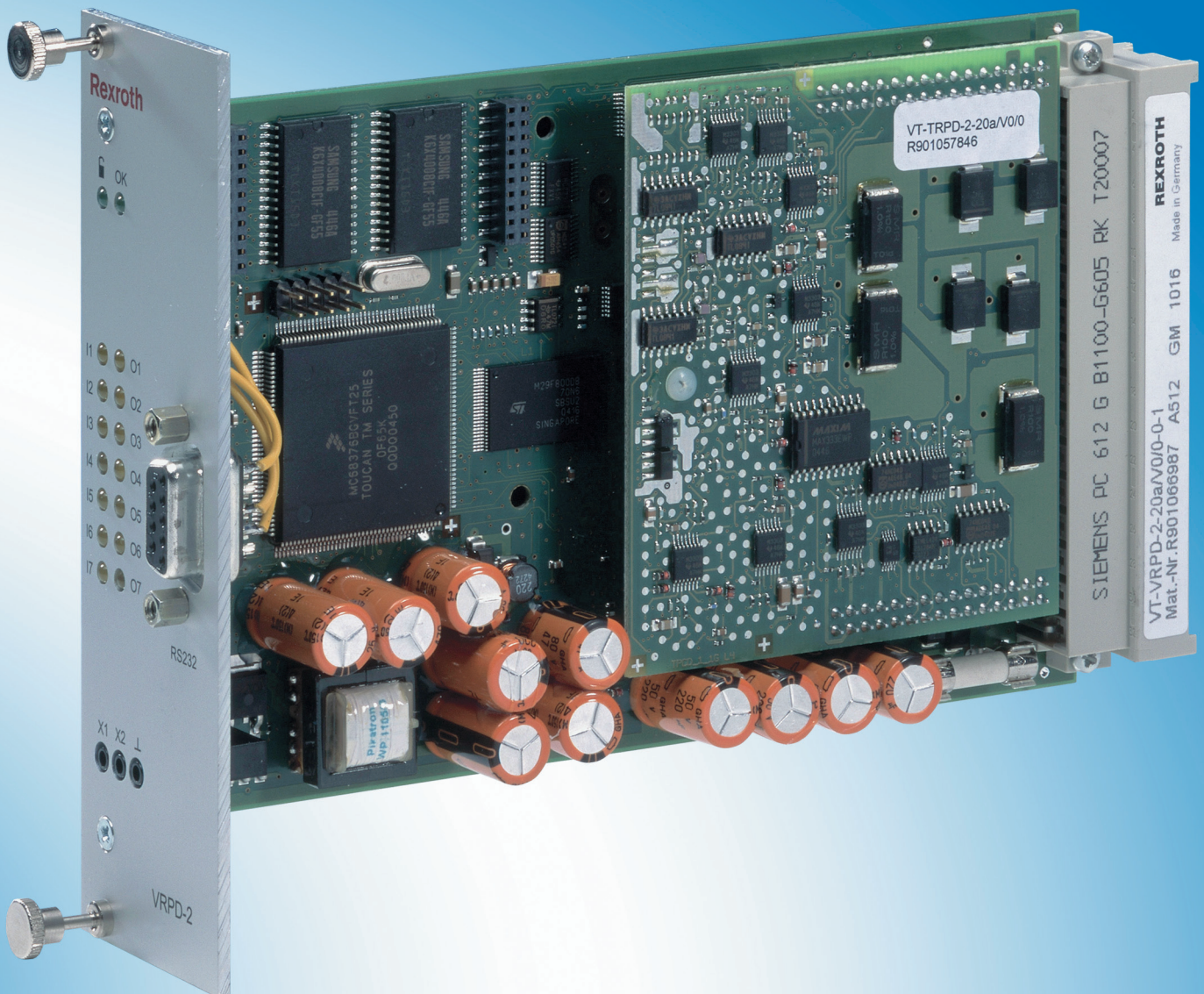


VT-VRPD-2 – Digital valve amplifier for valve types 4WRE 6, component series 2X 4WRE 10, component series 2X

RE 30126-B/09.13
Replaces: 08.07

Installation and Operation



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1 General

1.1 About this Manual

Before installing or operating your VRPD Controller card for the first time, you should read this Manual. Please note the safety requirements described in section 2.1.

Persons involved with the start-up and operation of the controller card should have proper training on the installation and operation of this type of equipment.

This manual is intended to inform you about the functions of this controller card and its intended use.

The Manual contains important safety instructions on proper installation and operation of the controller card. Observing these instructions will help you:

- avoid hazards and dangers
- minimize repair costs and downtime
- increase the useful life and reliability of the controller card

Additionally, please observe all regulations that are in effect in the country and/or community to prevent accidents and to protect the environment.

This manual only describes the installation and operation of the controller card. Information about starting up the controller card using BODAC software is located in a separate document: "Operation of the BODAC Software and Starting up the VRPD Control Card". A list of documentation for the VRPD can be found in the "Additional Documentation" section.

Additional Documentation

Additional information to this document "VRPD Digital Control for Electro-mechanical and Electro-hydraulic Drives is available.

It contains:

- RE sheet "RE 30 126" in paper form.
- Document "RE 30 126-B " Starting up the VRPD Control Card and Operation of the BODAC Software ".
- Internet: <http://www.boschrexroth.com/HACD>

1 General

Characters and Symbols

The following characters and symbols are used in the manual:

- Action symbol: The text following this symbol describes actions. These should be performed, from top to bottom, in the given order.
- ✓ Result symbol: The text following this symbol describes the results of an action.



Following this symbol you will find notes and useful tips for optimal use of the controller card..

Warning symbols

Special safety notes are provided at the relevant locations. These are indicated by the following symbols.



General hazard potential

Indicates a potentially hazardous condition which, if not avoided, could result in death or serious injury

If the hazard source can be specifically indicated, the corresponding pictogram will be used.



Electrical current hazard

This symbol refers to a hazardous condition caused by electrical current which, if not avoided, could result in death or serious injury.



Equipment damage

This symbol pertains to actions which could result in damage to equipment.

1.2 Scope of Supply

The equipment is packed in anti-static packaging to protect the controller card from electrostatic discharge. Observe instructions on the top side of the packaging.

Included in the shipment:

- Controller Card VRPD
- RE sheet RE 30 126-B

1.3 Requirements

Mounting the controller card in a card holder

- VT 3002-2x/G64

described in datasheet RE 29 928.

The card holder should be used only inside a control cabinet, as there is no protection from accidental contact.

If no power is provided by the user, the following power supply is available as an option:

- VT-NE30

described in datasheet RE 29 929.

2 Installing the VRPD

2 Installing the VRPD

2.1 Safety Requirements

Operate the VRPD controller card only if it is not damaged and is in proper operating condition and is applied for its intended purpose. Observe all safety and hazard instructions in the included documentation.

When faults occur, which compromise safety and result in changes in operating conditions, shut down the controller card immediately and notify responsible personnel.

Fault free and safe running of the controller card assumes appropriate transport, storage and installation, as well as proper startup and operation.

The VRPD Control Card has been built using the latest technology, and in accordance with recognized safety standards. Nevertheless, operation may result in hazard to persons or property if:

- The VRPD Controller Card is not used properly.
- The VRPD Control Card is not installed, commissioned and operated by qualified persons.
- Changes or modifications are made to the VRPD controller card.
- Safety requirements and safety notes are not observed.

The VRPD controller card is intended for industrial use.

The card must not be operated until it has been determined that the system in which the controller card is installed, meets all applicable standards and safety regulations for the application.

In European countries: EC Directive 89/392/EEG (Machine Directive)

Operation is permitted only when applicable EMC regulations for the application are met.

Adherence to limits defined by regulations and standards are the responsibility of the manufacturer of the system or machine.

In European countries: EC Directive 89/336/EEG (EMC Directive)

In the United States: National Electrical Code (NEC) and National Electrical Manufacturers Association (NEMA), as well as local standards should be observed. The operator is required to adhere to the above named standards at all times.

Proper Use

The VRPD is designed to control Electromechanical and Electrohydraulic Drives.

Possible application areas are:

- Valve Amplifiers

Proper use requires adherence to the manuals and supplementary documentation, and observing relevant safety and operating standards.

Personnel Selection and Qualifications

Operation and Startup

Operation and startup of the VRPD controller card requires specialized skills. Therefore this work should be performed only by properly trained individuals.

Only persons who are trained or properly instructed should start up and operate the VRPD controller card. Additionally the oversight of a qualified supervisor may be advised.

Personnel are considered qualified if they are familiar with the installation, startup and operation of the VRPD controller card, and with all the warning notes and safety regulations contained in the accompanying documentation.

Work on the electrical equipment must be performed only by qualified specialists or by personnel appropriately instructed and under the supervision and guidance of persons qualified and familiar with electrical safety standards.

An electrical specialist is someone who, based on his technical knowledge and training, as well as knowledge of the relevant standards, is able to evaluate the tasks assigned to him, recognize potential hazards and take the appropriate safety measures.

Repair and troubleshooting

Repair and troubleshooting requires specialized skills. Therefore, this work should be performed only by trained and designated specialists.

Design Changes and Electrical Installation

User changes to the VRPD controller card may result in safety hazards.

Note the following recommendations on electrical installation:

- Use low-capacitance cables. Make cable connections without intermediate connections whenever possible.
- Control electronics should be isolated from electromagnetic noise sources (IE: V/F drives).
- Power wiring should not be routed in the vicinity of control electronics.
- Power wiring should not be routed in the vicinity of control wiring or cables.
- Route sensor lines separately.
- Maintain a distance of at least 1 meter from antenna lines, RF devices and radio equipment.
- When using differential inputs switch both inputs on and off at the same time.
- When switching signal inputs, use dry circuit rated relays with gold-plated contacts (low voltages, low currents)
- Always shield all analog signal lines. Connect shields at the card end only, connecting to the "Shield" terminal, and leave the other end open to prevent ground loops.
- Connect to an appropriate system ground using stranded copper wire (min 2.5mm² / 12 AWG)
- The system ground is an essential component of the EMC protection for the controller card. The ground provides a path for noise that could otherwise enter the controller card through the signal and power supply lines. Noise is bypassed only if the system ground does not couple noise into the controller card.

2 Installing the VRPD

- Bosch Rexroth also recommends shielding solenoid wiring.
- Do not use logical signals from the controller card (IE: "OK" signal) for switching machine safety circuits (see European Norm "Safety Requirements for Fluid Power Systems and Components" EN982:1996).

2.2 Repair and Troubleshooting

If the control cabinet contains additional electrical components utilizing high voltage, always observe safety standards to prevent accidents! Use appropriate protective gear, such as safety shoes and safety gloves, when prudent!

Use appropriate tools (IE: insulated tools)

Before opening control cabinet doors, open the main disconnect.

To ensure safe working conditions, observe the following safety rules:

- Remove all power
- Ensure against unintended energization: lockout devices when possible, and use lockout warning tags
- Verify that voltage is not present
- Cover or close off adjacent areas that are still energized.

If work on energized components is necessary, have a second person present as a safety backup to actuate an E-STOP switch or open the main disconnect, if necessary. Use insulated tools only.

2.3 Transport, Storage and Handling the Controller Card

The packaging contains notes on handling of the controller card. These must be strictly followed.

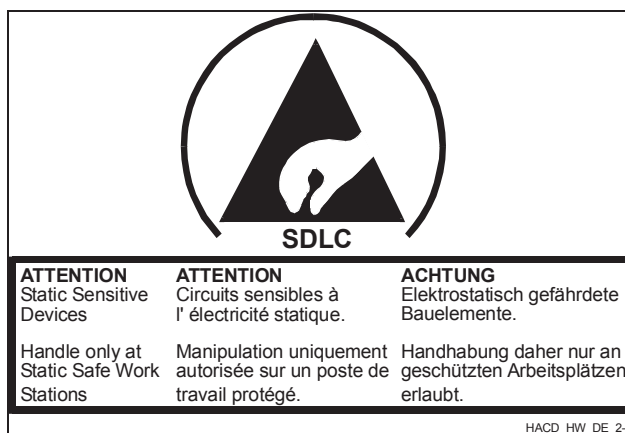


Fig. 1 Notes for handling printed on the packaging

Observe the following:

- Keep the controller card away from moisture and dust
- Observe the allowable storage temperature range of -20°C to $+70^{\circ}\text{C}$. (allowable operating temperature: $0 - 50^{\circ}\text{C}$)



Electrostatic discharge (ESD) can damage components on the controller card. To prevent damage, observe the following recommendations.

Discharge static voltage from your body using accepted practices.

Work in a safe environment. Do not use any devices in the working environment that generate or hold static charge. Avoid working with the controller card in areas where floors or work surfaces is composed of materials that can generate a static charge.

Handle the controller card carefully. Do not touch any exposed pins or electronic components.

Transport and store the control card in its original packaging.

2 Installing the VRPD

2.4 Card Installation

Remove the card from its packaging only at a protected work place.

Do not touch any electrical components when placing the controller card in its proper card holder as shown in Fig. 2.

Correctly installing the VRPD controller card:

- Remove power from the rack when installing the card.
- Hold the card by the front panel and remove it from the packaging.
- Slide the card into the guide rails of the rack without using excessive force, as shown in Fig. 2 Installing the controller card.
- Snap the edge connector in place by gently pressing on the front panel.

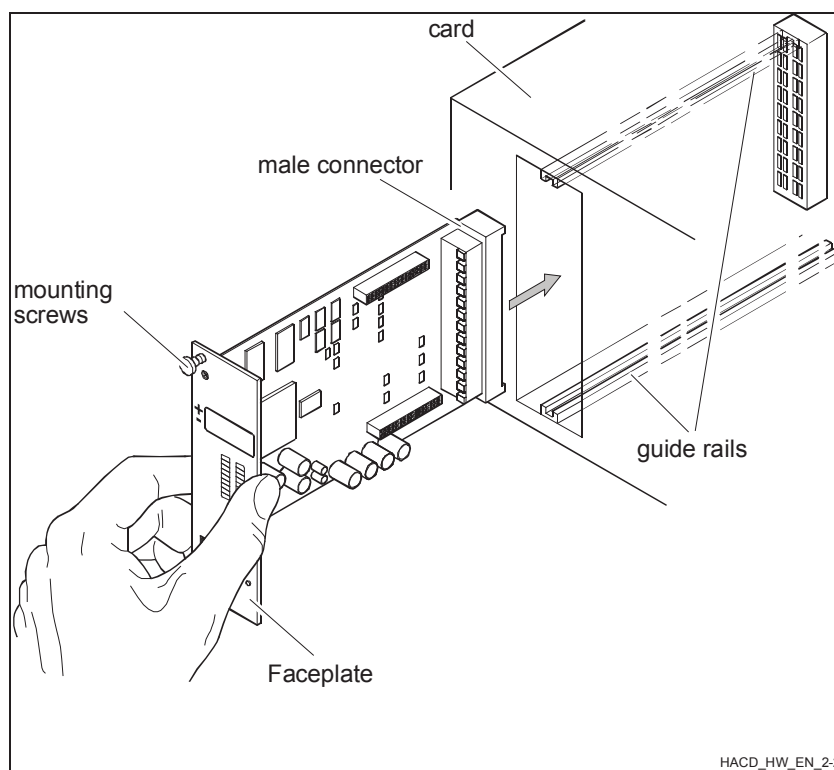


Fig. 2 Installing the controller card

- Tighten the two mounting screws on the front panel.
- ✓ The card is now installed correctly.

2.5 Edge Connector Terminals and Pin Assignments

The edge connector is a 64-pin, Type G (DIN 41612).

The pin assignments for the edge connector are not fully downward compatible with older amplifier products.

Differences in pin assignments have been implemented such that damage is prevented if an old controller card (VT 12350-3x or VT 12352-3x) is replaced by a VRPD controller card.

Row d	Pin	Description	Type
	2	DI 1	Discrete input
	4	DI 2	Discrete input
	6	DI 3	Discrete input
	8	DI 4	Discrete input
	10	DI 5	n. c.
	12	DI 6	Discrete input
	14	DI 7	n. c.
	16	DI 8	n. c.
	18	DI 9	Discrete input
	20	DO 1	Discrete output
	22	OK	Discrete output
	24	Data +	Local CAN Bus Input/Output
	26	DO 2	Discrete output
	28	Data –	Local CAN Bus Input/Output
	30	AO 1	Analog output
	32	AO 2	n. c.

Tab. 1 Pin assignment of edge connector Row d

2 Installing the VRPD

Row b	Pin		
	Pin	Description	Type
	2	AI3+	n. c.
	4	AI3-	n. c.
	6	AI2+	Differential input
	8	AI2-	Differential input
	10	AI1+	n. c.
	12	AI1-	n. c.
	14	AI4+	Differential input
	16	AI4-	Differential input
	18	AI5+	Differential input
	20	AI5-	Differential input
	22	AI6+	Differential input
	24	AI6-	Differential input
	26	AO3	Analog Output
	28	AGND	Analog GND
	30	REF-	Reference voltage -10V
	32	REF+	Reference voltage +10V

Tab. 2 Pin assignment of edge connector Row b

Row z	Pin		
	Pin	Description	Type
	2	MA+	Solenoid a +
	4	MA-	Solenoid a -
	6	MB+	Solenoid b +
	8	MB -	Solenoid b -
	10	Shield	Shield
	12	L1O-	LVDT valve pin 2
	14	L1I-	LVDT valve pin 4
	16	L1I+	LVDT valve pin 3
	18	L1O+	LVDT valve pin 1
	20	Ground	System ground
	22	DO 3	Discrete output
	24	DO 4	Discrete output
	26	DO 5	Discrete output
	28	DO 6	Discrete output
	30	U _B	Supply voltage
	32	LO	Supply GND

Tab. 3 Pin assignment of edge connector Row z

2 Installing the VRPD

Row f	Pin		
	Description		Type
	2	DO 7	n. c.
	4	SSI Clk +	n. c.
	6	SSI Clk -	n. c.
	8	AI7+	n. c.
	10	AI7-	n. c.
	12	Ua2	n. c.
	14	/Ua2	n. c.
	16	Ua0	n. c.
	18	/Ua0	n. c.
	20	L2O-	n. c.
	22	L2I-	n. c.
	24	L2I+	n. c.
	26	L2O+	n. c.
	28	GND_CAN	n. c.
	30	CANL	n. c.
	32	CANH	n. c.

Tab. 4 Pin assignment of edge connector Row f

2.6 Installation Local Bus

The local bus is used to connect the individual amplifier cards of the HACD family.

Up to 32 cards can be connected. Each amplifier must be assigned a clear bus address.

The connection is established using a CAN protocol with a baud rate of 250kbit. The maximum length of the most distant amplifier cards must not exceed 280m. Moreover, the maximum length of the branch lines of 1 m must be observed.

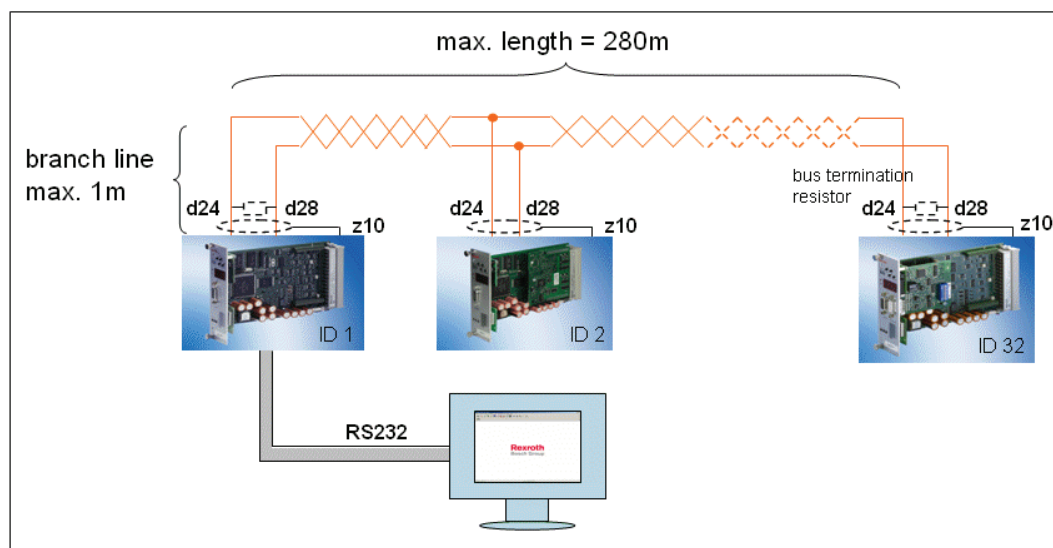


Fig. 3 Schematic structure of "Local Bus"



Data is to be transmitted via a shielded twisted-pair cable.

Two bus terminating resistors of 120 Ohm are required.

2 Installing the VRPD

2.7 Connecting the proportional valve

When connecting the proportional valve, be sure that the solenoid cables are routed separately from the inductive position transducers.

It is strongly recommended that the solenoid cable is shielded.

For lengths up to 50 m cable 2 x 1.5 mm² of type LiYCY-CY (16 AWG double-shielded cable) is recommended. When double shielded cable is used the outer shield can be terminated entering the control cabinet and the inner shield needs to be terminated at the controller card.

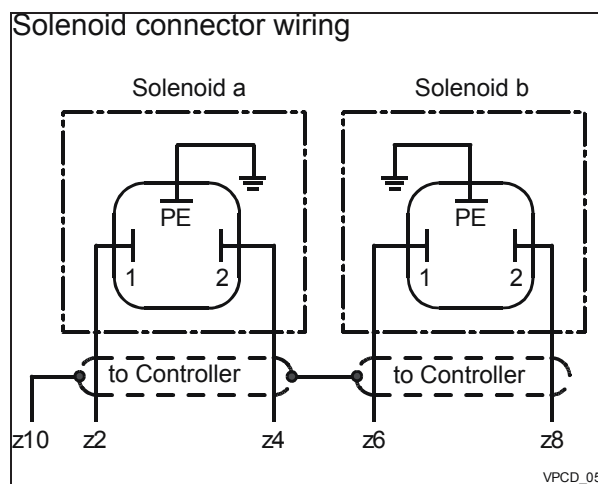


Fig. 4 Connecting the solenoids

A CECc 75301-803-A002FA-H3008-G cable connector according to DIN EN 175 301-803 and ISO 4400 is recommended for connecting the solenoids.

- Solenoid a, cable connector color gray
Order separately under material number **R901017010**
- Solenoid b, cable connector color black
Order separately under material number **R901017011**



Single-solenoid valves are to be connected to solenoid A+/A-. The solenoid B+/B- connection then remains open. For single-solenoid valves, only positive command values are recognized as being valid.



When using single-solenoid valves in conjunction with current input b22/b24, it must be noted that range +/-100% is set as default setting. To be able to utilize the full range 0...20mA, range 0~100% must be set.

2.8 Connecting the valve position transducer

Connection for the valve position transducer is shown in the following illustration.

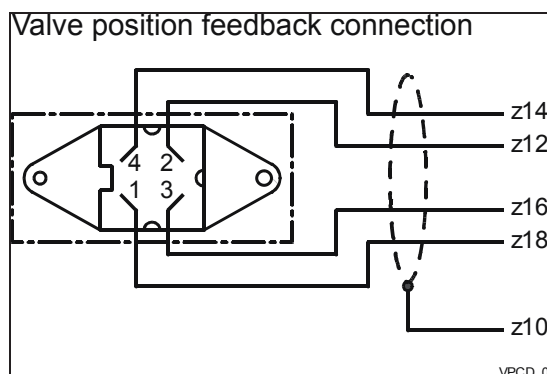


Fig. 5 Connecting the valve transducer

The transducer is connected using a 4-pole cable connector Pg7-G5W1F, which can be ordered separately under material number **R900023126**.

Cable 4 x 0.25 mm² of type LiYCY-CY (4 x 30 AWG Double shielded cable) is recommended for lengths up to 50 m.

The shield should be connected to z10 on the edge connector of the controller on the supply side only.

3 Startup of the VRPD Controller Card

3 Startup of the VRPD Controller Card

3.1 Preparing for Use

The startup procedure for the VRPD controller card depends on a variety of factors that are determined by the individual application. For this reason, only the basic startup steps are described in this manual.

Preparing the controller card for use:

- Carefully check cabling.
- Apply power to the VRPD controller card.

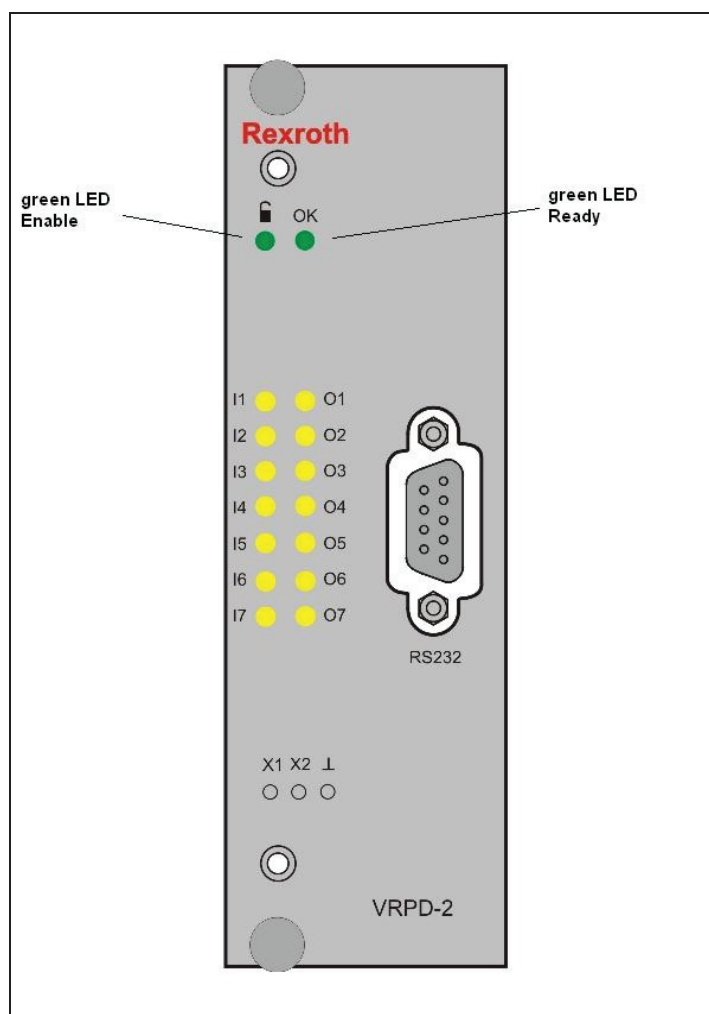


Fig. 6 Front panel of the VRPD Controller Card

- ✓ The controller card performs an internal function test.
- ✓ The display on the controller card shows the manufacturer name and version number in scrolling text (when powered up)

3.2 Installing BODAC software

BODAC software (ordering code SYS-HACD-BODAC-01 ordering number R900777335) can download via Internet (www.boschrexroth.com/hacd). This software is used for initial startup and as a convenient configuration and monitoring tool for the controller card. BODAC can be used to configure the settings and parameters for optimal operation of the VRPD controller card. The connected VRPD card configures the function, menus and program windows in BODAC. This makes using the software easy.

Installation Requirements

Hardware 100% IBM compatible PC with the following minimum requirements:

- 200 MHz Pentium processor (or equivalent)
- 32 MB working memory (RAM)
- VGA graphics card, minimum resolution: 800x600 pixels
- Hard drive with minimum 2 MB available space
- CD-ROM drive
- Mouse
- Available serial port

Software ■ Operating system: Windows 2000 / XP.

If the hardware/software requirements are met, you can install BODAC as described in the next section.

BODAC Setup

To start the installation of BODAC, execute the "Setup.exe" file.

Installing BODAC software:

- Insert the CD-ROM and locate the file "Setup.exe".
- Double-click on "Setup.exe".
- ✓ The setup program will load and display a start screen.
- To run Setup, follow the instructions on the screen.
- ✓ BODAC software will then be installed.

3 Startup of the VRPD Controller Card

3.3 Initial startup with BODAC

After installing the VRPD controller card in a rack, as described in section 2.4 "Card Installation", and all initial steps have been completed properly, the card startup is ready.

Before proceeding with the following steps, be sure that the following requirements have been met:

- Serial interface cable is available
- A serial port on the PC is available
- BODAC software is installed.

Proceed with the initial startup:

- Connect serial cable (ordering number R900776897) to the connector on the VRPD card.
- Plug serial cable into the serial port (COM) on the PC (or use USB-converter – S/N R90166684).
- ✓ The VRPD card and PC are now connected.
- Start the BODAC software.
- Perform the software-side startup as described in the "Starting up the VRPD Control Card and Operation of the BODAC Soft-ware" document.

4 VRPD Operation

4.1 Display/Input Keys and Connectors on the Front Panel

You can use the display, input keys and connectors on the front panel of the VRPD to check parameters and settings, attach diagnostic instruments and connect the card to a PC.

The following illustration shows an overview of the display, input keys and connectors on the front panel.

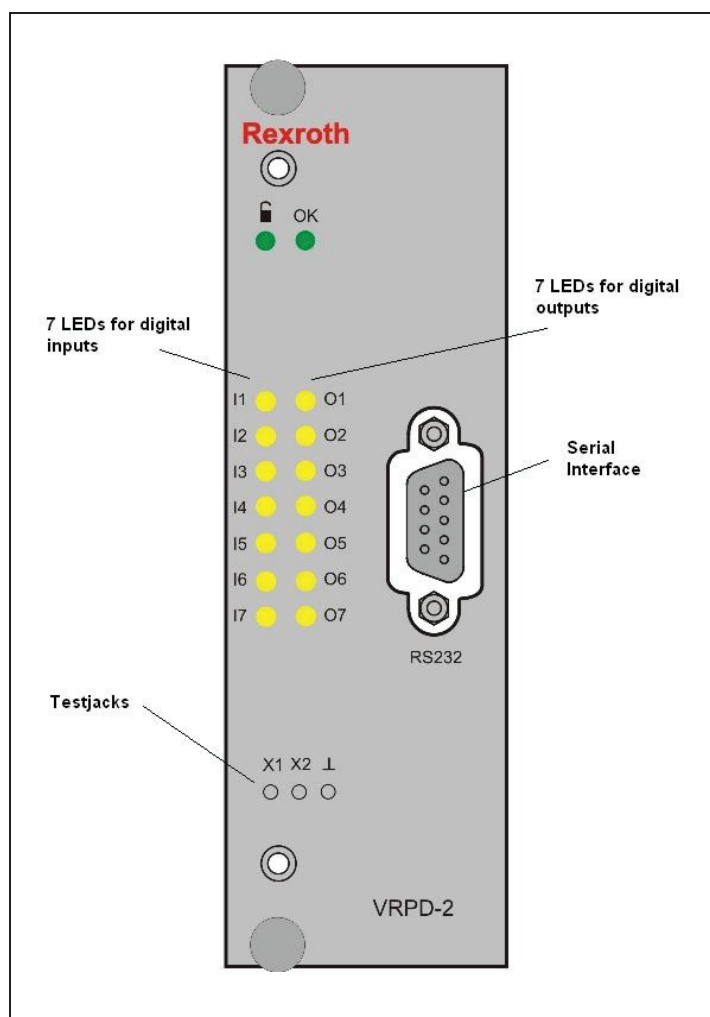


Fig. 7 Display, input keys and connectors on the control card

LEDs for Discrete I/O

The input LEDs indicate the state of the discrete input signals. The output LEDs show the state of discrete outputs from the controller card. When a signal is present on a discrete I/O, the associated LED will illuminate.

4 VRPD Operation

Serial port The serial port on the front panel is configured as a standard RS-232 port using a 9-pin D-Sub female connector. A standard 9 pin serial data cable is used to connect the serial port to a PC.

4.2 Diagnostics Test Jacks

The diagnostic test jacks on the front panel of the card can be used to connect external test instruments. Two analog voltage signals are available to perform measurements.

5 Diagnostics

5.1 Diagnostic Options on the VRPD Controller Card

Diagnostics terminal

X1

X2

⊥

Diagnostics test jack "X1"

Diagnostics test jack "X2"

The diagnostic test jacks on the front panel of the VRPD controller card (see section 4.1 Display/Input Keys and Connectors on the Front Panel, Fig. 7) provide two analog outputs with the following ratings:

- X1, 10 Volts for test equipment having R_i 100 k Ω)
- X2, 10 Volts for test equipment having R_i 100 k Ω)
- COM, ground

Here, you can select the signal to be measured. The following signals can be output: Pressure command value, swivel angle command value, power command value, actual valve value, actual pressure value, and actual swivel angle value.

5.2 Diagnostics Using BODAC

The BODAC software includes additional detailed diagnostics capabilities.

The "Motion Data" screen and the "Status" screen display the current status of the controller card and of the connected sensors and devices.

Motion Data Screen

The Motion Data screen displays the internal control signal values in the controller card. This provides a quick overview of the process status and values.

Status Screen

The Status screen is used to display the status of the controller card. Each entry will display either "OK", "WARNING" or "ERROR" as a value.

For additional information on the Motion Data screen and the Status screen, refer to document "Starting up the VRPD Control Card and Operation of the BODAC Software".

6 Detecting Errors

6 Detecting Errors

6.1 Error Messages

Error message	Description
+/- 10V Source	Reference voltage +10V (b32) or Reference voltage –10V (b30) outside the specified range.
Power 24V	Power supply Ub (z30) less than Ub min.
DO1~DO7, „OK“ Short	Short circuit of one or more of the 8 digital outputs.
Memory Checksum	Checksum error in Program- or Parameter memory (Flash or EEPROM)
Memory error	Error in Memory (RAM)
Version mismatch	Version Mismatch between the internal software
Analog Input AI2 (Ramp+)	The value of the analog input AI2 is not within the valid signal range.
Analog Input AI4 (Setpoint U)	The value of the analog input AI4 is not within the valid signal range.
Analog Input AI5 (Ramp-)	The value of the analog input AI5 is not within the valid signal range.
Analog Input AI6 (Setpoint I)	The value of the analog input AI6 is not within the valid signal range.
Following error	Following error is the difference between the setpoint (Ic1) and the actual value (LVDT). The value (Window) and time-delay (Debounce) of the following error are configurable.
LVDT primary/secondary	The LVDT cable is defective (Cable break or Short circuit).
Short circuit Sol. A/B	A short-circuit condition is present on the amplifier output(s) for the solenoids.

6.2 Changing fuses

The controller card is protected against overload by means of a fuse. The fuse is the following type:

■ F / 4A / 250V



NOTE!

The fuse is defective and must be replaced!

The fuse has opened due to mechanical damage or a product defect.

In this case, replace the fuse with a new one of the type indicated above.

The fuse has opened due to external connections, IE: externally connected components or wiring connected to the controller card have faulted.

In such cases, diagnose and correct the problem that caused the fuse to open.

Only then replace the fuse with a new one.

Replacing the fuse on the VRPD Control Card:

- Remove VRPD controller card the card holder (reverse of the procedure described in section 2.4 Card Installation)
- Gently remove the fuse from the fuse holder (see Fig. 8 Fuse on the VRPD Controller Card).

6 Detecting Errors

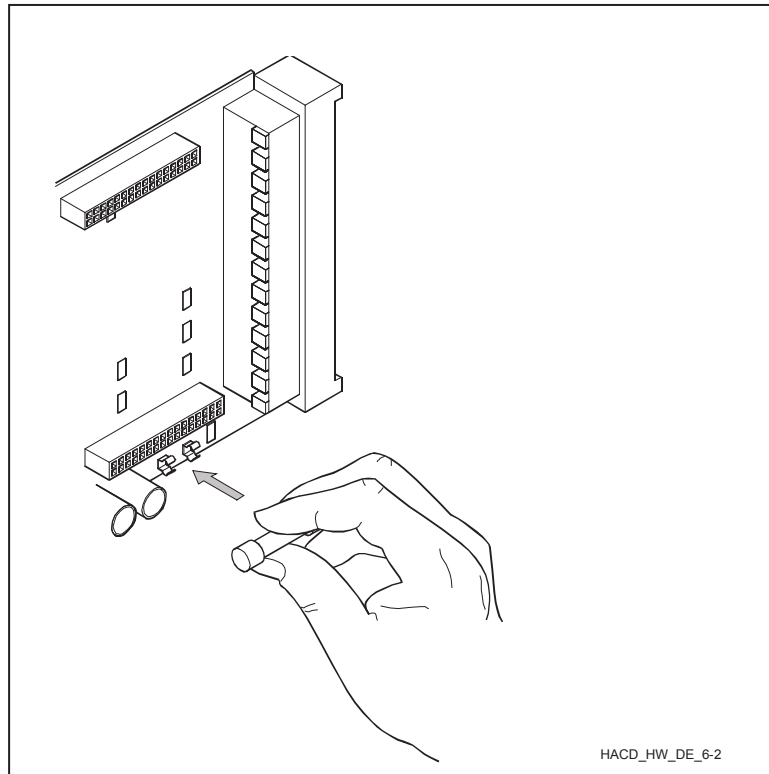


Fig. 8 Fuse on the VRPD Controller Card

- Use a suitable test device to check the fuse. (continuity test)
- If the fuse is defective, replace it with the same type.
- Reinstall the VRPD controller card and perform a functional test.

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