

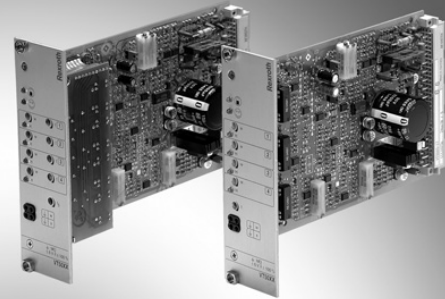
Electric amplifiers

RE 30095/04.11
Replaces: 05.02

1/8

Types VT 5005 to VT 5008

Component series 1X



H5581_d

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Features

- Suitable for the actuation of direct operated proportional directional valves with electr. position feedback (type 4WRE, component series 1X)
- Differential input
- Release input with LED display
- "Ready for operation" message by LED display
- Step function generator and ramp generator
- Ramp times adjustable by means of a potentiometer (with VT 5005 and VT 5006 one ramp each, with VT 5007 and VT 5008 four ramps each). In the condition as supplied, the ramps are set to 5 s
- Four command values adjustable by means of the potentiometer, call-ups indicated by LEDs
- Controller for valve spool position
- Two synchronized power output stages
- Oscillator and demodulator for inductive position measurement with cable break detection
- Reverse polarity protection for the voltage supply

Ordering code

VT 500 _ -1X / *

Amplifier with one ramp time:

For valves type 4WRE 6 ...-1X = 5
 For valves type 4WRE 10 ...-1X = 6

Amplifier with five ramp times:

For valves type 4WRE 6 ...-1X = 7
 For valves type 4WRE 10 ...-1X = 8

= 1X

Further details in the plain text

Component series 10 to 19

(10 to 19: Identical technical data and pinout)

Accessories (not included in scope of delivery)

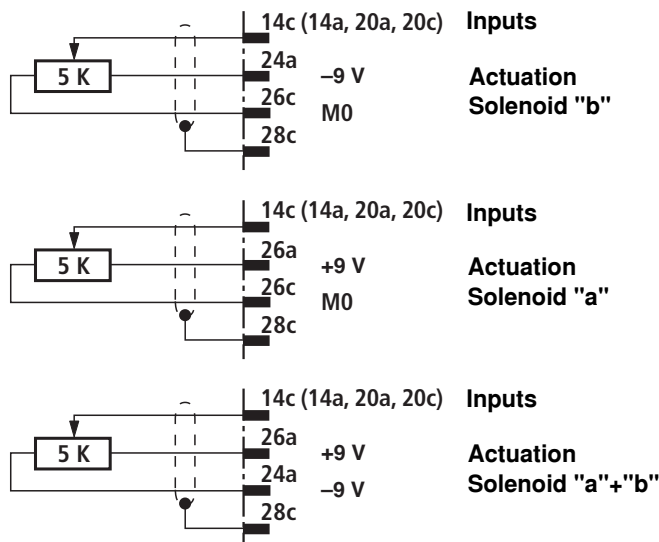
Card holder:

Type VT 3002-1-2X/32D, see data sheet 29928

Functional description

Using the command value inputs 1 to 4, command values can be retrieved [1] by actuating the related relays (K1 to K4). The command value voltage is either specified directly, by the controlled voltages $\pm 9\text{ V}$ of the internal power supply [12] or via an external command value potentiometer. To these inputs, the following applies: $\pm 9\text{ V} \approx \pm 100\% \text{ }^1$. If these four command value inputs are directly connected to the controlled voltages $\pm 9\text{ V}$, four different command values can be set at the "w1" to "w4" potentiometers. When using external command value potentiometers at these inputs, the internal potentiometers will function as attenuators or limiters unless they are set to the maximum.

External command value potentiometers



The LEDs "H1" to "H4" indicate which command value is just being called. If more than one command value is called at a time, the input with the highest number will take priority.

Example: If command value 1 and command value 3 are activated simultaneously, command value 3 will take effect.

Another output of the card supplies a feed voltage for the command value calls which can be switched from $+9\text{ V}$ to -9 V by means of the relay K6 ¹⁾.

For the amplifier variants with 5 ramp times (VT 5007 and VT 5008), each of the four call-up command values is allocated an adjustable ramp time ("t1" to "t4"). If no command value is called, the time "t5" will take effect in these devices. For the amplifier variants with one ramp time (VT 5005 and VT 5006), the time "t" is effective for all command values at all times.

All relays on the card are switched with 24 VDC (smoothed). The command value input 5 is a differential input (0 to $\pm 10\text{ V}$). If the command value is specified by external electronics with a different reference potential, this 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.

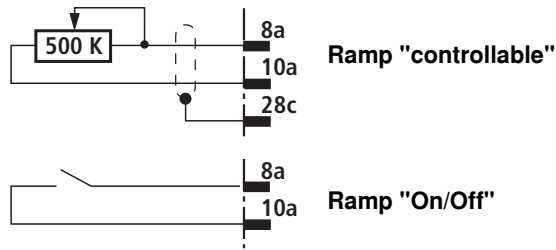
Before they are forwarded, all command values will be added up according to their absolute value and their sign [3].

The down-stream ramp generator [4] generates a ramp-shaped output signal from given a step-shaped input signal. The time constant of the output signal can be set using the potentiometers "t" or "t1" to "t5". The specified ramp time refers to a command value step of 100 % and may be approx. 1s or 5s, depending on the jumper setting (J5, J6). If a command value step of less than 100 % is switched to the ramp generator input, the ramp time will be correspondingly shorter.

¹⁾ The reference potential for the command values 1 to 4 is M0 (measurement null).

Functional description

External time potentiometer and ramp "Off"



Important:

When using an external time potentiometer, the internal potentiometer for the ramp time must be set to maximum. The maximum ramp time is reduced as the resistance value of the external potentiometer is switched in parallel to that of the internal one (approx. 500 k Ω).

By switching the relay K5 or by an external bride, the ramp time is set to its minimum value (approx. 30 ms).

The output signal of the ramp generator [4] is lead in parallel to the summing device [6] and the step function generator [5]. With command value voltages > 100 mV, the step function generator [5] generates a polarity-independent step signal that is added to the output signal of the ramp generator. This step function results in the fast passing of the valve spool overlap. With larger command value voltages, the step function generator emits a constant output signal.

The output signal of the summing device [6] is the position command value and is supplied to the PID controller [7], the "w" measurement socket on the front panel of the card and port 4a (command value after ramp/external limitation potential). A voltage of -6 V at the "w" measurement socket corresponds to a command value of +100 %.

The PID controller has been especially optimized for the 4WRE valve type (component series 1X). The current output stages are actuated depending on the difference between position command value and actual position value. A positive command value signal at the amplifier input actuates the output stage for solenoid "a", a negative command value signal the output stage for solenoid "b".

The inductive position transducer [13] detects the valve spool position. The AC voltage signal of the position transducer is converted in the oscillator/demodulator [11] and returned to the PID controller as actual position value.

The zero point of the position transducer (actual value zero point) can be adjusted by means of the "Zx" potentiometer (on the printed circuit board). The amplification of the actual position value has been calibrated in the factory and must not be changed ($\pm 6 \text{ V} \hat{=} \text{max. valve spool stroke}$).

With a signal of > 8.5 V at the release input (available from component series 17), the output stages (indication by the yellow "H11" LED on the front plate). By setting jumper J7, the output stages are permanently released irrespective of the release input status. The release input will then be ineffective.

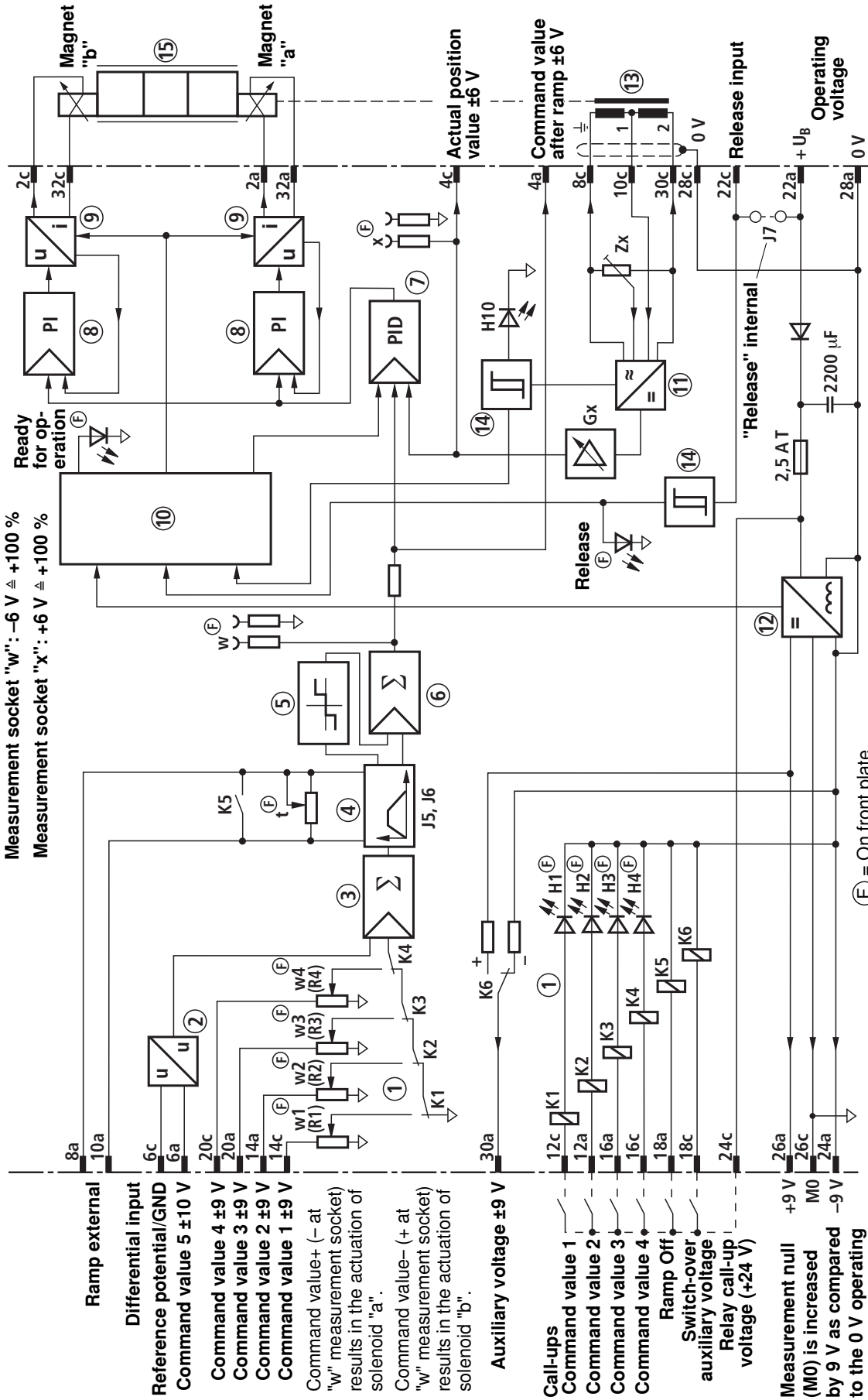
In case of failure-free operation, the "H12" LED (ready for operation) is illuminated; in detail if:

- The release signal is applied,
- The internal $\pm 9 \text{ V}$ voltage supply functions (amplitude and symmetry),
- No short-circuit of the solenoid lines and
- There is no cable break in the position transducer lines.

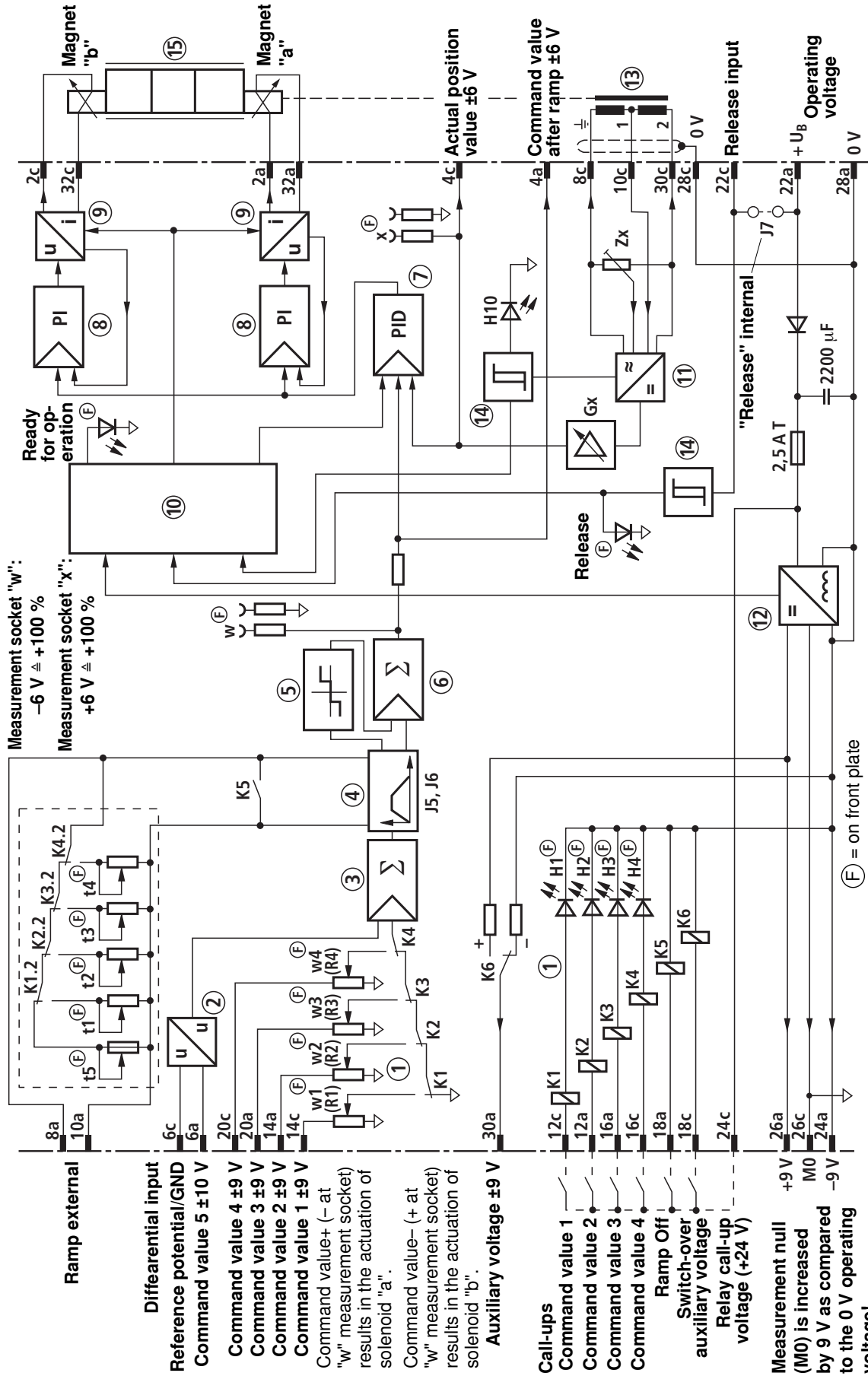
In case of failure, the two output stages are immediately de-energized, the controller is switched off and the "Ready for operation" message is reset. After remedy of the failure, the card is immediately functional again; the "H12" LED lights up again.

[] = Allocation to the block diagram on page 4 and 5

Block diagram / pinout: VT 5005 and VT 5006 (from component series 17)



Block diagram / pinout: VT 5007 and VT 5008 (from component series 17)



- 1 Command values
- 2 Differential amplifier
- 3; 6 Summing device
- 4 Ramp generator
- 5 Step function
- 7 Controller for spool position
- 8 Current controller
- 9 Output stage
- 10 Monitoring
- 11 Oscillator/demodulator
- 12 Power supply
- 13 Position transducer
- 14 Threshold detection
- 15 Proportional valve

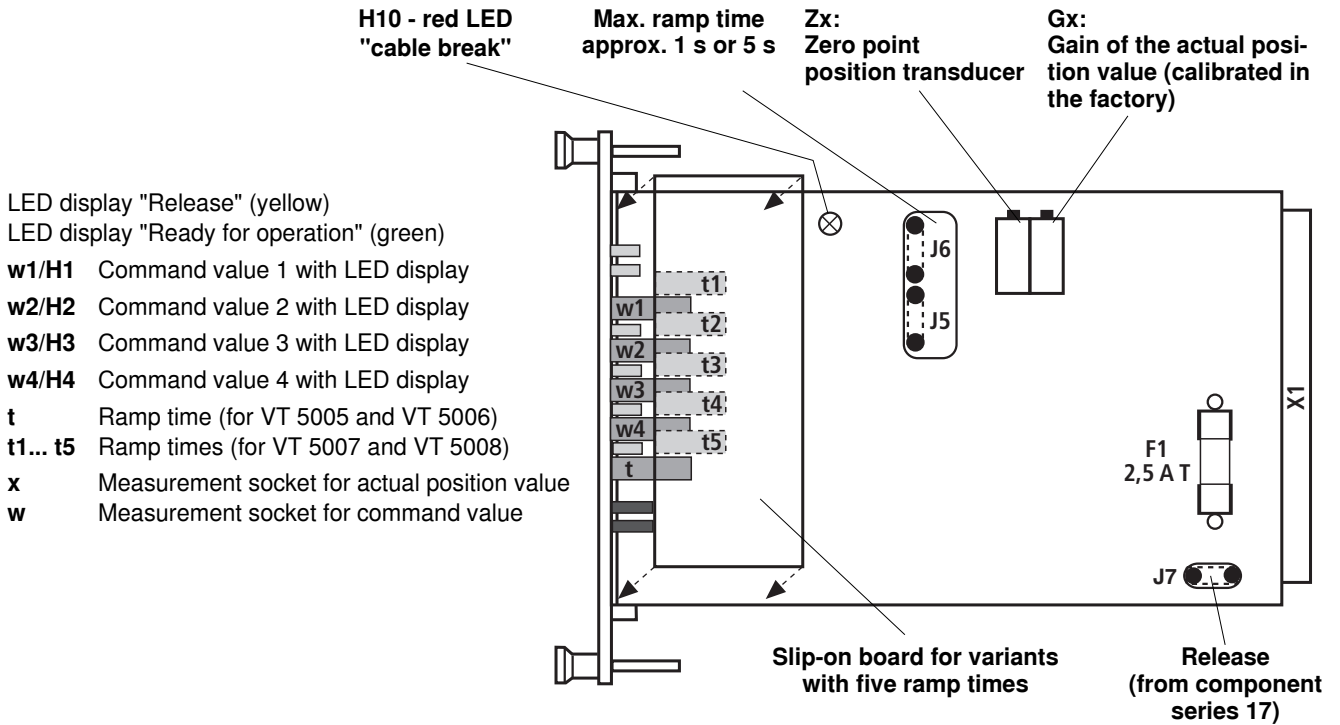
(F) = on front plate

Measurement null (M0) is increased by 9 V as compared to the 0 V operating voltage!

Technical Data (For applications outside these parameters, please consult us!)

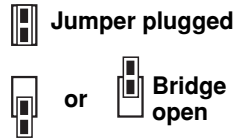
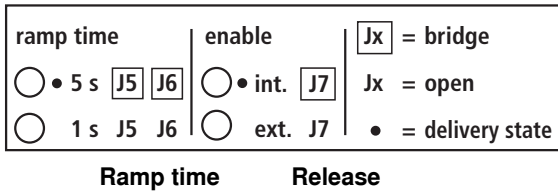
Operating voltage	U_B	24 VDC +40 % -5 %
Operating range:		
– Upper limit value	$u_B(t)_{\max}$	35 V
– Lower limit value	$u_B(t)_{\min}$	22 V
Power consumption	P_S	< 50 VA
Current consumption	I	< 2 A
Fuse	I_S	2.5 A T
Inputs:		
– Command values 1 to 4	U_e	± 9 V (reference potential is M0)
– Command value 5	U_e	0 to ± 10 V; $R_e \geq 100$ k Ω
– Release		
• Active	U_F	> 8.5 V
• Not active	U_F	< 6.5 V
Relay data:		
– Nominal voltage	U	Operating voltage U_B
– Response voltage	U	16.8 V
– Reverse voltage	U	2.4 V
– Coil resistance	R	2150 Ω
Ramp time (setting range)	t	30 ms to approx. 1 s or 5 s (in each case ± 20 %)
Outputs:		
– Output stage		
• Solenoid current/resistance		
VT 5005, VT 5007	I_{\max}	1.8 A ± 20 %; $R_{(20)} = 5.4$ Ω
VT 5006, VT 5008	I_{\max}	2.2 A ± 20 %; $R_{(20)} = 10$ Ω
• Clock frequency	f	Self-locking up to approx. 1.5 kHz
– Driver for the inductive position transducer:		
• Oscillator frequency	f	2.5 kHz ± 10 %
• Maximum load capacity	I	30 mA
• Voltage amplitude	U_{SS}	5 V per output
– Controlled voltage	U	± 9 V ± 1 %, 25 mA externally loadable
– Measurement sockets		
• Command value "w"	U_w	0 to ± 6 V (-6 V \triangleq +100 %; +6 V \triangleq -100 %); $R_i = 100$ Ω
• Actual position value "x"	U_x	0 to ± 6 V (+6 V \triangleq +100 %; -6 V \triangleq -100 %); $R_i = 100$ Ω
Type of connection		32-pole blade connector, DIN 41612, design D
Card dimensions		Euro board 100 x 160 mm, DIN 41494
Front plate dimensions:		
– Height		3 HE (128.4 mm)
– Width conductor path side		1 TE (5.08 mm)
– Width component side		7 TE
Admissible operating temperature range	ϑ	0 to 50 °C
Storage temperature range	ϑ	-20 to +85 °C
Weight	m	0.15 kg

Display / setting elements



Meaning of the jumpers on the card for the settings

(plate on the back side of the front plate)

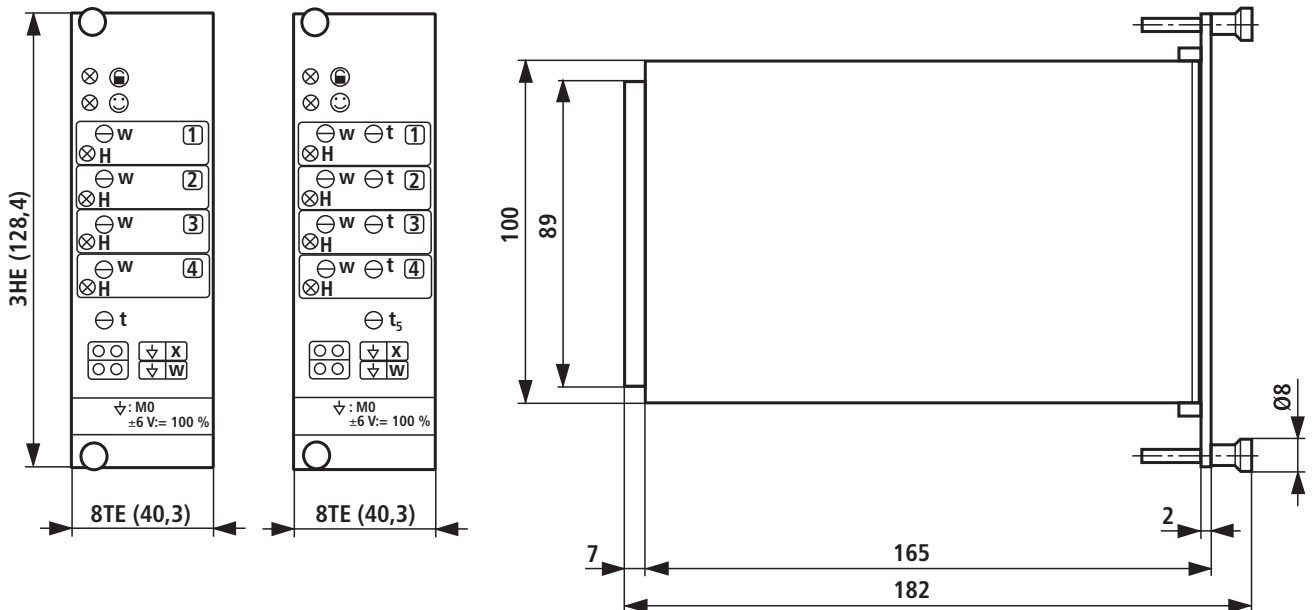


Important:

The circles (○) serve the marking of the settings made by the customer.

The condition is supplied is marked with "•".

Unit dimensions (dimensions in mm)



Project planning / maintenance instructions / additional information

- The amplifier card may only be unplugged and plugged when de-energized!
- No plug-in connectors with free-wheeling diodes or LED indicators must be used for solenoid connection!
- Only carry out measurements at the card using instruments $R_i > 100 \text{ k}\Omega$!
- Measurement null (M0) is increased by +9V compared to 0 V operating voltage and not isolated, i.e. –9 V controlled voltage = 0 V operating voltage. Thus, do not connect measurement null (M0) to 0 V operating voltage!
- For switching command values, relays with gold-plated contacts have to be used (small voltages, low currents)!
- Card relays may only be switched using contacts with a load capacity of approx. 40 V, 50 mA!
In case of actuation, the control voltage must have a residual ripple of max. 10 %!
- 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 solenoid lines!
 - For solenoid lines up to a length of 50 m, use the cable 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 and signal lines near power cables!
- The charging current of the smoothing capacitor on the card requires the series fuses to be of a slow-blowing nature!
- Do not connect the ground sign at the inductive position transducer with the ground!
(Prerequisite for the compatibility with previous component series!)
- **Attention:** If the differential input is used, both inputs must always be connected or disconnected at the same time!

Note: Electric signals taken out via control electronics (e.g. "Ready for operation" signal) must not be used for switching safety-relevant machine functions!
(See also the European standard "Safety requirements for fluid power systems and their components - Hydraulics", EN 982)