rexroth
A Bosch Company

IndraDrive

HNF01.x Mains Filters
HNL01.x Mains Chokes

Project Planning Manual
R911342564

Edition 05

Title IndraDrive
HNF01.x Mains Filters
HNL01.x Mains Chokes

Type of Documentation Project Planning Manual

Document Typecode DOK-INDRV*-HNF+HNL****-PR05-EN-P

Internal File Reference RS-166653b3b932e48e0a6846a5014848fa-5-en-US-6

Record of Revisions See chapter 1.1.1 "Editions of this documentation" on page 1

Editorial Department Engineering Drives [RoDo, HaSt, ReMa (UdSt; BaBo)]

Table of Contents

Page

1 Introduction

1.1 About this documentation

1.1.1 Editions of this documentation

Edition	Release date	Notes
01	2013-11	-
02	2017-06	-
03	2017-11	-
04	2018-07	-
05	2019-03	HNL01.2R: • Included information on how to handle short-circuit jumpers • Updated circuit diagram: Added U, V, W connections

Tab. 1-1: Editions

2 Safety instructions for electric drives and controls

2.1 Definitions of terms

Application documentation Application documentation comprises the entire documentation used to inform the user of the product about the use and safety-relevant features for configuring, integrating, installing, mounting, commissioning, operating, maintaining, repairing and decommissioning the product. The following terms are also used for this kind of documentation: Operating Instructions, Commissioning Manual, Instruction Manual, Project Planning Manual, Application Description, etc.

Component A component is a combination of elements with a specified function, which are part of a piece of equipment, device or system. Components of the electric drive and control system are, for example, supply units, drive controllers, mains choke, mains filter, motors, cables, etc.

Control system A control system comprises several interconnected control components placed on the market as a single functional unit.

Device A device is a finished product with a defined function, intended for users and placed on the market as an individual piece of merchandise.

Electrical equipment Electrical equipment encompasses all devices used to generate, convert, transmit, distribute or apply electrical energy, such as electric motors, transformers, switching devices, cables, lines, power-consuming devices, circuit board assemblies, plug-in units, control cabinets, etc.

Electric drive system An electric drive system comprises all components from mains supply to motor shaft; this includes, for example, electric motor(s), motor encoder(s), supply units and drive controllers, as well as auxiliary and additional components, such as mains filter, mains choke and the corresponding lines and cables.

Installation An installation consists of several devices or systems interconnected for a defined purpose and on a defined site which, however, are not intended to be placed on the market as a single functional unit.

Machine A machine is the entirety of interconnected parts or units at least one of which is movable. Thus, a machine consists of the appropriate machine drive elements, as well as control and power circuits, which have been assembled for a specific application. A machine is, for example, intended for processing, treatment, movement or packaging of a material. The term "machine" also covers a combination of machines which are arranged and controlled in such a way that they function as a unified whole.

Manufacturer The manufacturer is an individual or legal entity bearing responsibility for the design and manufacture of a product which is placed on the market in the individual's or legal entity's name. The manufacturer can use finished products, finished parts or finished elements, or contract out work to subcontractors. However, the manufacturer must always have overall control and possess the required authority to take responsibility for the product.

Product Examples of a product: Device, component, part, system, software, firmware, among other things.

Project Planning Manual A Project Planning Manual is part of the application documentation used to support the sizing and planning of systems, machines or installations.

Qualified persons In terms of this application documentation, qualified persons are those persons who are familiar with the installation, mounting, commissioning and operation of the components of the electric drive and control system, as well as with the hazards this implies, and who possess the qualifications their

work requires. To comply with these qualifications, it is necessary, among other things,

- to be trained, instructed or authorized to switch electric circuits and devices safely on and off, to ground them and to mark them.
- to be trained or instructed to maintain and use adequate safety equipment.
- to attend a course of instruction in first aid.

Qualified personnel for handling functionally safe products

Individuals configuring, commissioning and operating functionally safe products must have the knowledge specified under "Qualified persons". Additionally, these individuals must be familiar with technical safety concepts as well as prevailing standards and regulations in the field of functional safety.

User

A user is a person installing, commissioning or using a product which has been placed on the market.

2.2 General information

2.2.1 Using the Safety instructions and passing them on to others

Do not attempt to install and operate the components of the electric drive and control system without first reading all documentation provided with the product. Read and understand these safety instructions and all user documentation prior to working with these components. If you do not have the user documentation for the components, contact your responsible Rexroth sales partner. Ask for these documents to be sent immediately to the person or persons responsible for the safe operation of the components.

If the component is resold, rented and/or passed on to others in any other form, these safety instructions must be delivered with the component in the official language of the user's country.

Improper use of these components, failure to follow the safety instructions in this document or tampering with the product, including disabling of safety devices, could result in property damage, injury, electric shock or even death.

2.2.2 Requirements for safe use

Read the following instructions before initial commissioning of the components of the electric drive and control system in order to eliminate the risk of injury and/or property damage. You must follow these safety instructions.

- Rexroth is not liable for damages resulting from failure to observe the safety instructions.
- Read the operating, maintenance and safety instructions in your language before commissioning. If you find that you cannot completely understand the application documentation in the available language, please ask your supplier to clarify.
- Proper and correct transport, storage, mounting and installation, as well as care in operation and maintenance, are prerequisites for optimal and safe operation of the component.
- Only qualified persons may work with components of the electric drive and control system or within its proximity.
- Only use accessories and spare parts approved by Rexroth.

- Follow the safety regulations and requirements of the country in which the components of the electric drive and control system are operated.
- Only use the components of the electric drive and control system in the manner that is defined as appropriate. See chapter "Appropriate Use".
- The ambient and operating conditions given in the available application documentation must be observed.
- Applications for functional safety are only allowed if clearly and explicitly specified in the application documentation "Integrated Safety Technology". If this is not the case, they are excluded. Functional safety is a safety concept in which measures of risk reduction for personal safety depend on electrical, electronic or programmable control systems.
- The information given in the application documentation with regard to the use of the delivered components contains only examples of applications and suggestions.

  The machine and installation manufacturers must
  - make sure that the delivered components are suited for their individual application and check the information given in this application documentation with regard to the use of the components,
  - make sure that their individual application complies with the applicable safety regulations and standards and carry out the required measures, modifications and complements.
- Commissioning of the delivered components is only allowed once it is sure that the machine or installation in which the components are installed complies with the national regulations, safety specifications and standards of the application.
- Operation is only allowed if the national EMC regulations for the application are met.
- The instructions for installation in accordance with EMC requirements can be found in the section on EMC in the respective application documentation.

  The machine or installation manufacturer is responsible for compliance with the limit values as prescribed in the national regulations.
- The technical data, connection and installation conditions of the components are specified in the respective application documentations and must be followed at all times.

National regulations which the user has to comply with

- European countries: In accordance with European EN standards
- United States of America (USA):
  - National Electrical Code (NEC)
  - National Electrical Manufacturers Association (NEMA), as well as local engineering regulations
  - Regulations of the National Fire Protection Association (NFPA)
- Canada: Canadian Standards Association (CSA)
- Other countries:
  - International Organization for Standardization (ISO)
  - International Electrotechnical Commission (IEC)

2.2.3 Hazards by improper use

- High electrical voltage and high working current! Danger to life or serious injury by electric shock!
- High electrical voltage by incorrect connection! Danger to life or injury by electric shock!
- Dangerous movements! Danger to life, serious injury or property damage by unintended motor movements!
- Health hazard for persons with heart pacemakers, metal implants and hearing aids in proximity to electric drive systems!
- Risk of burns by hot housing surfaces!
- Risk of injury by improper handling! Injury by crushing, shearing, cutting, hitting!
- Risk of injury by improper handling of batteries!
- Risk of injury by improper handling of pressurized lines!

2.3 Instructions with regard to specific dangers

2.3.1 Protection against contact with electrical parts and housings

☞ This section concerns components of the electric drive and control system with voltages of **more than 50 volts**.

Contact with parts conducting voltages above 50 volts can cause personal danger and electric shock. When operating components of the electric drive and control system, it is unavoidable that some parts of these components conduct dangerous voltage.

High electrical voltage! Danger to life, risk of injury by electric shock or serious injury!

- Only qualified persons are allowed to operate, maintain and/or repair the components of the electric drive and control system.
- Follow the general installation and safety regulations when working on power installations.
- Before switching on, the equipment grounding conductor must have been permanently connected to all electric components in accordance with the connection diagram.
- Even for brief measurements or tests, operation is only allowed if the equipment grounding conductor has been permanently connected to the points of the components provided for this purpose.
- Before accessing electrical parts with voltage potentials higher than 50 V, you must disconnect electric components from the mains or from the power supply unit. Secure the electric component from reconnection.
- With electric components, observe the following aspects:

  Always wait **30 minutes** after switching off power to allow live capacitors to discharge before accessing an electric component. Measure the electrical voltage of live parts before beginning to work to make sure that the equipment is safe to touch.

- Install the covers and guards provided for this purpose before switching on.
- Never touch any electrical connection points of the components while power is turned on.
- Do not remove or plug in connectors when the component has been powered.
- Under specific conditions, electric drive systems can be operated at mains protected by residual-current-operated circuit-breakers sensitive to universal current (RCDs/RCMs).
- Secure built-in devices from penetrating foreign objects and water, as well as from direct contact, by providing an external housing, for example a control cabinet.

High housing voltage and high leakage current! Danger to life, risk of injury by electric shock!

- Before switching on and before commissioning, ground or connect the components of the electric drive and control system to the equipment grounding conductor at the grounding points.
- Connect the equipment grounding conductor of the components of the electric drive and control system permanently to the main power supply at all times. The leakage current is greater than 3.5 mA.
- Establish an equipment grounding connection with a minimum cross section according to the table below. With an outer conductor cross section smaller than 10 mm^2 (8 AWG), the alternative connection of two equipment grounding conductors is allowed, each having the same cross section as the outer conductors.

Cross section outer conductor	Minimum cross section equipment grounding conductor Leakage current ≥ 3.5 mA	
	1 equipment grounding conductor	2 equipment grounding conductors
1.5 mm^2 (16 AWG)	10 mm^2 (8 AWG)	2 × 1.5 mm^2 (16 AWG)
2.5 mm^2 (14 AWG)		2 × 2.5 mm^2 (14 AWG)
4 mm^2 (12 AWG)		2 × 4 mm^2 (12 AWG)
6 mm^2 (10 AWG)		2 × 6 mm^2 (10 AWG)
10 mm^2 (8 AWG)		-
16 mm^2 (6 AWG)	16 mm^2 (6 AWG)	-
25 mm^2 (4 AWG)		-
35 mm^2 (2 AWG)		-
50 mm^2 (1/0 AWG)	25 mm^2 (4 AWG)	-
70 mm^2 (2/0 AWG)	35 mm^2 (2 AWG)	-
...	...	...

Tab. 2-1: Minimum cross section of the equipment grounding connection

2.3.2 Protective extra-low voltage as protection against electric shock

Protective extra-low voltage is used to allow connecting devices with basic insulation to extra-low voltage circuits.

On components of an electric drive and control system provided by Rexroth, all connections and terminals with voltages up to 50 volts are PELV ("Protective Extra-Low Voltage") systems. It is allowed to connect devices equipped with basic insulation (such as programming devices, PCs, notebooks, display units) to these connections.

Danger to life, risk of injury by electric shock! High electrical voltage by incorrect connection!

If extra-low voltage circuits of devices containing voltages and circuits of more than 50 volts (e.g., the mains connection) are connected to Rexroth products, the connected extra-low voltage circuits must comply with the requirements for PELV ("Protective Extra-Low Voltage").

2.3.3 Protection against dangerous movements

Dangerous movements can be caused by faulty control of connected motors. Some common examples are:

- Improper or wrong wiring or cable connection
- Operator errors
- Wrong input of parameters before commissioning
- Malfunction of sensors and encoders
- Defective components
- Software or firmware errors

These errors can occur immediately after equipment is switched on or even after an unspecified time of trouble-free operation.

The monitoring functions in the components of the electric drive and control system will normally be sufficient to avoid malfunction in the connected drives. Regarding personal safety, especially the danger of injury and/or property damage, this alone cannot be relied upon to ensure complete safety. Until the integrated monitoring functions become effective, it must be assumed in any case that faulty drive movements will occur. The extent of faulty drive movements depends upon the type of control and the state of operation.

Dangerous movements! Danger to life, risk of injury, serious injury or property damage!

A **risk assessment** must be prepared for the installation or machine, with its specific conditions, in which the components of the electric drive and control system are installed.

As a result of the risk assessment, the user must provide for monitoring functions and higher-level measures on the installation side for personal safety. The safety regulations applicable to the installation or machine must be taken into consideration. Unintended machine movements or other malfunctions are possible if safety devices are disabled, bypassed or not activated.

To avoid accidents, injury and/or property damage:

- Keep free and clear of the machine's range of motion and moving machine parts. Prevent personnel from accidentally entering the machine's range of motion by using, for example:
  - Safety fences
  - Safety guards
  - Protective coverings
  - Light barriers
- Make sure the safety fences and protective coverings are strong enough to resist maximum possible kinetic energy.
- Mount emergency stopping switches in the immediate reach of the operator. Before commissioning, verify that the emergency stopping equipment works. Do not operate the machine if the emergency stopping switch is not working.
- Prevent unintended start-up. Isolate the drive power connection by means of OFF switches/OFF buttons or use a safe starting lockout.
- Make sure that the drives are brought to safe standstill before accessing or entering the danger zone.
- Additionally secure vertical axes against falling or dropping after switching off the motor power by, for example,
  - mechanically securing the vertical axes,
  - adding an external braking/arrester/clamping mechanism or
  - ensuring sufficient counterbalancing of the vertical axes.
- The standard equipment **motor holding brake** or an external holding brake controlled by the drive controller is **not sufficient to guarantee personal safety**!
- Disconnect electrical power to the components of the electric drive and control system using the master switch and secure them from reconnection ("lock out") for:
  - Maintenance and repair work
  - Cleaning of equipment
  - Long periods of discontinued equipment use
- Prevent the operation of high-frequency, remote control and radio equipment near components of the electric drive and control system and their supply leads. If the use of these devices cannot be avoided, check the machine or installation, at initial commissioning of the electric drive and control system, for possible malfunctions when operating such high-frequency, remote control and radio equipment in its possible positions of normal use. It might possibly be necessary to perform a special electromagnetic compatibility (EMC) test.

2.3.4 Protection against electromagnetic and magnetic fields during operation and mounting

Electromagnetic and magnetic fields!

Health hazard for persons with active implantable medical devices (AIMD) such as pacemakers or passive metallic implants.

- Hazards for the above-mentioned groups of persons by electromagnetic and magnetic fields in the immediate vicinity of drive controllers and the associated current-carrying conductors.

- Entering these areas can pose an increased risk to the above-mentioned groups of persons. They should seek advice from their physician.
- If overcome by possible effects on above-mentioned persons during operation of drive controllers and accessories, remove the exposed persons from the vicinity of conductors and devices.

2.3.5 Protection against contact with hot parts

Hot surfaces of components of the electric drive and control system. Risk of burns!

- Do not touch hot surfaces of, for example, braking resistors, heat sinks, supply units and drive controllers, motors, windings and laminated cores!
- According to the operating conditions, temperatures of the surfaces can be **higher than 60 °C** (140 °F) during or after operation.
- Before touching motors after having switched them off, let them cool down for a sufficient period of time. Cooling down can require **up to 140 minutes**! The time required for cooling down is approximately five times the thermal time constant specified in the technical data.
- After switching chokes, supply units and drive controllers off, wait **15 minutes** to allow them to cool down before touching them.
- Wear safety gloves or do not work at hot surfaces.
- For certain applications, and in accordance with the respective safety regulations, the manufacturer of the machine or installation must take measures to avoid injuries caused by burns in the final application. These measures can be, for example: Warnings at the machine or installation, guards (shieldings or barriers) or safety instructions in the application documentation.

2.3.6 Protection during handling and mounting

Risk of injury by improper handling! Injury by crushing, shearing, cutting, hitting!

- Observe the relevant statutory regulations of accident prevention.
- Use suitable equipment for mounting and transport.
- Avoid jamming and crushing by appropriate measures.
- Always use suitable tools. Use special tools if specified.
- Use lifting equipment and tools in the correct manner.
- Use suitable protective equipment (hard hat, safety goggles, safety shoes, safety gloves, for example).
- Do not stand under hanging loads.
- Immediately clean up any spilled liquids from the floor due to the risk of falling!

2.3.7 Battery safety

Batteries consist of active chemicals in a solid housing. Therefore, improper handling can cause injury or property damage.

Risk of injury by improper handling!

- Do not attempt to reactivate low batteries by heating or other methods (risk of explosion and cauterization).
- Do not attempt to recharge the batteries as this may cause leakage or explosion.
- Do not throw batteries into open flames.
- Do not dismantle batteries.
- When replacing the battery/batteries, do not damage the electrical parts installed in the devices.
- Only use the battery types specified for the product.

☞ Environmental protection and disposal! The batteries contained in the product are considered dangerous goods during land, air, and sea transport (risk of explosion) in the sense of the legal regulations. Dispose of used batteries separately from other waste. Observe the national regulations of your country.

2.3.8 Protection against pressurized systems

According to the information given in the Project Planning Manuals, motors and components cooled with liquids and compressed air can be partially supplied with externally fed, pressurized media, such as compressed air, hydraulics oil, cooling liquids and cooling lubricants. Improper handling of the connected supply systems, supply lines or connections can cause injuries or property damage.

Risk of injury by improper handling of pressurized lines!

- Do not attempt to disconnect, open or cut pressurized lines (risk of explosion).
- Observe the respective manufacturer's operating instructions.
- Before dismounting lines, relieve pressure and empty medium.
- Use suitable protective equipment (safety goggles, safety shoes, safety gloves, for example).
- Immediately clean up any spilled liquids from the floor due to the risk of falling!

☞ Environmental protection and disposal! The agents (e.g., fluids) used to operate the product might not be environmentally friendly. Dispose of agents harmful to the environment separately from other waste. Observe the national regulations of your country.

2.4 Explanation of signal words and the Safety alert symbol

The Safety Instructions in the available application documentation contain specific signal words (DANGER, WARNING, CAUTION or NOTICE) and, where required, a safety alert symbol (in accordance with ANSI Z535.6-2011).

The signal word is meant to draw the reader's attention to the safety instruction and identifies the hazard severity.

The safety alert symbol (a triangle with an exclamation point), which precedes the signal words DANGER, WARNING and CAUTION, is used to alert the reader to personal injury hazards.

⚠ DANGER

In case of non-compliance with this safety instruction, death or serious injury **will** occur.

⚠ WARNING

In case of non-compliance with this safety instruction, death or serious injury **could** occur.

⚠ CAUTION

In case of non-compliance with this safety instruction, minor or moderate injury could occur.

NOTICE

In case of non-compliance with this safety instruction, property damage could occur.

3 General data and specifications

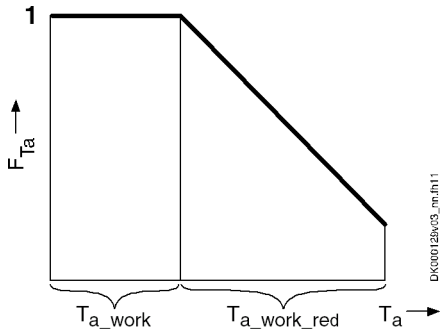
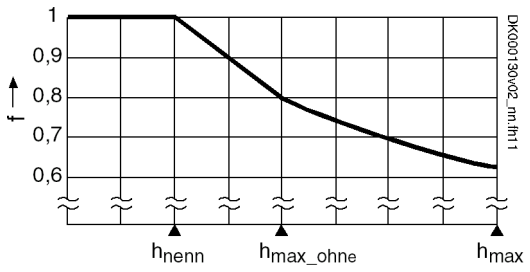
3.1 Ambient and operating conditions

☞ Check that the ambient conditions, in particular the control cabinet temperature, are complied with by calculating the heat levels in the control cabinet. Afterwards, make the corresponding measurements to verify that the ambient conditions have actually been complied with.

In the technical data of the individual components, the power dissipation is specified as an important input value for calculating the heat levels.

Ambient and operating conditions (HCS, HMV, HMS, HMD, HCQ, HCT, KCU, HLC, HNF)

Description	Symbol	Unit	Value
Conductive dirt contamination	-	-	Not allowed Protect the devices against conductive dirt contamination by mounting them in control cabinets with the degree of protection IP54 (in accordance with IEC529).
Degree of protection of the device (IEC529)	-	-	IP20
Use within scope of CSA / UL	-	-	For use in NFPA 79 Applications only!
Temperature during storage	-	-	See chapter 3.4 "Storing the components" on page 16
Temperature during transport	-	-	See chapter 3.3 "Transporting the components" on page 15
Allowed mounting position Definition of mounting positions: See chapter 3.2 "Mounting positions of components" on page 15	-	-	G1 [3)]
Installation altitude	h_{nenn}	m	1000
Ambient temperature range	T_{a_work}	°C	0 … 40

Description	Symbol	Unit	Value
Derating vs. ambient temperature: The performance data are reduced by the factor F_{Ta} in the ambient temperature range $T_{a\_work\_red}$: $F_{Ta} = 1 - [(T_a - 40) \times f_{Ta}]$ Example: With an ambient temperature T_a = 50 °C and a capacity utilization factor f_{Ta} = 2 %/K, the rated power is reduced to $P_{DC\_cont\_red} = P_{DC\_cont} \times F_{Ta} =$ P_{DC_cont} x (1 - [(50 - 40) x 0.02]) = P_{DC_cont} x 0.8 Operation at ambient temperatures outside of T_{a_work} and $T_{a\_work\_red}$ is not allowed!			
	$T_{a\_work\_red}$	°C	40 … 55
	f_{Ta}	%/K	2.0
Derating vs. installation altitude: At an installation altitude h > h_{nenn}, the available performance data are reduced by the **factor f**[2)]. At an installation altitude in the range h_{max_ohne} to h_{max}, an isolating transformer has to be installed at the drive system mains connection. Operation above h_{max} is not allowed!			
	h_{max_ohne}	m	2000
	h_{max}	m	4000
Simultaneous derating for ambient temperature **and** installation altitude	Allowed; reduce performance data with the product f × F_{Ta}		
Relative humidity	-	%	5 … 95
Absolute humidity	-	g/m^3	1 … 29
Climatic category (IEC 60721-3-3)	-	-	3K3
Allowed pollution degree (EN 50178)	-	-	2
Resistance to chemically active substances (IEC 60721-3-3)	-	-	Class 3C1
Vibration sine: amplitude (peak-peak) at 10 … 57 Hz [1)]	-	mm	0.15
Vibration sine: acceleration at 57 … 150 Hz [1)]	-	g	1
Overvoltage category	-	-	III (according to IEC 60664-1)

1) According to EN 60068-2-6

2) Reduced performance data for drive controllers: allowed DC bus continuous power, braking resistor continuous power, continuous current; additionally for HCS01, HCQ, HCT drive controllers: allowed mains voltage

3) Some components can be operated in mounting positions other than G1. The allowed mounting positions are specified in the technical data of the components.

Tab. 3-1: Ambient and operating conditions (HCS, HMV, HMS, HMD, HCQ, HCT, KCU, HLC, HNF)

3.2 Mounting positions of components

NOTICE **Risk of damage to the components by incorrect mounting position!**

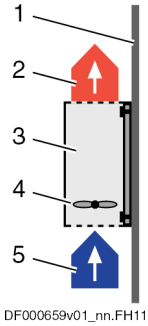
Only operate the components in their allowed mounting positions. The allowed mounting positions are specified in the technical data of the components.

For supply units and drive controllers installed in control cabinets, only the mounting position G1 is usually allowed.

Some components can also be operated in mounting positions other than G1. The allowed mounting positions are specified in the technical data of the component.

Mounting positions

The allowed mounting positions are specified with G1, G2, G3, G4 or G5 in the technical data of the components.

Mounting position	Description	
G1		**Normal mounting position** The air heated inside the component can flow unimpeded vertically upward. In the case of components with integrated fans, the natural convection supports the forced cooling air current. 1. Mounting surface 2. Outgoing, heated air 3. Component 4. Fan within the component (forces the cooling air current) 5. Cooling air
G2	180° to normal mounting position	
G3	90° to normal mounting position	
G4	bottom mounting; mounting surface on the bottom	
G5	top mounting; mounting surface at the top	

Tab. 3-2: Mounting positions

3.3 Transporting the components

Ambient and operating conditions for transport

Description	Symbol	Unit	Value
Temperature range	T_{a_tran}	°C	-20 … +70
Relative humidity		%	5 … 95

Description	Symbol	Unit	Value
Absolute humidity		g/m^3	1 … 60
Climatic category (IEC 721)			2K3
Moisture condensation			Not allowed
Icing			Not allowed

Tab. 3-3: Ambient and operating conditions for transport

3.4 Storing the components

NOTICE **Risk of damage to components from long-term storage!**

Some components contain electrolytic capacitors which may deteriorate during storage.

When storing the following components for a longer period of time, run them **once a year for at least 1 hour**:

- Converters and supply units: Operated with mains voltage U_{LN}
- Inverters and DC bus capacitor units: Operated with DC bus voltage U_{DC}

Ambient and operating conditions - storage

Description	Symbol	Unit	Value
Temperature range	T_{a_store}	°C	-20 … +55
Relative humidity		%	5 … 95
Absolute humidity		g/m^3	1 … 29
Climatic category (IEC721)			1K3
Moisture condensation			Not allowed
Icing			Not allowed

Tab. 3-4: Ambient and operating conditions - storage

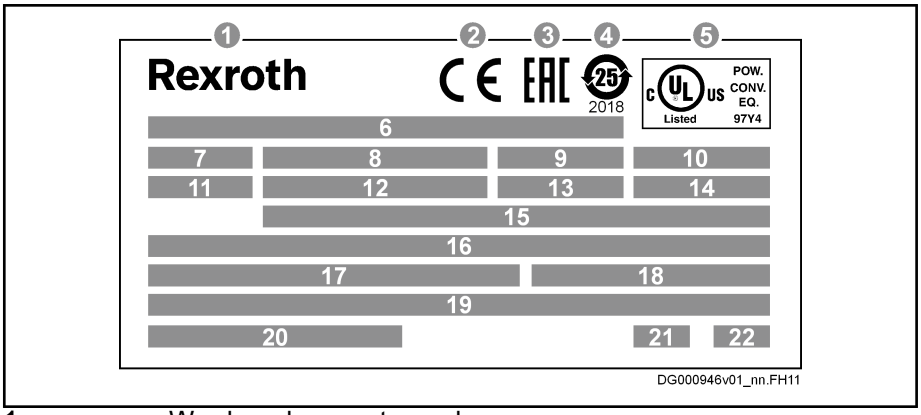
3.5 Plates

3.5.1 Type plate

1	Type designation
2	Country of manufacture
3	Factory
4	Customer material number
5	Material number
6	Bar code, 2D code
7	Serial number
8	Production week; 18W23, for example, means year 2018, week 23
9	Hardware index

Fig. 3-1: Type plate

3.5.2 Rating plate



1	Word mark or customer logo
2	CE conformity mark
3	EAC conformity mark
4	China RoHS 2 conformity label, production year
5	UL label
6	Type designation
7	Supply input data
8	Input voltage
9	Input current
10	Input frequency
11	Supply output data
12	Output voltage
13	Output current
14	Output frequency
15	UL text 2
16	UL text 1
17	SCCR
18	Ambient temperature during operation
19	Company address
20	Designation of origin
21	Degree of protection provided by enclosure
22	Factory

Fig. 3-2: Rating plate (electrical equipment)

3.6 China RoHS 2

www.boschrexroth.com.cn/zh/cn/home_2/china_rohs2

4 Brief description, use

4.1 HNF01.x mains filters

Mains filters reduce radio interference and mains pollution.

☞ When using HNF01.x mains filters at **mains grounded via outer conductor**, use an isolating transformer between mains and mains filter.

Type	Use
HNF01.x	Interference suppression of three-phase drive controllers up to 480 V for drive systems with a high number of axes and long motor cables

Tab. 4-1: Use of mains filters

☞ Only operate expressly allowed components at the mentioned mains filters.

Do not connect any other loads at the connection from the mains filter output to the mains connection of the supply unit or controller. For motor fans and power supply units, for example, use separate mains filters.

4.2 HNL01.x mains chokes

(Standard) mains chokes HNL01.xE, HNL01.xR

- reduce harmonics in the mains current
- increase the allowed DC bus continuous power of certain converters
- allow regenerative supply units to be operated at the mains

The different types may be used **exclusively** as follows:

Type	Use
HNL01.xE	For connection to components without regeneration to the power grid (HMV01.1E, HCS02.1E, HCS03.1E)
HNL01.xR	For connection to components with regeneration to the power grid (HMV01.1R)

Tab. 4-2: Use of mains chokes

5 HNF01.2 - mains filters

5.1 HNF01.2 type code

HNF01.2

Short type designation	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Example:	H	N	F	0	1	.	2	A	-	F	2	4	0	-	R	0	0	9	4	-	A	-	4	8	0	-	N	N	N	N												
	①			②			③	④		⑤					⑥	⑦					⑧		⑨				⑩															

①	**Product:** HNF = HNF
②	**Series:** 01 = 01
③	**Design:** 2 = 2
④	**EMC area in accordance with DIN EN 61800-3:** A = Category C3 in accordance with DIN EN 61800-3 B = Category C1 in accordance with DIN EN 61800-3 C = Category C2 in accordance with DIN EN 61800-3 D = Category C2 in accordance with DIN EN 61800-3, extended frequency range in accordance with EMC integration guidelines of the automotive industry for production environment
⑤	**Applications:** F240 = 6 axes, max. cable length 240 m M900 = 15 axes, max. cable length 900 m
⑥	**Supply system:** E = For feeding devices only R = For regenerative devices only
⑦	**Nominal current:** 0094 = e.g. 94 A
⑧	**Degree of protection:** A = IP20 N = IP00
⑨	**Mains connection voltage:** 480 = 3 × AC 400 … 480V – 15 + 10%, 50/60 Hz
⑩	**Other design:** NNNN = None

Tab. 5-1: HNF01.2, type code

5.2 UL

C-UL-US listing

The components are listed by **UL** (Underwriters Laboratories Inc.®).

Proof of certification can be found online. Enter the terms "UL" and "databases" in a search engine to get to the relevant UL web page. With the file number you will find the proof of certification.

Standards
• UL standard: UL 1283
• CSA standard: C22.2 No. 8
Company Name
1. BOSCH REXROTH AG
2. SCHAFFNER EMV AG
Category Name:
Electromagnetic Interference Filters - Component
File numbers
1. E172117
2. E64388

Tab. 5-2: C-UL listing

5.3 HNF01.2 mechanical data

5.3.1 Dimensions

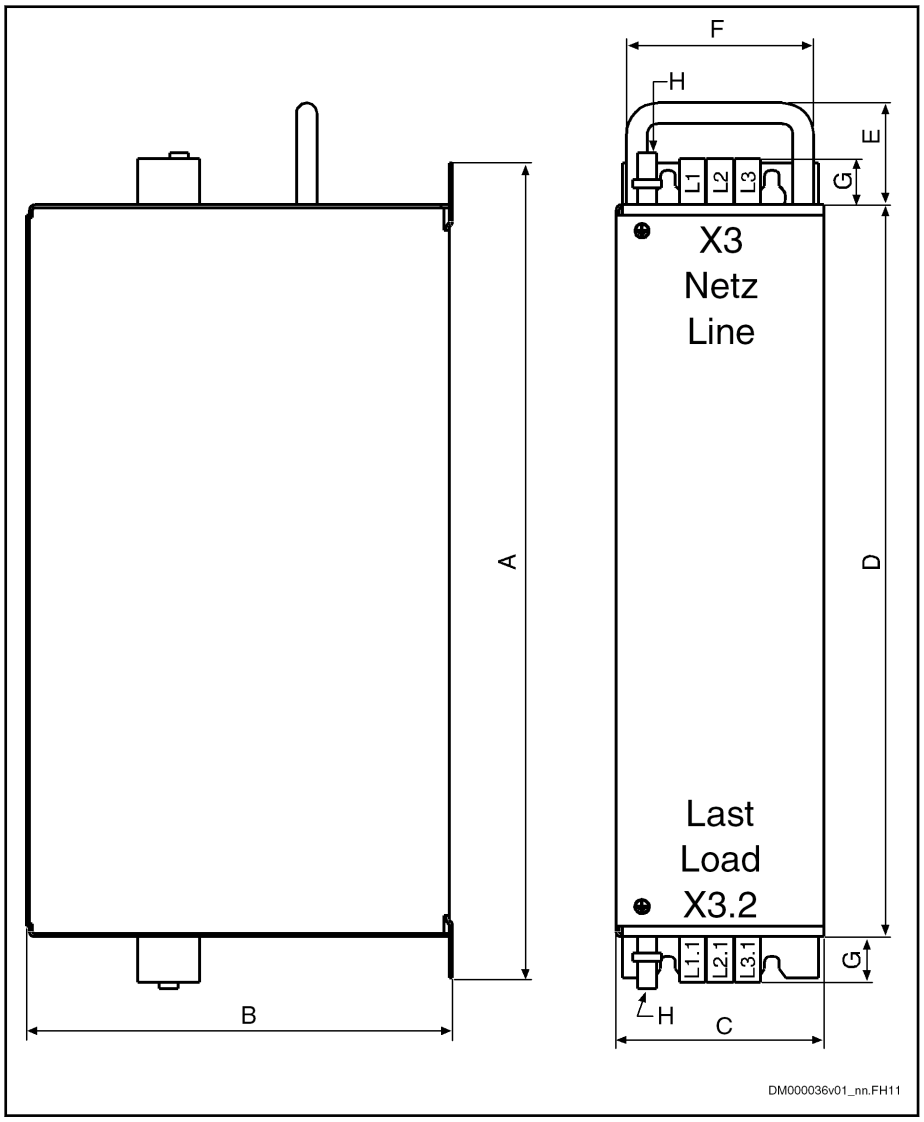


Fig. 5-1: Dimensions

HNF01.2 - mains filters

HNF01.2D-…	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G [mm]	H	
								[mm]	[Nm] *)
F240-R0026	480	262	100	440	-	-	29.5	M6	8.6
M900-R0026	480	262	150	440	40	110	20	M6	8.6
F240-E0051 M900-E0051	480	262	100	440	-	-	33	M6	8.6
F240-R0065 M900-R0065	480	262	150	440	40	110	39	M6	8.6
F240-R0094 M900-R0094	480	262	150	440	40	110	45	M10	25
F240-E0125 M900-E0125	480	262	150	440	40	110	45	M10	25
F240-E0202	480	262	150	440	40	110	63.5	M10	25
M900-E0202	480	262	180	440	40	110	63.5	M10	25

*) Maximum tightening torque

Tab. 5-3: Dimensions

5.3.2 Drilling pattern

Mounting position and distances

Mount HNF01 in the control cabinet in normal mounting position G1 and allow the device to be cooled by natural convection. For this purpose, keep at least 80 mm free from mounted parts, at the top side and bottom side of HNF.

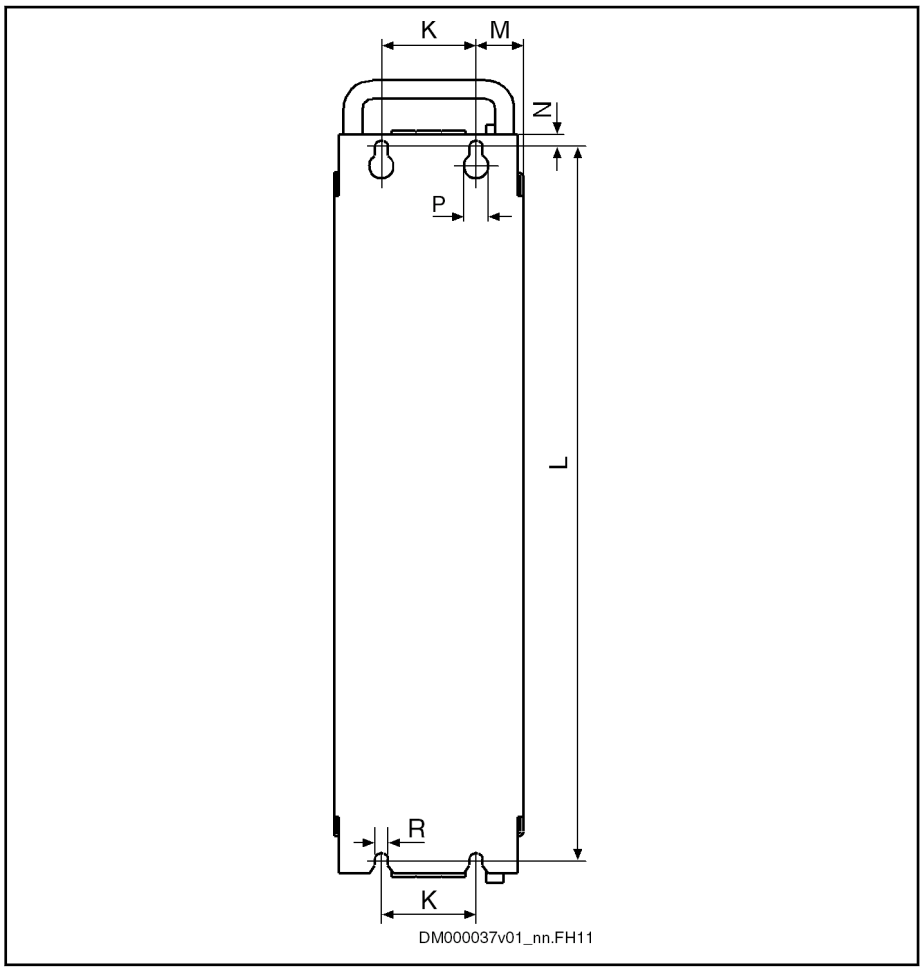


Fig. 5-2: Drilling pattern

HNF01.2D-…	K [mm]	L [mm]	M [mm]	N [mm]	P [mm]	R [mm]
F240-R0026	50	466	25	7	13	6.5
M900-R0026	100	466	25	7	13	6.5
F240-E0051 M900-E0051	50	466	25	7	13	6.5
F240-R0065 M900-R0065	100	466	25	7	13	6.5
F240-R0094 M900-R0094	125	466	12.5	7	13	6.5
F240-E0125 M900-E0125	125	466	12.5	7	13	6.5
F240-E0202	125	466	12.5	7	13	6.5
M900-E0202	150	466	15	7	13	6.5

Tab. 5-4: Drilling pattern

5.3.3 Terminal block

HNF01.2D-…	L1, L2, L3 L1.1, L2.1, L3.1								
	Rigid				Flexible				Nm *)
	max.		min.		max.		min.		
	mm²	AWG	mm²	AWG	mm²	AWG	mm²	AWG	
F240-R0026 M900-R0026	16	6 AWG	0.5	24 AWG	10	4 AWG	0.5	24 AWG	1.8
M900-E0051 F240-E0051	16	6 AWG	0.5	20 AWG	16	4 AWG	0.5	20 AWG	2.5
F240-R0065 M900-R0065	35	2 AWG	6	6 AWG	25	2 AWG	6	6 AWG **)	4.5
F240-R0094 M900-R0094	50	1/0 AWG	6	6 AWG	50	1/0 AWG	6	6 AWG	8
F240-E0125 M900-E0125	50	1/0 AWG	6	6 AWG	50	1/0 AWG	6	6 AWG	8
F240-E0202 M900-E0202	150	300 kcmil	35	2 AWG	150	300 kcmil	50	1/0 AWG	30

*) Tightening torque
) With **wire end ferrules the minimum allowed connection cross section is **8 AWG**

Tab. 5-5: Terminal block

5.4 HNF01.2 electrical data

5.4.1 HNF01.2D-xxxx-Exxxx-A-480-NNNN data for feeding supply systems

Using mains filters in mains grounded via outer conductor

When using HNF01 mains filters in **mains grounded via outer conductor**, use an isolating transformer between mains and mains filter.

With regenerative supply units, operation at a lower voltage than the specified voltage is not allowed, since this causes saturation phenomena in the input choke due to asymmetric currents. The filter thereby loses its effect, particularly in the higher frequency range.

Technical data - currents, voltages, power

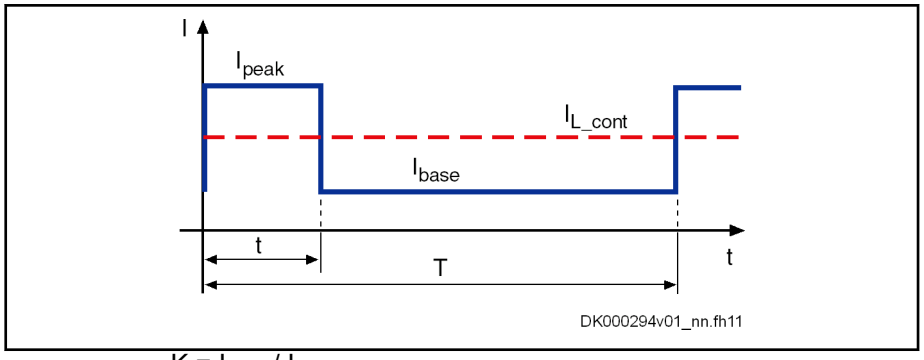
Description	Symbol	Unit	HNF01.2D-F240-E0051	HNF01.2D-M900-E0051	HNF01.2D-F240-E0125	HNF01.2D-M900-E0125	HNF01.2D-F240-E0202	HNF01.2D-M900-E0202
Degree of protection according to IEC 60529	IP		IP20					
Listing in accordance with UL standard			UL1283					
Listing in accordance with CSA standard			C22.2 No. 8					
Mass	m	kg	12	14	17	19	30	33
Three-phase mains voltage at TN-S, TN-C, TT mains	U_{LN}	V	380 … 480					
Mains voltage, three-phase at Corner-grounded-Delta mains[1)]	U_{LN}	V	Not allowed					
Mains voltage, three-phase at IT mains[2)]	U_{LN}	V	Not allowed					
Tolerance rated input voltage U_{LN}		%	±10					
Mains frequency	f_{LN}	Hz	50 … 60					
Tolerance input frequency		%	±2					
Nominal current	I_{LN}	A	51	51	125	125	202	202
Maximum allowed peak current[3)]	I_{L_max}	A	77	77	188	188	303	303
Power dissipation at continuous current and continuous DC bus power respectively[4)]	P_{Diss_cont}	W	89	91	127	174	238	373

Description	Symbol	Unit	HNF01.2D-F240-E0051	HNF01.2D-M900-E0051	HNF01.2D-F240-E0125	HNF01.2D-M900-E0125	HNF01.2D-F240-E0202	HNF01.2D-M900-E0202
Insulation resistance at 500 V DC[6)]	R_{is}	MOhm	1.33					
Required wire size in accordance with UL 508 A (internal wiring)[5)]	A_{LN}	AWG	chapter 5.3.3 "Terminal block" on page 27					

1) 2) Mains voltage > U_{LN}: Use a transformer with grounded neutral point, do not use autotransformers!
3) t = 0.3 s; T = 0.67 s; K = 2.5
4) Plus dissipation of braking resistor and control section
5) Copper wire; PVC-insulation (conductor temperature 90 °C; $T_a \leq 40$ °C) in accordance with NFPA 79 chapter 12 and UL 508 A chapter 28
6) Due to discharging resistors

Tab. 5-6: HNF - technical data - currents, voltages, power

Exemplary profile



$K = I_{peak} / I_{base}$
$I_{peak} \leq I_{L\_max}$
$I_{rms} \leq I_{L\_cont}$

Fig. 5-3: Exemplary profile

5.4.2 HNF01.2D-xxxx-Rxxxx-A-480-NNNN data for regenerative supply systems

☞ **Using mains filters in mains grounded via outer conductor**

When using HNF01 mains filters in **mains grounded via outer conductor**, use an isolating transformer between mains and mains filter.

Technical data - currents, voltages, power

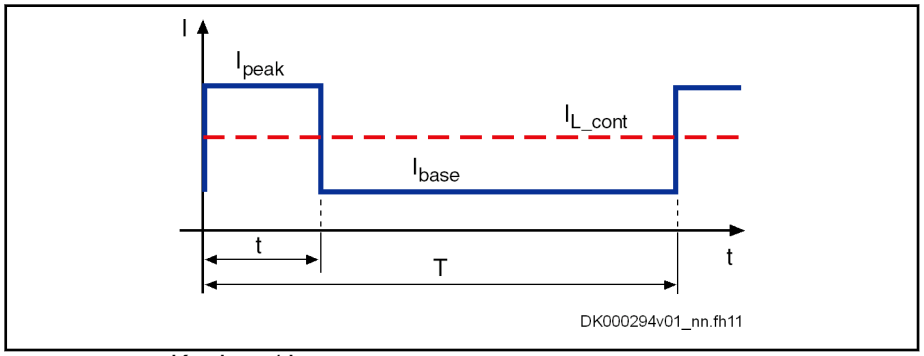
Description	Symbol	Unit	HNF01.2D-F240-R0026	HNF01.2D-M900-R0026	HNF01.2D-F240-R0065	HNF01.2D-M900-R0065	HNF01.2D-F240-R0094	HNF01.2D-M900-R0094
Degree of protection according to IEC 60529	IP		IP20					
Listing in accordance with UL standard			UL1283					
Listing in accordance with CSA standard			C22.2 No. 8					
Mass	m	kg	10	11.5	17	18	16	19.5
Three-phase mains voltage at TN-S, TN-C, TT mains	U_{LN}	V	380 … 480					
Mains voltage, three-phase at Corner-grounded-Delta mains[1)]	U_{LN}	V	Not allowed					
Mains voltage, three-phase at IT mains[2)]	U_{LN}	V	Not allowed					
Tolerance rated input voltage U_{LN}		%	±10					
Mains frequency	f_{LN}	Hz	50 … 60					
Tolerance input frequency		%	±2					
Nominal current	I_{LN}	A	26	26	65	65	94	94
Maximum allowed peak current[3)]	I_{L_max}	A	65	65	163	163	235	235
Power dissipation at continuous current and continuous DC bus power respectively[4)]	P_{Diss_cont}	W	73	77	163	157	135	146

Description	Symbol	Unit	HNF01.2D-F240-R0026	HNF01.2D-M900-R0026	HNF01.2D-F240-R0065	HNF01.2D-M900-R0065	HNF01.2D-F240-R0094	HNF01.2D-M900-R0094
Insulation resistance at 500 V DC[6)]	R_{is}	MOhm	1.33					
Required wire size in accordance with UL 508 A (internal wiring)[5)]	A_{LN}	AWG	chapter 5.3.3 "Terminal block" on page 27					

1) 2) Mains voltage > U_{LN}: Use a transformer with grounded neutral point, do not use autotransformers!
3) t = 0.3 s; T = 1.42 s; K = 2.5
4) Plus dissipation of braking resistor and control section
5) Copper wire; PVC-insulation (conductor temperature 90 °C); table 28.1; $T_a \leq 40$ °C
6) Due to discharging resistors

Tab. 5-7: HNF - technical data - currents, voltages, power

Exemplary profile



$K = I_{peak} / I_{base}$
$I_{peak} \leq I_{L\_max}$
$I_{rms} \leq I_{L\_cont}$

Fig. 5-4: Exemplary profile

6 HNL01.x - mains chokes for supply units and converters

6.1 Identification

6.1.1 Type code

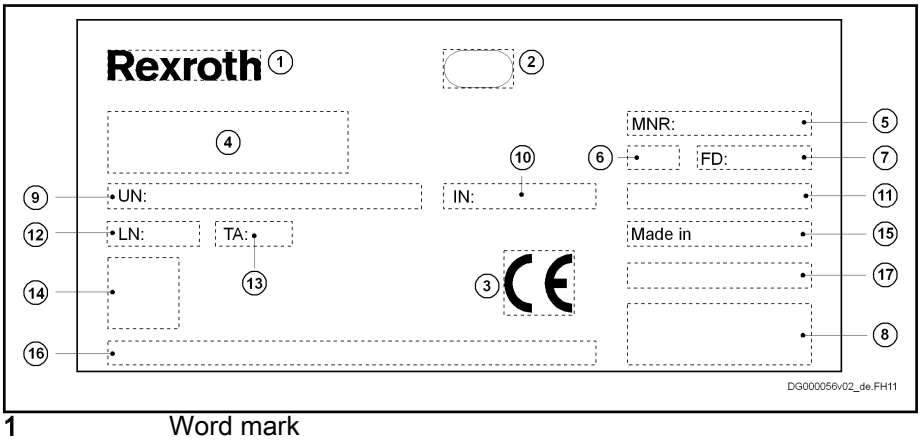
Short type designation	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Example:	H	N	L	0	1	.	2	E	-	0	4	0	0	-	N	0	0	5	1	-	A	-	4	8	0	-	N	N	N	N											
	①			②			③	④		⑤					⑥	⑦					⑧		⑨				⑩														

①	**Product:** HNL = Mains choke
②	**Series:** 01 = 01
③	**Design:** 1 = 1 2 = 2
④	**Supply system:** E = Feeding R = Regenerative D = Feeding and regenerative
⑤	**Nominal inductance:** 0400 = 400 µH (example)
⑥	**Additional option:** C = With capacitors S = Current-compensated N = None
⑦	**Nominal current:** 0051 = 51 A (example)
⑧	**Degree of protection:** A = IP10 N = IP00

Short type designation	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Example:	H	N	L	0	1	.	2	E	-	0	4	0	0	-	N	0	0	5	1	-	A	-	4	8	0	-	N	N	N	N											
	①			②			③	④		⑤					⑥	⑦					⑧		⑨				⑩														
⑨	**Mains connection voltage:** 380 = 3 x AC 380 V -10% … 3 x AC 600 V +20% (HNL01.1 only) 480 = 3 x AC 400 … 480 V -15/+10%, 50/60 Hz 500 = 3 x AC 380 … 500 V -15/+10%, 50/60 Hz 690 = 3 x AC 380 V -15% … 3 x AC 690 V +10%																																							
⑩	**Other design:** NNNA = Reduced overall height with lateral connection (HNL01.1 only) NNND = With attenuation by thyristor circuit (HNL01.1 only) NNNF = Liquid cooling (HNL01.1 only) NNNN = None																																							

Tab. 6-1: Type code

6.1.2 Type plate



1	Word mark
2	Business facility number
3	CE label
4	Type designation (two lines, 20 characters each)
5	Material number
6	Change release
7	Production date (YYWww)
8	Certification label
9	Nominal voltage / frequency
10	Nominal current
11	Product number
12	Nominal inductance
13	Temperature
14	2-D bar code
15	Designation of origin
16	Serial number
17	Manufacturer

Fig. 6-1: Type plate

6.1.3 UL

C-UL-US listing

The components are listed by **UL** (Underwriters Laboratories Inc.®).

Proof of certification can be found online. Enter the terms "UL" and "databases" in a search engine to get to the relevant UL web page. With the file number you will find the proof of certification.

Standards • UL standard: UL 508, UL 508C • CSA standard: C22.2 No. 274
Company Name BOSCH REXROTH AG **Category Name** POWER CONVERSION EQUIPMENT ELECTROMAGNETIC INTERFERENCE FILTERS - COMPONENT
File numbers Rexroth IndraDrive components: • E134201 • E227957 • E172117

Tab. 6-2: C-UL listing

6.2 HNL01.xE - mains chokes, feeding

6.2.1 Technical data

Mechanics and mounting

Allowed mounting position Magnetic axis vertically orientated

Type 1 dimensions:

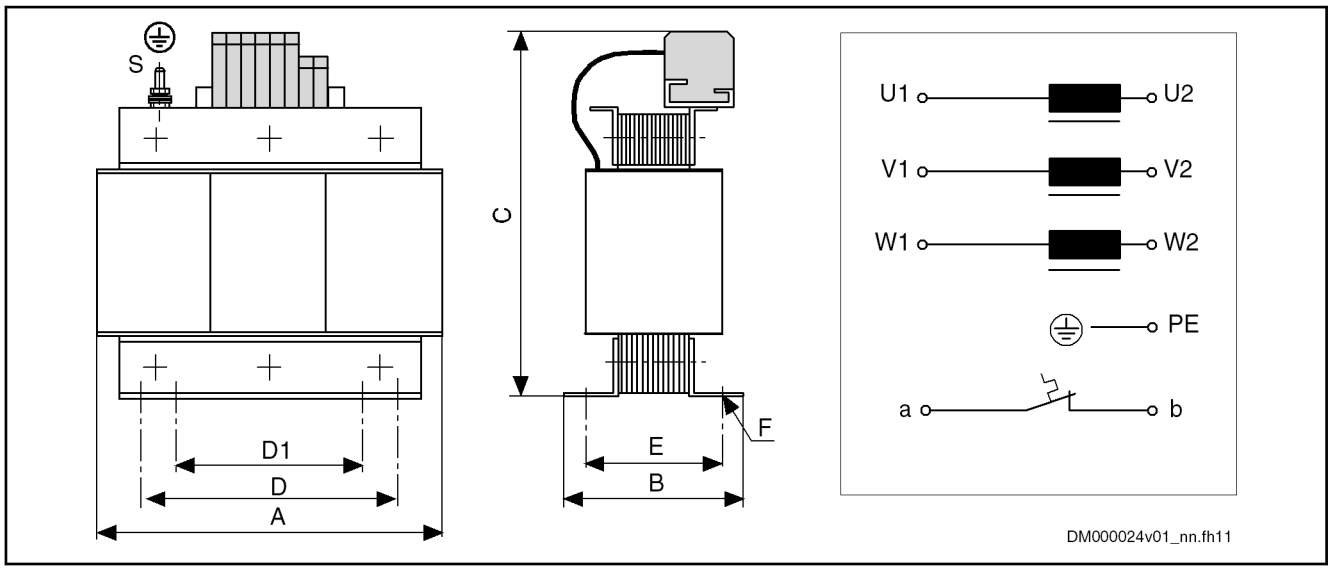


Fig. 6-2: Type 1 dimensions

Type 5 dimensions:

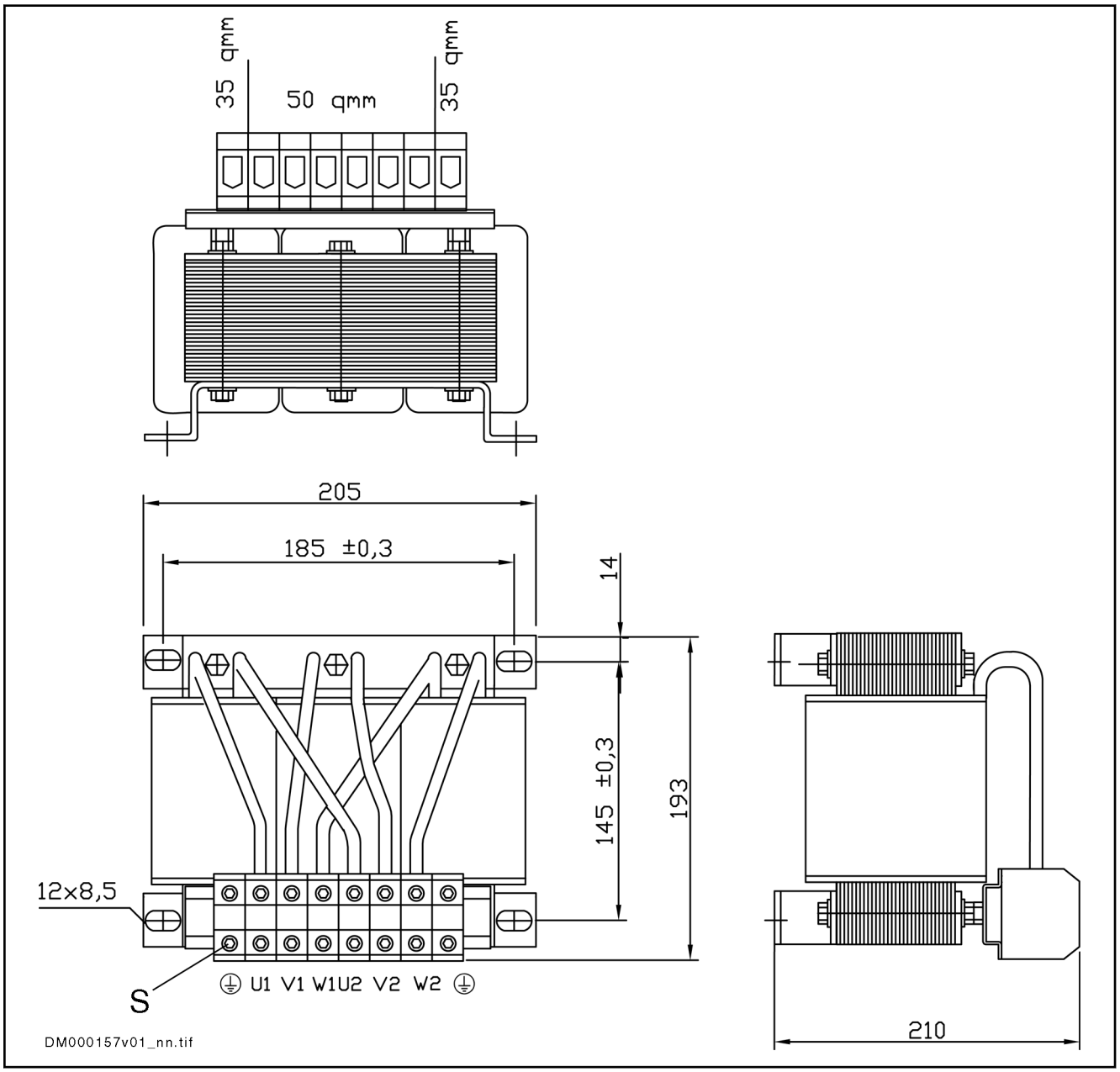


Fig. 6-3: Type 5 dimensions

Mains choke	Type	Dimensions [mm]										Weight [kg]
		A	B	C	D	D1	E	F 1)	G	H	S	
HNL01.2E-0400-N0051-A-480	1	180	120	225	125	80	87	7 × 15	-	-	M6	6
HNL01.2E-0240-N0106-A-500	5	See fig. 6-3 "Type 5 dimensions" on page 37								-	-	14
HNL01.1E-0100-N0220-A-480	1	261	152	347	215	-	126	15 × 11	-	-	M8	34

1) Long hole in "B" direction

Tab. 6-3: Dimensions, weight

Mains choke	Connection cross section [mm²]		Tightening torque [Nm]	
	U1, V1, W1 U2, V2, W2	a, b	U1, V1, W1 U2, V2, W2	a, b
HNL01.2E-0400-N0051-A-480	16	2.5	Observe the data imprinted on the component.	
HNL01.2E-0240-N0106-A-500	50 ⏚ : 35	-		
HNL01.1E-0100-N0220-A-480	120	1.5		

Tab. 6-4: Connection cross section, tightening torque

Basic data

Mains choke	U_N [V]	I_N [A]	L_N [µH]	P_V [W]	I_{max} [A]	L_{min} at I_{max}
HNL01.2E-0400-N0051-A-480	480	51	3 × 400	120	77	50% of L_N
HNL01.2E-0240-N0106-A-500	500	106	3 × 240	220	212	50% of L_N
HNL01.1E-0100-N0220-A-480	480	220	3 × 100	200	330	50% of L_N

Tab. 6-5: Electrical data

Temperature contacts a, b

Switching capacity	Switching temperature
1 A / AC 250 V DC 24 V	150 °C Type 1 mains chokes are equipped with a temperature contact (a, b), the other types are not.

Tab. 6-6: Temperature contact

6.3 HNL01.2R - mains chokes, regenerative

6.3.1 Safety instruction

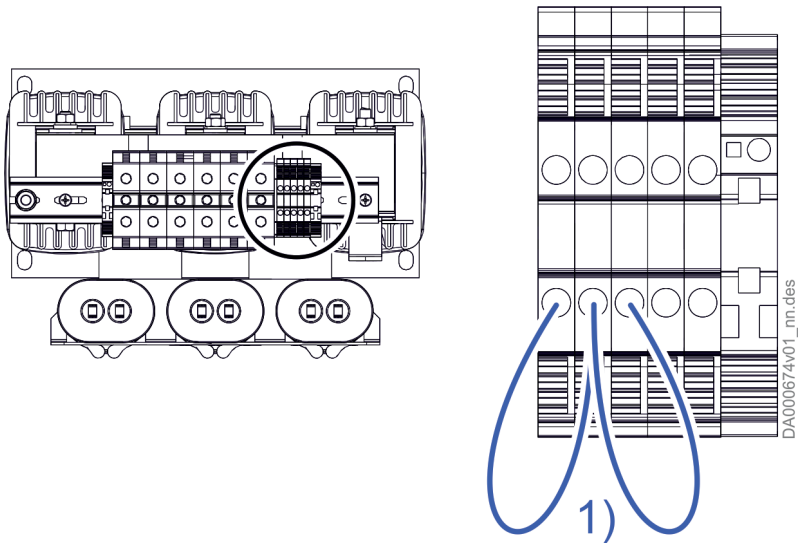
⚠ WARNING **High electrical voltage! Danger to life, risk of injury by electric shock or serious injury!**

- After power has been switched off, the capacitors in the choke will remain charged for a longer period. This may cause electric shock.
- Only operate the choke with connected discharging device or with connection to "X14, mains voltage synchronization" at a regenerative HMV supply unit (HMVxx.xR).
- Unless you use a supply unit with connection "X14, mains voltage synchronization", operation is only allowed with a connected discharging device, e.g. with HNF mains filter or additional discharging resistors.
- Before accessing the choke, wait up to 30 minutes after switching off power to allow the choke to discharge.
- Verify that energized connections have been isolated from supply before touching the connections.
- For correct use and before switching on power, read and observe the notes on project planning contained in the documentation.

NOTICE **Risk of damage by short-circuit jumpers!**

Before operating the mains choke, remove the **short-circuit jumpers** between U-V and V-W that are supplied with the choke.

Connect U, V, W to the supply unit (X14, mains voltage synchronization) or to a discharging device.



1) Short-circuit jumpers

6.3.2 Technical data

Mechanics and mounting

Allowed mounting positions Every mounting position is allowed.

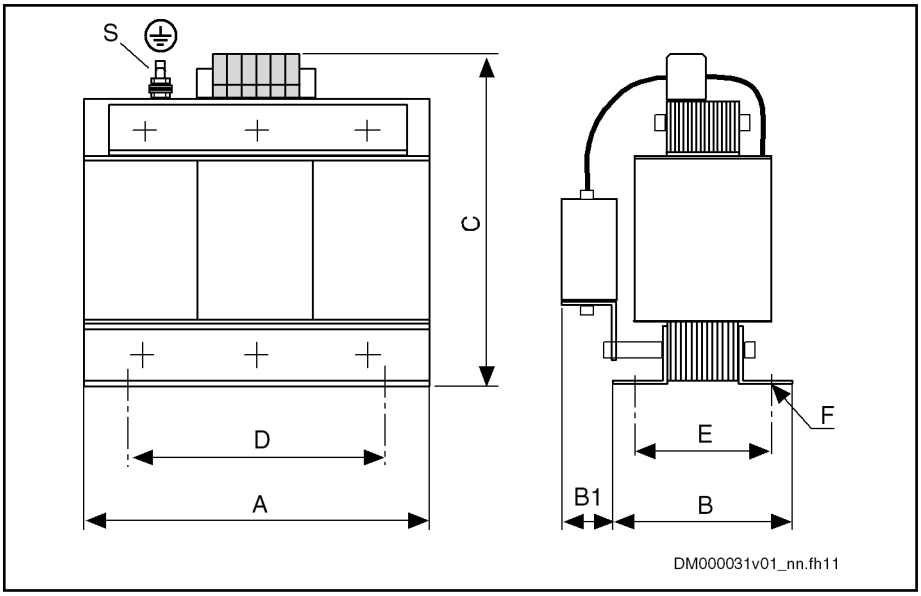


Fig. 6-4: Dimensions

Mains choke	Dimensions [mm]								Weight [kg]
	A	B	B1	C	D	E	F 1)	S	
HNL01.2R-0540-C0094-A-480	320	159	61	353	290	132	15 × 11	M8	65

1) Long hole in "B" direction

Tab. 6-7: Dimensions, weight

Basic data

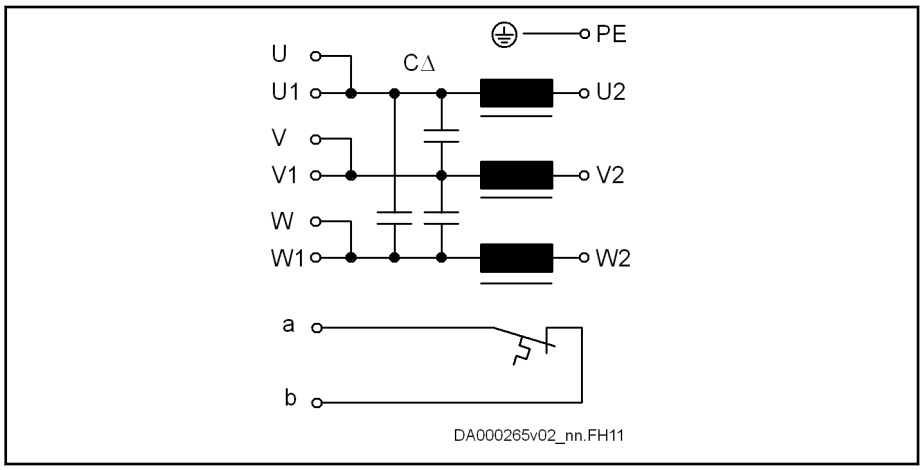


Fig. 6-5: HNL01.2R circuit diagram

Connect the choke inputs U1, V1, W1 to the **power grid** and the choke outputs U2, V2, W2 to the input of the **supply unit**.

Remove the **short-circuit jumpers** between U-V and V-W that are supplied with the mains choke. Connect U, V, W to the supply unit (X14, mains voltage synchronization) or to a discharging device.

Mains choke	Connection cross section [mm²]		Tightening torque [Nm]	
	U1, V1, W1 U2, V2, W2	a, b U, V, W	U1, V1, W1 U2, V2, W2	a, b U, V, W
HNL01.2R-0540-C0094-A-480	70	2.5	6 … 12	0.4 … 0.8

Tab. 6-8: Connection cross section, tightening torque

Temperature contacts a, b

Switching capacity	Switching temperature
1 A / AC 250 V DC 24 V	150 °C

Tab. 6-9: Temperature contacts a, b

Electrical data

Mains choke	U_N [V]	I_N [A]	L_N [µH]	P_V [W]	I_{max} 1) [A]	L_{min} at I_{max}	CΔ [µF]
HNL01.2R-0540-C0094-A-480	480	94	3 × 540	420	235	0.8 × L_N at I_{max}	20

1) For 300 ms at 1.42 s duty cycle and 60% basic load

Tab. 6-10: Electrical data

7 EMC limit value class to be achieved

7.1 Terms

Standard environment

The standard environment is the standard area regulated by standards. Standard environment means electrical or electronic installations in a general industrial environment in accordance with IEC 61000-6-2/-4.

The standard environment is the environment usually encountered nowadays in industrial plants. The standard environment does not contain any test equipment and only the EMC product standards are applied.

Production environment

The production environment refers to production areas of the automotive industry with their specific requirements. Production environment means electrical or electronic installations installed in a building or part of a building in which automobiles are manufactured.

The production environment does not contain any test equipment.

EMC integration guidelines of the automotive industry

The EMC integration guidelines of the automotive industry (in German: EMV-Integrationsleitfaden der Automobilindustrie) are used to achieve electromagnetic compatibility in electrical installations of the automotive industry.

Further information: www.emv-ila.de

7.2 HMV01.1E supply units

HMV01.1E-	HNL	HNF01.2D-	Standard combination for axis systems with …	Clock frequency [kHz]	Max. leakage capacitance (motor + cable) [nF]	EMC limit value class to be achieved	
						IEC 61800-3	EMC integration guidelines of the automotive industry
W0030	HNL01.2E-0400-N0051	F240-E0051	C_y ≤ 2 × 1225 nF Number of axes ≤ 18	4	290	C2	Production environment
				8			
	HNL01.2E-0400-N0051	M900-E0051	C_y ≤ 2 × 2040 nF Number of axes ≤ 40	4	1100		
				8			
W0075	HNL01.1E-0200-N0125	F240-E0125	C_y ≤ 2 × 1225 nF Number of axes ≤ 18	4	290		
				8			
	HNL01.1E-0200-N0125	M900-E0125	C_y ≤ 2 × 2040 nF Number of axes ≤ 40	4	1100		
				8			
W0120	HNL01.1E-0100-N0220-A-480	F240-E0202	C_y ≤ 2 × 1225 nF Number of axes ≤ 18	4	290		
				8			
				16			
	HNL01.1E-0100-N0220-A-480	M900-E0202	C_y ≤ 2 × 2040 nF Number of axes ≤ 40	4	1100		
				8		C3	Standard environment
				16			

Tab. 7-1: Selecting the HMV01.1E mains connection

EMC limit value class to be achieved

7.3 HMV01.1R supply units

HMV01.1R-	HNL	HNF01.2D-	Standard combination for axis systems with …	Clock frequency [kHz]	Max. leakage capacitance (motor + cable) [nF]	EMC limit value class to be achieved	
						IEC 61800-3	EMC integration guidelines of the automotive industry
W0018	HNL01.1R-0980-C0026-A-480	F240-R0026	C_y ≤ 2 × 1225 nF Number of axes ≤ 18	4	290	C2	Production environment
				8			
				16			
		M900-R0026	C_y ≤ 2 × 2040 nF Number of axes ≤ 40	4	1100		
				8			
				16			
W0045	HNL01.1R-0590-C0065-A-480	F240-R0065	C_y ≤ 2 × 1225 nF Number of axes ≤ 18	4	290		
				8			
				16		C3	
		M900-R0065	C_y ≤ 2 × 2040 nF Number of axes ≤ 40	4	1100	C2	
				8		C3	
				16			
W0065	HNL01.2R-0540-C0094-A-480	F240-R0094	C_y ≤ 2 × 1225 nF Number of axes ≤ 18	4	290	C2	
				8			
				16		C3	
		M900-R0094	C_y ≤ 2 × 2040 nF Number of axes ≤ 40	4	1100	C2	
				8			
				16		C3	

Tab. 7-2: Selecting the HMV01.1R mains connection

7.4 HCS03 drive controllers

HCS03.1E-	HNL	HNF01.2D-	Standard combination for axis systems with …	Clock frequency [kHz]	Max. leakage capacitance (motor + cable) [nF]	EMC limit value class to be achieved	
						IEC 61800-3	EMC integration guidelines of the automotive industry
W0150-A-05-NNNV	HNL01.2E-0240-N0106-A-500	F240-E0125	C_y ≤ 2 × 1225 nF Number of axes ≤ 18	4	290	C2	Production environment
				8			
	HNL01.2E-0240-N0106-A-500	M900-E0125	C_y ≤ 2 × 2040 nF Number of axes ≤ 40	4	1100		
				8			

Tab. 7-3: Selecting the HCS03.1E mains connection

Index

Notes

rexroth
A Bosch Company

Bosch Rexroth AG
Electric Drives and Controls
P.O. Box 13 57
97803 Lohr, Germany
Bgm.-Dr.-Nebel-Str. 2
97816 Lohr, Germany
Phone +49 9352 18 0
Fax +49 9352 18 8400
www.boschrexroth.com/electrics

R911342564

DOK-INDRV*-HNF+HNL****-PR05-EN-P