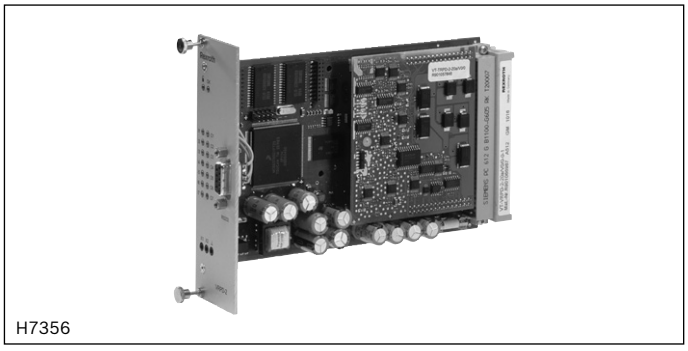
Digital valve amplifier for valve types 4WRE 6 ..., component series 2X 4WRE 10 ..., component series 2X

Type VT-VRPD-2

RE 30126
Edition: 2013-10
Replaces: 09.07



H7356

- Component series 2X
- Suitable for controlling proportional valves with electrical position feedback of types:
  4WRE 6, component series 2X
  4WRE 10, component series 2X

Features

- The user-specific data can be exactly reproduced and is protected against unintended or unauthorized adjustment
- Valve selection using the BODAC operating software
- Command value input, optionally as voltage or current interface
- Voltage input as differential input
- Command value input with variable input adjustment
- Ramp generator
- Digital inputs for calling up pre-set command value parameters
- Enable input and fault output
- Freely configurable measuring socket X2 (X1 fixed to actual valve value)
- Configuration and parameterization via serial interface with BODAC PC software (CD:SYS-HACD-BODAC-01) connection cable for BODAC
- Up to 32 valve amplifiers can be interconnected for parameterization and diagnosis via the local bus

Contents

Ordering code

01	02	03	04	05	06	07
VT-VRPD	**– 2 –**	**2X**	**/ V0**	**/ 0**	**– 0**	**– 1**

01	Digital amplifier for proportional valves with electrical position feedback	**VT-VRPD**
02	Amplifier for valve types 4WRE 6 ...-2X and 4WRE 10 ...-2X	**2**
03	Component series 20 ... 29 (20 to 29: Unchanged technical data and pin assignment)	**2X**
04	Basic device	**V0**
05	Without display	**0**
06	Basic device	**0**
07	With valve output stage (only suitable for valves with two solenoids)	**1**

Required accessories:

- PC program BODAC: CD ordering information: SYS-HACD-BODAC-01 (R900777335) or free download on the Internet at www.boschrexroth.com/hacd
- Interface cable: Cable set VT-HACD-1X/03.0/HACD-PC (R900776897) or standard 1:1 cable

Suitable card holders:

- Open card holder VT 3002-1-2X/64G (see data sheet 29928), mat. no. R900991843 (only for control cabinet installation)
- Connection adapter VT 10812-2X/64G (see data sheet 30105), mat. no. R900713826

Functional description

The valve amplifier is set-up as printed circuit board in Europe format 100 x 160 mm with daughter board, fitted on both sides. The central unit is a microcontroller controlling the entire process and realizing the position control. Data for configuration, command values and parameters are stored in a FLASH in a non-volatile form.
Four binarily coded digital inputs are used to call up parameter sets (command values) from the memory in which you can store a maximum of 16 sets. A call-up activates the command value for the control spool position with the related ramp times.
More control inputs have the following functions:

"Command value valid":	Enabling of the parameter set addressed by the current call-up (H active)
"Enable":	Activation of the outputs (acknowledgment of the fault message with low-high edge)

The valve amplifier comprises a controller for the control spool position of a proportional valve.

The command value can be preset via digital command value call-ups [5] and/or via analog inputs [1]. The analog input AI4 (b14/b16) is to be used for the command value presetting of ±10 V, the analog input AI6 (b22/b24) for any command value presetting from 4 to 20 mA.
Command values from 0 to +10 V (12...20 mA) control solenoid B.
Command values from 0 to –10 V (4...12 mA) control solenoid A.

The digital command value is added to the analog command value with the correct sign, according to the set call-up.
The command value inputs can be varied by means of software in the signal level.
Apart from the internal ramp generation option, you can also influence the ramp for "up" and "down" from external signals with correct total and correct sign by means of the AI2 (b6/b9) and AI5 (b18/b20) analog inputs.
For the 4WRE valves, the software offers a step function generator [9] for the realization of the overlap jump if an overlapped control spool is selected. The command value total is switched to the controller [12]. The actual valve value (b26) is generated from the valve position measurement system by means of an oscillator/a demodulator stage and also switched to the controller [12]. The controller output controls the flow-controlled output stages.

Enable and error messages
The control is activated by the H level at the enable input. If no command value call-up is active, the digital call-up 0 is set. Error logics [14] identify any control deviation, cable break of the actual value cables and the command value input for 4 to 20 mA as well as an inactive enable input. If there is an error, a fault message is output to (d22) by means of a low signal and displayed visually by the "OK" LED (OK goes out) on the front plate. It is possible to configure the enable so that an inactive enable input is not displayed as error.

Parameterization and diagnosis
Selection of the valve to be controlled and selection and configuration of the command value input, the ramp generator and the enable input as well as the setting of the command value call-up parameters are effected via the serial interface [6] at the front-side D-Sub socket [7]. Via the local bus, up to 32 valve amplifiers can be connected. Via BODAC, every valve amplifier is assigned a bus address. Reconnection of the serial interface cable is not required. For more information refer to the instructions 30126-01-B.

Digital outputs

DO 1	(d20)	Solenoid A active
DO 2	(d26)	Solenoid B active
DO 3	(z22)	Control error ≥ window
DO 4	(z24)	Freely configurable
DO 5	(z26)	Freely configurable
DO 6	(z28)	Freely configurable
DO 7	(f2)	Not assigned

Display elements and measuring sockets
The front plate of the command value card is equipped with measuring sockets for the two analog outputs.

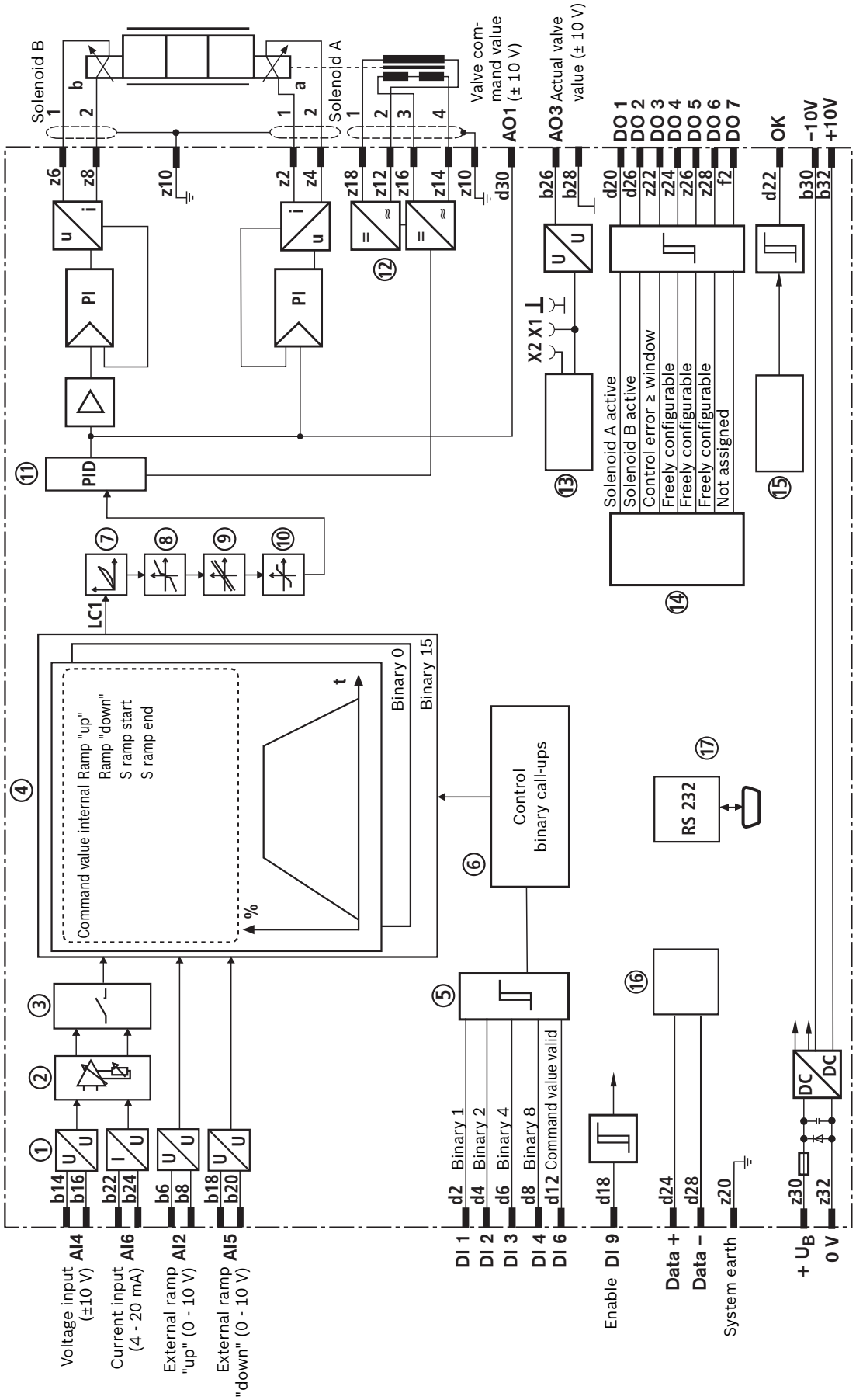
Measuring socket "X1":	Actual valve value (b26)
Measuring socket "X2":	Valve command value (default)
Measuring socket "⊥":	Reference potential (corresponds to port z32)

LEDs display the following states:

LED "🔓" (green):	Enable active
LED "OK" (green):	OK ready for operation
LEDs "I1"..."I4" (yellow):	Binarily coded command value call-ups
LED "I6" (yellow)	Command value valid
LED "I5, I7" (yellow)	Not assigned

[ ] = Assignment to the block diagram on page 4

Block diagram



1 U/U or I/U transformer
2 Analog input adjustment
3 Switching matrix
4 Switching power supply unit
5 Binary command value call-ups
6 Control of the binary call-ups
7 Characteristic curve adjustment
8 Step function generator
9 Offset
10 Limitation
11 PID controller
12 Oscillator / demodulator
13 Measuring sockets
14 Digital outputs
15 Error logics
16 Local bus
17 Serial interface

Measuring sockets:
X1 Actual valve value
X2 Valve command value (default)
⊥ Reference potential (0 V)

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

Valve amplifier VT-VRPD-2-2X/V0/0-0-1		
Operating voltage	U_B	24 VDC
Upper limit value	$u_B(t)_{max}$	30 V
Lower limit value	$u_B(t)_{min}$	21 V
Current consumption	I_{max}	1.5 A; standby current 270 mA
Fuse	I_S	4 A time-lag
Digital inputs	Signal	log 0 = 0 to 5 V
		log 1 = 16 V to U_B
Digital outputs	Signal	log 0 = 0 to 5 V
		log 1 = U_B – 3 V
		I_{max} = 30 mA, short-circuit protected
Analog inputs		
Voltage input AI4, AI2 and AI5		
Range	U	±10 V
Input resistance	R_e	100 kΩ, > 10 MΩ for input AI2
Resolution		5 mV for range ±10 V 2.5 mV for range 0...10 V
Non-linearity		< 10 mV
Current input (only AI6)		
Range	I	4...20 mA
Input resistance	R_e	100 Ω
Leakage current		0.15 % (with 500 Ω between pin b24 and 0 V)
Resolution	I	5 µA
Analog outputs		
Voltage outputs AO1 and AO3		
Output voltage	U	±10 V
Load	R_{Lmin}	1 kΩ
Resolution	U	1.25 mV (14 bit)
Residual ripple		±15 mV (without noise)
Ramp time	t	Max. 300 s
Valve output stage		
Solenoid current per solenoid	I_{max}	2.5 A
Reference voltage	U	±10 V, 30 mA, short-circuit-proof
Residual ripple		< 20 mV
Oscillator frequency	f	5.7 kHz
Scan time for command value preparation	t	2 ms
Serial interface		RS 232 (front plate), D-Sub socket
Type of connection		64-pole male multipoint connector, DIN 41612, design G
Local bus, distance to the furthermost device	l	Max. 280 m line length
Card dimensions		Euro-card 100 x 160 mm, DIN 41494
Front plate dimensions		
Height		3 HE (128.4 mm)
Width soldering 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 +70 °C
Weight	m	0.2 kg

Notice:
Information on the **environment simulation testing** for the areas EMC (electro-magnetic compatibility), climate and mechanical load, see data sheet 30126-U (environmental compatibility statement).

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

Valve 4WRE...-2X (not included in the scope of delivery)		
Solenoid		
Current consumption per solenoid	I_{max}	2.5 A
Solenoid coil resistance		
Cold value at 20 °C	R	2.7 Ω
Max. hot value	R	4.5 Ω
Electrical connection		Plug-in connection according to DIN EN 175301-803
Protection class according to EN 60529		IP 65 with mating connector correctly mounted and locked
Position transducer		
Carrier frequency	f	5 kHz
Coil resistance (at 20 °C):		
Between ports 1 and 2	R	113 Ω
Between ports 3 and 4	R	101 Ω
Electrical connection		Plug-in connection according to DIN 43650-BFZ-Pg9
Protection class according to EN 60529		IP 65 with mating connector correctly mounted and locked

Pin assignment of the male multipoint connector

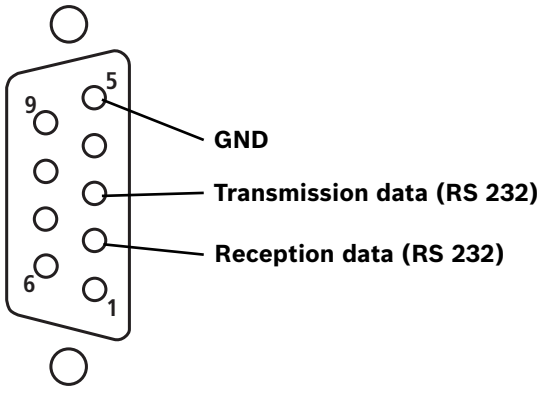
Row d		
Pin	**Short denomination**	**Description**
2	DI 1	Binary 1
4	DI 2	Binary 2
6	DI 3	Binary 4
8	DI 4	Binary 8
10	DI 5	n. c.
12	DI 6	Command value valid
14	DI 7	n. c.
16	DI 8	n. c.
18	DI 9	Enable
20	DO 1	Solenoid A active
22	OK	OK output
24	Data+	Local bus
26	DO 2	Solenoid B active
28	Data–	Local bus
30	AO 1	Valve command value
32	AO 2	n. c.

Row b		
Pin	**Short denomination**	**Description**
2	n. c.	n. c.
4	n. c.	n. c.
6	AI 2+	Ramp + (U)+
8	AI 2–	Ramp + (U)–
10	n. c.	n. c.
12	n. c.	n. c.
14	AI 4+	Command value (U)+
16	AI 4–	Command value (U)–
18	AI 5+	Ramp – (U)+
20	AI 5–	Ramp – (U)–
22	AI 6+	Command value (I)+
24	AI 6–	Command value (I)–
26	AO 3	Actual valve value ±10 V
28	AGND	Analog GND
30	REF–	–10 V
32	REF+	+10 V

Row z		
Pin	**Short denomination**	**Description**
2	MA+	Solenoid A+
4	MA–	Solenoid A–
6	MB+	Solenoid B+
8	MB–	Solenoid B–
10	Shield	Shield
12	L 1O–	Position transducer of valve feed –, pin 2
14	L 1I–	Position transducer of valve actual value –, pin 4
16	L 1I+	Position transducer of valve actual value +, pin 3
18	L 1O+	Position transducer of valve feed +, pin 1
20	System earth	System earth
22	DO 3	Control error ≥ window
24	DO 4	Freely configurable
26	DO 5	Freely configurable
28	DO 6	Freely configurable
30	UB	Supply voltage
32	LO	Weight

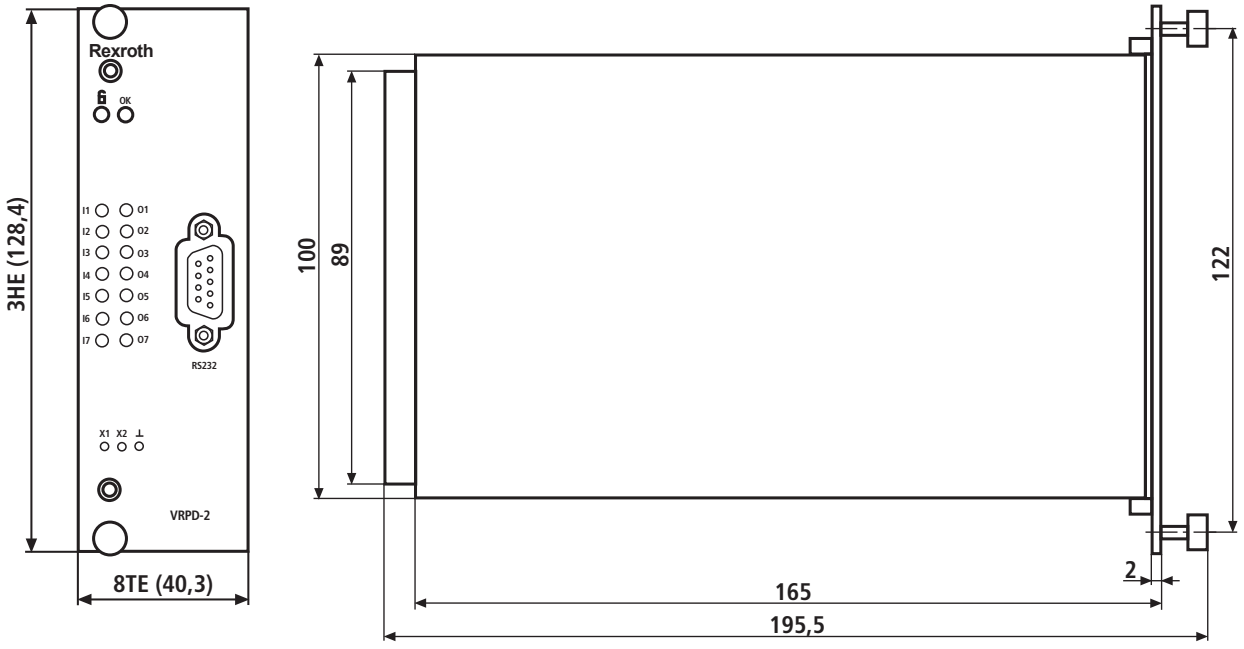
Row f		
Pin	**Short denomination**	**Description**
2	DO 7	n. c.
4	n. c.	n. c.
6	n. c.	n. c.
8	n. c.	n. c.
10	n. c.	n. c.
12	n. c.	n. c.
14	n. c.	n. c.
16	n. c.	n. c.
18	n. c.	n. c.
20	n. c.	n. c.
22	n. c.	n. c.
24	n. c.	n. c.
26	n. c.	n. c.
28	n. c.	n. c.
30	n. c.	n. c.
32	n. c.	n. c.

Pin assignment of the D-Sub socket



RS 232

Dimensions (dimensions in mm)



Project planning / maintenance instructions / additional information

Product documentation for valve amplifier VT-VRPD-2-2X/V0/0-0-1

- 30126
  Technical data sheet (this document)
- 30126-B
  Installation and operating instructions
- 30126-01-B
  Commissioning and operating instructions
- 30126-U
  Environmental compatibility statement
- 30126-Z
  Additional information for replacing the VT-VRPD-2-1X by VT-VRPD-2-2X

- The valve amplifier may only be unplugged and plugged when de-energized.
- No 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 kΩ.
- For switching command values, relays with gold-plated contacts have to be used (low voltages, low currents).
- Always shield command value lines and lead them separately; connect shielding to port z10 on the card-side, other side open (risk of ground loops).
- For solenoid conductors up to 50 m in length, use the line type LiYCY 1.5 mm². With greater lengths, please contact us.
  Recommendation: Also shield the solenoid conductors.
- Use highly flexible CU conductors (at least 2.5 mm²) in order to connect the system earth.
  The system earth is a main part of the EMC protection of the valve amplifier. It is intended to eliminate interferences which are transported via the data and supply lines. However, this is only possible if the system earth itself does not introduce interferences into the command value card.
- 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.
- The charging power of the smoothing capacitor on the card requires the pre-fuses to be of a slow-blowing nature.
- **Notice:** If a **differential input** is used, **both inputs must always be connected or disconnected at the same time**.