Rexroth
Bosch Group

Digital drive controller for hydraulic axes with sercos interface

Type VT-HNC100.../S

RE 30159
Edition: 2012-03
Replaces: 09.11

H7644

- Component series 3X

CE

Contents

Features

The VT-HNC100...3X/S digital drive controller complies with the specific requirements for closed-loop control of hydraulic linear drives.
It is designed for being used in rough industrial environments as regards interference immunity, mechanical vibration, shock, and climate resistance.

Areas of application
- Machine tools
- Bending machines

Technology functions
- Positioning
- Velocity controller:
  - Controlled
  - Regulated
- Force controller
- Substitutional closed-loop control
- Moving without following error
- Quadrant error correction

Hydraulic axes
- Measurement system:
  - Incremental TTL 5V
  - SSI transducer
  - EnDat 2.2
  - Analog 0 to ±10 V
- Actuating variable output voltage or current
- Freely configurable controller variants
  - Position / force / velocity controller
  - Substitutional closed-loop control (position/force)

Programming
- Via the control with IndraWorks

Operation
- IndraWorks

Process connection
- Digital inputs and outputs,
- Analog inputs and outputs,
- sercos II or sercos III to communicate with a superior control system

Assembly
- Top hat rail 35 mm

CE conformity
- CE conformity according to EMC Directive 2004/108/EC and EMVG (Act on electromagnetic compatibility of operating media) from February 26, 2008
  Harmonized standards used:
  EN 61000-6-2:2005
  EN 61000-6-3:2007

More information
www.boschrexroth.com/hnc100

Ordering code

VT-HNC100	–		–	3X	/	S	–		–		/	
01		02		03		04		05		06		07

01	Serial unit	**VT-HNC100**
02	Versions for an hydraulic axis	
	Compact	**C**
	Standard	**1**
03	Component series 30 to 39 (30 to 39: Unchanged technical data and pin assignment)	**3X**
04	Bus connection	
	sercos II / sercos III [1]	**S**
05	Position transducer	
	Incremental/EnDat 2.2/SSI (standard) [2]	**I**
	EnDat 2.2/SSI (only in connection with Compact version) [2]	**S**
06	sercos II (only in connection with Compact version)	**00**
	sercos III (only in connection with Standard version)	**30**
07	Option	**E**
	Without	**000**

Available variants	
Type	Material number
VT-HNC100-C-3X/S-S-00/000	R901112919
VT-HNC100-1-3X/S-I-30/000	R901234133

[1] Ethernet service interface only in connection with sercos III

[2] Can be selected by means of the IndraWorks PC program

Included in the scope of delivery:

Mating connector for

- X1S (type Phoenix Mini Combicon 3-pole),
- X2D (type Phoenix Micro Combicon 8-pole and/or Phoenix Mini Combicon 12-pole),
- X2A (type Phoenix Micro Combicon 8-pole and/or HD-SUB 15-pole),
- X8M (type Phoenix Micro Combicon 8-pole and/or HD-SUB 15-pole)

Recommended accessories (can be ordered separately)

Denomination	**Material number**
Interface cable RS232, length 3 m	R900776897
USB RS232 converter	R901066684
Cable set VT17220-1X/HNC100-3X, length 2 m, for analog signals (connection X2A) or digital position measurement systems (connection X8M) with HD connector and open breakout cable for VT-HNC100-1-3X	R901189300
Cable set VT17220-1X/HNC100-3X length 2 m, for analog signals (connection X2A) or digital position measurement systems (connection X8M) with FK-MC connector and open breakout cable for VT-HNC100-C-3X	R901189302

Software project planning

Project planning

Developing application-specific data sets forms the basis for the function of the VT-HNC100...3X/S. These data sets are generated on the PC and sent to the VT-HNC100...3X/S using a serial Ethernet interface. This software parameterization is implemented according to fix steps:

1. Depending on the assignment, the inputs and outputs and the parameters used are defined.
2. The parameters (selection of transducers and controllers) are defined.
3. The data are sent to the VT-HNC100...3X/S.
4. The settings are optimized at the machine.

PC program "IndraWorks"

To implement the project planning tasks, the "IndraWorks" PC program is available to the user. It serves for parameterizing, setting, and diagnosing the VT-HNC100...3X/S.

Scope of service:

- Comfortable dialog functions for setting the parameters online or offline
- Dialog window for the online setting of the parameter values
- Various options for the display of the process variables

Notice:

The PC program "IndraWorks" is **not** covered by the scope of delivery.

Queries: support.nc-systems@boschrexroth.de

Overview of the controller functions

Position controller:

- PDT1 controller
- Linear amplification characteristic curve
- Direction-dependant gain adjustment
- Adaptation of the valve characteristic curve
- Valve characteristic diagram
- Fine positioning
- Residual voltage principle
- Compensation of zero point errors
- State feedback via:
  - Force,
  - Position
- Command value feedforward

Force controller:

- PIDT1 controller
- I share switchable via window
- Differential pressure evaluation
- Additive velocity addition

Velocity controller:

- PI controller
- I share switchable via window

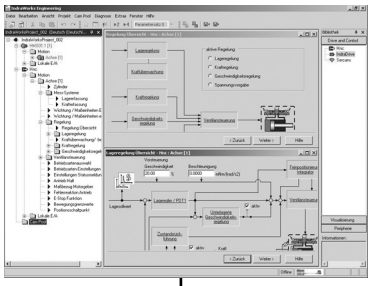
Monitoring functions:

- Dynamic following error monitoring
- Traversing range limits (electronic end switches)
- Cable break monitoring for position transducers
- Cable break monitoring for sensors with output 4 to 20 mA

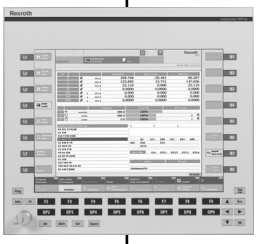
System overview

Example

IndraWorks
(engineering environment)



IndraMotion MTX
(CNC control)

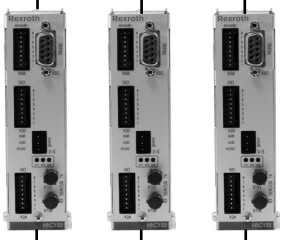


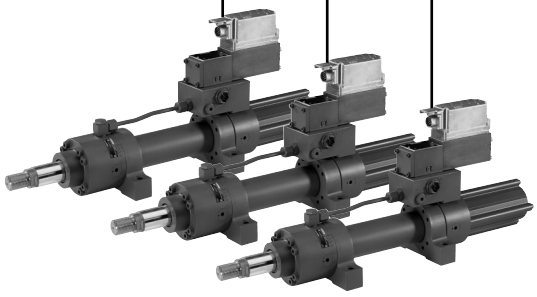
SERCOS interface

SERCOS interface

IndraDrive

HNC100-C-3X/S



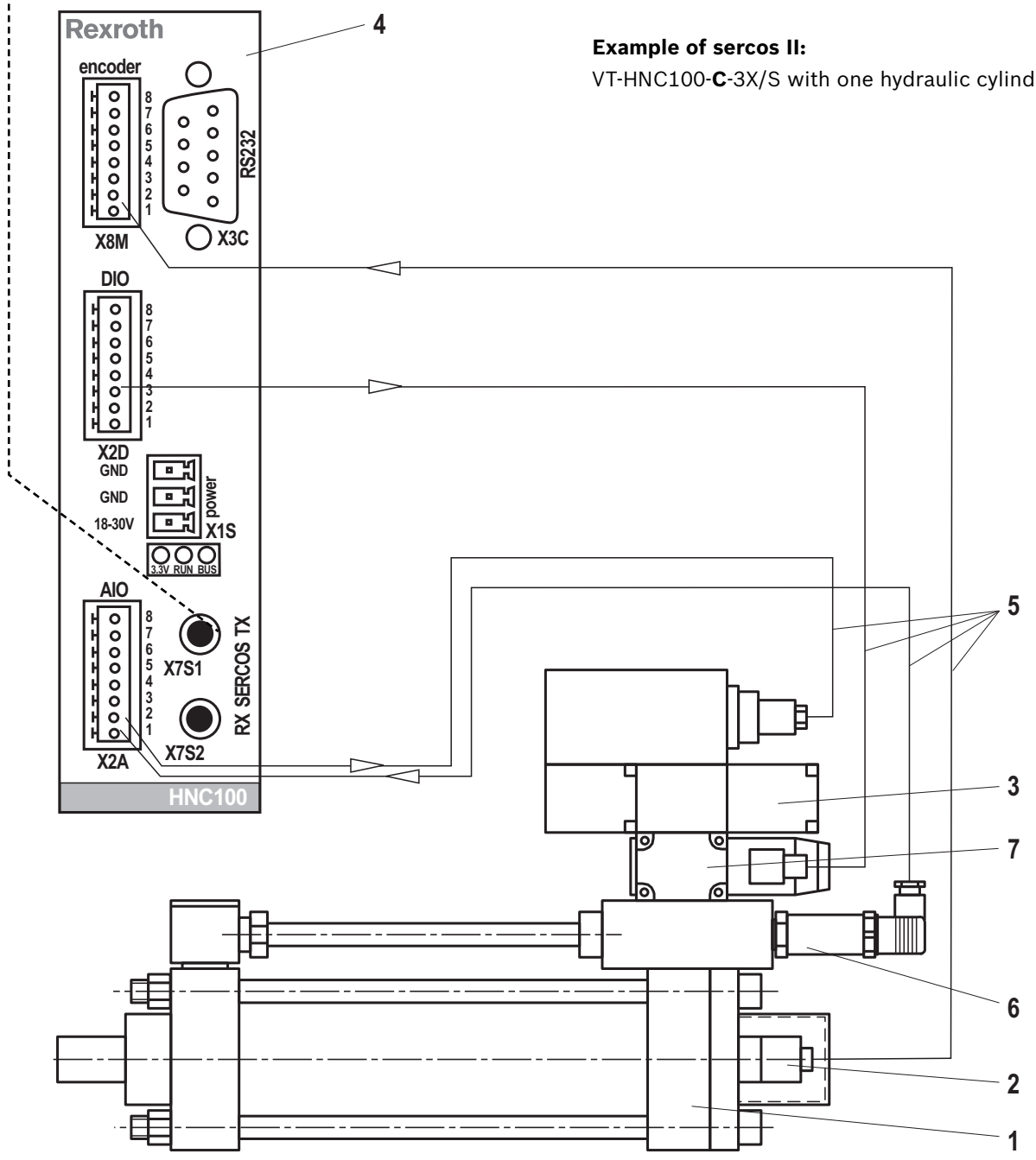


Electrical axes

Hydraulic axes

System overview, interfaces

Superior control system
Possible interfaces with the VT-HNC100...3X/S:
- Analog signals
- Digital inputs/outputs
- Serial interface
- Bus systems (sercos II or sercos III)



Example of sercos II:
VT-HNC100-**C**-3X/S with one hydraulic cylinder axis

1 Single-rod cylinder
2 Integrated position measurement system
3 Continuous control valve with integrated control electronics
4 VT-HNC100...3X/S
5 Connection cable
6 Pressure transducer
7 Sandwich plate shut-off valve (with connector switching amplifier)

Technical data VT-HNC100-C-3X/S (Compact)

Operating voltage [1]	U_B	18 to 30 VDC
Current consumption at 24 VDC		Approx. 200 mA (observe additional current consumption for connected sensors/actuators)
Processor		32 bit power PC
Analog inputs (AI):		
– Voltage input (reference to AGND - Analog ground)		
• Channel number		1
• Input voltage	U_E	Max. +12 V to –12 V (+10 V to –10 V measurable)
• Input resistance	R_E	200 kΩ ± 5 %
• Resolution		5 mV
• Non-linearity		< 0.2 %
• Calibration tolerance [2]		Max. 40 mV (with factory settings)
– Current inputs		
• Channel number		2
• Input current	I_E	4 mA to 20 mA
• Leakage current	I_V	0.1 to 0.4 % (with 100 Ω between pin 2 and/or pin 3 (Cin1+ and/or Cin2+) and "AGND"
• Resolution		5 µA
– Voltage supply for analog sensors via the VT-HNC100-C-3X/S	*U, I*	U_B, **max. 100 mA** at X2A, pin 7 (+24 Vsens)
Analog outputs (AO):		
– Voltage outputs		
• Channel number		2
• Output voltage	U_{nom}	–10 V to +10 V (max. –10.7 V to +10.7 V)
• Output current	I_{max}	±10 mA
• Load	R_{min}	1 kΩ
– Resolution		1.25 mV
– Non-linearity		
• In the range –9.5 V to +9.5 V		< 0.1 %
• In the range –10 V to –9.5 V and +9.5 V to +10 V		< 0.2 %

[1] If a 24 V transducer supply is implemented directly via the VT-HNC100...3X/S (supply voltage is looped in), the transducer specification has to be observed.

[2] If the factory settings are insufficient, the measurement technology can be calibrated on site via software in a system-specific way.

Technical data VT-HNC100-C-3X/S (Compact) continued

Bus interface		sercos II
Switching inputs (DI)	Quantity	4
	Logic level	log 0 (low) ≤ 5 V; log 1 (high) ≥ 10 V to U_B, I_e = 20 mA with U_B = 24 V
	Connection	Flexible conductor up to 1.5 mm²
Switching outputs (DO)	Quantity	2
	Logic level	log 0 (low) ≤ 2 V; log 1 (high) ≤ U_B; I_{max} = 20 mA, maximum load capacity C = 0.047 µF
	Connection	Flexible conductor up to 1.5 mm²
Reference potential for all signals		DGND
Digital position transducers (encoders):		
– **SSI transducer** (Due to the higher control quality, an SSI transducer with clock synchronization should be used.)		
• Coding		Gray-Code / binary code
• Data width		Adjustable 12 to 28 bits
• Line receiver / line driver		RS485
• Voltage supply via the VT-HNC100-C-3X/S	*U, I*	U_B, **max. 200 mA** at X8M, pin 7 (+24 Venc)
– **Position transducer, EnDat 2.2**		
• Interface (clock and data) according to RS485		
• Voltage supply via the VT-HNC100-C-3X/S	*U, I*	5.25 V ±1 %, **max. 400 mA** at X8M, pin 6 (+5 Venc) 3.6 to 5.25 V must be applied to the transducer.
• Resolution		Minimum 10 nm or higher
Reference potential for all signals		EGND
Dimensions		See page 13
Assembly		Top hat rail TH 35-7.5 or TH 35-15 according to EN 60715
Admissible operating temperature range	ϑ	0 to 50 °C
Storage temperature range	ϑ	–20 to +70 °C
Protection class according to EN 60529:1991		IP 20
Weight	*m*	440 g
CE conformity		See page 2

Further technical details upon request.

Notice:
For information on the environment simulation testing for the areas EMC (electro-magnetic compatibility), climate and mechanical load, see data sheet 30139-U.

Technical data VT-HNC100-1-3X/S (1-axis version)

Operating voltage [1]	U_B	18 to 30 VDC
Current consumption at 24 VDC		CPU card approx. 200 mA Per axis approx. 100 mA (observe additional current consumption for connected sensors/actuators)
Processor		32 bit power PC
Analog inputs (AI) per axis electronics:		
– Voltage inputs (differential inputs)		
• Channel number		2
• Input voltage	U_E	Max. +12 V to –12 V (+10 V to –10 V measurable)
• Input resistance	R_E	200 kΩ ± 5 %
• Resolution		5 mV
• Non-linearity		< 0.2 %
• Calibration tolerance [2]		Max. 40 mV (with factory settings)
– Current inputs		
• Channel number		2
• Input current	I_E	4 mA to 20 mA
• Leakage current	I_V	0.1 to 0.4 %
• Resolution		5 µA
– Voltage supply for analog sensors via the VT-HNC100-1-3X/S	U, I	U_B, **max. 200 mA** at X2A, pin 14 (+24 Vsens)
Analog outputs (AO) per axis electronics: [3]		2
– Non-linearity		
• In the range –9.5 V to +9.5 V		< 0.1 %
• In the range –10 V to –9.5 V and +9.5 V to +10 V		< 0.2 %
– Voltage output		
• Output voltage	U_{nom}	–10 V to +10 V (max. –10.7 V to +10.7 V)
• Output current	I_{max}	±10 mA
• Load	R_{min}	1 kΩ
• Residual ripple		±60 mV (without noise)
• Resolution		1.25 mV
– Current output		
• Output current standardized	I_{nom}	4 mA to 20 mA
• Load	R_{max}	500 Ω
• Resolution		0.625 µA
Bus interface		sercos III
Switching inputs (DI) and/or outputs (DO) per axis electronics (adjustable via software)	Quantity	11
Switching inputs (DI)	Logic level	log 0 (low) ≤ 5 V; log 1 (high) ≥ 10 V to U_B, I_e = 20 mA with U_B = 24 V
	Connection	Flexible conductor up to 1.5 mm²
Switching outputs (DO)	Logic level	log 0 (low) ≤ 2 V; log 1 (high) ≤ U_B; I_{max} = 20 mA, maximum load capacity C = 0.047 µF
	Connection	Flexible conductor up to 1.5 mm²
Reference potential for all signals		DGND

[1] If a 24 V transducer supply is implemented directly via the VT-HNC100-1-3X/S (supply voltage is looped in), the transducer specification has to be observed.

[2] If the factory settings are insufficient, the measurement technology can be calibrated on site via software in a system-specific way.

[3] Configurable as current or voltage output.

Technical data VT-HNC100-...-3X (1-axis version), continued

Digital position transducers (encoder) per axis electronics:		
– **Position transducer, incremental** (transducer with TTL output)		
• Input voltage	log 0	0 to 1 V
	log 1	2.8 to 5.5 V
• Input current	log 0	–0.8 mA (with 0 V)
	log 1	0.8 mA (with 5 V)
• Max. frequency referring to Ua1	f_{max}	250 kHz
• Voltage supply via the VT-HNC100...3X/S	*U, I*	5.25 V ±1 %, **max. 400 mA** at X8M1, pin 12 (+5 Venc)
– **SSI transducer** (Due to the higher control quality, an SSI transducer with clock synchronization should be used.)		
• Coding		Gray-Code / binary code
• Data width		Adjustable 12 to 28 bits
• Line receiver / line driver		RS485
• Voltage supply via the VT-HNC100...3X/S	*U, I*	U_B, **max. 500 mA** at X8M1, pin 14 (+24 Venc)
– **Position transducer, EnDat 2.2**		
• Interface (clock and data) according to RS 485		
• Voltage supply via the VT-HNC100...3X/S	*U, I*	5.25 V ±1 %, **max. 400 mA** at X8M1, pin 12 (+5 Venc) 3.6 to 5.25 V must be applied to the transducer.
• Resolution		Minimum 10 nm or higher
Analog position transducer (encoder):		
• Input voltage	U_E	Max. +12 V to –12 V (+10 V to –10 V measurable)
• Input resistance	R_E	> 10 MΩ
• Resolution		5 mV
• Non-linearity		< 0.2 %
• Calibration tolerance [1)]		Max. 40 mV (with factory settings)
• Voltage supply via the VT-HNC100...3X/S	*U, I*	+10 V ± 25 mV, max. 20 mA at X8M1, pin 13 (+10 Vref)
Reference potential for all signals		EGND
Dimensions		See page 13
Assembly		Top hat rail TH 35-7.5 or TH 35-15 according to EN 60715
Admissible operating temperature range	ϑ	0 to 50 °C
Storage temperature range	ϑ	–20 to +70 °C
Protection class according to EN 60529:1991		IP 20
Weight	*m*	585 g
CE conformity		See page 2

Further technical details upon request.

Notice:
For information on the environment simulation testing for the areas EMC (electro-magnetic compatibility), climate and mechanical load, see data sheet 30139-U.

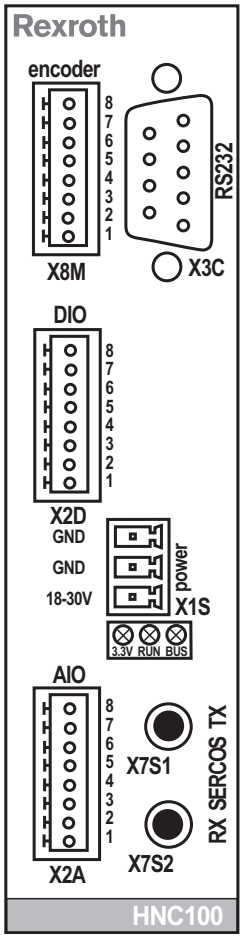
1) If the factory settings are insufficient, the measurement technology can be calibrated on site via software in a system-specific way.

Pin assignment VT-HNC100-C-3X/S... (Compact with sercos II)

X8M	Encoder	
Pin	SSI	EnDat 2.2
8	Shield	Shield
7	24 Venc	
6		+5 V
5	– Clk	– Clk
4	+ Clk	+ Clk
3	– Data	– Data
2	+ Data	+ Data
1	EGND	

X2D	DIO (Digital)
Pin	
8	Shield
7	OUT2
6	OUT1
5	IN 4
4	IN 3
3	IN 2
2	IN 1
1	DGND

X2A	AIO (Analog)
Pin	
8	Shield
7	24 Vsens
6	Vout1 +
5	Vout2 +
4	Vin 1
3	Cin2 +
2	Cin1 +
1	AGND



X3C	RS232
Pin	
1	
2	TxD
3	RxD
4	Reserved
5	GND
6	Reserved
7	Reserved
8	Reserved
9	

X1S	Power
Pin	
1	GND
2	GND
3	18 – 30 V

X7	sercos II
S1	TX
S2	RX

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

Pin assignment VT-HNC100-1-3X/S... (1-axis version with sercos III)

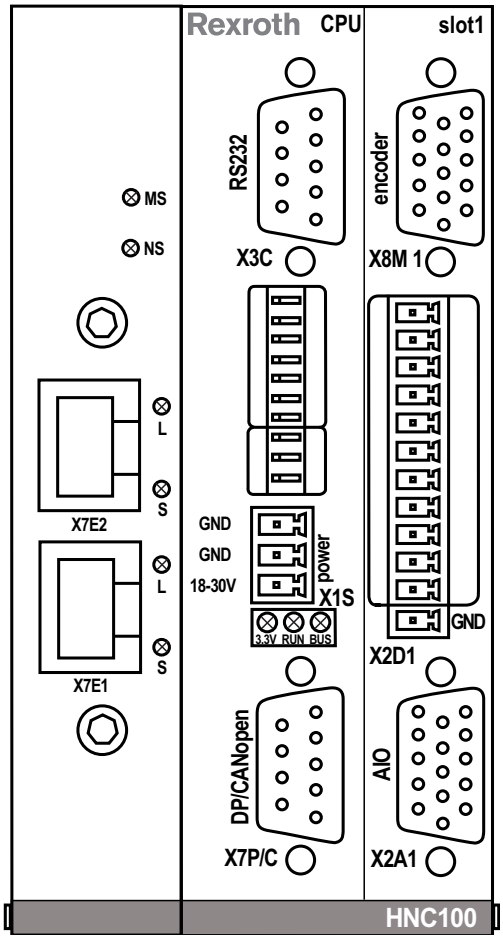
Slot 1 X8M1	Encoder			
	Incremental	**EnDat 2.2**	**SSI**	**Analog**
Pin				
1	– B (Inc)			
2		+ CLK	+ CLK	
3	+ R (Inc)			
4	– R (Inc)			
5	+ A (Inc)			
6	– A (Inc)			
7		– CLK	– CLK	
8	+ B (Inc)			
9		– Data	– Data	
10	EGND	EGND	EGND	EGND
11		+ Data	+ Data	
12	+5 Venc	+5 Venc		
13				+10 Vref
14			+24 Venc	
15				Vimp1

X3C	RS232
Pin	
1	
2	TxD
3	RxD
4	Reserved
5	GND
6	Reserved
7	Reserved
8	Reserved
9	

X1S	Power
Pin	
1	GND
2	GND
3	18 – 30 V

X7E1, X7E2
sercos III connection

Notices:
The pins marked with **"reserved"** are reserved and must not be connected!



Slot 1 X2D1	DIO (Digital)
Pin	
1	I/O 1
2	I/O 2
3	I/O 3
4	I/O 4
5	I/O 5
6	I/O 6
7	I/O 7
8	I/O 8
9	I/O 9
10	I/O 10
11	I/O 11
12	DGND

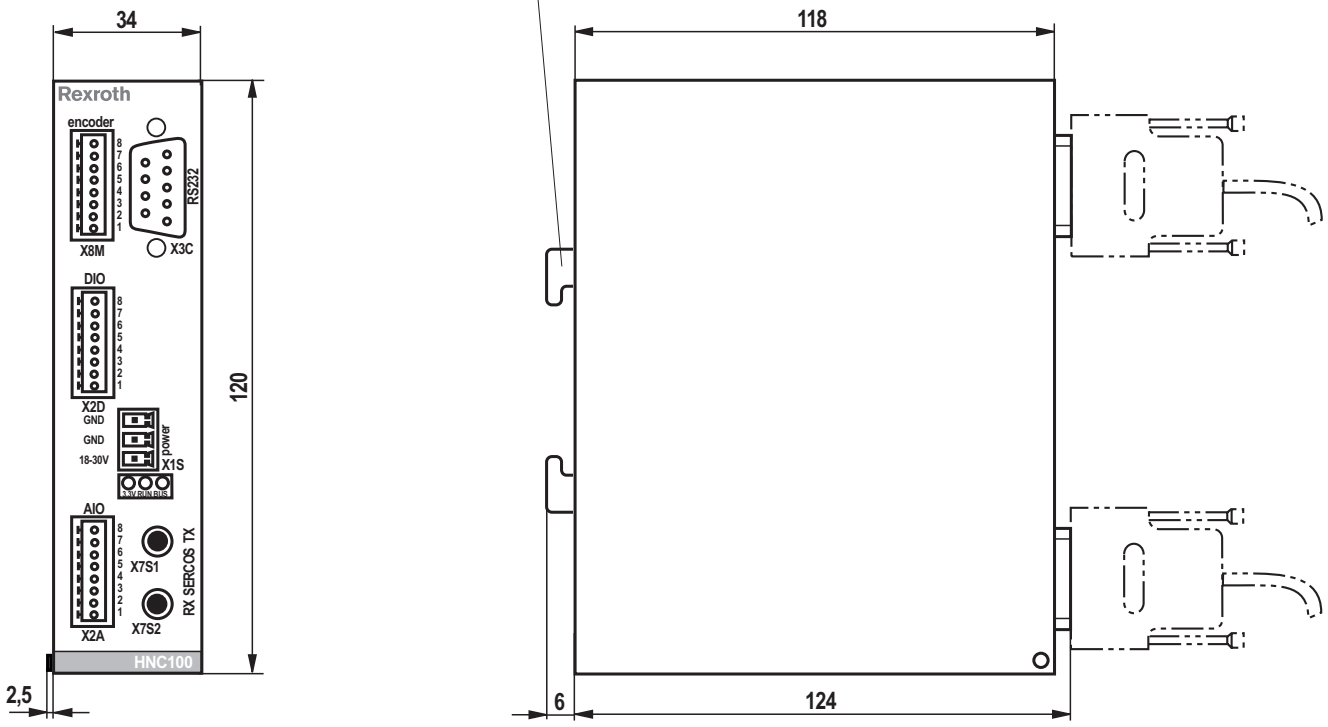
Slot 1 X2A1	AIO (Analog)
Pin	
1	Vin1 +
2	Vin1 –
3	Vin2 +
4	Vin2 –
5	Cin1 +
6	Cin1 –
7	Cin2 +
8	Cin2 –
9	Reserved
10	AGND
11	Vout1 +
12	Vout2 +
13	Cout1
14	+24 Vsens
15	Reserved

PROFIBUS DP or CANopen (connection X7P/C) are not available with the sercos version.

Unit dimensions (dimensions in mm)

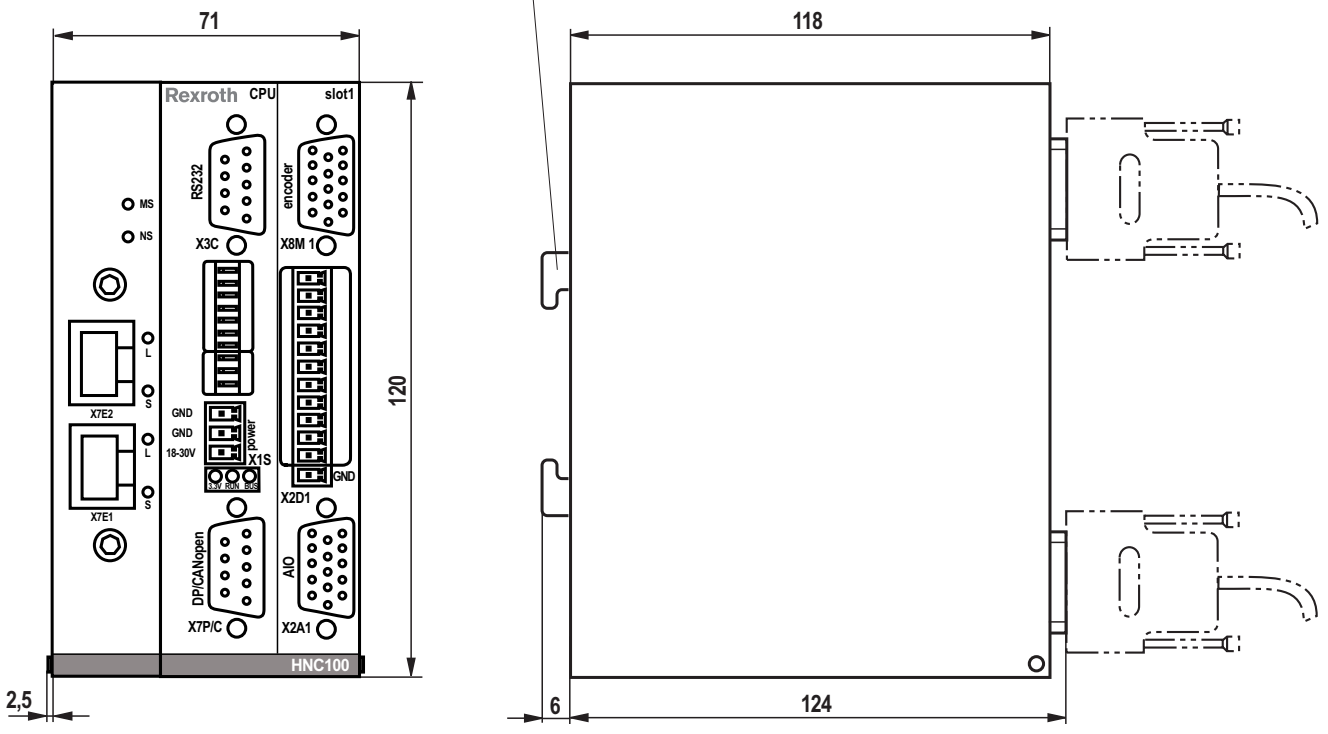
VT-HNC100-C-3X/S...

Assembly on top hat rail TH 35-7.5 or TH 35-15 according to EN 60715



VT-HNC100-1-3X/S...

Assembly on top hat rail TH 35-7.5 or TH 35-15 according to EN 60715



Project planning / maintenance instructions / additional information

Product documentation for VT-HNC100...3X/S

Product information 09956
Data sheet 30159
Operating instructions 30159-B
Functional description 30159-FK
Parameter description 30159-PA
Environmental compatibility statement 30139-U

Commissioning software and documentation on the Internet: www.boschrexroth.com/HNC100

Maintenance instructions:

- The devices have been tested in the plant and are supplied with default settings.
- Only complete units can be repaired. Repaired devices are returned with default settings. User-specific settings are not accepted. The user must transfer all appropriate user parameters and programs again.

Notices:

- The VT-HNC100...3X/S does not support rotary drives
- Electric signals taken out via control electronics (e.g. "No error" signal) must not be used for switching safety-relevant machine functions! (See also the European standard "Safety requirements for fluid power systems and their components - Hydraulics", EN 982.)
- If electro-magnetic interference is to be anticipated, suitable measures must be taken to ensure the function (depending on the application, e.g. shielding, filtration)!
  In order to satisfy the requirements of the CE mark, a cable of category 7 (cat. 7 according to ISO/IEC 11801) must be used for the sercos III communication.
- The upper and lower ventilation slots must not be concealed by adjacent units in order to provide for sufficient cooling.

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