1X	/	V0	/	/	*

01	Valve amplifier for proportional pressure valves, analog, Euro-card format	VT-VSPA1
02	For controlling direct operated proportional pressure valves DBET-6X and DBEM...-7X	2
03	Component series 10 to 19 (10 to 19: Unchanged technical data and pin assignment)	1X
04	Version: Standard	V0
05	Option: Standard	0
	Option: 4 command value call-ups	A4
06	Further details in the plain text (additional functions on request)	*

Accessories

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

Function

Power supply unit (1)

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

Command value specification (2), (3), (4)¹⁾, (5), (6)

The internal command value signal is calculated from the total (6) of the external command value signal or the called-up signal (4)¹⁾ available at the differential input (2) or at the current input (3) and the zero point offset (5) (zero point potentiometer "Zw").

The following applies:

Standard values	Current input	Differential input	Command value socket
0 %	4 mA	0 V	0 V
+100 %	20 mA	+10 V	+10 V

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

Command value call-ups (4)¹⁾

Four command value call-ups "w1" to "w4" can be called up. The external voltages (command values 1 to 4) are either defined directly by the voltage output +10 V or by external potentiometers. If these command value inputs are directly connected to the regulated voltage, 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 "w1" has the lowest priority and call-up "w4" has the highest priority. The active call-up is indicated by a yellow LED.

Enable function (7)

The enable function (7) enables the power output stage and forwards the internal command value signal to the ramp generator (8). The enable signal is indicated by an LED. If the release is connected (via 24 V input or jumper J1), 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 (8)

The ramp generator (8) limits the rise of the control output. The downstream amplitude limiter (12) does not extend or shorten the ramp time. Using the jumper J3, the ramp time is changed by the factor 10.

The following applies:

J3	U_{socket} / V	2	1	0.2	0.1	0.02
Open*	t/ms	50	100	500	1000	5000
Closed	t/s	0.5	1	5	10	50

* Basic setting (condition as supplied)

¹⁾ Only with option A4

Formula:

$$t = \frac{100 \text{ ms}}{U_{\text{socket}} / V}$$

Ramp on/off (9)

Using jumper J2 or the "Ramp on/off" input (9) (see terminal assignment), the ramp time is set to a minimum (< 50 ms).

An activated ramp is indicated by an LED.

"Ramp on/off" input	J2	LED "T"	Ramp
0 V	Open	On	On
+24 V	Open	Off	Off
0 V	Closed	Off	Off
+24 V	Closed	On	On

Ramp time setting external (10)

Using an external potentiometer or an external voltage presetting (according to the formula in section "Ramp generator"), the internally set ramp time can be extended. The setting can be verified at the measuring sockets. In case of a cable break, the internal default setting will be valid automatically.

The following applies to the external potentiometer:

Setting range*		
R	Min. ramp time (potentiometer at left turn)	Max. ramp time (rotary angle of potentiometer at approx. 95 %)
1 kΩ	100 ms	1 s
100 Ω	1 s	10 s

* The minimum ramp time can only be reached if the internally set ramp time is lower, i.e. the corresponding potentiometer is at the left turn. The specified ramp times are true for J3 = open.

Characteristic curve generator (11)

The maximum current for the solenoid is set using the "Gw" (12) potentiometer. In the characteristic curve generator (11), the command value signal is changed so that a linear command value pressure characteristic curve (correction characteristic curve for DBET-6X and DBEM...-7X) results. For this purpose, jumper J4 has to be closed and jumper J5 has to be opened.

In order to deactivate the correction characteristic curve, jumper J4 has to be opened and jumper 5 has to be closed.

Amplitude limiter (12)

The internal command value is limited to approx. +120 % of the nominal range.

Command value output (13)

0 % $\hat{=}$ 0 V +100 % $\hat{=}$ +10 V

Clock generator (14)

In the clock generator (14), a frequency for the output stage is generated. The frequency is influenced by the supply voltage.

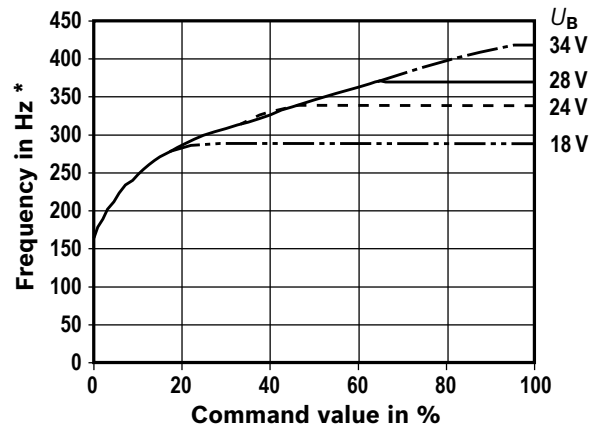
A frequency dependent on the command value signal is generated using the jumper J6 (for DBET-6X and DBEM...-7X). For a universal use, jumper J6 is to be opened. A frequency adjustment via the "frequency" potentiometer can be realized by means of jumper J7.

Example 1:

(frequency adjustment via "frequency" potentiometer – without command value dependency; J6 = open, J7 = closed)
Setting range: 210 Hz ... 310 Hz \pm 15 %

Example 2:

(command-value dependent frequency – J6 closed)



* Tolerance: \pm 15 %

Via the "frequency" potentiometer, the frequency can be corrected by $>$ \pm 10 % (J6 and J7 closed).

Power output stage (15)

The power output stage creates a clocked solenoid current for the proportional valve.

The output stage output is de-energized in case of an internal fault signal or if the release is missing. The output stage output is short-circuit-proof.

Actual value output (16)

1 mA (I_{solenoid}) $\hat{=}$ 1 mV (actual value output)

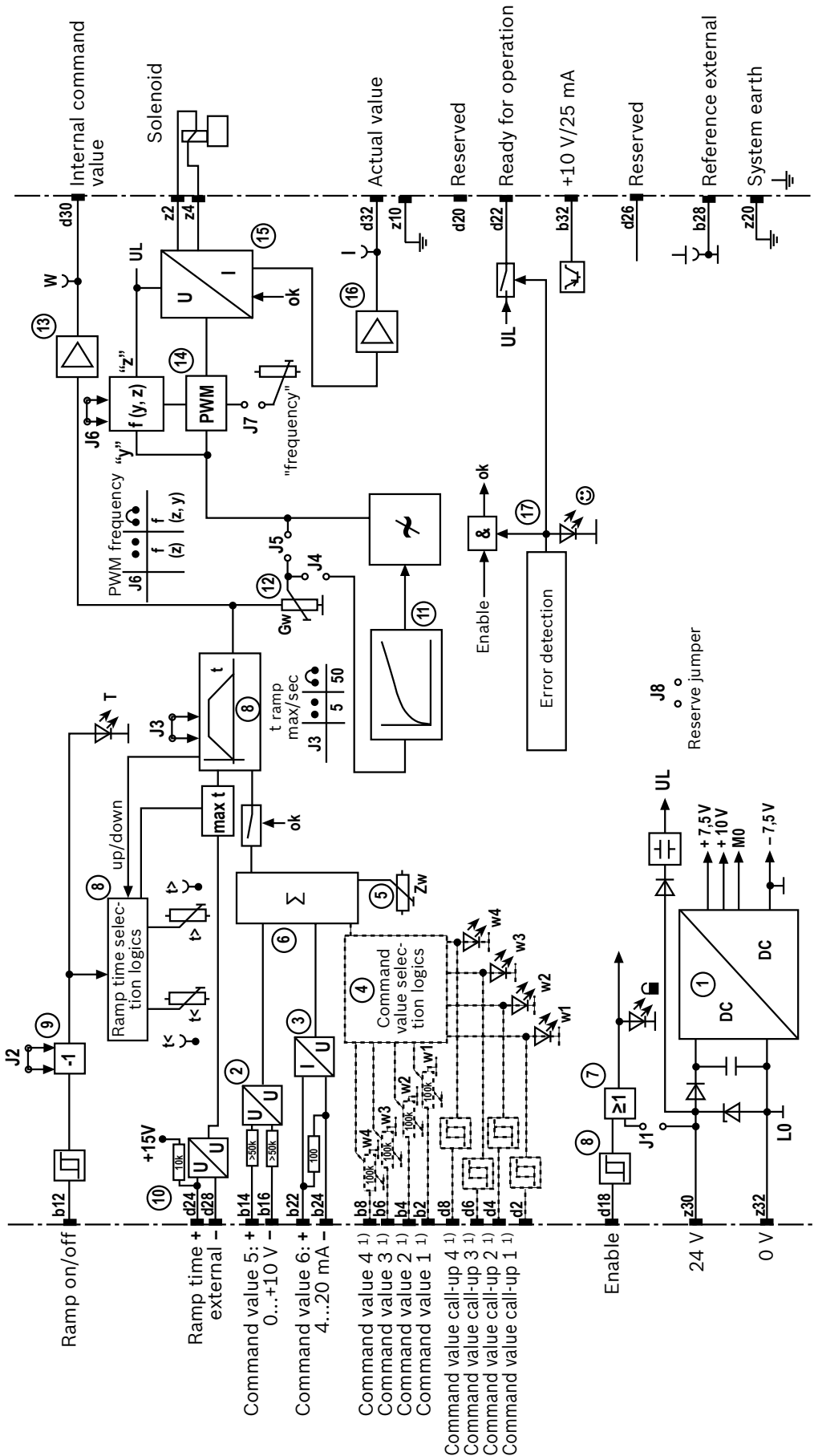
Fault recognition (17)

The solenoid conductor is monitored for cable break and short-circuits. If there is no fault, a voltage $>$ 16 V is output at the "ready-for-operation" output and the "ready-for-operation" LED is illuminated.

In case of a fault, the following applies:

	Output	LED
Short-circuit	Low	Off
Cable break	Clocking	Flashing

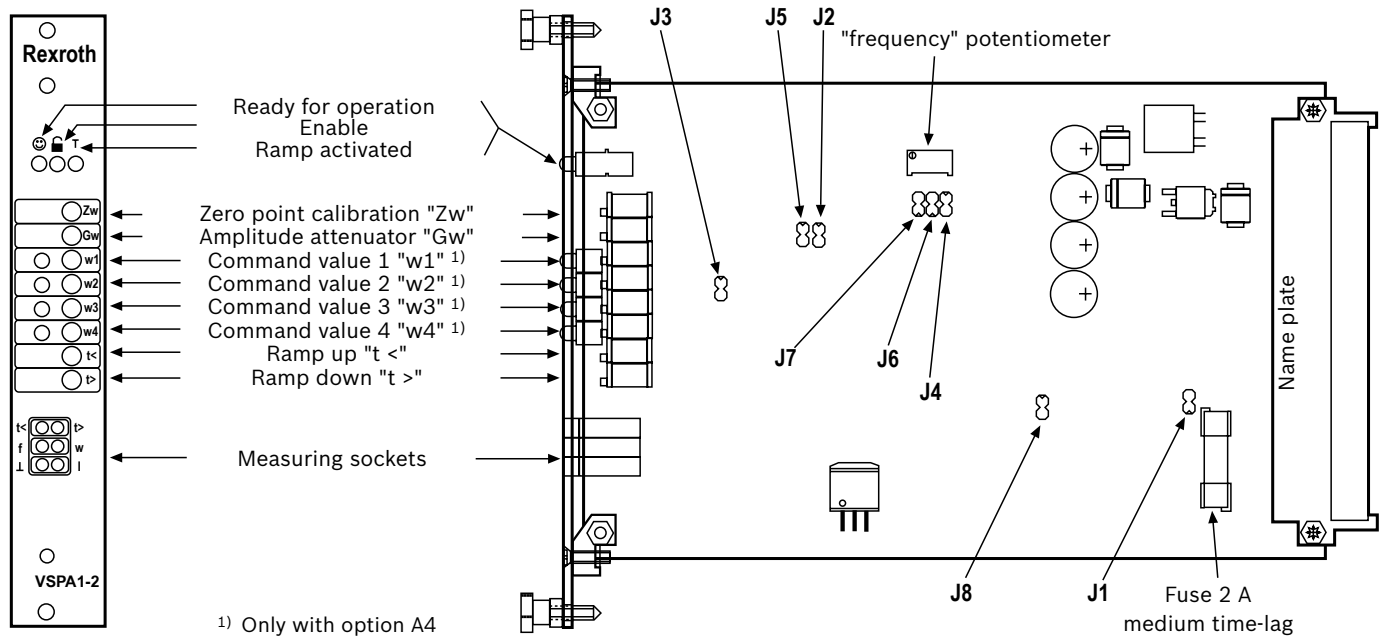
Block diagram



- 1 Power supply unit
- 2 Differential input
- 3 Current input
- 4 Command value call-ups
- 5 Zero point setting
- 6 Command value summation
- 7 Enable
- 8 Ramp generator
- 9 Ramp on/off
- 10 Ramp time external
- 11 Characteristic curve generator
- 12 Amplitude limiter
- 13 Command value output
- 14 Clock generator
- 15 Power output stage
- 16 Actual value output
- 17 Fault recognition

1) Only with option A4

Setting and operating controls



1) Only with option A4

Measuring sockets

- t < Ramp time "Ramp up"
- t > Ramp time "Ramp down"
- w Command value output (0...10 V)
- I Actual value (1 mV \cong 1 mA)
- f Clock frequency of the output stage
- \perp Reference for outputs

Additional potentiometer

- "frequency" Frequency setting (to be activated using J7)

LED

- ☺ Ready-for-operation LED
- 🔒 Enable LED ("enable")
- T "Ramp on active" LED
- w1-w4 "Command value call-up" LEDs (only with A4 variant)

Jumpers

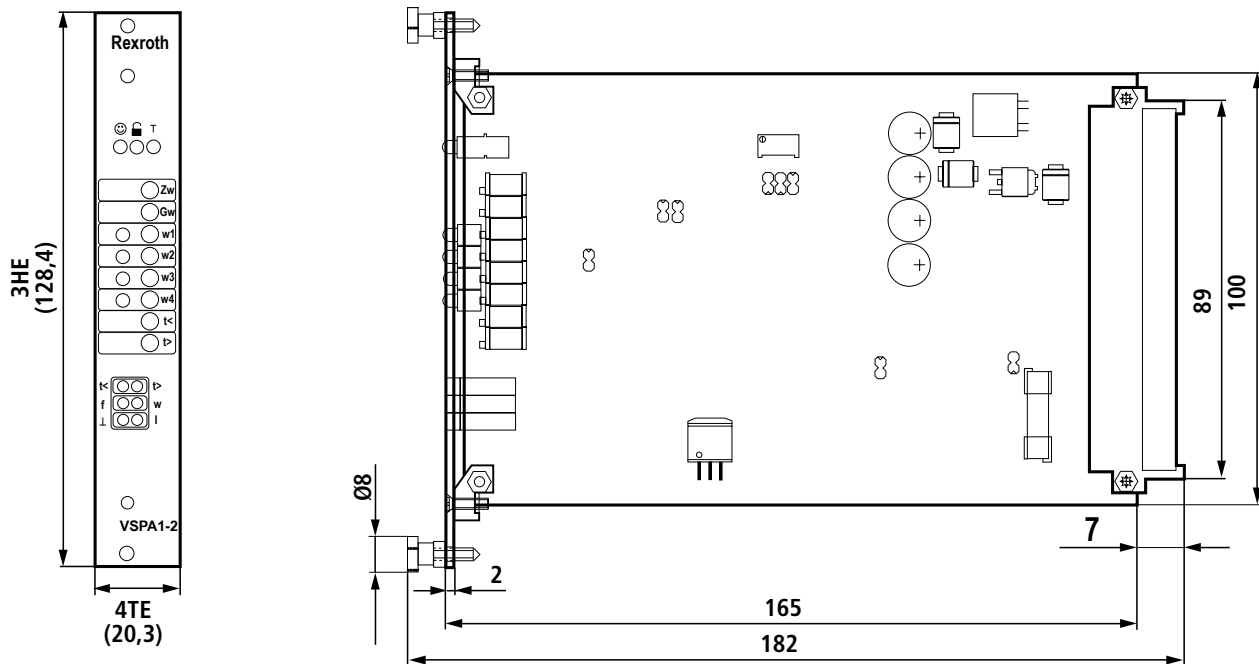
J1	Open Closed	<ul style="list-style-type: none"> • No enabled • Enable activated 	
J2		Ramp function on/off (• = open) (see table under "Ramp on/off" on page 3)	
J3	Open Closed	<ul style="list-style-type: none"> • Ramp time 20 ms ... 5 s • Ramp time 200 ms ... 50 s 	
J4	Open Closed	<ul style="list-style-type: none"> • Command value pressure characteristic curve correction inactive • Command value pressure characteristic curve correction active 	J4 and J5 must not be simultaneously closed.
J5	Open Closed	<ul style="list-style-type: none"> • Command value pressure characteristic curve correction active • Command value pressure characteristic curve correction inactive 	
J6	Open Closed	<ul style="list-style-type: none"> • Command value-dependent frequency deactivated • Command value-dependent frequency activated (for DBET-6X and DBEM...-7X) 	
J7	Open Closed	<ul style="list-style-type: none"> • Frequency adjustment via "frequency" potentiometer deactivated • Frequency adjustment via "frequency" potentiometer activated 	
J8	Closed	<ul style="list-style-type: none"> • Reserve jumper 	

• = Jumper condition as supplied

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, $R_e > 100 \text{ k}\Omega$
Differential input	U_e	0 ... +10 V, $R_e > 50 \text{ k}\Omega$
Current input	I_e	4 ... 20 mA, load $R_B = 100 \Omega$
Ramp time external	U_e	0 ... +5 V, $R_e > 10 \text{ k}\Omega$
Inputs, digital		
Command value call-ups (only with option A4)	U	8.5 V ... $U_B \rightarrow$ call-up operated, $R_e > 100 \text{ k}\Omega$ U 0 ... 6.5 V \rightarrow no call-up, $R_e > 100 \text{ k}\Omega$
Ramp on/off	U	8.5 V ... $U_B \rightarrow$ ramp on, $R_e > 100 \text{ k}\Omega$ U 0 V ... 6.5 V \rightarrow ramp off, $R_e > 100 \text{ k}\Omega$
Release	U	8.5 V ... $U_B \rightarrow$ ON, $R_e > 100 \text{ k}\Omega$ U 0 ... 6.5 V \rightarrow OFF, $R_e > 100 \text{ k}\Omega$
Clock frequency	f	250 Hz \pm 10 % (J6 and J7 = open)
Setting ranges		
Zero adjustment (potentiometer "Zw")		+30 %
Command values (potentiometers "w1" to "w4")		0 ... 100 %
Ramp times (potentiometer "t <" and "t >")	t	20 ms ... 5 s, switchable to 0.2 s ... 50 s
Amplitude attenuator (potentiometer "Gw")		0 ... +120 %
Frequency adjustment with "frequency" potentiometer (J7 operated)	f	See explanation: Clock generator, page 3
Outputs		
Command value signal	U	0 ... +10 V \pm 2 %, $I_{\max} = 2 \text{ mA}$
Actual value signal	U	0 ... +10 V \pm 2 %, $I_{\max} = 2 \text{ mA}$
Ready for operation	U	high: >16 V, $I_{\max} = 50 \text{ mA}$ low: <1 V
Regulated voltage	U	+10 V \pm 2 %, $I_{\max} = 25 \text{ mA}$, short-circuit-proof
Ramp signals measuring socket	U	+100 mV ... +5 V \pm 10 %, +10 mV ... +100 mV \pm 50 %
Power output stage	I	0 ... 1.9 A, short-circuit-proof, clocked
Type of connection		48-pin male multipoint connector, DIN 41612, design F
Card dimensions		Euro-card 100 x 160 mm, DIN 41494
Operating temperature range	ϑ	0 ... 50 °C
Storage temperature range	ϑ	-25 ... +85 °C
Weight	m	0.15 kg (net)

Unit dimensions (dimensions in mm)



Project planning information/maintenance instructions/additional information

- ▶ In the condition as supplied the parameters are set as follows: Correction characteristic curve and command value-dependent frequency = active (for valves DBET-6X and DBEM...-7X), max. ramp time = 5 s, pilot current = 100 mA, max. output current = 1.6 A.
- ▶ The amplifier card may only be assembled when de-energized.
- ▶ No connectors with free-wheeling diodes or LED displays must be used for the solenoid connection.
- ▶ Only carry out measurements at the card using instruments $R_i > 100 \text{ k}\Omega$.
- ▶ 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 earth on the card-side, other side open. If no system earth exists, connect 0 V operating voltage.

Recommendation:

Shield solenoid conductors as well. For solenoid conductors up to 50 m in length, use the line type LiYCY 1.5 mm². 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 conductors and signal lines near power lines.
- ▶ If the differential input is used, both inputs must always be connected or disconnected at the same time.

Notes

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