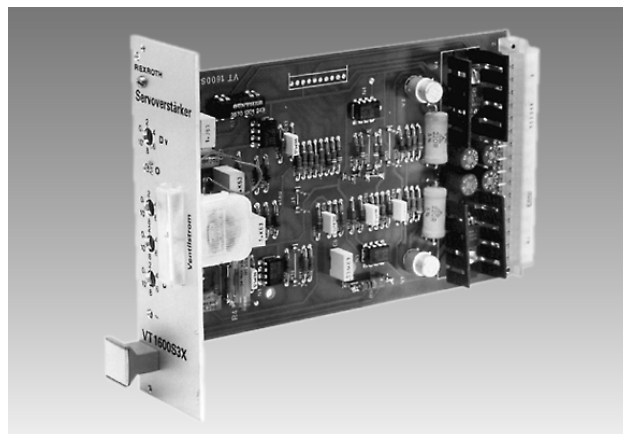


**MANNESMANN
REXROTH****Servo Amplifier VT 1600 (Series 3X)
Euro Card Format****RA
29 716/06.98****Replaces: 05.94**

Electronic amplifier cards Model VT 1600 are used to control servo valve (pilot) without LVDT feedback Model 4WS.EM, 2DS1EO, and 3DS2EH. Typically for closed loop applications.

They incorporate the following features:

- Voltage stabilizer to provide clean voltage for consistent and stable performance
- Face plate mounted ammeter for fast visual reference of current to the valve
- Integrated PID (proportional, integrator, derivative) control circuit which allows tuning for optimum performance of position control, or constant velocity circuits. With the added ability to combine the PI, PD, or PID controls for any circuit, which results in complete versatility
- 3 internal potentiometers accessible through the face plate for quick adjustment of the PID values
- Additional control input, control for use with VE 102, or UK 2 system cards, which allows increased control capabilities above the standard PID closed loop



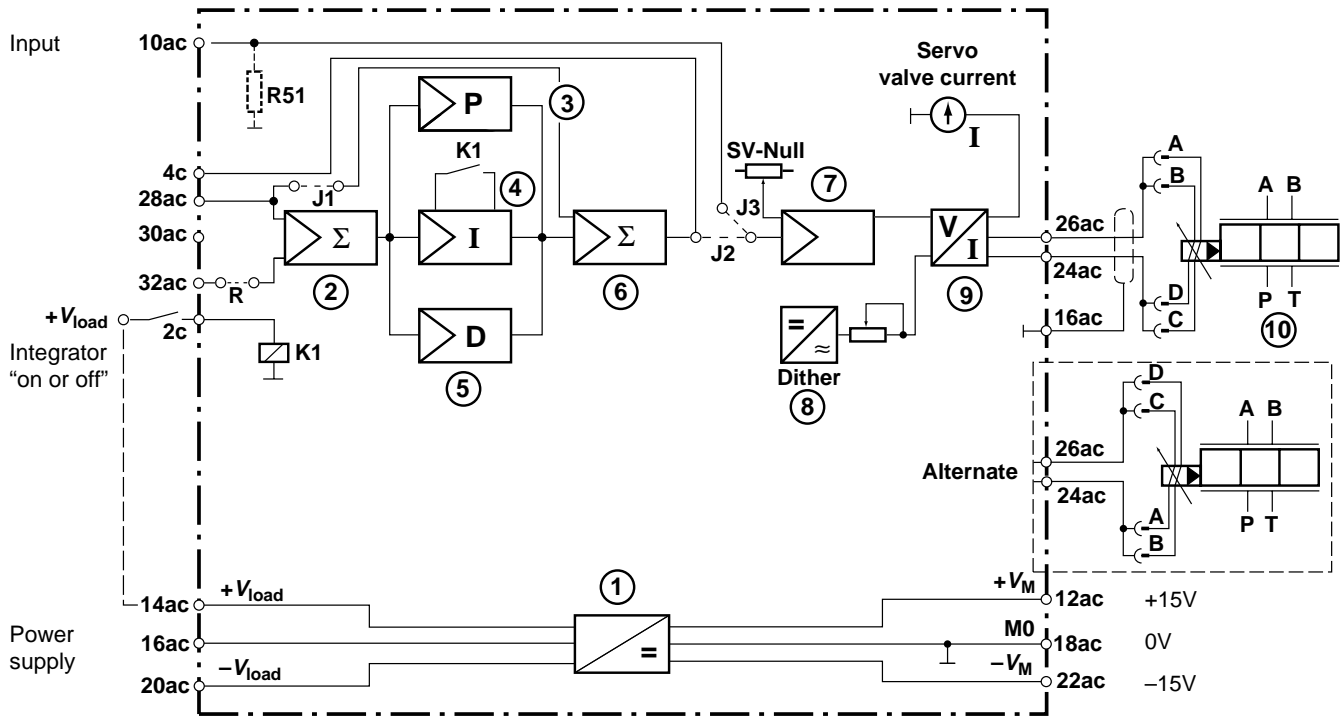
R 85/31
VT 1600 S 3X/E1

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

Power supply voltage	(E0)	V_{DC}	$\pm 15V$ regulated supply (voltage regulators removed)
	(E1)	V_{DC}	± 22 to $\pm 28V$ (voltage regulators installed)
Power supply current		I_{DC}	< 200 mA
Internal control voltage		V_{IN}	0 to $\pm 10V$
Output current		I_O	± 60 mA, ± 100 mA
Dither current (typical)		I_f	340 Hz/3 mA _{PP}
Relay data			
Relay coil voltage		V	22V to 28V
Duty cycle		t	1 ms
Nominal coil resistance		R	2000 Ω
Card dimensions			Euro card 100 x 160 mm (DIN 41 494)
Front plate dimensions			
– Height			3U [5.05 in (128 mm)]
– Width solder side	1 division		0.20 in (5.08 mm)
– Width component side			7 divisions
– Total width			8 divisions (8 HP)
Ambient temperature range		T	32 to 122 °F (0 to 50 °C)
Storage temperature			– 4 to 158 °F (– 20° to 70°C)
Weight (approx.)		w	0.33 lbs (0.15 kg)

Terminal connections VT 1600 S 3X

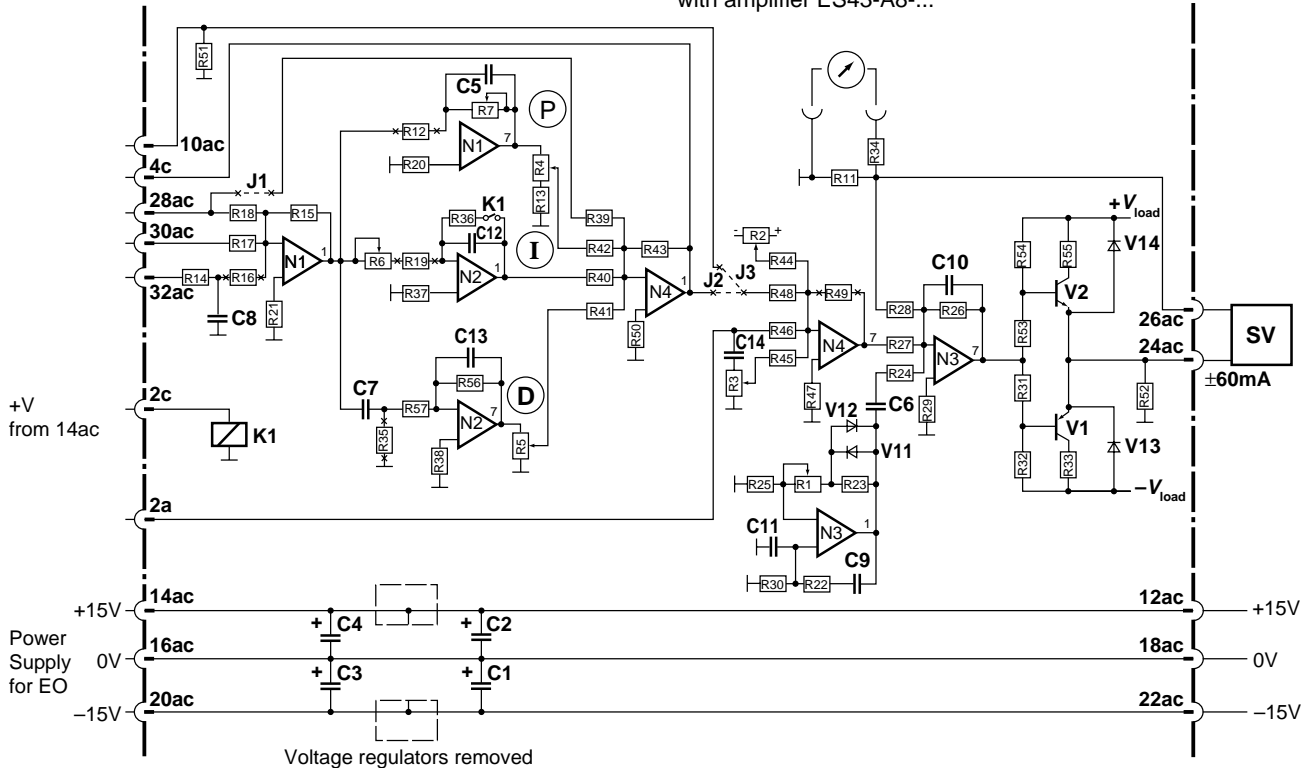
Block diagram



- | | | |
|-------------------------------|------------------------|----------------------|
| 1 Voltage regulator (E1 only) | 4 Integrator amplifier | 7 Voltage control |
| 2 Summing amplifier | 5 Derivative amplifier | 8 Dither oscillator |
| 3 Proportional amplifier | 6 Summing amplifier | 9 Output stage |
| | | 10 Servo pilot valve |

Detailed diagram

For full details, refer to drawing supplied with amplifier ES43-A8-...



Functional description

Electronic amplifier card VT 1600 drives a servo valve (10) without inductive feedback (LVDT). Typical valves include 4WS2EM, 4WS2EB, 3DS2EH, 4DS1EO, and A2V..HS pump with potentiometer feedback. An input signal is converted to a proportional current for the torque motor. The torque motor controls the pressure balance in the pilot valve.

In an unregulated power supply system, the VT 1600 voltage regulators (1) must be used (option code "1"). The dual supply is connected to pins 14ac (+22 V..+28 V), pins 16ac (0 V), pins 20ac (-22 V..-28 V). The card provides regulated voltage at pins 12ac (+15), pins 22ac (-15 V).

In a regulated ± 15 V power supply system, the VT 1600 voltage regulators must be removed (option code "0"). Otherwise, incorrect operation will result. The regulators are mounted on black heat sinks along the edge connector. Note that installing a card without regulators into an unregulated system will damage the amplifier. Regulated power is connected to pins 14ac (+15 V), pins 16ac (0 V), pins 20ac (-15 V).

The input at pin 10ac is a direct command to the valve driver, if J3 is installed. This is a common configuration that will bypass the external PID section (2-6). Standard range is 0 to ± 10 V. This input can be modified for 0 to ± 5 V or 4 to 20 mA.

The voltage control (7) scales the input to the valve amplifier stage (9). The "0" (zero) potentiometer can offset the input at pin 10ac. A dither signal (8) is added to the output to reduce hysteresis. Dither magnitude is adjusted by potentiometer R1 (~). The output amplifier is shown with parallel coils. Output current can be observed on the face plate with the servo ammeter.

A positive voltage at pin 10ac will provide a positive signal at pin 24ac to drive the valve. Refer to the valve data sheet for valve direction. When a 4WS2EM10 pins C and D are connected to pin 24ac, the second stage flows P to B. Reverse coil connections (C and D to 26ac) will cause flow P to A.

Inputs at pins 28ac, 30ac and 32ac are normally associated with closed loop applications. This command should be connected to pin 28ac. J1 is only installed for feed forward circuits. Feedback must be opposite in polarity. The signals are summed (2) together to develop an error voltage for the PID control circuit. Proportional (3) adjusts the loop gain. Integral (4) increases the signal if the error is maintained. Derivative (5) uses the rate of change to improve the response. The control values are combined (6) to become the valve command. J2 is normally installed when the PID section is used. J3 can be installed with an external jumper from 4c to 10ac to replace J2, when the PID section is used.

Parts of the PID are not used in some applications. Hardware changes can disable these corresponding potentiometers. The K1 relay only disables the Integral control when it is energized. This is selected when using Integral, but the system is not able to regulate in closed loop. Otherwise, the valve will start from an open condition when the system is able to begin regulation.

The VT 1600 is usually modified for valve type, application and power supply. An electrical schematic details the specific changes. Refer to this drawing and related documentation for more information. Include this drawing number when ordering spare parts. Other Rexroth groups may use an SO number or a second VT number (VT, 5-digits, A). For Rexroth (Bethlehem), the ES43-A8-... drawing number appears on 32 pin connector.



Ordering code

VT 1600 S 3X / 0 *

32 pin plug Euro card design
(for installation in Euro magazines and card holders) = S

Series 30 to 39
(30 to 39 externally interchangeable) = 3X

For new application, specify contact person and telephone, regarding control options
ES# is required for spares (prior to delivery, not prior to ordering).
The ES# is marked on the card connector.

Further details to be written in clear text

0 = without ± 15 V voltage regulator (± 15 V power)
1 = with ± 15 V voltage regulator (± 24 V power)
ES43-A8-... = Electrical schematic (assigned by Rexroth)

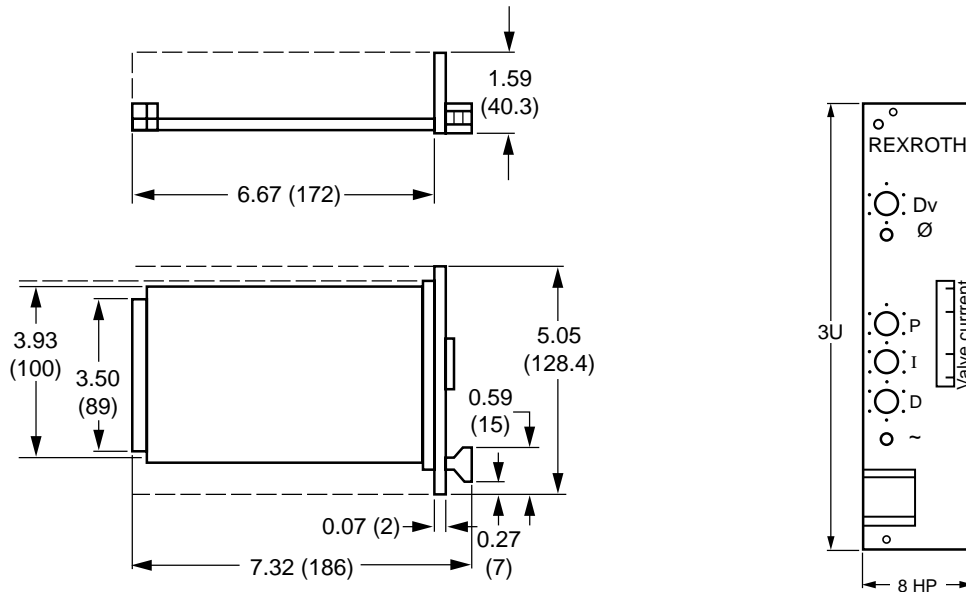
E = English face plate

Additional information

- Turn off power before connecting or disconnecting the amplifier card.
- Measurements to be made with high impedance meter $R_i > 100 \text{ k}\Omega$.
- Radio transmitters or similar devices may not be used within 3 ft (1 m) of the card.
- Switches used for input signal must handle currents under 1 mA (dry circuit contact, reed switches).
- Shield all control voltage wires, connect the card end of shield of panel ground on the enclosure and leave one end of the shield open.
- Do not run wires in the vicinity of power wires.
- Input and output terminals which are labelled with the suffix "ac" are internally connected, therefore connections may be made to either terminals "a" or "c".

Unit dimensions: dimensions in inches (millimeters)

VT 1600 S 3X



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