

Digital axis control

VT-HMC...1X



The data specified only serve to describe the product.

If information on the use of the product is given, it is only to be regarded as application examples and recommendations.

Catalog specifications do not constitute assured characteristics. The information given does not release the user from the obligation of own judgment and verification. It must be remembered that our products are subject to a natural process of wear and aging.

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An example configuration is shown on the title page.

The product delivered may differ from the image on the cover.

Translation of the original operating instructions. The original operating instructions were prepared in German language.

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1 About this documentation

1.1 VALIDITY OF THE DOCUMENTATION

This documentation is valid for the digital axis control VT-HMC of series 1X.

This documentation is intended for fitters, operators, service technicians, system operators and machine manufacturers.

This documentation contains important information on the safe and proper mounting, transport, commissioning, operation, use, maintenance, demounting and simple troubleshooting of the product.

- Read this documentation thoroughly, especially Chapter 2 “Safety instructions” and Chapter 3 “General notes on damage to property and damage to the product”, before working with the digital axis control.

1.2 REQUIRED AND SUPPLEMENTARY DOCUMENTATION




- The product must not be commissioned until you have been provided with the documentation marked with the book symbol  and you have understood and observed it. The documentations can be found on the product site or at www.boschrexroth.com/mediadirectory.

Tabelle 1: Required and supplementary documentation

Title	Document number	Document type
 Digital axis control, type VT-HMC...1X	RE 30239	Data sheet
 Online help in commissioning software IndraWorks		Integrated help
Rexroth HydraulicDrive HDS-16, HDx-17 to HDx-20, Parameters	RE 30330-PA www.boschrexroth.com/hmc	Parameter description
Rexroth HydraulicDrive, Functions	RE 30338-FK www.boschrexroth.com/hmc	Functional description
Rexroth HydraulicDrive HDS-16, HDx-17 to HDx-20, Diagnostic Messages	RD 30330-WA www.boschrexroth.com/hmc	Description of diagnostic messages
Rexroth HydraulicDrive, Rexroth IndraMotion MLD (2G)	RE 30336-AP www.boschrexroth.com/hmc	Application manual
Rexroth HydraulicDrive, Rexroth IndraMotion MLD (2G), Libraries	RE 30336-RE www.boschrexroth.com/hmc	Library description
Release Notes	RD 30330-RN www.boschrexroth.com/hmc	Firmware Release Notes

1.3 REPRESENTATION OF INFORMATION

In order that this documentation allows you to work directly and safely with your product, standardized safety notes, symbols, terms, and abbreviations are used. For a better understanding, they are explained in the following sections.

1.3.1 Safety instructions




In this documentation, safety instructions precede a sequence of activities whenever there is a risk of personal injury or damage to equipment. The hazard avoidance measures described must be observed.

Safety instructions are structured as follows:

 SIGNAL WORD
Type and source of danger! Consequences in case of non-compliance <ul style="list-style-type: none"> ► Hazard avoidance measures ► <Enumeration>

- **Warning symbol:** draws attention to a hazard
- **Signal word:** identifies the degree of hazard
- **Type and source of danger:** Specifies the type and source of danger
- **Consequences:** describes the consequences in case of non-observance
- **Precaution:** specifies how the hazardous situation can be prevented


Tabelle 2: Hazard classifications according to ANSI Z535.6-2011

Warning sign, signal word	Meaning
 DANGER	Indicates a hazardous situation which, if not avoided, will certainly result in death or serious injury.
 WARNING	Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
 CAUTION	Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
NOTICE	Damage to property: The product or the environment could be damaged.

1.3.2 Symbols

The following symbols indicate notices which are not safety-relevant but increase the comprehensibility of the documentation.

Tabelle 3: Meaning of the symbols

Symbol	Meaning
	If this information is disregarded, the product cannot be used or operated in an optimum manner.
►	Individual, independent action
1.	Numbered instruction:
2.	The numbers indicate that the actions must be carried out one after the other.
3.	

1.3.3 Designations

The following terms are used in this documentation:

Tabelle 4: Designations

Designation	Meaning
VT-HMC...1X	Digital axis control
IndraWorks	Software
RE xxxxx	Rexroth document in English language
Vencoder_ANA	Supply voltage for external sensors

1.3.4 Abbreviations

The following abbreviations are used in this documentation:

Tabelle 5: Abbreviations

Abbreviation	Meaning
CPU	C entral P rocessing U nit
I/O	I nputs/ O utputs
EMC	E lectromagnetic c ompatibility
FAT32	32-bit F ile A llocation T able
FC	F requency c onverter
HMC	H ydraulic M otion C ontrol
PC	P ersonal C omputer
PLC	P rogrammable L ogic C ontrol
PELV	P rotective E xtra L ow V oltage
n.c.	n ot c onnected

2 Safety instructions

2.1 ABOUT THIS CHAPTER

The product has been manufactured according to the generally accepted codes of practice. However, there is still a risk of personal injury and damage to property if you do not observe this chapter and the safety instructions in this documentation.

- ▶ Read this documentation completely and thoroughly before working with the product.
- ▶ Keep this documentation in a location where it is accessible to all users at all times.
- ▶ Always include the required documentation when you pass the product on to third parties.

2.2 INTENDED USE

The product is an electrical component.

You may use the product as follows:

- For controlling one or two hydraulic axes in position control, force control, alternating control (position/pressure or force) and velocity control in the operating modes of direct valve control, drive-controlled position control, drive-controlled positioning and positioning block mode, optional position synchronization master/slave, average, min/max (optional) and optional force synchronization.

The product is intended exclusively for professional use and not for private usage.

Operation according to the intended use also implies that you have read and understood this documentation completely, especially chapter 2 “Safety instructions”.

2.3 IMPROPER USE

Any use other than described in the section “Intended use” is considered as improper and is therefore not permitted.

The installation or use of inappropriate products in safety-relevant applications could result in unintended operating states in the application which in turn could cause personal injuries and/or damage to property. Therefore, please only use a product for safety-relevant applications if this use is expressly specified and permitted in the documentation of the product. For example, in explosion-protection areas or in safety-related parts of a control (functional safety).

Bosch Rexroth AG does not assume any liability for damage caused by improper use. The user assumes all risks involved with improper use.

Improper use includes, but is not limited to:

- operating the digital axis control outside the specified performance limits and operating conditions, especially the prescribed ambient conditions;
- the use as safety-related part of controls in the sense of DIN EN ISO 13849. Functional safety must be realized by means of appropriate, additional components.

2.4 QUALIFICATION OF PERSONNEL

The activities described in this documentation require basic knowledge of electrics and hydraulics as well as knowledge of the associated technical terms. In order to ensure safe use, these activities may only be carried out by an expert in the respective field or an instructed person under the direction and supervision of an expert.

Experts are those who are able to recognize potential hazards and apply the appropriate safety measures due to their professional training, knowledge and experience, as well as their understanding of the relevant requirements pertaining to the work to be undertaken. An expert must observe the relevant specific professional rules and have the necessary expert knowledge.

With regard to hydraulic products, expertise means, for example:

- Reading and completely understanding hydraulic circuit diagrams,
- in particular, completely understanding the correlations regarding safety equipment and
- knowledge of the function and structure of hydraulic components,

Operating the digital axis control VT-HMC...1X implies that the operator is familiar with the PC program IndraWorks. We recommend that users attend a product-specific training by Bosch Rexroth.

Documentation about IndraWorks and download options can be found at:
www.boschrexroth.com/IndraWorks



Bosch Rexroth offers training courses that support your qualification in specific fields. An overview of the training contents can be found on the Internet at: www.boschrexroth.com/didactic. Or contact our online support via the e-mail address support.automation@boschrexroth.de

2.5 GENERAL SAFETY INSTRUCTIONS

- Observe the valid regulations on accident prevention and environmental protection.
- Observe the safety regulations and provisions of the country in which the product is used/applied.
- Exclusively use Rexroth products in technically perfect condition.
- Observe all notices on the product.
- Persons who install, commission, operate, demount or maintain Rexroth products must not consume any alcohol, drugs or pharmaceuticals that may affect their ability to respond.
- Only use accessory and spare parts released by the manufacturer in order to rule out personnel hazards arising from unsuitable spare parts.
- Comply with the technical data and ambient conditions specified in the product documentation.
- If unsuitable products are installed or used in safety-relevant applications, unintended operational states can occur in these applications, which can cause personal injury and damage to property. Therefore, use the product only in safety-relevant applications, if this use is expressly specified and permitted in the documentation of the product, for example, in explosion-protection areas or in safety-related parts of a control (functional safety).
- You may commission the product only when it has been established that the final product (for example, a machine or system), in which the Rexroth product is installed, complies with national regulations, safety regulations and standards relevant for the application.

2.6 PRODUCT- AND TECHNOLOGY-RELATED SAFETY INSTRUCTIONS



WARNING

Hazardous movements!

Risk of injury due to incorrect connection or incorrect activation of the digital axis control and resulting unforeseeable machine movements.

- ▶ Observe safety in accordance with EN 13849 or IEC 62061.
- ▶ If persons have to enter the hazard zone while the control is active, provide superordinate monitoring functions or measures for personal safety. These measures must be provided according to the specific data of the system and on the basis of the risk and error analysis of the system manufacturer/user. In this connection, the safety provisions applied for the system must be taken into account.
- ▶ Failures and defects in the control current or the energy supply can result in uncontrolled machine movements. Observe safety in accordance with EN ISO 13849 or IEC 62061.
- ▶ The electronics emits interference to other electronics within the permitted limit values. This can cause malfunction in the control process. Only use electronics below the EMC limit values or provide appropriate shielding.
- ▶ The electronics of the digital axis control VT-HMC...1X responds to electromagnetic interference from non-shielded, improperly installed or wrongly connected signal cables. If the limit values given in the data sheet are exceeded, malfunction or uncontrolled movements are possible. Adhere to the limit values given in the data sheet, use only electronics below the EMC limit values or provide proper shielding.
- ▶ Electrostatic processes, an inadequate grounding concept or missing equipotential bonding can lead to damage to the electronics and hence cause malfunction or uncontrolled movements of the machine. Ensure proper grounding and provide equipotential bonding.
- ▶ Using the product outside the specified IP protection class can result in short-circuit and malfunction and hence in uncontrolled machine movements. Therefore, use the product only within the IP protection class and in environments as specified in the data sheet.
- ▶ Provide safety functions for personal safety separately. The digital axis control VT-HMC...1X itself does not include safety functions for personal safety and is no safety-related component.

High electrical voltage by incorrect connection!

Danger to life, risk of injury due to electric shock.

- ▶ When carrying out any work, disconnect the relevant machine section from the power supply and protect it against being switched on again.
- ▶ Only connect devices, electrical components and cables which feature protective extra low voltage (PELV) to connections or terminals having voltages from 0 to 50 Volt.
- ▶ Only connect voltages and power circuits that feature safe isolation from dangerous voltages. Safe isolation can be achieved with isolation transformers, safe optocouplers or mains-free battery operation.

Lightning!

Risk of uncontrolled machine movements.

- ▶ An inadequate grounding concept or missing equipotential bonding can lead to damage to the electronics. Provide for equipotential bonding of the device.

2.7 PERSONAL PROTECTIVE EQUIPMENT

Check determined personal protective equipment for completeness and protective effect and wear it (observe customer regulations and list of personal protective equipment).

2.8 OBLIGATIONS OF THE MACHINE END-USER

The operation of installations, systems and machines basically requires the implementation of a holistic IT security concept which is state-of-the-art in terms of technology. Accordingly, Bosch Rexroth products and their properties must be considered as components of installations, systems and machines for their holistic IT security concept.

Unless otherwise documented, Bosch Rexroth products are designed for operation in local, physically and logically secured networks with access restrictions for authorized persons, and they are not classified according to IEC 62443-4-2.

3 General notes on damage to property and damage to the product

NOTICE

High voltage!

The digital axis control may be damaged.

- ▶ Wire the digital axis control only when disconnected from the power supply.

Wrong cables! Power loss, scorching of cable!

Risk of damage to the product!

- ▶ Only use the cables specified in the data sheet with the respective cable cross-sections for the digital axis control.

Overloading!

Risk of overloading and damage to the supply cable in the case of insufficient dimensioning and/or operation with several electrical devices.

- ▶ Provide current limitation by overload protection.
- ▶ Select an appropriate rating of the power supply unit and cable.

Short-circuit!

Risk of overloading and damage of the supply cable in the case of defects of the electrical device.

- ▶ Provide current limitation by overload protection.

Impermissible temperature range!

Risk of overheating. The device can be thermally destroyed.

- ▶ Adhere to the specification in the data sheet.

The warranty only applies to the delivered configuration.

The warranty becomes void if the product is incorrectly mounted, commissioned or operated, not used as intended and/or handled improperly.

4 Scope of delivery

The scope of delivery includes:

- Digital axis control VT-HMC...1X
- Mating connectors for XD1 and XG20/XG21:
 - XD1: Weidmüller BLZF 3.50/03/180F SN BK...
 - XG20/XG21: Weidmüller B2CF 3.50/30/180 LH SN BK...
 - Keying elements: Weidmüller B2L/S2L 3.50 KO BK BX

Accessories such as cables and mains adaptor and cable sets are not included in the scope of supply, but have to be ordered separately. See also chapter 7.2 “Recommended accessories” on page 17.

5 About this product

5.1 PERFORMANCE DESCRIPTION

The VT-HMC...1X is a digital axis control with integrated axis controller and optional PLC functionality in accordance with IEC 61131-3. The VT-HMC...1X can be used to realize position/pressure/force/velocity controls, alternating control (position/pressure) as well as optionally synchronization (position synchronization master/slave, average, min/max and force synchronization). For the synchronization function you require the optional SD card.

For implementing project planning and parameterizing the VT-HMC...1X the engineering tool IndraWorks is provided.

5.2 PRODUCT DESCRIPTION

With regard to immunity to interference, resistance to mechanical vibration and shock as well as climate resistance, the VT-HMC...1X is designed for use in harsh industrial environments.

Controller variants The VT-HMC...1X comprises three configurable controller variants:

- Position control
- Force control
- Pressure control
- Alternating control (position/pressure or force)
- Velocity control
- Position synchronization master/slave, average, min/max (optional)
- Force synchronization (optional)

Operating modes These allow, among others, the following operating modes to be implemented:

- Direct valve control
- Drive-controlled position control
- Drive-controlled positioning
- Positioning block mode

Command values and actual values Command values are provided via the bus interfaces (XF20/XF21 or XF30), via the analog interface (XG20/XG21) or alternatively via an internal PLC program.

The actual value signals are fed back to the higher-level control either via the bus interfaces (XF20/XF21 or XF30) or the analog/digital interface (XG20/XG21).

Engineering tool IndraWorks Parameterization and diagnostics as well the implementation of the project are carried out using the PC software IndraWorks Ds, which is available for the individual control types as download on the Internet at www.boschrexroth.com/hmc. It allows you to parameterize the VT-HMC...1X individually and adapt it to the requirements of your axes. Moreover, IndraWorks supports you in commissioning and diagnostics and provides for convenient data administration on the PC. A precondition for this is the PC operating system Windows 7 or higher.

For creating a user-specific PLC program, the engineering tool IndraWorks MLD has to be used. IndraWorks MLD has to be ordered separately.

Monitoring The digital control electronics features comprehensive monitoring functions, fault detection and more.

- Undervoltage
- Communication errors
- Cable break for analog sensor inputs and digital position measuring system
- Short-circuit monitoring for analog/digital outputs
- Monitoring of the microcontroller (watchdog)
- Temperature of electronics
- Overcurrent of 24 V sensor voltages and digital outputs

Measuring system The measuring system of the hydraulic axes is incremental or absolute (SSI), analog ± 10 V and 4 to 20 mA.

Memory card The VT-HMC...1X is provided with a slot for an SD memory card. It can be used for saving the PLC program and other optional data. Only SD memory cards with SPI bus interface up to max. 4 GB are supported. When the control is switched on, the card must be plugged, otherwise it is not recognized. Not-FAT-formatted cards are automatically formatted (FAT32).

General information For process interfacing, the digital axis control VT-HMC...1X is equipped with analog and digital inputs/outputs and with various bus systems. For more complex machines it is useful to employ a higher-level control that, in conjunction with the VT-HMC...1X, holistically controls the motion sequence of the machine and monitors it in view of safety.

Main fields of application of the VT-HMC...1X are machine tools, plastics machines, special machines, presses, and transfer systems.

The technology functions comprise:

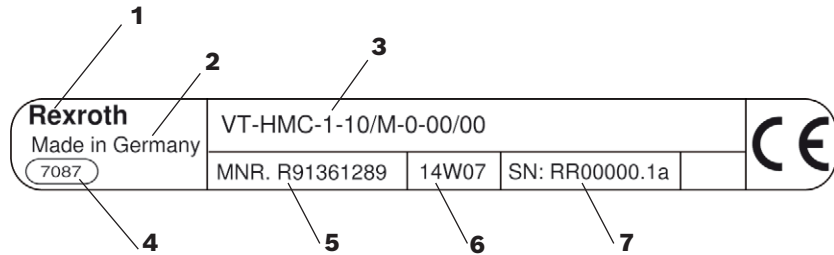
- Sequence programming
- Positioning
- Pressure/force control
- Differential pressure control
- Position synchronization master/slave, average, min/max (optional)
- Force synchronization (optional)

The basis for function of the VT-HMC...1X is the creation of application-specific parameter sets and, if required, user programs. These data are generated on the PC and sent via TCP/IP to the VT-HMC...1X. The combination of user program and parameter sets is called project.

The technical data, operating conditions and operating limits of the axis control VT-HMC...1X can be found in the data sheet.

5.3 IDENTIFICATION OF THE PRODUCT

At the side of the VT-HMC...1X there is a label showing the most important data.



- | | |
|-----------------------|----------------------|
| 1 Word mark | 5 Material number |
| 2 Country of origin | 6 Date of production |
| 3 Material short text | 7 Serial number |
| 4 Plant | |

6 Transport and storage

There are no special transport instructions for this product. You must, however, observe the notes in Chapter 2. "General safety instructions" and comply with the ambient conditions for storage and transport which are detailed in the technical data of data sheet 30239.

6.1 STORING THE VT-HMC...1X

Proceed as follows in order to prepare the VT-HMC...1X for storage and further use:

- ▶ Use the original packaging for storage.
- ▶ Comply with the admissible storage temperature range of +5 °C to +40 °C.
- ▶ Protect the VT-HMC...1X against dust, humidity and UV radiation

7 Installation

NOTICE

Risk of short-circuit!

Water may condense within the housing!

- ▶ Let the VT-HMC...1X acclimate itself for several hours, as otherwise water may condense in the housing.

The housing of the VT-HMC...1X is provided with cooling slots. According to the specified protection class, dirt and fluids may easily enter and cause malfunction and short-circuit! The reliable operation of the VT-HMC...1X is thus no longer ensured.

- ▶ When working on the VT-HMC...1X, observe strictest cleanliness and make sure that no fluids will enter the housing.

Major potential differences!

Risk of destruction of the VT-HMC...1X by plugging or unplugging connectors under voltage.

- ▶ Switch off power supply to the relevant system part before installing the unit or plugging or unplugging connectors.

7.1 INSTALLATION CONDITIONS

- ▶ When installing the VT-HMC...1X, strictly adhere to the ambient conditions specified in data sheet 30239.

NOTICE:

- ▶ Keep the surroundings free from electrically conductive contamination (acids, bases, corrosive agents, salts, metal vapors, etc.) and do not expose the device to these substances. Generally rule out any deposits according to protection class IP 20. Avoid contact with the hydraulic fluid.

The VT-HMC...1X is intended for snapping onto DIN mounting rails in the control cabinet. The dimensions of the individual variants are given in data sheet 30239.

- ▶ Before commissioning, make sure that all the seals and plugs of the plug-in connections are correctly installed to ensure that they are leak-proof and no fluids or foreign particles can enter the product.
- ▶ Install the VT-HMC...1X vertically. To ensure sufficient venting, the cooling slots at the top and bottom have to be at least 2 cm away from covers and walls.

7.2 RECOMMENDED ACCESSORIES

We recommend the use of the following accessories for connecting the axis control VT-HMC...1X. These accessories are not included in the scope of delivery, but can be ordered separately from Bosch Rexroth:

Tabelle 6: Accessories

Designation	Material no.
CONNECTION PLUG 6ES7972-0BA42-0XA0 for port XF30 (PROFIBUS)	R901312863
PLUG SET VT-HMC...-1X/M...*ET	R961011116
SERVICE PACKAGE VT-HMC...-1X/M...shielding *ET	R961011117
SD MEMORY CARD XA-SD=1 (1 GByte)	R911173844
SD-card for synchronization, VT-SD-HMC-SYNC-000-001-000-000	R901512467
Connection cable PC VT-HMC (RJ45, XF20 or XF21)	R911321548
Commissioning software IndraWorks Ds of version 14V12 or higher (without PLC functionality)	
Commissioning software IndraWorks MLD of version 14V18 or higher	



IndraWorks Ds can be used only for parameterization and diagnostics. IndraWorks MLD is required, if the PLC functionality according to IEC 61131-3 is to be used additionally. The commissioning software IndraWorks MLD is subject to licensing. For further information, please visit www.boschrexroth.com/hmc.

7.3 INSTALLING THE VT-HMC...1X

- ▶ Lay cables and lines so that they cannot be damaged and no one can trip over them.
- ▶ By snapping the housing of the VT-HMC...1X on a conductive and earthed mounting rail, the earth connection is established with the rear wall of the control cabinet. This constitutes the RF grounding of the VT-HMC...1X.
- ▶ Do not use any silicone-containing sealants, adhesives or insulating agents.
- ▶ Ensure maintenance-friendly installation, i.e. simple access to the connection lines. Ensure free access to the connection side.
- ▶ Before installing the device, note the details given on the nameplate. If nameplates are no longer visible or legible after installation you will have the data at hand at any time.

Mount the VT-HMC...1X as follows on a mounting rail in the control cabinet:

- 1.** Disconnect the relevant system part from the power supply.
- 2.** Snap the back panel of the VT-HMC...1X carefully into position on the DIN mounting rail. Mechanical contact points on the rear panel of the VT-HMC...1X ensure firm seating on the DIN mounting rail and the connection of the housing to the grounding system of the control cabinet.

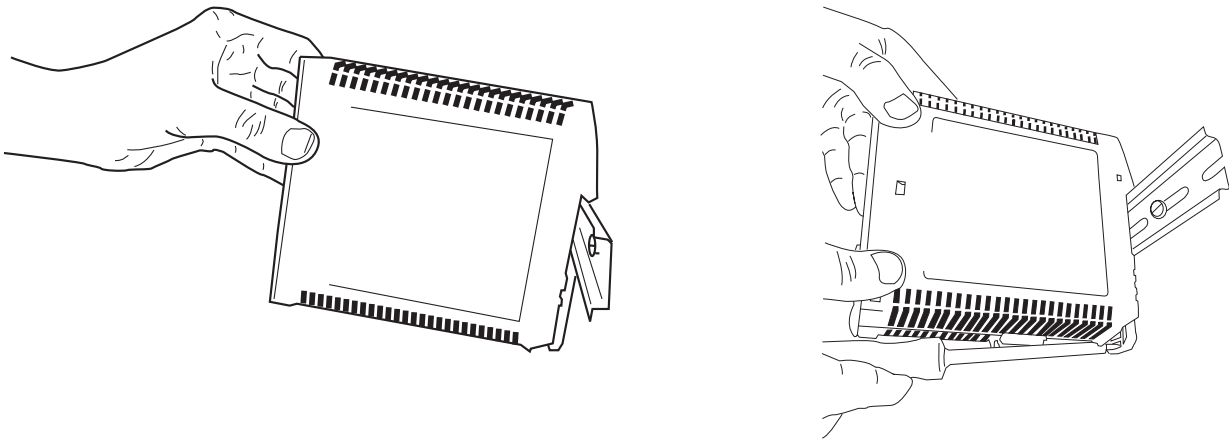


Fig. 1: Mounting of the VT-HMC...1X on the DIN mounting rail

Should the spring-loaded latch not snap in automatically, it can be released using a screwdriver. After having positioned the latch, let it spring back into the engaged position.

Observe the following notes on mounting the axis control VT-HMC...1X

- ▶ For mounting, observe the notes on applicable standards and operating conditions in the data sheet.
- ▶ Use low-capacitance cables.
- ▶ Whenever possible, execute cable connections without intermediate terminals.
- ▶ Install sensor cables separately.
- ▶ When sources of electromagnetic disturbance are used (e.g. frequency converter), malfunction may occur. Avoid the direct installation of the VT-HMC...1X in the direct vicinity to sources of disturbance.
- ▶ The distance to aerial lines, radio sources and radar equipment must be at least 1 m.
- ▶ Do not lay signal cables near power cables.
- ▶ Execute the installation so that when differential inputs are used, both inputs are always activated or deactivated simultaneously.
- ▶ Do not use any silicone-containing sealants, adhesives or insulating agents.
- ▶ The system ground is an essential, integral part of EMC protection of the axis control. Here, interference, which is transported to the axis control via data and voltage supply cables, is dissipated. This function can only be ensured, if the system ground itself does not inject interference into the control electronics.
- ▶ Ensure maintenance-friendly installation, i.e. simple access to the connection lines. Ensure free access to the connection side.

7.3.1 Place of installation

The VT-HMC...1X should not be installed next to power electronics (e.g. frequency converters, etc.). The power supply unit of the VT-HMC...1X should be installed as close to the VT-HMC...1X as possible.

NOTE: UV radiation!

Extended exposure to UV radiation can lead to discoloration.

- ▶ Do not install the VT-HMC...1X at a place exposed to direct sunlight.

7.3.2 Power supply

- ▶ Keep the connection as short as possible and install supply and return conductors (+24 V/GND) together. For voltage, see data sheet 30239.
- ▶ Install power cables consisting of two individual wires (voltage supply) in parallel or as twisted cable.

7.3.3 Supply of external components

For the supply of a 24-V encoder, the input voltage of the VT-HMC...1X at XD1 must meet the requirements of the encoder (e.g.: 24 V \pm 5 %, residual ripple <500 mV).

Analog components such as pressure cells can be supplied via the analog voltage output $V_{\text{encoder_ANA}}$ at XG20/XG21.

Prerequisite: The supply of the VT-HMC...1X meets the requirements of the pressure cell. For further notes on currents, etc., please refer to data sheet 30239.

7.3.4 Shielding

For signal cables, use only cables with a copper braid shield. Connect the cable shield on one side on a large area using a grounding bar. For this, mount the grounding bar as close as possible to the VT-HMC...1X and strip the cable sheath around the cable at the appropriate position. Observe the installation notes given in the data sheet of the grounding bar (e.g. from Wago: U-shaped busbar, art. no. 790-191, shield clamping saddle, art. no. 790-116).

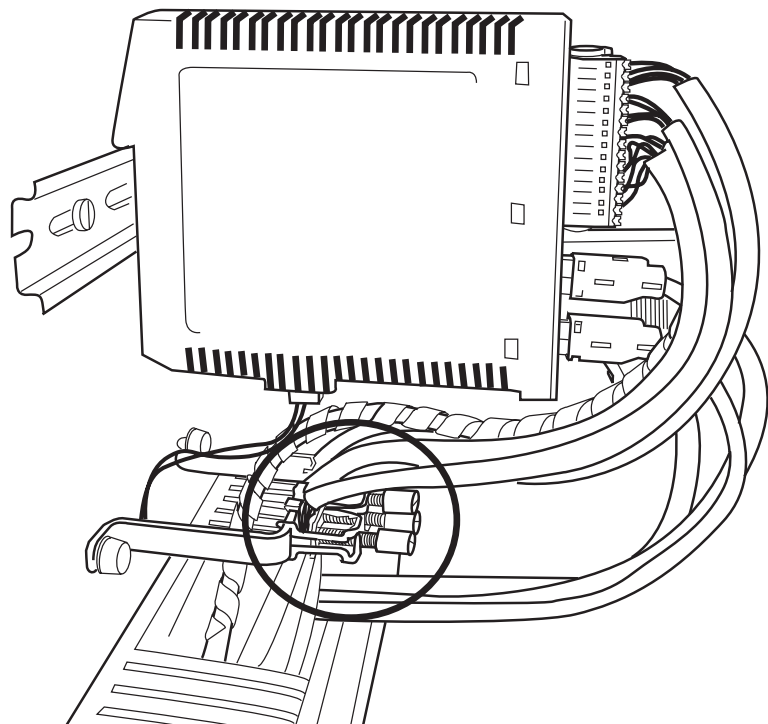


Fig. 2: Shielding of the VT-HMC...1X

7.3.5 General notes on shielding

- ▶ Install signal and power cables as far away from each other as possible and do not install them in parallel.
- ▶ Do not route signal cables through strong magnetic fields.
- ▶ Lay signal lines as continuously as possible. If intermediate terminals are required, use a terminal block with shield busbar.
- ▶ Cables should only have the number of wires actually required. If this is impossible, connect unused wires with each other and connect them to ground on one side in the control cabinet.

Tabelle 7: Recommended cable variants

Interface	Cable type	Max, length [m]	Minimum cross-section [mm ²]	Remarks
Incremental	*	50	0.25 for signal cable 1.0 for supply cable	* = according to the instructions of the sensor manufacturer, at least twisted pair, single shield
SSI	*	50	0.25 for signal cable 1.0 for supply cable	* = according to the instructions of the sensor manufacturer, at least twisted pair, single shield
EnDat2.2	*	50	0.25 for signal cable 1.0 for supply cable	* = according to the instructions of the sensor manufacturer, at least twisted pair, single shield
Digital in/out	In the control cabinet: Single wires outside the control cabinet: Shielded	30	0.25 to 1.0	
Analog in voltage	Twisted pair, shielded	50	0.25 to 1.0	
Analog in current	Twisted pair, shielded	50	0.25 to 1.0	
Analog out voltage	Shielded	50	0.25 to 1.0	
Analog out current	Shielded	50	0.25 to 1.0	
Ethernet	CAT5e			1: 1 connection cable with field buses (PROFINET, EtherNet/IP...) according to specification of the user organization
Supply	In the control cabinet: Single wires outside the control cabinet: Shielded	50	0.25 to 1.0	
PROFIBUS	*	*	*	* = according to the specification of the PROFIBUS user organization (standard)

Tabelle 8: Clamping range, rated connection

	Min.	Max.
Single-wire	0.2 mm ²	1.5 mm ²
Finely-stranded	0.2 mm ²	1.5 mm ²

The length to be stripped is 10 mm each.

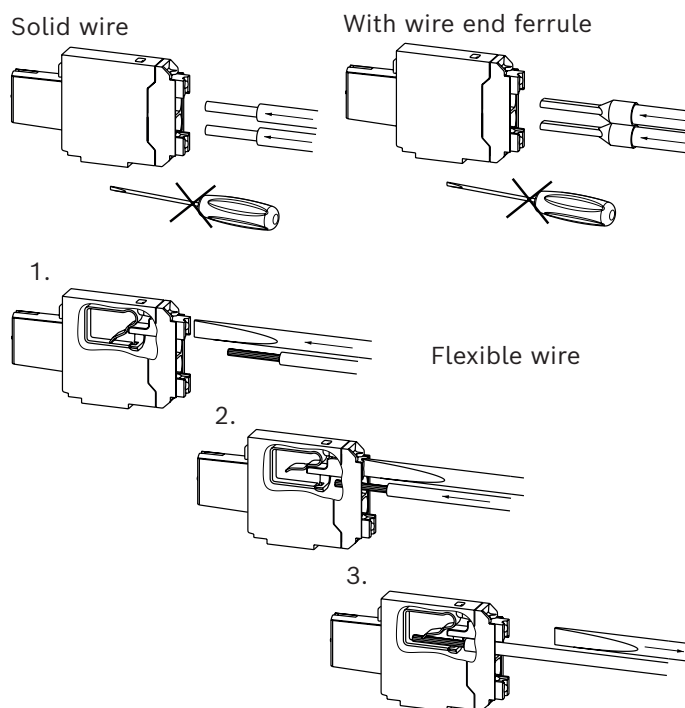
7.3.6 Connecting the individual contacts

Fig. 3: XG20/XG21: "PUSH-IN" contact

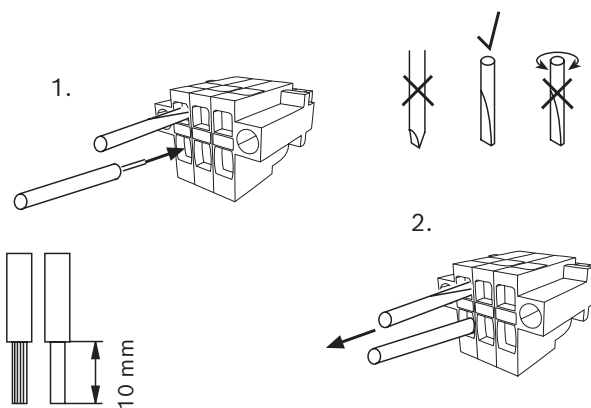
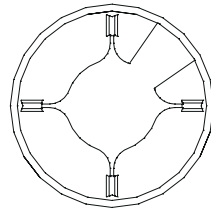


Fig. 4: XD1: Tension spring terminals

The tightening torque for mounting the plug-in connector is 0.2 - 0.25 Nm.

7.3.7 Keying

To prevent mismatch errors when connecting the VT-HMC...1X the plug-in connectors can be keyed on the plug and on the device side by means of keying elements made by Weidmüller that are included in the scope of supply.



Female multi-point connector on device side

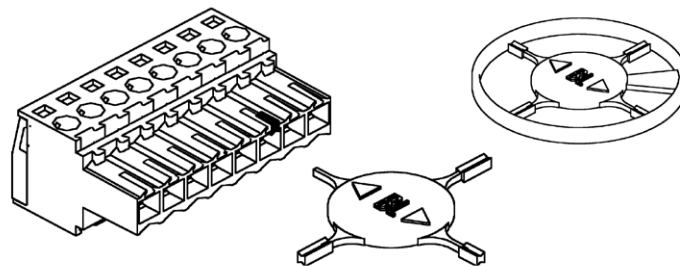


Fig. 5: Inserting and breaking off keying elements on the plug-in contacts of the female multi-point connector XG20

Male multi-point connector on device side

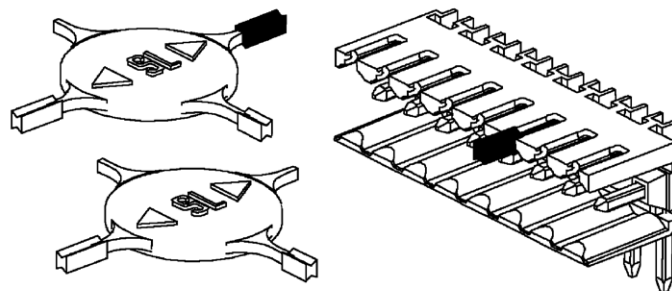
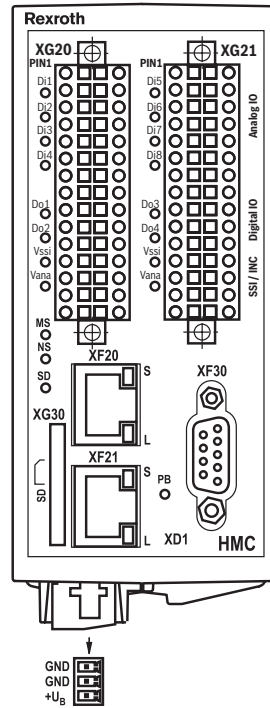


Fig. 6: Inserting and breaking off keying elements on the plug-in contacts of the male multi-point connector XG21

7.3.8 Wiring instructions

XG20 ¹⁾			
Signal	Pin	Pin	Signal
Vencoder_ANA (U _B)	a1	b1	AGND
Ai1+	a2	b2	Ai1-/Cin1 ¹⁾
Ai2+	a3	b3	Ai2-/Cin2 ¹⁾
Ai3+	a4	b4	Ai3-/Cin3 ¹⁾
Ai4+	a5	b5	Ai4-/Cin4 ¹⁾
Ao1	a6	b6	AGND
Ao2	a7	b7	AGND
Di1	a8	b8	Di2
Di3	a9	b9	Di4
Do1	a10	b10	Do2
R-	a11	b11	R+
CLK-/A-	a12	b12	CLK+/A+
Data-/B-	a13	b13	Data+/B+
+5Venc	a14	b14	GND
Vencoder_SSI (U _B)	a15	b15	GND



XG21 ¹⁾			
Signal	Pin	Pin	Signal
Vencoder_ANA (U _B)	a1	b1	AGND
Ai5+	a2	b2	Ai5-/Cin5 ¹⁾
Ai6+	a3	b3	Ai6-/Cin6 ¹⁾
Ai7+	a4	b4	Ai7-/Cin7 ¹⁾
Ai8+	a5	b5	Ai8-/Cin8 ¹⁾
Ao3	a6	b6	AGND
Ao4	a7	b7	AGND
Di5	a8	b8	Di6
Di7	a9	b9	Di8
Do3	a10	b10	Do4
R-	a11	b11	R+
CLK-/A-	a12	b12	CLK+/A+
Data-/B-	a13	b13	Data+/B+
+5Venc	a14	b14	GND
Vencoder_SSI (U _B)	a15	b15	GND

1) Wire current inputs (Cin) for XG20/XG21 only to pin b2 ... b5, leave pin a2... a5 unconnected.

2) Only for 2-axis variant XG20 and XG21 may be interchanged. The scope of delivery of the 2-axis variant contains keying elements. Their use is described above.

Fig. 7: Connector pinout

The pinout of connections XF20, XF21, XD1, and XF30 can be found in data sheet 30239.

7.3.9 Wiring example: Pressure sensor at analog input 1

Current input

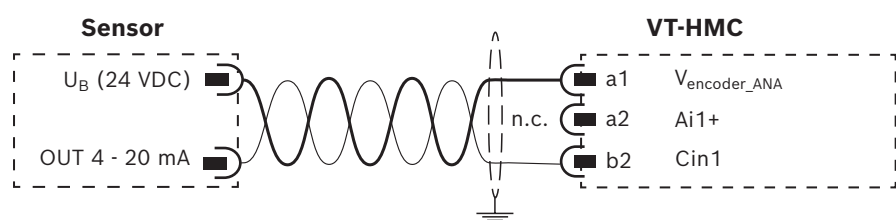


Fig. 8: Sensor supplied by VT-HMC...1X (2-conductor)

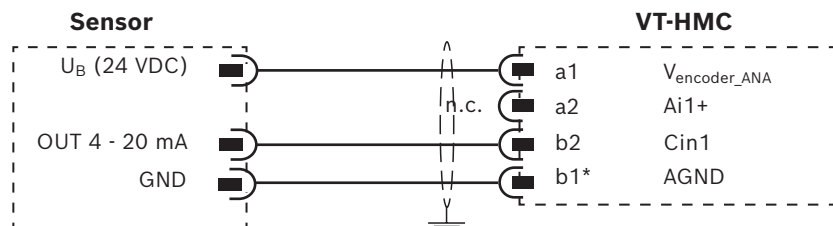


Fig. 9: Sensor supplied by VT-HMC...1X (3-conductor)

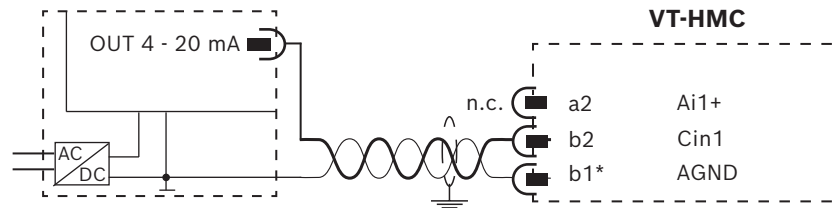


Fig. 10: Device/sensor supplied externally

Voltage input

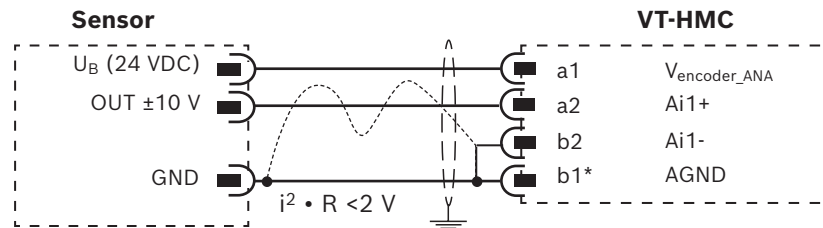


Fig. 11: Sensor supplied by VT-HMC...1X (3-conductor)

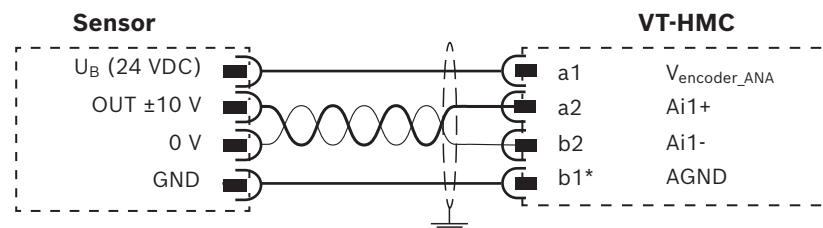


Fig. 12: Sensor supplied by VT-HMC...1X (4-conductor)

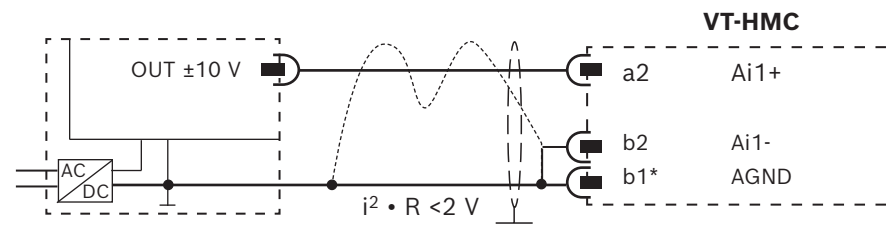


Fig. 13: Device/sensor supplied externally (4-conductor cable)

* or b6 or b7

- - - For compensating for the voltage drop across the GDN cable, the connection b2 - b1 can be made on the sensor. Precondition: $i^2 \cdot R < 2 \text{ V}$

7.3.10 Suppressing interference of the system

Should interference occur in conjunction with signals of the VT-HMC...1X, inspect the interference suppression of other electrical components, e.g. as follows:

Possible causes of faults	
Switched inductance	DC: antiparallel free-wheeling diode over actuator winding AC: type-related R/C combination over actuator winding.
Electric motors	R/C combination from each motor winding to earth.
Frequency converter	Inlet filter in the voltage supply of the frequency converter Motor control lines shielded and installed separately from other cables and/or output filter for motor cables. Large-area contact of the frequency converter housing to the rear wall of the control cabinet

8 Commissioning

8.1 BASIC PRINCIPLES

NOTICE

Uncontrolled plugging and unplugging of connectors!

The device might be destroyed. Damage to the control system caused by incorrect installation is not covered by the warranty!

- ▶ Before carrying out any installation work or plugging or unplugging connectors from the product, disconnect the device from the power supply or the voltage source or de-energize it reliably.
- ▶ Observe the protection class, the voltage supply and the environmental conditions according to data sheet 30239.

A prerequisite for the function of the VT-HMC...1X is its parameterization and programming (→ creation of the PLC application) using the software IndraWorks Ds or IndraWorks MLD.

- IndraWorks Ds can be used only for parameterization and diagnostics.
- IndraWorks MLD is required, if the PLC functionality according to IEC 61131-3 is to be used additionally.

For operation, the VT-HMC...1X must be ready for operation, connected to the PC via the Ethernet interface (XF20 or XF21) and be online.

8.2 INSTALLATION REQUIREMENTS

The following system requirements must be met for the operator program:

- IBM-compatible PC, at least Pentium IV
- CPU clock frequency 2 GHz
- RAM: 4 GB
- 5 GB free hard disk space on drive C: (incl. temporary memory for installation)
- DVD drive
- Graphics resolution
 - 800x600 pixels
 - Color depth 16 bits
- Ethernet-based service interface for connection of the VT-HMC...1X;

- Recommended:**
- IBM-compatible PC, i5 Quad Core
 - RAM: 4 GB with 64-bit operating systems

8.3 ACTIVATION OF THE SYNCHRONIZATION TECHNOLOGY FUNCTION IN THE 2-AXIS VERSION



A prerequisite for this is IndraWorks Ds 15V06 or higher.

To activate the synchronization function in the VT-HMC, proceed as follows:

- ▶ Switch the VT-HMC off and insert the SD card with the synchronization function into the memory card slot of the VT-HMC. When being switched on, the VT-HMC reads the data from the SD card and recognizes that the technology function is to be activated. The status LED “MS” starts to blink alternating red and green. After the technology function was activated, the VT-HMC briefly switches all LEDs off and reboots.

The technology function is then ready for operation.

8.4 CREATING A PROJECT WITH INDRAWORKS MLD AND ONLINE PARAMETERIZATION

1. Select menu item “Project > Scan for Devices...”.
2. In the dialog “Scan for Devices” select “HydraulicDrive (Ethernet)” as device to be searched for and confirm the selection by clicking the button “Next”.
3. The dialog “Network search” appears, in which you have to set under “Network connection” the Ethernet interface of your PC to which the VT-HMC...1X is connected.
4. In the subsequent dialog, select the VT-HMC...1X found by clicking the checkbox “Apply” and terminate the dialog by clicking the button “Finish”.
5. This adds the VT-HMC...1X to the IndraWorks project.
6. Then, select menu item “Project > Switch Devices Online” to establish a connection with the VT-HMC...1X. The VT-HMC...1X can then be parameterized via the dialog windows.
7. To create an empty PLC application for the VT-HMC...1X, double-click with the left mouse button on the entry “MLD > Logic” in the Project Explorer.
8. Confirm the subsequent dialog “Create Logic” by clicking OK. This causes the empty PLC application to be created in the Project Explorer below the entry “MLD > Logic”.
9. In this PLC application you can program the VT-HMC...1X (e.g. motion sequence).

10. To upload the PLC application to the VT-HMC...1X, select menu item “Debug > Login” and confirm the subsequent dialog by clicking “Yes”.
11. This transmits the PLC application to the VT-HMC...1X.
12. Save the project by selecting menu item “File > Save”.

Further information on the operation, engineering, programming and diagnostics of the VT-HMC...1X by means of IndraWorks can be found in the help menus of the program (→ e.g. “Drive Help > HYDRV*-HDx-18VRS” for firmware version HDx18VRS).

8.5 COMMISSIONING SOFTWARE INDRAWORKS DS OR MLD

For commissioning and later operation, the PC program IndraWorks is available to the user. It serves for parameterization, diagnostics and programming of the VT-HMC...1X.

Operating principle, menus and dialog windows are adapted to the individual variants of the VT-HMC...1X.

IndraWorks features the following functions:

- Comfortable dialog functions for parameterization
- PLC program creation according to IEC 61131-3 (IndraWorks MLD required)
- Comprehensive options for displaying process variables
- Recording and graphical representation of up to 8 process variables with wide selection of trigger options
- Dialog window for the simple configuration of the data exchange (PROFIBUS DP, PROFINET RT, EtherCAT, EtherNet/IP, POWERLINK) with a higher-level control

The PC program “IndraWorks” is not included in the scope of delivery of the VT-HMC...1X.

Download on the Internet: www.boschrexroth.com/hmc

9 Operation

A prerequisite for the function of the VT-HMC...1X is its parameterization and programming (→ creation of the PLC application) using the software IndraWorks Ds or IndraWorks MLD.

9.1 DIAGNOSTICS

The software IndraWorks offers users comprehensive diagnostic options. Moreover, the VT-HMC...1X features an error and diagnostic message memory, in which the errors occurred last are logged. This memory can be evaluated by means of the IndraWorks software.

During operation, LEDs signal the operating states:

Status LED	Module (MS)	Indication status
Off		No voltage supply
Flashing green/red		Initialization
Flashing green		Parameterization mode active
Green		Operating mode active
Flashing orange		Warning
Flashing red		Error
Permanently lit red		Exception

Status LED	Network (NS)	Indication status
Off		No voltage supply
Green		Operation

Status LED	SD card (SD)	Indication status
Off		No SD card available
Flashing green		SD card not ready for operation
Green		SD card available and ready for operation

Status LED	Digital inputs (Di1 through Di8)	Indication status
Off		Input logical "0"
Green		Input logical "1"
Digital outputs (Do1 to Do4, V_ANA and V_SSI)		
Off		Output logical "0"
Orange		Output logical "1"

Status LED	PROFIBUS (PB)	Indication status
Off		Bus not active
Green		Bus in "Data_Exchange" state

10 Maintenance

10.1 CLEANING AND CARE

NOTICE

Ingress of contaminants and humidity!

Malfunction!

- ▶ When working on the VT-HMC...1X, observe strictest cleanliness.
- ▶ Prevent the ingress of humidity and dirt into the perforated housing of the VT-HMC...1X.
- ▶ Only use a dry and dust-free cloth for cleaning.

Solvents and aggressive cleaning agents!

Damage to the surface of the VT-HMC...1X and faster aging.

- ▶ Never use solvents or aggressive cleaning agents.

Proceed as follow for cleaning and care:

- ▶ Check all plug-in and clamped connections of the VT-HMC...1X at least once a year for correct fit and damage.
- ▶ Inspect cables for rupture and crushes. Have damaged or defective cables replaced immediately!
- ▶ Clean the parts of the housing using a dry and dust-free cloth.

10.2 REPAIR

The VT-HMC...1X can only be replaced as a complete unit.

Unauthorized modifications of the VT-HMC...1X are not permitted for safety reasons!

11 Demounting and replacement

For replacement, a screwdriver is necessary.

11.1 PREPARING DEMOUNTING

Decommission the entire system as described in the general instructions for the system. In any case, bring the system to a safe state, shut it down, depressurize and disconnect it from the power supply and secure it against being switched on again.

11.2 DEMOUNTING THE VALVE AMPLIFIER

NOTICE

Electric arc and short-circuit!

Risk of destruction of system components.

- Put plug-in connectors down in a way that no short-circuit fault can occur.

To demount the VT-HMC...1X, proceed as follows:

1. Disconnect connection cables and unplug connectors.
2. Loosen the latch from its snapped-in position using a screwdriver.
3. Carefully remove the VT-HMC...1X from the DIN rail while the latch is pulled out.

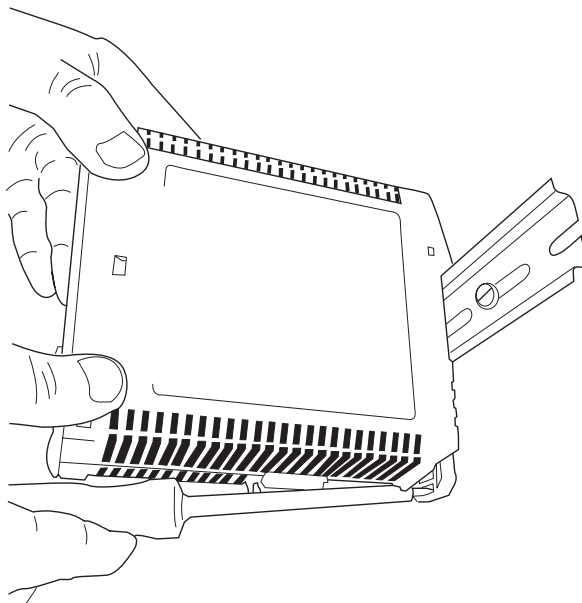


Fig. 14: Removing the VT-HMC...1X from the DIN rail

11.3 PREPARING THE COMPONENTS FOR STORAGE OR FURTHER USE

Proceed as follows in order to prepare the VT-HMC...1X for storage and further use:

- Use the original packaging for storage.
- Observe the permissible storage temperature range specified in RE 30239.
- Protect the axis control from dust and humidity.

12 Disposal

12.1 ENVIRONMENTAL PROTECTION

Careless disposal of the VT-HMC...1X and the packaging material can lead to pollution of the environment.

- Therefore, dispose of the VT-HMC...1X and the packaging material in accordance with the currently applicable regulations in your country and recycle the material.

13 Extension and modification

The control electronics VT-HMC...1X must be neither extended nor converted. If you convert the VT-HMC...1X, the warranty becomes void.

Only optional accessories may be used, see chapter 7.2 on page 17.

14 Troubleshooting

14.1 HOW TO PROCEED FOR TROUBLESHOOTING

Always work systematically and purposefully, even when under time pressure. Random and imprudent disassembly and readjustment of settings can, in the worst-case scenario, result in the inability to determine the original cause of error.

- First obtain a general overview of how your product works in conjunction with the entire system.
- Try to find out whether the product has functioned properly in conjunction with the overall system before the fault occurred.
- Try to determine any changes of the overall system in which the product is integrated:
 - Were there any changes to the product's operating conditions or operating range?
 - Were there any changes (e.g. retrofit) or repairs carried out on the complete system (machine/system, electrics, control) or on the product?
If yes: What were they?
 - Was the product or machine used as intended?
 - How did the fault become apparent?
 - Try to get a clear idea of the cause of error. If possible, ask the direct (machine) operator.
- For troubleshooting, use the diagnostic possibilities of IndraWorks.

If you cannot rectify the error, contact one of the contact addresses which can be found at www.boschrexroth.com or in the address directory in chapter 16.1.

15 Technical data

For the technical data of the axis control VT-HMC series 1X, please refer to the technical data sheet 30239.

16 Annex

16.1 LIST OF ADDRESSES

Contact for service and spare parts

Bosch Rexroth AG
Service Industriegydraulik
Bürgermeister-Dr.-Nebel-Strasse 8
97816 Lohr am Main
Germany

Phone +49 (0) 9352/40 50 60
E-mail service@boschrexroth.de

Outside Germany you will find service subsidiaries in your vicinity on the Internet at www.boschrexroth.com

Headquarters

Bosch Rexroth AG
Zum Eisengiesser 1
97816 Lohr am Main
Germany

Phone +49 (0) 9352/40 30 20
Email my.support@boschrexroth.com

The addresses of our sales and service network and sales organizations can be found at www.boschrexroth.com/addresses

Contact and email address for support

Phone +49 (0) 9352 / 18-14 33
Email support.automation@boschrexroth.de

16.2 OPEN SOURCE SOFTWARE

HydraulicDrive devices use third-party software components.

These 3rd party software components are subject to the following license terms.

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pstshint.h, version 0.1.12

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lwIP 2.1.2 - TCP/IP stack

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lwIP 2.1.2 - SNMP agent

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