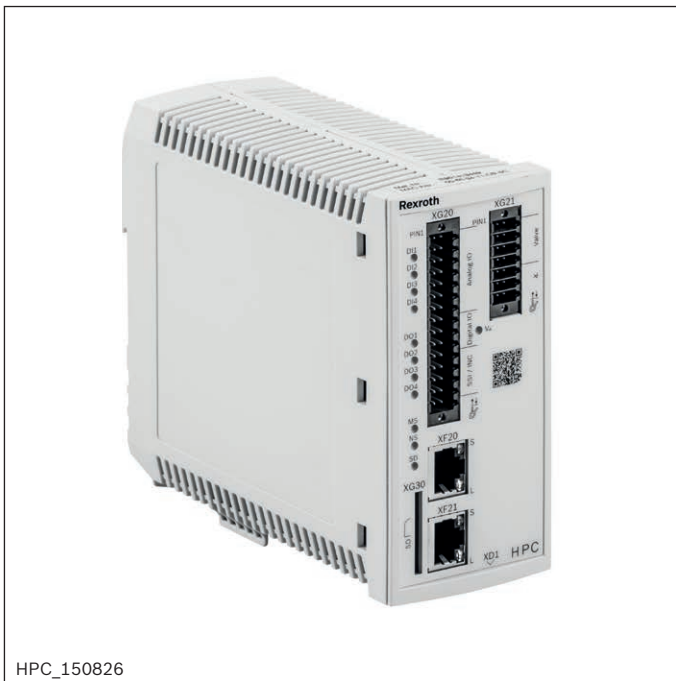# Rexroth
Bosch Group

Digital control electronics
for axial piston pumps

Type VT-HPC

RE 30237
Edition: 2018-07
Replaces: 2016-05

HPC_150826

▶ Component series 1X
▶ Control electronics for the A4VS axial piston pump with HS5 adjustment
▶ Function: Swivel angle, pressure control, torque limitation, master/slave
▶ Communication: Sercos, PROFINET RT, EtherCAT, EtherNET/IP, POWERLINK, optionally PROFIBUS, analog
▶ Parameterizable via standard Ethernet

CE

Features

▶ Digital control electronics for the axial piston pump A4VS with HS5 control from size 40 to size 1000
▶ Bus connection (slave)/Service interface (TCP/IP) switchable by parameters (Sercos, EtherNet/IP, PROFINET RT, EtherCAT, Powerlink, PROFIBUS DP)
▶ Pressure and swivel angle controller
▶ Parameterizable torque limitation
▶ Optional: Speed-variable function
▶ Leakage compensation
▶ Master/slave capability
▶ Mooring capability
▶ CE mark according to EMC Directive 2004/108/EC
▶ Optional: PLC functionality according to IEC 61131-3

Contents

Ordering code

01	02	03	04	05	06
VT–HPC–1	– 1X	/ M	–	– 00	/ 00

01	Digital control electronics for controlling axial piston variable displacement pumps	**VT-HPC-1**
02	Component series 10 to 19 (10 to 19: unchanged technical data and pin assignment)	**1X**
03	Multi-Ethernet	**M**
04	**With** Profibus	**P**
	Without Profibus	**0**
05	Software option: Standard	**00**
06	Hardware option: Standard	**00**

Available variants

Type	Material no.
VT-HPC-1-1X/M-0-00/00	R901413449
VT-HPC-1-1X/M-P-00/00	R901413446

Included within the scope of delivery:

Mating connector for
▶ XD1 (Weidmüller BLZF 3.50/03/180F SN BK BX)
▶ XG20 (Weidmüller B2CF 3.50/30/180LH SN BK BX)
▶ XG21 (Weidmüller B2CF 3.50/14/180LH SN BK BX)

Recommended accessories (can be ordered separately)

Denomination	Material no.
STECKER 6ES7972-0BA42-0XA0 for port XF30 (Profibus)	R901312863
Connection cable PC VT-HPC (RJ45, XF20 or XF21) RKB0011/005.0 length: 5 m	R911321548
STECKERSATZ VT-HMC...-1X/M...*ET	R961011116
SERVICEPAKET VT-HMC...-1X/M...shielding*ET	R961011117
Commissioning software IndraWorks DS from version 14V14	–
SD memory card XA-SD01 (1 GByte)	R911173844
SD card for PLC functionality VT-SD-HDX-PLC-10VXX	R901444436
SD card for n function VT-SD-HPC-HSSN-10VXX	R901495806

Functional description using the A4VS axial piston pump with HS5 control as an example

The swivel angle and pressure control as well as the torque limitation of the A4VS... variable displacement pump are effected by an electrically controlled proportional valve (1). Via the actuating piston (2) of the pump, this valve determines the position of the swash plate (3). The position of the swash plate is determined by a swivel angle sensor (4); the actual pressure value is recorded by a pressure transducer.

The actual torque value is calculated from the product of the actual pressure value and the actual swivel angle value. The controller software ensures by means of a minimum value generator that the controller corresponding to the working point is always active.

The sectional drawing shows the A4VS... variable displacement pump with HS5 control; the proportional valve (1) is controlled using the VT-HPC control electronics.

👉 **Notice for the HS5 control:**
▶ With de-energized proportional valve and pump with clockwise rotation and if the set pressure is available, the pump swivels to swivel angle α = 0 (A4VSO design) or α = −100% (A4VSG design).
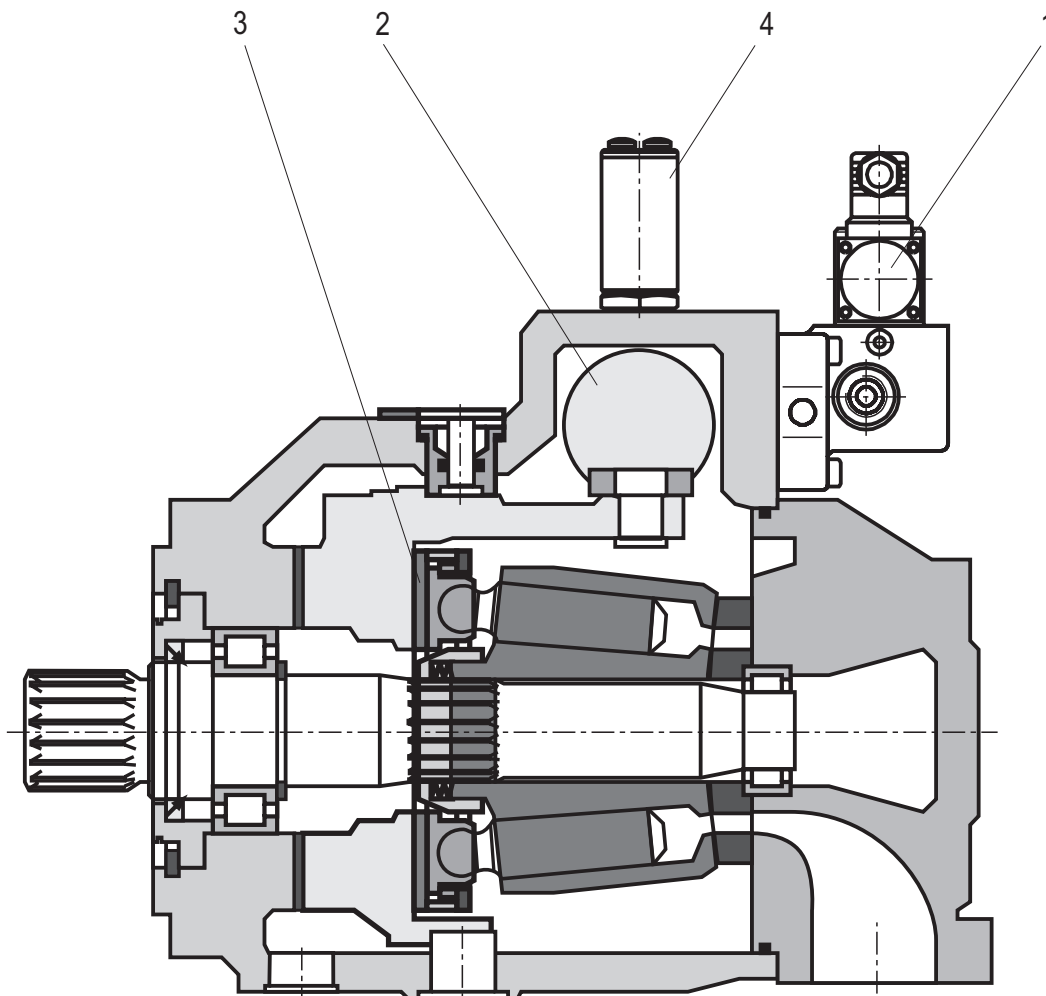
Functional description of the control electronics

Description

The VT-HPC (Hydraulic Pump Control) is a digital control system with integrated controller, optionally with programming according to IEC 61131. The internal PLC functionality is activated by plugging the SD card SD-HPC-PLC. It is not included in the VT-HPC scope of delivery and must be ordered separately.

The following controller functionalities are available:
▶ Pressure control
▶ Swivel angle/flow control
▶ Torque limitation
▶ Optional: Speed-variable function (n function)

This enables, amongst others, the following operating modes:
▶ Pressure/swivel angle control
▶ Pressure/flow control

Command value presetting is done via the bus interfaces (XF20/XF21 or XF30), via the analog interface (XG20) or, alternatively, via an internal PLC program.

The feedback information of the actual value signals to the superior control system is provided optionally either via the bus interfaces (XF20/XF21 or XF30) or the analog/digital interface (XG20).

The controller parameters are set via one of the two Ethernet interfaces (XF20/XF21) (integrated switch functionality)

Monitoring

The digital control electronics enable comprehensive monitoring functions/error detection including:
▶ Undervoltage
▶ Communication error
▶ Cable break for analog sensor inputs (4 ... 20 mA)
▶ Short-circuit monitoring for analog/digital outputs
▶ Temperature of the integrated electronics

IndraWorks PC program

To implement the project planning task and to parameterize the VT-HPC, the user may use the IndraWorks DS operation tool. For the use of the PLC function, IndraWorks MLD is necessary: Project planning
▶ Parameterization
▶ Commissioning
▶ Diagnosis
▶ Comfortable management of all data on a PC
▶ Requirement: PC operating system at least Windows 7

Slot for one SD memory card
The following data may be saved:
▶ Parameter data
▶ Any other data
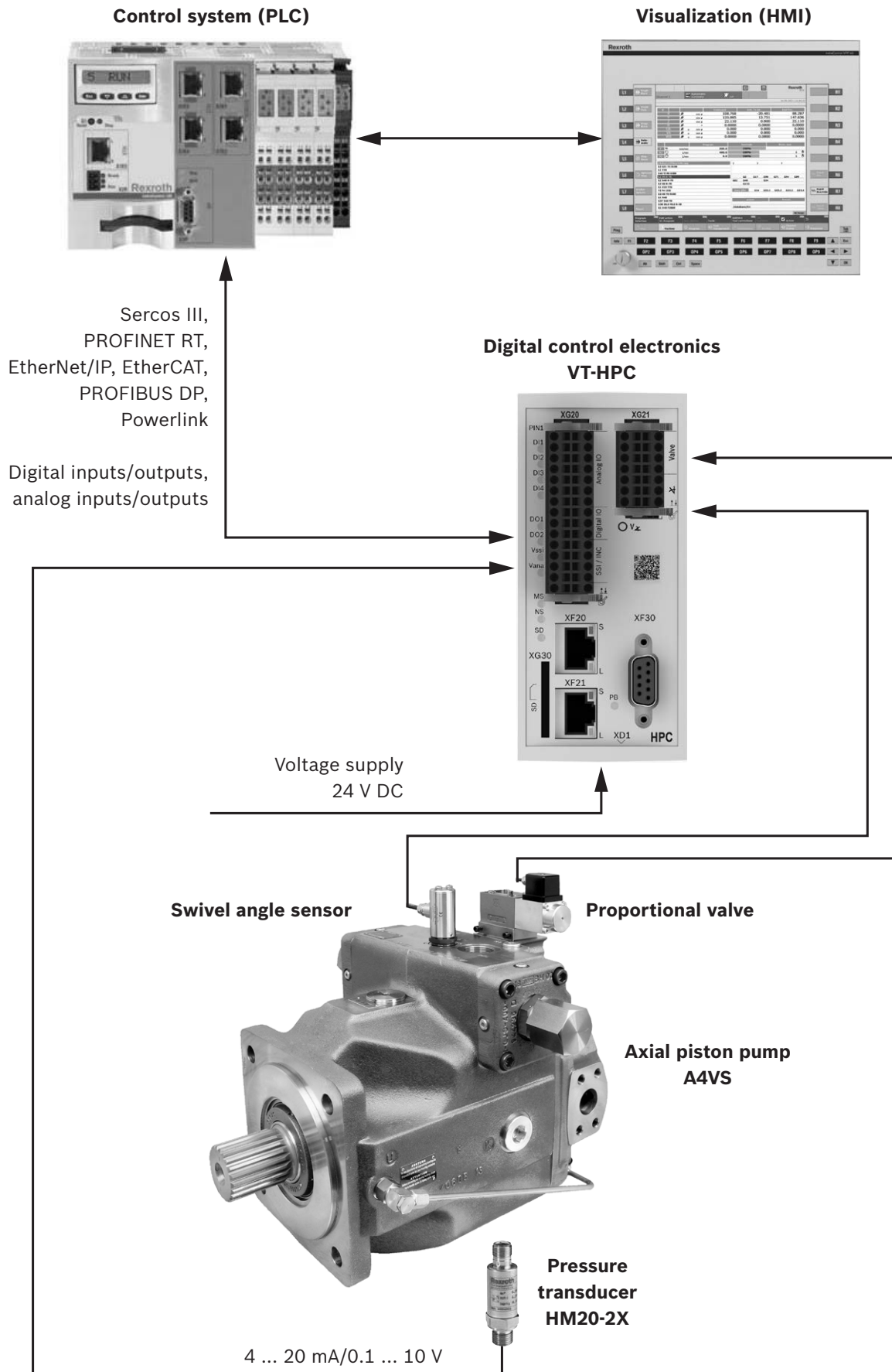▶ Update of the speed-variable function (see Accessories)

Only SD and SDHC memory cards up to a size of 4 Gbyte with FAT32 formatting are supported. The card must already be inserted when the device is switched on, otherwise it will not be detected. It is recommended to use the Rexroth memory card (see Accessories).

Overview of the controller functions (in the condition as supplied)
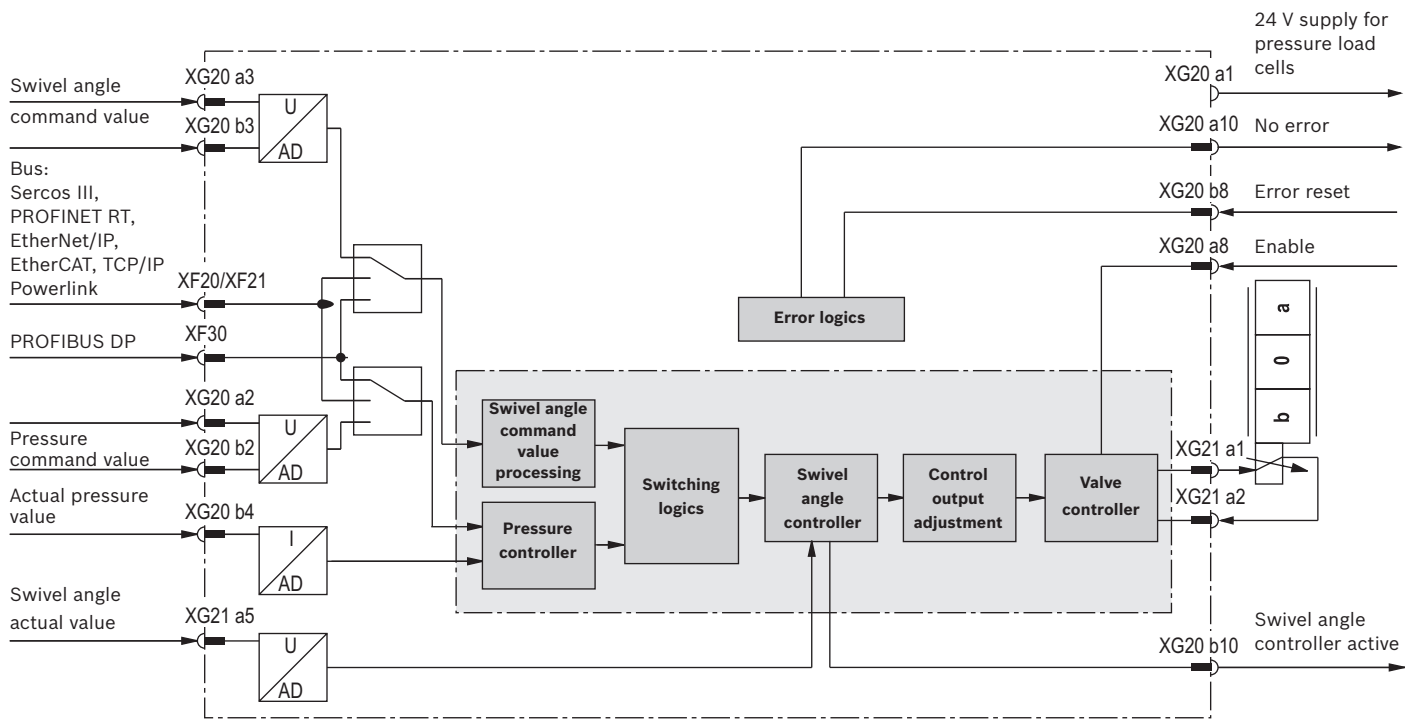
Example of open circuit, switch-over between current and voltage interface for the analog inputs via IndraWorks (observe wiring).

System overview (example)

Control system (PLC)

Visualization (HMI)

Sercos III,
PROFINET RT,
EtherNet/IP, EtherCAT,
PROFIBUS DP,
Powerlink

Digital inputs/outputs,
analog inputs/outputs

**Digital control electronics
VT-HPC**

Voltage supply
24 V DC

Swivel angle sensor

Proportional valve

**Axial piston pump
A4VS**

**Pressure
transducer
HM20-2X**

4 ... 20 mA/0.1 ... 10 V

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

Operating voltage			
– Nominal voltage	U_B	24 V DC	
– Lower limit	$U_{Bmin.}$	20 V DC	
– Upper limit	$U_{Bmax.}$	28 V DC	
– Maximum admissible residual ripple (40 ... 400 Hz)	u	5 V_{pp} (observe the admissible limits)	
Total current consumption	I	– Running empty: 0.2 ... 0.4 A – Max. admissible load: 0.9 ... 2.6 A (external fuse protection required)	
Power loss (at 24 V)		< 15 W	
External fuse		4 A time-lag	
Bus systems		PROFIBUS DP (max. 12 MBaud acc. to IEC61158), Sercos III, PROFINET RT, EtherNet/IP, EtherCAT, Powerlink	
Parameterization interface		Ethernet	
Scan time swivel angle/pressure controller (minimum)		0.5 msec	
Booting time		< 15 sec (from switch on until the control system is active)	
Digital inputs Di			
– Number		4	
– Low level	U	−3 V ... 5 V	
– High level	U	11 V ... U_B	
– Current consumption at High level	I	2 mA ... 15 mA	
– Reference potential		GND	
Digital outputs Do			
– Number		4	
– Low level	U	0 ... 3 V	
– High level	U	14.5 V ... U_B	
– Current carrying capacity	$I_{max.}$	50 mA (short-circuit-proof) [1]	
– Maximum capacitive load		200 µF	
– Signal delay time	t	Depending on the set performance	
– Reference potential		GND	
Analog inputs Ai			
– Inputs Ai1 to Ai5			
• Number (current or voltage input parameterizable)		5	
• Resolution		14 Bit [2]	
– Input Ai_sv (swivel angle sensor)			
• Number (current or voltage input via separate pin)		1	
• Resolution		13 Bit [2]	
– Voltage inputs (differential inputs)			
• Measurement range	U_E	−10 V ... +10 V	
• Input resistance	R_E	200 kΩ ± 10%	
• Linearity at 20 °C	U	< 20 mV	
• Noise	U	± 15 mV	
• Temperature drift		< 12 mV/10 K	
– Current inputs (reference to AGND)			
• Input current	I_E	4 mA ... 20 mA (0 ... 20 mA physical)	
• Input resistance	R_E	100 Ω	
• Linearity at 20 °C	I	< 20 µA	
• Temperature drift		< 12 µA/10 K	

[1] If a short-circuit is detected, all digital outputs are switched to Low level.

[2] Minimum feasible resolution of 1.465 mV or 1.27 µA

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

Analog outputs Ao		
– Number (current or voltage parameterizable individually)		2
– Resolution		16 Bit [1]
– Voltage outputs		
• Output range	U	−10 V ... +10 V (0 ... 10 V via software)
• Minimum load impedance	Z	1000 Ω
• Linearity and noise at 20 °C	U	< 25 mV
• Temperature drift		< 12 mV/10 K
– Current outputs		
• Output range	I	0 ... 20 mA (4 mA ... 20 mA via software)
• Maximum load	R	500 Ω
• Linearity and noise at 20 °C	I	< 35 µA
• Temperature drift		< 12 µA/10 K
Swivel angle V_{SV}		
– Voltage supply	U	U_B - 3V
– Maximum supply current	I	60 mA
Valve output stage		
– Maximum solenoid current	$I_{max.}$	2.7 A

[1]   0.334 mV/Bit

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

Environmental conditions, other specifications		
– Protection class according to EN 60529		IP20
– Ambient temperature range		−20 °C ... 60 °C
– Maximum admissible temperature change		5 °C/min
– Transport temperature range		−40 °C ... +70 °C
– Recommended storage temperature range with UV protection		+5 °C ... +40 °C
– Relative air humidity		10 ... 95% (without condensation)
– Max. altitude		2000 m
– UV resistance		Housing is only partly UV resistant. Extended exposure to radiation may cause color changes.
– Transport shock according to DIN EN 60068-2-27		15 g / 11 ms / 3 axes
– Sine test according to DIN EN 60068-2-6		10 ... 500 Hz / maximum of 2 g / 10 cycles / 3 axes
– Noise test according to DIN EN 60068-2-64		20 ... 500 Hz / 2.2 g RMS / 6.6 g peak / 30 min. / 3 axes
– Free fall (in original packaging)		1 m (see EN ISO 61131-2)
– Electro-magnetic compatibility (EMC)		
• EN 61000-6-2 / EN 61131-2:		
▶ EN 61000-4-2 ESD		4 kV CD / 8 kV AD with BWK B
▶ EN 61000-4-3 HF radiated		10 V/m (80 ... 6000 MHz) with BWK A
▶ EN 61000-4-4 Burst		2 kV with BWK B
▶ EN 61000-4-5 Surge		0.5 kV / (sym. / unsym.) with BWK B
▶ EN 61000-4-6 HF conducted		10 Veff (150 kHz ... 80 MHz) with BWK A
▶ EN 61000-4-8 Magnetic field 50/60 Hz		100 A/m with BWK A
• EN 61000-6-3 / EN 61000-6-4 / EN 61131-2:		
▶ EN 55016-2-1 Interference voltage		0.15 ... 30 MHz, class A, EN 55022
▶ EN 55016-2-3 Radio interference field strength		30 ... 6000 MHz, class A, EN 55022
– Installation position		Vertical. For the ventilation of the assembly, the ventilation slots of the top and bottom side must be at least 2 cm away from covers, walls, etc.
– Installation		Top hat rail TH35-7.5 or TH35-15 according to EN 60715
– Housing material		Glass-fiber reinforced polyamide plastic
– Resistance against aggressive media		Contact with conductive dusts is not admissible. Avoid contact with hydraulic fluids.
– Weight	m	0.7 kg
– Dimensions		See page 10
– Conformity		CE according to the EMC directive
		CE according to the RoHS directive
MTTF$_D$ values according to EN ISO 13849 [1]		For further details, see data sheet 08012
▶ **With** Profibus **"P"**	Years	28.3
▶ **Without** Profibus **"0"**	Years	29.3
MTBF values according to EN ISO 13849 [1] ?		For further details, see data sheet 08012
▶ **With** Profibus **"P"**	Years	14.1
▶ **Without** Profibus **"0"**	Years	14.7

[1] With an ambient temperature of the components of 60 °C

Pin assignment VT-HPC-1-1X

XG20, encoder/DIO/AIO			
Signal	**Pin**	**Pin**	**Signal**
Do4 [1]	a1	b1	AGND
Ai1+	a2	b2	Ai1−/Cin1 [2]
Ai2+	a3	b3	Ai2−/Cin2 [2]
Ai3+	a4	b4	Ai3−/Cin3 [2]
Ai4+	a5	b5	Ai4−/Cin4 [2]
Ao1	a6	b6	AGND
Ao2	a7	b7	AGND
Di1	a8	b8	Di2
Di3	a9	b9	Di4
Do1 [1]	a10	b10	Do2 [1]
reserved	a11	b11	reserved
reserved	a12	b12	reserved
reserved	a13	b13	reserved
reserved	a14	b14	GND
Do3 [1]	a15	b15	GND

XG21			
Signal	**Pin**	**Pin**	**Signal**
Ma+	a1	b1	reserved
Ma-	a2	b2	reserved
reserved	a3	b3	reserved
reserved	a4	b4	reserved
Ai_sv [3]	a5	b5	Cin_sv [3]
Vsv	a6	b6	GNDsv
Ai5+	a7	b7	Ai5-/Cin5 [2]

XF20, XF21	
Ethernet connections	
Signal	**Pin**
TD+	1
TD−	2
RD+	3
−	4
−	5
RD−	6
−	7
−	8

XD1, Power	
Pin	**Signal**
1	GND
2	GND
3	$+U_B$

XF30, PROFIBUS DP (only for variant P)	
Pin	**Signal**
1	reserved
2	reserved
3	RxD/TxD-P
4	CNTR-P
5	DGND
6	VP
7	reserved
8	RxD/TxD-N
9	reserved

[1] All digital outputs may be used as a voltage supply pin for sensor technology.

[2] Wire current inputs (Cin) for XG20 only at pin b2 … b5, leave pin a2 … a5 open. For XG21, wire pin b7, leave pin a7 open. (See also the information in the operating instructions 30237-B)

[3] When connecting swivel angle sensors, you may only connect the relevant required input (Ai_sv for voltage or Cin_sv for current input). The other output must remain open (in this connection also refer to 30237-B)

☞ **Notice:**
▶ The pins marked with "reserved" are reserved and must not be connected!

LED displays (Status LEDs)

Status LED	Display status
Module (MS)	
Off	No voltage supply
Green-red, flashing	Initialization
Green, flashing	Drive ready for operation
Green	Drive active
Orange, flashing	Warning
Red, flashing	Error
Network status (NS)	
Off	No voltage supply
Green	Operation
SD card (SD)	
Off	No SD card available
Green, flashing	SD card not ready for operation
Green	SD card available and ready for operation

Status LED	Display status
Digital inputs (Di1 to Di4)	
Off	Logic input "0"
Green	Logic input "1"
Digital outputs (Do1 to Do4, V_x)	
Off	Logic output "0"
Orange	Logic output "1"
Profibus (PB)	
Off	Bus not active
Green	Bus in "Data_Exchange" status

☞ **Notes:**
▶ For a detailed description of the diagnosis LEDs, please refer to the functional description Rexroth HydraulicDrive HDx20.

Dimensions
(dimensions in mm)
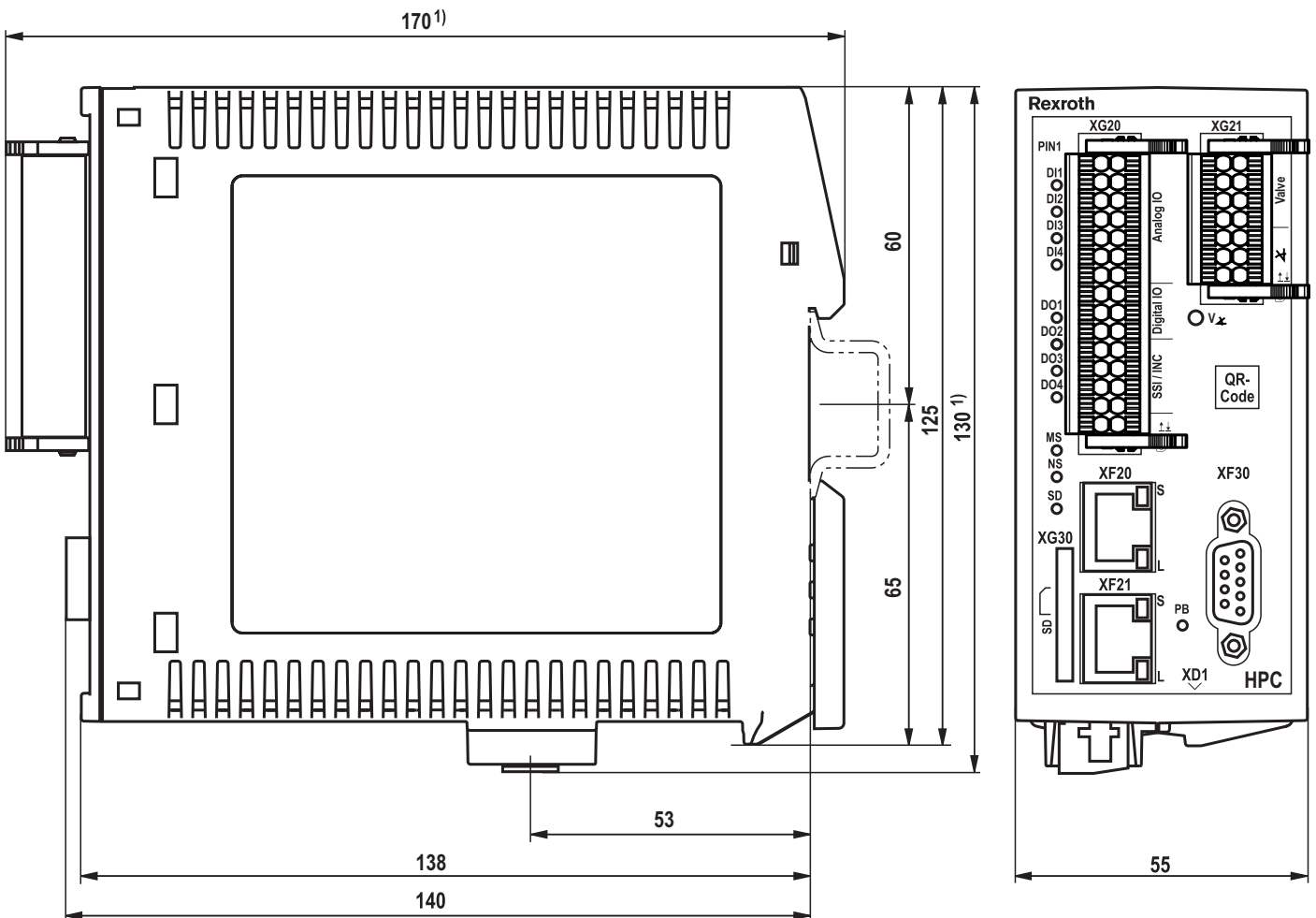
[1] Plus 15 mm for connecting/disconnecting the plug-in connector

Project planning information/maintenance instructions/additional information

Product documentation for VT-HPC:
- ▶ Data sheet 30237 (this data sheet)
- ▶ Operating instructions 30237-B
- ▶ CE declaration of conformity (available from Bosch Rexroth upon request)
- ▶ Operation of VT-HPC (from firmware version 20V06):
  - – Functional description Rexroth HydraulicDrive from HDx-20
  - – Parameter description Rexroth HydraulicDrive from HDx20 RD30330-PA
  - – Description of diagnosis Rexroth HydraulicDrive from HDx20 RD3030-WA
  - – Library description Rexroth HydraulicDrive, Rexroth IndraMotion MLD (2G), libraries from HDx-20
- ▶ Additional information Pump control 30237-Z:
  - – Notes for commissioning and controller optimization
  - – Description of the technology function speed-variable pump control
- ▶ General information on the maintenance and commissioning of hydraulic components: Data sheet 07800 / 07900

Product documentation for base pump A4/HS:
- ▶ Data sheet RE 92076

Commissioning software and documentation on the Internet: www.boschrexroth.com/HPC

Maintenance instructions:
- ▶ The devices have been tested in the plant and are supplied with default settings.
- ▶ Only complete devices can be repaired.
  Repaired devices are returned with default settings. User-specific settings will not be applied. The machine end-user will have to retransfer the corresponding user parameters.

Enquiries: support.nc-systems@boschrexroth.de

[1] To use the HPC for household or small business applications, special precautions, such as installation of a shielded housing and appropriately approved filter systems, are required to fulfill the emission requirements according to EN61000-6-3.

☞ **Notes:**
- ▶ The supply voltage must be permanently connected; otherwise bus communication is not possible.
- ▶ In particularly EMC-sensitive environments, additional measures must be taken (depending on the application, e.g. shielding, filtration) [1]
- ▶ Wiring information
  - – Maximum possible separation between signal and load lines.
  - – Do not lead signal lines through magnetic fields.
  - – If possible, install signal lines without intermediate terminals.
  - – Do not install signal lines in parallel to the load lines.
  - – Cable shields must be attached on both sides.
  - – For digital inputs and outputs, the max. recommended cable length is 30 m.
  - – Only use shielded lines for sensors. Max. recommended cable length: 50 m; also observe the sensor manufacturers' information.
  - – Valve lines are to be shielded. Max. recommended cable length: 30 m; also observe the information on the valve.
  - – The signals of the connector XG20 and XG21 are not galvanically separated. A potential reference therefore always has to be established when connecting external devices.
- ▶ For additional notes, see IndraWorks online help and operating instructions 30237-B.
- ▶ The upper and lower ventilation slots must not be concealed by adjacent devices in order to provide for sufficient cooling.
- ▶ Observe the installation information in the operating instructions 30237-B

Further information

> ☞ **Notice:**
> For general information on safety, installation or commissioning, see operating instructions:
>
> 07602-B   Electronics for industrial applications

Bosch Rexroth AG
Industrial Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 40 30 20
my.support@boschrexroth.de
www.boschrexroth.de

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
documentation@boschrexroth.de
www.boschrexroth.de