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Rexroth RD 500 RD51 Drive Control Devices V/f characteristic control

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Application Manual

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Purpose of Documentation
This documentation explains the frequency converters of the drive series RD 500 RD51. It provides information.

- for planing the mechanical control cabinet construction.
- for planing the electrical control cabinet construction.
- for commissioning the drive controls.
- for basic parameterization of the drive controls.
- to fault messages and notes to cause and remedy.

Record of Revisions

Description	Release Date	Notes
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Validity
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Note
This document has been printed on chlorine-free bleached paper.

List of Contents

1 Safety Instructions for Electric Servo Drives and Controls

1.1 Introduction

Read these instructions before the equipment is used and eliminate the risk of personal injury or property damage. Follow these safety instructions at all times.

Do not attempt to install, use or service this equipment without first reading all of the documentation provided with the product. Read and understand these safety instructions and all user documentation of the equipment prior to working with the equipment at any time. If you do not have the user documentation for your equipment contact your local Indramat Refu representative to send this documentation immediately to the person or persons responsible for the safe operation of this equipment.

If the product is resold, rented, transferred or passed on to others, then these safety instructions must be delivered with the product.

WARNING

Inappropriate use of this equipment, failure to follow the safety instructions in this document or tampering with the product, including disabling of safety devices, may result in product damage, personal injury, severe electrical shock or death!

1.2 Explanations

The safety warnings in this documentation describe individual degrees of hazard seriousness in compliance with ANSI:

Warning symbol with text	Degree of hazard seriousness The degree of hazard seriousness describes the consequences resulting from non-compliance with the safety guidelines:
 **DANGER**	Bodily harm or product damage will occur.
 **WARNING**	Death or severe bodily harm may occur.
 **CAUTION**	Death or severe bodily harm may occur.

Fig. 1-1:Classes of danger according to ANSI

1.3 Hazards due to inappropriate use

DANGER

High voltage and high discharge current! Danger to life, risk of severe electrical shock and risk of injury!

DANGER

Dangerous movements! Danger to life and risk of injury or equipment damage by unintentional motor movements!

WARNING

High electrical voltage due to wrong connections! Danger to life, severe electrical shock and severe bodily injury!

WARNING

Health hazard for persons with heart pacemakers, metal implants and hearing aids in proximity to electrical equipment!

CAUTION

Surface of machine housing could be extremely hot! Danger of injury! Danger of burns!

CAUTION

Risk of injury due to inappropriate handling! Bodily injury caused by crushing, shearing, cutting and mechanical shock or improper handling of pressurized systems!

CAUTION

Risk of injury due to inappropriate handling of batteries!

1.4 General information

- Indramat Refu GmbH is not liable for damages resulting from failure to observe the warnings given in these documentation.
- Read all of the operating, maintenance and safety instructions in your language before starting up the machine. If you find that due to a translation error you can not completely understand the documentation for your product, please ask your supplier to clarify.
- Proper and correct transport, storage, assembly and installation as well as care in operation and maintenance are prerequisites for optimal and safe operation of this equipment.
- Trained and qualified personnel in electrical equipment:
  Only trained and qualified personnel may work on this equipment or in its proximity. Personnel are qualified if they have sufficient knowledge of the assembly, installation and operation of the product as well as an understanding of all warnings and precautionary measures noted in these instructions.
  Furthermore, they should be trained, instructed and qualified to switch electrical circuits and equipment on and off, to ground them and to mark them according to the requirements of safe work practices and common sense. They must have adequate safety equipment and be trained in first aid.
- Only use spare parts and accessories approved by the manufacturer.
- Follow all safety regulations and requirements for the specific application as practiced in the country of use.
- The equipment is designed for installation on commercial machinery.

European countries: see directive 89/392/EC (Machinery Directive)

- The ambient conditions specified in the product documentation must be observed.
- Use only safety features that are clearly and explicitly approved in the Project Planning manual.
  For example, the following areas of use are not allowed: Cranes and hoisting equipment, elevators used for people or freight, devices and vehicles to transport people, medical applications, refinery plants, the transport of hazardous goods, radioactive or nuclear applications, applications sensitive to high frequency, mining, control of protection equipment (also in a machine).
- Start-up is only permitted once it is ensured that the machine, in which the product is installed, complies with the requirements of national safety regulations and safety specifications of the application.
- Operation is only permitted if the national EMC regulations for the application are met.

  The machine builder is responsible for compliance with the limiting values as prescribed in the national regulations and specific EMC regulations for the application.

European countries: see Directive 89/336/EC (EMC Directive).

US.: Refer to the National Electrical Code (NEC), National Electrical Manufacturers Association (NEMA), and local building codes. The user of this equipment must observe the above noted items at all times.

- Technical data, connections and operational conditions are specified in the product documentation and must be followed at all times.

1.5 Protection against contact with electrical parts

Note: This section refers to equipment with voltages above 50 Volts.

Making contact with parts at voltages above 50 Volts could be dangerous to personnel and cause an electrical shock. When operating electrical equipment, it is unavoidable that some parts of the unit conduct dangerous voltages.

DANGER

High electrical voltage! Danger to life, severe electrical shock and severe bodily injury!

⇒ Only those trained and qualified to work with or on electrical equipment are permitted to operate, maintain or repair this equipment.

⇒ Follow general construction and safety regulations when working on electrical installations.

⇒ Before powering-up, the productive conductor must be permanently connected to all electrical units according to the connection diagram.

⇒ Do not operate electrical equipment at any time if the protective conductor is not permanently connected, even for brief measurements or tests.

⇒ Before working with electrical parts with voltage potentials higher than 50 V, the equipment must be disconnected from the line supply or power supply.

⇒ The following should be observed with electrical drives, power supplies, and filter components:

Wait five (5) minutes after switching off power to allow capacitors to discharge before beginning work. Measure the voltage at the capacitors before beginning work to make sure that the equipment is safe to touch.

⇒ Never touch the electrical connection points of a component while power is turned on.

⇒ Install the covers and guards provided with the equipment properly before switching the equipment on. Prevent contact with live parts at any time.

⇒ A residual-current-operated protective device (r.c.d.) must not be used on an electric drive! Indirect contact may be prevented by other means, for example, by an overcurrent protective device.

⇒ Equipment that is built into machines must be se-

cured against direct contact. Use appropriate housings, for example a control cabinet.

European countries: according to EN 50178/1998, section 5.3.2.3.

US: Refer to the National Electrical Code (NEC), National Electrical Manufacturers Association (NEMA) and local building codes. The user of this equipment must observe the above noted instructions at all times.

To be observed for electric drives and filter components:

DANGER

High voltage! High leakage current! Danger to life, danger of injury and bodily harm from electrical shock!

⇒ Before powering-up all housings and motors must be permanently grounded according to the connection diagram. This applies even for brief tests.

⇒ The protective conductor of the electrical equipment must be permanently connected to the line supply. The leakage current is greater than 3.5 mA.

⇒ Use a copper conductor with at least 10 mm² cross section over its entire course for this protective connection!

⇒ Prior to startups, even for brief tests, always connect the protective conductor or connect with ground wire. High voltage levels can occur on the housing that could lead to severe electrical shock and personal injury.

European countries: EN 50178 / 1998, Section 5.3.2.1.

US: Refer to the National Electrical Code (NEC), National Electrical Manufacturers Association (NEMA), and local building codes. The user of this equipment must observe the above noted instructions at all times.

1.6 Protection against electrical shock by protective low voltage (PELV)

All connections and terminals with voltages between 5 and 50 Volts on Indramat Refu products are protective low voltages designed in accordance with the following Standards:

- International: IEC 60364-4-41
- EU countries: Refer to EN 50178/1998, Section 5.2.8.1.

WARNING

High voltage due to wrong connections! Danger to life, severe electrical shock and severe bodily injury!

⇒ Only equipment, electrical components and cables of the protective low voltage type (PELV = Protective Extra Low Voltage) may be connected to all terminals and connections with 0 to 50 Volts.

⇒ Only safely isolated voltages and electrical circuits may be connected. Safe isolation is achieved, for example, with an isolating transformer, a safe opto-electronic coupler or when battery-operated.

1.7 Protection against dangerous movements

Dangerous movements can be caused by faulty control or the connected motors. There are various causes:

- unclean or wrong wiring of cable connections
- inappropriate or wrong operation of equipment
- malfunction of sensors, encoders and monitoring circuits
- defective components
- software errors

Dangerous movements can occur immediately after equipment has been powered-up or even after an unspecified time of trouble-free operation.

The monitors in the drive components make faulty operation almost impossible. Regarding personnel safety, especially the danger of bodily harm and property damage, this alone should not be relied upon to ensure complete safety. Until the built-in monitors become active and effective, it must be assumed in any case that some faulty drive movements will occur. The extent of these faulty drive movements depends on the type of control and the state of operation.

DANGER

Dangerous movements! Danger to life and risk of injury or equipment damage!

⇒ Personnel protection must be secured for the above listed reason by means of superordinate monitors or measures.

These are implemented in accordance with the specific situation of the plant/system and a danger and fault analysis conducted by the manufacturer of the plant/system. All the safety regulations that apply to this plant/system are included. By switching off, circumventing or if safety devices have simply not been activated, then random machine movements or other types of faults can occur.

Avoiding accidents, injury or property damage:

⇒ Keep free and clear of the machine's range of motion and moving parts. Prevent people from accidentally entering the machine's range of movement:

- use protective fences
- use protective railings
- install protective coverings
- install light curtains or light barriers

⇒ Fences must be strong enough to withstand maximum possible momentum.

⇒ Mount the emergency stop switch (E-stop) in the immediate reach of the operator. Verify that the emergency stop works before startup. Don't operate the machine if the emergency stop is not working.

⇒ Isolate the drive power connection by means of an emergency stop circuit or use a start-inhibit system to prevent unintentional start-up.

⇒ Make sure that the drives are brought to standstill before accessing or entering the danger zone.

⇒ Secure vertical axes against falling or slipping after switching off the motor power by, for example:

- Mechanically securing the vertical axes
- Adding an external brake / clamping mechanism
- Balancing and thus compensating for the vertical axes weight and the gravitational force

The standard equipment motor brake or an external brake controlled directly by the servo drive are not sufficient to guarantee the safety of personnel!

⇒ Disconnect electrical power to the equipment using a master switch and lock-out the switch against reclosure:

- for maintenance and repair work
- for cleaning of equipment
- if the equipment is not used for long periods of time

⇒ Avoid operating high-frequency, remote control and radio equipment near electronic circuits and feeder cables. If use of such equipment cannot be avoided, verify the system and the plant for possible malfunctions at all possible positions of normal use before the first start-up. If necessary, perform a special electromagnetic compatibility (EMC) test on the plant.

1.8 Protection against magnetic and electromagnetic fields during operations and mounting

Magnetic and electromagnetic fields generated by current-carrying conductors and permanent magnets in motors represent a serious health hazard to persons with heart pacemakers, metal implants and hearing aids.

WARNING

Health hazard for persons with heart pacemakers, metal implants and hearing aids in proximity to electrical equipment!

⇒ Persons with pacemakers, metal implants and hearing aids are not permitted to enter following areas:

- Areas in which electrical equipment and parts are mounted, being operated or started up.
- Areas in which parts of motors with permanent magnets are being stored, operated, repaired or mounted.

⇒ If it is necessary for a person with a pacemaker to enter such an area, then a physician must be consulted prior to doing so. Pacemakers, that are already implanted or will be implanted in the future, have a considerable deviation in their immunity to interference. Due to the unpredictable behavior there are no generally valid rules.

⇒ Persons with hearing aids, metal implants or metal pieces must consult a doctor before they enter the areas described above. Otherwise health hazards will occur.

1.9 Protection against contact with hot parts

CAUTION

Housing surfaces could be extremely hot! Danger of injury! Danger of burns!

⇒ Do not touch surfaces near the source of heat! Danger of burns!

⇒ Wait ten (10) minutes before you access any hot unit. Allow the unit to cool down.

⇒ Do not touch hot parts of the equipment, such as housings, heatsinks or resistors. Danger of burns!

1.10 Protection during handling and installation

Under certain conditions inappropriate handling and installation of parts and components may cause injuries.

CAUTION

Risk of injury through incorrect handling! Bodily harm caused by crushing, shearing, cutting and mechanical shock!

⇒ Observe general instructions and safety regulations during handling installation.

⇒ Use only appropriate lifting or moving equipment.

⇒ Take precautions to avoid pinching and crushing.

⇒ Use only appropriate tools. If specified by the product documentation, special tools must be used.

⇒ Use lifting devices and tools correctly and safely.

⇒ Wear appropriate protective clothing, e.g. safety glasses, safety shoes and safety gloves.

⇒ Never stay under suspended loads.

⇒ Clean up liquids from the floor immediately to prevent personnel from slipping.

1.11 Battery safety

Batteries contain reactive chemicals in a solid housing. Inappropriate handling may result in injuries or equipment damage.

CAUTION

Risk of injury through incorrect handling!

⇒ Do not attempt to re-activate discharged batteries by heating or other methods (danger of explosion and corrosion).

⇒ Never charge batteries (danger from leakage and explosion).

⇒ Never throw batteries into a fire.

⇒ Do not dismantle batteries.

⇒ Handle with care. Incorrect withdrawal or installation of a battery can damage equipment.

Note: Environmental protection and disposal! The batteries contained in the product should be considered as hazardous material for land, air and sea transport in the sense of the legal requirements (danger of explosion). Dispose of batteries separately from other refuse. Observe the legal requirements given in the country of installation.

1.12 Protection against pressurized systems

Certain Motors (ADS, ADM, 1MB etc.) and drives, corresponding to the information in the Project Planning manual, must be provided with various media at a high pressure such as compressed air, hydraulic oil, cooling fluid or coolant. In these cases, improper handling of the supply of the pressurized systems or connections of the fluid or air under pressure can lead to injuries or accidents.

CAUTION

Danger of injury when pressurized systems are handled by untrained personnel!

⇒ Do not attempt to disassemble, to open or to cut a pressurized system.

⇒ Observe the operation restrictions of the respective manufacturer.

⇒ Before the disassembly of pressurized systems, lower pressure and drain off the fluid or gas.

⇒ Use suitable protective clothing (for example protective eyewear, safety shoes and gloves)

⇒ Remove any fluid that has leaked out onto the floor immediately.

Note: Environmental protection and disposal! The fluids used in the operation of the pressurized system equipment is not environmentally compatible. Fluid that is damaging to the environment must be disposed of separately from normal waste. Observe the national specifications of the country of installation.

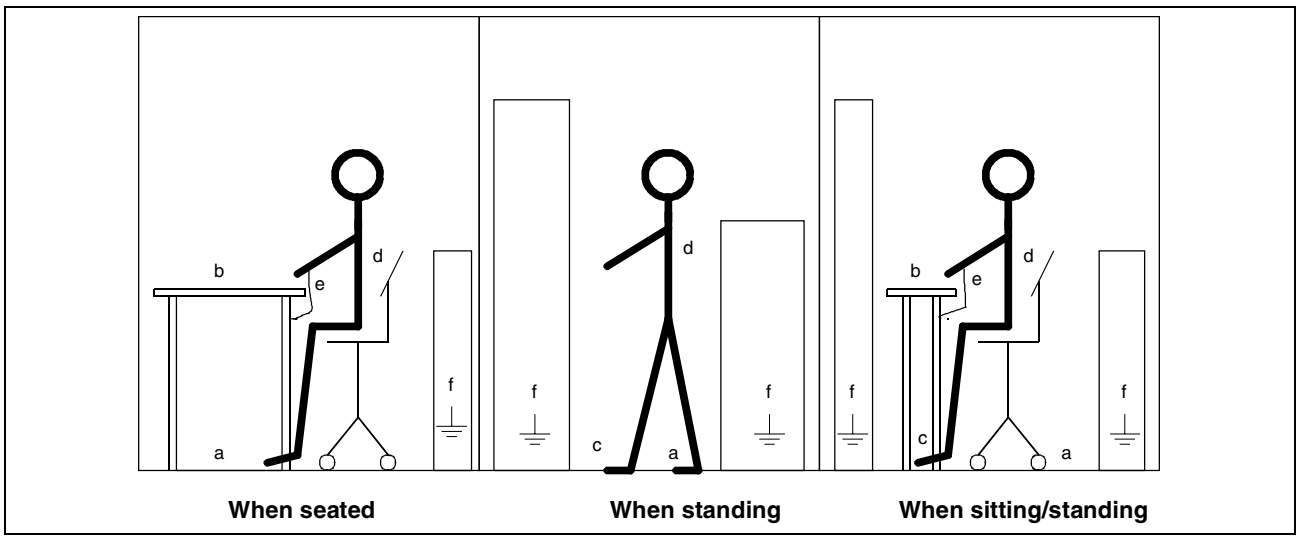
1.13 Precautionary measures when handling components which can be destroyed by electrostatic discharge (ESDS)

The drive units contain components and parts which can be destroyed by electrostatic discharge. Please observe the following when working with electronic modules and boards:

- Electronic modules and boards should only be touched if absolutely necessary.
- Before touching an electronic module/board, the human body must first be electrically discharged.
- Electronic modules/boards may not come into contact with highly-insulating materials (e.g. plastic foils, insulating work surfaces, articles of clothing manufactured from man-made fiber).
- Electronic modules/boards may only be placed on conductive surfaces.
- The soldering iron tip must be grounded when carrying-out soldering work on electronic modules/boards.

- Electronic modules/boards and components may only be stored and shipped in conductive packaging (e.g. metalized plastic or metal containers).
- If the packaging is not conductive, electronic modules/boards must be wrapped in a conductive material. In this case, e.g. conductive foam rubber or household aluminum foil can be used.

The necessary ESDS protective measures are clearly shown in the following diagram:



a: Conductive floor
b: ESDS table
c: ESDS shoes
d: ESDS overall
e: ESDS bracelet
f: Grounding connection of the cabinets

Fig. 1-2: ESDS protective measures

2 Description of RD51

2.1 The RD 500 Device Series

RD 500 is a state-of-the-art, universal three-phase drive system for various synchronous and induction motors. The modular hardware and software design allows the drive system to be flexibly adapted to the particular drive application.

The system includes various AC drive converters (with/without braking chopper, line contactor etc.), inverters for DC supply as well as rectifier and supply modules which are capable of regenerative feedback into the line supply. The modules can be individually purchased, or as a system, completely wired in the cabinet.

The power sections are designed for cooling at the rear. This means that forced cooling, also outside the cabinet, can be implemented with an associated higher degree of protection (where the heat sink extends outside the cabinet or using a conductive plate). In addition, versions are available with liquid cooling with either integrated or external heat exchangers.

Handling

Special significance was placed on simple handling, for instance, automatic motor adaptation with parameter identification.

The drive system is commissioned with prompts using the operator panel with graphical display or with the highest level of user friendliness using a PC with the high-performance RDwin software package.

Electromagnetic Compatibility

In order to reduce the harmonics fed back into the line supply, radio interference suppression filters and line reactor are integrated into the AC drive converters, size classes C - E. RD 500 is in full compliance with the EMC Directives regarding noise immunity and noise emission according to the EMC Product Standard for electric drives EN 61800-3, EN 55011 Class A (IEC 61800-3). RD 500 is immune to noise in conformance with EN 50082-2.

Technical Characteristics

- AC or DC supply
- Either forced air cooling, heat conducting plate or liquid cooling
- Removable user panel with parameter copy function
- 4-line graphical display
- Various interfaces, which can be used to control, monitor and parameterize the drive system (“download” parameterization):

⇒ SERCOS

⇒ Profibus DP

⇒ Interbus S

⇒ CAN bus

⇒ RS 232 / RS 485

- Peer-to-peer coupling or Synchrolink for fast communication between several drives

- Expanded, freely-combinable technology functions

⇒ PID, PI controller, AND, OR, XOR, RS flipflop and D latch

⇒ mathematical function elements

⇒ timers, comparitors, ramp-function generators

⇒ freely-assignable characteristic

- Additional signal processor (32-bit floating point) for high-dynamic performance applications, including servo applications

⇒ torque rise times of 0.3 ms

⇒ current cycle times of 0.1 ms

- 200% overload capability for 0.5 sec (not for drive units ≥132 kW)
- 170% overload capability for 1 sec

2.2 Type Label

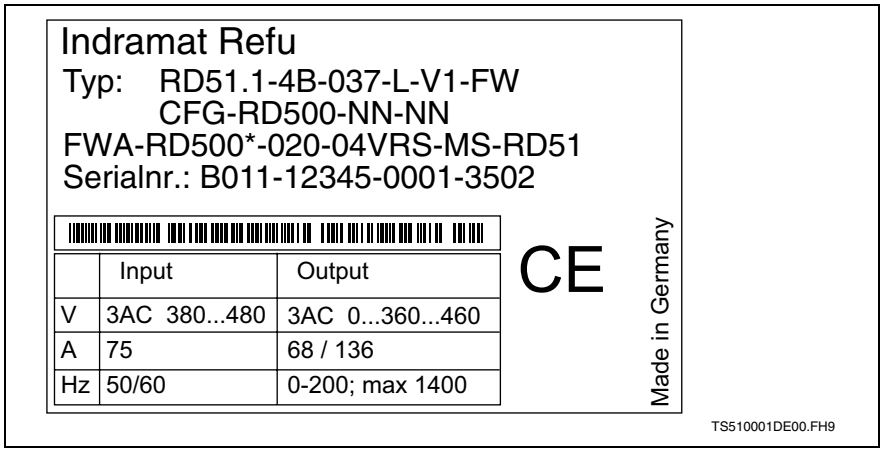


Fig.: 2-1 RD51.1 type label (size classes C - H)

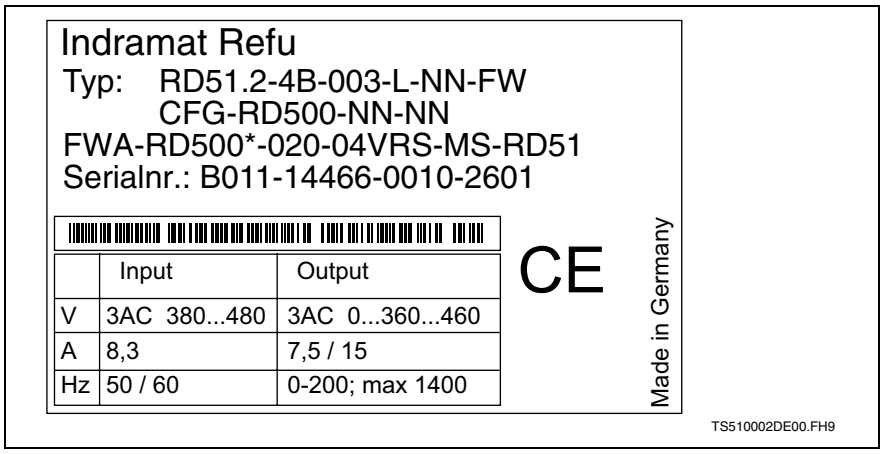


Fig.: 2-2 RD51.2 type label (size classes A - B)

2.3 Type Key

Basic Device Type Key, Size Classes A - B

Abbrev. Column →	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
Example:	R	D	5	1	.	2	-	4	B	-	0	0	5	-	L	-	A	1	-	F	W									

1. Product
1.1 RD . . . . . = RD

2. Line
2.1 U/f curve control . . . . . = 51

3. Design
3.1 2 . . . . . = 2

4. Unit type / Nominal connecting voltage (1)
4.1 Converter 3 x AC 200 to 230 V, ±15 %. . . . . = 2
4.2 Converter 3 x AC 380 to 480 V, ±10 %. . . . . = 4
4.3 Converter 3 x AC 500 V, ±15 %. . . . = 5

5. Brake chopper for converter
5.1 **Converter**
5.1.1 with built-in brake chopper . . . . . = B

6. Rated power data (kW) (2)
6.1 3.0 kW (1.5 kW) . . . . . = 003
6.2 5.5 kW (2.8 kW) . . . . . = 005
6.3 7.5 kW (3.8 kW) . . . . . = 007
6.4 15.0 kW (7.5 kW) . . . . . = 015
6.5 18.5 kW (9.0 kW) . . . . . = 018

7. Cooling mode
7.1 forced air cooling . . . . . = L
7.2 heat dissipation panel . . . . . = P

8. Additional functions
8.1 Stand-by-power external, starting lock-out, filter current feedback . . . . . = A1
8.2 Stand-by-power external, starting lock-out . . . . . = A2
8.3 Connection for RZC01.1-XN and 24V stand-by power, external. . . . . .= CF
8.4 Connection for RZC01.1-XT, with NAMUR terminal strip, 24V stand-by power, external. . . . . = DF

9. Firmware
9.1 Denotes that firmware must be ordered as separate subposition = FW

Note:
(1) Unit type / Nominal connecting voltage "2" is only available with additional functions "A1"
(2) Values in brackets are valid for Unit type / Nominal connecting voltage 3 x AC 200 to 230 V

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Fig.: 2-3 Basic device type key, size classes A - B

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Basic Device Type Key, Size Classes C - H

Abbrev. Column →	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
Example:	R	D	5	1	.	1	-	4	N	-	0	0	1	-	L	-	V	1	-	F	W									

1. Product
1.1 RD . . . . . = RD

2. Line
2.1 U/f curve control . . . . . = 51

3. Design
3.1 1 . . . . . = 1

4. Unit type / Nominal connecting voltage ①
4.1 Converter 3 x AC
380 to 480 V, ±10 % . . . . . = 4
4.2 Converter 3 x AC 500 V, ±10 % . . . . = 5
4.3 Inverter DC 530 to 670 V, ±10 % . . . = 7
4.4 Inverter DC 700 V, ±10 % . . . . . = 8

5. Brake chopper for converter
5.1 **Converter**
5.1.1 with built-in brake chopper . . . . . = B
5.1.2 without built-in brake chopper . . . . . = N
5.2 **Inverter**
5.2.1 Operating as RD51 SFT. . . . . .= C ②
5.2.2 without built-in brake chopper . . . . . = N

6. Rated power data (kW) ③
22 30 37 45 55 75 90 110 132 160
200 315 400
e.g., 22 kW . . . . . = 022
e.g., 400 kW. . . . . = 400

7. Cooling mode
7.1 plug-through cooler . . . . . (≤ 110 kW) = D
7.2 forced air cooling with integrated
liquid circulation. . . . . (≥ 132 kW) = F
7.3 forced air cooling . . . . . (≤ 110 kW) = L
7.4 heat dissipation panel. . . . . (≤ 18,5 kW) = P
7.5 Liquid cooling with internal pump. . . . . (≥ 132 kW) = R
7.6 Liquid cooling . . . . . = W ④

8. Additional functions ⑤
8.1 Connection for RZC01.1-XN and 24 V stand-by power, external (≤ 110 kW) = C1
8.2 Connection for RZC01.1-XT, with NAMUR terminal strip,
24 V stand-by power, external. . . . . .(≤ 110 kW) = D1
8.3 Feedback of current filter (U6, V6, W6). . . . . = F1
8.4 Feedback of cable damping (C3, D3). . . . . = L1
8.5 Frequency converter > 150 Hz, without output chokes. . . . . (≥ 132 kW) = M1
8.6 not equipped. . . . . = NN
8.7 24 V stand-by power, external. . . . . = V1
8.8 95 mm² terminals "C" and "F". . . . . (≥ 132 kW) = W1
8.9 Operating on IT mains only with unit type/mains connecting 4. . . . . = Y1
8.10 95 mm² terminals "C" and "D". . . . . (≥ 132 kW) = Z1

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Fig.: 2-4 Basic device type key, size classes C - H (page 1)

Abbrev. Column →	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
Example:	R	D	5	1	.	1	-	4	N	-	0	0	1	-	L	-	V	1	-	F	W									

9. Firmware

9.1 Denotes that firmware must be ordered as separate subposition. . . = FW

Note:

(1) All converters are equipped with mains filter.

(2) Inverter "C" is only available for rated power data "160" kW with unit type / nominal connecting voltage "8" and cooling mode "F" and "R". The additional function "W1", "Y1" and "Z1" and the combinations with the code "L4", "LW", "LZ", "V3", "VW", "VY", "VZ" and "WZ" are excluded.

(3) These three codes supply information about typical rated power of a 4-pole standard AC motor with a relevant connecting voltage.

(4) Cooling mode "W" is only available with
- unit type / nominal connecting voltage "4" and "5" for rated output "022" till "110"

(5) permissible combinationes of additional functions

Additional functions			Code
C1	F1	-	**CF**
C1	L1	-	**CL**
D1	F1	-	**DF**
D1	L1	-	**DL**
F1	M1	V1	**F3**
F1	M1	-	**FM**
F1	V1	-	**FV**
L1	M1	V1	**L3**
L1	V1	W1	**L4**
L1	M1	-	**LM**
L1	V1	-	**LV**
L1	W1	-	**LW**
L1	Z1	-	**LZ**
M1	V1	-	**MV**
V1	W1	Z1	**V3**
V1	W1	-	**VW**
Y1	V1	-	**VY**
V1	Z1	-	**VZ**
W1	Z1	-	**WZ**

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Fig.:2-5 Basic device type key, size classes C - H (page 2)

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Type Key Configuration

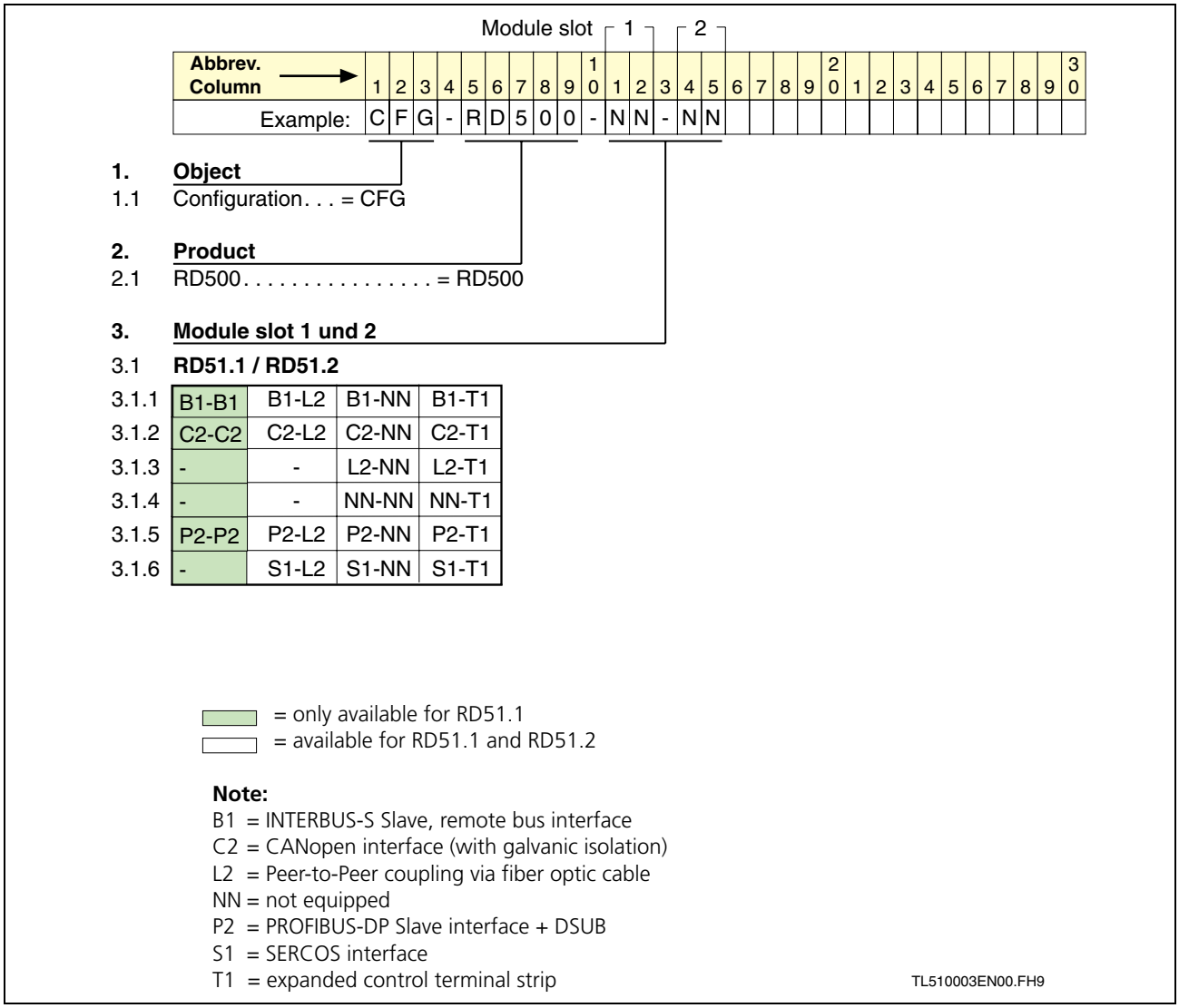

Fig.: 2-6 Type key configuration

Note: Your local sales center will provide you with information about the versions which are presently available.

2.4 Important Notes Regarding Use

Proper Use

Introduction

Indramat Refu products are developed and manufactured according to the state of the art. Before they are delivered, they are inspected to ensure that they operate safely.

The products may only be used in the proper manner. If they are not used in the proper manner, situations may arise that result in damage to material and personnel.

Note: As the manufacturer, Indramat Refu in no way provides a guarantee, responsibility or compensation for damages in the case of improper use of the products; the risks in the case of improper use of the products are borne solely by the user.

Before you put Indramat Refu products into operation, the following requirements must be fulfilled to ensure proper use of the products:

- Everyone who in any way deals with one of our products must read and understand the corresponding notes regarding safety and proper use.
- If the products are hardware, they must be kept in their original state, i.e. no constructional modifications may be made. Software products may not be decompiled; their source codes may not be modified.
- Damaged or improperly working products must not be installed or put into operation.
- It must be ensured that the products are installed according to the regulations listed in the documentation.

Areas of Use and Application

Indramat Refu drive control units are designed to control electric motors and to monitor their operation.

It may be necessary to connect additional sensors and actuators to control and monitor motors.

Note: The drive control units may only be operated with the accessories and mounted components specified in the RD 500 documentation. Components that are not explicitly mentioned may be neither attached nor connected. The same is true for cables and lines.

Operation may be carried out only in the explicitly mentioned configurations and combinations of the component and with the software and firmware specified in the corresponding description of functions.

Every drive control unit must be programmed before it is commissioned so that the motor is controlled corresponding to the specific functions for the application.

Equipment types with various drive outputs and different interfaces are available for application-specific use.

Typical applications include:

- Chemical and process technology,
- Machine tools,
- Hoist- and Conveyor technology,
- Handling and assembly systems, and
- Packing and foodstuff machines.

The drive control unit may only be operated under the specified mounting and installation conditions, in the specified mounting position and under the specified ambient conditions (temperature, degree of protection, humidity, EMC etc.).

Improper use

The use of the drive control units in other applications than those specified or described in the documentation and technical data is considered as "improper".

Drive control units may not be used if they

- are exposed to operating conditions that do not fulfill the prescribed ambient conditions. For example, operation under water, under extreme variations in temperature or under extreme maximum temperatures is prohibited.
- are used for applications which have not been clearly released by Indramat Refu. In this regard, it is required that you refer to the statements in the general notes regarding safety!

3 Converter Technical Data

3.1 Technical Data for Size Classes A and B with Pulse Frequency f_p = 4 kHz / 8kHz (3AC 380...480V)

		4 kHz					8 kHz				
RD51		**003**	**005**	**007**	**015**	**018**	**003**	**005**	**007**	**015**	**018**
Rated motor output[1]	[kW]	3.0	5.5	7.5	15	18.5	2.2	4.0	5.5	11	15
Supply voltage, 3-phase 380 ... 480 V AC (±10 %) [2]											
Output frequency	[Hz]	0 - 250					0 - 500				
Rated current	[A]	7.5	13	18	30	35	5.8	10	13	25	30
Peak current for t = 60 s	[A]	9.8	17	23	39	46	7.5	13	17	33	39
t = 1 s	[A]	13	22	31	51	60	9.9	17	22	43	51
t = 0.5 s	[A]	15	26	36	60	70	12	20	26	50	60
Rated output S_N	[kVA]	4.9	8.6	12	20	23	3.8	6.6	8.6	16	20
Peak power for t = 60s	[kVA]	6.5	11	15	26	30	4.9	8.6	11	22	26
Supply voltage, 3-phase 500 V AC (±10 %)											
Output frequency	[Hz]	0 - 250					0 - 500				
Rated current	[A]	6	10	14	24	28	4.5	8	10	20	24
Peak current for t = 60 s	[A]	7.8	13	18	31	36	5.9	10	13	26	31
t = 1 s	[A]	10	17	24	41	48	7.7	14	17	34	41
t = 0.5 s	[A]	12	20	28	48	56	9.0	16	20	40	48
Rated output S_N	[kVA]	4.9	8.2	12	20	23	3.7	6.6	8.2	16	20
Peak power for t = 60s	[kVA]	6.4	11	15	26	30	4.9	8.2	11	21	26
Ambient conditions, noise suppression level, interference immunity											
Environmental class		3K3 according to DIN IEC 721-3-3 (ambient temperature 0 - 40° C)									
Cooling air requirement	[m³/s]	0.03	0.03	0.03	0.05	0.05	0.03	0.03	0.03	0.05	0.05
Power loss		In preparation									
Radio int. sup. level/noise immunity		A 1 according to EN 55011 / EN 61800-3 (only with RZF line filter)									
Mechanical design											
Size classes		A	A	A	B	B	A	A	A	B	B
Degree of protection		IP 20 according to EN 60529 with connected plug									
Weight of converter for the various cooling types											
L Forced air cooling	[kg]	6.5	6.5	6.5	11.3	11.3	6.5	6.5	6.5	11.3	11.3
P heat dissipation panel	[kg]	5.5	5.5	5.5	10.3	10.3	5.5	5.5	5.5	10.3	10.3
Performance data of chopper											
Continuous power	[kW]	1.5	2.8	3.8	7.5	9	1.5	2.8	3.8	7.5	9
Peak power for t = 1 s	[kW]	10	18	18	37	37	10	18	18	37	37
Minimum resistance value	[Ω]	60	35	35	17.5	17.5	60	35	35	17.5	17.5

1: Max. permissible motor power based on a 4-pin standard induction motor

2: Starting at an output voltage Ua > 400 V, the rated current is linearly reduced from 100% to 83% for Va = 480 V.

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3.2 Technical Data for Size Classes A and B with Pulse Frequency f_p = 12 kHz (3AC 380...480V)

		12 kHz				
RD51		**003**	**005**	**007**	**015**	**018**
Supply voltage, 3-phase 380...480 V AC (±10 %) [1]						
Output frequency	[Hz]	0 - 1400				
Rated current	[A]	4	7	10	18	22
Peak current for t = 60 s	[A]	5.2	9.1	13	23	29
t = 1 s	[A]	6.8	12	17	31	37
t = 0.5 s	[A]	8	14	20	36	44
Rated output S_N	[kVA]	2.6	4.6	6.6	12	14
Peak power for t = 60 s	[kVA]	3.4	6.0	8.6	16	18
Ambient conditions, noise suppression level, interference immunity						
Environmental class		3K3 according to DIN IEC 721-3-3 (ambient temperature 0 - 40° C)				
Cooling air requirement	[m³/s]	0.03	0.03	0.03	0.05	0.05
Power loss		In preparation				
Radio int. sup. level / noise immunity		A 1 according to EN 55011 / EN 61800-3				
Mechanical design						
Size classes		A	A	A	B	B
Degree of protection		IP 20 according to EN 60529, with connected plug				
Weight of converter for the various cooling types						
L Forced air cooling	[kg]	6.5	6.5	6.5	11.3	11.3
P heat dissipation panel	[kg]	5.5	5.5	5.5	10.3	10.3
Performance data of chopper						
Continuous power	[kW]	1.5	2.8	3.8	7.5	9
Peak power for t = 1 s	[kW]	10	18	18	37	37
Minimum resistance value	[Ω]	60	35	35	17.5	17.5

1: Starting at an output voltage Ua > 400 V, the rated current is linearly reduced from 100% to 83% for Va = 480 V.

3.3 Technical Data for Size Classes A and B with Pulse Frequency f_p = 4 kHz / 8kHz (3AC 200...230V)

		4 kHz					8 kHz				
RD51		**003**	**005**	**007**	**015**	**018**	**003**	**005**	**007**	**015**	**018**
Rated motor output[1]	[kW]	1.5	2.8	3.8	7.5	9	1.1	2	2.8	5.5	7.5
Supply voltage, 3-phase 200...230 V AC (±15 %)											
Output frequency	[Hz]	0 - 250					0 - 500				
Rated current	[A]	7.5	13	18	30	35	5.8	10	13	25	30
Peak current for t = 60 s	[A]	9.8	17	23	39	46	7.5	13	17	33	39
t = 1 s	[A]	13	22	31	51	60	9.9	17	22	43	51
t = 0.5 s	[A]	15	26	36	60	70	12	20	26	50	60
Rated output S_N	[kVA]	2.4	4.3	6	10	11	1.9	3.3	4.3	8	10
Peak power for t = 60s	[kVA]	3.2	5.5	7.5	13	15	2.4	4.3	5.5	11	13
Supply voltage SNT- connection C1 / D1		DC530...670V ±10% 100W									
Ambient conditions, noise suppression level, interference immunity											
Environmental class		3K3 according to DIN IEC 721-3-3 (ambient temperature 0 - 40° C)									
Cooling air requirement	[m³/s]	0.03	0.03	0.03	0.05	0.05	0.03	0.03	0.03	0.05	0.05
Power loss		In preparation									
Radio int. sup. level/noise immunity		A 1 according to EN 55011 / EN 61800-3 (only with RZF line filter)									
Mechanical design											
Size classes		A	A	A	B	B	A	A	A	B	B
Degree of protection		IP 20 according to EN 60529 with connected plug									
Weight of converter for the various cooling types											
L Forced air cooling	[kg]	6.5	6.5	6.5	11.3	11.3	6.5	6.5	6.5	11.3	11.3
P heat dissipation panel	[kg]	5.5	5.5	5.5	10.3	10.3	5.5	5.5	5.5	10.3	10.3
Performance data of chopper											
Continuous power	[kW]	1.5	2.8	3.8	7.5	9	1.1	2	2.8	5.5	7.5
Peak power for t = 1 s	[kW]	10	18	18	37	37	10	18	18	37	37
Minimum resistance value	[Ω]	60	35	35	17.5	17.5	60	35	35	17.5	17.5

1: Max. permissible motor power based on 4-pin standard induction motor

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3.4 Technical Data for Size Classes A and B with Pulse Frequency f_p = 12 kHz (3AC 200...230V)

		12 kHz				
RD51		**003**	**005**	**007**	**015**	**018**
Supply voltage, 3-phase 200...230 V AC (±15 %)						
Output frequency	[Hz]	0 - 1400				
Rated current	[A]	4	7	10	18	22
Peak current for t = 60 s	[A]	5.2	9.1	13	23	29
t = 1 s	[A]	6.8	12	17	31	37
t = 0.5 s	[A]	8	14	20	36	44
Rated output S_N	[kVA]	2.6	4.6	6.6	12	14
Peak power for t = 60 s	[kVA]	3.4	6.0	8.6	16	18
Supply voltage SNT- connection C1 / D1		DC530...670V ±10% 100W				
Ambient conditions, noise suppression level, interference immunity						
Environmental class		3K3 according to DIN IEC 721-3-3 (ambient temperature 0 - 40° C)				
Cooling air requirement	[m³/s]	0.03	0.03	0.03	0.05	0.05
Power loss		In preparation				
Radio int. sup. level / noise immunity		A 1 according to EN 55011 / EN 61800-3				
Mechanical design						
Size classes		A	A	A	B	B
Degree of protection		IP 20 according to EN 60529, with connected plug				
Weight of converter for the various cooling types						
L Forced air cooling	[kg]	15	15	15	18	18
P heat dissipation panel	[kg]	10	10	10	12	12
Performance data of chopper						
Continuous power	[kW]	0.75	1.1	2.2	4	11
Peak power for t = 1 s	[kW]	10	18	18	37	37
Minimum resistance value	[Ω]	60	35	35	17.5	17.5

3.5 Technical Data for Size Classes C, D and E with Pulse Frequency f_p = 4 kHz

			4 kHz						
RD51			**022**	**030**	**037**	**045**	**055**	**075**	**090**	**110**
Rated motor output [1]		[kW]	22	30	37	45	55	75	90	110
Supply voltage, 3-phase 380...480 V AC (±10 %) [2]										
Output frequency		[Hz]	0 - 250							
Rated current		[A]	43	56	68	82	99	135	165	195
Peak current for	t = 60 s	[A]	55	73	88	107	129	176	215	254
	t = 1 s	[A]	72	95	116	139	168	230	281	332
	t = 0.5 s	[A]	85	112	136	164	198	270	330	390
Rated output S_N		[kVA]	28	37	45	54	65	89	109	128
Peak power for	t = 60s	[kVA]	37	48	58	70	85	116	142	167
Supply voltage, 3-phase 500 V AC (±10 %)										
Output frequency		[Hz]	0 - 250							
Rated current		[A]	34	45	54	66	80	108	130	160
Peak current for	t = 60 s	[A]	44	59	70	86	104	140	169	208
	t = 1 s	[A]	58	77	92	112	136	184	221	272
	t = 0.5 s	[A]	68	90	108	132	160	216	260	320
Rated output S_N		[kVA]	28	37	44	54	66	89	107	132
Peak power for	t = 60s	[kVA]	36	49	58	71	86	115	139	171
Ambient conditions, noise suppression level, interference immunity										
Environmental class			3K3 according to DIN IEC 721-3-3 (ambient temperature 0 - 40° C)							
Cooling air requirement		[m³/s]	0.1	0.1	0.2	0.2	0.4	0.4	0.4	0.4
Power loss			In preparation							
Radio int. sup. level/noise immunity			A 1 according to EN 55011 / EN 61800-3							
Mechanical design										
Size classes			C	C	C	C	D	D	E	E
Degree of protection			IP 20 according to EN 60529 (without connection terminals)							
Weight of converter for the various cooling types										
L Forced air cooling		[kg]	36	36	36	36	52	52	74	74
W Liquid cooling		[kg]	28	28	28	28	42	42	57	57
D Plug-through cooler		[kg]	33	33	33	33	49	49	71	71
Performance data of chopper										
Continuous power		[kW]	14	19	23	27	33	45	55	55
Peak power for	t = 1 s	[kW]	56	74	93	111	130	148	260	260
Minimum resistance value		[Ω]	11.7	8.8	7	5.8	5	4.4	2.5	2.5

1: Max. permissible motor power based on 4-pin standard induction motor

2: Starting at an output voltage Ua > 400 V, the rated current is linearly reduced from 100% to 83% for Va = 480 V.

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3.6 Technical Data for Size Classes C, D and E with Pulse Frequency f_p = 8 kHz

		8 kHz							6 kHz
RD51		**022**	**030**	**037**	**045**	**055**	**075**	**090**	**110**
Rated motor output[1]	[kW]	18.5	22	30	37	45	55	75	90
Supply voltage, 3-phase 380...480 V AC (±10 %)[2]									
Output frequency	[Hz]	0 - 500							
Rated current	[A]	35	43	56	68	82	99	135	165
Peak current for t = 60 s	[A]	46	55	73	88	107	129	176	215
t = 1 s	[A]	60	72	95	116	139	168	230	280
t = 0.5 s	[A]	70	85	112	136	164	198	270	330
Rated output S_N	[kVA]	23	28	37	45	54	65	89	109
Peak power for t = 60s	[kVA]	30	36	48	58	70	85	116	142
Supply voltage, 3-phase 500 V AC (±10 %)									
Output frequency	[Hz]	0 - 500							
Rated current	[A]	28	34	45	55	66	80	108	130
Peak current for t = 60 s	[A]	36	44	59	72	86	104	140	169
t = 1 s	[A]	48	58	77	94	112	136	184	221
t = 0.5 s	[A]	56	68	90	110	132	160	216	260
Rated output S_N	[kVA]	23	28	37	45	54	66	89	107
Peak power for t = 60s	[kVA]	30	36	49	59	71	86	115	139
Ambient conditions, noise suppression level, interference immunity									
Environmental class		3K3 according to DIN IEC 721-3-3 (ambient temperature 0 - 40° C)							
Cooling air requirement	[m³/s]	0.1	0.1	0.2	0.2	0.4	0.4	0.4	0.4
Power loss		In preparation							
Radio int. sup. level / noise immunity		A 1 according to EN 55011 / EN 61800-3							
Mechanical design									
Size classes		C	C	C	C	D	D	E	E
Degree of protection		IP 20 according to EN 60529 (without connection terminals)							
Weight of converter for the various cooling types									
L Forced air cooling	[kg]	36	36	36	36	52	52	74	74
W Liquid cooling	[kg]	28	28	28	28	42	42	57	57
D Plug-through cooler	[kg]	33	33	33	33	49	49	71	71
Performance data of chopper									
Continuous power	[kW]	14	19	23	27	33	45	55	55
Peak power for t = 1 s	[kW]	56	74	93	111	130	148	260	260
Minimum resistance value	[Ω]	11.7	8.8	7	5.8	5	4.4	2.5	2.5

1: Max. permissible motor power based on 4-pin standard induction motor

2: Starting at an output voltage Ua > 400 V, the rated current is linearly reduced from 100% to 83% for Va = 480 V.

3.7 Technical Data for Size Classes C, D and E with Pulse Frequency f_p = 12 kHz

		12 kHz							
RD51		**022**	**030**	**037**	**045**	**055**	**075**	**090**	**110**
Supply voltage, 3-phase 380...480 V AC (±10 %)[1]									
Output frequency	[Hz]	0 - 1400							
Rated current	[A]	30	35	40	52	68	80	80	80
Peak current for t = 60 s	[A]	39	46	52	68	88	104	104	104
t = 1 s	[A]	51	60	68	88	116	136	136	136
t = 0.5 s	[A]	60	70	80	104	136	160	160	160
Rated output S_N	[kVA]	20	23	26	34	45	53	53	53
Peak power for t = 60s	[kVA]	26	30	34	44	58	68	68	68
Ambient conditions, noise suppression level, interference immunity									
Environmental class		3K3 according to DIN IEC 721-3-3 (ambient temperature 0 - 40° C)							
Cooling air requirement	[m³/s]	0.1	0.1	0.2	0.2	0.4	0.4	0.4	0.4
Power loss		In preparation							
Radio int. sup. level/noise immunity		A 1 according to EN 55011 / EN 61800-3							
Mechanical design									
Size classes		C	C	C	C	D	D	E	E
Degree of protection		IP 20 according to EN 60529 (without connection terminals)							
Weight of converter for the various cooling types									
L Forced air cooling	[kg]	36	36	36	36	52	52	74	74
W Liquid cooling	[kg]	28	28	28	28	42	42	57	57
D Plug-through cooler	[kg]	33	33	33	33	49	49	71	71
Performance data of chopper									
Continuous power	[kW]	14	19	23	27	33	45	55	55
Peak power for t = 1 s	[kW]	56	74	93	111	130	148	260	260
Minimum resistance value	[Ω]	11.7	8.8	7	5.8	5	4.4	2.5	2.5

1: Starting at an output voltage Ua > 400 V, the rated current is linearly reduced from 100% to 83% for Va = 480 V.

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3.8 Technical Data for Size Classes G and H with Pulse Frequency f_p = 4 kHz / 8kHz

		4 kHz					8 kHz				
RD51		**132**	**160**	**200**	**315**	**400**	**132**	**160**	**200**	**315**	**400**
Rated motor output [1]	[kW]	132	160	200	315	400	110	132	160	200	315
Supply voltage, 3-phase 380...480 V AC (±10 %) [2]											
Output frequency [4]	[Hz]	0-250	0 - 150				0 - 500	0 - 250			
Rated current	[A]	230	290	350	540	680	195	230	280	400	540
Peak current for t = 60 s	[A]	299	377	455	702	884	254	299	364	520	702
t = 1 s	[A]	391	493	595	918	1156	332	391	476	680	918
Rated output S_N	[kVA]	151	191	230	355	448	128	151	184	263	355
Peak power for t = 60s	[kVA]	197	248	299	462	582	166	197	240	342	462
Supply voltage, 3-phase 500 V AC (±10 %)											
Output frequency [4]	[Hz]	0 - 250	0 - 150				0 - 500	0 - 250			
Rated current	[A]	190	240	280	432	550	160	190	240	345	432
Peak current for t = 60 s	[A]	247	312	364	562	715	208	247	312	449	562
t = 1 s	[A]	323	408	476	734	935	272	323	408	587	734
Rated output S_N	[kVA]	156	197	230	355	452	132	156	197	284	355
Peak power for t = 60s	[kVA]	203	257	299	462	588	171	203	257	369	462
Ambient conditions, noise suppression level, interference immunity											
Environmental class		3K3 according to DIN IEC 721-3-3 (ambient temperature 0 - 40° C)									
Cooling air requirement	[m³/s]	0.4	0.4	0.6	0.8	1.2	0.4	0.4	0.6	0.8	1.2
Power loss		In preparation									
Radio int. sup. level / noise immunity		A 1 according to EN 55011 / EN 61800-3									
Mechanical design											
Size classes		G	G	G	H	H	G	G	G	H	H
Degree of protection		IP 20 according to EN 60529 (without connection terminals)									
Weight of converter for the various cooling types											
F Forced air cooling with integrated liquid circuit	[kg]	180	180	180	358	358	180	180	180	358	358
R Liquid cooling with internal pump	[kg]	157	157	157	312	312	157	157	157	312	312
Performance data of chopper											
Continuous power	[kW]	40	40	40	2 x 40	2 x 40	40	40	40	2 x 40	2 x 40
Continuous power [3]	[kW]	100	100	100	2x100	2x100	100	100	100	2x100	2x100
Peak power for t = 0.1 s	[kW]	270	270	370	2x270	2x370	270	270	370	2x270	2x370
Minimum resistance value	[Ω]	2.2	2.2	1.6	2x2.2	2x1.6	2.2	2.2	1.6	2x2.2	2x1.6

1: Max. permissible motor power based on 4-pin standard induction motor

2: Starting at an output voltage Ua > 400 V, the rated current is linearly reduced from 100% to 83% for Va = 480 V.

3: Additional function W1 required

4: If Output frequency >150Hz the additional function M1 is required (without integrate Motor filter)

3.9 Technical Data for Size Classes G and H with Pulse Frequency f_p = 12 kHz

			12 kHz				
RD51			**132**	**160**	**200**	**315**	**400**
Supply voltage, 3-phase 380...480 V AC (±10 %) [1]							
Output frequency [3]		[Hz]	0 - 1000	0 - 500			
Rated current		[A]	140	170	210	310	395
Peak current for	t = 60 s	[A]	182	221	273	403	514
	t = 1 s	[A]	238	289	357	527	672
Rated output S_N		[kVA]	92	112	138	204	260
Peak power for	t = 60 s	[kVA]	120	145	180	265	338
Ambient conditions, noise suppression level, interference immunity							
Environmental class			3K3 according to DIN IEC 721-3-3 (ambient temperature 0 - 40° C)				
Cooling air requirement		[m³/s]	0.4	0.4	0.6	0.8	1.2
Power loss			In preparation				
Radio int. sup. level/noise immunity			A 1 according to EN 55011 / EN 61800-3				
Mechanical design							
Size classes			G	G	G	H	H
Degree of protection			IP 20 according to EN 60529 (without connection terminals)				
Weight of converter for the various cooling types							
F Forced air cooling with integrated liquid circuit		[kg]	180	180	180	358	358
R Liquid cooling with internal pump		[kg]	157	157	157	312	312
Performance data of chopper							
Continuous power		[kW]	40	40	40	2 x 40	2 x 40
Continuous power [2]		[kW]	100	100	100	2 x 100	2 x 100
Peak power for	t = 0.1 s	[kW]	270	270	370	2 x 270	2 x 370
Minimum resistance value		[Ω]	2.2	2.2	1.6	2 x 2.2	2 x 1.6

1: Starting at an output voltage Ua > 400 V, the rated current is linearly reduced from 100% to 83% for Ua = 480 V.

2: Additional function W1 required

3: If Output frequency >150Hz the additional function M1 is required (without integrate Motor filter)

Rexroth Bosch Group

3.10 Circuit Principle

Circuit Principle of Electronics Section

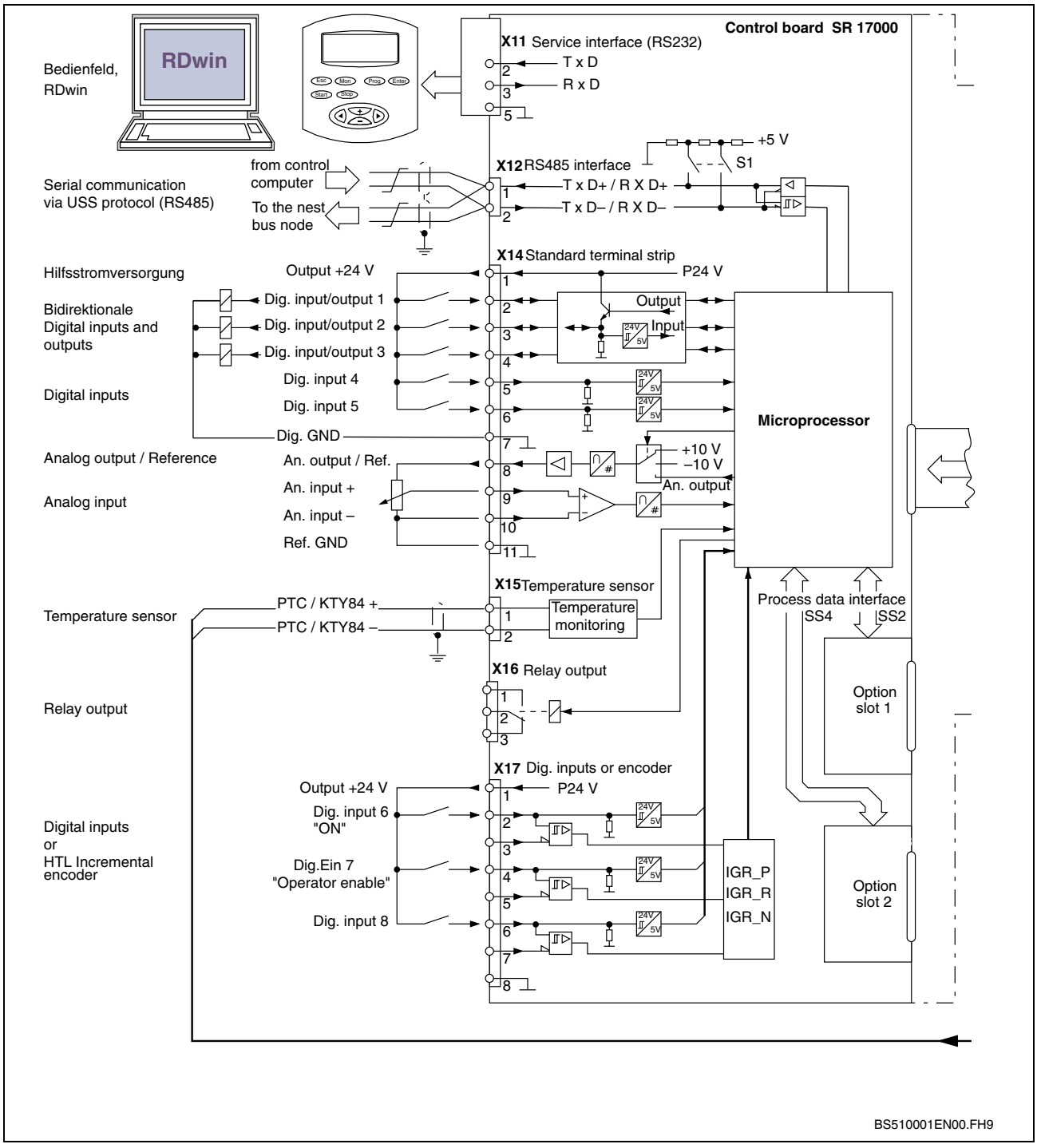


Fig.: 3-1 Circuit principle of electronics section

Circuit Principle of Power Section, Size Classes A and B

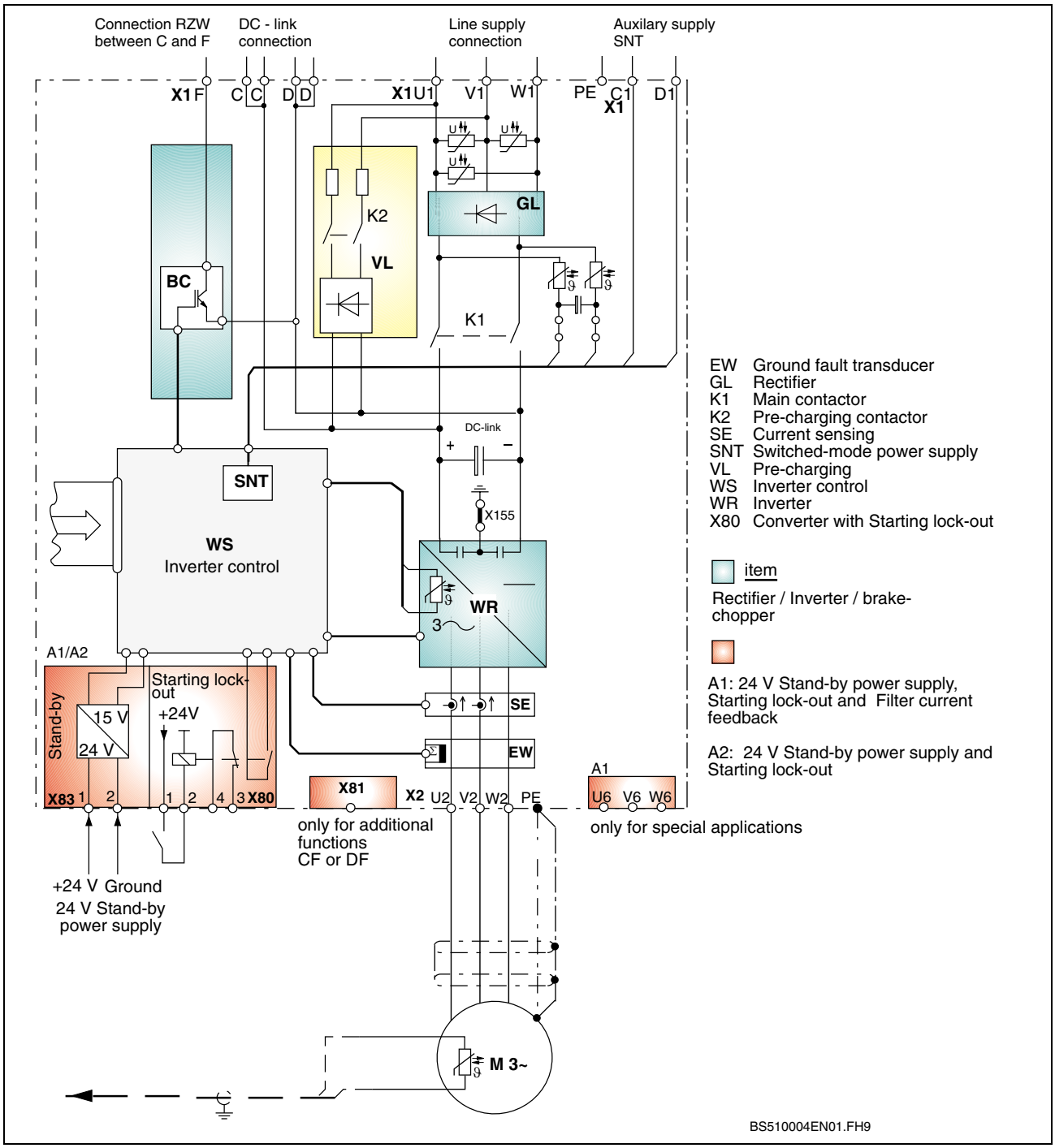


Fig.: 3-2 Circuit principle of power section, converter classes A and B

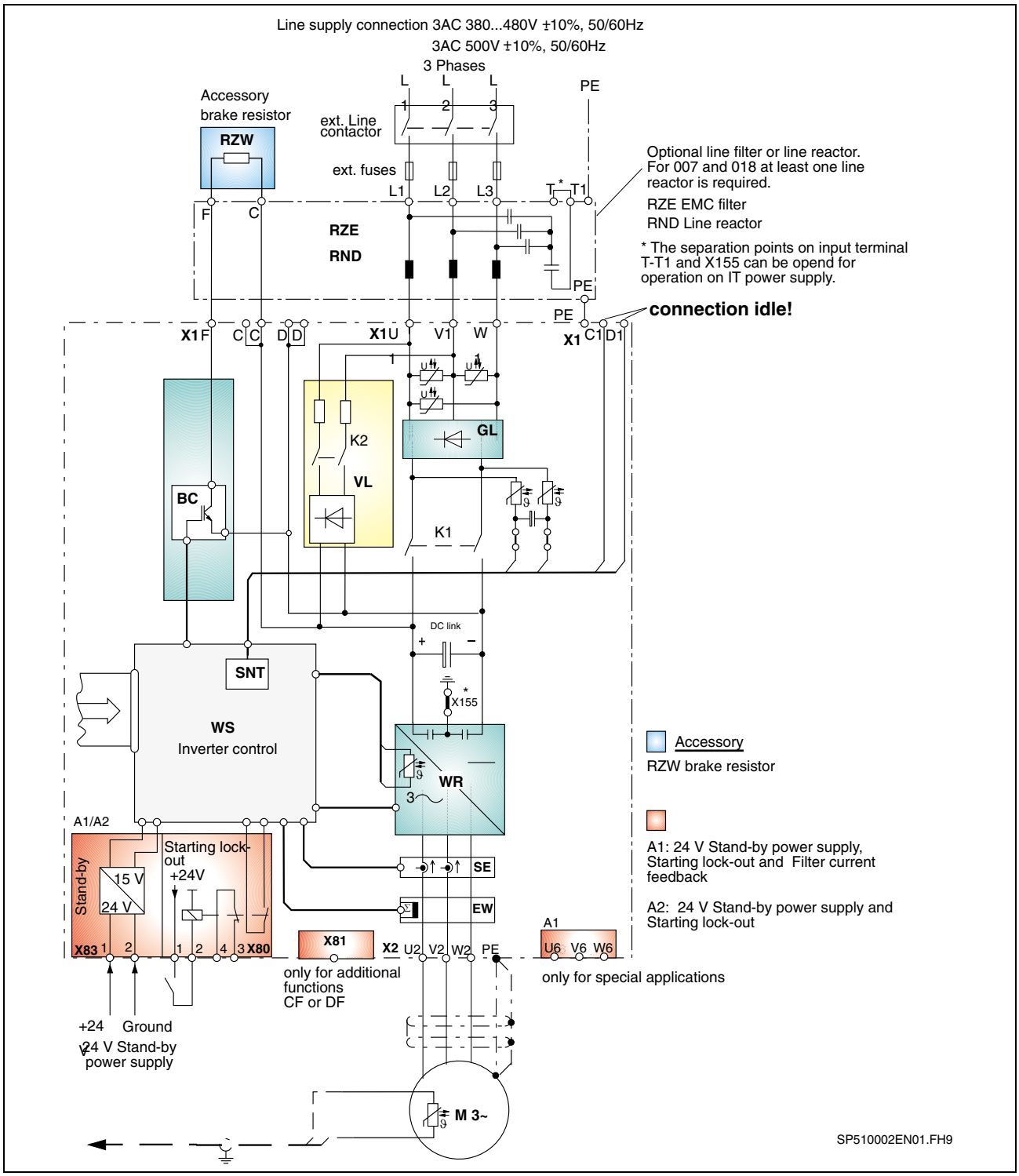


Fig.: 3-3 Sample connection of classes A – B, 3AC 380-480V / 3AC 500V

Note: Optional EMC-filter or line reactor. For 007 and 018 at least one line reactor is required.
The separation points on input terminal T – T1 and X155 can be opened for operation on IT power supply.

Note: The connections C1 and D1 are never assign!

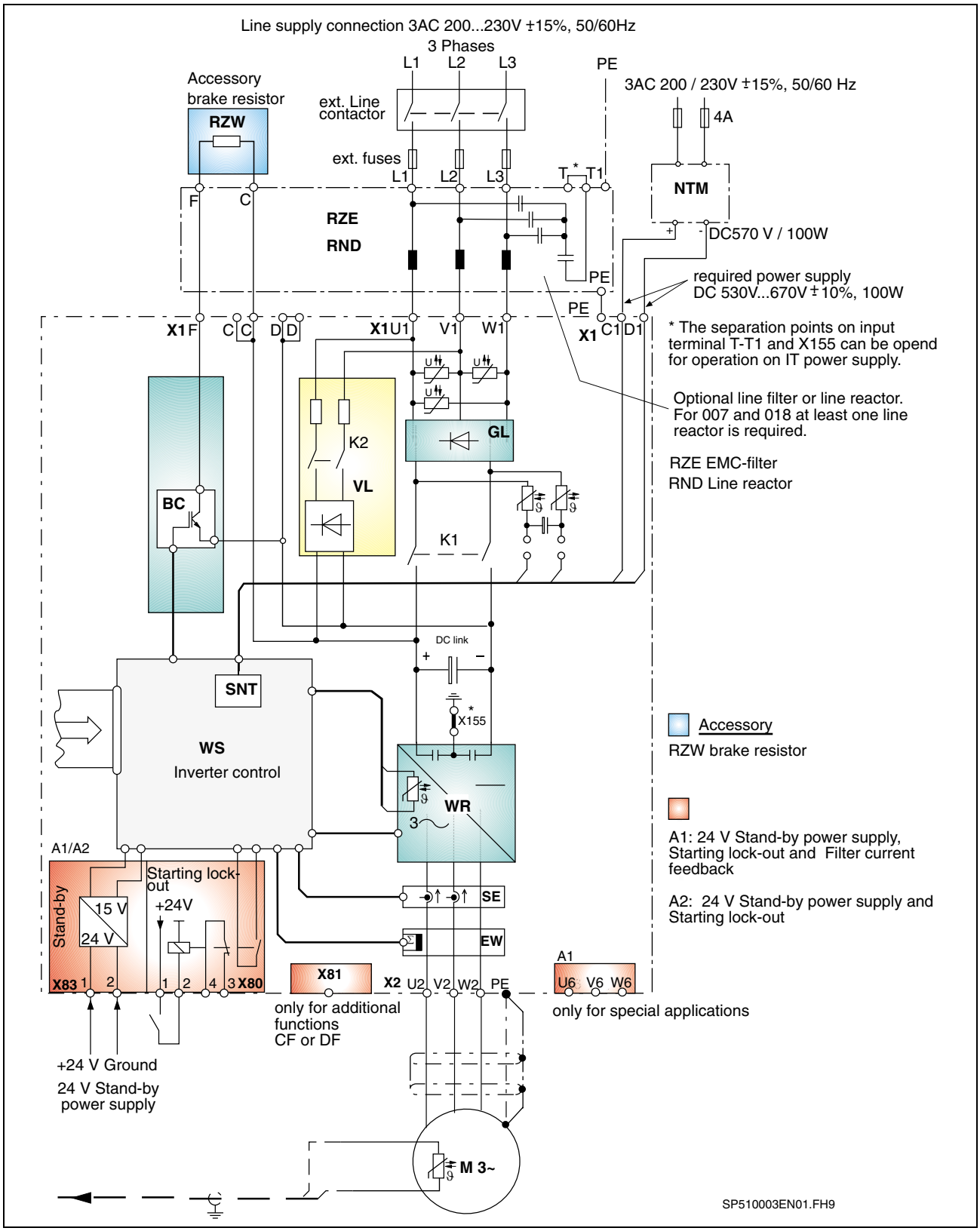


Fig.: 3-4 Sample connection of classes A - B, 3AC 200-230V

Note: A 570 V DC power supply voltage is required for the switched mode power supply.

EMC- Filter

EMC standard EN61800-3 A2 is maintained using the upstream EMC-filter.

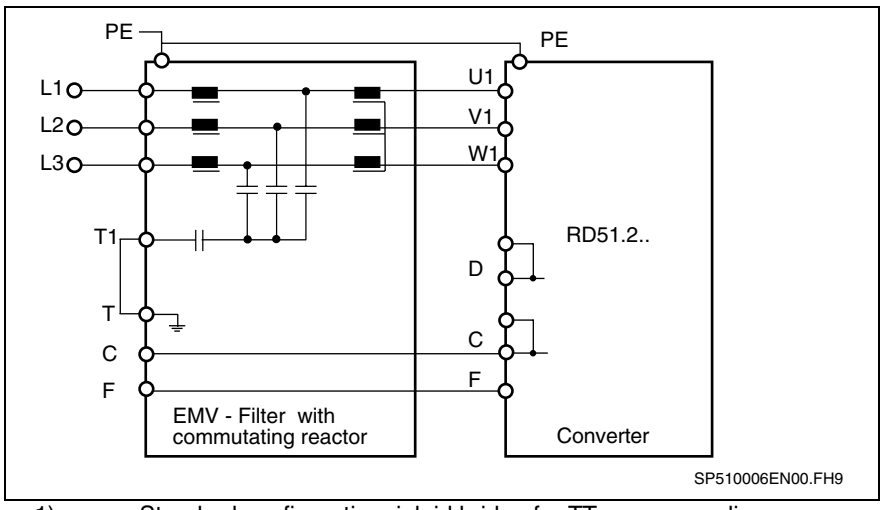
The devices in device series RD51.2 can be operated with or without a EMC filter / line reactor.

Exception Devices with power outputs of 7.5 kW and 18.5 kW must be operated with either a line reactor RND01.1 or a EMC-filter RZE01.2.

.

Description of EMC-filter with integrated line reactor RZE01.2

Presentation of Principle



1): Standard configuration: inlaid bridge for TT power supplies
2): Separation point at input terminal T-T1 for IT power supplies

Fig.: 3-5 Circuit principle of EMC-filter with integrated line reactor

Type Key

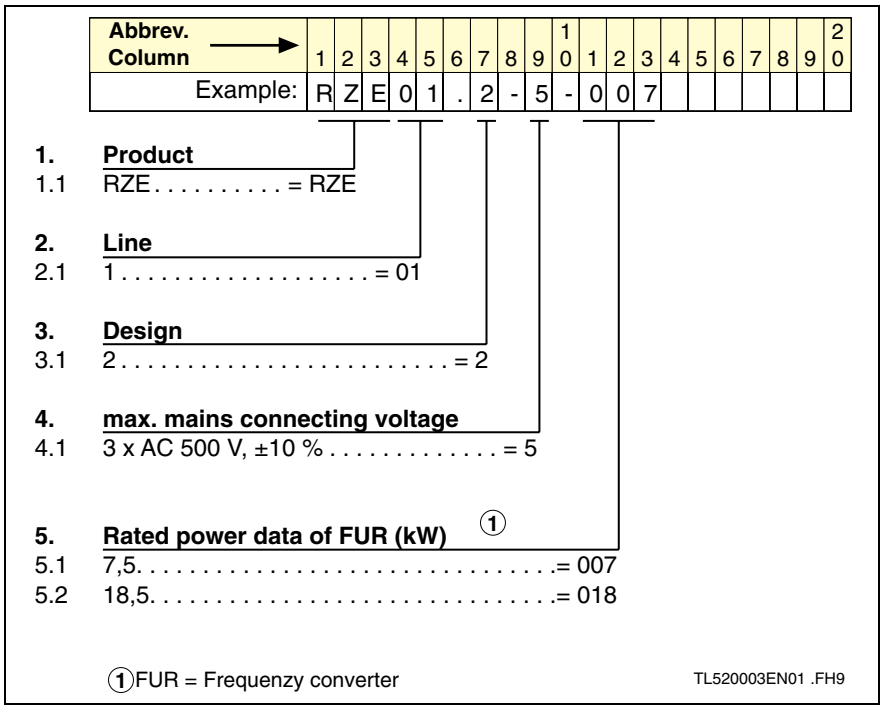


Fig.: 3-6 Type key of RZE01.2 EMC-filter with integrated line reactor

Technical Data

Con-verter								EMC-filter RZE01.2...
Power class	**Size class**	**Max. line voltage**	**Line current** **A**	**Fre-quency** **Hz**	**Connect-able cross-section** **mm²**	**Max. ambient temperature during transport, storage and operation, ta °C**	**Weight** **kg**	**Designation**
007	A	3AC 500V ±10%	20	50 / 60	Single wire 10 (AWG 8) Wire end sleeve 6 (AWG 10)	40	4,4	RZE01.2-5-007
018	B	3AC 500V ±10%	38	50 / 60	Single wire 10 (AWG 8) Wire end sleeve 6 (AWG 10)	40	6,3	RZE01.2-5-018

Fig.: 3-7 Technical data for RZE01.2 EMC-filter with integrated line reactor

The protective class is IP20

Note: The leakage current compared to PE is greater than 3.5 mA. The grounded conductor connection is laid out for 10 mm².

Type Label

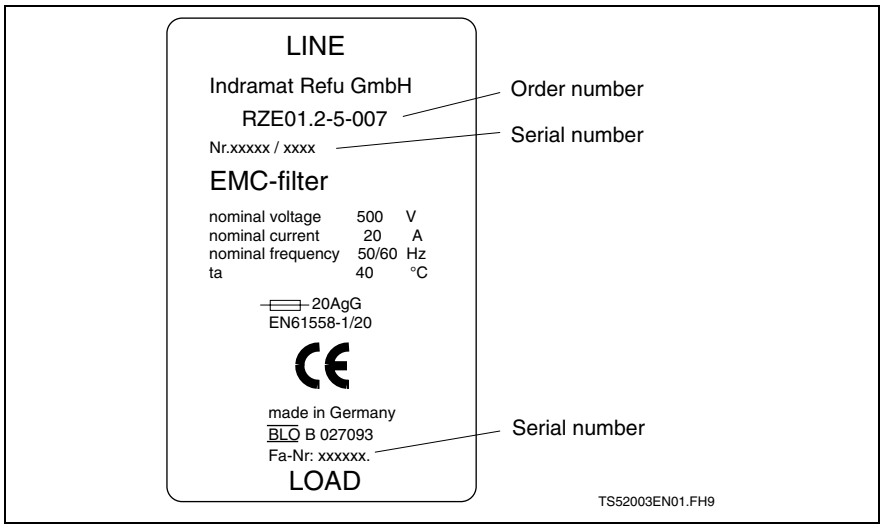
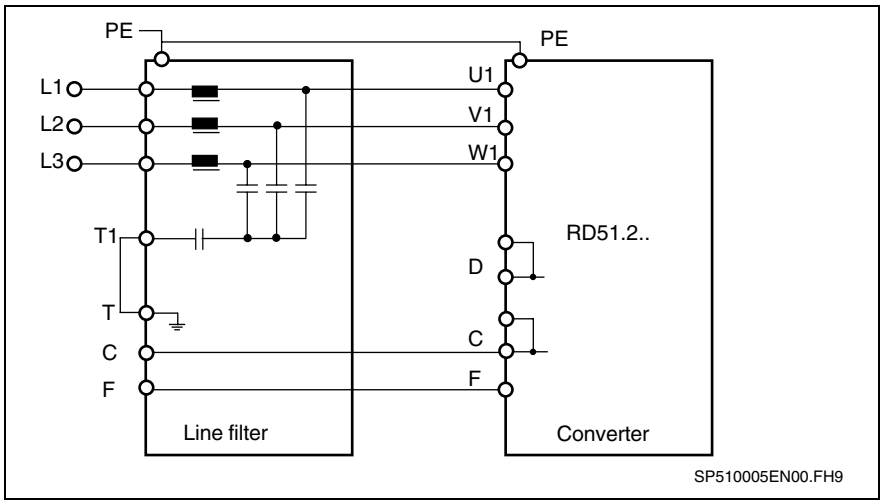


Fig.: 3-8 Type label of RZE01.2 EMC-filter with integrated line reactor

Description of EMC-filter without commutating reactor RZE02.1

Presentation of Principle



1): Standard configuration: inlaid bridge for TT power supplies
2): Separation point at input terminal T-T1 for IT power supplies

Fig.: 3-9 Circuit principle of EMC-filter RZE02.1 without commutating reactor

Type Key

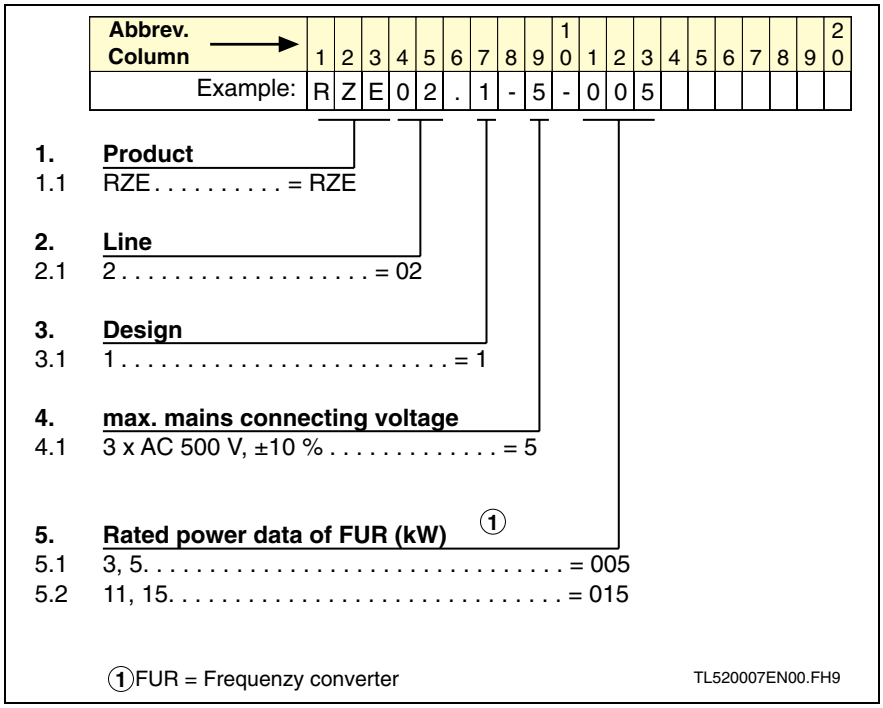


Fig.: 3-10 Type key of RZE02.1 EMC-filter without commutation reactor

Technical Data

Con-verter								EMC-filter RZE02.1...
Power class	Size class	Max. line voltage	Line current A	Fre-quency Hz	Connect-able cross-section mm^2	Max. ambient temperature during transport, storage and operation, ta °C	Weight kg	Designation
005	A	3AC 500V ±10%	20	50 / 60	Single wire 10 (AWG 8) Wire end sleeve 6 (AWG 10)	40	2,5	RZE02.1-5-005
015	B	3AC 500V ±10%	38	50 / 60	Single wire 10 (AWG 8) Wire end sleeve 6 (AWG 10)	40	3,5	RZE02.1-5-015

Fig.: 3-11 Technical data for RZE02.1 EMC-filter without commutation reactor

The protective class is IP20

Note: The leakage current compared to PE is greater than 3.5 mA. The grounded conductor connection is laid out for 10 mm² (AWG 6).

Type Label

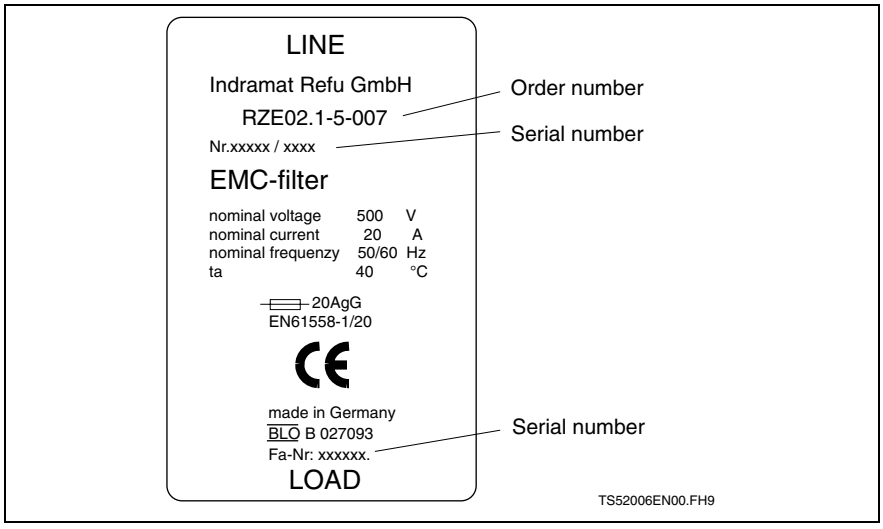
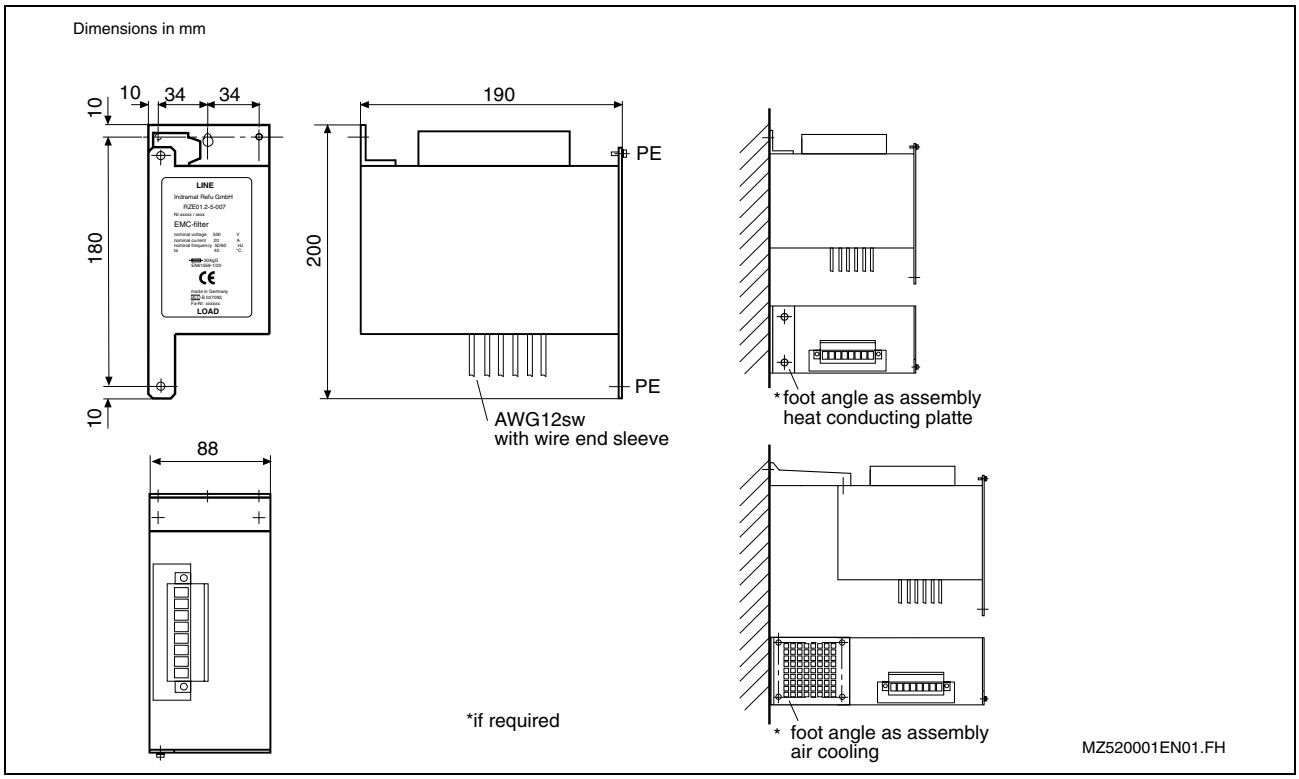


Fig.: 3-12 Type label of RZE02.1 EMC-filter without commutation reactor

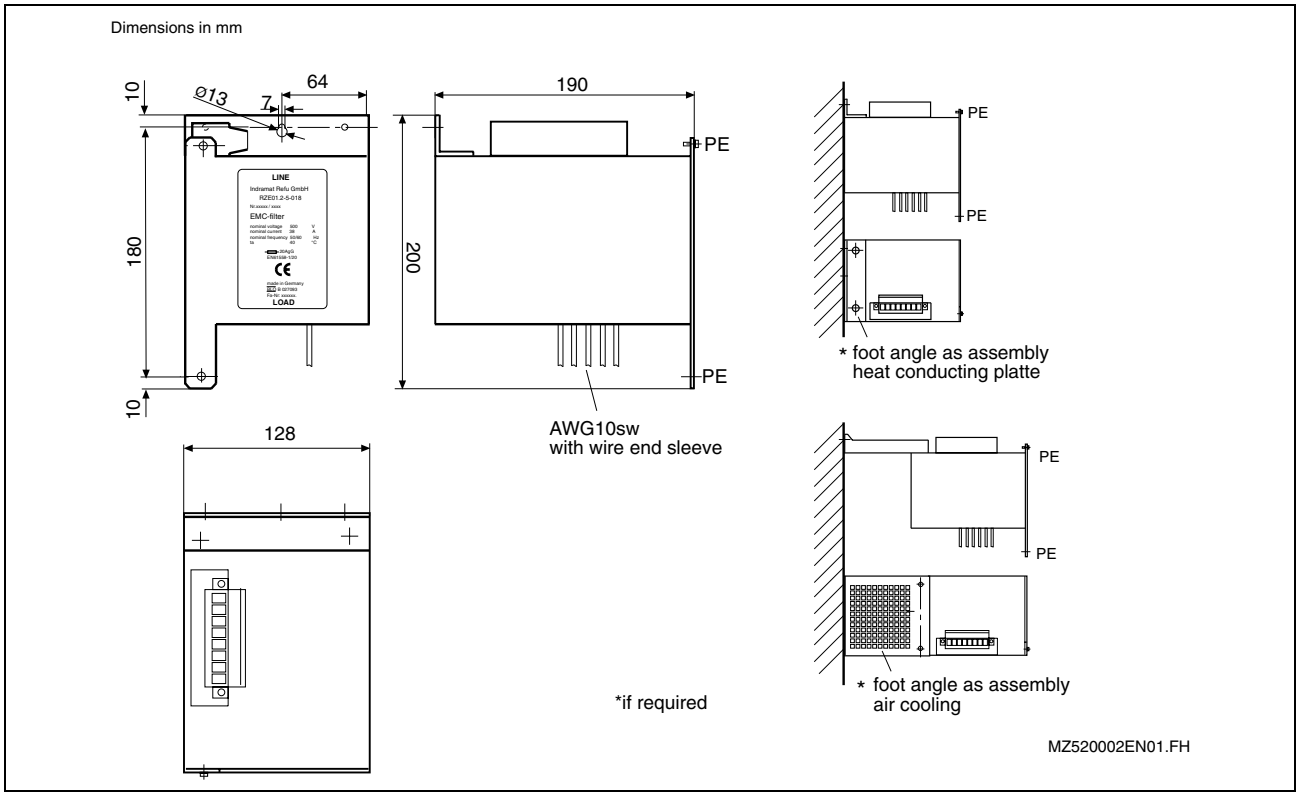
Mechanical Assembly RZE01.2 and RZE02.1

Dimension Drawings



*: select according to cooling method and foot angle

Fig.: 3-13 EMC filter RZE01.2-5-007 / RZE02.1-5-005



*: select according to cooling method and foot angle

Fig.: 3-14 EMC filter RZE01.2-5-018 / RZE02.1-5-015

Assembly Example

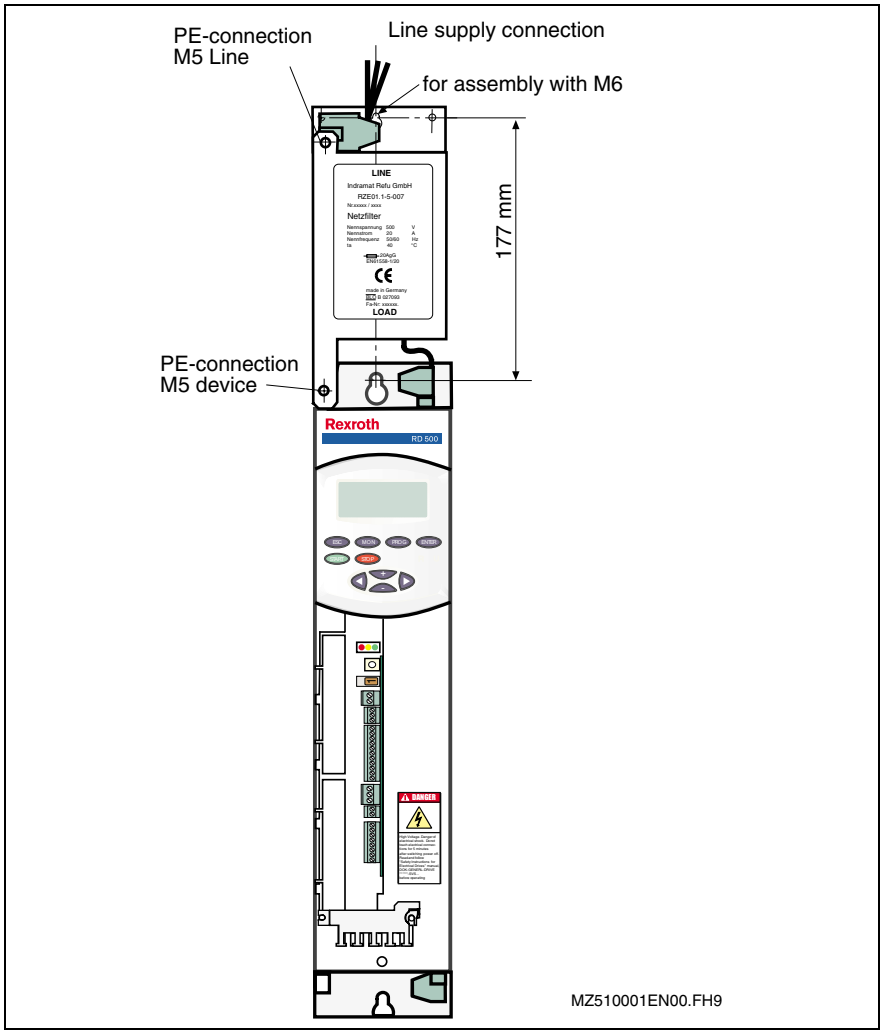


Fig.: 3-15 Assembly example for RZE01.2 / RZE02.1

Screw M5, which is already present for the PE connection, is used to fasten the line filter and the PE connection of the EMC filter.

Line Reactor

Description of RND01.1 Line Reactor

Presentation of Principle

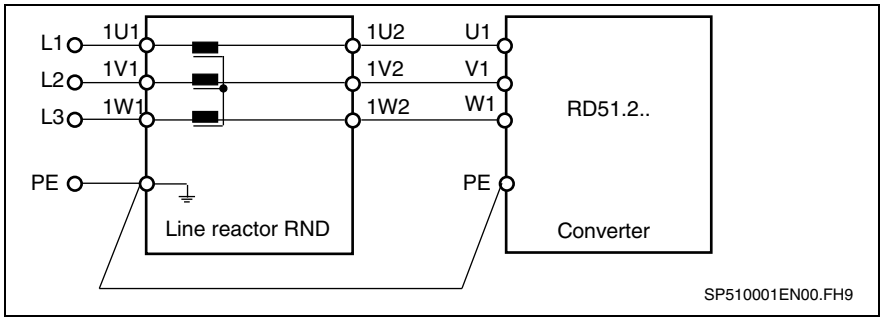


Fig.: 3-16 Circuit principle of line reactor RND

Type Key

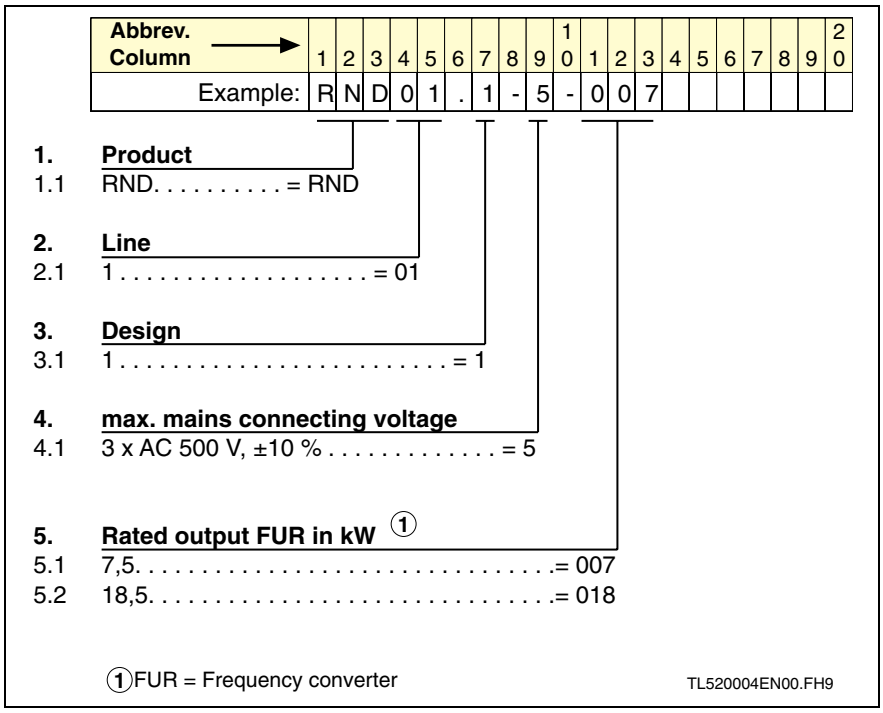


Fig.: 3-17 Type key of line reactor RND

Technical Data

Con-verter									Line reactor RND01.1...
Power class	**Size class**	**Max. line voltage**	**Line current** **A**	**In-ductivity** **mH**	**Fre-quency,** **Hz**	**Connect-able cross-section** **mm²**	**Max. ambient temperature during transport, storage and operation ta °C**	**Weight** **kg**	**Designation**
007	A	3AC 500V +10%	20	0.39	50 / 60	Single wire 10 (AWG 8) Wire end sleeve 6 (AWG 10)	40	3.3	RND01.1-5-007
018	B	3AC 500V +10%	38	0.29	50 / 60	Single wire 10 (AWG 8) Wire end sleeve 6 (AWG 10)	40	3.3	RND01.1-5-018

Fig.: 3-18 Technical data for line reactor RND01.1

The protective class is IP20

Note: The grounded conductor connection is laid out for 10 mm² (AWG 6).

Type Label

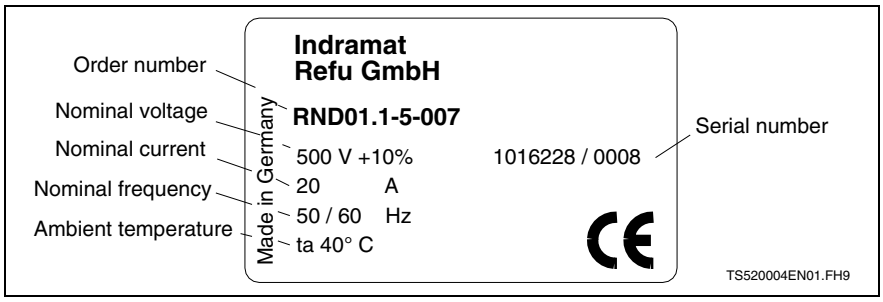


Fig.: 3-19 Type label of line reactor RND

Mechanical Assembly

Dimension Drawing

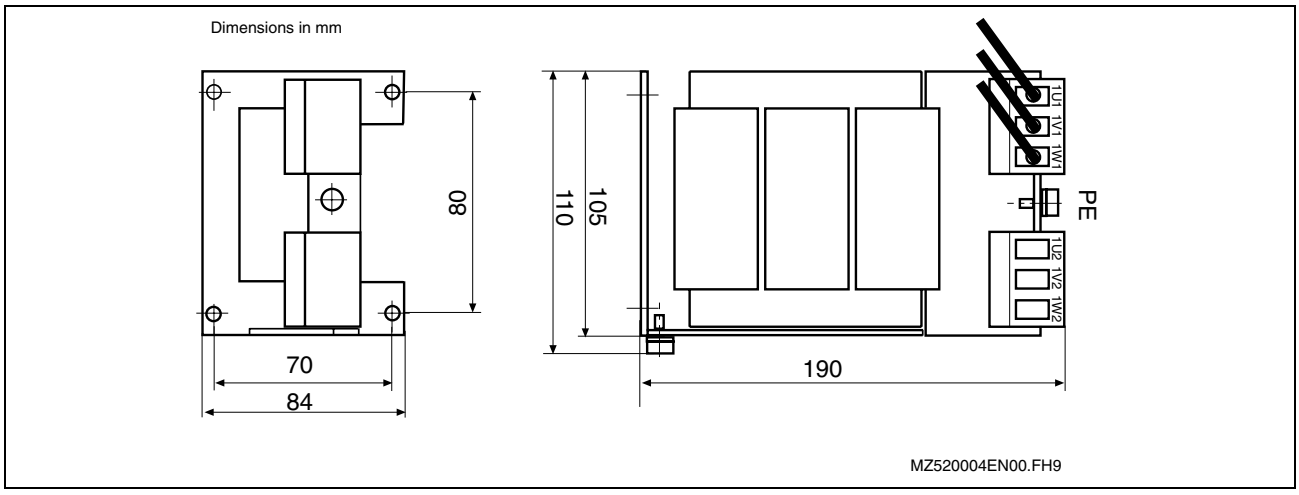


Fig.: 3-20 Line reactor RND01.1-5-007 / 018

Assembly Example

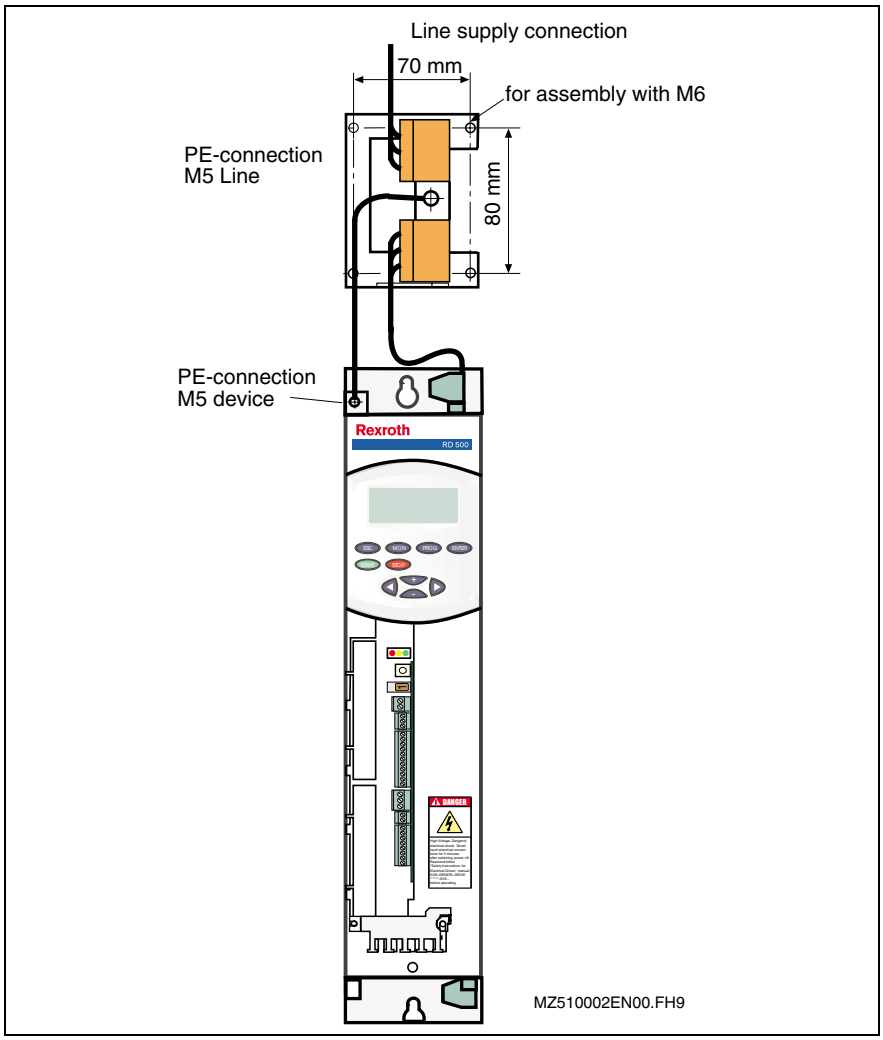


Fig.: 3-21 Assembly example of line reactor RND

Description of NTM02.1 power pack module

When converters with a 3AC 200...230V power connection are used, a 570 V DC power supply voltage is required for the switched mode power supply.

Using the NTM02.1-200-570-00 power pack module, the 570 V DC power supply voltage can be obtained from a 200 / 230V AC input voltage.

Presentation of Principle

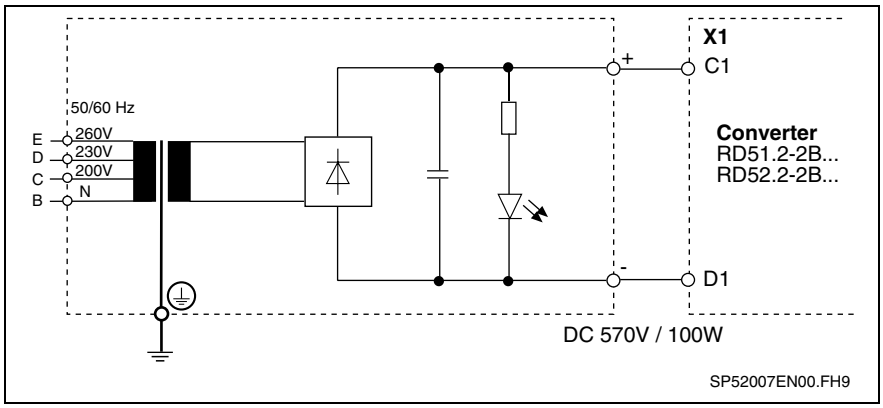


Fig.: 3-22 Presentation of Principle NTM02.1 power pack module

Type Key

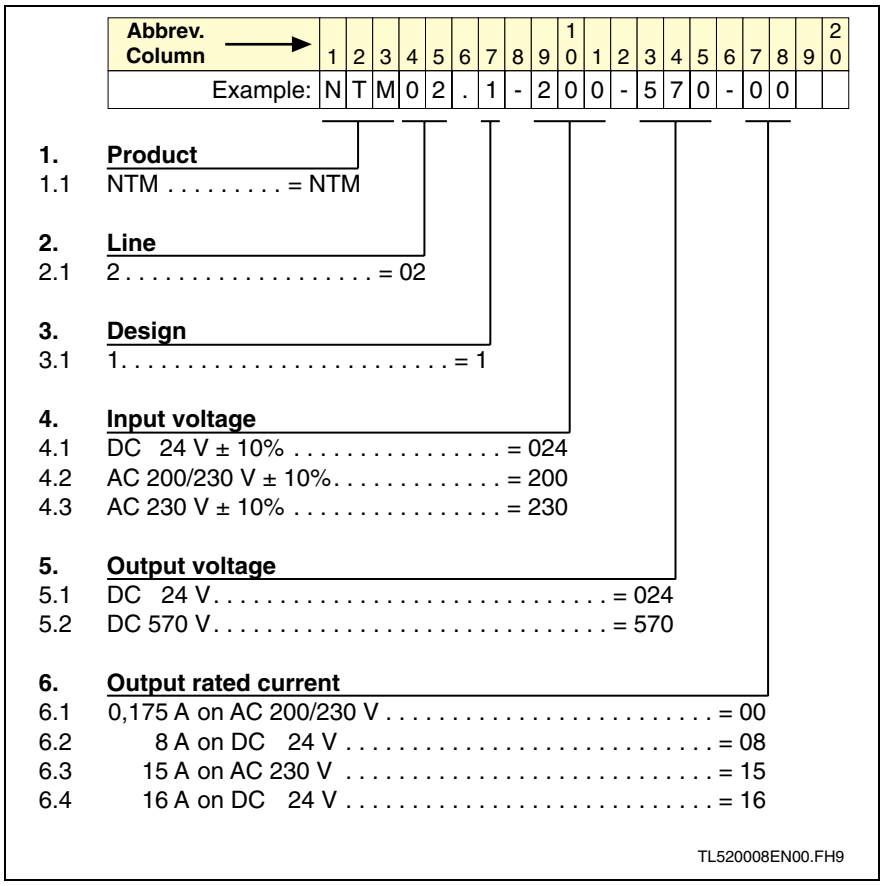


Fig.: 3-23 Type key of NTM02.1 power pack module

Technical Data

		NTM02.1-200-570-00 power pack module		
Input voltage	[V]	200 V AC ± 10%	230 V AC ± 10%	260 V AC ± 10%
Connection		C	D	E
Neutral conductor connection		B	B	B
Mains frequency	[Hz]	50 / 60		
Mains protection	[A]	4		
Start-up current	[A]	10		
AC power consumption	[A]	0.5		
Max. output current	[A]	0.175		
Output voltage	[V]	570 DC		
Cable length of DC connection	[m]	Twisted-pair cables, max. 2m		
Connectable / recommended cable cross-section	[mm²]	1.5 (AWG 16)		
Ambient conditions				
Environmental class in operation		3K3 acc. to DIN IEC 721-3-3 (ambient temperature 0-40°, air humidity 5-85%)		
Radio interference suppression level / noise immunity		A2 according to EN 50081-2 / EN 50082-2		
Protection type		IP00 according to EN 60529		
Weight	[kg]	3.6		

Fig.: 3-24 Technical Data NTM02.1 power pack module

The Ready display indicates that more than 50V is present at the outlet terminals.

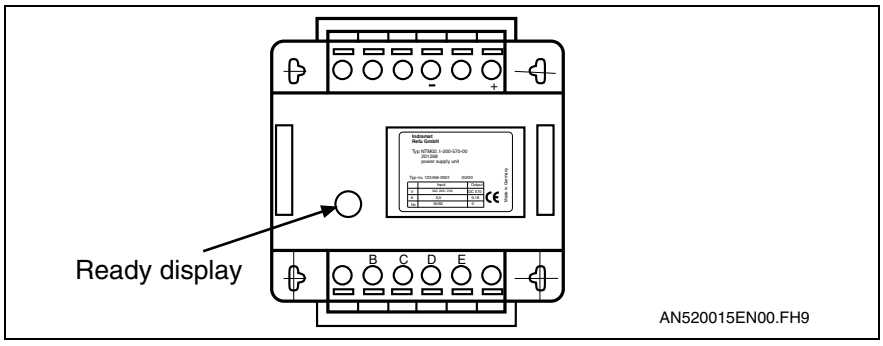


Fig.: 3-25 Ready display NTM02.1 power pack module

Overload protection using locking temperature switch in the primary circuit.

CAUTION

Death by electrocution possible due to live parts with more than 50V!

⇒ The power supply contains capacitors whose terminals can have a dangerous voltage up to 5 minutes after the device is switched off!

Type Label

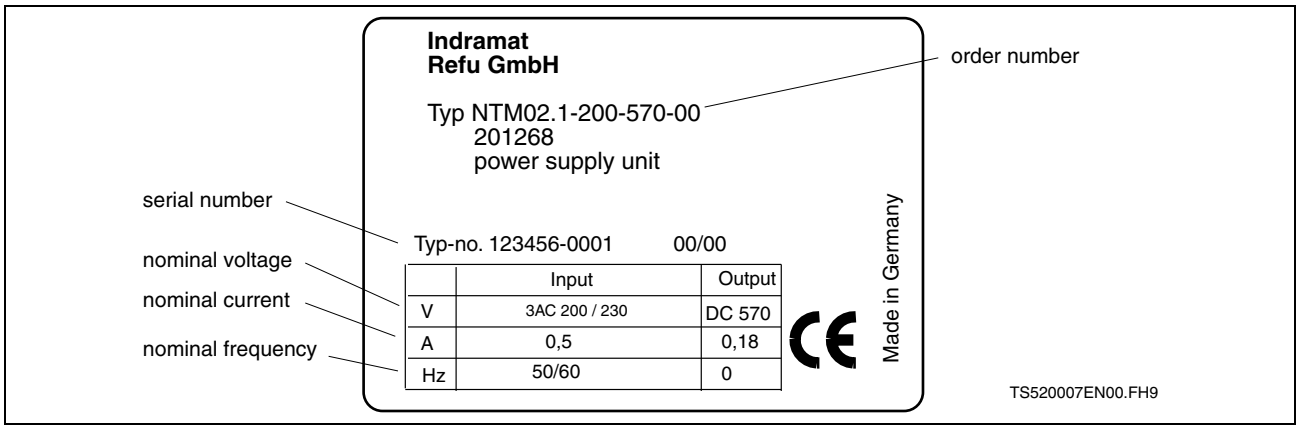


Fig.: 3-26 Type label NTM02.1 power pack module

Mechanical Assembly NTM02.1 power pack module

Dimension Drawing

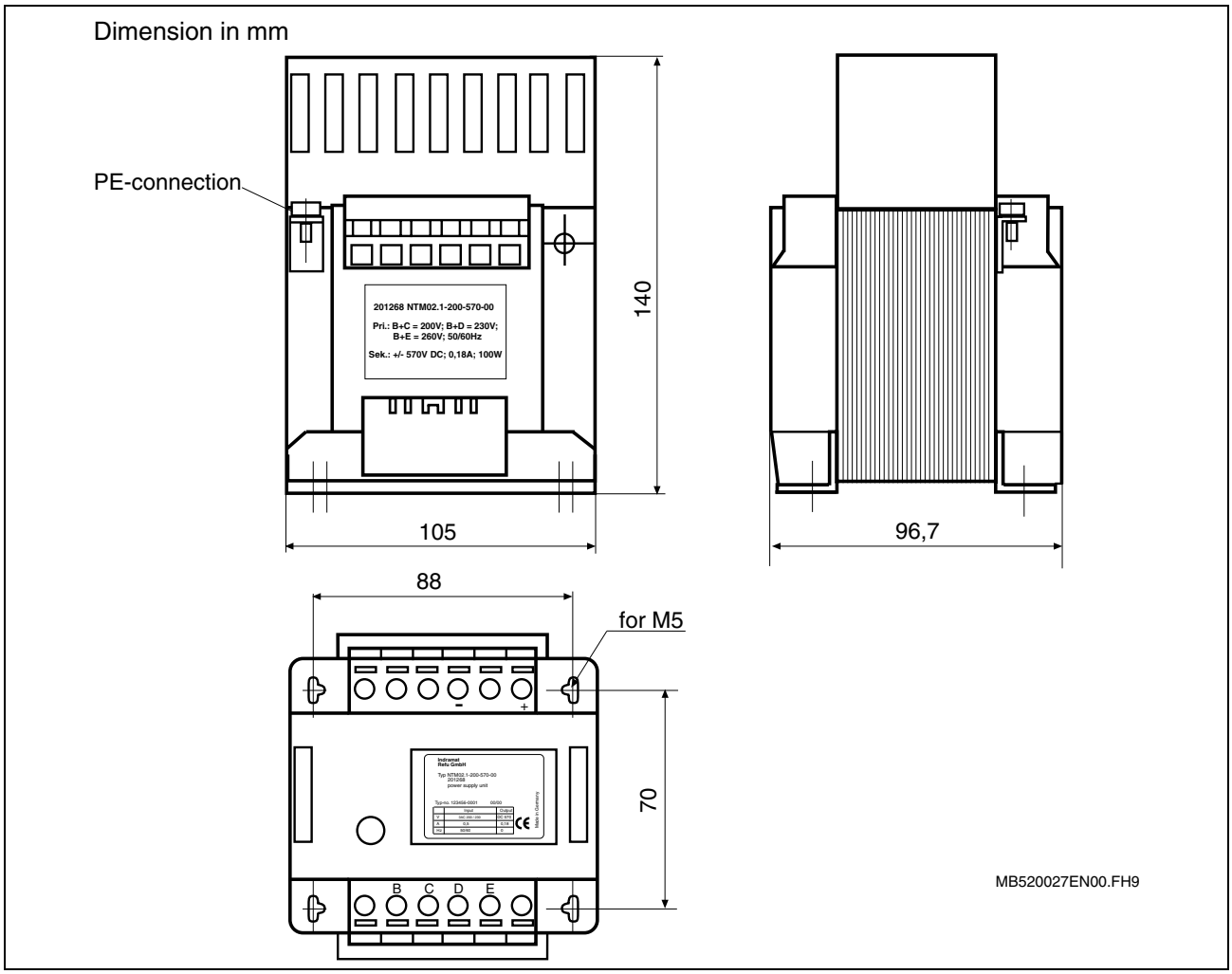


Fig.: 3-27 Dimension Drawing NTM02.1 power pack module

Circuit Principle of Power Section, Size Classes C - E

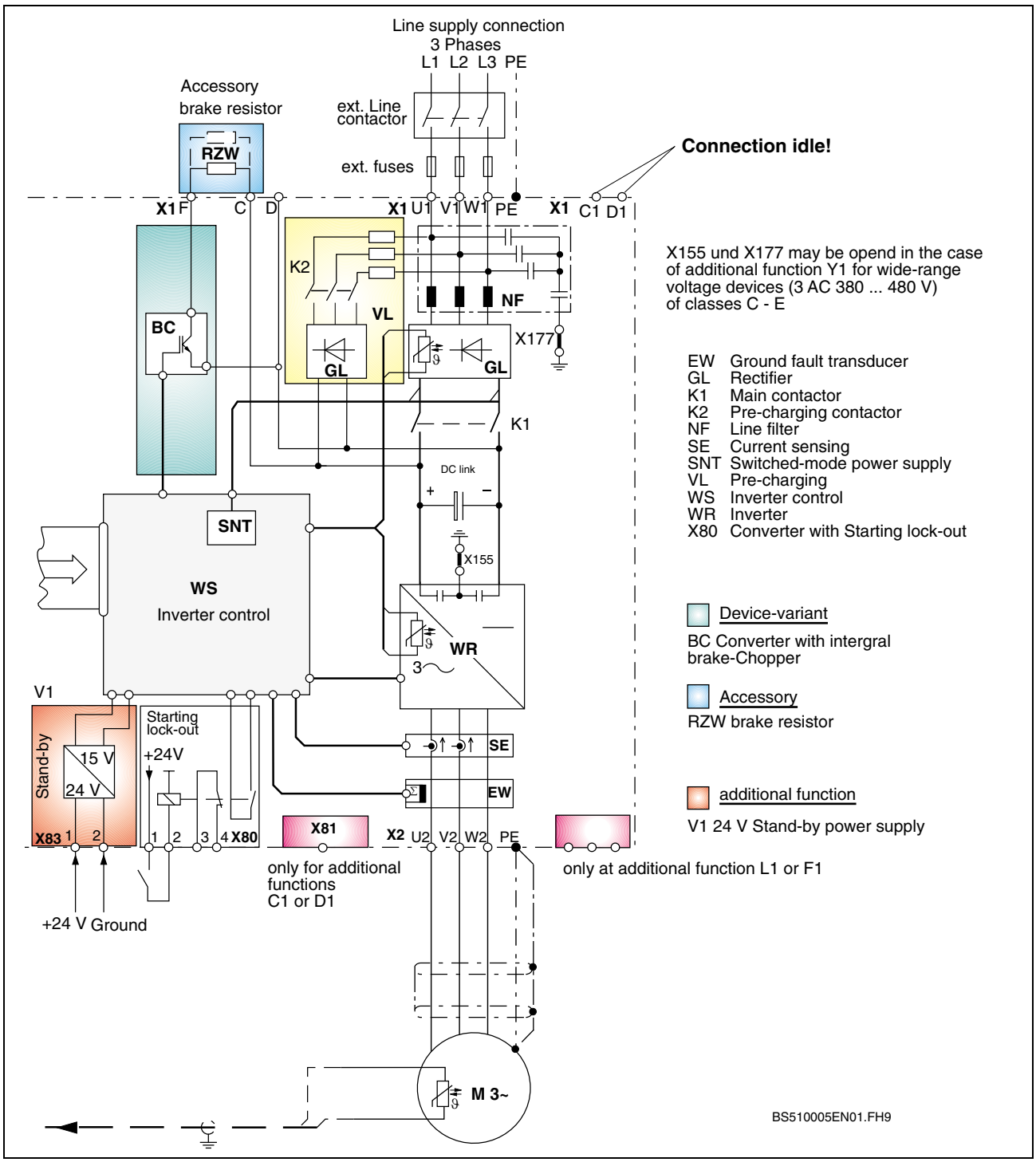


Fig.: 3-28 Circuit principle of power section, converter classes C - E

Note: X155 and X177 may be opened only in the case of additional function Y1 for wide-range voltage devices (3AC380 ... 480V) of classes C - E.

Note: The connections C1 and D1 are never assign!

Circuit Principle of Power Section, Size Classes G - H

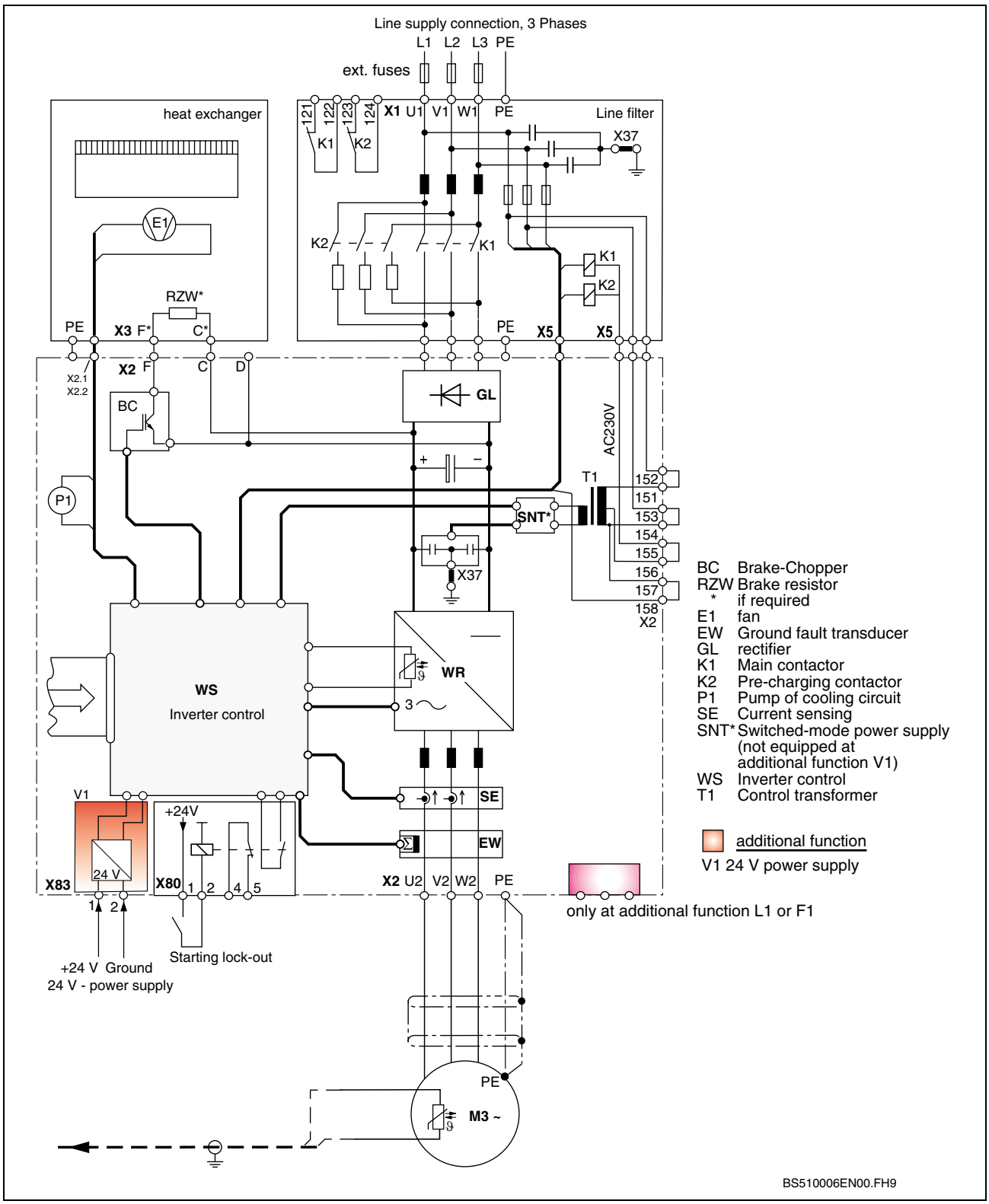


Fig.: 3-29 Circuit principle of power section, converter size classes G - H

Note: When additional function V1 is used, module SNT is not equipped. See Chapter 11.1.

3.11 Mechanical Assembly

Storage and Setup

Storage

The devices must be stored in a clean, dry space. The storage temperature must be between -25° C and +70° C. Temperature variations greater than 20 K per hour are not permitted.

Note:

The converter and supply modules have AL electrolytic capacitors as DC Link capacitors. They can be stored for a maximum of 2 years, not under power, at a storage temperature of ≤ 40°

Minimum Requirements at the Installation Location

- The operating area should be dust-free. Dust-laden air must be filtered (3K3 acc. to DIN IEC 721-3-3).
- The ambient temperature must lie between 0 and 40° C.
- The relative humidity may not exceed 90%; condensation is not permissible.
- The supplied air must not contain any aggressive or electrically conducting gases that may endanger functioning of the device.
- The airflow of the fans may not be impeded. The minimum free spaces specified for the supply air and exhaust air for each size class must not be restricted by additional add-ons.
- The device causes power loss and heats the surroundings. Therefore, a sufficient spacing from heat-sensitive devices must be ensured.

Setup Elevations Exceeding 1000 Meters above Sea Level:

The utilization of the drive converter must be reduced (derated) according to the diagram below for installation altitudes above 1000 meters above sea level.

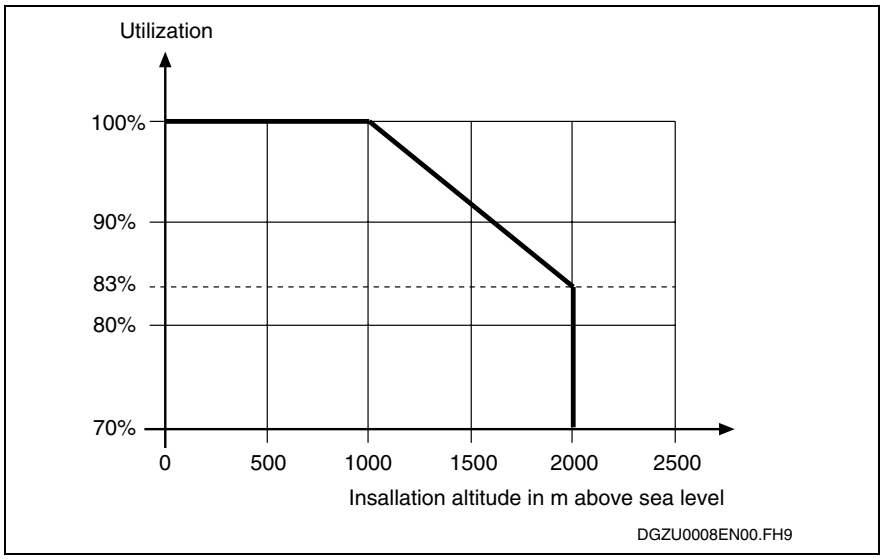


Fig.: 3-30 Derating depending on setup elevation

3.12 Assembly of Converter Size Classes A to E

- The RD 500 units, sizes A to E are modular and are designed for mounting in cabinets.
- The units have a 22.5 mm mechanical grid pattern. Several drive units can be mounted next to one another without any intermediate space (with the exception of converter size classes A - B with cooling type P) when using mounting rails with tapped holes (also refer to the assembly example).
- Assembly must be carried out perpendicular to a level construction area.
- A minimum clearance of 100 mm above and below the unit must be maintained to ensure that the cooling air can flow unrestricted.
- When the drive units are mounted in a cabinet, the cooling air requirement of the units must be calculated (refer to Technical data 3.1 to 3.7) and the cabinet ventilation appropriately dimensioned.
- The fastening screws are shown in the drilling templates of the dimension drawings.

Dimension Drawing, Size Classes A - B

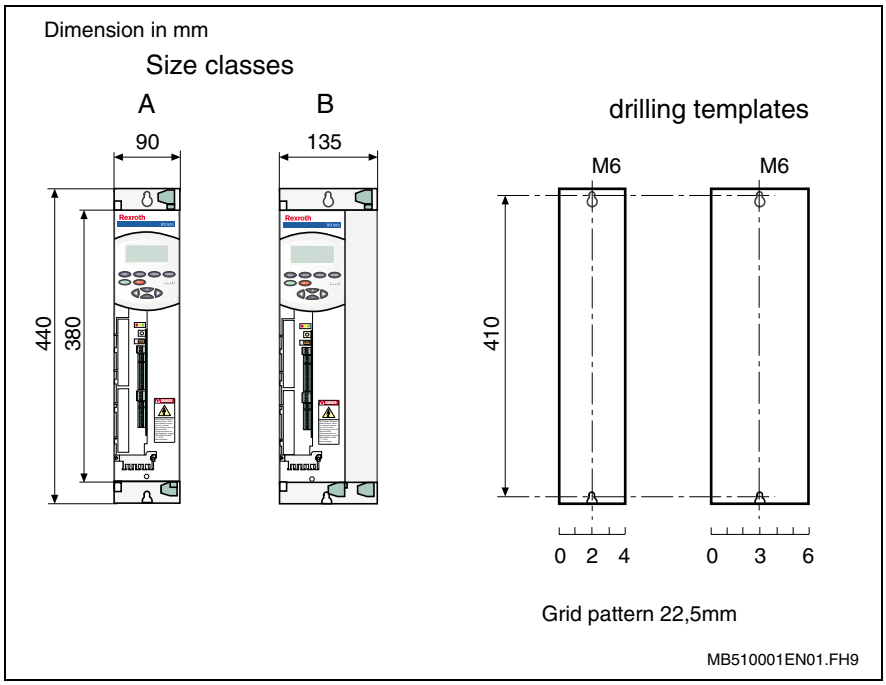


Fig.: 3-31 Dimension sheet, size classes A - B

Dimension Drawings for Cooling Types L and P for Size Classes A - B

Drive converters with forced air-cooling, sizes A and B to E have different depths. Clearance brackets are available for size A drive converters. These allow the depth to be compensated when mounted with other drive converters having different sizes. Refer to Fig.: 3-32.

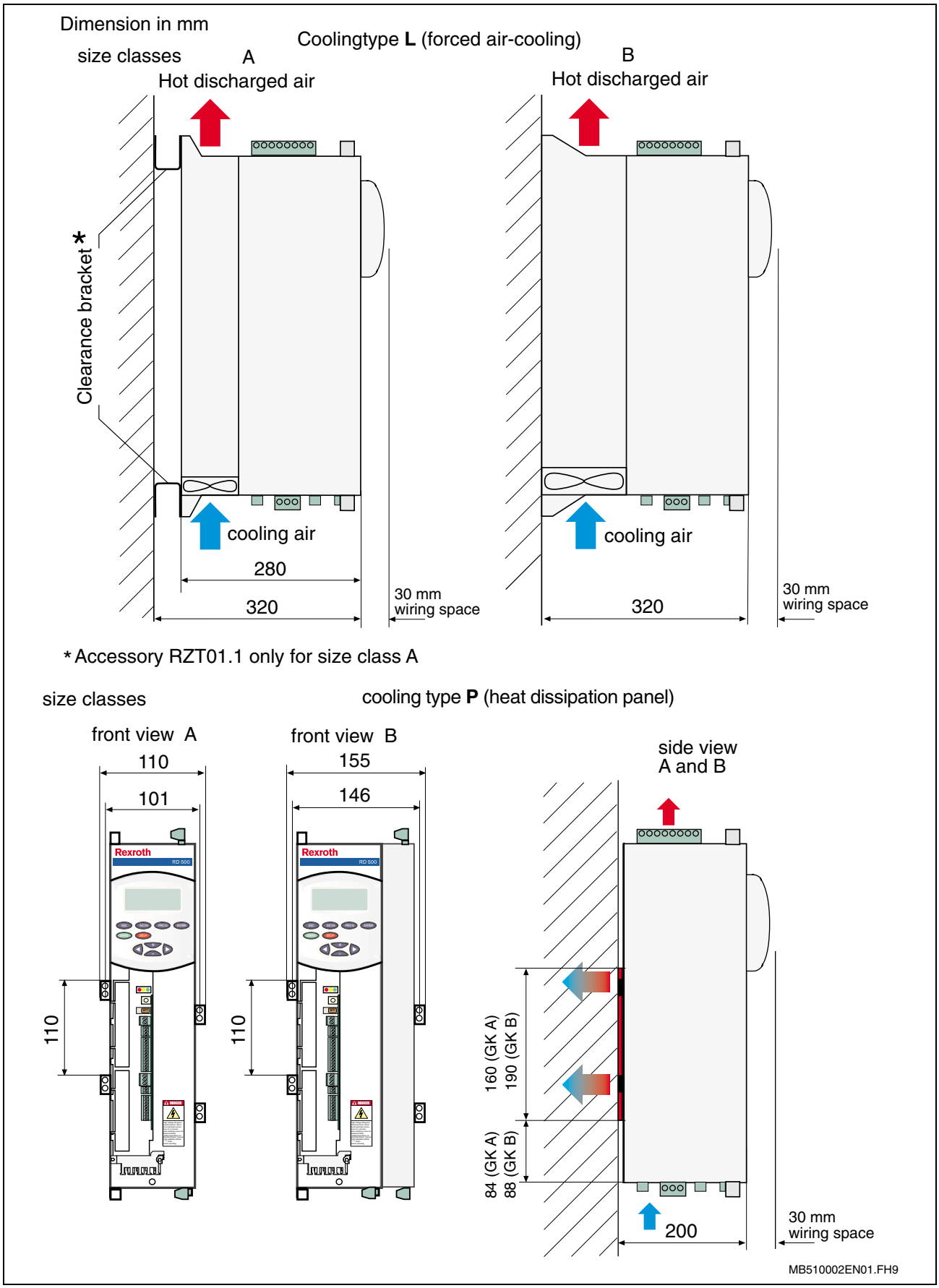


Fig.: 3-32 Cooling types, size classes A - B

Assembly Example of Several Converters next to Each Other for Cooling Type P

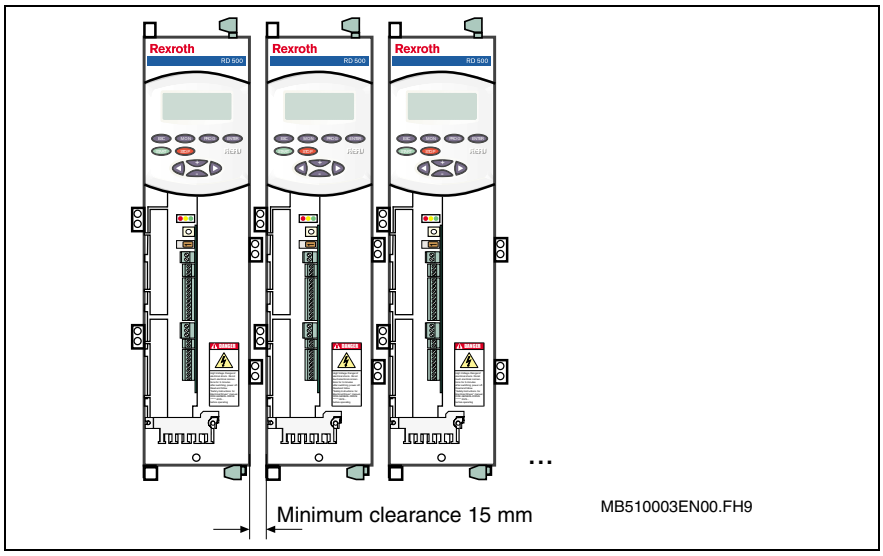


Fig.: 3-33 Arrangement of several converters next to each other for cooling type P

Minimum Spacing for Cooling for Cooling Type L and P

An assembled converter with forced air-cooling and heat dissipation panel, size classes A and B, is shown in the drawing below.

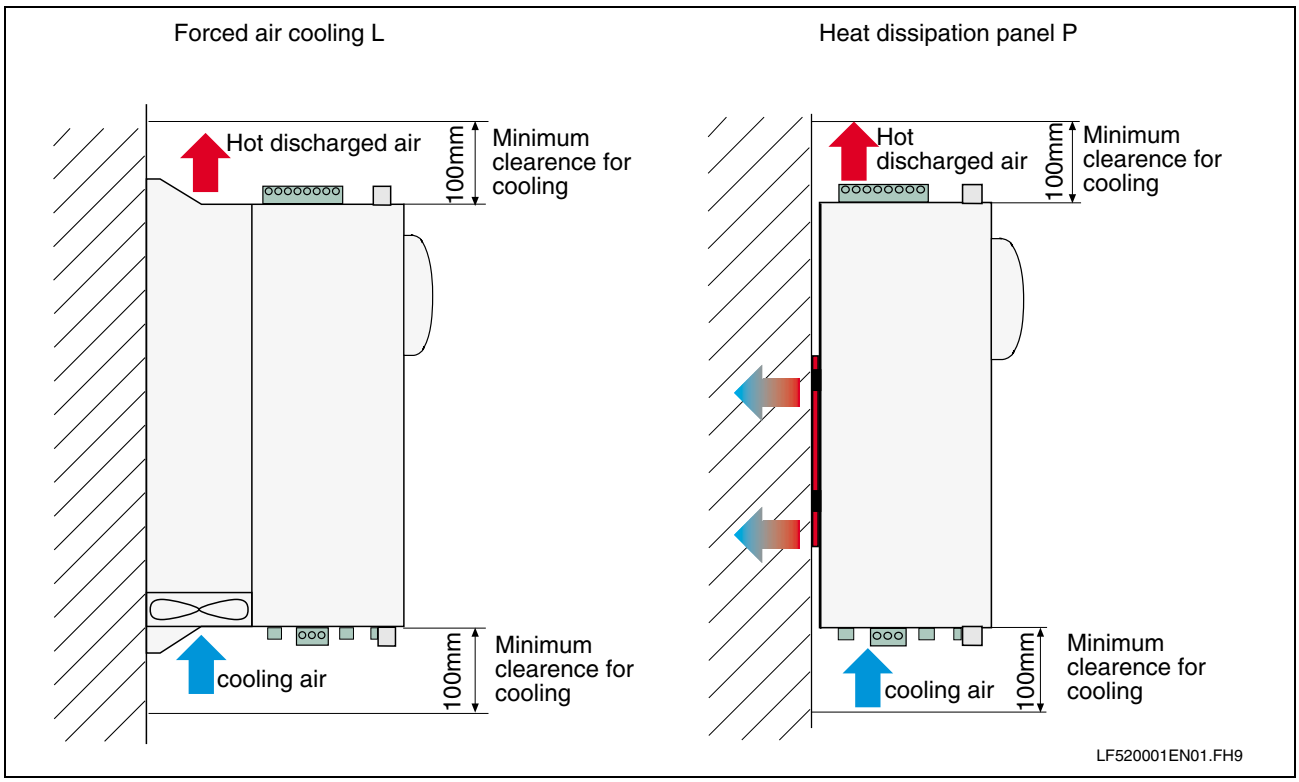


Fig.: 3-34 Minimum spacing for assembly

Dimension Drawing, Size Classes C, D, E

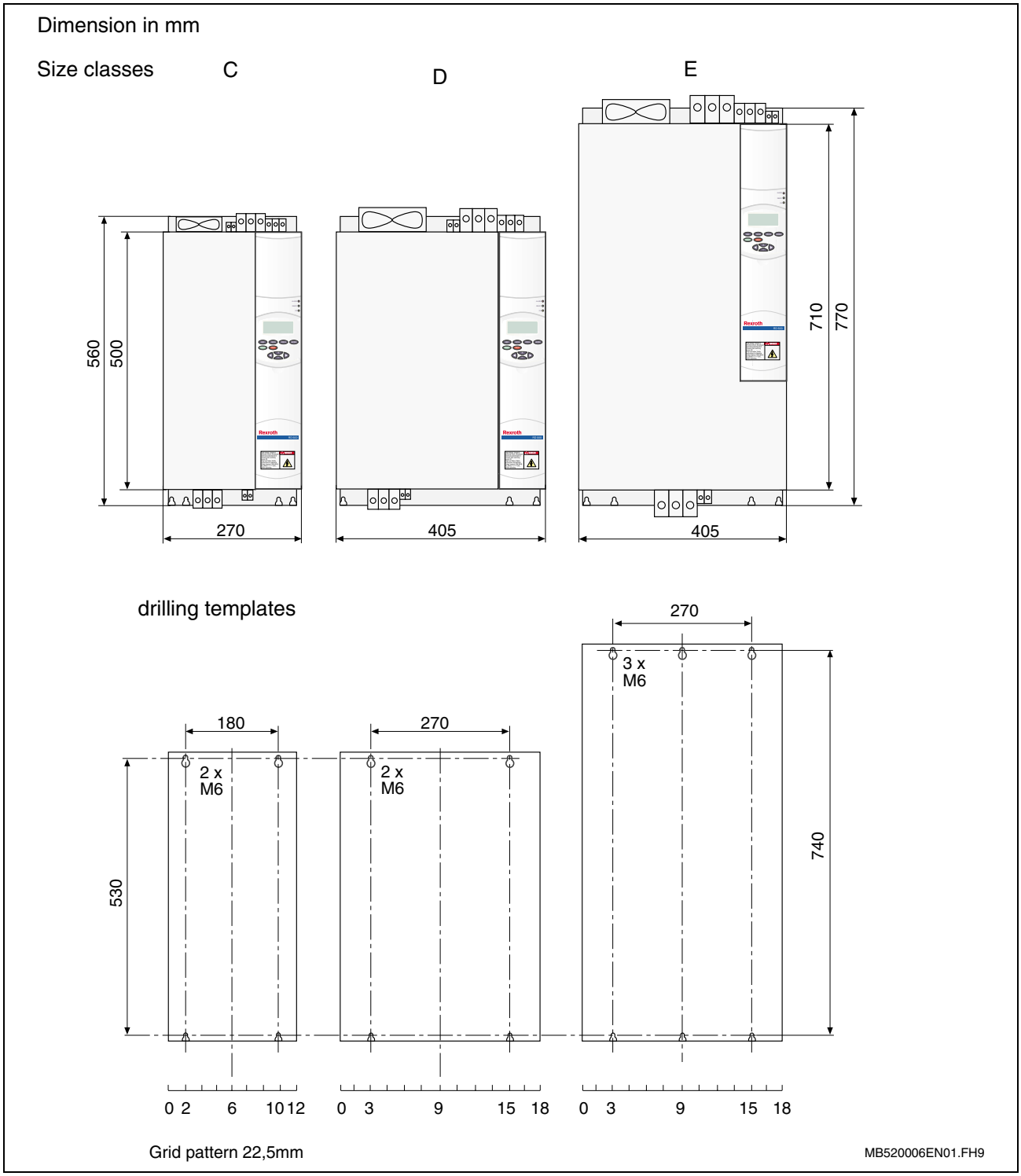


Fig.: 3-35 Dimension sheet, size classes C, D, E

Dimension Drawing of Cooling Type L for Size Classes C, D, E

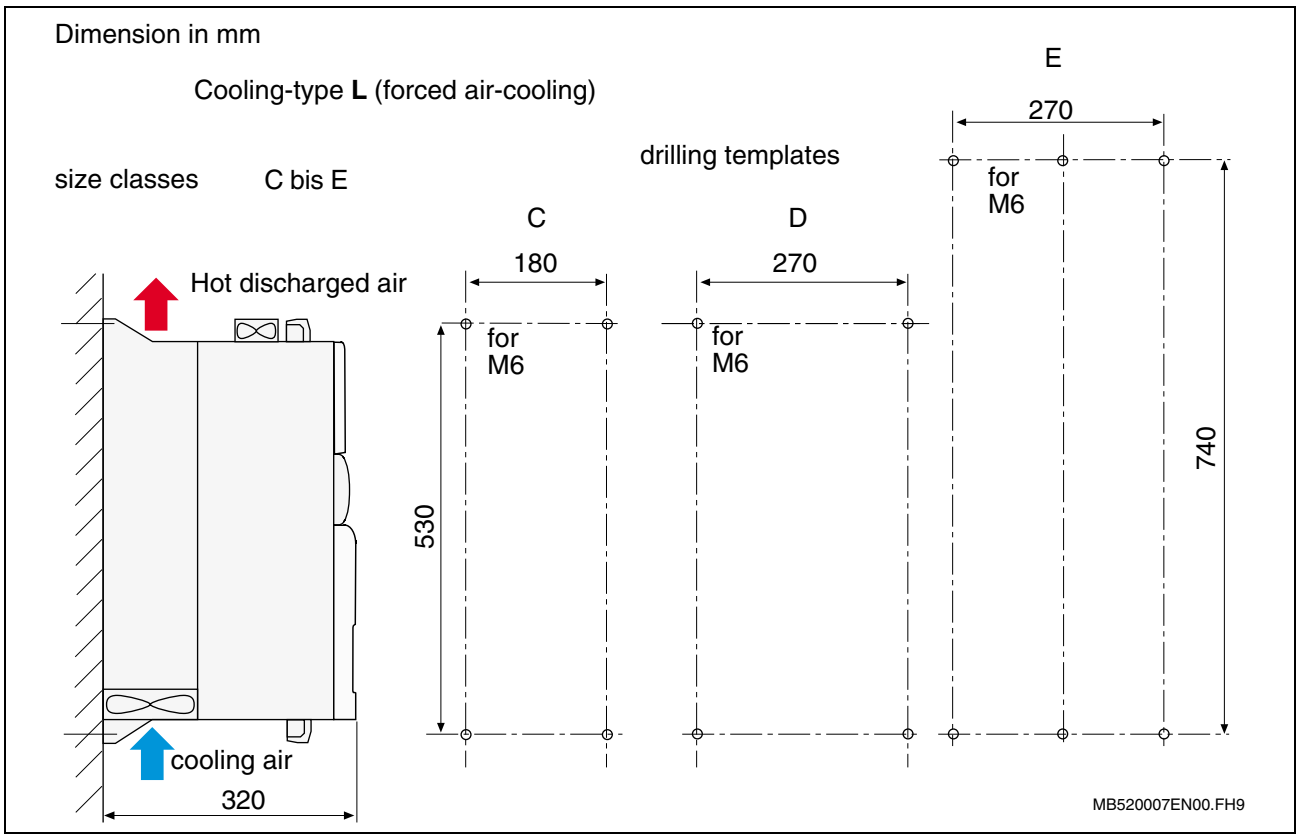


Fig.: 3-36 Dimension sheet for cooling type L, size classes C, D, E

Minimum Cooling Spacing for Cooling Type L

An assembled converter with forced-air cooling, size classes C, D and E, is shown in the drawing below.

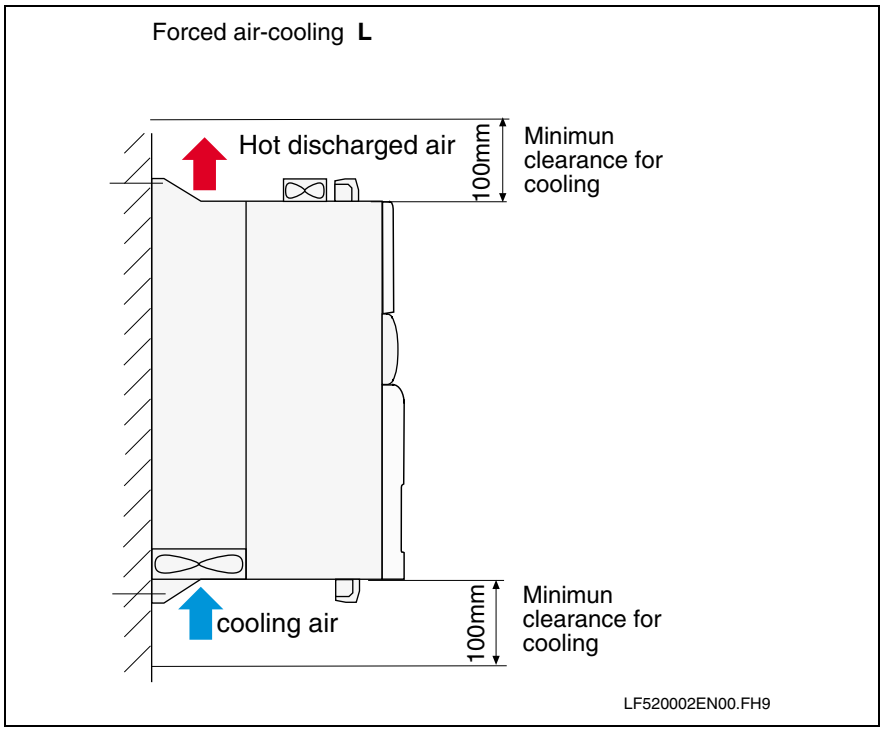


Fig.: 3-37 Minimum spacing for assembly

Dimension Drawing of Cooling Type D for Size Classes C, D, E

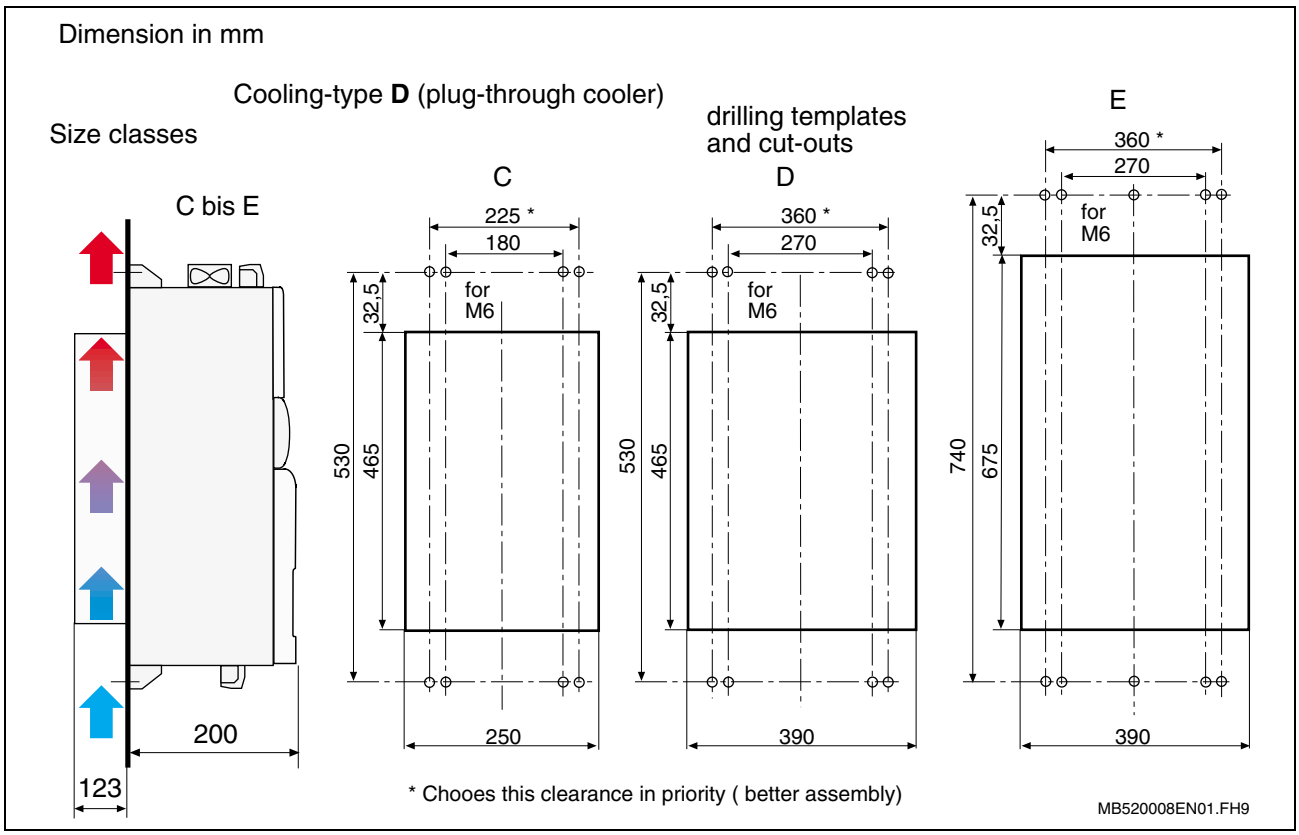


Fig.: 3-38 Dimension sheet for cooling type D, size classes C, D, E

Several Converters next to Each Other with Plug-through cooler

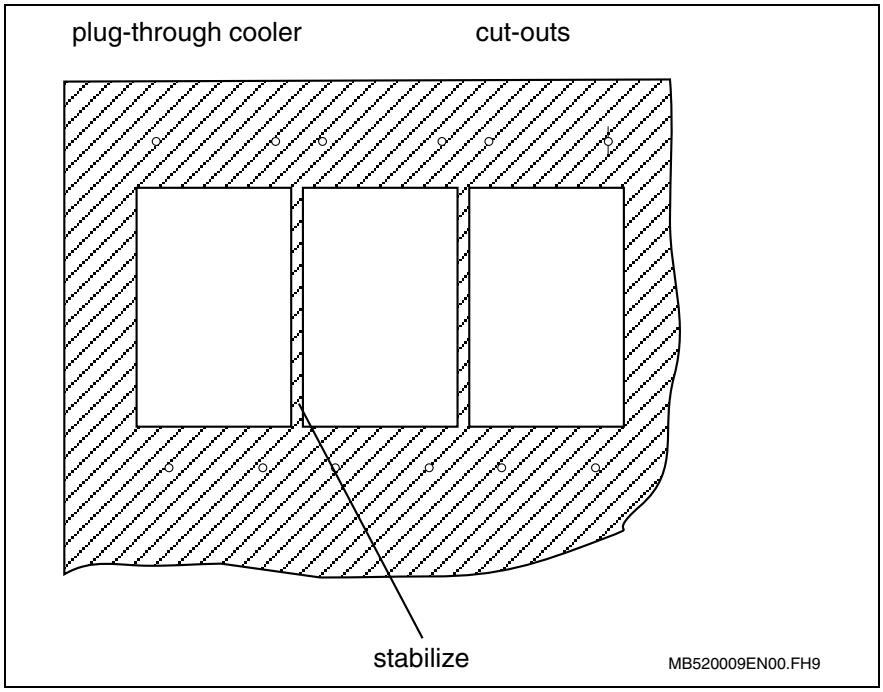


Fig.: 3-39 Cut-outs for devices with plug-through cooler

Note: In order to obtain a hermetic overlay, the remaining segment must be stabilized.

Dimension Drawing of Cooling Type W for Size Classes C, D, E

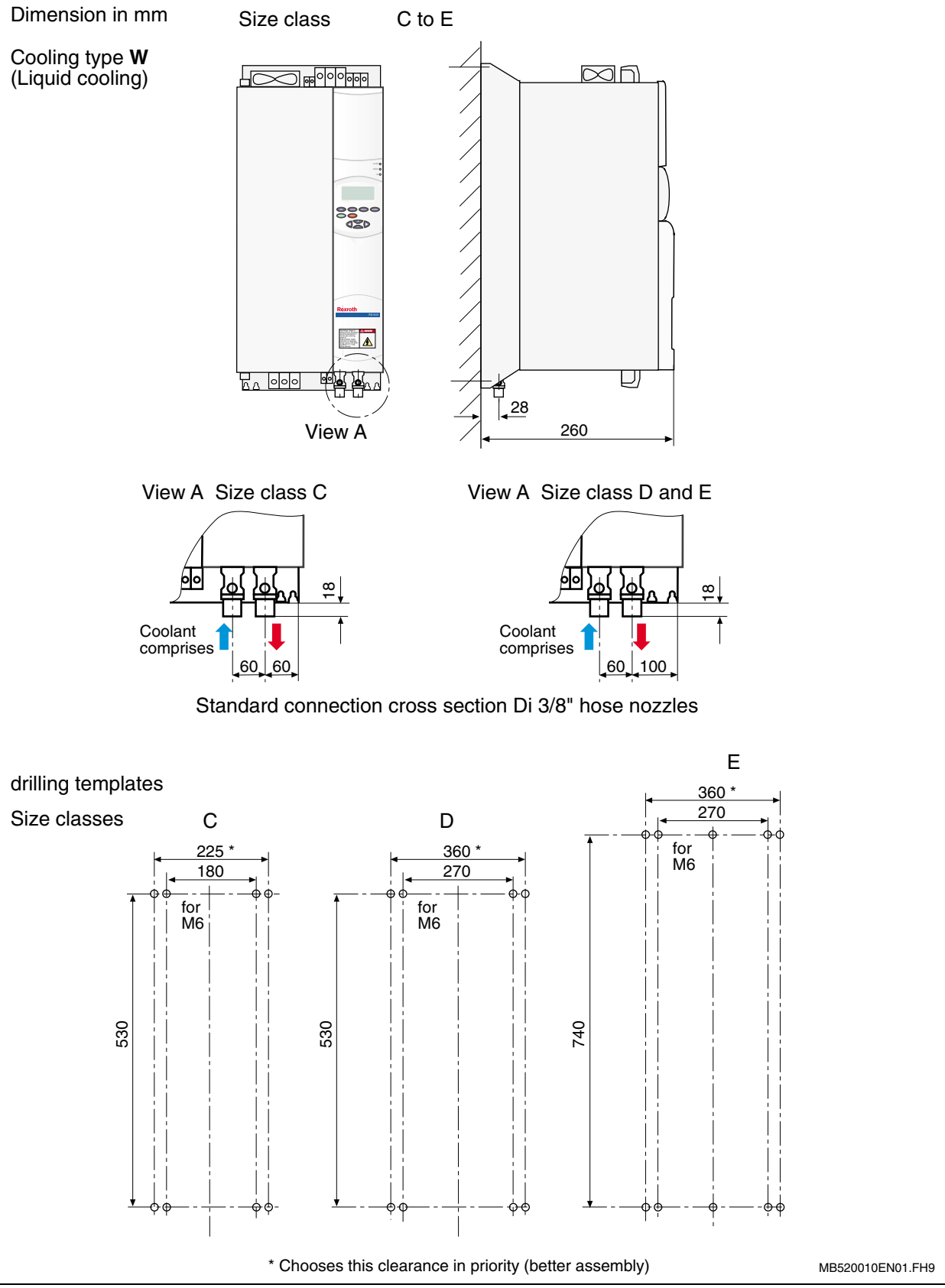


Fig.: 3-40 Dimension sheet for cooling type W, size classes C, D, E

3.13 Working with the Coolant Circulation, Size Classes C, D and E

CAUTION

Antifreeze is hazardous to health!

⇒ If antifreeze is swallowed, immediately consult a doctor and keep the packaging or label for reference.

CAUTION

Mixture with other antifreezes!

⇒ Do not mix the coolant with other antifreezes.

⇒ Only use the specified antifreeze if coolant must be added to installed drive units.

WARNING

Burns due to hot components with temperatures above 30°C!

⇒ Wear protective gloves

⇒ Replace devices only when the liquid circulation system has cooled

WARNING

Damage to materials due to condensation!

⇒ In temperate climate zones (up to 40 °C and 70% humidity), the inlet temperature of the coolant must lie max. 5 K below the interior switch cabinet temperature!

Note: The most certain protection against condensation is:

inlet temperature of coolant = ambient temperature

Coolant that generally has a temperature that differs from that of the ambient air flows through fluid-cooled drive components.

If warm air comes into contact with a less warm object, condensation forms on the surface of the object if the temperature of the object is below the dew-point temperature. Dew forms on the object.

WARNING

Damage to materials due to corrosion!

⇒ Ensure that there is sufficient corrosion control and antifreeze

WARNING

Damage to materials due to malfunction in coolant circulation system!

⇒ Ensure fault-free operation of the coolant circulation system

Note: Prevent deposits in the cooling tubes.

Note: Pay attention to the change in volume of the coolant due to the temperature differences.

Recommendation

Divide the coolant circulation by using a suitable heat exchanger (e.g. plate heat exchanger).

WARNING

Damage to materials due pump function failure

⇒ When simultaneous occurring the following conditions!

- Operation at overload
- Short circuit on output
- Failure of the cooling pump

⇒ The device can age prematurely

Failure of the cooling pump without overload or short circuit at the output

Note: To guarantee the cooling function, a pump monitor is required

DANGER

Destruction of device due to short-circuit!

⇒ Collect drip water during assembly

Assembly of Fluid-Cooled Converter, Size Classes C, D, E

The fluid-cooled devices of size classes C, D and E consist of the device and a copper plate with a brazed-on copper pipe. This is connected to the quick-release couplings by a kink-proof hose. The connecting couplings are integrated in the device. Take the following into account during assembly:

- Assembly must be carried out perpendicular to a level construction area.
- The fastening screws are shown in the drilling templates of the dimension drawings.
- The devices are supplied with quick-release couplings (with lock) Di = 3/8“. However, it is possible to modify the connection cross-section to 1/2“ or 3/4“.

Note: Your distributor can provide you with further information regarding coolant hoses, hose nozzles, couplings, angular connections, etc.

Technical Data of Coolant Circulation System, Size Classes C, D and E

Maintain the following to avoid exceeding the highest permitted temperature in the devices.

- The nominal diameter of the cooling system is D = 10 mm
- The maximum system pressure is < 3 bar
- The fluid intake temperature and the dynamic pressure depend on the volume flow. They can be determined using the diagrams.
- Volume

Size class	Volume, cm³
C	120
D	150
E	190

Fig.: 3-41 Volume

The coolant comprises tap water and antifreeze, type Antifrogen N (Clariant). It is mixed in the ratio 1 : 1 (Indramat Refu, Order No.: 0015343). This guarantees frost protection down to -30 °C.

Dynamic Pressure and Coolant Temperature / Volume Flow, Class C

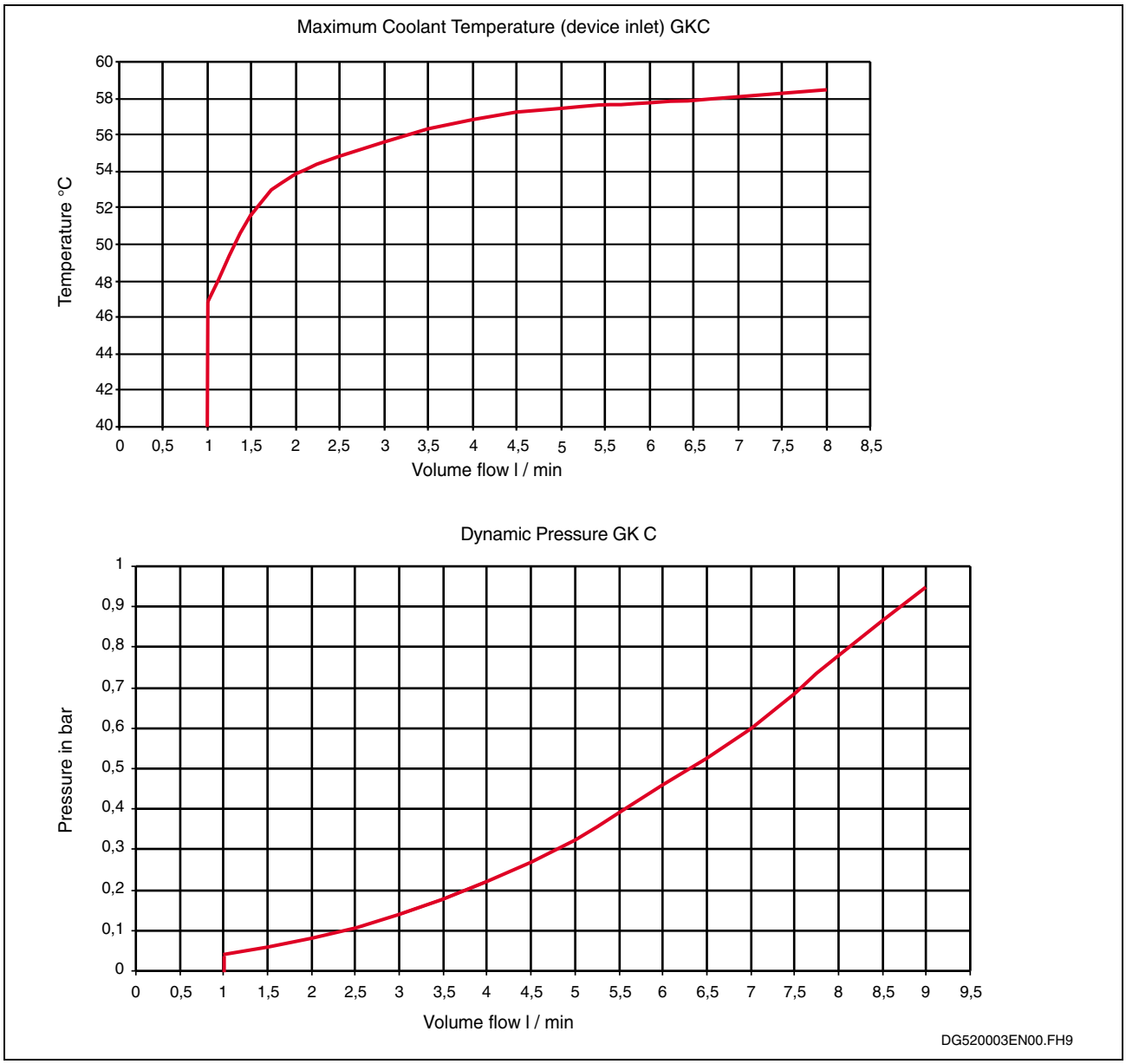


Fig.: 3-42 Dynamic pressure and coolant temperature / volume flow, class C

Dynamic Pressure and Coolant Temperature / Volume Flow, Class D

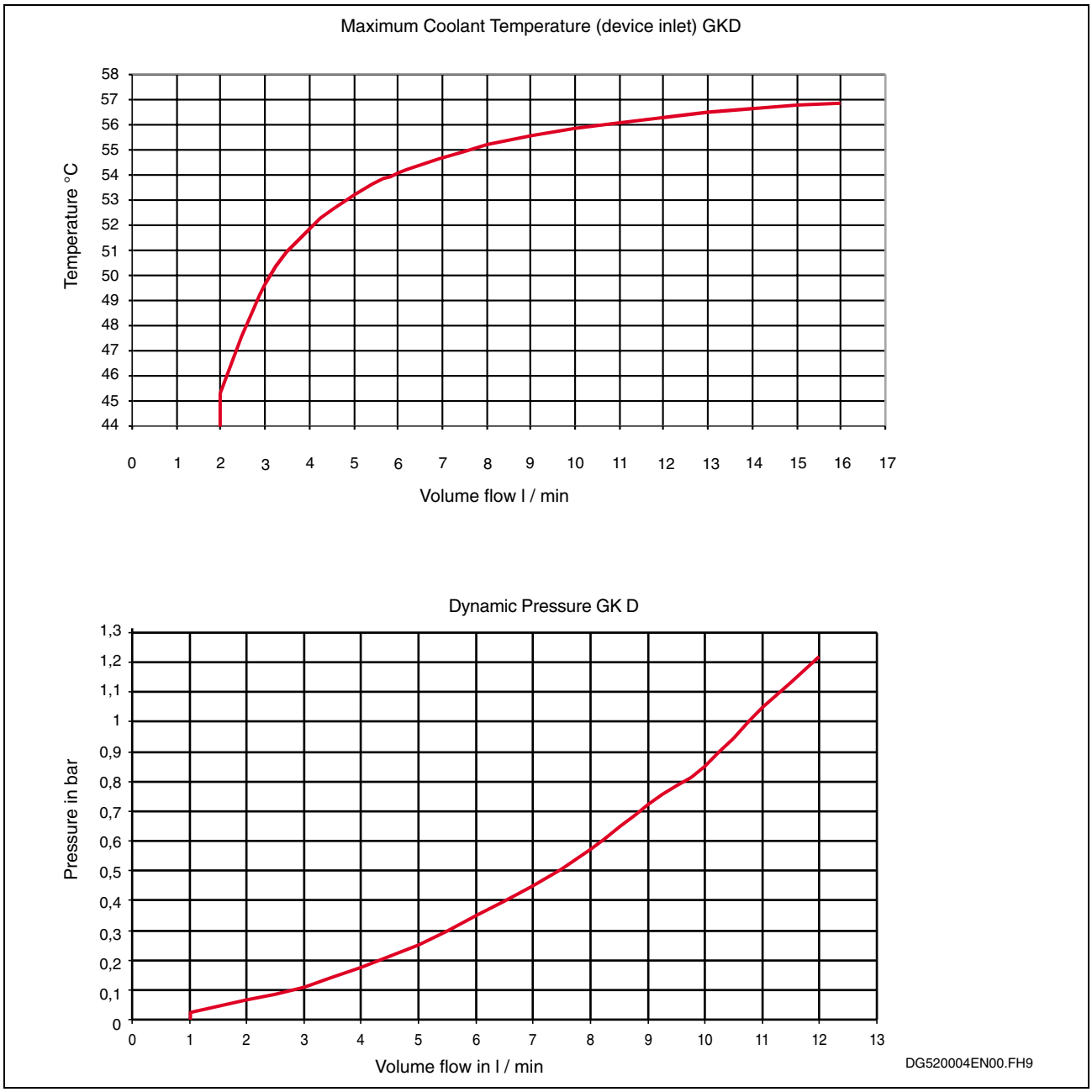


Fig.: 3-43 Dynamic pressure and coolant temperature / volume flow, class D

Dynamic pressure and coolant temperature / volume flow, Class E

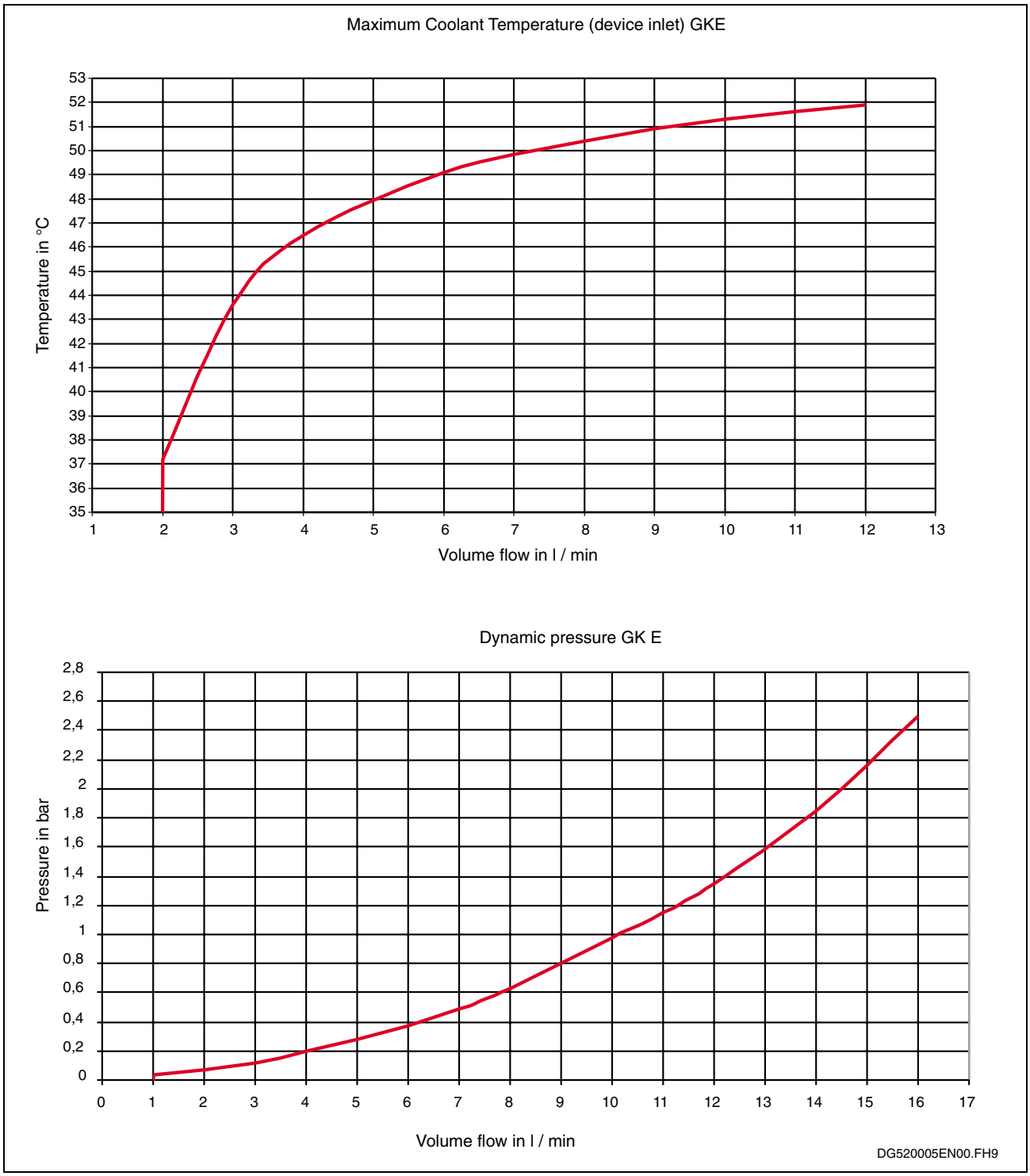


Fig.: 3-44 Dynamic pressure and coolant temperature / volume flow, class E

3.14 Assembly of Converter, Size Classes G and H, with Forced Air Cooling and Integrated Liquid Circulation System (Cooling Type F)

Converters of size classes G and H comprise the following elements: line filter, converter and heat exchanger. The converter and heat exchanger are mounted on a common mounting plate and are fully connected. The line filter has its own mounting plate as a result of its weight.

- Assembly must be carried out perpendicular to a level construction area.
- To ensure that the warm exhaust air can flow without impedance, a space with a height of at least 200 mm must be maintained above the devices.
- When the drive units are mounted in a cabinet, the cooling air requirement of the units must be calculated (refer to Technical data 3.8, 3.9) and the cabinet ventilation appropriately dimensioned.
- The fastening screws are shown in the drilling templates of the dimension drawings.
- Two hoisting support points are provided to mount the units using a crane. These are let in at the top of the mounting plate on both sides and secured using a screw.
- First mount the line filter, then the converter and heat exchanger above the mounting plate. The two mounting plates must be assembled, as shown in the dimension drawing, without any clearance between so that the cooling airflow is not impeded. The busbars to connect the line filter and converter are supplied with the equipment.

Dimension Drawing, Size Classes G and H, with Cooling Type F

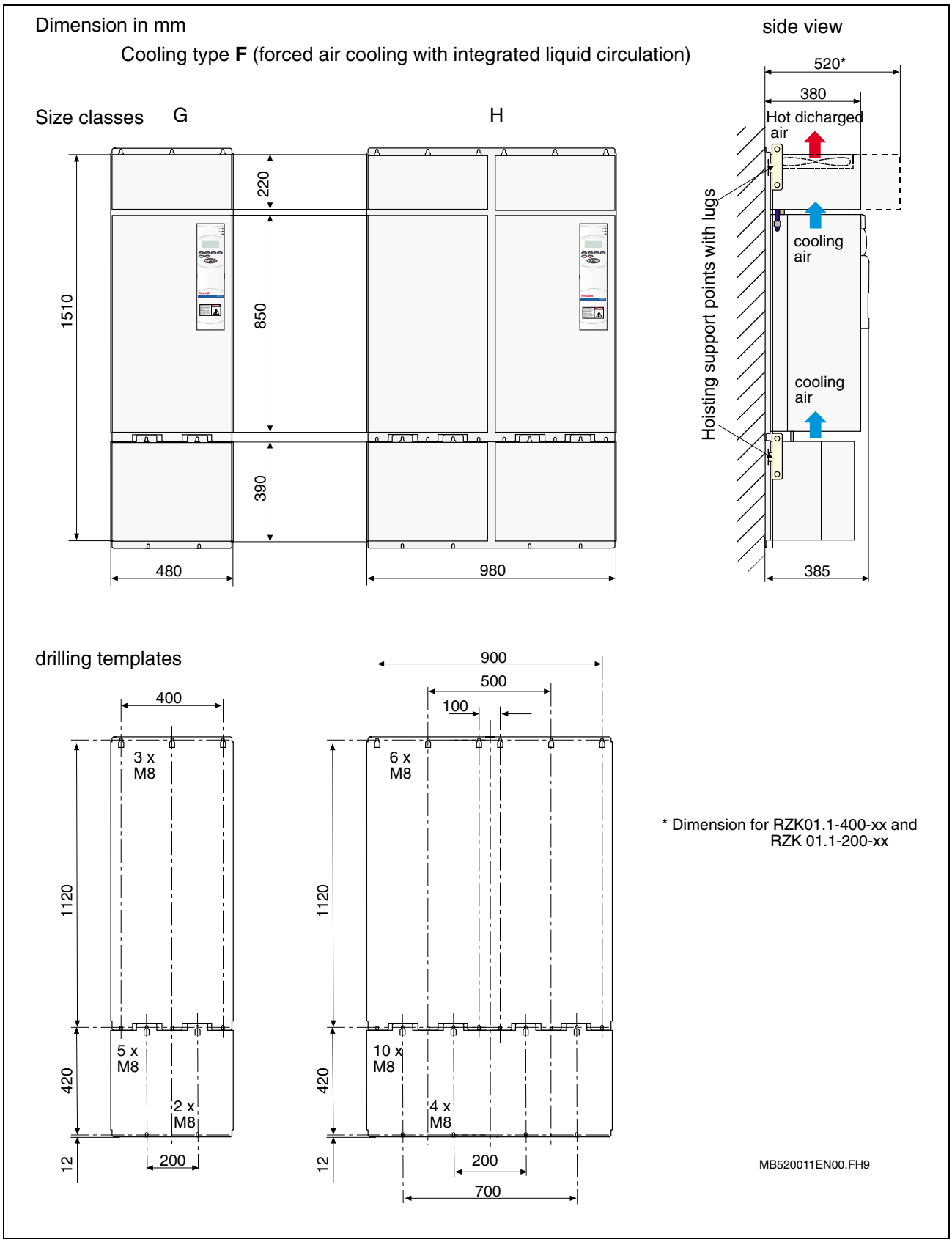


Fig.: 3-45 Dimension sheet of converter, size classes G and H, with cooling type F

3.15 Assembling Liquid-Cooled Converters, Size Classes G and H, with External Heat Exchanger

General Notes Regarding Assembly

Converters of size classes G and H comprise the following elements: line filter, converter and heat exchanger. The converter, line filter and heat exchanger are each mounted on a separate mounting plate. In externally assembled heat exchangers, the converter is not cooled by the air flow of the heat exchanger. This means that additional fans are provided on the converter.

- Assembly must be carried out perpendicular to a level construction area.
- To ensure that the warm exhaust air can flow without impedance, a space with a height of at least 200 mm must be maintained above the devices.
- When the devices are mounted in a cabinet, the cooling air requirement of the units must be calculated (refer to Technical data, section 3.8, 3.9) and the cabinet ventilation appropriately dimensioned.
- The fastening screws are shown in the drilling templates of the dimension drawings.
- Two hoisting support points are provided to mount the units using a crane. These are let in at the top of the mounting plate on both sides and secured using a screw (refer to the dimension drawings).
- First mount the line filter, then the converter above the mounting plate. The two mounting plates must be assembled, as shown in the dimension drawing, without any clearance between so that the cooling airflow is not impeded. The busbars to connect the line filter and converter are supplied with the equipment.
- Attach the external heat exchanger to the desired location. This can be mounted on the roof or wall of the cabinet. See Fig.: 3-49 , Fig.: 3-50 . Additional technical data are described in documentation DOK-RD500*-RD500*SUPPL-FKxx-EN-P (Accessories).
- Connect the cooling circuit of the converter to the heat exchanger using the heat exchanger hoses; for additional information, refer to 3.16 . Depending on the requirements, the heat exchanger hoses must be ordered together with the converter.

Note: Your distributor can provide you with further information regarding coolant hoses, hose nozzles, couplings, angular connections, etc.

Supplementary Fan Transformer

- For 200 kW and 400 kW devices, the size of the internal power supply is not adequate for these supplementary fans. An external fan transformer is included to supply power to the fans.
- The fan transformer to connect the converter fans must be mounted at a suitable location in the cabinet.

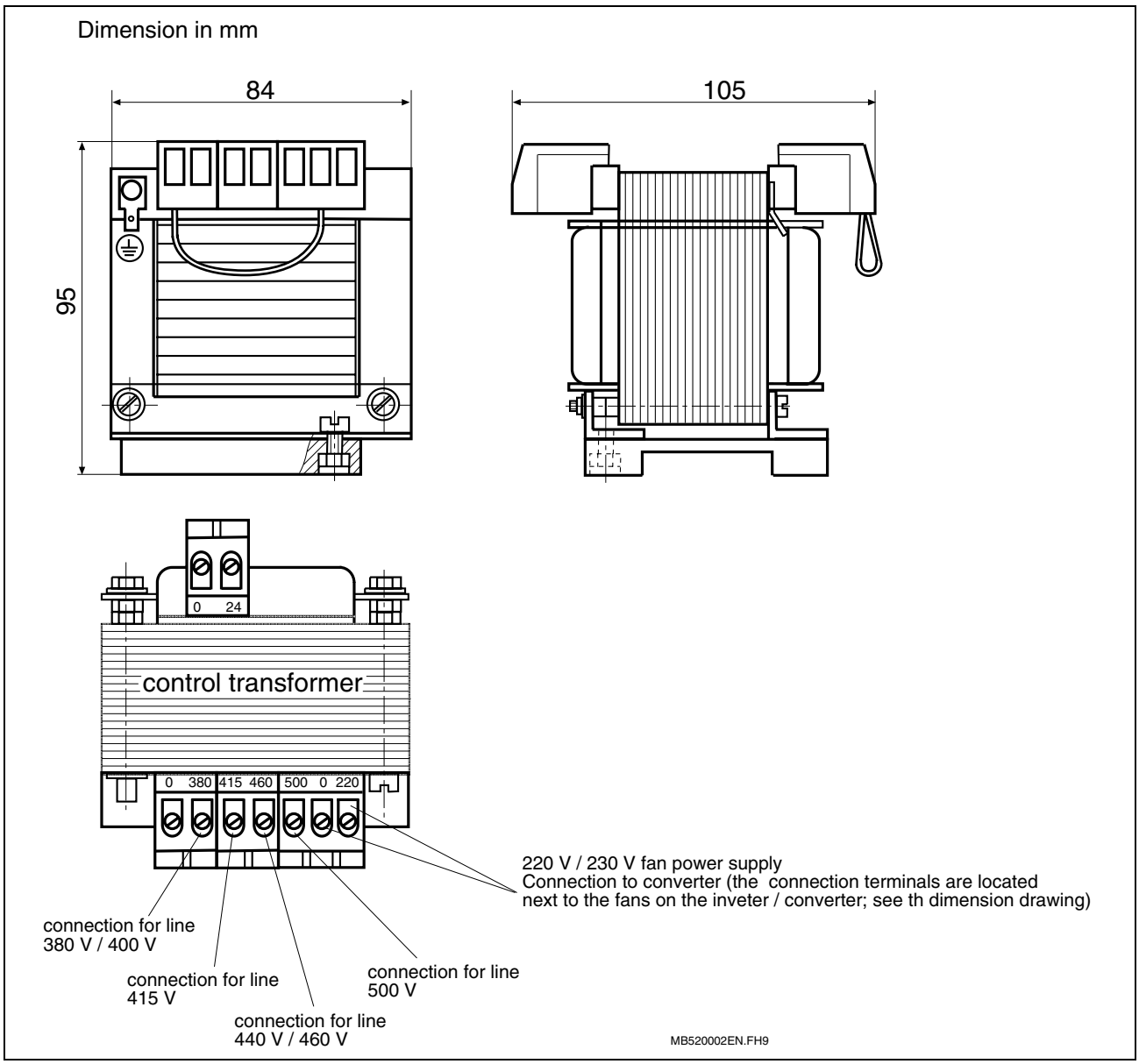


Fig.: 3-46 Separate fan transformer for 200 kW and 400 kW devices

Note: 220V / 230V fan power supply

Connection to converter (the connection terminals are located next to the fans on the inverter / converter; see the dimension drawing)

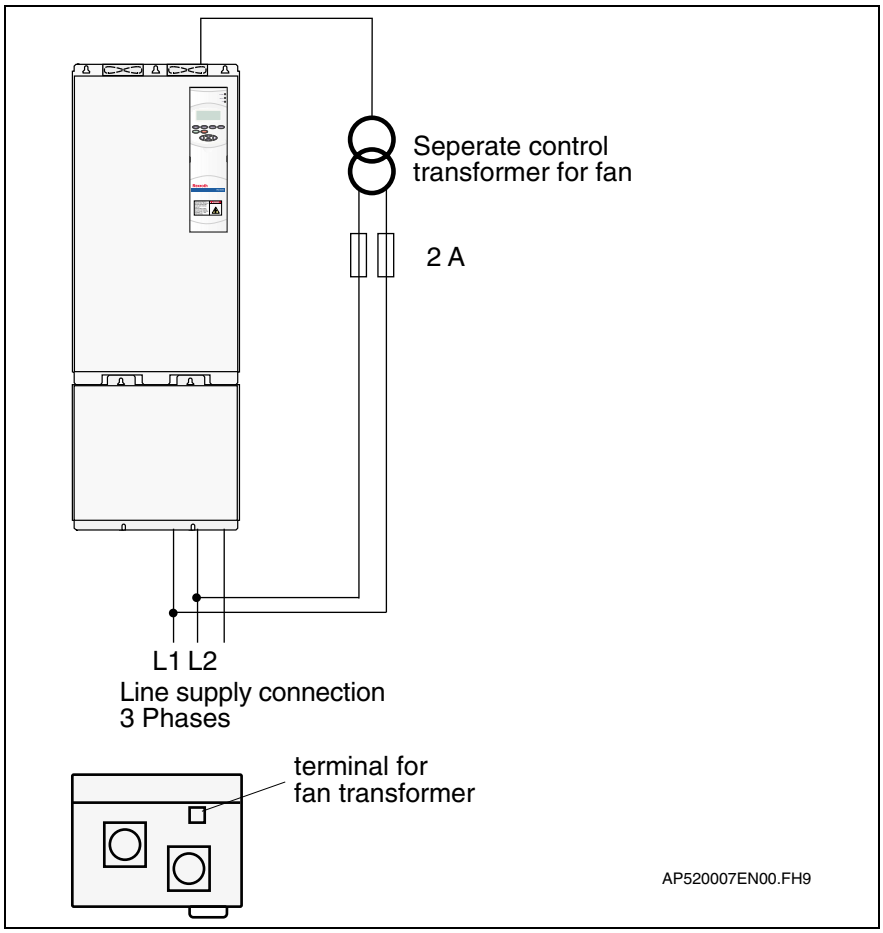


Fig.: 3-47 Connection plan for separate fan transformer for size classes G and H with cooling type R

Dimension Drawing, Size Classes G and H, with Cooling Type R

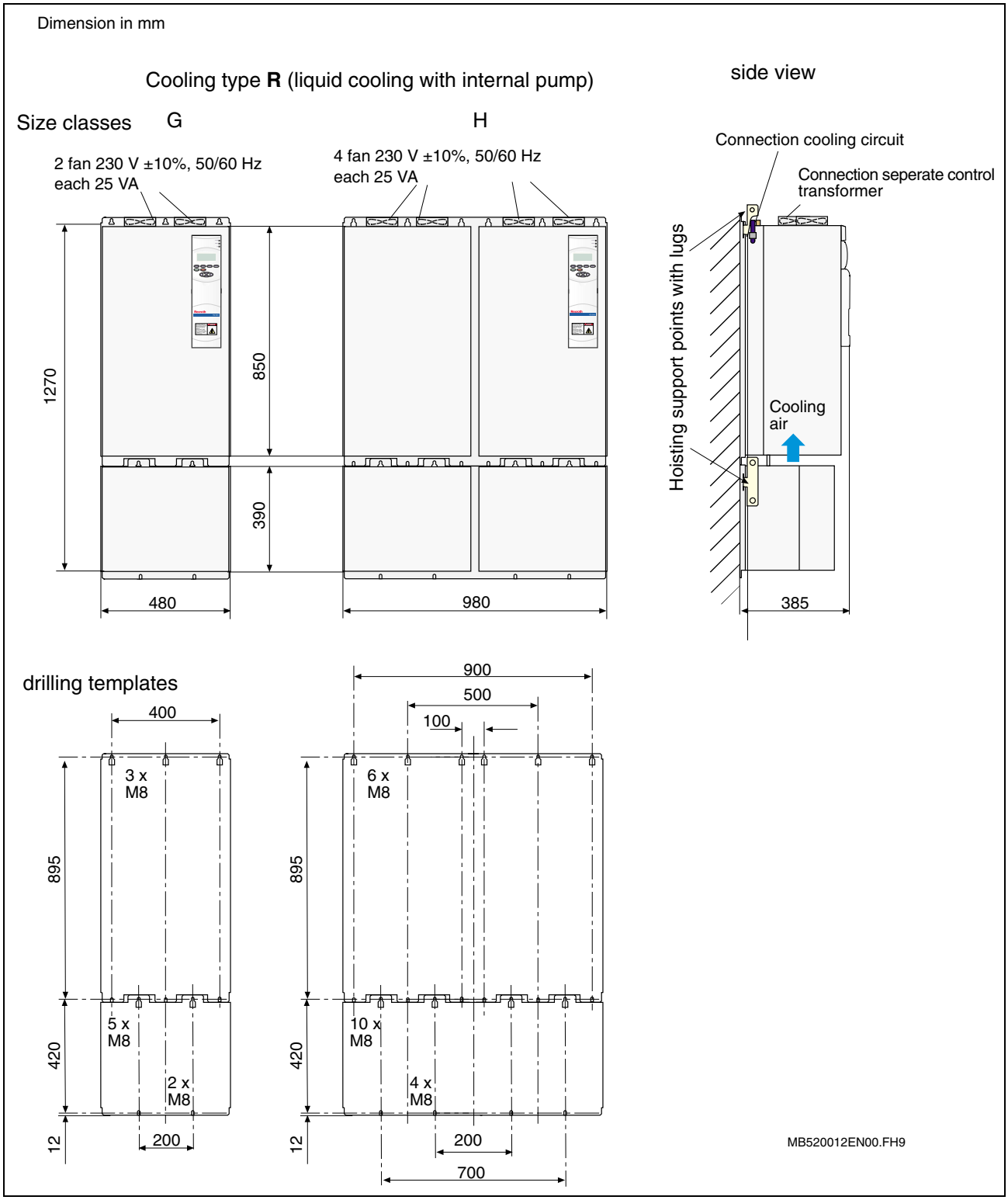


Fig.: 3-48 Dimension sheet of converter, size classes G and H, with cooling type R

Mounting Drawing for Devices with External Heat Exchanger for Cabinet Roof Mounting, Size Class G

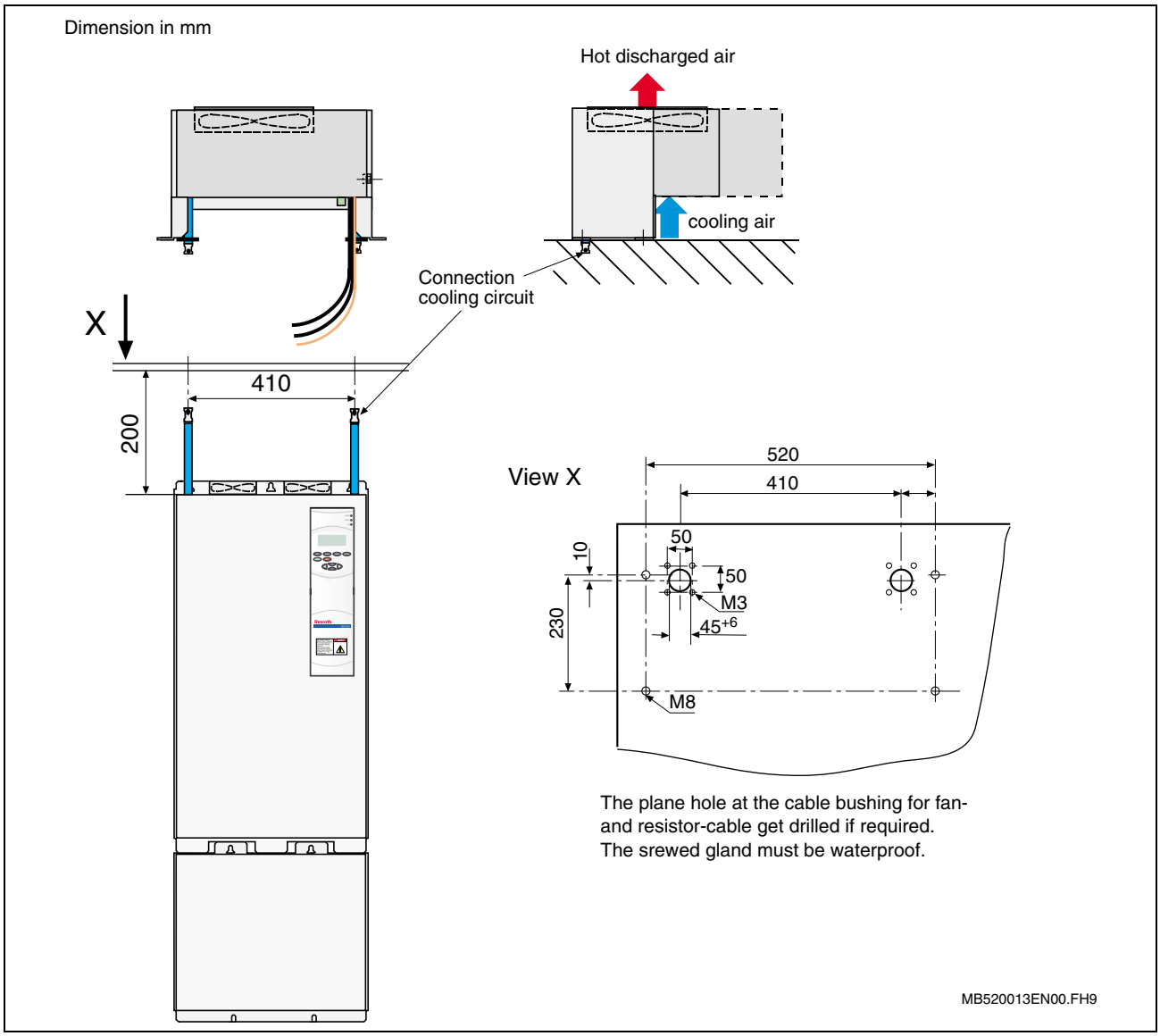


Fig.: 3-49 Dimension sheet for cabinet roof mounting, size class G

Mounting Drawing for Devices with External Heat Exchanger for Cabinet Roof Mounting, Size Class H

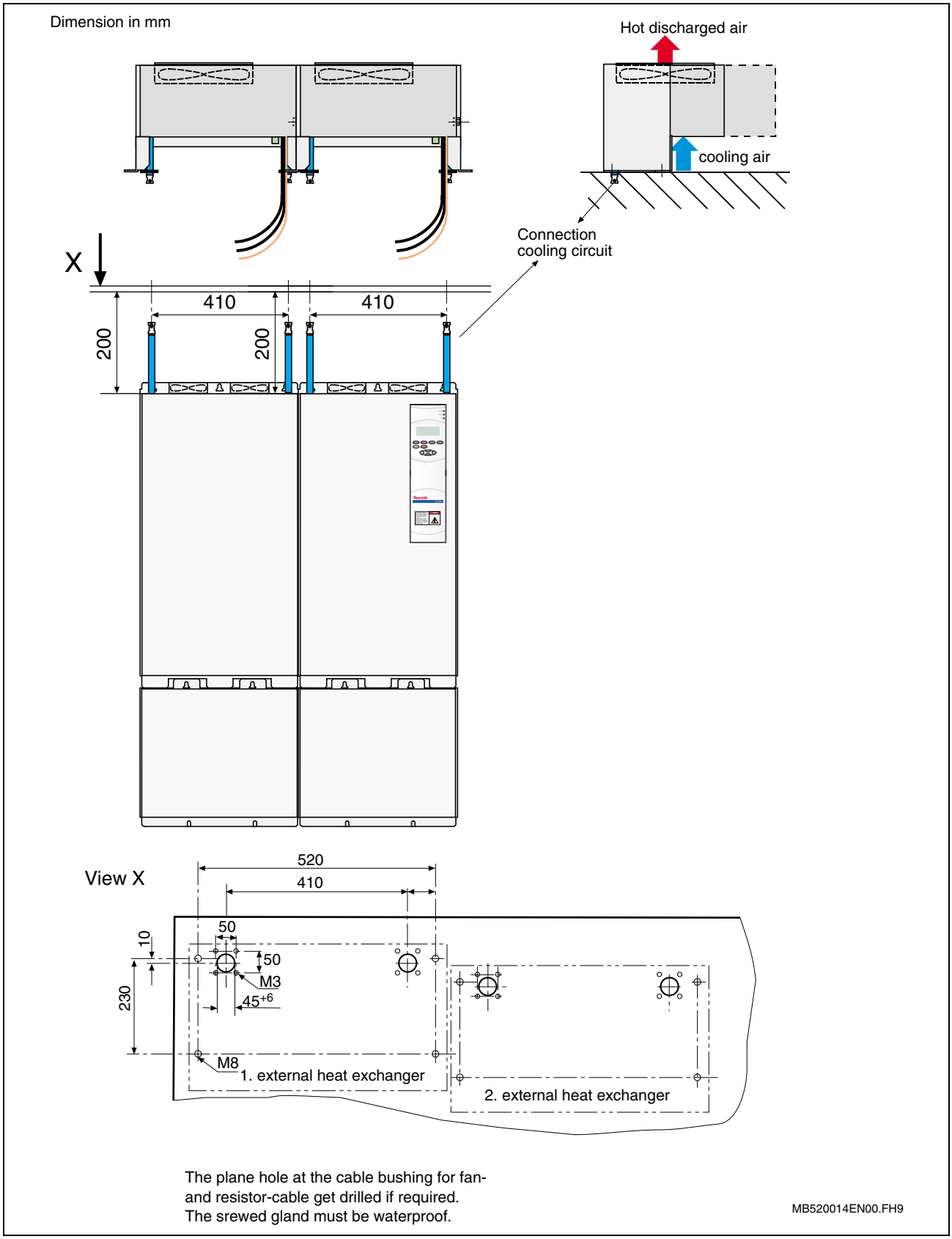


Fig.: 3-50 Dimension sheet for cabinet roof mounting, size class H

Mounting Drawing for Devices with External Heat Exchanger for Wall Mounting

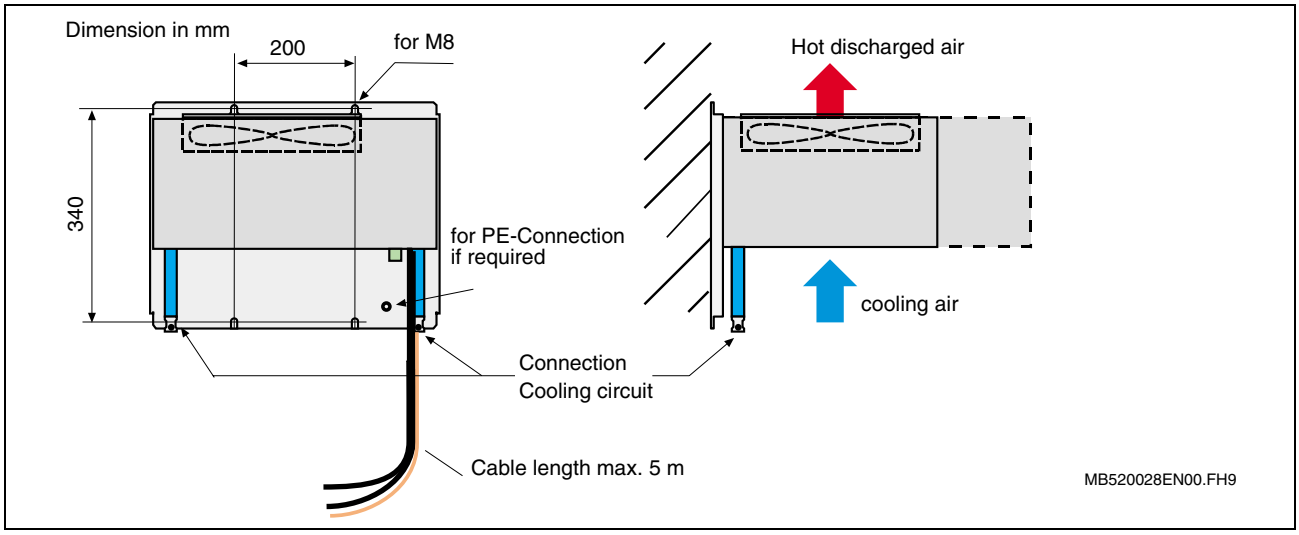


Fig.: 3-51 Dimension sheet for wall mounting, size class H

3.16 Working on the Coolant Circulation System Size Classes G and H

Both versions of the liquid-cooled drive units, with integrated and external heat exchanger, are supplied filled with liquid. The coolant comprises tap water and antifreeze, type Antifrogen N (Clariant). It is mixed in the ratio 1 : 1 (Indramat Refu, Order No.: 0015343). This guarantees frost protection down to -30 °C.

CAUTION

Antifreeze is hazardous to health!

⇒ If antifreeze is swallowed, immediately consult a doctor and keep the packaging or label for reference.

CAUTION

Mixture with other antifreezes!

⇒ Do not mix the coolant with other antifreezes.

⇒ Only use the specified antifreeze if coolant must be added to installed drive units.

WARNING

Burns due to hot components with temperatures above 30°C!

⇒ Wear protective gloves

⇒ Replace devices only when the liquid circulation system has cooled

WARNING

Damage to materials due to condensation!

⇒ In temperate climate zones (up to 40 °C and 70% humidity), the inlet temperature of the coolant must lie max. 5 K below the interior switch cabinet temperature!

Note: The most certain protection against condensation is:
inlet temperature of coolant = ambient temperature

Coolant that generally has a temperature that differs from that of the ambient air flows through fluid-cooled drive components.

If warm air comes into contact with a less warm object, condensation forms on the surface of the object if the temperature of the object is below the dew-point temperature. Dew forms on the object.

WARNING

Damage to materials due to corrosion!

⇒ Ensure that there is sufficient corrosion control and antifreeze

WARNING

Damage to materials due to malfunction in coolant circulation system!

⇒ Ensure fault-free operation of the coolant circulation system

Note: Prevent deposits in the cooling tubes.

Note: Pay attention to the change in volume of the coolant due to the temperature differences.

Recommendation

Divide the coolant circulation by using a suitable heat exchanger (e.g. plate heat exchanger).

WARNING

Damage to materials due pump function failure

⇒ When simultaneous occurring the following conditions!

- Operation at overload
- Short circuit on output
- Failure of the cooling pump

⇒ The device can age prematurely

Failure of the cooling pump without overload or short circuit at the output

Note: To guarantee the cooling function, a pump monitor is required

DANGER

Destruction of device due to short-circuit!

⇒ Collect drip water during assembly

Mounting Extension Hoses for External Heat Exchanger

For devices with external heat exchangers, all of the parts required for the hose extensions (hoses, connectors, couplings, clamps, coolant, etc.) are supplied according to the customer's specification when ordering. Customers must assemble the extension hoses themselves, as described below:

1. Shorten the heat exchanger hose to the required length, if necessary.
2. Mount the connector with hose liner at one end of the heat exchanger hose using a clamp.
3. Fill the hose with coolant using a funnel. The connector and coupling have self-closing valves.
4. Connect the coupling with the hose liner at the other end of the heat exchanger hose using a clamp.

Connect the converter to the heat exchanger using the filled hoses. When the hoses are connected or disconnected, low amounts of drip water escape as a result of the self-closing valves of the connector and couplings. The converter should be powered up for a few minutes so that the pump circulates the coolant and vents the cooling system. Small air bubbles in the coolant circulation, which can occur when connecting the extension hoses, then collect in the compensation tank. After the air has been vented, it should be checked whether the coolant level is at the center of the compensation tank. If this is not the case, coolant must be added to the compensation tank. To add coolant, remove the sheet metal cover of the heat exchanger.

If the heat exchanger was connected in the way described above, it will not be necessary to add any coolant to the compensation tank.

Servicing the Coolant Circulation System

The coolant circulation system is a closed cooling system that does not require either servicing or inspection. If the “Device excess temperature” fault occurs during operation, it should be checked whether the coolant level is at the center of the compensation tank.

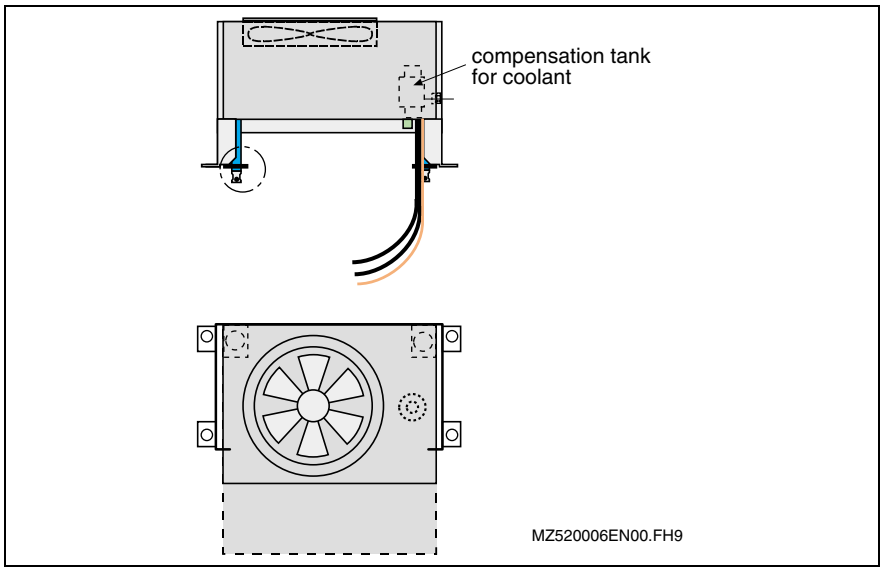


Fig.: 3-52 Compensation tank in external heat exchanger

Technical Data of Coolant Circulation System, Size Classes G and H

- The maximum system pressure is < 1 bar

4 Electrical Installation of Converter

4.1 10 Rules for Installation of Drives According to EMC

The following 10 rules are the basics for designing drive systems in compliance with EMC.

Rules 1 to 7 are generally valid. Rules 8 to 10 are especially important to limit noise emission.

Rule 1 All metal parts of the switch cabinet should be connected with one another through the largest possible surface area so that the best electrical connection is established (no paint on paint!). If necessary, use contact or scraper discs. The cabinet door should be connected to the cabinet using the shortest possible grounding straps.

Rule 2 Signal, line supply, motor and power cables should be routed away from another (this eliminates mutual interference!). The minimum clearance is 20 cm. Barriers should be provided between power and signal cables. These barriers should be grounded at several locations.

Rule 3 Contactors, relays, solenoid valves, electromechanical operating hour counters etc. in the cabinet must be provided with noise suppression devices, e.g. using RC elements, diodes, varistors. These devices must be connected directly at the coil.

Rule 4 Non-shielded cables belonging to the same circuit (feeder and return cables) should be twisted with the smallest possible distance between them. Wires which are not used must be grounded at both ends.

Rule 5 Generally, noise which is coupled in can be reduced by routing cables as closely as possible to grounded steel panels. For this reason, cables and wires should not be routed freely in the cabinet, but as closely as possible to the cabinet itself and the mounting panels. This is also true for reserve cables.

Rule 6 Incremental encoders must be connected using shielded cables. The shield must be connected at the incremental encoder and at the AC drive converter through the largest possible surface area. The shield may not be interrupted, e.g. using intermediate terminals.

Rule 7 The shields of signal cables must be connected to ground at both ends through the largest possible surface area to establish a good electrical connection (transmitter and receiver). If the potential bonding between the screen connections is poor, an additional potential bonding conductor with a cross-section of at least 10 mm² (AWG 6) should be connected in parallel with the shield to reduce the shield current. The shields can be connected to ground at several locations, e.g. on the cabinet housing and on cable trays. Foil shields are not recommended. Braided screens provide a better shielding effect (factor of 5).

If the potential bonding is poor, analog signal cables may only be grounded to the converter at one end in order to prevent low-frequency noise being radiated into the screen (50 Hz).

Rule 8 Always place a radio interference suppression filter close to the noise source. The filter is to be connected flush with the cabinet housing, mounting plate, etc. The best solution is a bare metal mounting panel (e.g. stainless steel, galvanized steel), because the complete mounting surface can be used to establish good electrical contact.

The incoming and outgoing cables of the radio interference suppression filter should be separated.

Rule 9 All variable-speed motors should be connected using shielded cables, whereby the shield is connected at both ends to the housings through the largest possible surface area to minimize the inductance. The motor feeder cables should also be shielded outside the cabinet, or at least screened using barriers.

Cables with steel shields are not suitable.

To connect the shield at the motor, a suitable PG gland with shield connection can be used (e.g. “SKINDICHT SHV/SRE/E” from the Lapp Company, Stuttgart). It should be ensured that the connection between the motor terminal box and the motor housing has a low impedance. Otherwise, use an additional grounding strap between them. **Never use plastic motor terminal boxes!**

Rule 10 The shield between the motor and the frequency converter may not be interrupted by installing components such as output reactors, sinusoidal filters, motor filters, fuses, contactors, etc. The components must be mounted on mounting panels which also simultaneously serve as the shield connection for the incoming and outgoing motor cables. Metal barriers may be required to shield the components.

4.2 Warnings and Notes

DANGER

Death by electrocution possible due to live parts with more than 50V!

⇒ RD 500 devices are operated at high voltage levels. All work must be carried out when they are not under power!

⇒ All work must be carried out only by qualified personnel!

⇒ If this warning information is not observed, death, severe bodily injury or significant material damage can result.

⇒ Due to the DC link capacitors, the device is still under a dangerous voltage up to 5 minutes after power has been switched off. This means that it is only permissible to work on the device or the DC link terminals after an appropriate time and after a careful check has been made to ensure that the equipment really is not under power.

⇒ The power and control terminals may be live even if the motor is at a standstill.

⇒ In the case of a central supply of the DC link voltage, ensure that the inverter is safely separated from the DC link voltage!

⇒ When working on an open device, note that live parts are exposed.

⇒ The user is responsible for ensuring that all devices are set up and connected according to the recognized technical regulations in the country of use as well as other regionally valid regulations. Cable dimensioning, fuse protection, grounding, switching off, separation and protection from excess currents must be especially taken into account.

CAUTION

Damage to the devices as a result of an incorrect supply voltage!

⇒ RD 500 devices are designed for various supply voltages! This is the reason why supply voltages are not specified in the drawings and tables for the terminal strips.

⇒ When connecting the converter, always observe the rating plate and the line supply voltage specified in Technical data.

Information on protective grounding: The cross-section of the protective conductor to the cabinet must be at least 10mm² (AWG 6) Cu, or a second protective conductor must be routed in parallel in accordance with DIN VDE 0160. This is due to the discharge currents of the drive units (>3.5 mA) through the protective conductor (PE) (VDE 0160, Section 6.5.2). The discharge currents of the drive converter can be up to 100 mA.

For higher connected powers, the minimum cross-section of the protective conductor must be in an appropriate ratio to the cross-section of the main phase conductor. Refer to DIN VDE 0160-5.5.3.4.2, Fig. 8.

A current-operated earth-leakage circuit breaker may not be used as a protective measure.

4.3 Cable Cross-Sections

The cable cross-sections refer to the rated converter current. The associated protective conductor cross-section must be a minimum of 10 mm^2 (AWG 6) (if power cables with cable cross-sections >10 mm^2 (AWG 6) are used, the protective conductor must have the same cross-section).

The following is assumed for the line supply feeder cables / DC link cables:

- The cross-sections are valid for one phase for multi-stranded conductors, and were defined in accordance with VDE0298.
- Up to 35 mm² (AWG 2), individual wires in a cable duct.
- Above 50 mm² (AWG1/0), freely routed in the cabinet without any contact to other cables

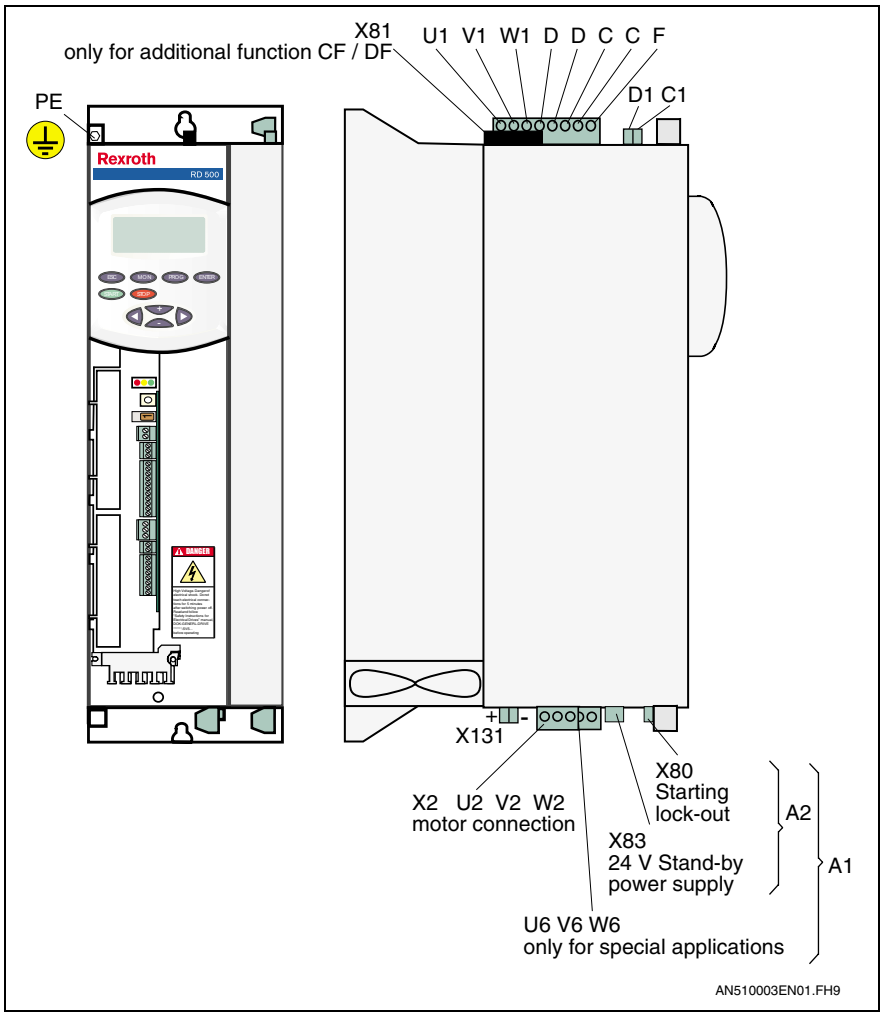
The following is assumed for motor feeder cables:

- The cross-sections are valid for shielded 4-core cables and were defined in accordance with VDE0298.
- Up to 35 mm² (AWG 2),, routed in the cable duct, without any cable bundling.
- Above 50 mm² (AWG1/0), freely routed in the cabinet without any contact to other cables.

Note: The provided cable cross-section in mm² is based on the assumption that PVC 70° C cables are used. The provided cable cross-section in AWG is based on the assumption that THHN or THHW 194° C cables are used.

4.4 Power Terminals RD51 Size Classes A-E

Terminal Layout Diagram Size Classes A - B



A1: 24 V standby power supply, starting lock-out and filter current feedback

A2: 24 V standby power supply and starting lock-out

Fig.: 4-1 Terminal layout diagram classes A, B

Description of Converter Power Terminals, Size Classes A - B

Power class	Power supply connection			Motor connection	
	Cable cross-section which can be connected 1), mm²	AWG	Maximum series fuse, type gL, A 2)	Cable cross-section which can be connected 1), mm²	AWG
003	0.5 - 6	20 - 10	10	0.5 - 6	20 - 10
005	0.5 - 6	20 - 10	16	0.5 - 6	20 - 10
007	0.5 - 6	20 - 10	20	0.5 - 6	20 - 10
015	0.5 - 10	20 - 10	35	0.5 - 10	20 - 10
018	0.5 - 10	20 - 10	50	0.5 - 10	20 - 10

1): As a result of the terminal size

2): Safety values are provided for the 3AC 400V input voltage and for the rated output X1 of the device. If the input voltage differs, the safety value must be changed.

Tab. 4-1 Cable cross-sections for line supply and motor feeder cables, classes A - B

Terminal	Comment
X1	**Line supply, DC link connection**
PE	Protective conductor connection min. 10mm² (AWG 6) steel plate lug on the housing with captive nut M5
L1 / U1	Line supply connection 3 phases L1, L2, L3 for permissible line supply voltage, refer to the rating plate on the upper side of the drive unit
L2 / V1	
L3 / W1	
C	DC link connection (IC) L+
D	DC link connection (IC) L-
F	Connection, external brake resistor (RZW) between C and F

C1	External SNT supply +1) DC530...670V±10% 100W only for device type 2 (RD52.2-2Bxxx) on device type 4 and 5 **never** assigned	Cable cross-section which can be connected 0.5 – 2.5 mm² (AWG 20 – 14)
D1	External SNT supply -1) DC530...670V±10% 100W only for device type 2 (RD52.2-2Bxxx) on device type 4 and 5 **never** assigned	

X2	Motor connection
U2	Motor connection U, V, W
V2	
W2	
PE	Protective conductor connection for motor and shield connection for cables min. 10mm² (AWG 6); steel plate lug on the housing with captive nut M5

X2	Filter current feedback (only in A1)	
U6	Operation possible only with the original Refu filter	Cable cross-section which can be connected 0.2 -4 mm² (AWG 24 –12)
V6		
W6		

Rexroth Bosch Group

X80	Starting lock-out (only in A1 and A2)	
1	During operation, terminals 1 - 2 must be closed; when they are opened, the start of the connected motor is inhibited.	Recommended minimum cross-section 1 mm² (AWG 18) Cable cross-section which can be connected 0.08 – 1.5 mm² (AWG 28 – 16)
2		
3	Starting lock-out floating acknowledge contact, 30 V DC / 1 A N/C contact	
4		

X83	24V standby power supply for the electronics (only in A1 and A2)	
1	P24V 24VDC –15/+20%, ripple, max 5% (VDE0411 / 500), power consumption ~40 W, startup current 5 A	Recommended minimum cross-section 1mm² (AWG 18) Cable cross-section which can be connected 0.2 -2.5 mm² (AWG 27 - 14)
2	Ground	

X131	Internal fan supply
	+ / -

X81	Additional function CF / DF Connection RZC01.x...
	Only for internal use

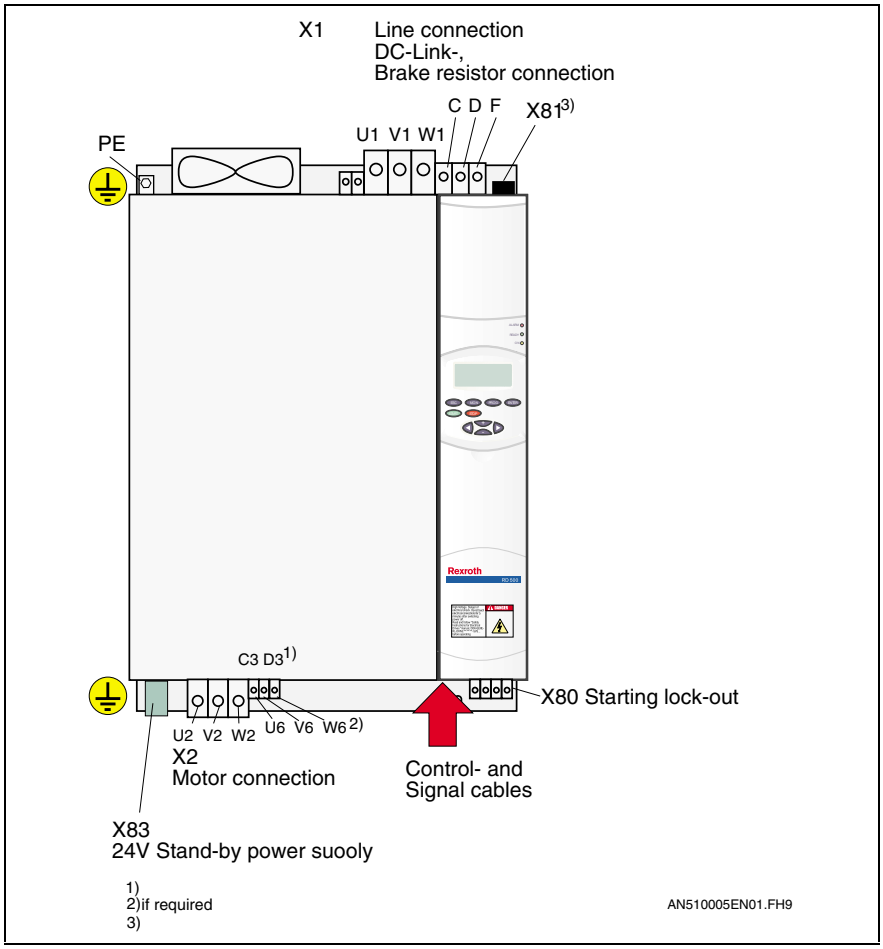
1): External fuse required (4 A)

Tab. 4-2 Power terminals, classes A - B

Terminal Layout Diagram, Size Classes C, D

A converter, size C (270 mm wide) is illustrated in the terminal layout diagram. The position of the terminals is essentially the same for the narrower or wider drive units. The line supply, DC link and brake resistor terminals are always at the top and the motor connection at the bottom of the housing.

Note: The additional function 24V Stand by power supply (terminal X83) is only mounted if it was actually ordered.

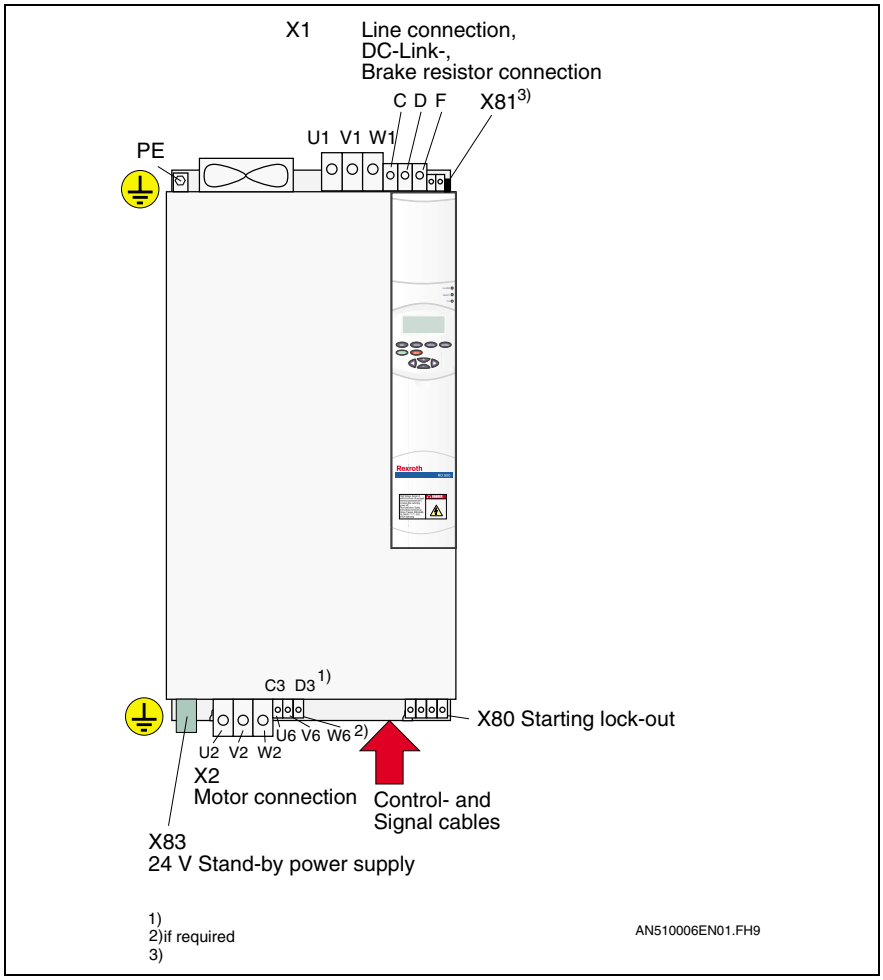


1): Only with additional function L1
2): Only with additional function F1
3): Only with additional function C1 / D1

Fig.: 4-2 Terminal layout diagram, classes C, D

Terminal Layout Diagram, Size Class E

Note: The additional function 24V standby power supply (terminal X83) is only mounted if it was actually ordered.



1): Only with additional function L1
2): Only with additional function F1
3): Only with additional function C1 / D1

Fig.: 4-3 Terminal layout diagram, class E

Description of Converter Power Terminals, Size Classes C - E

Power class	Power supply connection			DC link and RZW connection		Motor connection	
	Cable cross-section which can be connected [1], mm²	AWG	Maximum series fuse [2], type gL A	Cable cross-section which can be connected [1], mm²	AWG	Cable cross-section which can be connected [1], mm²	AWG
022	25 - 50	3 - 1/0	50	0.75 - 35	18 - 2	25 - 50	3 - 1/0
030	25 - 50	3 - 1/0	63	0.75 - 35	18 - 2	25 - 50	3 - 1/0
037	25 - 50	3 - 1/0	80	0.75 - 35	18 - 2	25 - 50	3 - 1/0
045	25 - 50	3 - 1/0	100	0.75 - 35	18 - 2	25 - 50	3 - 1/0
055	35 - 95	2 - 4/0	125	25 - 50	3 – 1/0	35 - 95	2 - 4/0
075	35 - 95	2 - 4/0	160	25 - 50	3 – 1/0	35 - 95	2 - 4/0
090	50 - 150	1/0 – 6/0	250	35 - 95	2 - 4/0	50 - 150	1/0 – 6/0
110	50 - 150	1/0 – 6/0	250	35 - 95	2 - 4/0	50 - 150	1/0 – 6/0

1): As a result of the terminal size

2): Safety values are provided for the 3AC 400V input voltage and for the rated output X1 of the device. If the input voltage differs, the safety value must be changed.

Tab. 4-3 Cable cross-sections for line supply, DC link and motor cables, classes C - E cables

Terminal	Comment
X1	**Line supply, DC link connection**
PE	Protective conductor connection min. 10 mm² (AWG 6); steel plate lug on the housing with captive nut for size classes C and D = M6 for size class E = M8
L1 / U1	Line supply connection 3 phases L1, L2, L3 for permissible line supply voltage, refer to the rating plate on the upper side of the drive unit
L2 / V1	
L3 / W1	
C	DC link connection (IC) L+
D	DC link connection (IC) L-
F	Accessory: connection of external brake resistor between C and F
C1	**Connection idle!**
D1	**Connection idle!**

X2	Motor connection
U2	Motor connection U, V, W
V2	
W2	
PE	Protective conductor connection for motor and shield connection for motor cables min. 10 mm² (AWG 6); steel plate lug on the housing with captive nut for size classes C and D = M6 for size class E = M8

X2 additional function F1 Filter current feedback		
U6	Operation possible only with the original Refu filter	Cable cross-section which can be connected, mm² Class C = 0.5 – 10 (AWG 20 – 8) Class D = 0.5 – 16 (AWG 20 – 6) Class E = 0.5 – 16 (AWG 20 – 6)
V6		
W6		

X2 additional function L1 cable damping		
C3	DC link L+	Cable cross-section which can be connected, mm² Class C = 0.5 – 10 (AWG 20 – 8) Class D = 0.5 – 16 (AWG 20 – 6) Class E = 0.5 – 16 (AWG 20 – 6)
D3	DC link L-	

Note: The additional function L1 is required to connect the motor filter RZM01.1-108 or RZM01.1-130 in converter of power class 075 and 090.

X80	Starting lock-out	
1	During operation, terminals 1 - 2 must be closed; when they are opened, the start of the connected motor is inhibited.	Recommended minimum cross-section 1 mm² (AWG 18) Cable cross-section which can be connected 0.08 -1.5 mm² (AWG 28 - 16)
2		
3	Starting lock-out floating acknowledge contact, 30 V DC / 1 A N/C contact	
4		

X83	24V standby power supply for the electronics	
1	P24V 24VDC –15/+20%, ripple, max 5% (VDE0411 / 500), power consumption ~40 W, startup current 5 A	Recommended minimum cross-section 1 mm² (AWG 18) Cable cross-section which can be connected 0.2 -2.5 mm² (AWG 24 - 14)
2	Ground	

X81	Additional function C1 / D1 Connection RZC01.x..
	Only for internal use

Tab. :4-4 Power terminals, size classes C - E

Note: Depending on the national regulations at the setup location, an external fuse and / or a short-circuit-proof layout may also be required.

4.5 Power Terminals RD51 Size Classes G - H

After the device has been mounted, the electrical connections between the line filter and drive converter must be established:

- Bolt the busbars provided between the main contactor of the line filter and the converter.
- Insert the assembled cable with connector (coming from the line filter) into terminal strip X5 in the converter.
- Depending on the line supply voltage, check whether the settings on the control transformer are correct. (See Example Control transformer page 4-15).

Terminal Layout Diagram Converter Size Class G

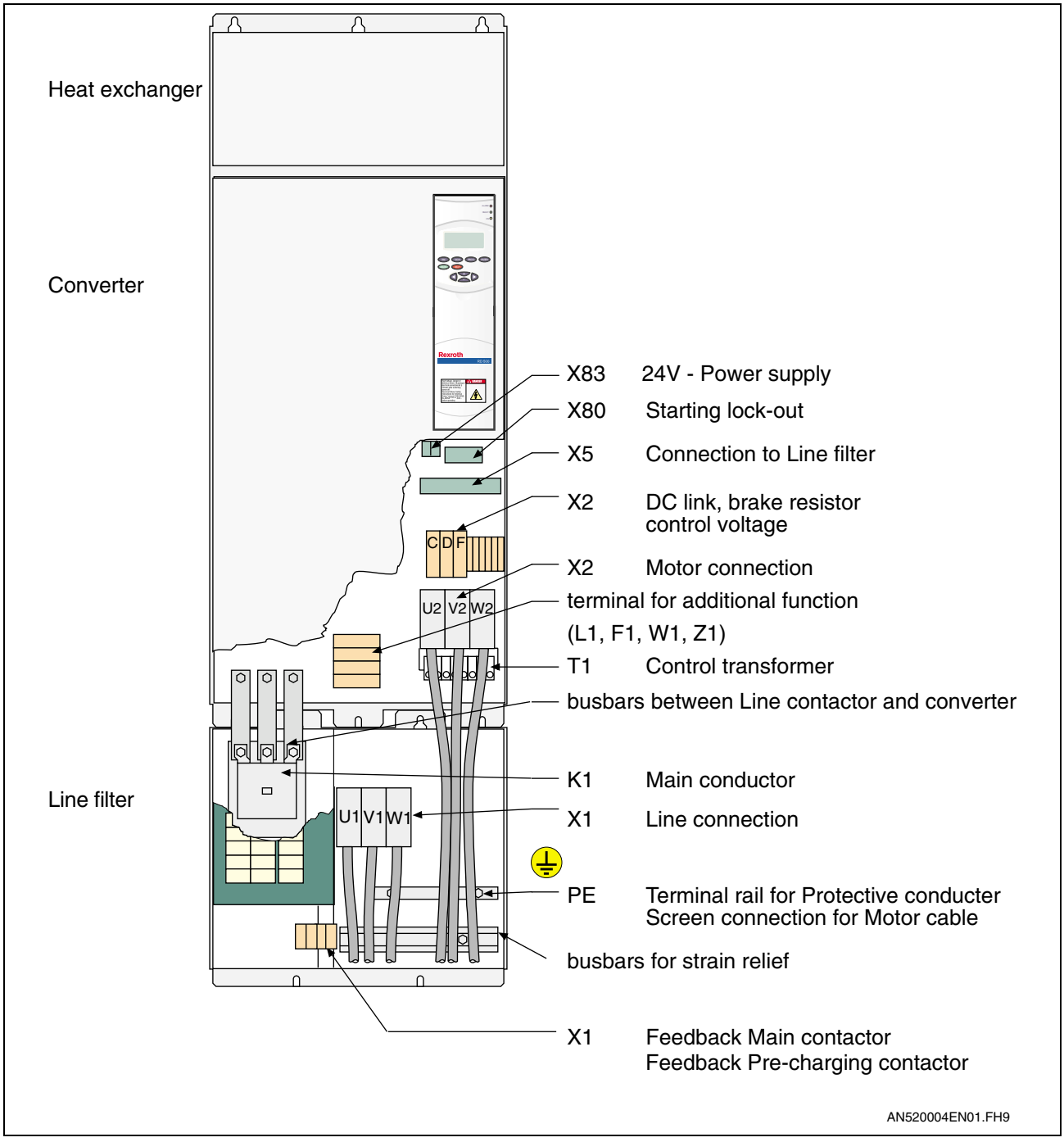


Fig.: 4-4 Terminal layout diagram, converter size class G

Terminal Layout Diagram Converter Size Class H

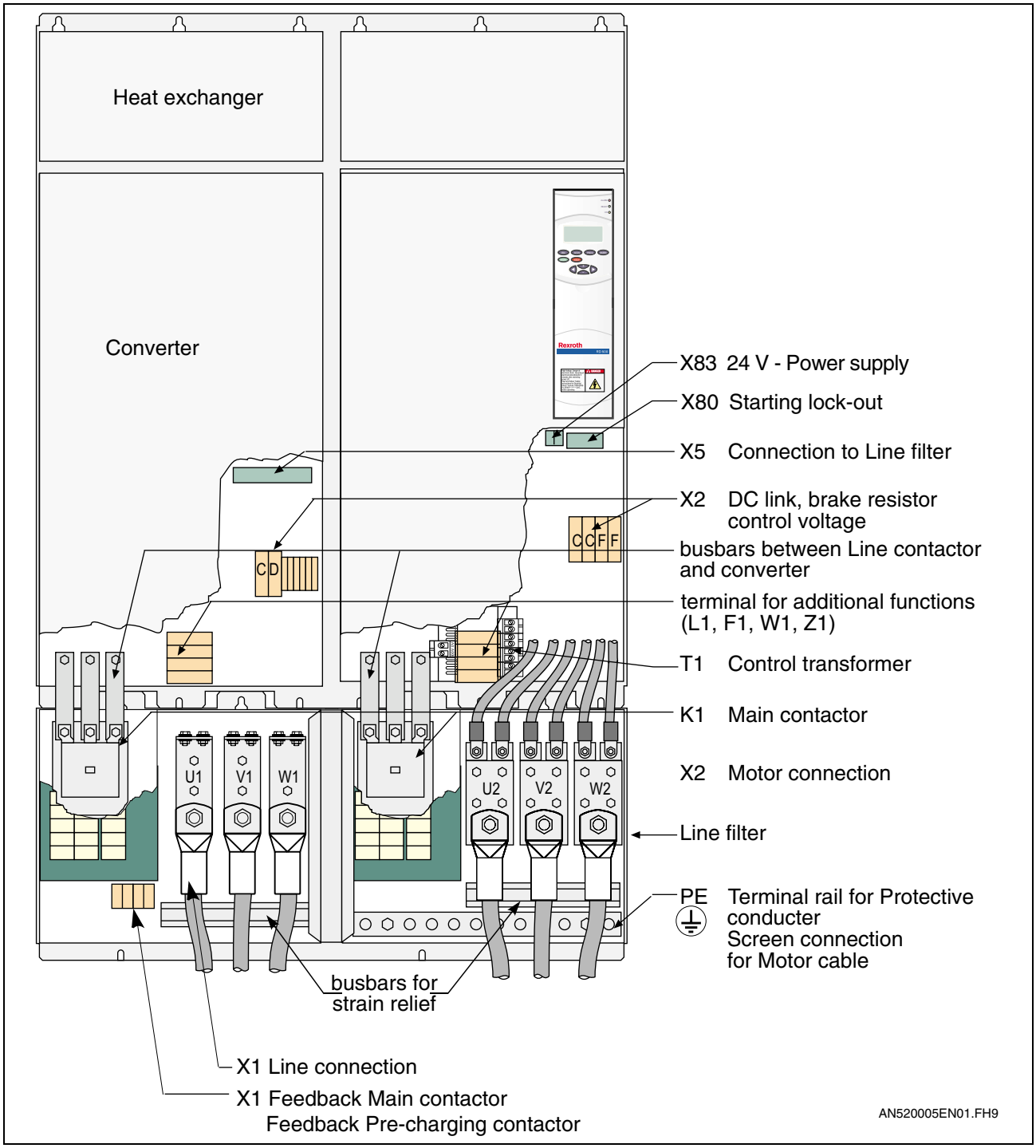


Fig.:4-5 Terminal layout diagram, converter size class H

Description of Power Terminals, Converter Size Classes G - H

Power class	Power supply connection			Motor connection	
	Cable cross-section which can be connected [1], mm²	AWG	Maximum series fuse [2], type gL, A	Cable cross-section which can be connected [1], mm²	AWG
132	50 - 150	1/0 – 6/0	250	50 - 150	1/0 – 6/0
160	50 - 150	1/0 – 6/0	315	50 - 150	1/0 – 6/0
200	70 - 240	2/0 - 500	400	70 - 240	2/0 - 500
315	Stud connection M16		630	Stud connection 1x M16 or 2x M12	
400	Stud connection M16		1000	Stud connection 1x M16 or 2x M12	

1): As a result of the terminal size

2): Safety values are provided for the 3AC 400V input voltage and for the rated output X1 of the device. If the input voltage differs, the safety value must be changed.

Tab. 4-5 Cable cross-sections for line supply and motor cables, classes G - H

Terminal	Comment
X1	**Line supply connection**
PE	Protective conductor connection; for size G = terminal rail with cable clamp for size H = terminal rail with M16 and M12 screws
U1	Line supply connection, 3 phases L1, L2, L3 Permissible line supply voltage, refer to the rating plate for size class G = terminal block with cable clamp for size class H = connecting bar with M16 screws
V1	
W1	
121	Feedback signal contact (NC contact) from main contactor
122	
123	Feedback signal contact (NC contact) from pre-charging contactor
124	

X2	**Size class G**	
	Motor connection, DC link, line supply isolation	
C	DC link terminal L+	Cable cross-section which can be connected 10 – 35 mm² (AWG 8 – 2) at additional function Z1 and W1 35 - 95 mm² (AWG 2 – 4/0)
D	DC link terminal L -	
F	Internal brake resistor connected in the heat exchanger between C and F	
X2	**Size class H**	
	Motor connection, DC link, line supply isolation	
C	DC link terminal L+	Cable cross-section which can be connected 16 - 70 mm² (AWG 2 – 2/0) at additional function Z1 and W1 35 - 95 mm² (AWG 2 – 4/0)
D	DC link terminal L -	
F	Internal brake resistor connected in the heat exchanger between C and F	Cable cross-section which can be connected, 2 x 10 – 35 mm² (2 x AWG 8 – 2) at additional function Z1 and W1 35 - 95 mm² (AWG 2 – 4/0)

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X2	Size classes G and H
1 (L/P)	Connection for the heat exchanger fan
2 (0V AC)	
U2	Motor connection U, V, W for size class G = cable terminal for size class H = M16 and M12 screws
V2	
W2	
151	Function: Isolation from the line supply In operation, terminals 151-152 and 153-154 must be closed; the converter is isolated from the line supply when these terminals are opened When the converter is to be isolated from the line supply, both terminals must be opened in order to prevent erroneous functions when a ground fault occurs. When the terminals are open, the auxiliary circuits are not under power; the open-loop and closed-loop controls are disabled.
152	
153	
154	
155	Function: Isolation from the line supply In operation, terminals 155-156 and 157-158 must be closed; the converter is isolated from the line supply when these terminals are opened When the converter is to be isolated from the line supply, both terminals must be opened in order to prevent erroneous functions when a ground fault occurs. When the terminals are opened, the auxiliary circuits are still energized and the open-loop and closed-loop controls remain enabled.
156	
157	
158	

X5	Control voltage for the line filter	
1	Connection, 3 x AC control voltage	The customer must establish the connection from the line filter to the converter after mounting. The assembled cable with connector (coming from the line filter) is inserted in X5. **Make the settings on the control transformer depending on the line supply voltage that is present**[1)]
3		
5		
7	Control for pre charging and main contactor with check-back signal (N/O contact) for the main contactor	
9		
11		
13		
15		

X2 additional function L1 cable damping		
C3	Cable damping return	Cable cross-section which can be connected 0.75 - 35 mm² (AWG 18 – 2)
D3		

X2 additional function F1 filter current feedback		
U6	Operation possible only with the original Refu filter	Cable cross-section which can be connected 25 -50 mm² (AWG 3 – 1/0)
V6		
W6		

X80	Starting lock-out	
1	During operation, terminals 1 - 2 must be closed; when they are opened, the start of the connected motor is inhibited.	Recommended minimum cross-section 1 mm² (AWG 18) Cable cross-section which can be connected 0.08 -1.5 mm² (AWG 28 – 16)
2		
4	Start inhibitor floating acknowledge contact, 30 V DC / 1 A N/C contact	
5		

X83	24V power supply	
1	P24V 24VDC -15/+20%, ripple, max 5% (VDE0411 / 500); power consumption approx. 80W (size class G) / 160W (size class H); switch-on current 15 A (size class G) / 30 A (size class H).	Recommended minimum cross-section 1.5 mm² (AWG 16) Cable cross-section which can be connected 0.2 -2.5 mm² (AWG 24 – 14)
2	Ground	

1) See Example Control transformer page 4-15

Tab. 4-6 Cable cross-section, size classes G and H

Control Transformer T1

A control voltage of AC 230 V is required in converters of size classes G and H for the contactor fan and pump. This voltage is obtained from the applied line supply voltage using an installed T1 control transformer.

In devices with voltage class 4: 3 AC380V - 480V, the control transformer is designed primarily for the following power supplies:

- Voltage: AC 380 V / 400 V / 415 V / 440 V and 460 V
- Voltage tolerance: ± 15 %
- Frequency: 50 / 60 Hz

The control transformer has been set to a line supply voltage of AC 400 V at the factory.

Example For a converter with a line input supply voltage of 3 AC 480 V, the cable must be removed from transformer terminal 400 V and connected to transformer terminal 460 V.

For a converter with a line input supply voltage of 3 AC 500V, switching terminals is not required. The transformer is laid out for a line supply voltage of 500 V.

Note: If the line supply voltage that is used and the current setting do not agree, the correct setting is to be made by switching terminals on the control transformer.

CAUTION

Material damage due to overload of the component!

⇒ the correct setting is to be made by switching terminals on the control transformer.

Dimension Drawing of Control Transformer

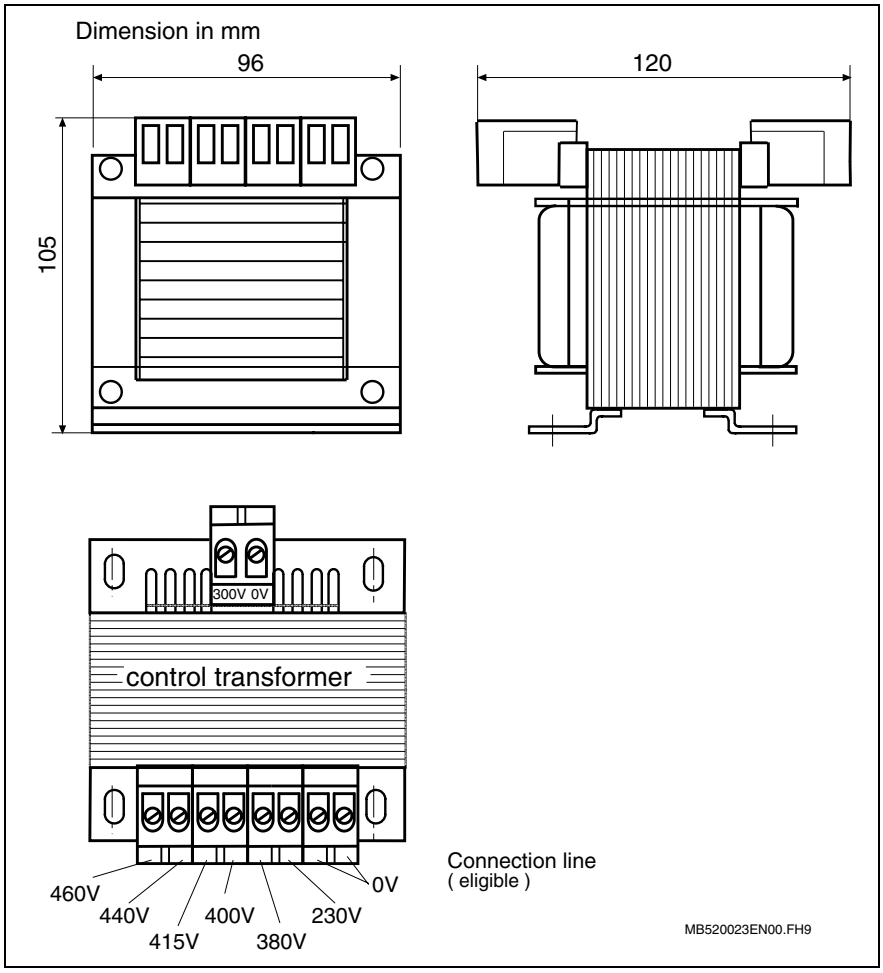
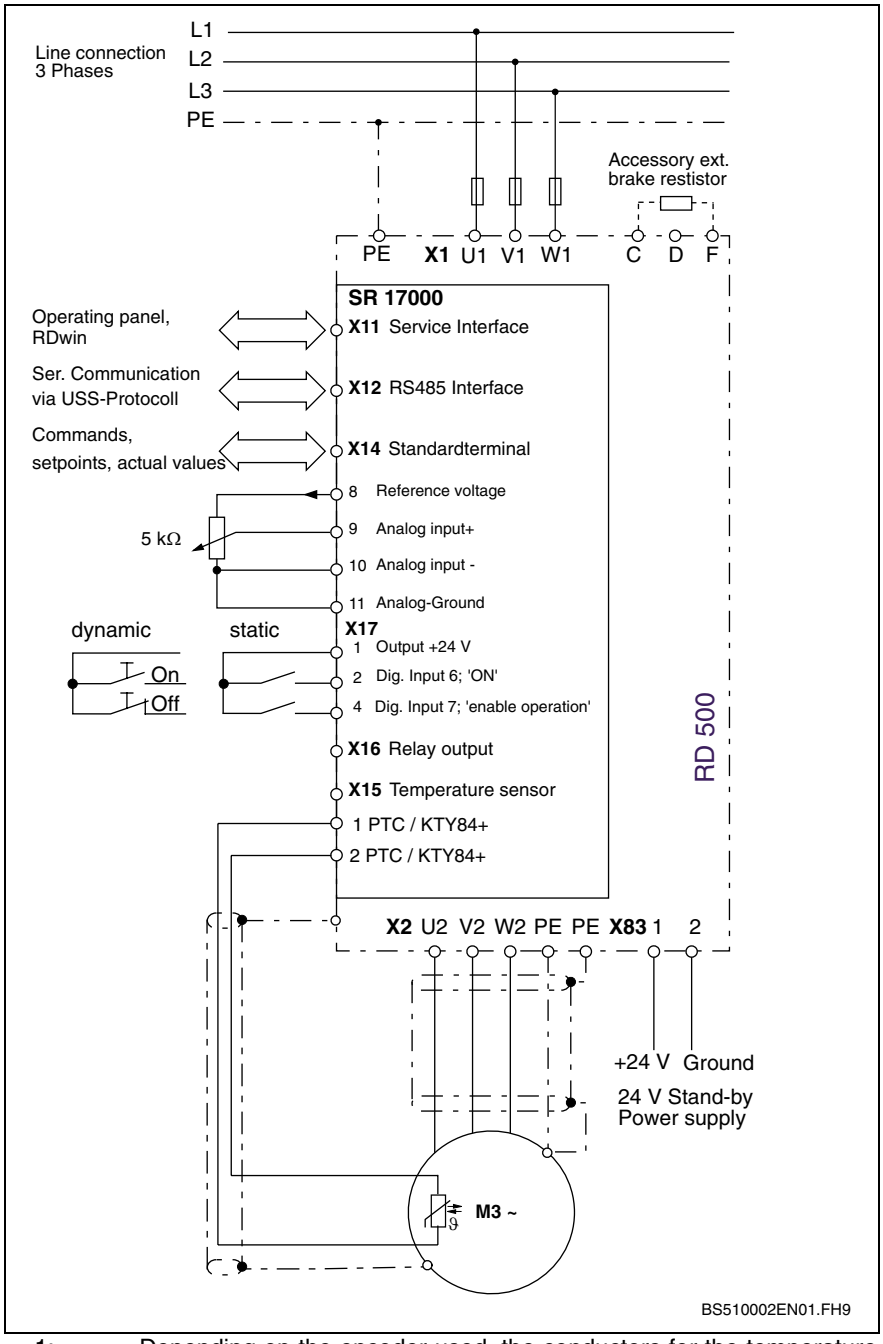


Fig.: 4-6 Control transformer T1

4.6 Connection Diagram



1: Depending on the encoder used, the conductors for the temperature sensor are routed in the encoder cable or are connected using a separate cable on connector X15.

Fig.: 4-7 Connection diagram for converter size classes A - E

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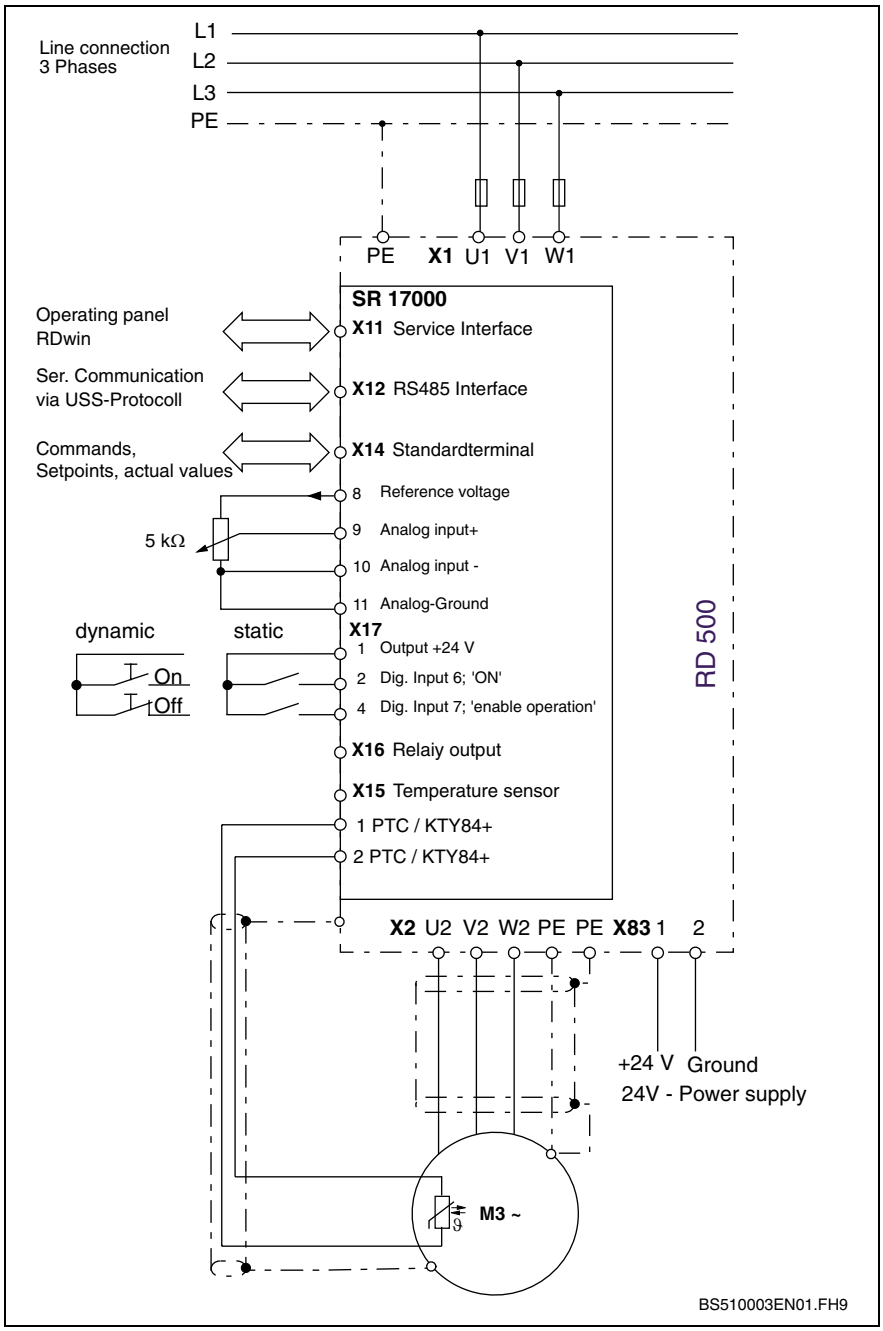

1: Depending on the encoder used, the conductors for the temperature sensor are routed in the encoder cable or are connected using a separate cable on connector X15.

Fig.:4-8 Connection diagram for converter size classes G - H

4.7 Control Terminals

Terminal Layout Diagram SR17000 Size classes A - B

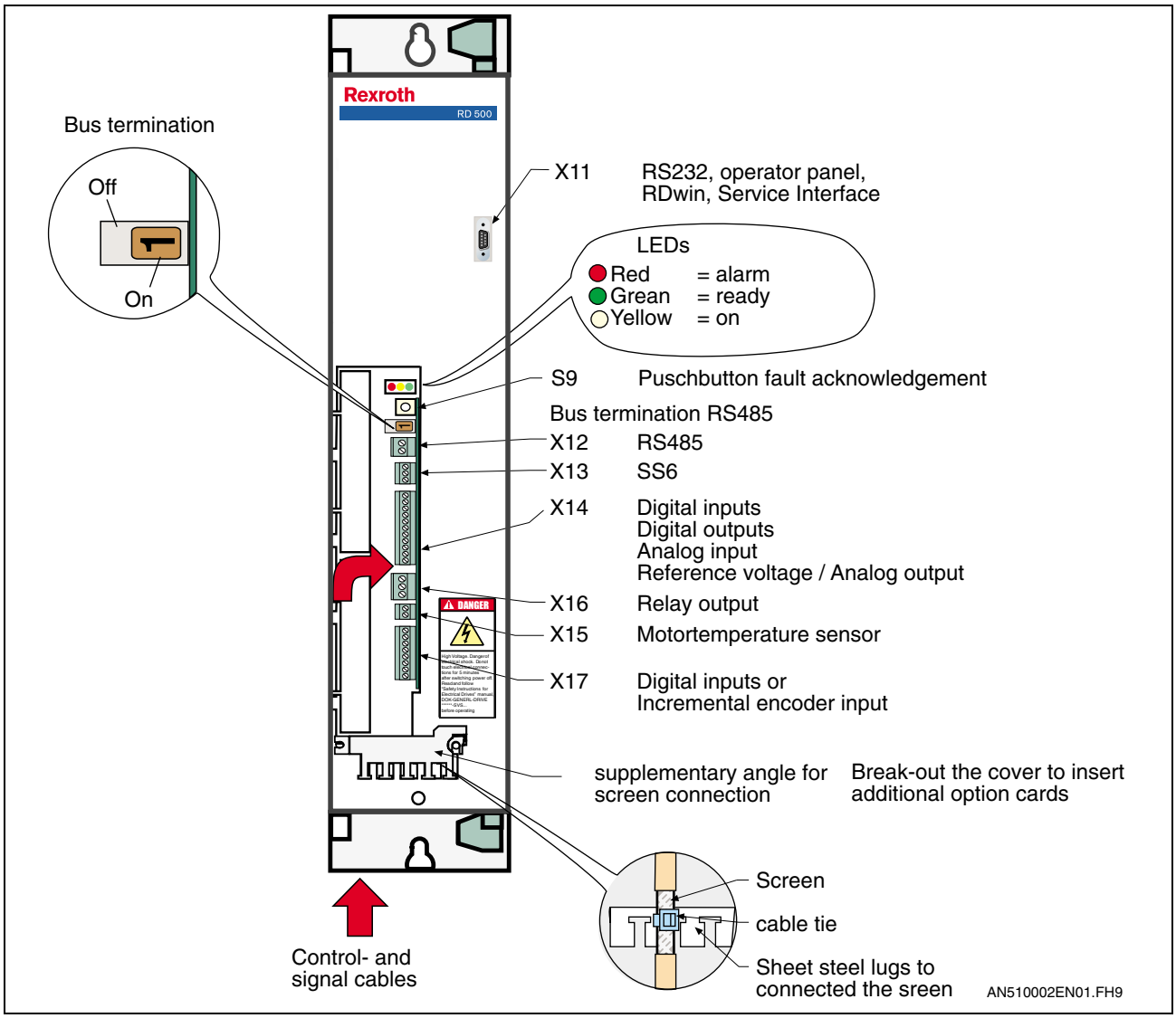

Fig.:4-9 Control terminals on the SR17000 logic and control board

Terminal Layout Diagram SR17000 Size class C - H

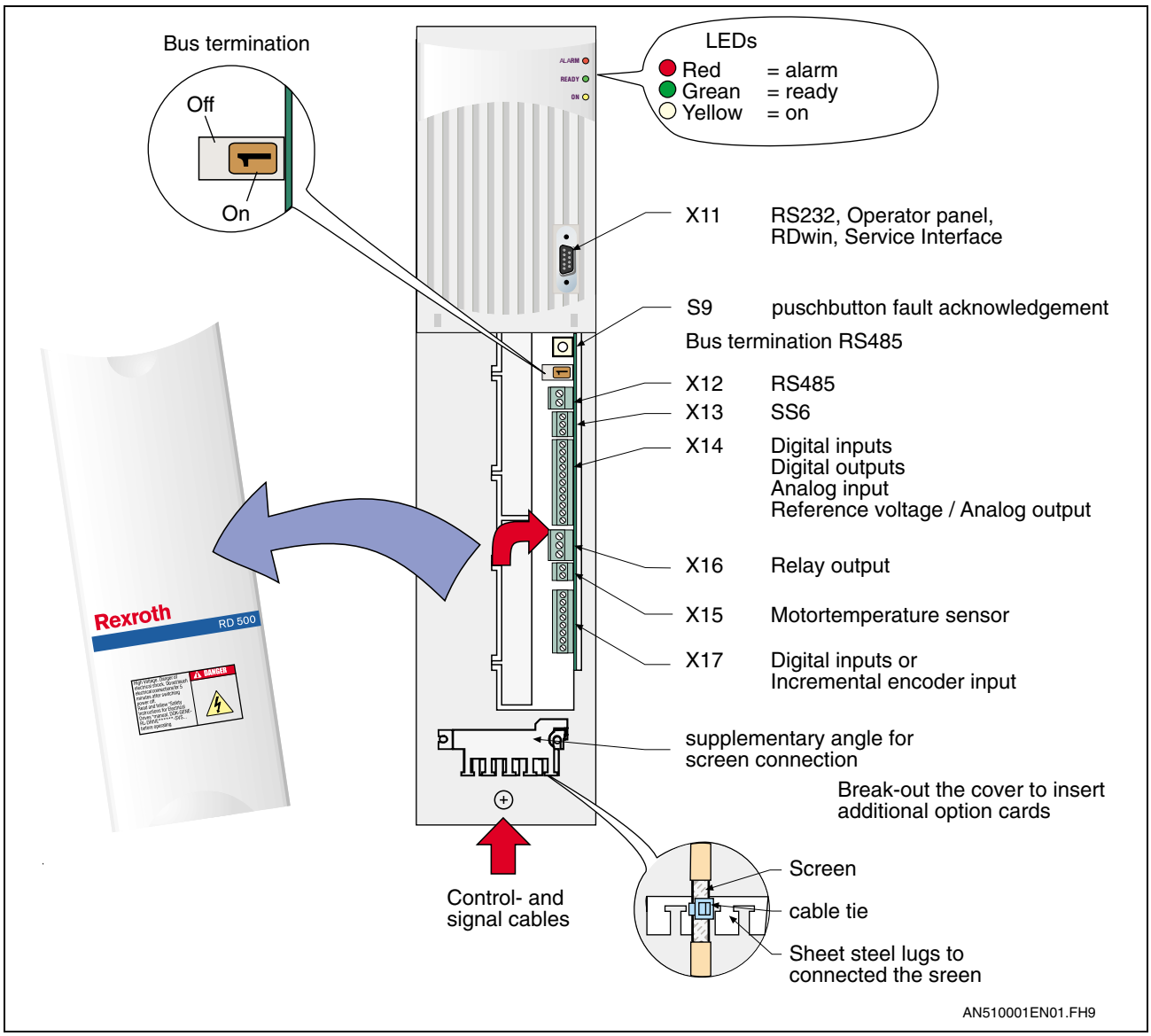

Fig.:4-10 Control terminals on the SR17000 logic and control board

Description of Control Terminals

Terminal	Designation	Comment
X11	**Service interface**	
3	R x D	RS232 service interface;
2	T x D	To plug in the operator panel
5	Ground	To connect a PC with the RDwin user interface

X12	RS485 interface	
1	R x D+ / T x D +	RS485 interface; communication with the USS protocol
2	R x D- / T x D -	

X13	SS6 interface	
1	CAN high	Point-to-point connection between RD51 and RD51 with internal bus termination. The lines from X13.1 of the first RD51 to X13.1 of the second RD51 and X13.2 of the first and X13.2 of the second RD51 must be twisted. The maximum cable length is 5 m.
2	CAN low	
3	Ground	

X14	Standard terminal strip		
1	P24V output	Load capability max. 50 mA	
2	Dig. input 1 Dig. output 1	Digital inputs without electrical isolation (non-floating): Input current at 24 V: 8.6 mA H signal: +13 V - +33 V L signal: -3 V - +5V or open-circuit terminal Digital outputs H signal: +21 V, max. 20 mA L signal: 0 V ON / OFF	Optional input / output; function can be selected using P0471
3	Dig. input 2 Dig. output 2		Optional input / output; function can be selected using P0473
4	Dig. input 3 Dig. output 3		Optional input / output; function can be selected using P0475
5	Dig. input 4		Function can be selected using P0878
6	Dig. input 5		Function can be selected using P0878
7	Digital ground	Reference ground, P24V (X14.1)	
8	Reference ±10 V Analog output	Optional function, can be selected using P0890 (5 mA load capability, short-circuit-proof): Reference voltage +10 V Reference voltage -10 V fact Output frequency Iact Output current Isp torque-producing Uact Output voltage Pact Output power Pwirk Active power	
9	Analog input+	Differential input can be optionally set: ±10 V; A/D converter ±9 bit; resolution 20 mV, R_e = 40 kΩ	
10	Analog input -	0 ... 20 mA; A/D converter 10 bit; resolution 0.02 mA, R_e = 150 Ω 4 ... 20 mA; A/D converter 10 bit; resolution 0.02 mA, R_e = 150 Ω	
11	Analog ground	Reference ground of the reference voltage or the analog output (X14.8)	

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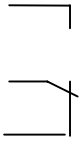
Terminal	Designation	Comment
X15	**Motor temperature sensor**	
1	PTC / KTY+	Connecting a motor temperature sensor (PTC or KTY84). When connecting a KTY84, observe the correct polarity!
2	PTC / KTY -	

X16	Relay output	
1	N/O contact	 Relay output Load capability: 250 V AC, 7 A 30 V DC, 7 A 
2	Common contact	
3	N/C contact	Contact-lifetime: - 500.000 switching cycles at 7A (250V AC, resistive load, cos phi = 1) - 7.600.000 switching cycles at 0,01A (230V AC, cos phi = 0.38)

X17	Digital inputs / incremental encoder	
1	P15V output	I_{maxIGR} = 250 mA – (Number of digital outputs ∗ 11,4 mA) When connecting the optional terminal strip expansion KL17037: I_{maxIGR} = 150 mA – (Number of digital outputs ∗ 11,4 mA)
2	Dig. input 6 encoder track A+	Selectable function: Digital input / encoder (IGR) The standard function of the terminal is a digital input. Digital inputs without electrical isolation Input current at 24 V: 8.6 mA H signal: +13 V ... +33 V L signal: –3 V ... +5V or open terminal In the factory setting, the following applies digital input 6: Function “**ON**” digital input 7: Function “**Operating enable**” digital input 8: Function can be selected using P0880 Connecting an incremental encoder with 15 V supply, two signal tracks, zero signal track and the inverted track is possible
3	Dig. input 9 encoder track A-	
4	Dig. input 7 encoder track B+	
5	Dig. input 10 encoder track B-	
6	Dig. input 8 encoder track R+	
7	Dig. input 11 encoder track R-	
8	Dig. Ground P15V	Reference ground, to +15 V (X17.1)

Tab.:4-11 Description of control terminals on SR17000

Providing the Reference Potential when Operating Serveral RD 500s

If devices of the RD 500 series are potentially connected with each other and / or to an external control, a central connection must be established between the reference ground and the PE. To do this, proceed as follows:

- Disconnect the reference ground X14.7 – PE (housing) cable connection from all converters / inverters (RD51, RD52, RS51)
- Disconnect bridge X11.14 from X11.15 in the supply modules (RD41, RD42)
- Create a neutral point connection of all RD500 reference grounds (terminal X14.7 / X11.14 for each) using any existing PLC ground
- Connect the reference ground neutral point to the PE, preferentially in the PLC switch cabinet (if necessary, set the terminal)

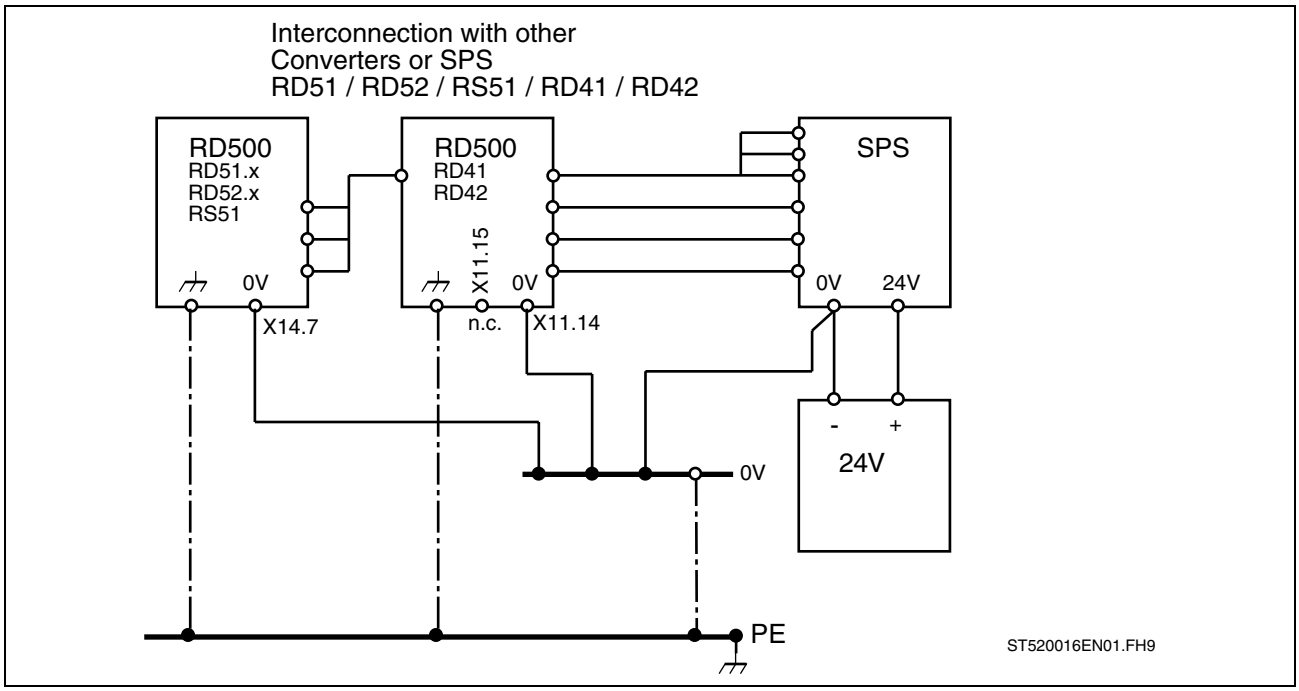


Fig.:4-12 Central Connection reference ground to PE

If there is no potential control connection between the devices (e.g. coupling using fiber optic cabler), the reference ground is directly connected to the PE on each device.

Note: When delivered, RD 500 devices have a direct connection between the reference ground and the PE via the X14.7 cable connection to the housing (RD51, RS51, RD52) or via jumper X11.14 / 15 (RD41, RD42).

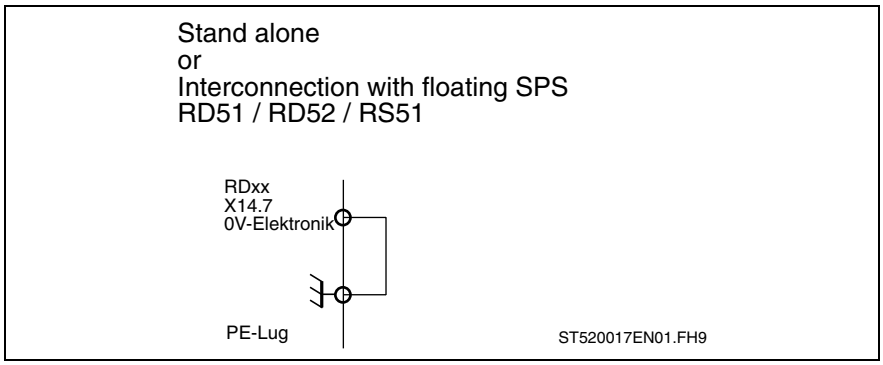


Fig.:4-13 Central connection between reference ground PE in RD51, RS51 and RD52

Incremental encoder connection

Terminal strip X17 has a double function. When the equipment is supplied, the terminals are used as digital inputs. This can be changed-over to connect an HTL incremental encoder using parameter P0130 (encoder selection).

Note: The maximum cable length between the encoder and evaluation electronics depends on the encoder!

Please observe the limit frequency of the evaluation electronics as well as that of the encoder.

Connection	Limit frequency
Connection without inverted tracks	150 Hz
Connection with inverted tracks	300 Hz

Tab.:4-14 Limit frequency of the evaluation electronics

Signals shown when viewing the drive side of the motor shaft with the motor rotating clockwise

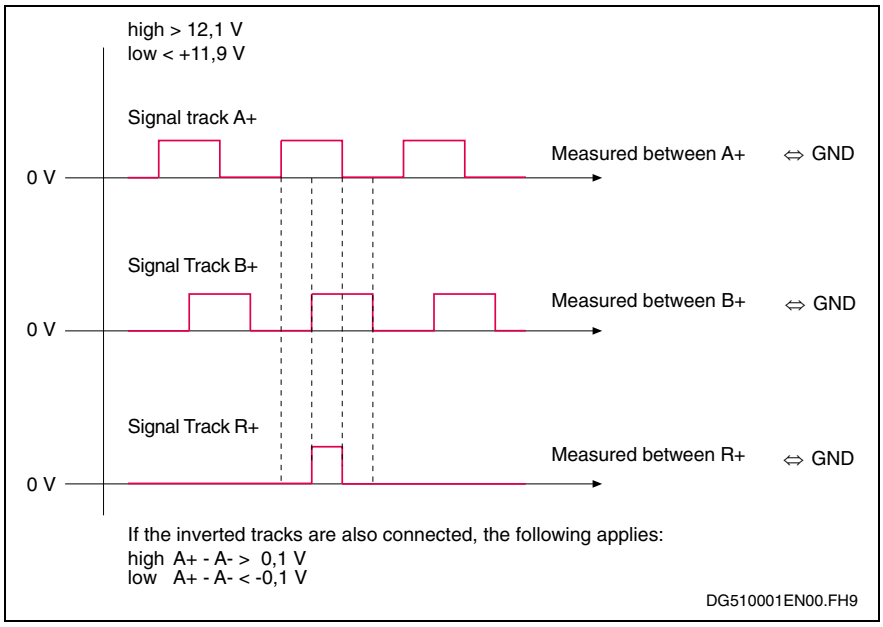


Fig. 4-15: Incremental encoder, signals

Parameterization

The incremental encoder is parameterized in the “Free parameterization“.

Parameter No.:	Name	Description / explanation of the selectable options	Factory setting min ... max values	Pass-word
0130	Encoder selection X17	Selects the incremental encoder: 0 = no encoder 1 = incremental, 2 track 2 = incremental, 1 track, clockwise 3 = incr., 1 track, counter-clockwise	No encoder 0 ... 3	2
0132	IGR pulse number X17	Selects the incremental encoder pulse number	1024 1 ... 8192	2
0135	Encoder, normalization	Incremental encoder normalization: 0 = internal 1 = external	Internal 0 / 1	2
0136	Pole pair number external		2 1 ... 32	2

Parameter No.:	Name	Description / explanation of the selectable options	Factory setting min ... max values	Pass-word
0137	Freq.normalization ext.		50.0 Hz 5.0 ... 1500.0 Hz	2
0138	IGR measuring time X17		D1800 1 ... 2044 (D par)	2

Fig. 4-16: Incremental encoder parameterization

Connection schematic, incremental encoder evaluation, HTL signal level

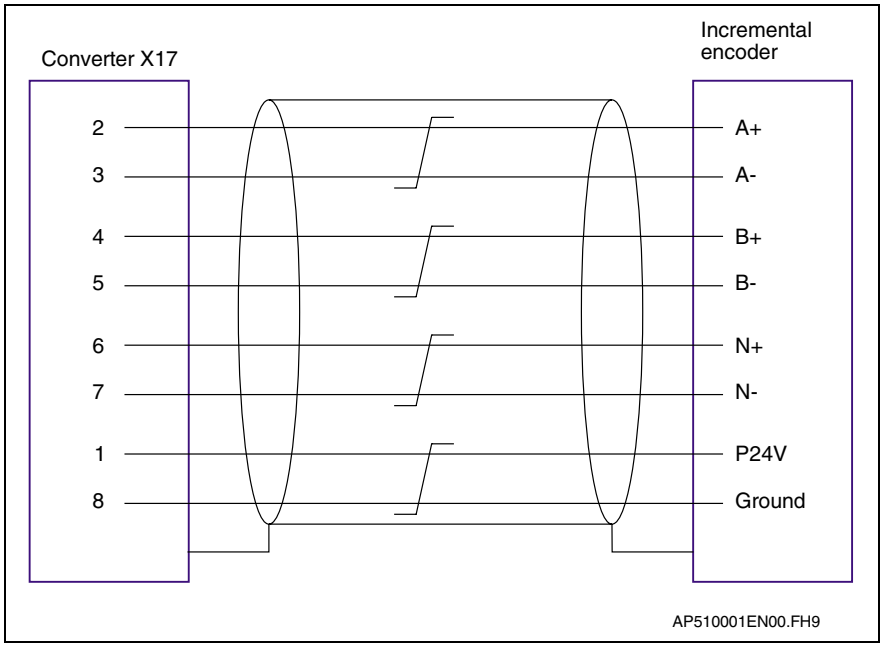


Fig. 4-17: Incremental encoder, connection schematic

Technical data

Supply voltage V_B (DC): 24 V

Max. output current: I_{maxIGR} = 250 mA – (number of digital outputs ∗ 11.4 mA)

When connecting a terminal strip expansion KL 17037:
I_{maxIGR} = 150 mA – (number of digital outputs ∗ 11.4 mA)

Limit frequency: 150 kHz, when using the inverted tracks, 300 kHz

4.8 Service Interface RS 232 (X11)

This interface is used to connect the user panel or a PC with RDwin. A preassembled standard extension cable can be obtained from Indramat Refu to connect the devices (Order No.: 0013456, length 5 m).

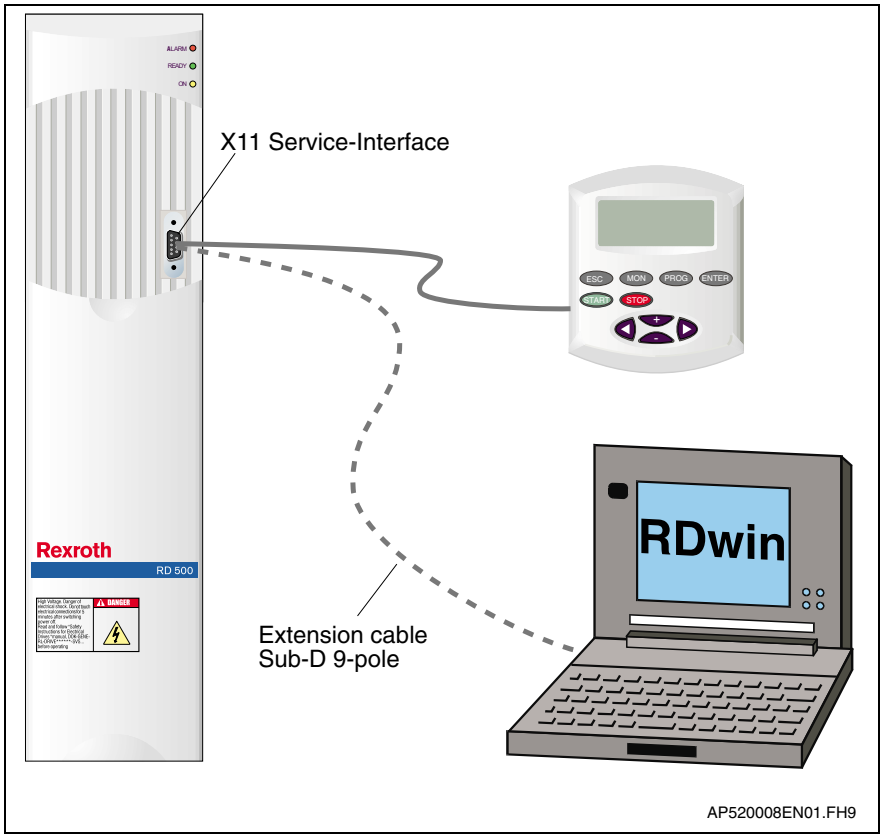


Fig.: 4-18: Possibilities of connecting to the service interface

Connecting the User Panel

The user panel can either be directly connected to connector X11 or connected using the cable specified above.

Connecting a PC

The cable to connect a PC must have the following configuration:

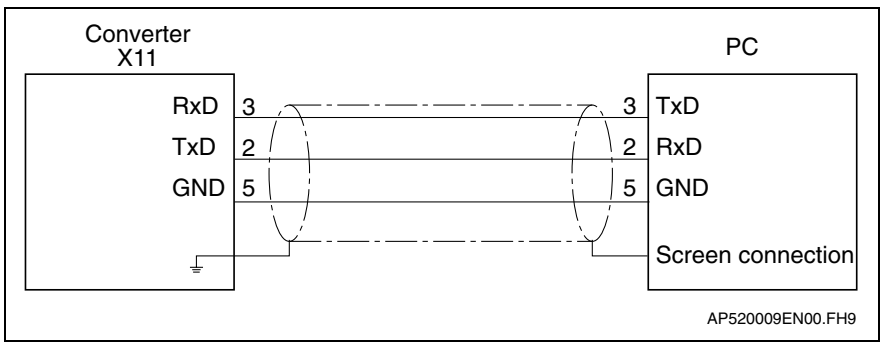


Fig.:4-19 Connecting cable for PC

Alternatively, the user panel cable can also be used.

Parameterizing Service Interface RS232

The service interface also operates with the USS protocol.

However, the protocol type is fixed (4 / 6 words, even parity, 1 stop bit).

See function description: DOK-RD500-RD51*xxVRS*-FKxx-EN-P.

The baud rate can be selected using P0499.

Parameter No.:	Name	Description / explanation of selectable options	Factory setting min / max values	Pass-word
0499	RS232 baud rate X11	Parameter value: 0 = 1200 Baud 1 = 2400 Baud 2 = 4800 Baud 3 = 9600 Baud 4 = 19,200 Baud 5 = 38,400 Baud 6 = 57,600 Baud 7 = 76,800 Baud	9600 baud 0 - 7	2

Fig.:4-20 Parameters for RS232

The following settings should be observed:

Baud rate: Can be set using P0499: 1200, 2400, 4800, **9600** (factory setting), 19200, 38400, 57600, 76800 baud

Data bits: 8

Parity: Even

Stop bits: 1

Protocol type: USS protocol, 4 / 6 words

4.9 Standard Interface RS485 (X12)

The RS485 interface supports the USS protocol, which is used to control the converter from a PLC. The USS protocol for a universal serial interface defines an access technique according to the master-slave principle for communication via a serial bus.

See function description: DOK-RD500-RD51*xxVRS*-FKxx-EN-P.

Terminal Diagram of the Logic and Control Card

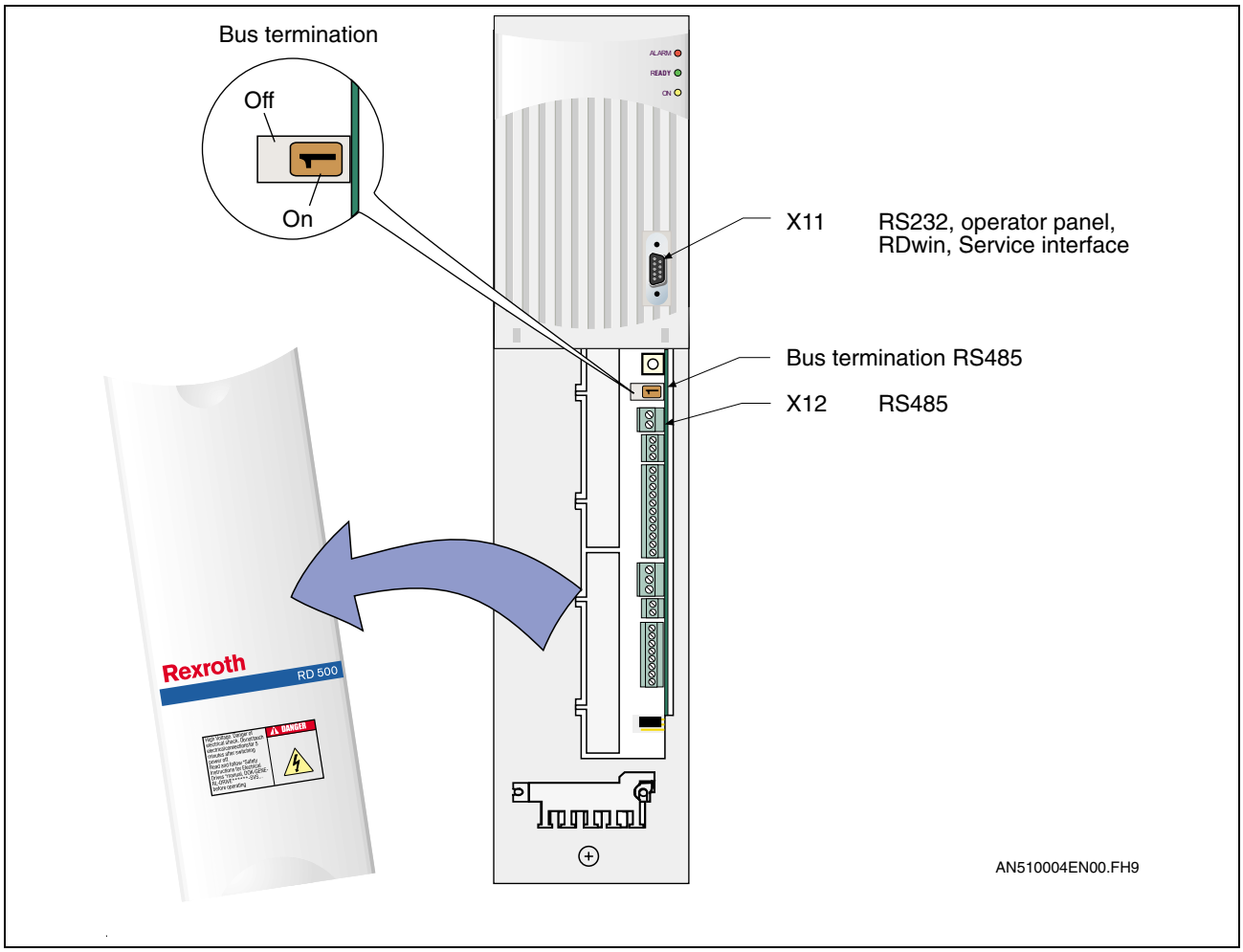


Fig.: 4-21 Terminal diagram SR 17000

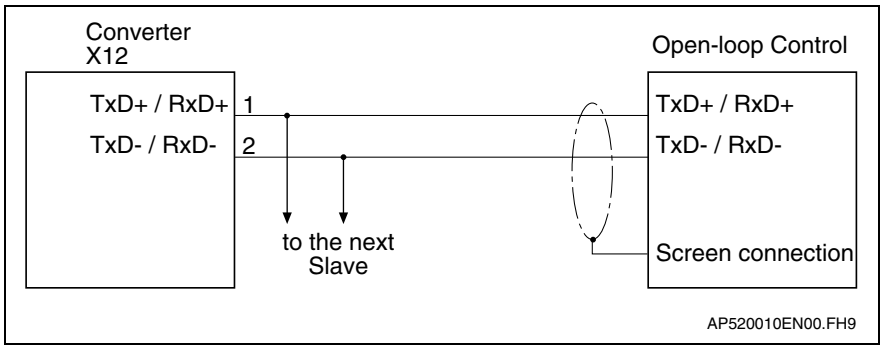


Fig.: 4-22 Connection, standard interface

When using this interface, it should be ensured that the same interface configuration is set for each bus node.

Exception: "SS1 slave address"; in this case, each bus node (station) has its own address.

Bus Termination

The bus must be terminated at the first and last node of a bus system to protect it against interference effects. The bus terminator is switched on using a switch on the control card (refer to Fig.: 4-21 Terminal diagram SR 17000).

Parameterizing the Converter

The configuration of the standard RS485 interface should be set using parameters P0500 to P0506.

The parameters are accessed as follows via the menu:

PARAMETERIZATION/PROMPTEDPARAMETR/SER. COMMUNICATION

Parameterizing the Standard RS485 Interface

Parameter No.:	Name	Description / explanation of selectable options	Factory setting min / max values	Pass-word
0500	SS1 protocol X12	Serial interface 1 (SS1) is a RS485 interface (X12 connection) Parameter value: 0 = no protocol 1 = USS 4 / 2 words 2 = USS 4 / 6 words 3 = USS 0 / 2 words 4 = USS 0 / 6 words 5 = USS 4 / 0 words	USS 4 / 6 words 0 - 5	2
0501	SS1 baud rate X12	Parameter value: 0 = no protocol 1 = 1200 Baud 2 = 4800 Baud 3 = 9600 Baud 4 = 19,200 Baud 5 = 38,400 Baud 6 = 76,800 Baud	9600 baud 0 - 6	2
0502	SS1 parity X12	Parameter value: 0 = no parity 1 = ODD 2 = EVEN	EVEN 0 - 2	2
0503	SS1 stop bits X12	Either 1 or 2 stop bits can be set.	1 1 - 2	2
0504	SS1 slave address	For the RS485 bus, the address of the device can be set between 0 and 31. **Caution:** This address must be unique on the bus, i.e. there must be no identical addresses!	0 0 - 31	2
0505	SS1 Rx monitoring	Parameter value: 0 = no action 1 = warning 2 = malfunction	Fault 0 - 2	2
0506	SS1 Rx mon. time	Monitoring time for standard interface SS1. If the interface does not receive an error-free protocol within this time, the response selected in P0505 is initiated.	0.1 s 0.1 - 60.0 s	2

Fig. :4-23 Parameters for RS485

5 Inverter Technical Data

5.1 Technical Data for Size Classes A and B with Pulse frequency f_p = 4 kHz / 8kHz

		4 kHz					8 kHz				
RD51		**003**	**005**	**007**	**015**	**018**	**003**	**005**	**007**	**015**	**018**
Rated motor output [1]	[kW]	3.0	5.5	7.5	15	18.5	2.2	4.0	5.5	11	15
Supply voltage DC 530 ... 670 V (±10 %) [2]											
Output frequency	[Hz]	0 - 250					0 - 500				
Rated current	[A]	7.5	13	18	30	35	5.8	10	13	25	30
Peak current for t = 60 s	[A]	9.8	17	23	39	46	7.5	13	17	33	39
t = 1 s	[A]	13	22	31	51	60	9.9	17	22	43	51
t = 0.5 s	[A]	15	26	36	60	70	12	20	26	50	60
Rated output S_N	[kVA]	4.9	8.6	12	20	23	3.8	6.6	8.6	16	20
Peak power for t = 60s	[kVA]	6.5	11	15	26	30	4.9	8.6	11	22	26
Supply voltage, 700 V DC (±10 %)											
Output frequency	[Hz]	0 - 250					0 - 500				
Rated current	[A]	6	10	14	24	28	4.5	8	10	20	24
Peak current for t = 60 s	[A]	7.8	13	18	31	36	5.9	10	13	26	31
t = 1 s	[A]	10	17	24	41	48	7.7	14	17	34	41
t = 0.5 s	[A]	12	20	28	48	56	9.0	16	20	40	48
Rated output S_N	[kVA]	4.9	8.2	12	20	23	3.7	6.6	8.2	16	20
Peak power for t = 60s	[kVA]	6.4	11	15	26	30	4.9	8.2	11	21	26
Ambient conditions, noise suppression level, interference immunity											
Environmental class		3K3 according to DIN IEC 721-3-3 (ambient temperature 0 - 40° C)									
Cooling air requirement	[m³/s]	0.03	0.03	0.03	0.05	0.05	0.03	0.03	0.03	0.05	0.05
Power loss		In preparation									
Radio int. sup. level/noise immunity		A 1 according to EN 55011 / EN 61800-3 (only with RZF line filter)									
Mechanical design											
Size classes		A	A	A	B	B	A	A	A	B	B
Degree of protection		IP 20 according to EN 60529 with connected plug									
Weight of inverter for the various cooling types											
L Forced air cooling	[kg]	6.5	6.5	6.5	11.3	11.3	6.5	6.5	6.5	11.3	11.3
P heat dissipation panel	[kg]	5.5	5.5	5.5	10.3	10.3	5.5	5.5	5.5	10.3	10.3

1: Max. permissible motor power based on 4-pin standard induction motor
2: Starting at an output voltage Ua > 400 V, the rated current is linearly reduced from 100% to 83% for Va = 480 V.

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5.2 Technical Data for Size Classes A and B with Pulse Frequency f_p = 12 kHz

			12 kHz				
RD51			**003**	**005**	**007**	**015**	**018**
Supply voltage DC 530...670V (± 20 %) [1]							
Output frequency		[Hz]	0 - 1400				
Rated current		[A]	4	7	10	18	22
Peak current for	t = 60 s	[A]	5.2	9.1	13	23	29
	t = 1 s	[A]	6.8	12	17	31	37
	t = 0.5 s	[A]	8	14	20	36	44
Rated output S_N		[kVA]	2.6	4.6	6.6	12	14
Peak power for	t = 60 s	[kVA]	3.4	6.0	8.6	16	18
Ambient conditions, noise suppression level, interference immunity							
Environmental class			3K3 according to DIN IEC 721-3-3 (ambient temperature 0 - 40° C)				
Cooling air requirement		[m³/s]	0.03	0.03	0.03	0.05	0.05
Power loss			In preparation				
Radio int. sup. level/noise immunity			A 1 according to EN 55011 / EN 61800-3				
Mechanical design							
Size classes			A	A	A	B	B
Degree of protection			IP 20 according to EN 60529, with connected plug				
Weight of inverter for the various cooling types							
L Forced air cooling		[kg]	6.5	6.5	6.5	11.3	11.3
P heat dissipation panel		[kg]	5.5	5.5	5.5	10.3	10.3

1: Starting at an output voltage Ua > 400 V, the rated current is linearly reduced from 100% to 83% for Va = 480 V.

5.3 Technical Data for Size Classes C, D and E with Pulse Frequency f_p = 4 kHz

		4 kHz							
RD51		**022**	**030**	**037**	**045**	**055**	**075**	**090**	**110**
Rated motor output [1]	[kW]	22	30	37	45	55	75	90	90
Supply voltage DC 530...670 V (±10 %) [2]									
Output frequency	[Hz]	0 - 250							
Rated current	[A]	43	56	68	82	99	135	165	195
Peak current for t = 60 s	[A]	55	73	88	107	129	176	215	254
t = 1 s	[A]	72	95	116	139	168	230	281	332
t = 0.5 s	[A]	85	112	136	164	198	270	330	390
Rated output S_N	[kVA]	28	37	45	54	65	89	109	128
Peak power for t = 60 s	[kVA]	37	48	58	70	85	116	142	167
Supply voltage 700 V DC (±10 %)									
Output frequency	[Hz]	0 - 250							
Rated current	[A]	34	45	54	66	80	108	130	160
Peak current for t = 60 s	[A]	44	59	70	86	104	140	169	208
t = 1 s	[A]	58	77	92	112	136	184	221	272
t = 0.5 s	[A]	68	90	108	132	160	216	260	320
Rated output S_N	[kVA]	28	37	44	54	66	89	107	132
Peak power for t = 60s	[kVA]	36	49	58	71	86	115	139	171
Ambient conditions, noise suppression level, interference immunity									
Environmental class		3K3 according to DIN IEC 721-3-3 (ambient temperature 0 - 40° C)							
Cooling air requirement	[m³/s]	0.1	0.1	0.2	0.2	0.4	0.4	0.4	0.4
Power loss		In preparation							
Radio int. sup. level / noise immunity		A 1 according to EN 55011 / EN 61800-3							
Mechanical design									
Size classes		C	C	C	C	D	D	E	E
Degree of protection		IP 20 according to EN 60529 (without connection terminals)							
Weight of inverter for the various cooling types									
L Forced air cooling	[kg]	22	22	22	22	32	32	44	44
D Plug-through cooler	[kg]	20	20	20	20	30	30	42	42

1: Max. permissible motor power based on 4-pin standard induction motor
2: Starting at an output voltage Ua > 400 V, the rated current is linearly reduced from 100% to 83% for Va = 480 V.

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5.4 Technical Data for Size Classes C, D and E with Pulse Frequency f_p = 8 kHz

		8 kHz							**6 kHz**
RD51		**022**	**030**	**037**	**045**	**055**	**075**	**090**	**110**
Rated motor output [1]	[kW]	18.5	22	30	37	45	55	75	90
Supply voltage DC 530... 670 V (±10 %) [2]									
Output frequency	[Hz]	0 - 500							
Rated current	[A]	35	43	56	68	82	99	135	165
Peak current for t = 60 s	[A]	46	55	73	88	107	129	176	215
t = 1 s	[A]	60	72	95	116	139	168	230	280
t = 0.5 s	[A]	70	85	112	136	164	198	270	330
Rated output S_N	[kVA]	23	28	37	45	54	65	89	109
Peak power for t = 60s	[kVA]	30	36	48	58	70	85	116	142
Supply voltage DC 700 V (±10 %)									
Output frequency	[Hz]	0 - 500							
Rated current	[A]	28	34	45	55	66	80	108	130
Peak current for t = 60 s	[A]	36	44	59	72	86	104	140	169
t = 1 s	[A]	48	58	77	94	112	136	184	221
t = 0.5 s	[A]	56	68	90	110	132	160	216	260
Rated output S_N	[kVA]	23	28	37	45	54	66	89	107
Peak power for t = 60s	[kVA]	30	36	49	59	71	86	115	139
Ambient conditions, noise suppression level, interference immunity									
Environmental class		3K3 according to DIN IEC 721-3-3 (ambient temperature 0 - 40° C)							
Cooling air requirement	[m³/s]	0.1	0.1	0.2	0.2	0.4	0.4	0.4	0.4
Power loss		In preparation							
Radio int. sup. level/noise immunity		A 1 according to EN 55011 / EN 61800-3							
Mechanical design									
Size classes		C	C	C	C	D	D	E	E
Degree of protection		IP 20 according to EN 60529 (without connection terminals)							
Weight of inverter for the various cooling types									
L Forced air cooling	[kg]	22	22	22	22	32	32	44	44
D Plug-through cooler	[kg]	20	20	20	20	30	30	42	42

1: Max. permissible motor power based on 4-pin standard induction motor
2: Starting at an output voltage Ua > 400 V, the rated current is linearly reduced from 100% to 83% for Va = 480 V.

5.5 Technical Data for Size Classes C, D and E with Pulse Frequency f_p = 12 kHz

		12 kHz							
RD51		**022**	**030**	**037**	**045**	**055**	**075**	**090**	**110**
Supply voltage DC 530...670 V (±10 %)									
Output frequency	[Hz]	0 - 1400							
Rated current	[A]	30	35	40	52	68	80	80	80
Peak current for t = 60 s	[A]	39	46	52	68	88	104	104	104
t = 1 s	[A]	51	60	68	88	116	136	136	136
t = 0.5 s	[A]	60	70	80	104	136	160	160	160
Rated output S_N	[kVA]	20	23	26	34	45	53	53	53
Peak power for t = 60s	[kVA]	26	30	34	44	58	68	68	68
Ambient conditions, noise suppression level, interference immunity									
Environmental class		3K3 according to DIN IEC 721-3-3 (ambient temperature 0 - 40° C)							
Cooling air requirement	[m³/s]	0.1	0.1	0.2	0.2	0.4	0.4	0.4	0.4
Power loss		In preparation							
Radio int. sup. level / noise immunity		A 1 according to EN 55011 / EN 61800-3							
Mechanical design									
Size classes		C	C	C	C	D	D	E	E
Degree of protection		IP 20 according to EN 60529 (without connection terminals)							
Weight of inverter for the various cooling types									
L Forced air cooling	[kg]	22	22	22	22	32	32	44	44
D Plug-through cooler	[kg]	20	20	20	20	30	30	42	42

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5.6 Technical Data for Size Classes G with Pulse Frequency f_p = 4 kHz / 8kHz

		4 kHz			8 kHz		
RD51		**132**	**160**	**200**	**132**	**160**	**200**
Rated motor output [1]	[kW]	132	160	200	110	132	160
Supply voltage DC 530...670 V (±10 %) [2]							
Output frequency [3]	[Hz]	0-250	0 - 150		0 - 500	0 - 250	
Rated current	[A]	230	290	350	195	230	280
Peak current for t = 60 s	[A]	299	377	455	254	299	364
t = 1 s	[A]	391	493	595	332	391	476
Rated output S_N	[kVA]	151	191	230	128	151	184
Peak power for t = 60s	[kVA]	197	248	299	166	197	240
Supply voltage DC 700 V (±10 %)							
Output frequency [3]	[Hz]	0 - 250	0 - 150		0 - 500	0 - 250	
Rated current	[A]	190	240	280	160	190	240
Peak current for t = 60 s	[A]	247	312	364	208	247	312
t = 1 s	[A]	323	408	476	272	323	408
Rated output S_N	[kVA]	156	197	230	132	156	197
Peak power for t = 60 s	[kVA]	203	257	299	171	203	257
Ambient conditions, noise suppression level, interference immunity							
Environmental class		3K3 according to DIN IEC 721-3-3 (ambient temperature 0 - 40° C)					
Cooling air requirement	[m³/s]	0.4	0.4	0.6	0.4	0.4	0.6
Power loss		In preparation					
Radio int. sup. level / noise immunity		A 1 according to EN 55011 / EN 61800-3					
Mechanical design							
Size classes		G	G	G	G	G	G
Degree of protection		IP 20 according to EN 60529 (without connection terminals)					
Weight of inverter for the various cooling types							
F Forced air cooling with integrated liquid circuit	[kg]	128	128	128	128	128	128
R Liquid cooling with internal pump	[kg]	105	105	105	105	105	105

1: Max. permissible motor power based on 4-pin standard induction motor
2: Starting at an output voltage Ua > 400 V, the rated current is linearly reduced from 100% to 83% for Va = 480 V.
3: If Output frequency >150Hz the additional function M1 is required (without integrate Motor filter)

5.7 Technical Data for Size Classes G with Pulse Frequency f_p = 12 kHz

		12 kHz		
RD51		**132**	**160**	**200**
Supply voltage DC 530...670 V (±10 %)				
Output frequency [1]	[Hz]	0 - 1000	0 - 500	
Rated current	[A]	140	170	210
Peak current for t = 60 s	[A]	182	221	273
t = 1 s	[A]	238	289	357
Rated output S_N	[kVA]	92	112	138
Peak power for t = 60 s	[kVA]	120	145	180
Ambient conditions, noise suppression level, interference immunity				
Environmental class		3K3 according to DIN IEC 721-3-3 (ambient temperature 0 - 40° C)		
Cooling air requirement	[m³/s]	0.4	0.4	0.6
Power loss		In preparation		
Radio int. sup. level / noise immunity		A 1 according to EN 55011 / EN 61800-3		
Mechanical design				
Size classes		G	G	G
Degree of protection		IP 20 according to EN 60529 (without connection terminals)		
Weight of inverter for the various cooling types				
F Forced air cooling with integrated liquid circuit	[kg]	128	128	128
R Liquid cooling with internal pump	[kg]	105	105	105

1: If Output frequency >150Hz the additional function M1 is required (without integrate Motor filter)

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5.8 Circuit Principle

Circuit Principle of Electronics Section

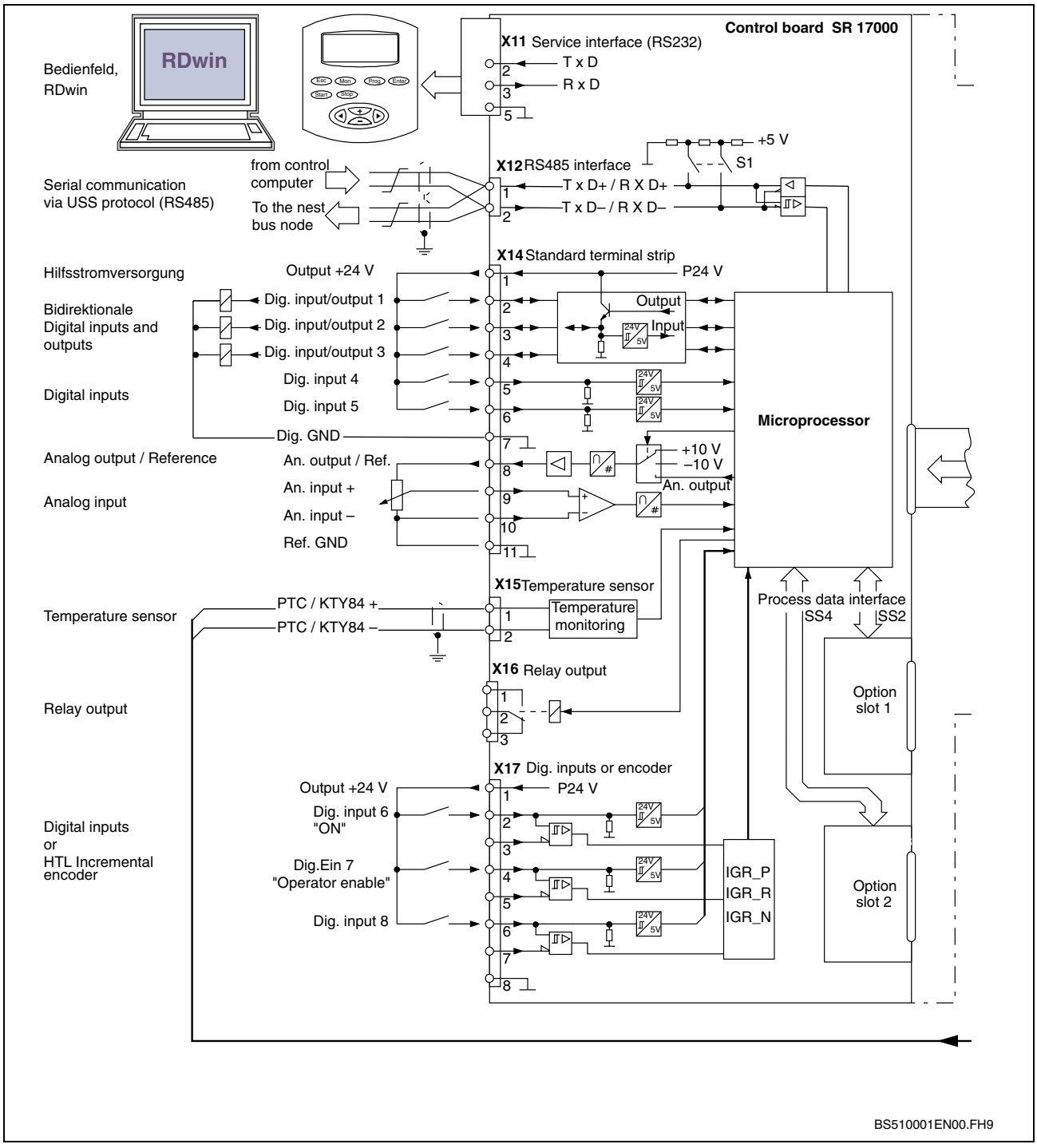


Fig.: 5-1 Circuit principle of electronics section

Circuit Principle of Power Section, Size Classes A and B

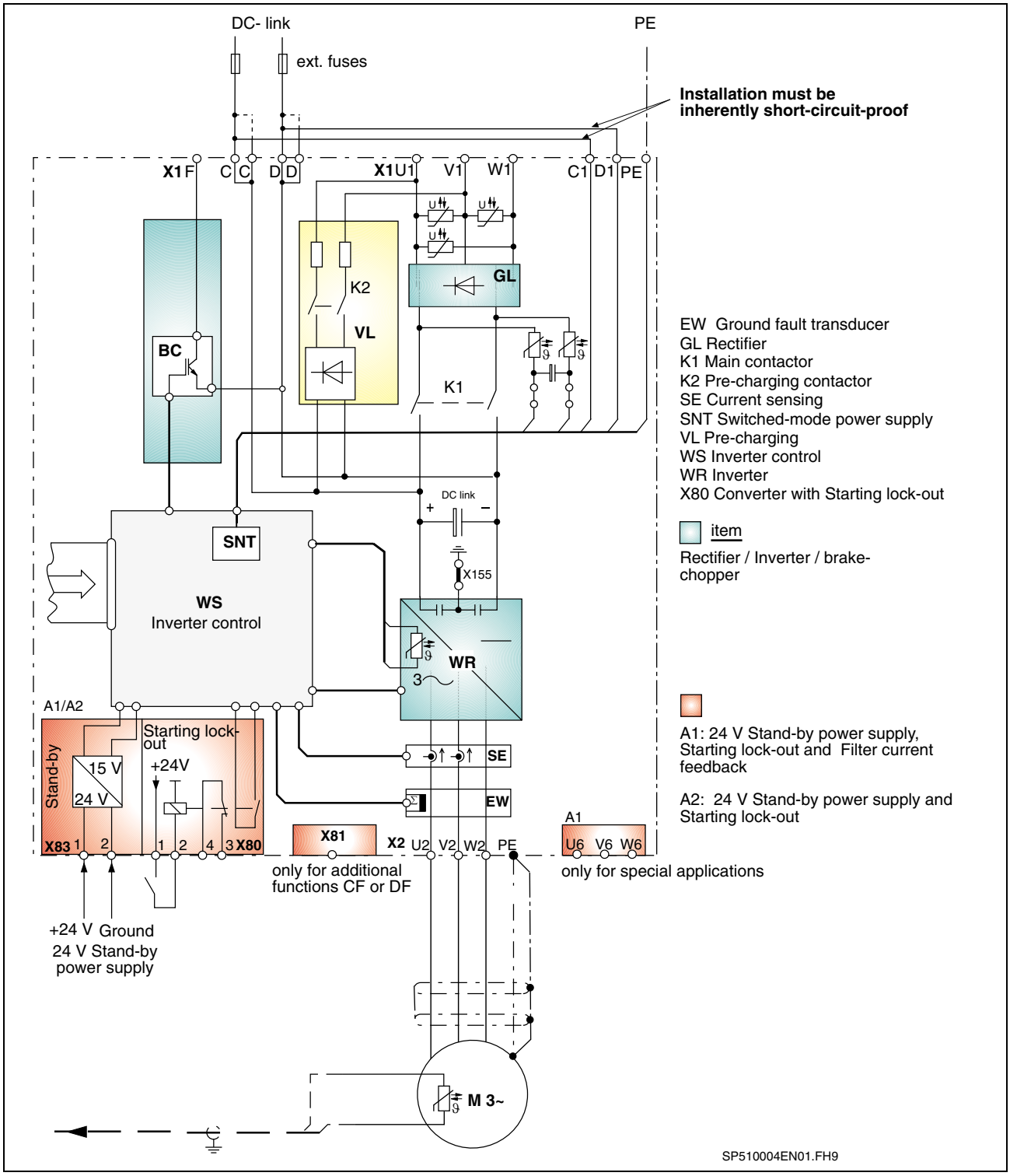


Fig.: 5-2 Sample connection of classes A – B when using inverter

Note: Connections C1 - C and D1 - D absolutely must be made.

Note: The leakage current compared to PE is greater than 3.5 mA. The grounded conductor connection is laid out for 10 mm² (AWG 6).

Circuit Principle of Power Section, Size Classes C - E

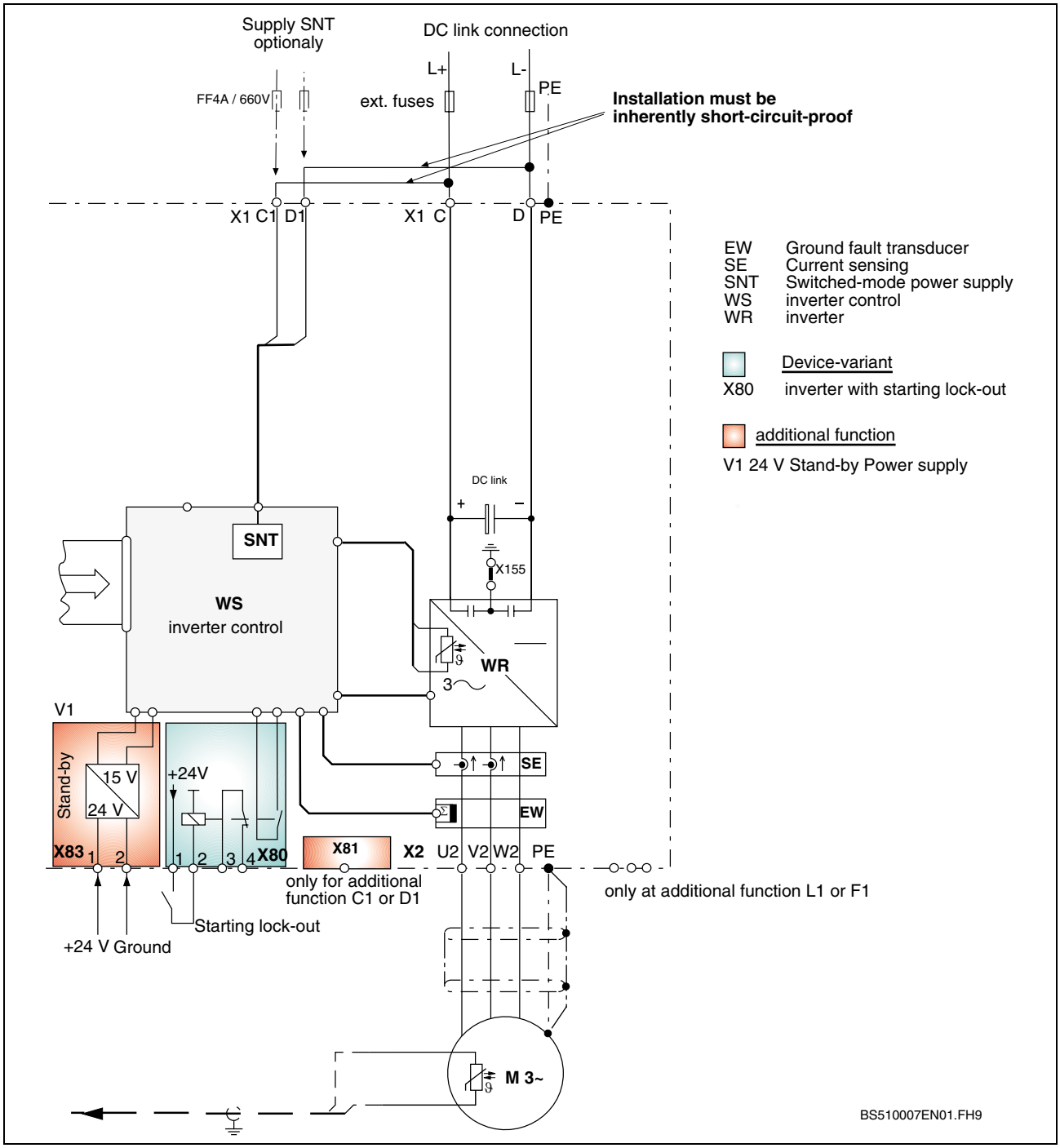


Fig.: 5-3 Circuit principle of power section, inverter classes C - E

Note: The connection (inherently short circuit proof) between C1 – C and D1 - D can be made .

-or-

As an Option the external supply of switched-mode power supply is possible.

Circuit Principle of Power Section, Size Class G

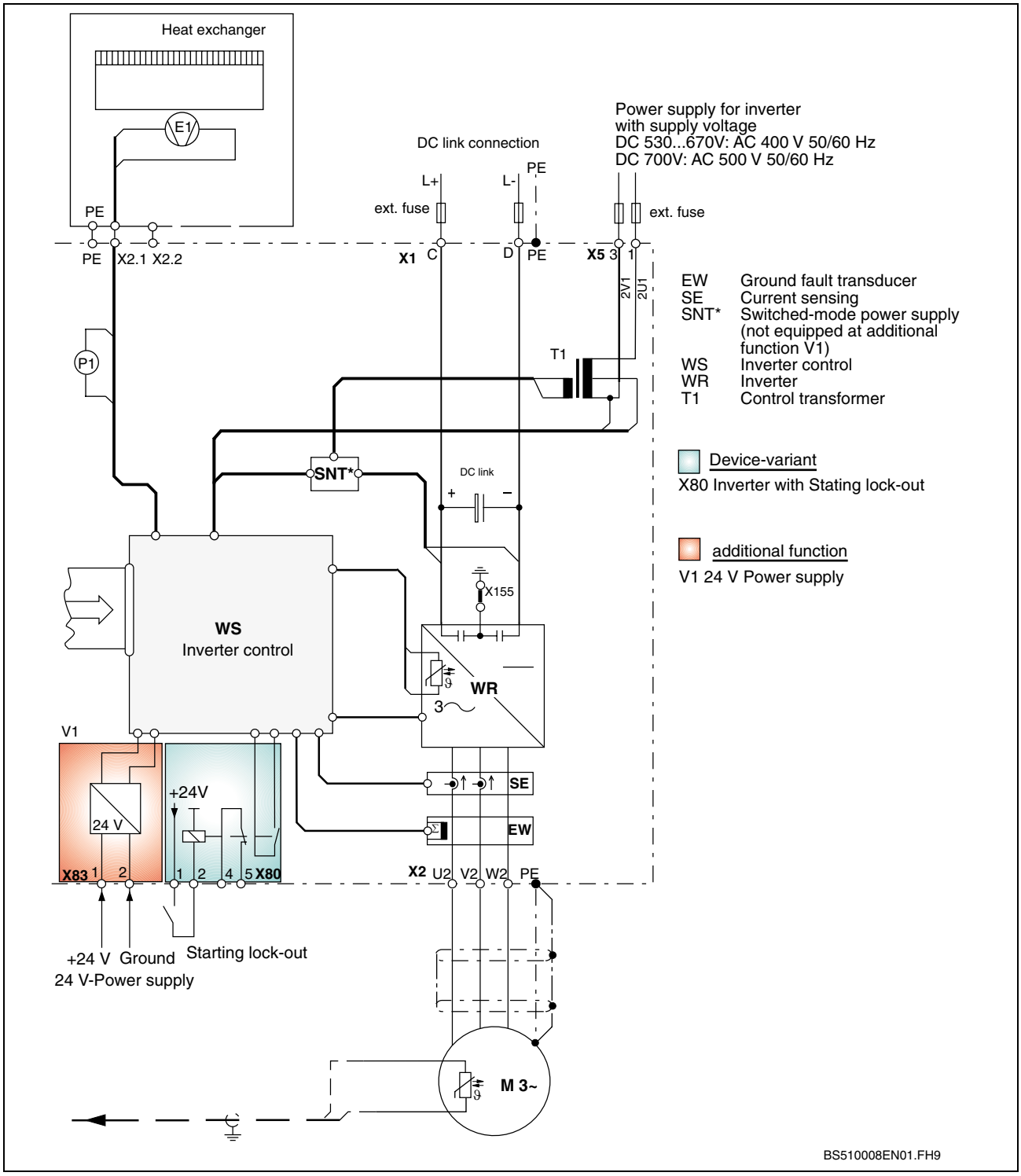


Fig.: 5-4 Circuit principle of power section, inverter size class G

Note: When additional function V1 is used, module SNT is not equipped. See Chapter 11.1.

5.9 Mechanical Assembly

Storage and Setup

Storage

The devices must be stored in a clean, dry space. The storage temperature must be between -25° C and +70° C. Temperature variations greater than 20 K per hour are not permitted.

Note:

The converter and supply modules have AL electrolytic capacitors as DC link capacitors. They can be stored for a maximum of 2 years, not under power, at a storage temperature of ≤ 40°

Minimum Requirements at the Installation Location

- The operating area should be dust-free. Dust-laden air must be filtered (3K3 acc. to DIN IEC 721-3-3).
- The ambient temperature must lie between 0 and 40° C.
- The relative humidity may not exceed 90%; condensation is not permissible.
- The supplied air must not contain any aggressive or electrically conducting gases that may endanger functioning of the device.
- The airflow of the fans may not be impeded. The minimum free spaces specified for the supply air and exhaust air for each size class must not be restricted by auxiliary add-ons.
- The device causes power loss and heats the surroundings. Therefore, a sufficient clearance from heat-sensitive devices must be ensured.

Setup Elevations Exceeding 1000 Meters above Sea Level:

The utilization of the inverter must be reduced (derated) corresponding to the diagram below for installation altitudes above 1000 meters above sea level.

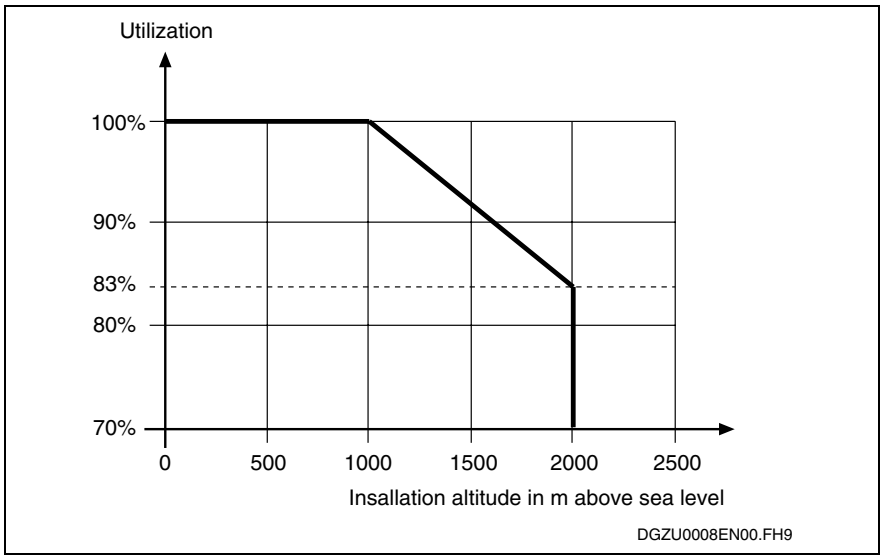


Fig.: 5-5 Derating depending on setup elevation

5.10 Mounting Inverter Size Classes A to E

- The RD 500 units, sizes A to E are modular and are designed for mounting in cabinets.
- The units have a 22.5 mm mechanical grid pattern. Several drive units can be mounted next to one another without any intermediate space (with the exception of device size classes A - B with cooling type P) when using mounting rails with tapped holes (also refer to the assembly example).
- Assembly must be carried out perpendicular to a level construction area.
- A minimum clearance of 100 mm above and below the unit must be maintained to ensure that the cooling air can flow unrestricted.
- When the drive units are mounted in a cabinet, the cooling air requirement of the units must be calculated (refer to Technical data 5.1 to 5.5) and the cabinet ventilation appropriately dimensioned.
- The fastening screws are shown in the drilling templates of the dimension drawings.

Dimension Drawing, Size Classes A - B

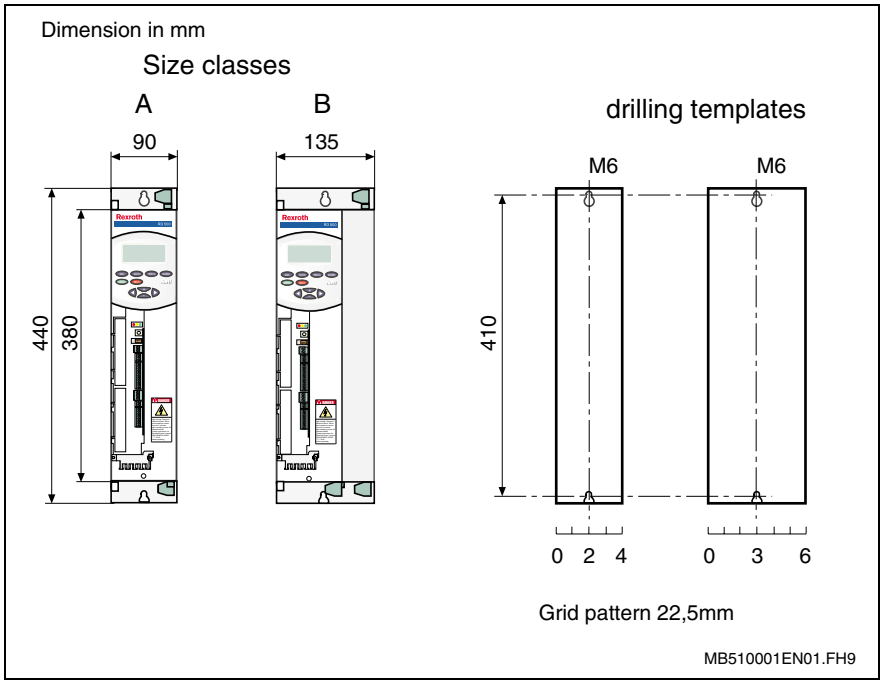


Fig.: 5-6 Dimension sheet, size classes A - B

Dimension Drawings for Cooling Types L and P for Size Classes A - B

Devices with forced air-cooling, sizes A and B to E have different depths. Clearance brackets are available for size A drive converters. These allow the depth to be compensated when mounted with other inverters having different sizes. Refer to Fig.: 5-7.

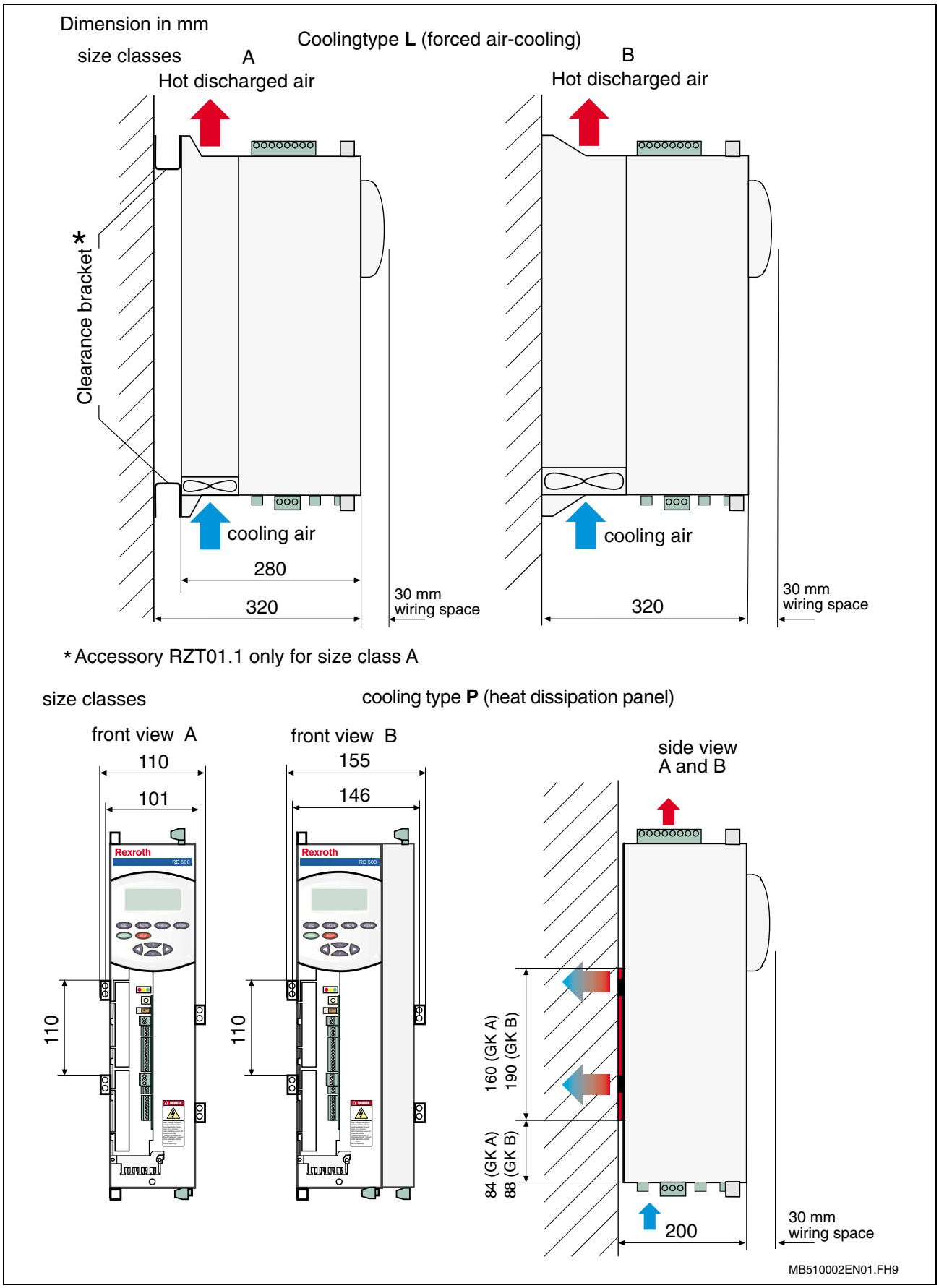


Fig.: 5-7 Cooling types, size classes A - B

Assembly Example of Several Devices next to Each Other for Cooling Type P

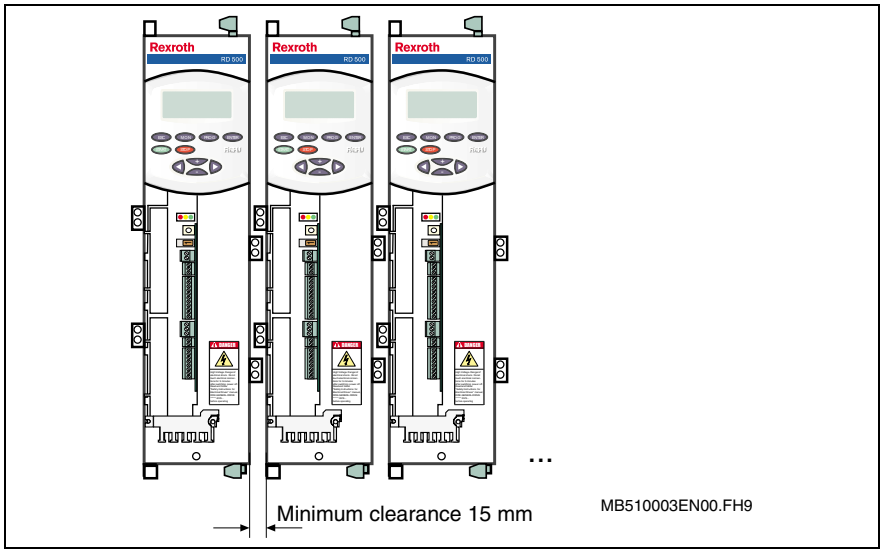


Fig.: 5-8 Arrangement of several devices next to each other for cooling type P

Minimum Cooling Spacing for Cooling Type L and P

An assembled device with forced air-cooling and Heat dissipation panel, size classes A and B, is shown in the drawing below.

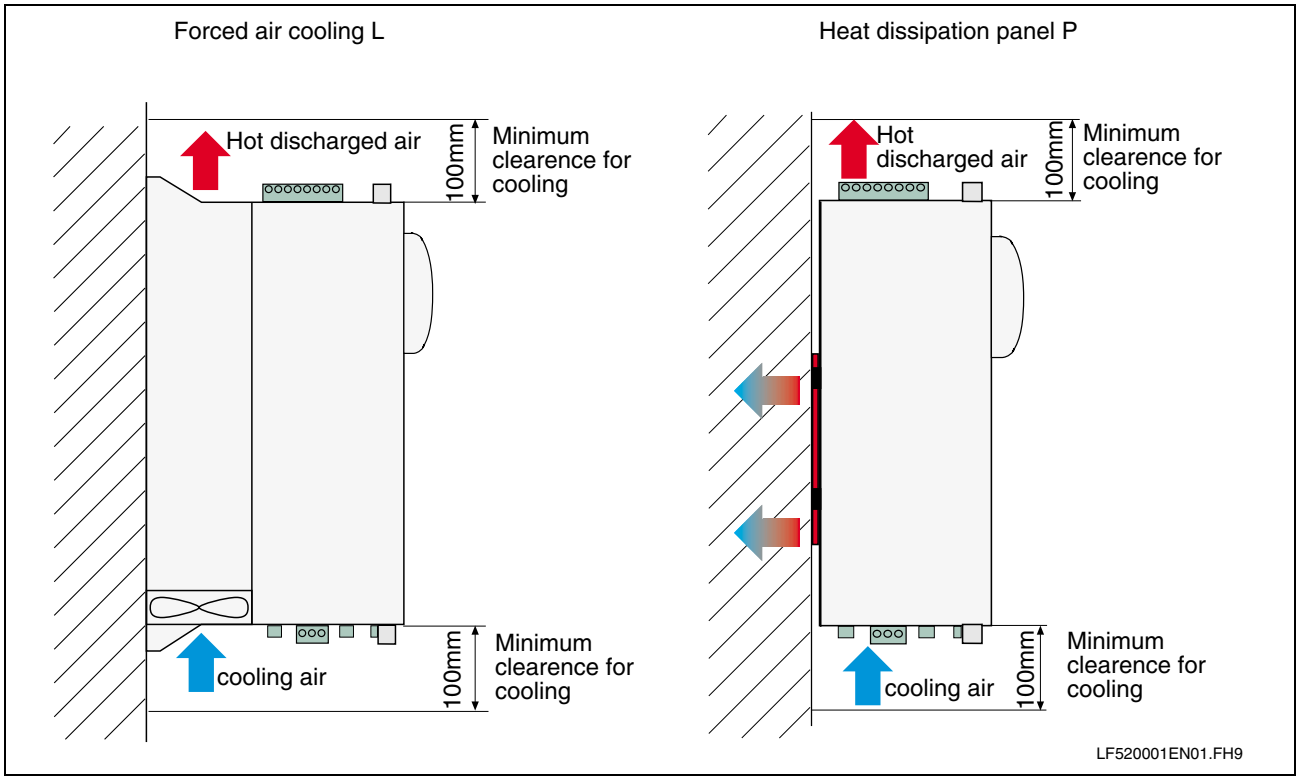


Fig.: 5-9 Minimum spacing for assembly

Dimension Drawing, Size Classes C, D, E

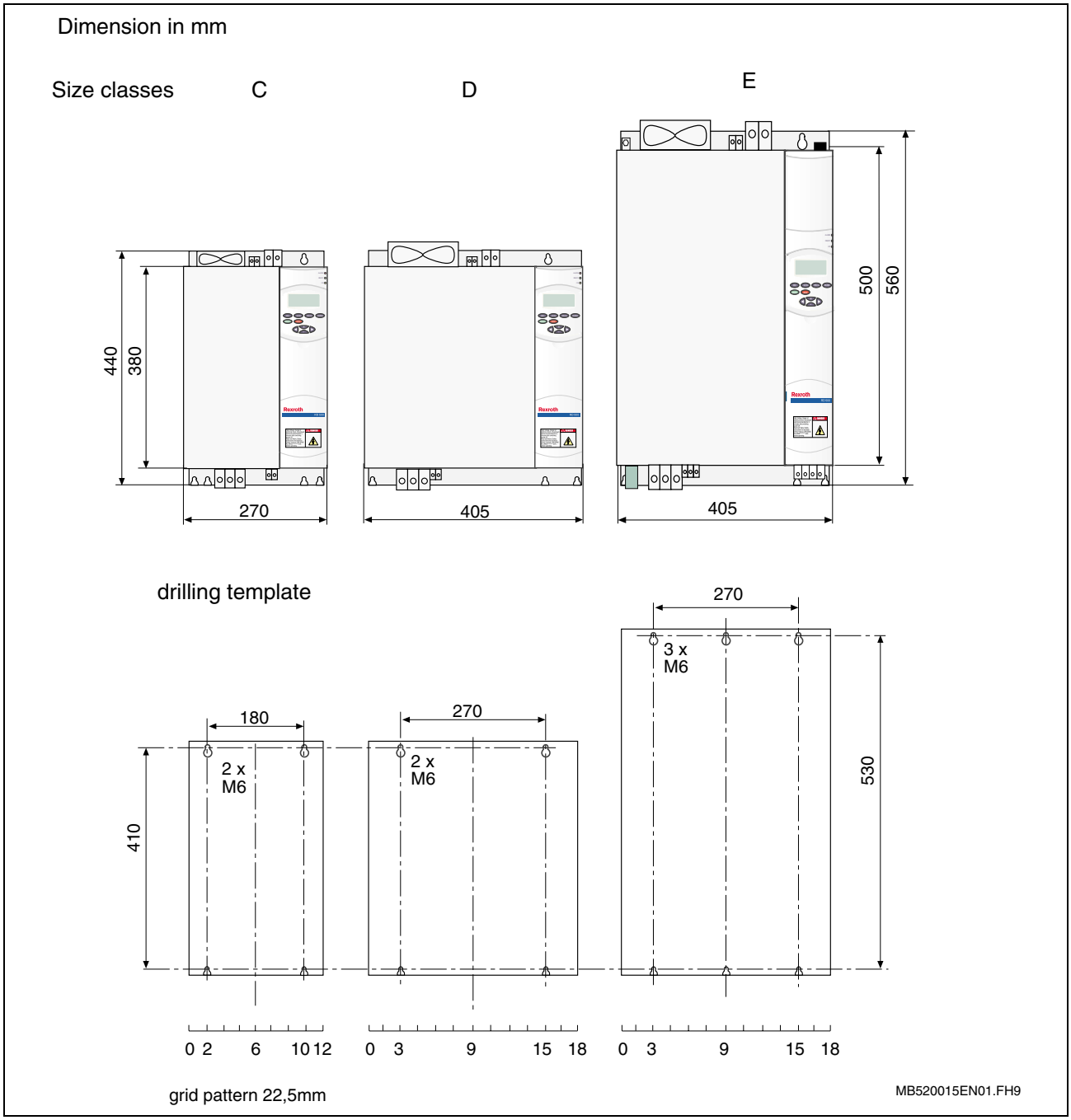


Fig.: 5-10 Dimension sheet, size classes C, D, E

Dimension Drawing of Cooling Type L for Size Classes C, D, E

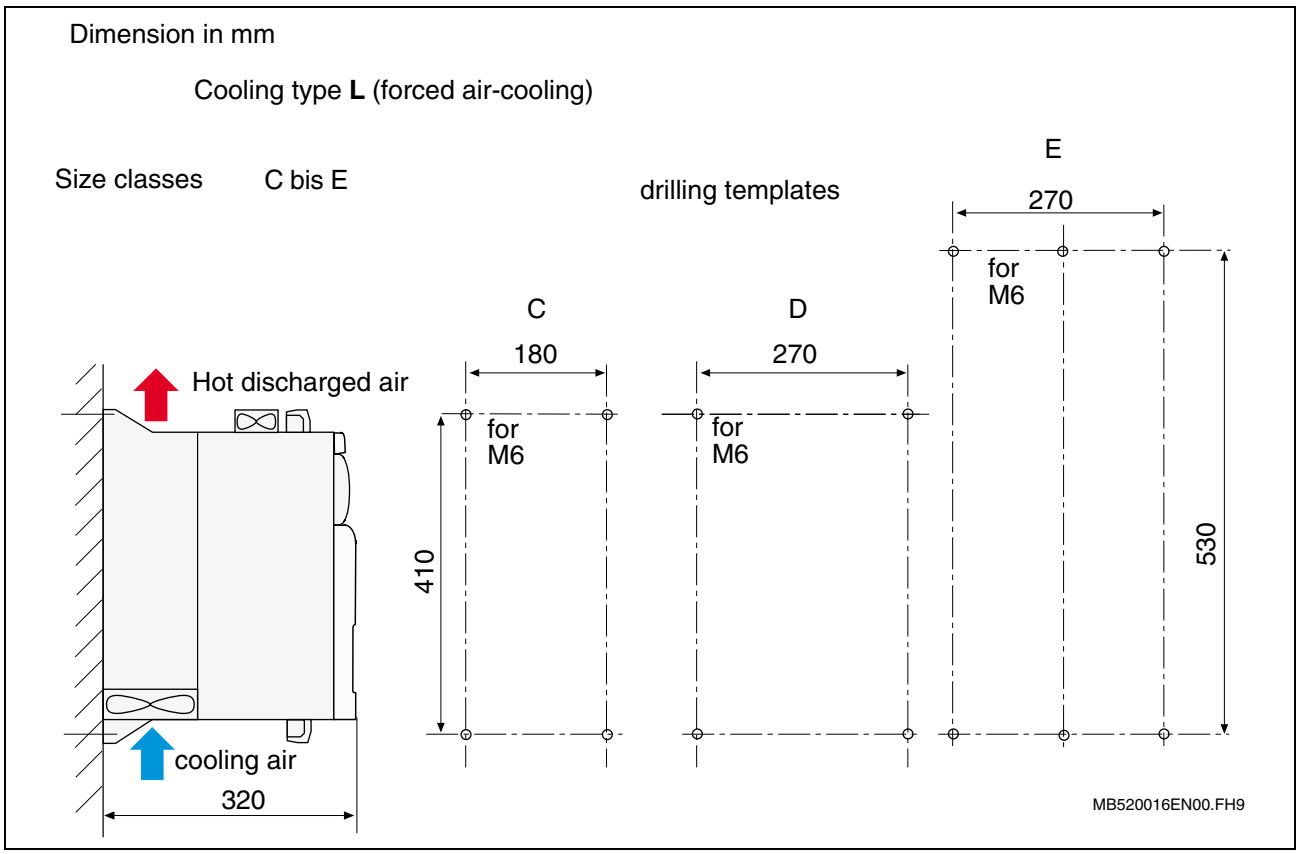


Fig.: 5-11 Dimension sheet for cooling type L, size classes C, D, E

Minimum Cooling Spacing for Cooling Type L

An assembled inverter with forced-air cooling, size classes C, D and E, is shown in the drawing below.

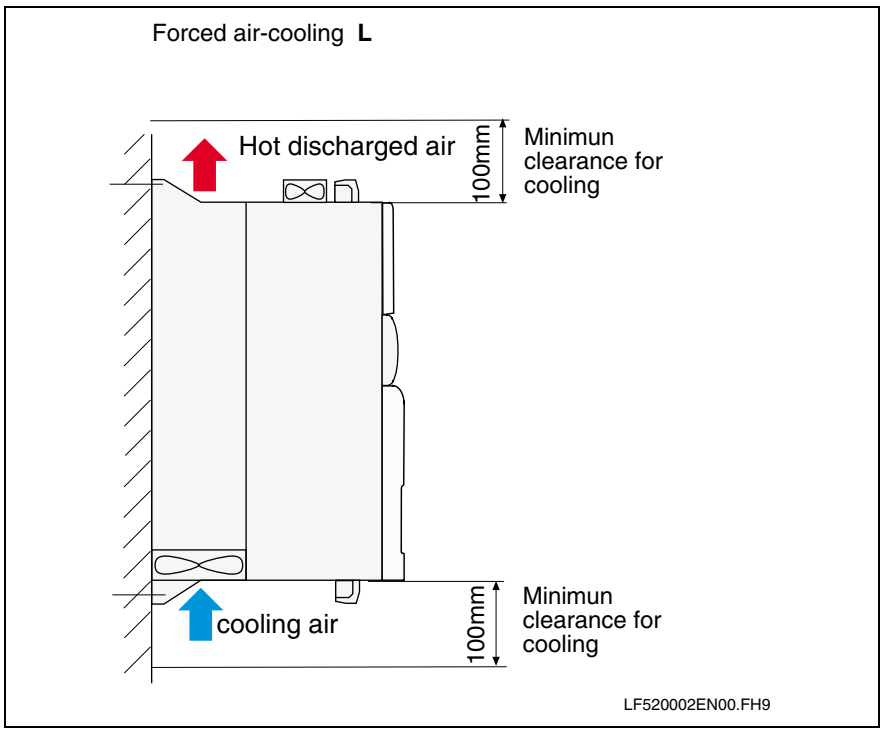


Fig.: 5-12 Minimum spacing for assembly

Dimension Drawing of Cooling Type D for Size Classes C, D, E

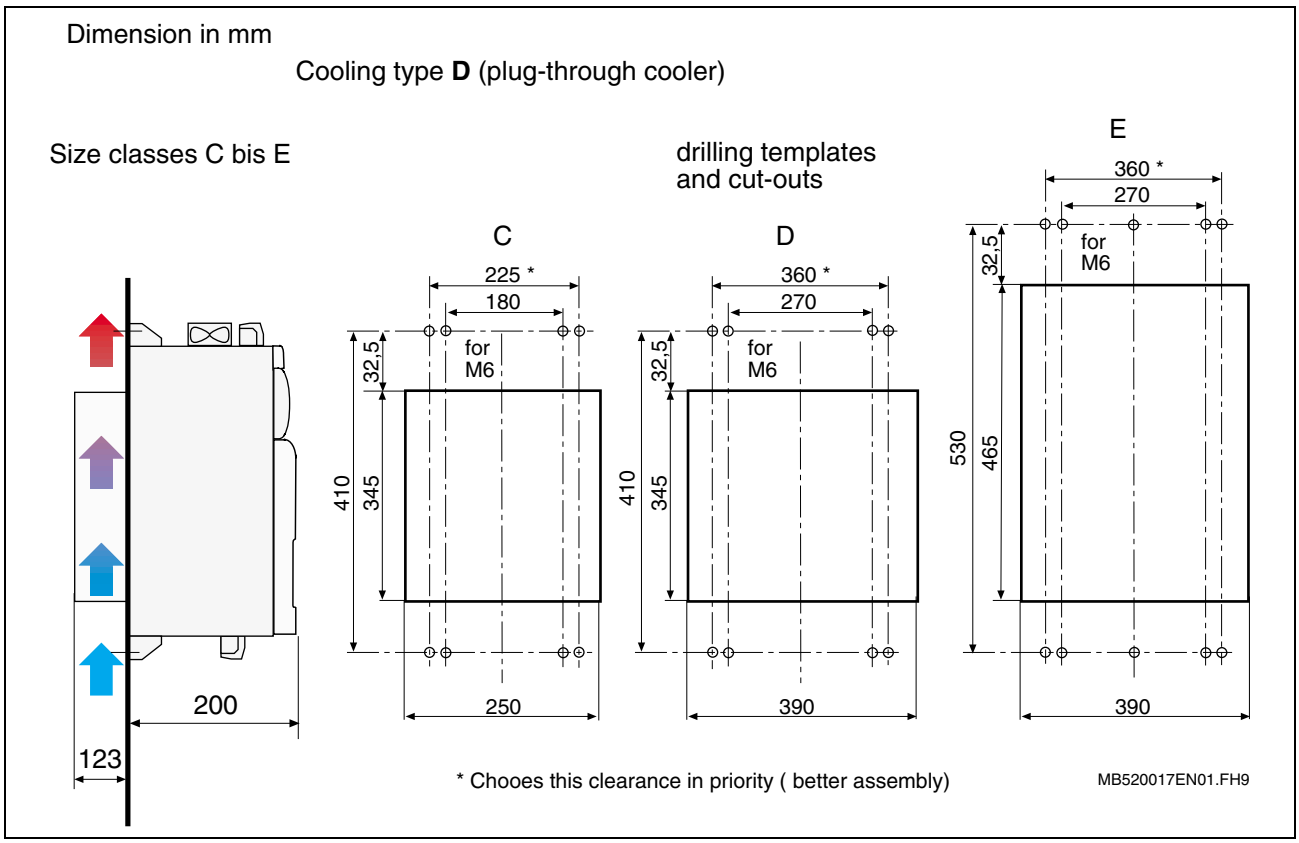


Fig.: 5-13 Dimension sheet for cooling type D, size classes C, D, E

Several Inverters next to Each Other with Through-Hole Cooling

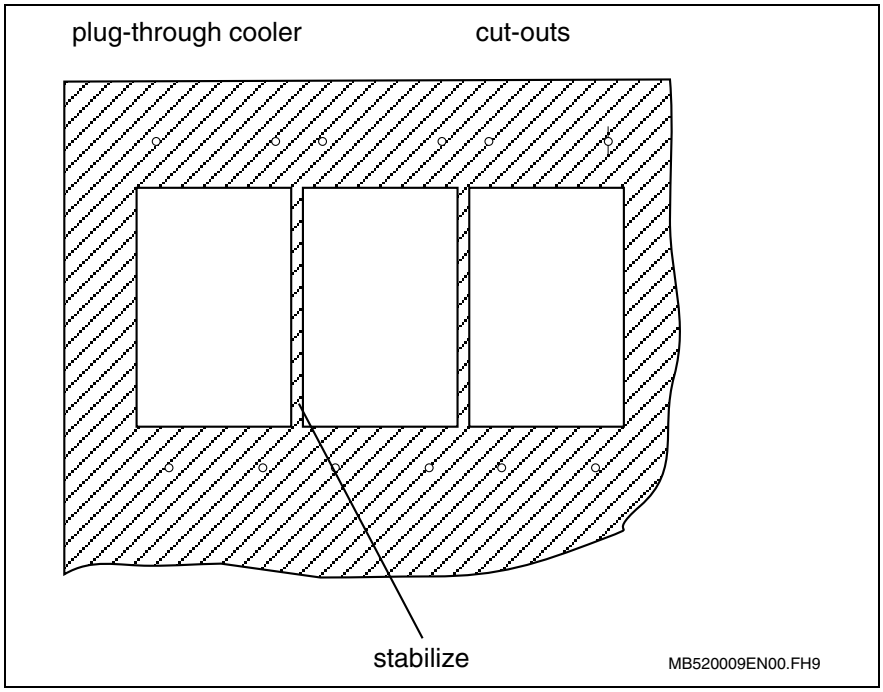


Fig.: 5-14 Cut-outs for devices with plug - through cooler

Note: In order to obtain a hermetic overlay, the remaining segment must be stabilized.

5.11 Assembly of Inverter, Size Classes G with Forced Air Cooling and Integrated Liquid Circulation System (Cooling Type F)

Inverters of size class G comprise the following elements: inverter and heat exchanger. The inverter and heat exchanger are mounted on a common mounting plate and are fully connected. Assembly must be carried out perpendicular to a level construction area.

- To ensure that the warm exhaust air can flow without impedance, a space with a height of at least 200 mm must be maintained above the devices.
- When the drive units are mounted in a cabinet, the cooling air requirement of the units must be calculated (refer to Technical data, section 5.6, 5.7) and the cabinet ventilation appropriately dimensioned.
- The fastening screws are shown in the drilling templates of the dimension drawings.
- Two hoisting support points are provided to mount the units using a crane. These are let in at the top of the mounting plate on both sides and secured using a screw.

Dimension Drawing, Size Class G with Cooling Type F

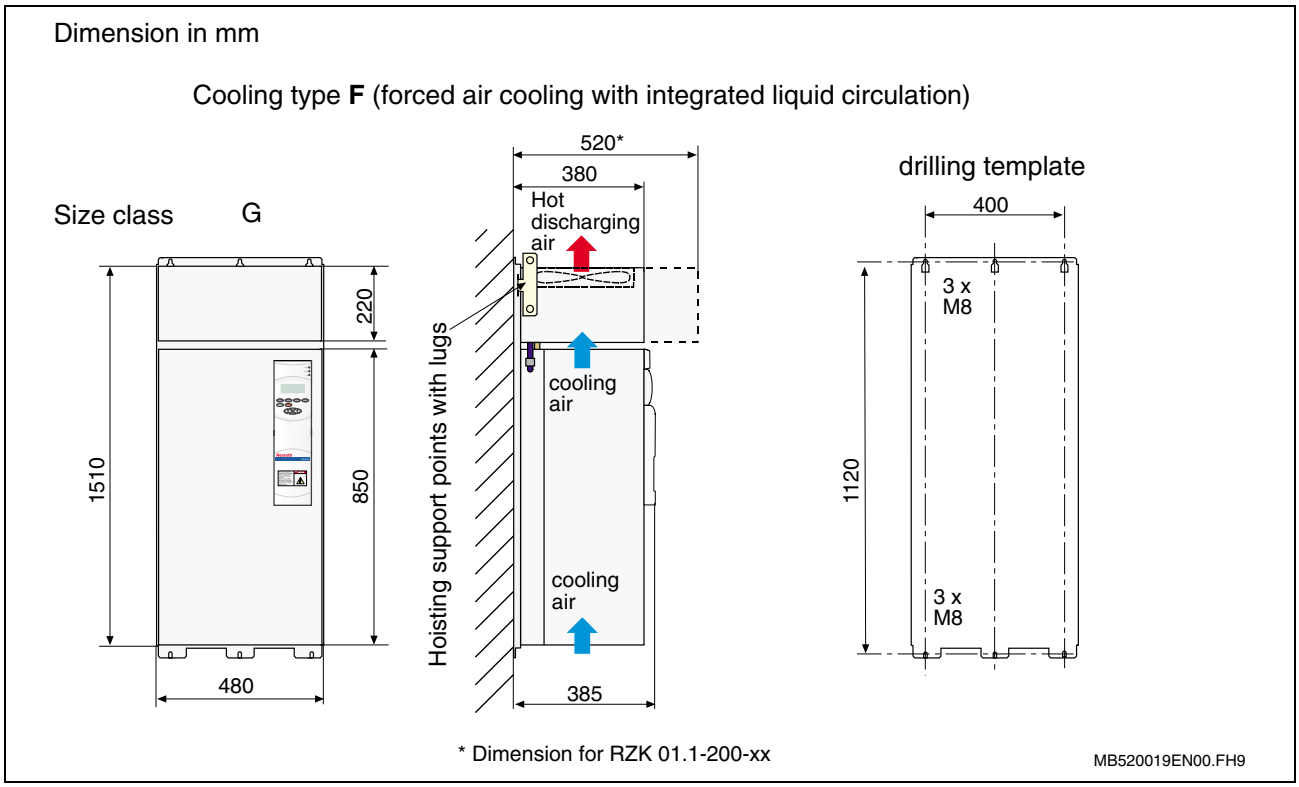


Fig.: 5-15 Dimension sheet of inverter, size class G with cooling type F

Rexroth Bosch Group

5.12 Assembling Liquid-Cooled Inverters, Size Class G with External Heat Exchanger

General Notes Regarding Assembly

Inverters of size class G comprise the following elements: inverter and heat exchanger. In externally assembled heat exchangers, the inverter is not cooled by the air flow of the heat exchanger. This means that additional fans are provided on the inverter.

- Assembly must be carried out perpendicular to a level construction area.
- To ensure that the warm exhaust air can flow without impedance, a space with a height of at least 200 mm must be maintained above the devices.
- When the devices are mounted in a cabinet, the cooling air requirement of the units must be calculated (refer to Technical data, section 5.6, 5.7) and the cabinet ventilation appropriately dimensioned.
- The fastening screws are shown in the drilling template of the dimension drawing.
- Two hoisting support points are provided to mount the units using a crane. These are let in at the top of the mounting plate on both sides and secured using a screw (refer to the dimension drawing).
- Attach the external heat exchanger to the desired location. This can be mounted on the roof or wall of the cabinet. See Fig.: 5-19. Additional technical data are described in documentation DOK-RD500*-RD500*SUPPL-FKxx-EN-P (Accessories).
- Connect the cooling circuit of the converter to the heat exchanger using the heat exchanger hoses; for additional information, refer to 5.13. Depending on the requirements, the heat exchanger hoses must be ordered together with the converter.

Note: Your distributor can provide you with further information regarding coolant hoses, hose nozzles, couplings, angular connections, etc.

Supplementary Fan Transformer

- For 200 kW device, the size of the internal power supply is not adequate for these additional fans. An external fan transformer is included to supply power to the fans.
- The fan transformer to connect the inverter fans must be mounted at a suitable location in the cabinet.

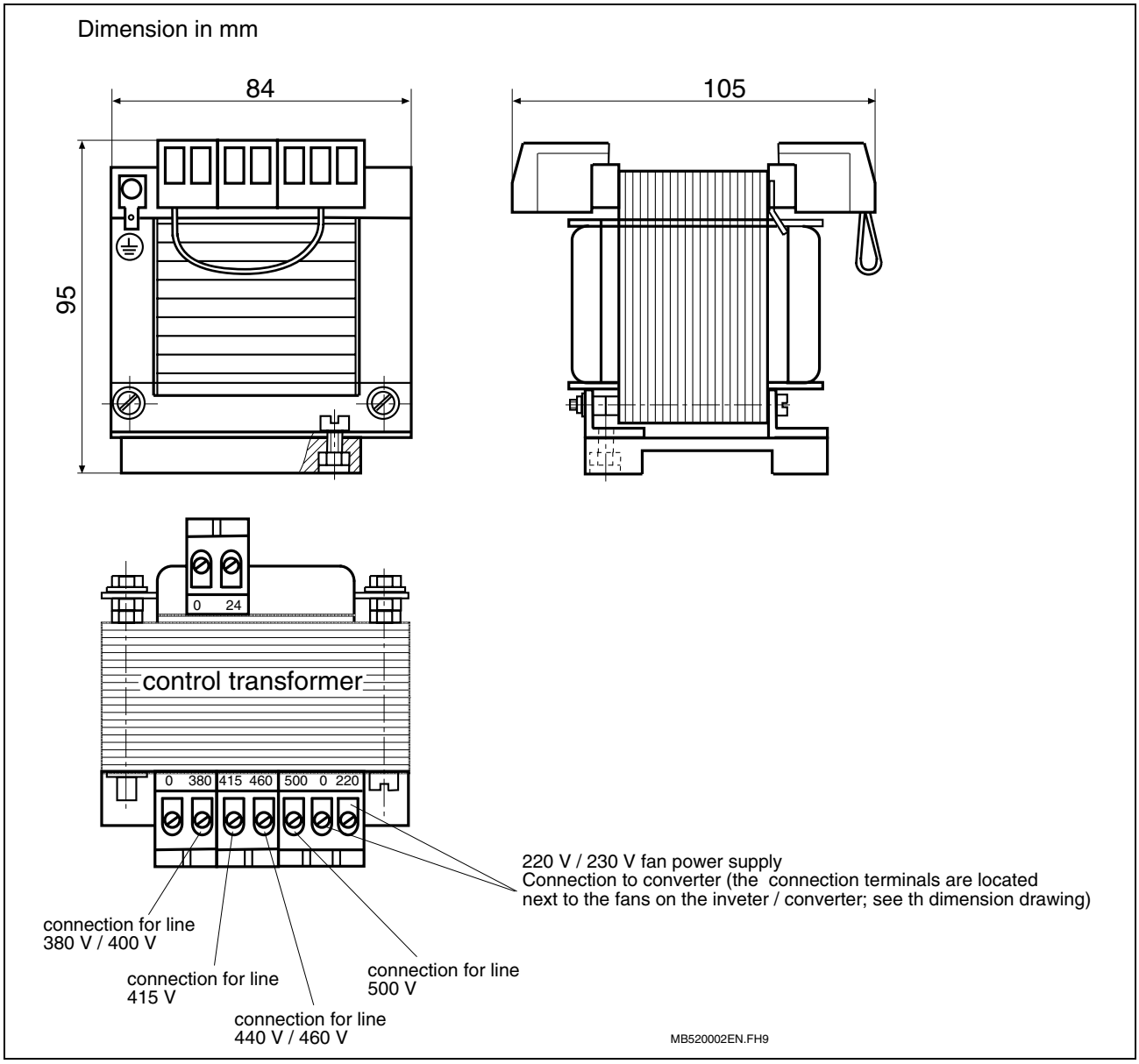


Fig.: 5-16 Separate fan transformer for 200 kW devices

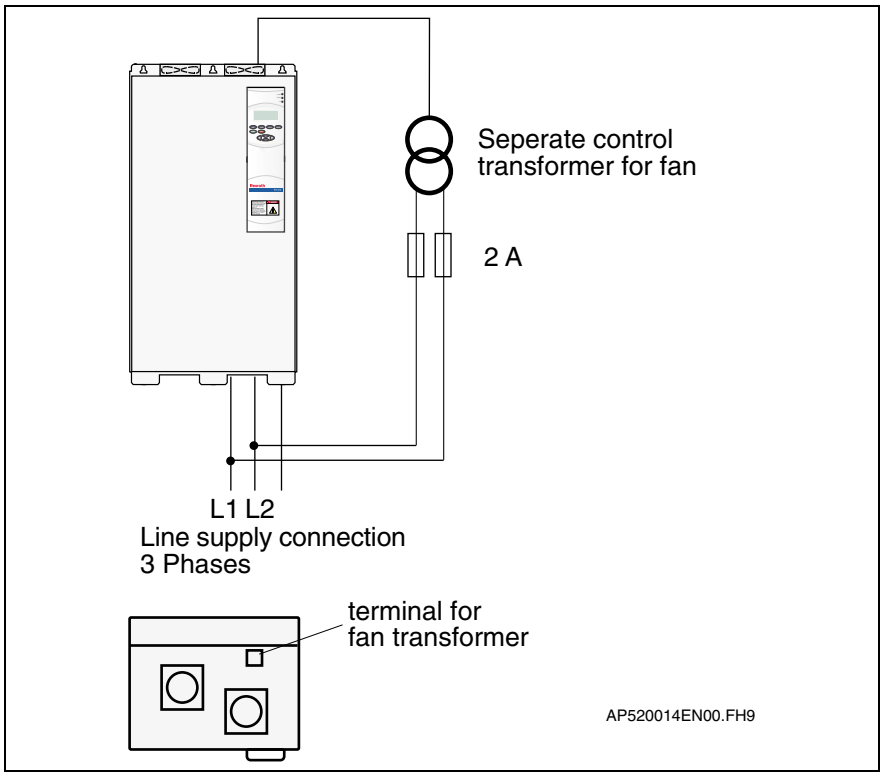


Fig.: 5-17 Connection plan for separate fan transformer for size class G with cooling type R

Dimension Drawing, Size Classes G with Cooling Type R

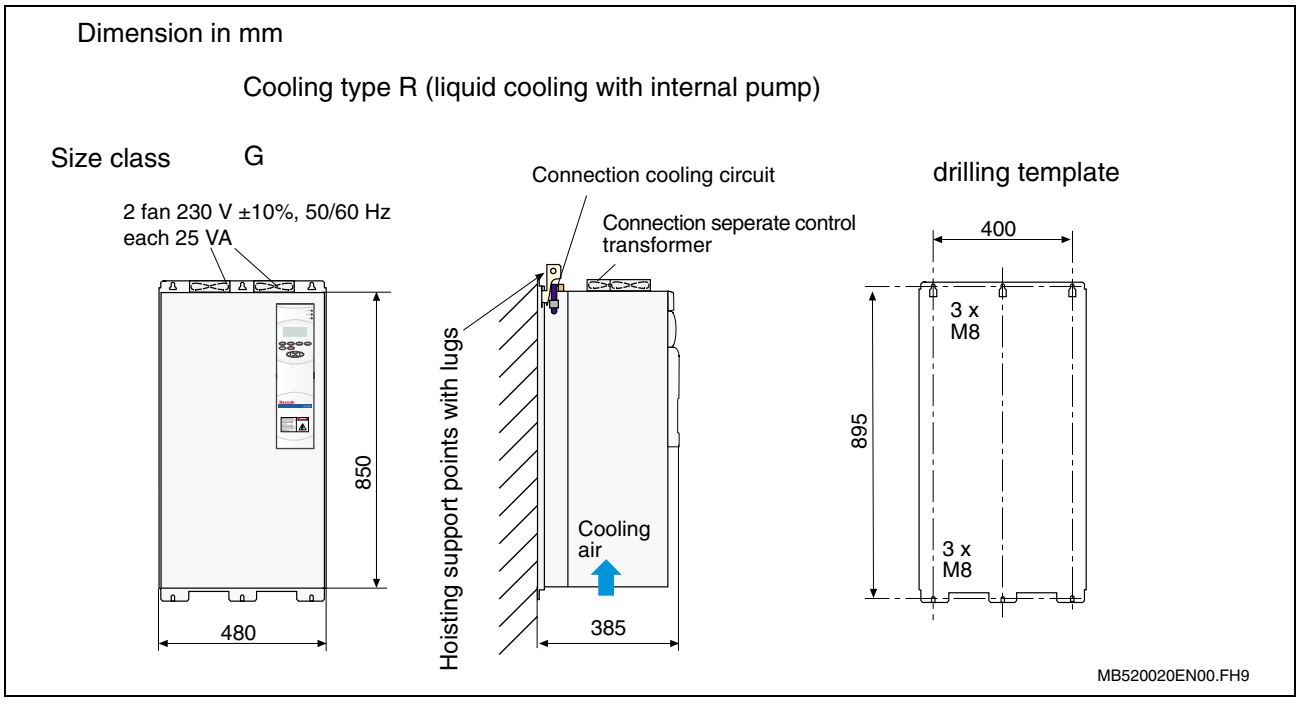


Fig.: 5-18 Dimension sheet of inverter, size classes G with cooling type R

Mounting Drawing for Devices with External Heat Exchanger for Cabinet Roof Mounting, Size Class G

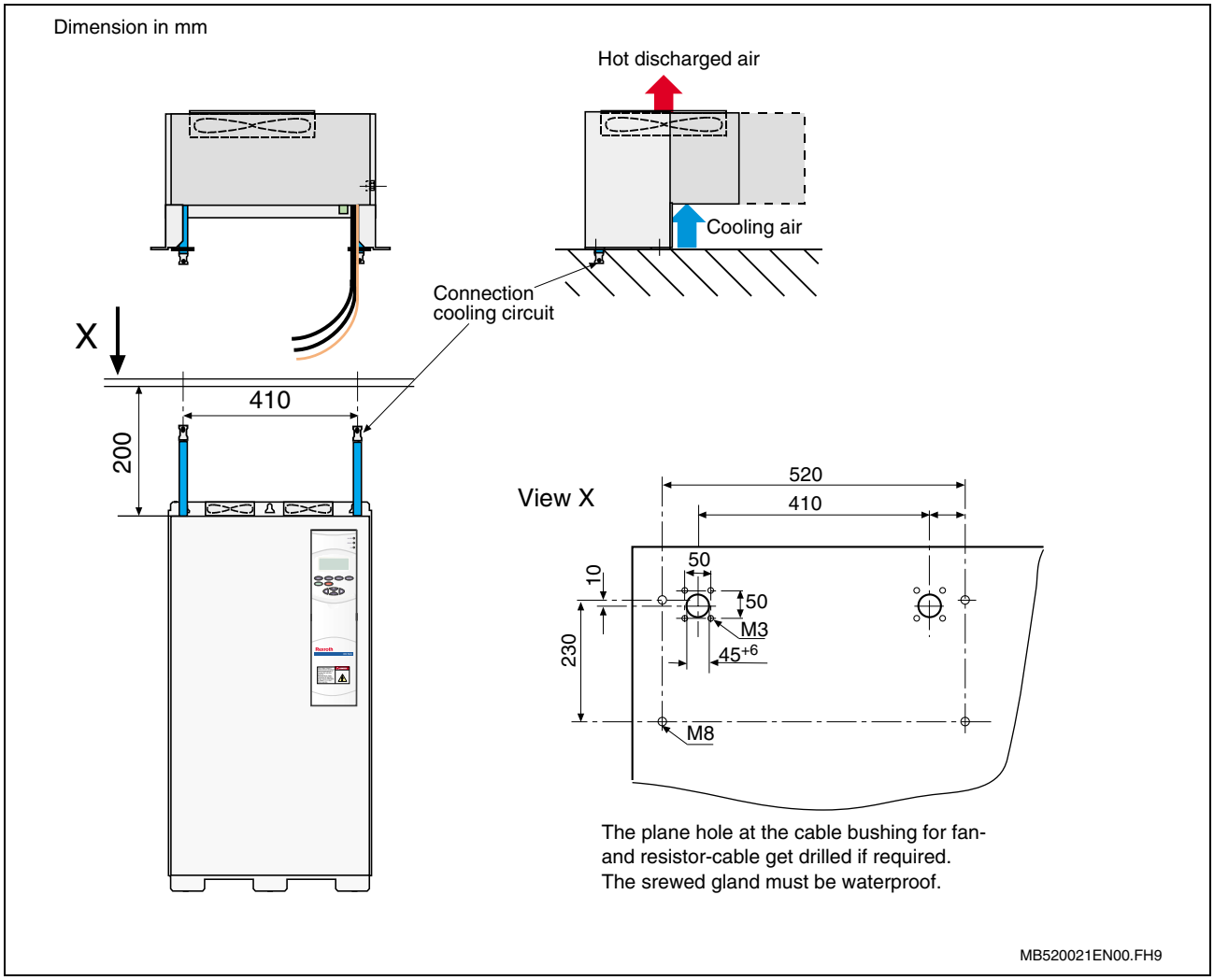


Fig.: 5-19 Dimension sheet for cabinet roof mounting, size class G

Mounting Drawing for Devices with External Heat Exchanger for Wall Mounting

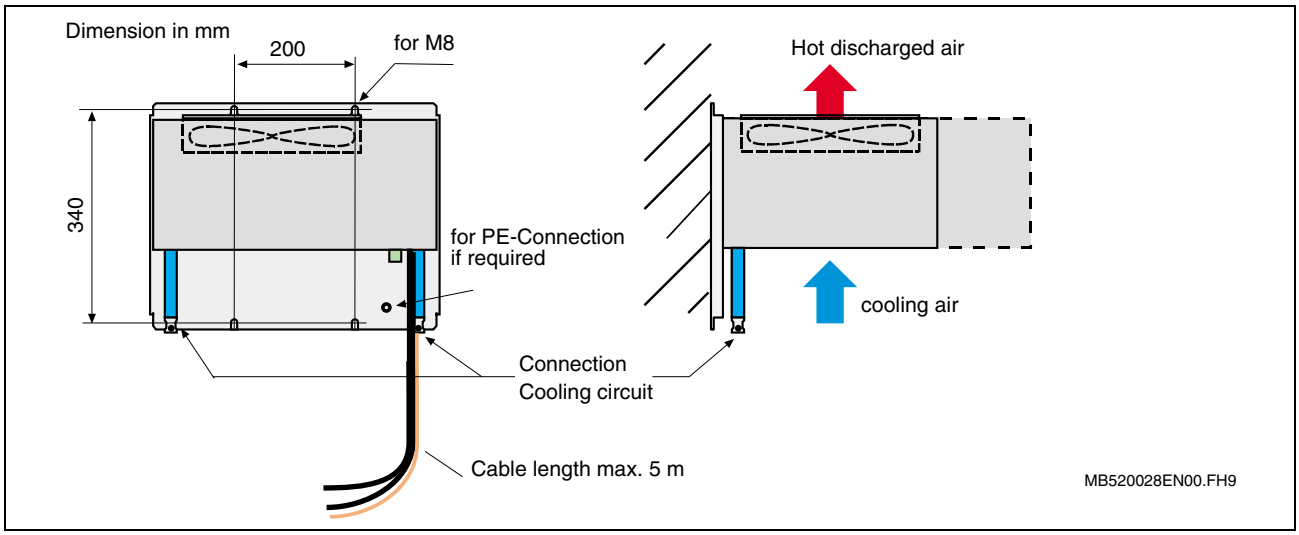


Fig.: 5-20 Dimension sheet for wall mounting, size class G

5.13 Working on the Coolant Circulation System Size Class G

Both versions of the liquid-cooled drive units, with integrated and external heat exchanger, are supplied filled with liquid. The coolant comprises tap water and antifreeze, type Antifrogen N (Clariant). It is mixed in the ratio 1 : 1 (Indramat Refu, Order No.: 0015343). This guarantees frost protection down to -30 °C.

CAUTION

Antifreeze is hazardous to health!

⇒ If antifreeze is swallowed, immediately consult a doctor and keep the packaging or label for reference.

CAUTION

Mixture with other antifreezes

⇒ Do not mix the coolant with other antifreezes.

⇒ Only use the specified antifreeze if coolant must be added to installed drive units.

WARNING

Burns due to hot components with temperatures above 30°C!

⇒ Wear protective gloves

⇒ Replace devices only when the liquid circulation system has cooled

WARNING

Damage to materials due to condensation!

⇒ In temperate climate zones (up to 40 °C and 70% humidity), the inlet temperature of the coolant must lie max. 5 K below the interior switch cabinet temperature!

Note: The most certain protection against condensation is:

inlet temperature of coolant = ambient temperature

Coolant that generally has a temperature that differs from that of the ambient air flows through fluid-cooled drive components.

If warm air comes into contact with a less warm object, condensation forms on the surface of the object if the temperature of the object is below the dewpoint temperature. Dew forms on the object.

WARNING

Damage to materials due to corrosion!

⇒ Ensure that there is sufficient corrosion control and antifreeze

WARNING

Damage to materials due to malfunction in coolant circulation system!

⇒ Ensure fault-free operation of the coolant circulation system

Note: Prevent deposits in the cooling tubes.

Note: Pay attention to the change in volume of the coolant due to the temperature differences.

Recommendation Divide the coolant circulation by using a suitable heat exchanger (e.g. plate heat exchanger).

WARNING

Damage to materials due pump function failure

⇒ When simultaneous occurring the following conditions!

Operation at overload

Short circuit on output

Failure of the cooling pump

⇒ The device can age prematurely

Failure of the cooling pump without overload or short circuit at the output

Note: To guarantee the cooling function, a pump monitor is required

DANGER

Destruction of device due to short-circuit!

⇒ Collect drip water during assembly

Mounting Extension Hoses for External Heat Exchanger

For devices with external heat exchangers, all of the parts required for the hose extensions (hoses, connectors, couplings, clamps, coolant, etc.) are supplied according to the customer's specifications when ordering. Customers must assemble the extension hoses themselves, as described below:

1. Shorten the heat exchanger hose to the required length, if necessary.
2. Mount the connector with hose liner at one end of the heat exchanger hose using a clamp.
3. Fill the hose with coolant using a funnel. The connector and coupling have self-closing valves.
4. Connect the coupling with the hose liner at the other end of the heat exchanger hose using a clamp.

Connect the inverter to the heat exchanger using the filled hoses. When the hoses are connected or disconnected, low amounts of drip water escape as a result of the self-closing valves of the connector and couplings. The converter should be powered up for a few minutes so that the pump circulates the coolant and vents the cooling system. Small air bubbles in the coolant circulation, which can occur when connecting the extension hoses, then collect in the compensation tank. After the air has been vented, it should be checked whether the coolant level is at the center of the compensation tank. If this is not the case, coolant must be added to the compensation tank. To add coolant, remove the sheet metal cover of the heat exchanger.

If the heat exchanger was connected in the way described above, it will not be necessary to add any coolant to the compensation tank.

Servicing the Coolant Circulation System

The coolant circulation system is a closed cooling system that does not require either servicing or inspection. If the “Device excess temperature” fault occurs during operation, it should be checked whether the coolant level is at the center of the compensation tank.

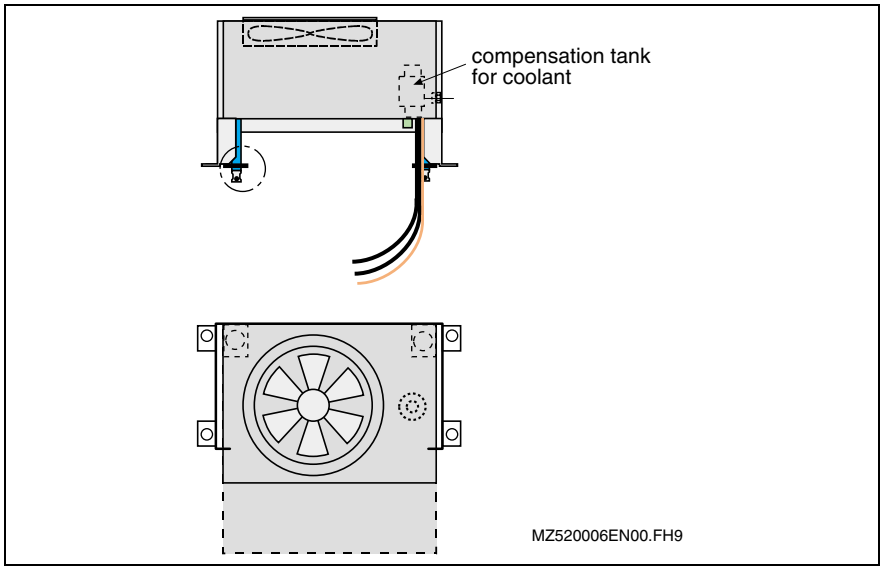


Fig.: 5-21 Compensation tank in external heat exchanger

Technical Data of Coolant Circulation System, Size Class G

- The maximum system pressure is < 1 bar

6 Electrical Installation of Inverter

6.1 10 Rules for Installation of Drives According to EMC

The following 10 rules are the basics for designing drive systems in compliance with EMC.

Rules 1 to 7 are generally valid. Rules 8 to 10 are especially important to limit noise emission.

Rule 1 All metal parts of the switch cabinet should be connected with one another through the largest possible surface area so that the best electrical connection is established (no paint on paint!). If necessary, use contact or scraper discs. The cabinet door should be connected to the cabinet using the shortest possible grounding straps.

Rule 2 Signal, line supply, motor and power cables should be routed away from another (this eliminates mutual interference!). The minimum clearance is 20 cm. Barriers should be provided between power and signal cables. These barriers should be grounded at several locations.

Rule 3 Contactors, relays, solenoid valves, electromechanical operating hour counters etc. in the cabinet must be provided with noise suppression devices, e.g. using RC elements, diodes, varistors. These devices must be connected directly at the coil.

Rule 4 Non-shielded cables belonging to the same circuit (feeder and return cables) should be twisted with the smallest possible distance between them. Cores which are not used must be grounded at both ends.

Rule 5 Generally, noise which is coupled in can be reduced by routing cables as closely as possible to grounded sheet steel panels. For this reason, cables and wires should not be routed freely in the cabinet, but as closely as possible to the cabinet itself and the mounting panels. This is also true for reserve cables.

Rule 6 Incremental encoders must be connected using shielded cables. The shield must be connected at the incremental encoder and at the AC drive converter through the largest possible surface area. The shield may not be interrupted, e.g. using intermediate terminals.

Rule 7 The shields of signal cables must be connected to ground at both ends through the largest possible surface area to establish a good electrical connection (transmitter and receiver). If the potential bonding between the screen connections is poor, an additional potential bonding conductor with a cross-section of at least 10 mm² (AWG 6) should be connected in parallel with the shield to reduce the shield current. The shields can be connected to ground at several locations, e.g. on the cabinet housing and on cable trays. Foil shields are not recommended. Braided screens provide a better shielding effect (factor of 5).

If the potential bonding is poor, analog signal cables may only be grounded to the converter at one end in order to prevent low-frequency noise being radiated into the screen (50 Hz).

Rule 8 Always place a radio interference suppression filter close to the noise source. The filter is to be connected flush with the cabinet housing, mounting plate, etc. The best solution is a bare metal mounting panel (e.g. stainless steel, galvanized steel), because the complete mounting surface can be used to establish good electrical contact.

The incoming and outgoing cables of the radio interference suppression filter should be separated.

Rule 9 All variable-speed motors should be connected using shielded cables, whereby the shield is connected at both ends to the housings through the largest possible surface area to minimize the inductance. The motor feeder cables should also be shielded outside the cabinet, or at least screened using barriers.

Cables with steel shields are not suitable.

To connect the shield at the motor, a suitable PG gland with shield connection can be used (e.g. “SKINDICHT SHV/SRE/E” from the Lapp Company, Stuttgart). It should be ensured that the connection between the motor terminal box and the motor housing has a low impedance. Otherwise, use an additional grounding strap between them. Never use plastic motor terminal boxes!

Rule 10 The shield between the motor and the frequency converter may not be interrupted by installing components such as output reactors, sinusoidal filters, motor filters, fuses, contactors, etc. The components must be mounted on mounting panels which also simultaneously serve as the shield connection for the incoming and outgoing motor cables. Metal barriers may be required to shield the components.

6.2 Warnings and Notes

DANGER

Death by electrocution possible due to live parts with more than 50V!

⇒ RD 500 devices are operated at high voltage levels. All work must be carried out when they are not under power!

⇒ All work must be carried out only by qualified personnel!

⇒ If this warning information is not observed, death, severe bodily injury or significant material damage can result.

⇒ Due to the DC link capacitors, the device is still under a dangerous voltage up to 5 minutes after power has been switched off. This means that it is only permissible to work on the device or the DC link terminals after an appropriate time and after a careful check has been made to ensure that the equipment really is not under power.

⇒ The power and control terminals may be live even if the motor is at a standstill.

⇒ In the case of a central supply of the DC link voltage, ensure that the inverter is safely separated from the DC link voltage!

⇒ When working on an open device, note that live parts are exposed.

⇒ The user is responsible for ensuring that all devices are set up and connected according to the recognized technical regulations in the country of use as well as other regionally valid regulations. Cable dimensioning, fuse protection, grounding, switching off, separation and protection from excess currents must be especially taken into account.

CAUTION

Damage to the devices as a result of an incorrect supply voltage!

⇒ RD 500 devices are designed for various supply voltages! This is the reason why supply voltages are not specified in the drawings and tables for the terminal strips.

⇒ When connecting the converter, always observe the rating plate and the line supply voltage specified in Technical data.

Information on protective grounding: The cross-section of the protective conductor to the cabinet must be at least 10mm² (AWG 6) Cu, or a second protective conductor must be routed in parallel in accordance with DIN VDE 0160. This is due to the discharge currents of the drive units (>3.5 mA) through the protective conductor (PE) (VDE 0160, Section 6.5.2). The discharge currents of the drive converter can be up to 100 mA.

For higher connected powers, the minimum cross-section of the protective conductor must be in an appropriate ratio to the cross-section of the main phase conductor. Refer to DIN VDE 0160-5.5.3.4.2, Fig. 8.

A current-operated earth-leakage circuit breaker may not be used as a protective measure.

6.3 Cable Cross-Sections

The cable cross-sections refer to the rated inverter current. The associated protective conductor cross-section must be a minimum of 10 mm^2 (AWG 6) (if power cables with cable cross-sections >10 mm^2 (AWG 6) are used, the protective conductor must have the same cross-section).

The following is assumed for the line supply feeder cables / DC link cables:

- The cross-sections are valid for one phase for multi-stranded conductors, and were defined in accordance with VDE0298.
- Up to 35 mm² (AWG 2), individual wires in a cable duct.
- Above 50 mm² (AWG 1/0), freely routed in the cabinet without any contact to other cables (busbars are recommended as an alternative).

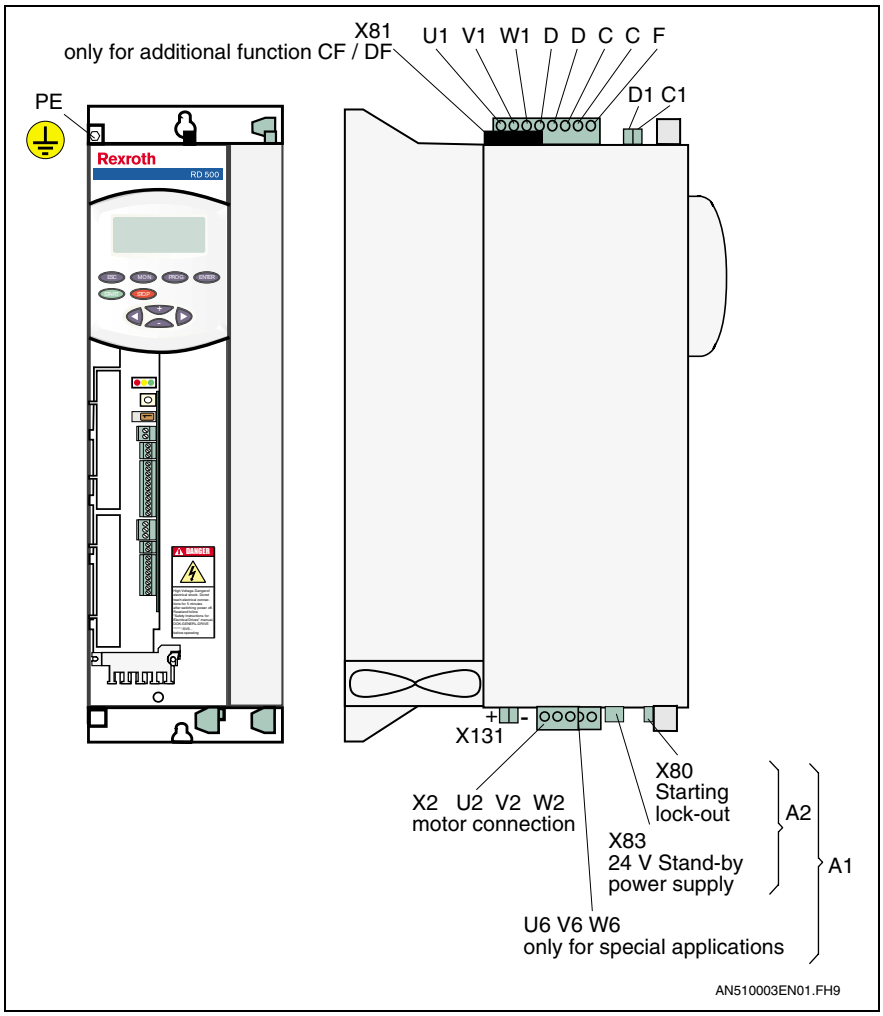
The following is assumed for motor feeder cables:

- The cross-sections are valid for shielded 4-core cables and were defined in accordance with VDE0298.
- Up to 35 mm² (AWG 2), routed in the cable duct, without any cable bundling.
- Above 50 mm² (AWG 1/0), freely routed in the cabinet without any contact to other cables.

Note: The provided cable cross-section in mm² is based on the assumption that PVC 70° C cables are used. The provided cable cross-section in AWG is based on the assumption that THHN or THHW 194° C cables are used.

6.4 Power Terminals RD 51 Size Classes A - E

Terminal Layout Diagram, Size Classes A - B



A1: 24 V standby power supply, starting lock-out and filter current feedback
A2: 24 V standby power supply and start inhibitor

Fig.: 6-1 Terminal layout diagram classes A, B

Description of Inverter Power Terminals Size Classes A - B

Power class	DC link connection			Motor connection	
	Cable cross-section which can be connected 1) mm²	AWG	Maximum series fuse 2), type gL A	Cable cross-section which can be connected 1) mm²	AWG
003	2x 0.5 - 6	2 x 20 - 10	16	0.5 - 6	20 - 10
005	2x 0.5 - 6	2 x 20 - 10	20	0.5 - 6	20 - 10
007	2x 0.5 - 6	2 x 20 - 10	25	0.5 - 6	20 - 10
015	2x 0.5 - 6	2 x 20 - 10	40	0.5 - 6	20 - 10
018	2x 0.5 - 6	2 x 20 - 10	50	0.5 - 6	20 - 10

1): As a result of the terminal size
2): Safety values are provided for the 3AC 400V input voltage and for the rated output X1 of the device. If the input voltage differs, the safety value must be changed.

Tab. 6-1 Cable cross-sections for DC link and motor feeder cables, classes A - B

Terminal	Comment	
X1	**Line supply, DC link connection**	
PE	Protective conductor connection min. 10 mm² (AWG 6); steel plate lug on the housing with captive nut M5	
C	DC link connection (IC) L+	DC 530...670V ± 20%
C		
D	DC link connection (IC) L-	
D		
F		

C1	SNT supply + Bridge to connection C	**Installation must be inherently short-circuit-proof**	Cable cross-section which can be connected 0.5 -2.5 mm² (AWG 20 – 14)
D1	SNT supply - Bridge to connection D		

X2	**Motor connection**
U2	Motor connection U, V, W
V2	
W2	
PE	Protective conductor connection for motor and shield connection for cables min 10 mm² (AWG 6); steel plate lug on the housing with captive nut M5

X80	**Starting lock-out (only in A1 and A2)**	
1	During operation, terminals 1 - 2 must be closed; when they are opened, the start of the connected motor is inhibited.	Recommended minimum cross-section 1 mm² (AWG 18) Cable cross-section which can be connected 0.08 -1.5 mm² (AWG 28 - 16)
2		
3	Starting lock-out floating acknowledge contact, 30 V DC / 1 A N/C contact	
4		

X83	**24V standby power supply for the electronics (only in A1 and A2)**	
1	P24V 24VDC –15/+20%, ripple, max 5% (VDE0411 / 500), power consumption ~40 W, startup current 5 A	Recommended minimum cross-section 1 mm² (AWG 18) Cable cross-section which can be connected 0.2 -2.5 mm² (AWG 24 - 14)
2	Ground	

X131	Internal fan supply
	+ / -

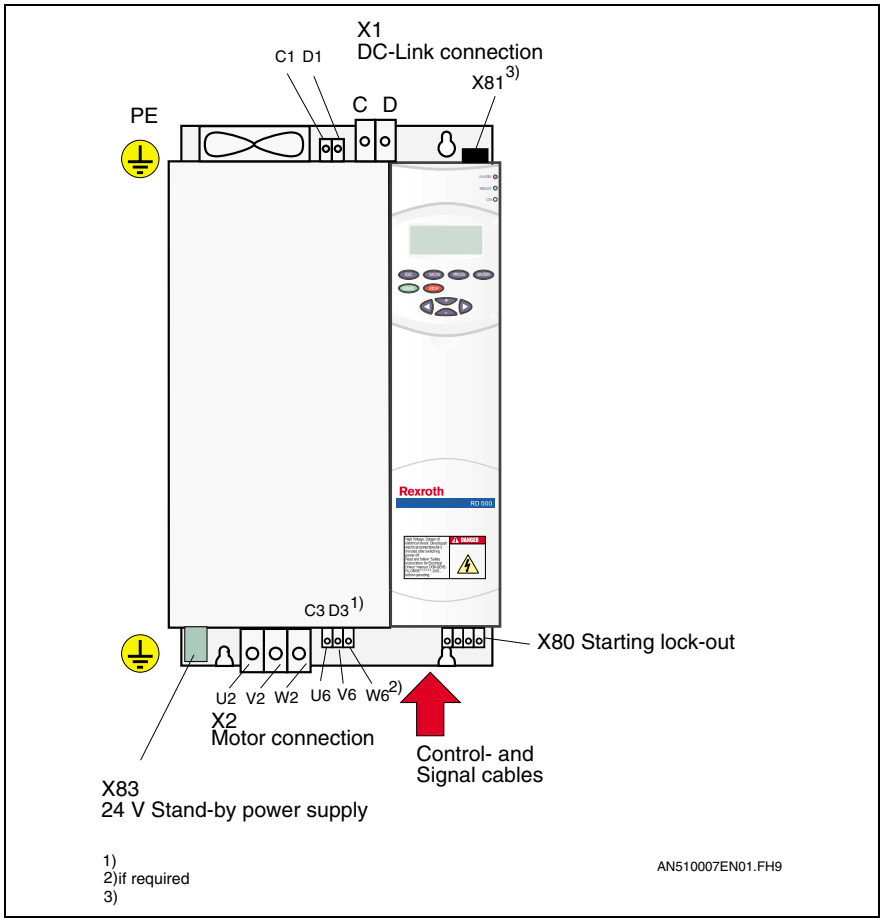
X81	Additional function CF / DF Connection RZC01.x...
	Only for internal use

Tab. 6-2 Power terminals classes A - B

Terminal Layout Diagram Size Classes C, D

An inverter of size class C is illustrated in the terminal layout diagram. The position of the terminals is essentially the same for the narrower or wider drive units. The DC link terminal is always at the top and the motor connection at the bottom of the housing.

Note: The additional function 24V standby power supply (terminal X83) is only mounted if it was actually ordered.

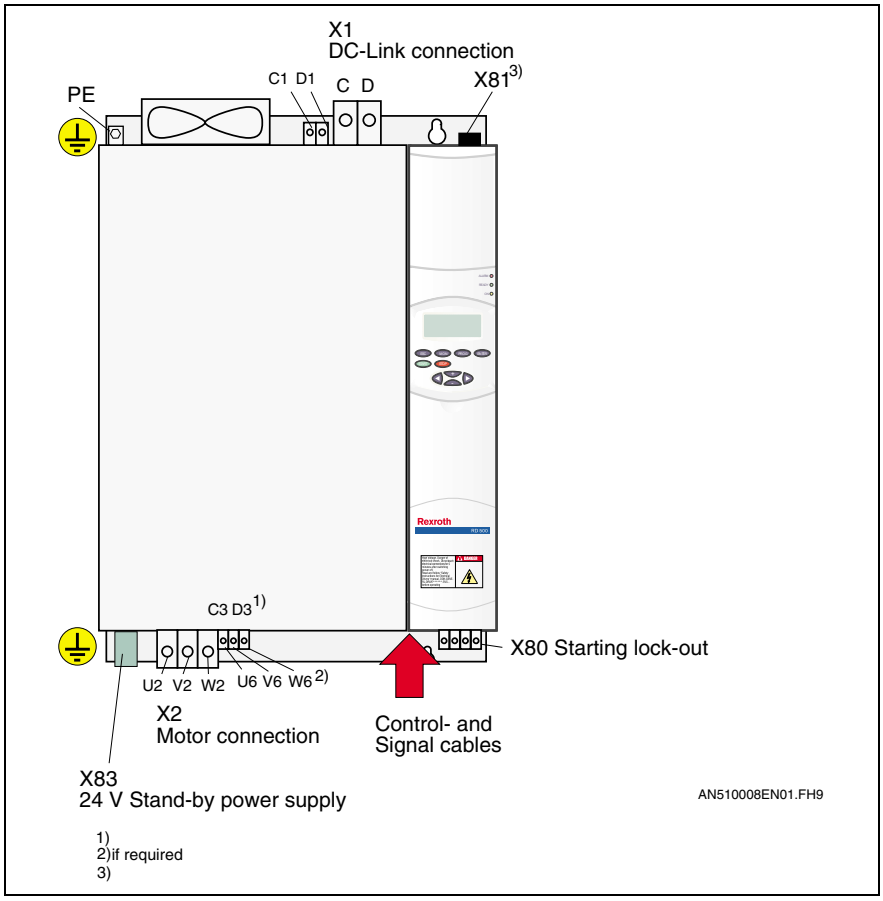


1): Only with additional function L1
2): Only with additional function F1
3): Only with additional function C1 / D1

Fig.: 6-2 Terminal layout diagram classes C, D

Terminal Layout Diagram Size Class E

Note: The additional function 24V standby power supply (terminal X83) is only mounted if it was actually ordered.



1): Only with additional function L1
2): Only with additional function F1
3): Only with additional function C1 / D1

Fig.: 6-3 Terminal layout diagram class E

Description of Inverter Power Terminals Size Classes C - E

Power class	DC link connection			Motor connection	
	Cable cross-section which can be connected 1) mm²	AWG	Maximum series fuse 2), type gL A	Cable cross-section which can be connected 1) mm²	AWG
022	25 - 50	3 – 1/0	63	25 - 50	3 – 1/0
030	25 - 50	3 – 1/0	80	25 - 50	3 – 1/0
037	25 - 50	3 – 1/0	100	25 - 50	3 – 1/0
045	25 - 50	3 – 1/0	125	25 - 50	3 – 1/0
055	35 - 95	2 – 4/0	160	35 - 95	2 – 4/0
075	35 - 95	2 – 4/0	200	35 - 95	2 – 4/0
090	50 - 150	1/0 – 6/0	250	50 - 150	1/0 – 6/0
110	50 - 150	1/0 – 6/0	250	50 - 150	1/0 – 6/0

1): As a result of the terminal size
2): Safety values are provided for the 3AC 400V input voltage and for the rated output X1 of the device. If the input voltage differs, the safety value must be changed.

Tab. 6-3 Cable cross-sections for DC link and motor cables, classes C - E

Terminal	Comment
X1	**DC link connection**
PE	Protective conductor connection min 10 mm² (AWG 6); steel plate lug on the housing with captive nut for size classes C and D = M6 for size class E = M8
C	DC link connection (IC) L+
D	DC link connection (IC) L-

C1	SNT supply + Bridge to connection C	**Installation must be inherently short-circuit-proof**	Cable cross-section which can be connected, mm² Class C = 0.2 – 4 (AWG 24 – 12) Class D = 0.2 – 4 (AWG 24 – 12) Class E = 0.5 – 10 (AWG 20 – 8)
D1	SNT supply - Bridge to connection D		

X2	**Motor connection**
U2	Motor connection U, V, W
V2	
W2	
PE	Protective conductor connection for motor and shield connection for motor cables min 10 mm² (AWG 6); steel plate lug on the housing with captive nut for size classes C and D = M6 for size class E = M8

X2 additional function L1 cable damping		
C3	DC link L+	Cable cross-section which can be connected, mm² Class C = 0.5 – 10 (AWG 20 – 8) Class D = 0.5 – 16 (AWG 20 – 6) Class E = 0.5 – 16 (AWG 20 – 6)
D3	DC link L-	

Note: The additional function L1 is required to connect the motor filter RZM01.1-108 or RZM01.1-130 in inverter of power class 075 and 090.

X2 additional function F1 filter current feedback		
U6	Operation possible only with the original Refu filter	Cable cross-section which can be connected, mm² Class C = 0.5 – 10 (AWG 20 – 8) Class D = 0.5 – 16 (AWG 20 – 6) Class E = 0.5 – 16 (AWG 20 – 6)
V6		
W6		

X80	Starting lock-out	
1	During operation, terminals 1 - 2 must be closed; when they are opened, the start of the connected motor is inhibited.	Recommended minimum cross-section 1 mm² (AWG 18) Cable cross-section which can be connected 0.08 -1.5 mm² (AWG 28 – 16)
2		
3	Starting lock-out floating acknowledge contact, 30 V DC / 1 A N / C contact	
4		

X83	24V standby supply for the electronics	
1	P24V 24VDC –15/+20%, ripple, max 5% (VDE0411 / 500), power consumption ~40 W, startup current 5 A	Recommended minimum cross-section 1 mm² (AWG 18) Cable cross-section which can be connected 0.2 -2.5 mm² (AWG 24 – 14)
2	Ground	

X81	Additional function C1 / D1 connection RZC01.x..
	Only for internal use

Tab.: 6-4 Power terminals, size classes C - E

Note: Depending on the national regulations at the setup location, an external fuse and / or a short-circuit-proof layout may also be required.

6.5 Power Terminals RD51 Size Class G

After the device has been mounted, the electrical connections must be established:

Terminal Layout Diagram Inverter Size Class G

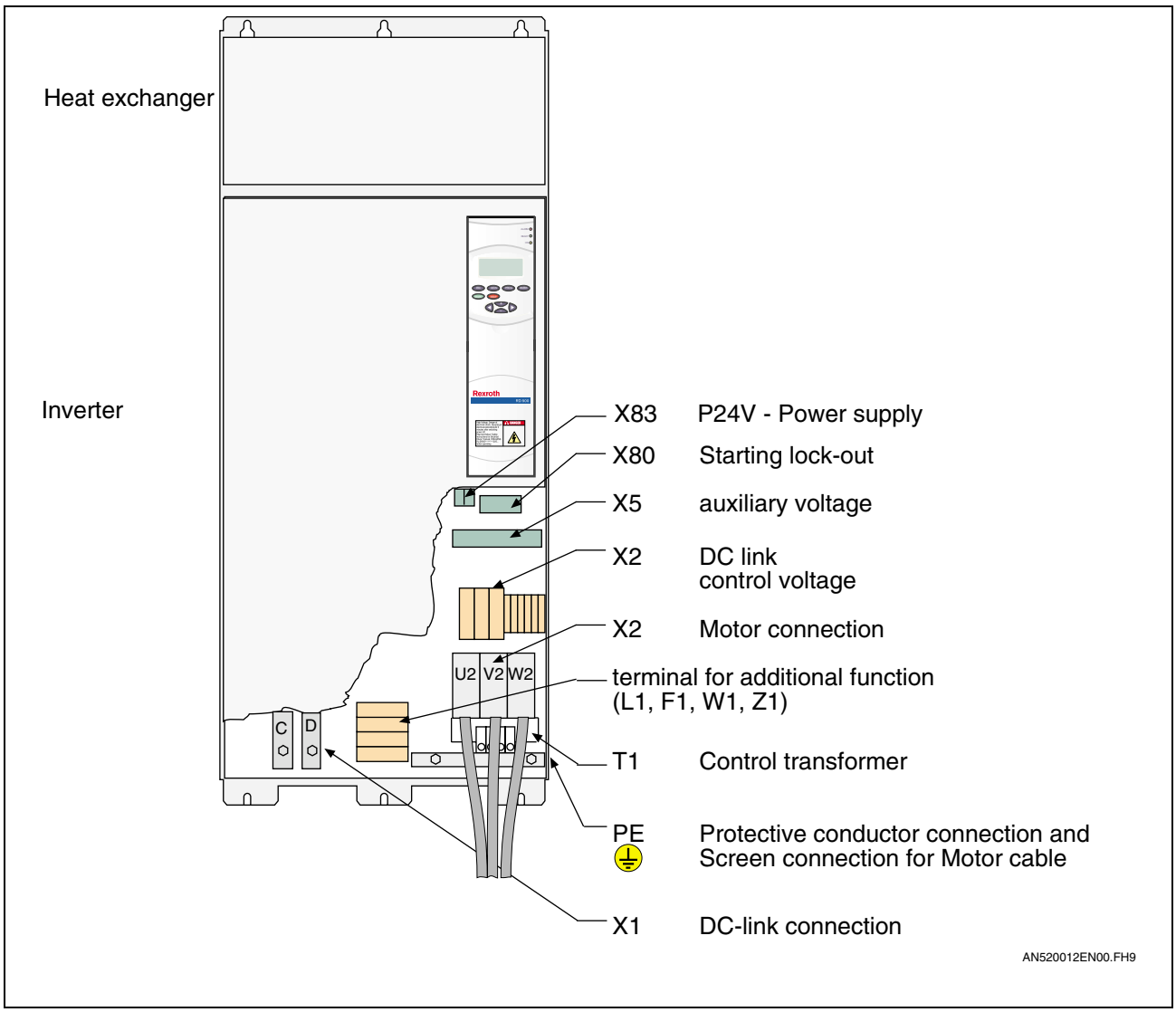


Fig.: 6-4 Terminal layout diagram, converter size class G

Description of Power Terminals Inverter Size Class G

Power class	DC link connection		Motor connection	
	Cable cross-section which can be connected 1) mm²	Maximum series fuse 2), type gL A	Cable cross-section which can be connected 1) mm²	AWG
132	Stud connection M12	250	50 - 150	1/0 – 6/0
160	Stud connection M12	315	50 - 150	1/0 – 6/0
200	Stud connection M12	400	70 - 240	2/0 – 500

1): As a result of the terminal size
2): Safety values are provided for the 3AC 400V input voltage and for the rated output X1 of the device. If the input voltage differs, the safety value must be changed.

Tab. 6-5 Cable cross-sections for DC link and motor cables, class G

Terminal	Comment
X1	**DC link voltage**
PE	Protective conductor connection; for size G = stud M8

X2	**Size class G**	
	Motor connection, DC link, line supply isolation	
C	DC link terminal L+	Cable cross-section which can be connected 10 – 35 mm² (AWG 8 – 2) at additional function Z1 95 mm² (AWG 4/0)
D	DC link terminal L -	
1 (L/P)	Connection for the heat exchanger fan	
2 (0V AC)		
U2	Motor connection U, V, W terminal blocks	
V2		
W2		

X5	**Control voltage**	
1	Control voltage connection for voltage class 7 AC400 V ... 480 V 50 / 60 Hz Control voltage connection for voltage class 8 AC500 V 50 / 60 Hz	
3		

X2 additional function L1 cable damping		
C3	Cable damping return	Cable cross-section which can be connected 0.75 - 35 mm² (AWG 18 – 2)
D3		

X2 additional function F1 filter current feedback		
U6	Operation possible only with the original Refu filter	Cable cross-section which can be connected 25 - 50 mm² (AWG 3 – 1/0)
V6		
W6		

Additional function Z1		
C / D		Cable cross-section which can be connected 35 - 95 mm² (AWG 2 – 4/0)

X80	Starting lock out	
1	During operation, terminals 1 - 2 must be closed; when they are opened, the start of the connected motor is inhibited.	Recommended minimum cross-section 1 mm² (AWG 18) Cable cross-section which can be connected 0.08 -1.5 mm² (AWG 28 – 16)
2		
4	Start inhibitor floating acknowledge contact, 30 V DC / 1 A N/C contact	
5		

X83	Electronics P24V power supply	
1	P24V 24VDC –15 / +20%, ripple, max 5% (VDE0411 / 500); power consumption approx. 80W (class G); startup current 15 A (class G)	Recommended minimum cross-section 1.5 mm² (AWG 16) Cable cross-section which can be connected 0.2 -2.5 mm² (AWG 24 – 14)
2	Ground	

Tab. 6-6 Cable cross-section, size classes G

Control Transformer T1

A control voltage of AC 230 V is required in inverters of size class G for the contactor fan and pump. This voltage is obtained from the line supply voltage applied to X5 using an installed T1 control transformer.

For devices with voltage class 7: DC 530V...670V – the control transformer is designed for the following power supplies on the primary side:

- Voltage: AC 400 V
- Voltage tolerance: ± 15 %
- Frequency: 50 / 60 Hz

The control transformer has been set to a line supply voltage of AC 400 V at the factory.

For devices with voltage class 8: DC 700V – the control transformer is designed for AC 500V on the primary side:

CAUTION

Material damage due to overload of the component!

⇒ the correct setting is to be made by switching terminals on the control transformer.

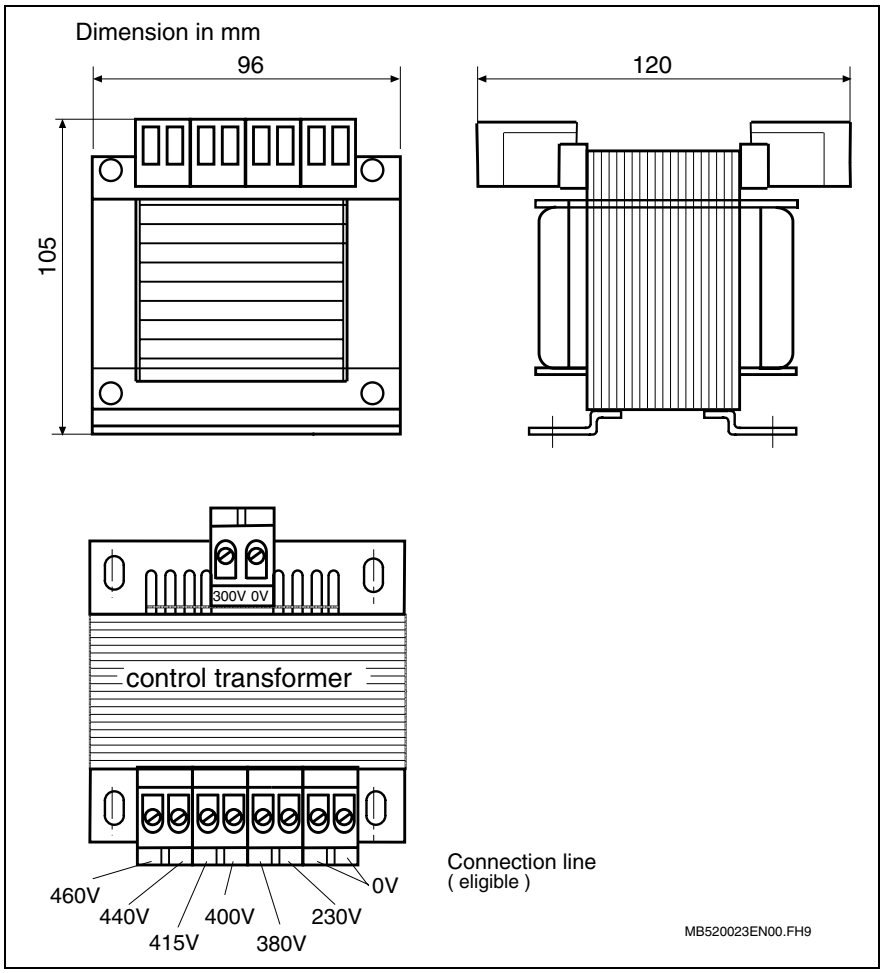


Fig.: 6-5 Control Transformer T1

6.6 Connection Diagram

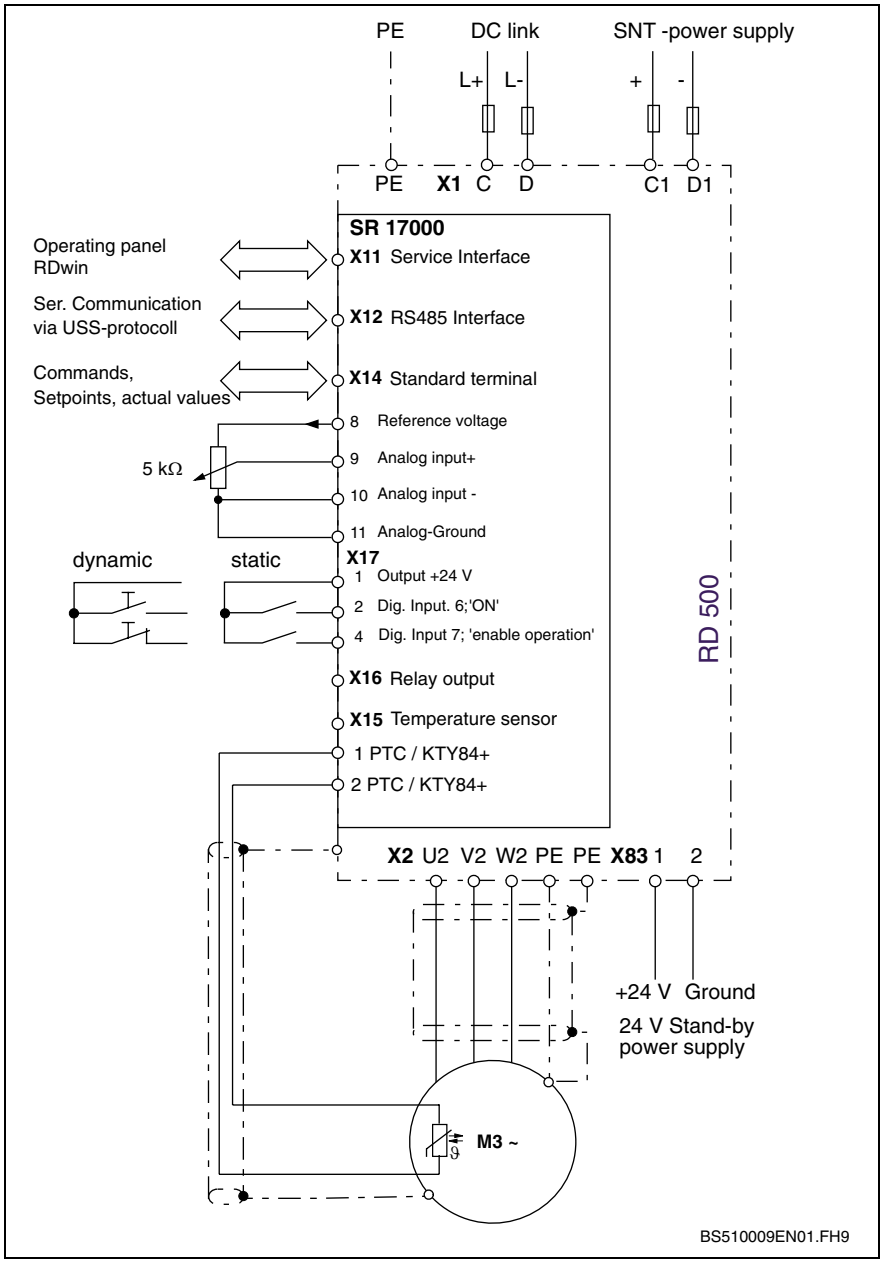


Fig.: 6-6 Connection diagram for inverter size classes A - E

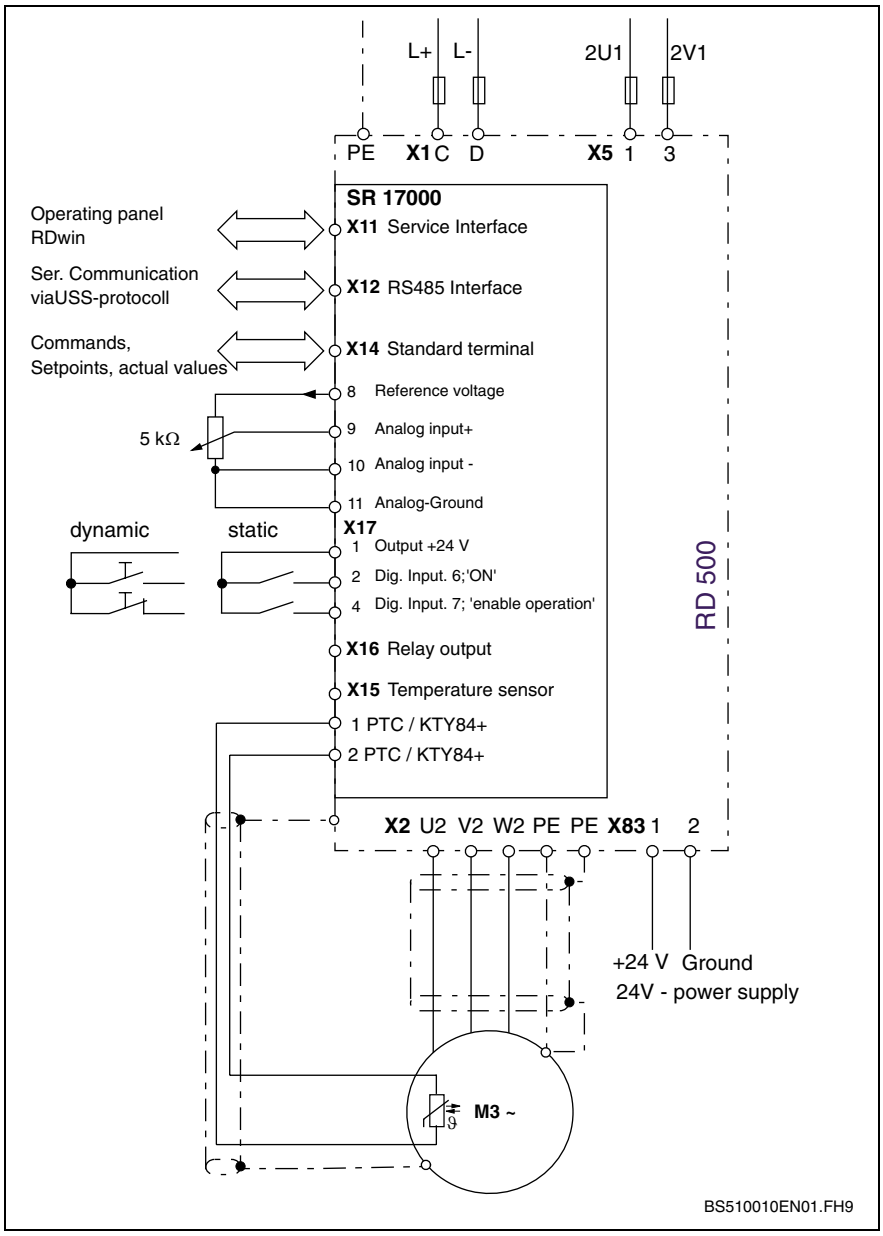


Fig.:6-7 Connection diagram for inverter size class G

6.7 Control terminals see Chapter 4.7

7 Operator Control and Visualization

7.1 Possibilities of Operator Control

The user panel (option), the RDwin PC user interface and several other interfaces are available to operate, visualize and parameterize RD 500 units.

Serial interfaces RS232 and RS485 are installed as standard on the logic and control board. In addition, the optional interface cards Sercos, Profibus DP, Interbus S, CAN bus and CAN open are available for setting parameters.

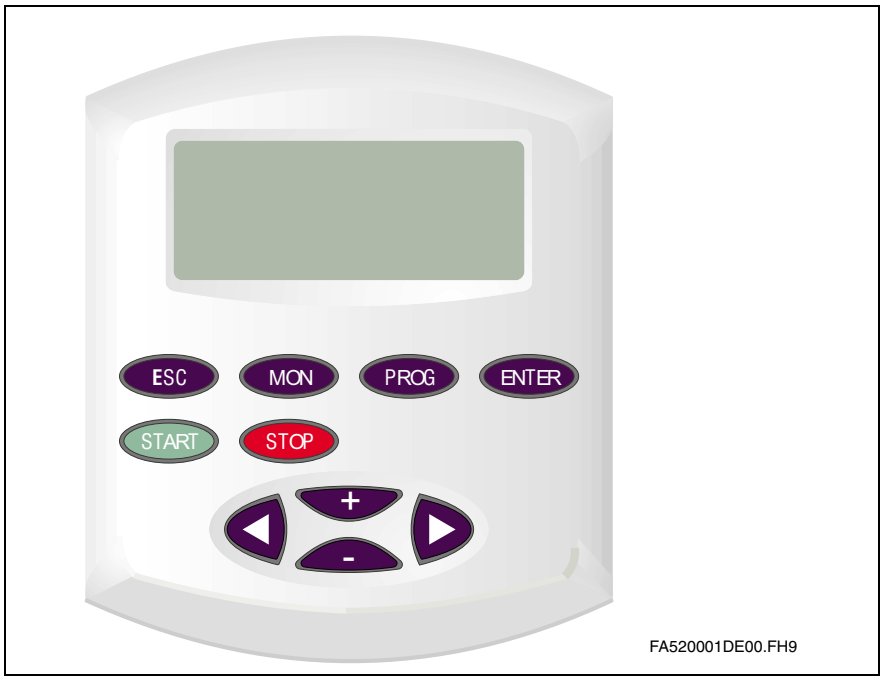


Fig. 7-1: User panel with graphics display (accessory)

7.2 Operator Control with the User Panel

Visualization (Monitor) with the User Panel

Key	Menu level
Esc	Return to previous menu item
Mon	Changes to monitor
Prog	Changes to parameterization
Enter	Accepts the selected menu item
+	To previous menu item
-	To next menu item

Fig. 7-2: Key functions of the user panel in monitor mode

Operation with the operator panel

When supplied (standard values of the basic parameterization are set), the start / stop key and the plus / minus key (for the motorized potentiometer function) are active.

Key	Function	Conditions
Start	Starts the drive	The On/Off command must be set to “Terminal steady-state + operator panel” or “Operator panel, dynamic”.
Stop	Stops the drive	
+	Motorized potentiometer setpoint increases	The setpoint must be set to “Motorized potentiometer” and the ON/OFF logic must be set to “Terminal steady-state + operator panel” or “Operator panel, dynamic”.
−	Motorized potentiometer setpoint decreases	
+	Toggles between the NORMAL and TEST modes	Password level 2 must be selected and the inverter must be inhibited

Fig. 7-3: Function of the operator panel in “Operation”

Normal and test operation (local / remote)

The two operating modes are intended for setting-up or for service purposes (test mode) and for normal operation (normal mode). The On / Off commands and the setpoint input can be separately set for each mode. For example, the normal mode can be set-up for terminal operation (P0870 = terminal, steady-state) and the test mode for operator control using the operator panel (P0871 = operator panel, steady-state).

Parameterization Using the User Panel

Key	Menu level	Parameterizing level
Esc	Return to previous menu item	Cancels the changed value
Mon	Changes to monitor	
Prog	Changes to parameterization	Value is temporarily accepted. All of the values are accepted only after pressing the “Enter” key.
Enter	Accepts selected menu item	Accepts the changed value
+	To previous menu item	Increases value
−	To next menu item	Decreases value
▶	Jump to end of list	Cursor position to right
◀	Jump to beginning of list	Cursor position to left

Fig. 7-4: Key functions of user panel when parameterizing

Fast Parameterization using Key Combinations

Key	Response
+ + −	If these keys are simultaneously pressed: – the complete parameter number is set to zero (numerical list). – the complete parameter value is set to zero (for numerical parameters).
◀ + ▶	If these two keys are pressed simultaneously, the factory setting of the active value is set.
Mon + Prog	If these keys are simultaneously pressed, the system changes from the monitor or prog. area into a temporary actual value display. When the ESC key is pressed again, the display goes back to the selected menu. In order for the user to be able to differentiate between the standard operating display and the temporary actual value display, the temporary actual value display has a flashing frame.

Fig. 7-5: Key combinations

Load Standard Values

When the drive converter or inverter is supplied, the parameters are set to standard values. The “Load factory setting” function can also be activated by parameter P0071.

SET PARAMETERS

Prompted parameterization

Unit setting

P0071 Load factorySetting

No action

Basic parametrizat.

Free parametrizat.

NAMUR applications

Sercos applic. free

Note: All of the parameters of the selected password level are reset using the “Load factory setting” function.

Depending on the application, the user must adapt the following parameters after the standard values have been set.

Application/output frequency	Option	Firmware	Pulse frequency
-200 Hz	Without filter		4 kHz
-200 Hz	With sinusoidal filter	FWA-RD500*-02x-xxVRS-MS-RD52	8 kHz
-1000 Hz	With / without sinusoidal filter	FWA-RD500*-10x-xxVRS-MS-RD52	10 kHz
- 1400 Hz	With / without sinusoidal filter	FWA-RD500*-14x-xxVRS-MS-RD52	12 kHz

Fig. 7-6: P0026 pulse frequency

CAUTION

Damage caused by parameterizing errors!

⇒ The filter or motor could be damaged if the pulse frequency (P0026) is incorrectly selected.

Fault Messages when Parameterizing

Error message	Cause	Solution
Parameter is not accessible in the basic parameterization.	Parameter numbers which are not accessible have been entered into the numerical list.	Only pre-defined parameters are available in the basic parameterization. Only parameter numbers from the Tables in Section 5 can be entered.
Please select basic parameterization	The selected parameter is a macro parameter and is not accessible in the free parameterization.	Change into the basic parameterization. **Caution! Data could be lost**.
Parameter inhibited	Drive is operational.	Inhibit the inverter and then change the parameter.
Data conflict (general)	Some parameter settings are dependent on others. If a parameter is changed and is acknowledged with Enter, then data conflicts can occur.	
Data conflict e.g. P0182 with P0183	The V/Hz characteristics are not correct. The frequencies must have a minimum 1 Hz clearance between them.	Initially accept the value of the first parameter change with Prog after the second parameter change acknowledge with Enter to save.
Data conflict e.g. P0870 steady-state<==>dynam	Changing the “steady-state” into the “dynamic On/Off command” or vice versa. Steady-state / dynamic On/Off operation for the test / normal operating modes cannot be selected, mixed.	Initially accept the value of the first parameter change with Prog, after the second parameter change acknowledge with Enter to save.
Data conflict e.g. P0875 with dynam. ON / OFF	In the device control is ON / OFF (P0870 / 0871) “terminal static” selected. The function “enable operation” is permanently switched on digital input 7	The function “enable operation” can only switched on an optional digital input, when the command ON / OFF (P0870 / 0871) are setting dynamic.

1: For parameters which are dependent on the motor data set changeover (P0070), both data sets (indexes 0 and 1) are monitored. This includes the parameter set which isn’t active.

Fig. 7-7: Fault messages when parameterizing

Copy Function

A copy function is integrated in the user panel. This allows a parameter set to be saved in the user panel (P0733) and then transferred quickly into another unit (P0732). In this case, only those parameters which are accessible with the selected password level are transferred to the unit.

Note:

The parameter set can be saved in the operator panel after start-up and after the drive has been optimized. This means that when the AC drive converter is replaced, it can be quickly recommissioned.

Password level 3 must be used to transfer (download) data into the drive.

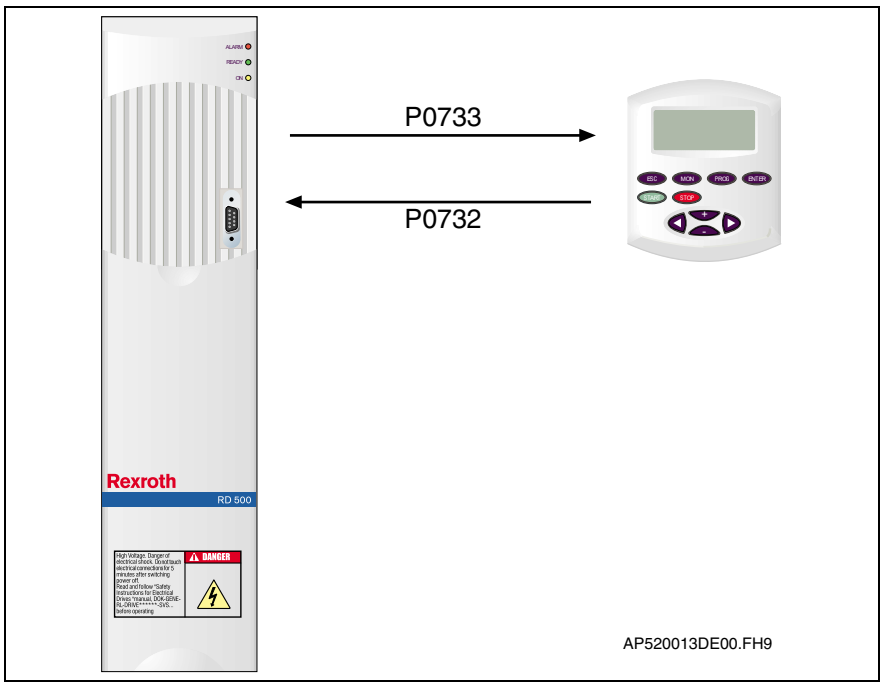


Fig. 7-8: Copy function

Note: After Copy, can be checked over Monitor copy-Status if faults be arise at the transmission

Fault Acknowledgement

After a fault occurs, “Fault” is displayed in the operating display. The cause of the fault and the fault time are displayed below this. After the cause of the fault has been removed, it can be acknowledged using the Esc key of the user panel.

7.3 Visualization

Monitor

Monitor Structure

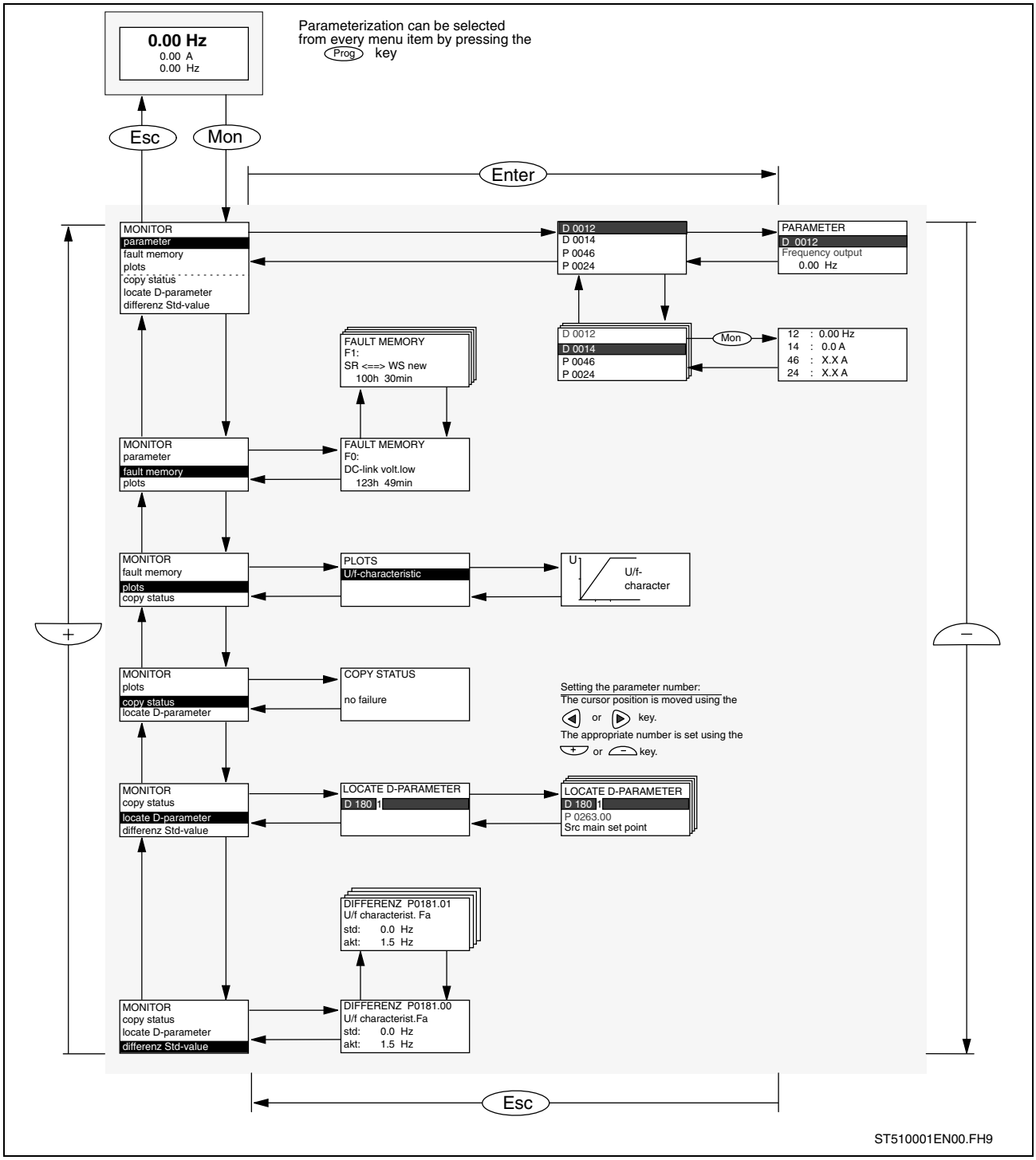


Fig.: 7-9 Monitor program structure

Monitor Functions

Parameter Four selectable parameters are simultaneously displayed. The parameter monitor can be used to support commissioning, e.g. the speed setpoint route can be tracked using the parameterizable functions of the converter. In this case, use the D parameters from the function charts.

Fault memory The last 10 faults are saved in the fault memory. The most recent fault is in memory location S0, the oldest in S9. A new fault is always saved in memory location S0. All of the older faults are always shifted one position upwards in the memory. This means the fault in memory location S9 is lost.

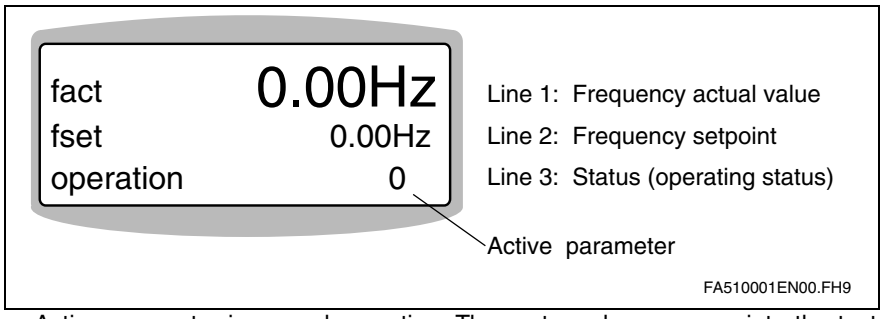
Graphic display The existing V/f (V/Hz) characteristic is graphically displayed in this menu.

Copy status Faults and irregularities which occur when copying a data set from the operator field in the converter are displayed in this menu. The copy status is lost when the drive converter is shut down.

Search for D parameters A list of “Parameter sources” in which the selected D parameter is connected is displayed using “Search for D parameters”. The list can be scrolled using the Enter key. If the selected D parameter is not linked with a “Parameter source”, the following is displayed: “is not linked”. Refer to the function charts with legend for additional information on this subject.

Operating Display

From ten display values, three can be selected to be displayed in the operating display; refer to P0037.0x.



Active parameter in normal operation. The system changes-over into the test mode when the (<) and (>) key are simultaneously pressed. “0T” is then displayed.

Fig.: 7-10 Operating display

Warning Display

If a critical operating condition develops, a warning message and operating display are displayed alternatingly until this critical condition has been resolved.

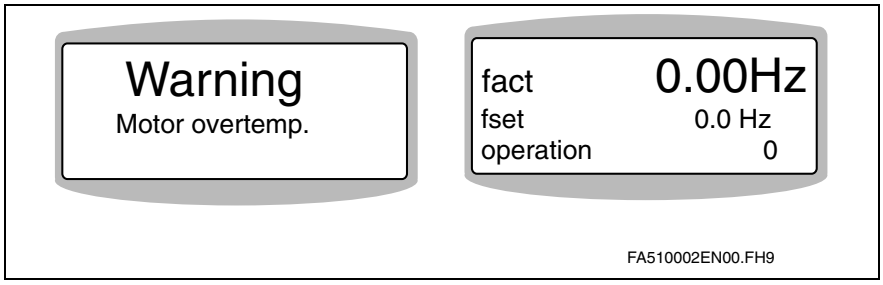


Fig.: 7-11 Warning display

Fault Display

If an operating condition which initiates a fault occurs, the fault display replaces the operating display.

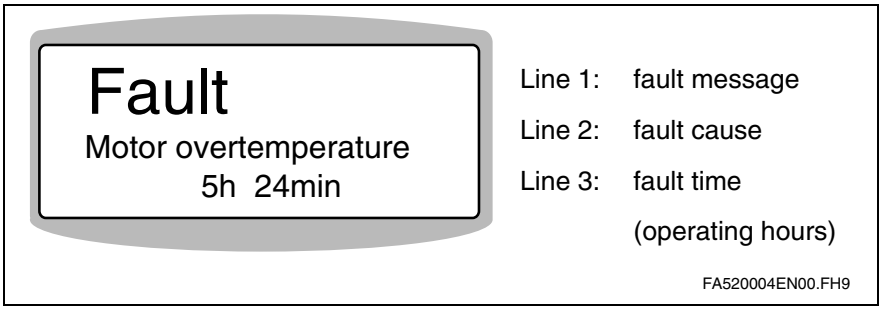


Fig.: 7-12 Fault display

LED Display

LED display		Meaning
○ ○ ○	No LED lit	Operating condition, power-on inhibitor not ready to power-up
○ ● green ○	Green LED lit	Operating condition, ready to power-up
○ ● green ● yellow	Green LED lit Yellow LED lit	Operating condition, ready
○ ○ ● yellow	Yellow LED lit	Operating condition, operation (run)
● red ○ ○	Red LED lit	Operating condition, fault

Fig.: 7-13 LEDs

8 Parameter Value Assignment

8.1 Parameterization

The RD 500 series can be parameterized with two possibilities:

1. **Basic parameterization**: The operator has pre-defined parameters in the "basic parameterization". It is menu-prompted, and it allows many applications to be quickly set in a user-friendly fashion. It is selected in the condition when supplied from the factory. The basic parameterization is selected in the condition when supplied from the factory. Only the description of the "basic parameterization" is provided in this chapter.
2. **Free parameterization:** In addition to the basic functions, logic gates, comparators, a technology controller, several multi-function blocks, etc. are provided. The description of the free parameterization is provided in the documentation “DOK-RD500*-RD51*xxVRS*-FK0x-EN-P – function charts and parameter lists”.

Parameterization Structure

Parameterization comprises three main menus:

Quick setup: Selected parameters for fast start-up (motor adaptation, ramp-up / ramp-down time, etc.)

Prompted parameterization: Menu-prompted, individual adaptation of the converter

Numerical list: The adaptation possibilities can be directly selected.

The main parameterization menu is displayed by pressing the Prog key. The main menu is subdivided again into additional levels. The structure of the various menu levels is shown in the following diagram.

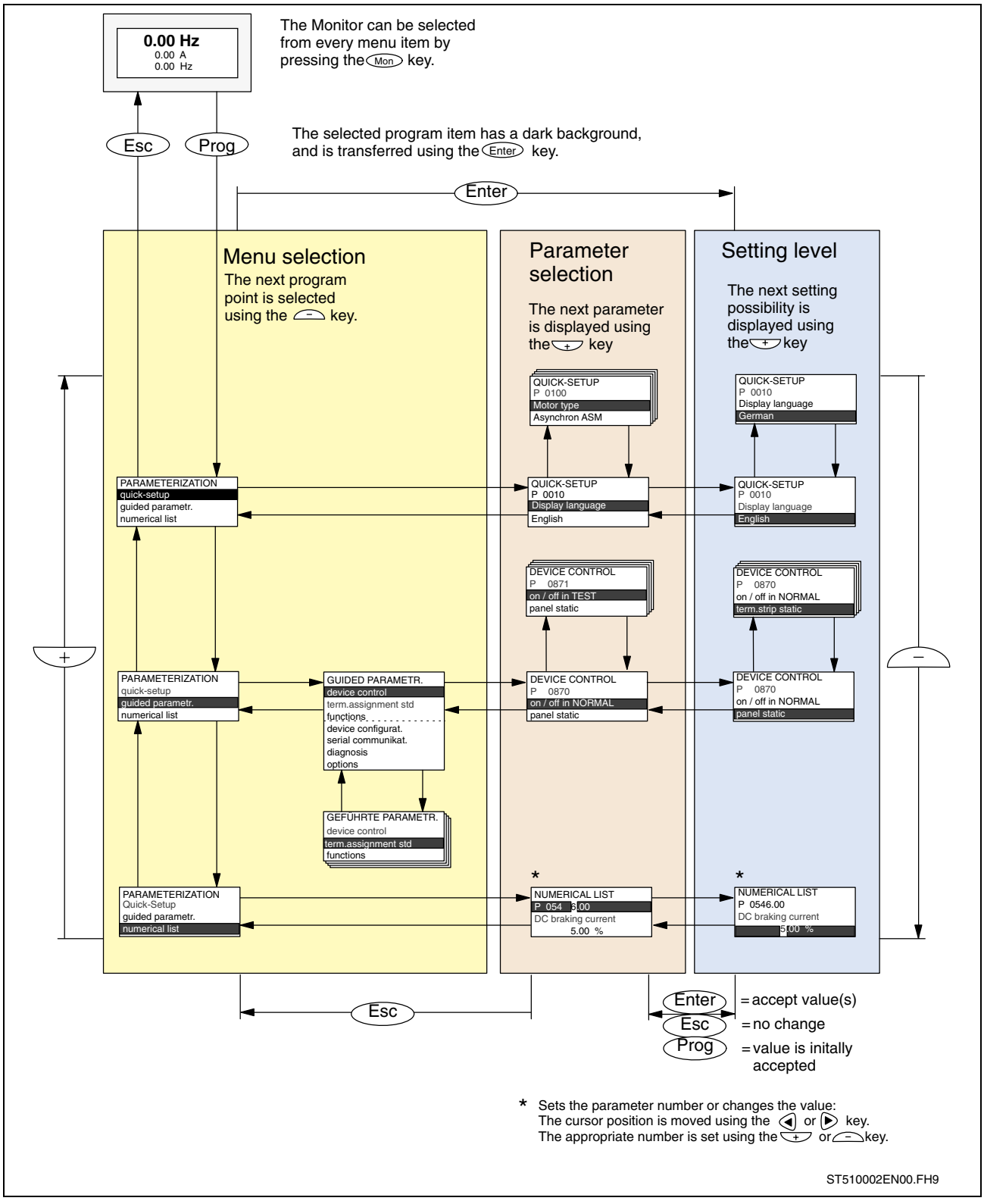


Fig. 8-1: Parameterization menu structure

Overview

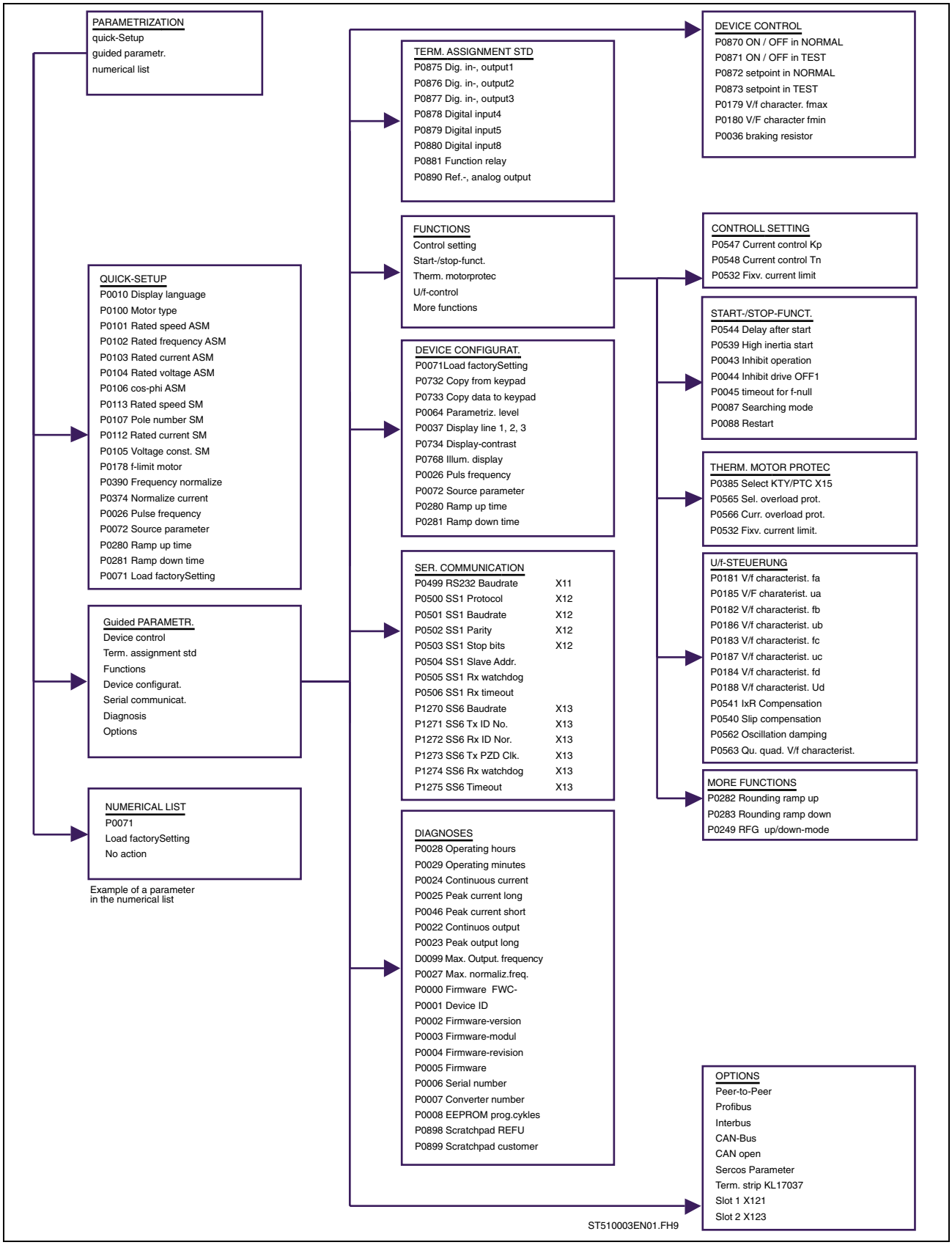


Fig. 8-2: Menu overview

8.2 Password Levels

The parameters are located at various access levels. A password is required to change parameters. If several parameters are changed in the parameterization, the password has to be entered only the first time. The required password level can be taken from the parameter table.

Password 0 Password not required

Password 1 Esc, Mon, Prog and acknowledge with Enter

Password 2 Esc, Mon, Prog, + and acknowledge with Enter

Password 3 ▶, Esc, Mon, Prog and acknowledge with Enter.

All of the parameters of the lower password levels are also accessible with the selected password.

8.3 Quick Setup

Parameter No.:	Name	Description / explanation selectable options	Factory setting min ... max values	Password
0010	**Language**		**German**	**0**
		Selects the display language: 0 = German 1 = English	0 / 1	
0100.00	**Motor type**		**Induction motor ASM**	**2**
		Selects the motor type: 0 = Induction motor ASM 1 = Synchronous motor SM	0 / 1	
0101.00	**Rated speed ASM**		**1)**	**2**
		Rated speed from the motor rating plate.[2)]	100 ... 210000 RPM	
0102.00	**Rated frequency ASM**		**1)**	**2**
		Rated frequency from the motor rating plate.[2)]	5.0 Hz... 3500 Hz	
0103.00	**Rated current ASM**		**1)**	**2**
		Rated current from the motor rating plate.[2)]	0.5 A... P0033	
0104.00	**Rated voltage ASM**		**1)**	**2**
		Rated voltage from the motor rating plate.[2)]	0.50 ... 600 V	
0106.00	**cos-phi ASM**		**1)**	**2**
		cos-phi from the motor rating plate.[2)]	0.50 ... 0.98	
0112.00	**Rated current SM**		**1)**	**2**
		Rated current from the motor rating plate.[3)]	0.5 A ... P0033	
0113.00	**Rated speed SM**		**1)**	**2**
		Rated speed from the motor rating plate.[3)]	100 ... 210000 RPM	

Para-meter No.:	Name	Description / explanation selectable options	Factory setting min ... max values	Pass-word
0105.00	**Voltage constant SM**		**1)**	**2**
		Voltage constant from the motor rating plate.[3)]	0.01 ... 50.00 V / Hz	
0107.00	**Pole number SM**		**1)**	**2**
		Pole number from the motor rating plate.[3)]	1 ... 64	
0178.00	**f limit, motor**		**50.00 Hz**	**2**
		Highest permissible motor frequency (protection against centrifugal force). The maximum output frequency is limited, as a function of the pulse frequency, to the value of P0027. When changing the motor rating plate data, P0178 is set to the rated motor frequency plus 5%.	0.0 Hz ...P0027	
0390.00	**Frequency normalization**		**50.00 Hz**	**2**
		Reference value for frequency setpoints and actual values. This parameter is set to 50 Hz in the factory. To operate the motor with 50 Hz, a setpoint of 100% must be entered.	15.0 Hz ... P0027	
0374.00	**Current normalization**		**P0024**	**2**
		Reference value for current setpoints and actual values. Is set to the value of the drive current in the factory (P0024).	0.5 ... 6553.5	
0026.00	**Pulse frequency**		**4.0 kHz**	**2**
		Pulse frequency of converter	1.0 ... 12kHz	
0072	**Param. setting**		**4**	**2**
		Enters from which source the parameter can be set. 0 = Operator panel , PC (RS232) 1 = Bus SS1 , 2 = Bus SS2 , 3 = Bus SS4 , 4 = All buses , 5 = Bus SS6	0...5	
0280.XX	**Ramp-up time**	**Refer to Fig. 8-4: Up- and down-ramps**	**5.000 s**	**1**
		Ramp-up time of the ramp-function generator. The entered time is valid for a setpoint change from 0 % to 100 %. **XX** = The index, in which a value can be saved, is selected in parameters P0875, P0876; P0877; P0878, P0879 or P0880 (function: Setpoint memory, bits 20 ... 23).	0.000 ... 90000.000 s	
0281.XX	**Ramp-down time**	**Refer to Fig. 8-4: Up- and down-ramps**		**1**
		Ramp-down time of the ramp-function generator. The entered time is valid for a setpoint change normalized for 100%. **XX** = The index, in which a value can be saved, is selected in parameters P0875, P0876; P0877; P0878, P0879 or P0880 (function: Setpoint memory, bits 20 ... 23).	0.000 ... 90000.000 s	1

Para-meter No.:	Name	Description / explanation selectable options	Factory setting min ... max values	Pass-word
0071	**Load factorySetting**		**0**	**0**
		Load factorySetting 0 = no action 1 = basic parametrizat. 2 = free parametrizat. 3 = NAMUR applications 4 = Sercos applic. free	0 ... 4	

1: The motor data of a typical motor are set as factory setting for each drive output class.

2: This menu item is only displayed, if an induction motor was selected as motor type.

3: This menu item is only displayed if a synchronous motor was selected as motor type.

Fig. 8-3: Parameter list of Quick setup

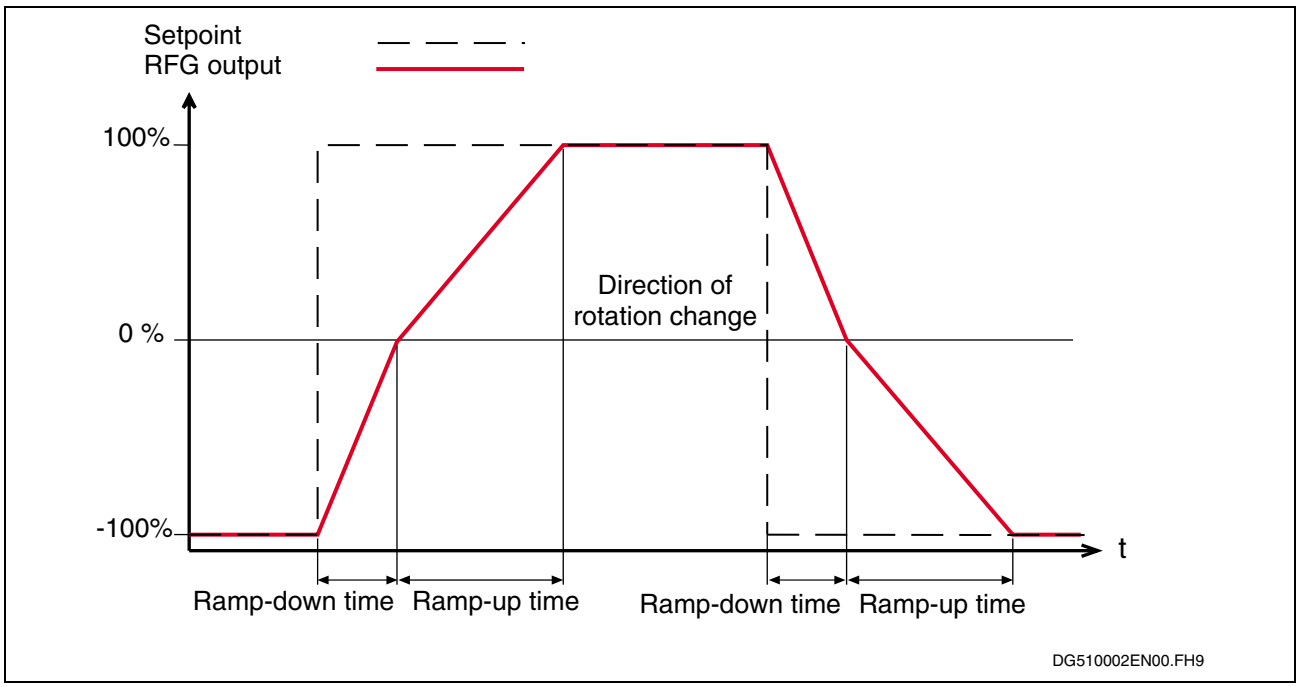


Fig. 8-4: Up- and down-ramps

8.4 Guided parameterization

Drive control / setpoints

Para-meter No.:	Name	Description / explanation selectable options	Factory setting min ... max values	Pass-word
0870	**On / off for NORMAL**		**Terminal dynamic**	**1**
		Enters On / off for NORMAL operation 0 = Term. steady-st. (steady-st. corr. to a switch function) 1 = T. stat. + OP (T = terminals OP = operator panel) 2 = T. stat. + PC (PC w / RDwin via service-interface) 3 = T. stat. + bus SI1 (SI = serial interface) 4 = T. stat. + bus SI2 (if available) 5 = T. stat. + bus SI4 (if available) 6 = T. dyn. (OFF always) (dyn. = dynamic) 7 = OP dyn. (OFF always) 8 = T. dynamic (dynamic corr. to a pushbutton funct.) 9 = OP dynamic 10 = OP static 11 = T. stat. + bus SI6 12 = T. stat. + SI2 Sercos 13 = T. stat. + SI4 Sercos	0...13	
0871	**On / off in TEST**		**OP (Operator panel) static**	**1**
		Enters On / off for TEST operation. As for parameter 0870.	0...13	
0872	**Setpoint in NORMAL**		**Fix fixvalue**	**1**
		Enters the setpoint for NORMAL operation 0 = Motor potentiometer 1 = Fix fixvalues 2 = Analog input 0 .. ± 10 V 3 = Analog input 0 .. + 20 mA 4 = Analog input 4 .. + 20 mA 5 = Opt. an. input 0 .. ± 10 V (opt. = optional) 6 = Opt. an. input 0 .. + 20 mA 7 = Opt. an. input 4 .. + 20 mA 8 = PC (PC with RDwin via service interface) 9 = Bus SI1 10 = Bus SI2 11 = Bus SI4 12 = Analog input 2..+ 10 V 13 = Bus SI6	0...13	1
0873	**Setpoint in TEST**		**Motor potentiometer**	**1**
		Enters the setpoint for TEST operation as for parameter 0872.	0...13	

Rexroth Bosch Group

Para-meter No.:	Name	Description / explanation selectable options	Factory setting min ... max values	Pass-word
0196	**Mot. pot. mode**	**Supplementary parameter for "motor potentiometer".**	**Start f set, expon.**	**1**
		For **Start f set**, the motor potentiometer setpoint, which was set the last after the off command, is approached. For **Start f min**, the actual f min (P0180.XX) is approached. Furthermore, the rate-of-change of the motor potentiometer can be set using the parameter: linear = Uniform change corresponding to the selected step width expon. = The rate-of-change increases the longer that the button remains pressed 0 = Start f set, linear 1 = Start f min, linear 2 = Start f set, exponential 3 = Start f min, exponential	0 ... 3	1
0195	**Mot. pot. step value**	**Supplementary parameter for "motor potentiometer".**	**0.01**	**1**
		The motor potentiometer rate-of-change is set using the step width.	0.01 ... 10.00 Hz	
0265.XX	**Fix value main s / p**	**Supplementary parameter for "fixed setpoint".**	**5.00 %**	**1**
		Parameter P0390 is the reference value for the frequency setpoints and actual values. P0390 is set to 50 Hz in the factory. This means that to operate the motor with 50 Hz, a setpoint of 100% must be entered. **XX** = The index, in which a value can be saved, is selected in parameters P0875, P0876; P0877; P0878, P0879 or P0880 (function: Setpoint memory, bits 20 ... 23).	-199.99 ... 199.99 %	1
0200.00	**Analog input norm.**	**Supplementary parameter for "analog input".**	**100 %**	**2**
		The analog input normalization refers to the frequency normalization P0390.	-199.99 ... 199.99 %	2
0202.00	**Analog input offs.**	**Supplementary parameter for "analog input".**	**0.00 %**	**2**
		Analog input offset	-199.99 ... 199.99 %	
0203.00	**Analog input sign.**	**Supplementary parameter for "analog input".**	**Direct**	**2**
		Analog input signal 0 = direct 1 = absolute value 2 = inverted 3 = absolute value, inverted	0 ... 3	
0204.00	**Analog input filtr.**	**Supplementary parameter for "analog input".**	**2 ms**	**2**
		Analog input, filter time to smooth the analog signal.	0 ... 10000 ms	

Para-meter No.:	Name	Description / explanation selectable options	Factory setting min ... max values	Pass-word
0284	**Analog window STD**	**Supplementary parameter for “analog input”.**	**0.50 %**	**1**
		The analog setpoint smoothing is specified in a window width in %. For example: Window width = 1 %. A change in the actual setpoint is only transferred, if a change greater than 0.99 % of the possible final value is detected at the analog input.	0.00 ... 20.00 %	
0286	**Analog window OPT2**	**Supplementary parameter for “analog input”.** The analog setpoint smoothing is specified in a window width in %. For example: Window width = 1 %. A change in the actual setpoint is only transferred, if a change greater than 0.99 % of the possible final value is detected at the analog input.	**0.50 %** 0.00 ... 20.00 %	**1**
0564.XX	**Reaction on I < 4mA**	**Supplementary parameter for “analog input 4 ... + 20 mA”.**	**Warning**	**2**
		Response for “I < 4 mA” 0 = no reaction 1 = warning 2 = fault **XX** = 00 for STANDARD mode **XX** = 01 for TEST	0 ... 2	2
0179.XX	**V/f character. Fmax**		**100.00 %**	**2**
		XX = The index, in which a value can be saved, is selected in parameters P0875, P0876; P0877; P0878, P0879 or P0880 (function: Setpoint memory, bits 20 ... 23).	P0180 ... 199.99 %	
0180.XX	**V/f character. Fmin**		**0.00 %**	**2**
		XX = The index, in which a value can be saved, is selected in parameters P0875, P0876; P0877; P0878, P0879 or P0880 (function: Setpoint memory, bits 20 ... 23).	0.00 % ... P0179	
0036	**Braking resistor**		**0**	**1**
		0 = REFU standard 1 = disabled 2 = no protection 3 = external programable	0 ... 3	
0623.00	**Ext. BR: Resistance**	**Supplementary parameters for brake resistor (P0036) “can be externally programmed”**	**199.9 W**	**2**
			0.1 ... 199.9 W	
0624.00	**Ext. BR: Rated power**	**Supplementary parameters for brake resistor (P0036) “can be externally programmed”**	**1.0 kW**	**2**
			0.1 ... 199.9 kW	
0625.00	**Ext. BR: heatup time**	**Supplementary parameters for brake resistor (P0036) “can be externally programmed”**	**1.0 sec**	**2**
			1.0 ...655.4 sec	

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Standard terminal assignment

Para-meter No.:	Name	Description / explanation selectable options	Factory setting min ... max values	Pass-word
0875	**Dig. input, output1**		**I no function**	**1**
		Combined digital input and output 0 = **I** no function (**I**=input) : 2 = **I** no alarm ext. (alarm) 3 = **I** no fault ext. (fault) 4 = **I** fault reset 5 = **I** fmin select 6 = **I** direct. rotat. (direction of rotation reversal) 7 = **I** no volt. disc. (power disconnected) 8 = **I** no fast stop (fast stop) 9 = **I** RFG park (RFG=ramp-funct.gener.) 10 = **I** RFG-up stop 11 = **I** motp. faster (motp.=motorized potentiometer) 12 = **I** motp. slower : 21 = **I** TEST / STANDARD (toggles between the TEST and STANDARD modes, simultaneously disables the changeover from the operator panel.) 22 = **I** setp. mem. bit0 (weighting 2^0: Changes-over the f set, f min, fmax memory and the ramp-function generator) 23 = **I** setp. mem. bit1 (weighting 2^1: Changes-over the f set, f min, fmax memory and the ramp-function generator) 24 = **I** setp. mem. bit2 (weighting 2^2: Changes-over the f set, f min, fmax memory and the ramp-function generator) 25 = **I** setp. mem. bit3 (weighting 2^3: Changes-over the f set, f min, fmax memory and the ramp-function generator) 26 = **I** parblock bit0 (weighting 2^0: Changes-over the specific motor data : 32 = **IN** no alarm. ext. (**IN**=input which is only active in the “STANDARD” mode) 33 = **IN** no fault ext. 34 = **IN** fault reset 35 = **IN** fmin select 36 = **IN** direct. rotat. 37 = **IN** no volt. disc. 38 = **IN** no fast stop 39 = **IN** RFG parking 40 = **IN** RFG-up stop 41 = **IN** motp. faster 42 = **IN** motp. slower :	0...98	

Para-meter No.:	Name	Description / explanation selectable options	Factory setting min ... max values	Pass-word
		52 = **IT** no alarm. ext. (**IT** = input which is only active in the “TEST” mode) 53 = **IT** no fault ext. 54 = **IT** fault reset 55 = **IT** fmin select 56 = **IT** direct. rotat. 57 = **IT** no volt. disc. 58 = **IT** no fast stop 59 = **IT** RFG park 60 = **IT** RFG-up stop 61 = **IT** motp. faster 62 = **IT** motp. slower : 70 = **O** no function 71 = **O** ready to switch-on (**O** = output) 72 = **O** status: Ready to switch-on 73 = **O** ready 74 = **O** status: Ready 75 = **O** operation (run) 76 = **O** no fault 77 = **O** power-on inhibit 78 = **O** no alarm 79 = **O** motor rotating 1 (on & ((t <x.x sec) or (i>x.xx %))) 80 = **O** motor rotating 2 (on & (fact > fmin) & (i> x.xx %)) 81 = **O** direction of rotation, clockwise 82 = **O** current limiting 83 = **O** not mot. alarm temp. (alarm: Motor temperature) 84 = **O** not motovertemp (fault: Motor temperature) 85 = **O** RFG up 86 = **O** RFG down 87 = **O** RFG reached 88 = **O** setpoint reached 89 = **O** setpoint in tolerance 90 = **O** fmin limiting 91 = **O** fmax limiting 92 = **O** TEST selected 93 = **O** control line contactor 94 = **O** f act ≤ f min : 97 = **O** open mechanical brake 98 = **O** standstillsign.		
0876	**Dig. in- output2**		**I no function**	**1**
		As parameter 0875	0 ... 98	
0877	**Dig. in- output3**		**I no function**	**1**
		As parameter 0875	0 ... 98	
0878	**Dig. Input4**		**I test / standard**	**1**
		As parameter 0875 from value 0 to 69	0 ... 69	
0879	**Dig. Input5**		**I fault reset**	**1**
		As parameter 0875 from value 0 to 69	0 ... 69	
0880	**Dig. Input8**		**I direct. rotat.**	**1**
		As parameter 0875 from value 0 to 69	0 ... 69	
0881	**Function relay**		**I no alarm**	**1**
		As parameter 0875 from value 70 to 93	70 ... 98	

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Parameter No.:	Name	Description / explanation selectable options	Factory setting min ... max values	Password
0461	**Mode dig. In-output1**	**Supplementary parameter for output signals**	**3**	**1**
		Mode dig.output1 Terminal X14.2 3 = direct 4 = inverted	3 ... 4	
0463	**Mode dig. In-output2**	**Supplementary parameter for output signals**	**3**	**1**
		Mode dig.output2 Terminal X14.3 3 = direct 4 = inverted	3 ... 4	
0465	**Mode dig. In-output3**	**Supplementary parameter for output signals**	**3**	**1**
		Mode dig.output3 Terminal X14.4 3 = direct 4 = inverted	3 ... 4	
0467	**Mode output relay**	**Supplementary parameter for output signals**	**1**	**1**
		Mode output relay connector X16 0 = relay direct 1 = relay inverted	0 ... 1	
0571	**Sel. security break**	**Supplementary parameter for connection voltagefree in active NAMUR-functions**	**1**	**1**
		Selects the response for safety trip 0 = alarm 1 = fault	0 ... 1	
0289	**Fast stop, ramp-down time**	**Supplementary parameter for “I fast stop”.**	**5.000 sec**	**1**
		Ramp-down time for fast stop	0.000 ... 3200.000 sec	
0288	**Fast stop, ramp-up time**	**Supplementary parameter for “I fast stop”.**	**5.000 sec**	**1**
		Ramp-up time for fast stop	0.000 ... 3200.000 sec	
0739	**Motpot cycl. time ext.**	**Supplementary parameter for motorized potentiometer**	**0.90 sec**	**1**
		Motorized potentiometer cycle time external	0.01 ... 5.00 sec	
0756	**Time 1 timer**	**Supplementary parameter for “O motor rotating1”**	**1.0 sec**	**1**
		Time for the timer	0.01 ... 6500.00 sec	
0730	**Fixvalue for D1517**	**Supplementary parameter for “O motor rotating1”**	**0.00 %**	**1**
		Current threshold value (100% Irated Motor)	-199.99 ... 199.99 %	
0757	**Hysteresis x:xs**	**Supplementary parameter for “O motor rotating 1”.**	**1.00 %**	**1**
		Hysteresis for current	0.00 ... 100.00 %	
0759.00	**Hysteresis x:xs**	**Supplementary parameter for “O motor rotating 2”.**	**1.00 %**	**1**
		Hysteresis for frequency	0.00 ... 100.00 %	

Para-meter No.:	Name	Description / explanation selectable options	Factory setting min ... max values	Pass-word
0759.01	**Hysteresis x:xs**	**Supplementary parameter for “O motor rotating 2”.**	**1.00 %**	**1**
		Hysteresis for current	0.00 ... 100.00 %	
0731.01	**Fixed value for D1518, 1519**	**Supplementary parameter for “O motor rotating 2”.**	**0.00 %**	**1**
		Current threshold value (100% = Irated motor)	-199.99 ... 199.99 %	
0760	**Fixvalue xs input**	**Supplementary parameter for “setpoint reached” and “setpoint within the tolerance bandwidth”.**	**2.00 %**	**1**
		Tolerance value for the frequency	0.10 ... 100.00 %	
0761	**Hysteresis x:xs**	**Supplementary parameter for “setpoint reached” and “setpoint within the tolerance bandwidth”.**	**1.00 %**	**1**
		Hysteresis for frequency	0.00 ... 90.00 %	1
0762	**Time, timer**	**Supplementary parameter for “setpoint in the tolerance bandwidth”.**	**1.0 sec**	**2**
		Time for the timer	0.0 ... 65000.0 sec	
0392	**Threshold standstill**	**Supplementary parameter for “standstill signal”**	**2.00 sec**	**1**
		Current threshold value for standstill	0.10 ... 100.0 sec	
0391	**Hysteresis standstill**	**Supplementary parameter for “standstill signal”**	**1.00 sec**	**1**
		Hysteresis for standstill	0.00 ... 90.00 %	
0890	**Ref., analogue output**	**Reference, analogue output**	**+10V reference output**	**1**
		0 = + 10 V reference output 1 = - 10 V reference output 2 = fact output frequency 3 = Iact output current (apparent current) 4 = Isq torque-generating (active current) 5 = Vact output voltage 6 = Pact output power 7 = Pactive active power	0...7	
0221.00	**PT1 filt. timeconst**	**Supplementary parameter for “analog output”.**	**0 ms**	**1**
		To smooth any value which is connected at the analog output.	0 ... 10000 ms	
0559	**Pactual PT1 time**	**Supplementary parameter for “analog output”.**	**50 ms**	**1**
		Only to smooth the Pact value.	0 ... 10000 ms	
0560	**Ptrue PT1 filter time**	**Supplementary parameter for “analog output”.**	**50 ms**	**1**
		Only to smooth the Pactive value.	0 ... 10000 ms	

Para-meter No.:	Name	Description / explanation selectable options	Factory setting min ... max values	Pass-word
0411	**Output-block signal**	**Supplementary parameter for “analog output”.**	**direct**	**1**
		Defines how a signal is transferred. 0 = direct 1 = absolute value 2 = inverted 3 = absolute value, inverted	0...3	
0413	**Output-block, norm.**	**Supplementary parameter for “analog output”.**	**100.00 %**	**1**
		Normalization of the analog output 10 V correspond to the value set here.	6.26 ... 200.00 %	
0561	**Output-block**	**Supplementary parameter for “analog output”.**	**0.. ± 100 %**	**2**
		0 = 0 ... ± 100 % 1 = + 20 ... + 100 %	0 / 1	
0412	**Output-block offs.**	**Supplementary parameter for “analog output”.**	**0.00 %**	**1**
		Offset	-100.00 ... 100.00 %	

Functions

- Controller setting
- Start / stop function
- Thermal motor protection
- V / Hz control (open loop)

Controller setting

Para-meter No.:	Name	Description / explanation selectable options	Factory setting min ... max values	Pass-word
0547.00	**Current control Kp**		**0.10**	**1**
		Current controller gain factor.	0.01 ... 128.00	
0548.00	**Current control Tn**		**10 ms**	**1**
		Current controller integral action time.	0 ... 5000 ms	
0532.00	**Fixv., current limit**		**100.00 %**	**1**
		Enters the current limit 100% corresponds to the contents of parameter P0374 (factory setting: Continuous output current of the drive).	0.00 ... 190.00 %	
0574.00	**Curr. limit timeout**		**0**	**1**
		Selects Current limit 0 = continuous 1 = 1 second 2 = 2 seconds 3 = 4 seconds 4 = 6 seconds 5 = 8 seconds 6 = 10 seconds 7 = 20 seconds 8 = 40 seconds 9 = 60 seconds 10 = 80 seconds 11 = 100 seconds		

Start- / stop functions

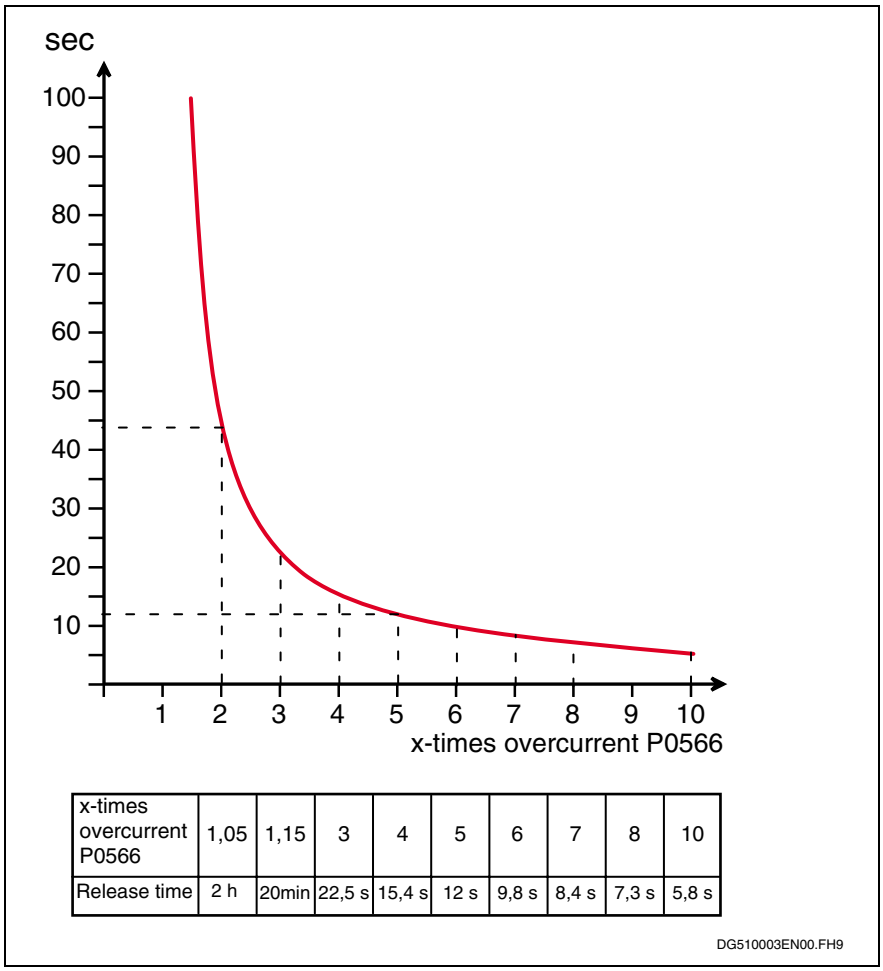
Para-meter No.:	Name	Description / explanation selectable options	Factory setting min ... max values	Pass-word
0544.00	**Delay after start**		**0.3 sec**	**1**
		After the start, the delay time fa (P0181) is entered after which, the drive accelerates to the selected setpoint.	0.0 ... 100.0 sec	
0539	**High inertia start**		**No**	**2**
		For the first run-up after start, twice the current limiting is enabled. 0 = no 1 = yes	0 / 1	
0043	**Inhibit operation**		**Coast-down**	**2**
		0 = braking 1 = coast-down	0 / 1	
0044	**Inhibit drive**		**Coast-down**	**2**
		0 =braking 1=coast-down	0 / 1	

Para-meter No.:	Name	Description / explanation selectable options	Factory setting min ... max values	Pass-word
0546	**DC braking current**	**Supplementary parameter for “braking operation” from P0043 and P0044:**	**5.00 %**	**1**
		100% corresponds to the contents of parameter P0374 (factory setting: Continuous output current of the drive).	1.00 ... 100.00 %	1
0545	**DC braking time**	**Supplementary parameter for “braking operation” from P0043 and P0044:**	**0.0 sec**	**1**
			0.0 ... 100.0 sec	
0045	**Timeout for f-null**	**Supplementary parameter for “braking operation” from P0043 and P0044:**	**1.5 sec**	**2**
			0.0 ... 300.0 sec	
0087	**Searching mode**		**no**	**2**
		0 = no: The drive starts as normal after an on command without a search run. 1 = after on: After the on command, the drive starts with the last direction of rotation and searches for the motor which is coasting down from f max towards 0 Hz. If the motor frequency is found, or for f = 0 Hz, the actual setpoint is approached via the ramp-function generator. 2 = after on ±: After the on command, the drive starts with the last direction of rotation and searches for the motor which is coasting down from f max towards 0 Hz. If the motor is not found by f = 0 Hz, then a search is made from f max towards 0 Hz with the other direction of rotation. If the motor frequency is found, or for f = 0 Hz, the actual setpoint is approached via the ramp-function generator.	0 ... 2	
0088	Restart		**no**	**2**
		Restart after power failure: 0 = no: The drive only starts after the line supply voltage returns if the drive detects a rising edge of the on command. 1 = yes: The drive automatically starts if, when the line supply voltage returns, the drive as an on command.	0 / 1	

Thermal motor protection

Para-meter No.:	Name	Description / explanation selectable options	Factory setting min ... max values	Pass-word
0385	**Select KTY / PTC X15**		**PTC**	**2**
		Selects the thermistor protection. 0 = without , 1 = KTY , 2 = PTC	0 ... 2	
0386	**KTY alarm X15**	**Supplementary parameter for KTY in P0385**	**135 °C**	**1**
		Enters the motor temperature to initiate the alarm.	30 ... 180 °C	
0387	**KTY fault X15**	**Supplementary parameter for KTY in P0385**	**155 °C**	**1**
		Enters the motor temperature to initiate the fault.	30 ... 195 °C	

Para-meter No.:	Name	Description / explanation selectable options	Factory setting min ... max values	Pass-word
0388	**PTC evaluation X15**	**Supplementary parameter for PTC in P0385**	**Fault**	**2**
		The following options can be selected when the selected PTC switching value (P389) is reached: 0 = alarm (alarm, motor temperature) 1 = fault (fault, motor temperature)	0 / 1	
0389	**PTC switch value X15**	**Supplementary parameter for PTC in P0385**	**4000 W**	**1**
		Enters the resistance switching threshold to initiate the response set using P0388 (PTC evaluation).	1000 .. 4500 W	
0565	**Sel. overload prot.**		**No response**	**2**
		The overload protection function is implemented corresponding to the SIEMENS 3UB1 overload relay, setting Class 10. The following options can be selected for the response of the IxT overload protection function: 0 = no action 1 = alarm 2 = fault	0 ... 2	
0566.00	**Curr. overload prot.**	**Refer to Fig. 8-5: Emulation of the thermal overload release.**	**0.5 A**	**1**
		Current threshold for the Ixt overload protection function. When the Ixt threshold is reached, the response, set using P565, is initiated. Emulates the thermal overload response When the motor rating plate data is changed, P0566 is set to the rated motor current.	0.5 ... 6553.5 A	1
0532.00	**Fixv. current limit**		**100.00 %**	**1**
		Enters the current limit 100% correspond to the contents of parameter P0374 (factory setting: Continuous output current of the drive).	0.00 ... 190.00 %	1



x-times overcurrent P0566	1,05	1,15	3	4	5	6	7	8	10
Release time	2 h	20min	22,5 s	15,4 s	12 s	9,8 s	8,4 s	7,3 s	5,8 s

Fig. 8-5: Emulation of the thermal overload release

Overload protection

The overload protection is switched-in and switched-out using P0565 and the response type, either alarm or fault, is selected.

The response threshold of the overload protection (P0566) can be set between 0.5 A and the peak current P0025. The overload function was implemented corresponding to the Siemens 3UB1 overload relay, Class 10 setting.

The delay time until the drive is ready to be powered-up after „overload protection“ fault depents on the response threshold:

- For P0566 < 20 A, the drive converter can be powered-up again after 1 minute.
- For P0566 > 20 A, the drive converter can be powered-up again after 10 minutes.

As long as the delay time is running, after the fault has been successfully acknowledged, the „motor overload“ alarm is displayed. The drive cannot be powered-up again during this time.

V / Hz control

Para-meter No.:	Name	Description / explanation selectable options	Factory setting min ... max values	Pass-word
0181.00	**V/f characteristic fa**	**Refer to Fig. 8-6: V / Hz characteristic diagram**		**2**
		The V / Hz characteristic data is calculated by the drive converter from the entered motor rating plate data. The characteristic values can then be changed and optimized. If the rating plate data are re-entered, a new calculation is made and manually entered characteristic data is overwritten. Select the monitor by pressing the Mon key. You can then display the V/Hz characteristics in the “Graphic display” sub-menu.	0.0 ... 6000.0 Hz	
0185.00	**V/f characteristic Ua**		**1)**	**2**
			0 V ... 3000 V	
0182.00	**V/f characteristic fb**		**1)**	**2**
			0.0 ... 6000.0 Hz	
0186.00	**V/f characteristic Ub**		**1)**	**2**
			0 V ... 3000 V	
0183.00	**V/f characteristic fc**		**1)**	**2**
			0.0 ... 6000.0 Hz	
0187.00	**V/f characteristic Uc**		**1)**	**2**
			0 V ... 3000 V	
0184.00	**V/f characteristic fd**		**1)**	**2**
			0.0 ... 6000.0 Hz	
0188.00	**V/f characteristic Ud**		**1)**	**2**
			0 V ... 3000 V	
0541.00	**I x R boost**		**0.00 %**	**1**
		I x R compensation factors. The I x R compensation is disabled by entering 0.00%. The I x R compensation can be used to compensate the voltage drop across the ohmic component of the stator winding which is proportional to the actual apparent current (I act).	0.00 ... 20.00 %	
0540.00	**Slip compensation**		**0.00 %**	**1**
		Enters the factors for slip compensation. The slip compensation is disabled by entering 0.00%. The slip compensation can be used to compensate the speed loss for induction motors, which is approximately proportional to the load torque.	0.00 ... 20.00 %	
0562.00	**Oscillation damping**		**0**	**2**
		For machines, which have a tendency to oscillate, a factor can be set here, which counter-acts this oscillation tendency using the oscillation damping. Oscillation damping is disabled by entering a factor of 0.	-127 ... 127	
0563	**Src. Quad. Charact.**		**1700**	**2**
		Variable parameter source for the function, changeover to square-law characteristic	1 ... 2044	

1): The unit calculated the values of the V / Hz characteristic data automatic, after you have entered the data on the rating plate of your motor.

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V / f characteristic

The values of the V / f characteristic (P 181 – P 188) are calculated from the rating plate data (P0181 – P0188). The unit calculates the characteristic data after you have entered the data on the rating plate of your motor. You can then modify and optimize the characteristic values. If you subsequently change the rating plate data again, this will cause recalculation of the characteristic data and your optimized data will be overwritten.

Linear V/f characteristic

Default calculation of the characteristic data from the rating plate data:

$$U_0 = R_S[P0120] * I_{sd\,nom}[P0117]$$

$$[P0181]\ldots f_a = f_{slip}$$

$$[P0185]\ldots V_a = \frac{V_{nom} \times f_{slip}}{f_{nom}} + R_S \times I_{sd\,nom}$$

$$[P0182]\ldots f_b = f_{nom}/2$$

$$[P0186]\ldots V_b = V_{nom}/2$$

$$[P0183]\ldots f_c = f_{nom}$$

$$[P0187]\ldots V_c = V_{nom}$$

$$[P0184]\ldots f_d = 2 \times f_{nom}$$

$$[P0188]\ldots V_d = V_{nom}$$

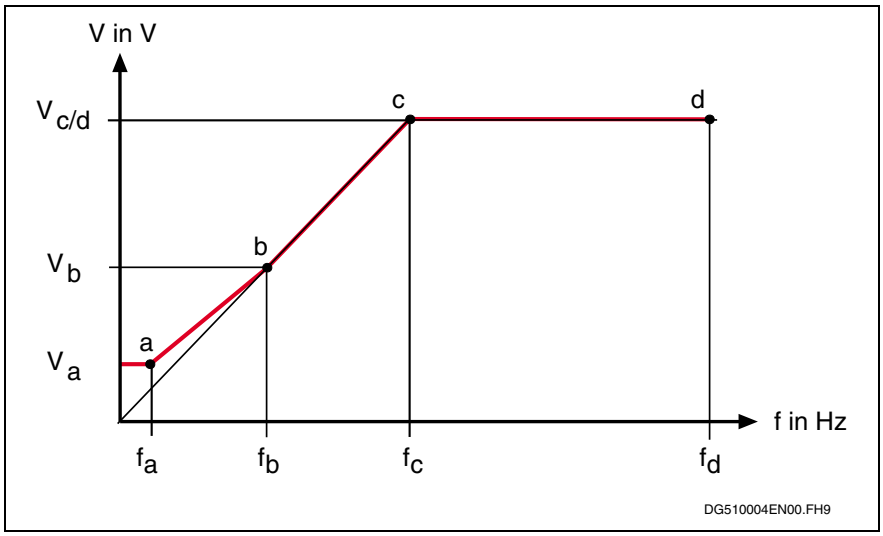


Fig. 8-6: V / Hz characteristic diagram

Square-law V/f characteristic

Default calculation of the characteristic data from the rating plate data:

$$U_0 = R_S[P0120] * I_{sd\,nom}[P0117]$$

$$[P0181]\ldots f_a = f_{slip}$$

$$[P0185]\ldots V_a = \frac{V_{nom} \times f_{slip}}{f_{nom}} + R_S \times I_{sd\,nom}$$

$$[P0182]\ldots f_b = f_a + ((f_d - f_a)/3$$

$$[P0186]\ldots V_b = V_a + (V_d - V_a) \times f_b^2 / f_d^2$$

$$[P0183]\ldots f_c = f_b + ((f_d - f_a)/3$$

$$[P0187]\ldots V_c = V_a + (V_d - V_a) \times f_c^2 / f_d^2$$

$$[P0184]\ldots f_d = f_{nom}$$

$$[P0188]\ldots V_d = U_{nom}$$

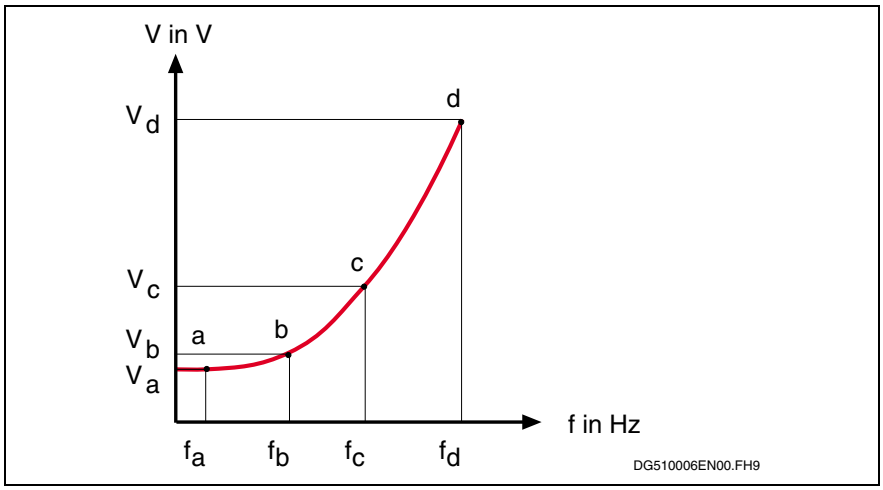


Fig. 8-7: Square-law characteristic diagram

Additional functions

Parameter No.:	Name	Description / explanation selectable options	Factory setting min ... max values	Password
0282.00	**Rounding ramp up**		**0.000 s**	**1**
		Rounding-off times UP for the ramp-function generator. This is used for jerk limiting when starting; this is generally not more than 1/10 of the ramp time.	0.000 ... 800.00 s	
0283.00	**Rounding ramp down**		**0.000 s**	**1**
		Diagram, ramp-up / ramp-down ramp with rounding-off	0.000 ... 800.00 s	
0249	**RFG up/down mode**	**Ramp-up and ramp-down with direction of rotation reversal**	**1**	**2**
		Ramp-up and ramp-down with direction of rotation reversal 0 = sign 1 = value	0/1	

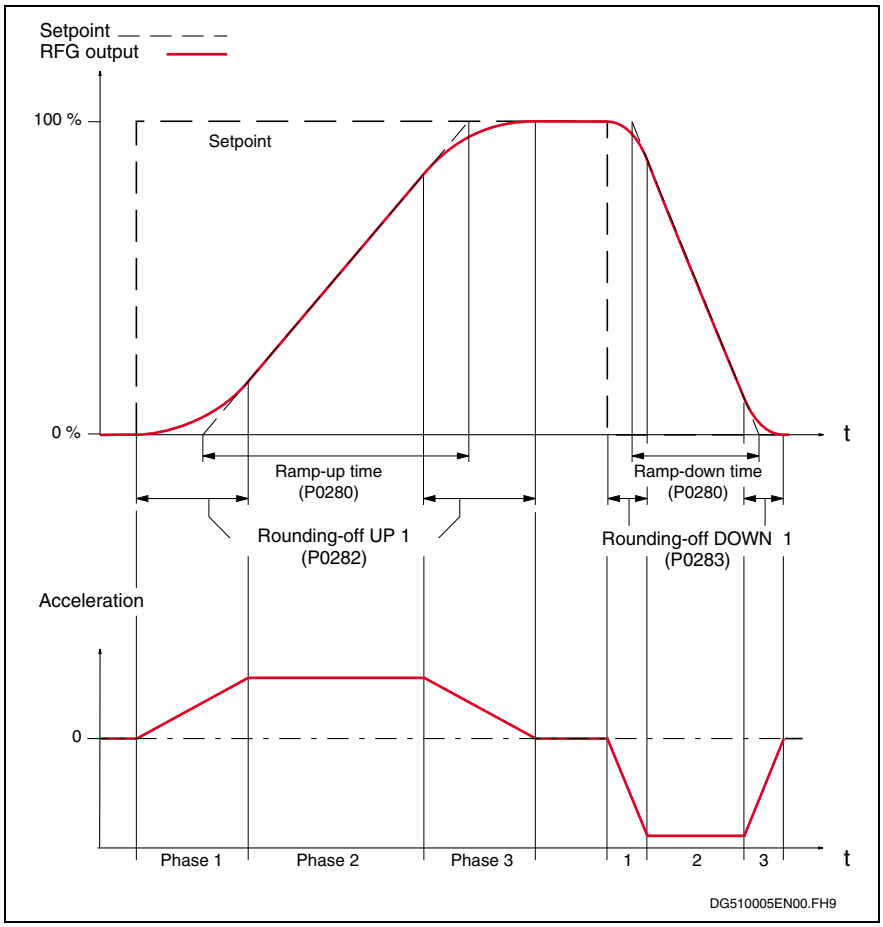
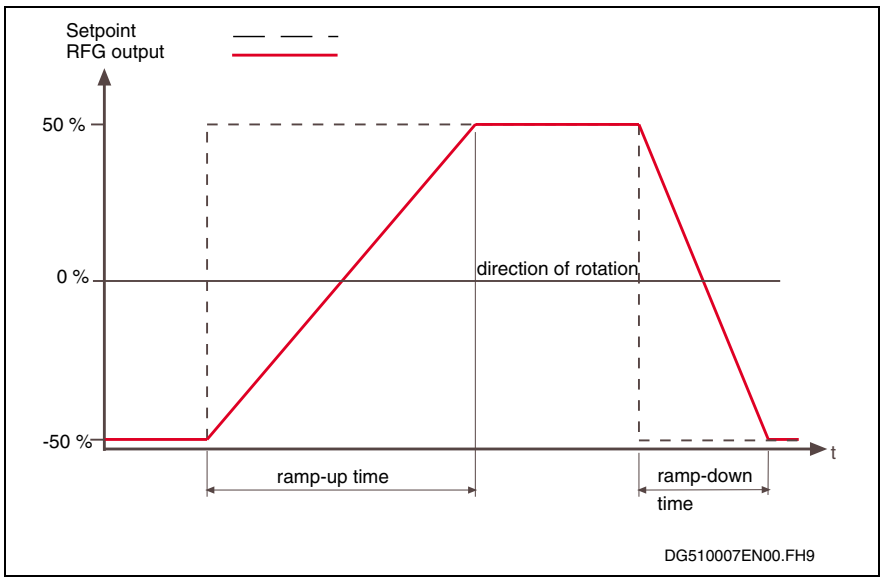
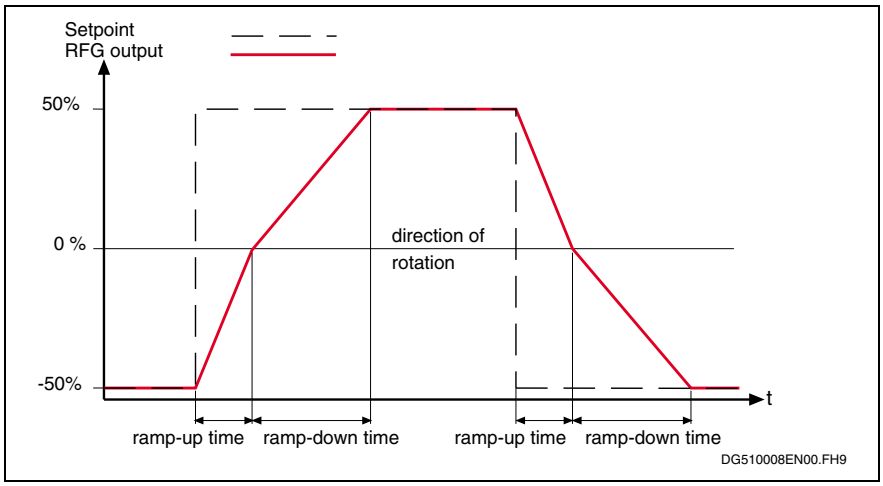


Fig. 8-8: Up and down ramp with rounding-off



For arithmetic positive setpoints changes, the RFG UP times are effective, for arithmetic negative setpoints changes, the RFG DOWN times are effective.

Abb. 8-9: Ramp-up and ramp-down with direction of rotation reversal



For absolute setpoints increases, the RFG UP are effective, for absolute setpoint decreases, the RFG DOWN times are effective

Abb. 8-10: Ramp-up and ramp-down with direction of rotation reversal

Drive setting

Para-meter No.:	Name	Description / explanation selectable options	Factory setting min ... max values	Pass-word
0071	**Load factorySetting**		**No action**	**0**
		0 = no action 1 = basic, standard values are loaded Parameters, with a password level less than or the same as the entered password level are set to the standard value of the basic parameterization. 2 = free standard values are loaded Parameters with a password level less than or equal to the entered password level are set to the standard value of the free parameterization. 3 = standard values for NAMUR applications are loaded Parameters, with a password level less than or the same as the entered password level are set to the standard value of the basic parameterization with activated NAMUR functions. 4 = standard values for Sercos applications are loaded Parameters, with a password level less than or the same as the entered password level are set to the standard value of the free parameterization for Sercos applications.	0 ... 4	
0732	**Copy from keypad**	**Caution: Only those parameters are copied which are enabled as a result of the selected password.**	**No**	
		The data set, saved in the operator panel is copied into the drive. 0 = no 1 = yes 2 = designation (the saved data set designation can be viewed here)	0 ... 2	
0733	**Copy data to keypad**		**No**	**0**
		The complete drive converter data set is copied into the operator panel. 0 = no 1 = yes A data set name can be entered after the data transfer. You can scroll through the ASCII code using the + and - keys (the system goes to the start of the following ranges by simultaneously pressing the + and - keys: A, a, 0 and the blank symbol). You can move the cursor to the right or left using the < or > key.	0 / 1	
0064	**Parameteriz. level**		**Basic parameterization:**	**23**
		0 = basic parameterization: The operator has access to the pre-defined parameters of the basic parameterization, menu-prompted or via the numerical list. 1 = free parameterization: The operator can access all of the parameters associated with the free parameterization. **Caution:** Data can be lost when changing the parameterizing modes! Please carefully read the Section, 1.3 Working with basic parameterization and the free parameterization in the Manual, Function charts and parameter list.	0 / 1	

Para-meter No.:	Name	Description / explanation selectable options	Factory setting min ... max values	Pass-word
0037.00	**Display, lines 1,2,3**		**f actual**	**0**
		Selects the operating display for line 1. 0 = status (drive status message) 1 = actual speed (electrical) 2 = output effective current 3 = output current (actual apparent current) 4 = output voltage 5 = DC link voltage 6 = frequency actual value 7 = frequency setpoint 8 = P act (actual apparent power) 9 = P active (active power which the motor takes)	0 ... 9	
0037.01	**Display, lines 1,2,3**		**Frequency setpoint**	**0**
		Selects the operating display for line 2. As for parameter 0037.00.	0 ... 9	
0037.02	**Display, lines 1,2,3**		**Status**	**0**
		Selects the operating display for line 3. As for parameter 0037.00.	0 ... 9	
0734	**Display contrast**		**11**	**0**
		Sets the contrast for the operator panel display	10 ... 20	
0768	**Illum. display**		**10 min**	**0**
		Background lighting in the operator panel display 0 = switched out 1 ... 998 = minutes remains switched-in after the last key was pressed 999 = continually switched-in	0 ...999	
0026	**Pulse frequency**		**4 kHz**	**2**
		Pulse frequency of the inverter drive		
0072	**Source parameter**		**All busses SSx**	**2**
		Specifies from which source parameters can be set. 0 = Keypad, PC (RS232), 1 = Bus SS1, 2 = Bus SS2, 3 = Bus SS4, 4 = All busses, 5 = Bus SS6	0 ... 5	
0280	**Ramp-up time**		**5.000 sec**	**1**
		Ramp-up time generator (RFG)	0.000 ... 900000.000	
0281	**Ramp-down time**		**5.000 sec**	**1**
		Ramp-down time generator (RFG)	0.000 ... 900000.000	

Serial communications

Sub-menu to set standard RS485 interfaces.

Para-meter No.:	Name	Description / explanation selectable options	Factory setting min ... max values	Pass-word
0499	**RS232 baud rate X11**		**9600 baud**	**2**
		0 = 1200 baud 1 = 2400 baud 2 = 4800 baud 3 = 9600 baud 4 = 19200 baud 5 = 38400 baud 6 = 57600 baud 7 = 76800 baud	0 ... 7	
0500	**SI1 protocol X12**		**USS 4 / 6 words**	**2**
		The serial interface 1 (SS1) is an RS485 interface (connection X12). 0 = No protocol 1 = USS 4 / 2 words 2 = USS 4 / 6 words 3 = USS 0 / 2 words 4 = USS 0 / 6 words 5 = USS 4 / 0 words	0 ... 5	
0501	**SI1 baud rate X12**		**9600 baud**	**2**
		0 = 1200 baud 1 = 2400 baud 2 = 4800 baud 3 = 9600 baud 4 = 19200 baud 5 = 38400 baud 6 = 76800 baud	0 ... 6	
0502	**SI1 parity X12**		**Even**	**2**
		0 = No parity 1 = ODD 2 = EVEN	0 ... 2	
0503	**SI1 stop bits X12**		**1**	**2**
		1 or 2 stop bits can be set.	1 ... 2	
0504	**SI1 slave address**		**0**	**2**
		The drive converter address can be set between 0 and 31 for the RS485 bus. **Caution:** There must be no two identical addresses on the bus	0 ... 31	
0505	**SI1 Rx watchdog**		**Fault**	**2**
		0 = No reaction 1 = Warning 2 = Fault	0 ... 2	
0506	**SI1 Rx timeout**		**0.1 s**	**2**
		Timeout (monitoring) time for the standard SS1 interface. If this interface does not receive an error-free protocol within this time, then the response, selected in P0505 is initiated.	0.1 ... 60.0 s	

Para-meter No.:	Name	Description / explanation selectable options	Factory setting min ... max values	Pass-word
1270	**SI6 baud rate X13**		**6**	**2**
		4 = 125 kbaud 5 = 250 kbaud 6 = 500 kbaud 7 = 1 Mbaud	4 ... 7	
1271.XX	**SI6 Tx ID No. X13**		**176**	**2**
		SI6 Tx identifier X13	1 ... 2047	
1272.XX	**SI6 Rx ID No. X13**		**160**	2
		SI6 Rx identifier X13	1 ... 2047	
1273.XX	**SI6 Tx PZD clock X13**		**254 ms**	**2**
		SI6 Tx-PZD-Clock X13	0 ... 255 ms	
1274	**SI6 Rx watchdog**		**Fault**	**2**
		0 = No response 1 = Warning 2 = Fault	0 ... 2	
1275	**SI6 Rx timeout X13**		**0.1 s**	**2**
		SI6 Rx timeout	0.01 ... 60.0 s	

Diagnostics / drive data

Para-meter No.:	Name	Description / explanation selectable options	Factory setting min ... max values	Pass-word
0028	**Operating hours**		**0 h**	**-**
		Operating hours with the inverter enabled.	0 ... 2147483647 h	
0029	**Operating minutes**		**0 h**	**-**
		Operating minutes with the inverter enabled.	0 ... 59 min	
0024	**Continuous current**	Device data correspond to the drive converter performance data		**0**
0025	**Peak current, long**			
0046	**Peak current, short**			
0022	**Continuous output**			
0023	**Peak output, long**			
0099	**Max. o/p frequency**			
0027	**Max. normaliz. freq.**			
0000	**Firmware FWC**	Firmware data	**0**	**0**
0001	**Device ID**		**501**	**0**
0002	**Firmware version**		**e.g. 2**	
0003	**Firmware module**		**e.g. 4**	
0004	**Firmware revision**		**e.g. 1**	
0005	**Firmware discript.**		**e.g. 0**	
0006	**Serial number**		**e.g. 3**	
0007	**Converter number**		**e.g. 1**	
0008	**EEPROM prog. cycles**		**0**	**-**
		Displays the EEPROM programming cycles	-1 ... 100000	
0898	**Data record number**		**0.000**	**2**
		Any numerical value, e.g. for archiving purposes can be saved here. This value is saved in the EEprom so that data is not lost during power failure. At load factorySetting P0071 a specific value are setting here.	0.000 ... 2147483.647	
0899	**Data record number**		**0.000**	**2**
		Any numerical value, e.g. for archiving purposes can be saved here. This value is saved in the EEprom so that data is not lost during power failure. At load factorySetting P0071 a specific value are setting here.	0.000 ... 2147483.647	

Options

These are only displayed if the actual option is available. The parameters are described in the associated option description.

8.5 Numerical list

All of the basic parameterization parameters can be directly selected in the numerical list using the parameter number (refer to the structure of the basic parameterization).

9 Commissioning

9.1 Preparatory Steps for Commissioning

The power terminals for the converters should be connected as specified in section 4.4, 4.5 and the control terminals as specified in section 4.7 The power terminals for the inverters should be connected as specified in sections 6.4, 6.5 and the control terminals as specified in section 4.7 .

Check that the star / delta jumpers are correctly inserted on the motor terminal board.

Please observe the “Warning against hazardous voltages” specified in section 4.2!

It should also be ensured that the signal, line supply and motor feeder cables are routed separately from one another with the specified minimum clearance! The setpoint cables must be shielded. Also observe Section 4.1“Assembly of Drives According to EMC”.

Before the electrical system is commissioned for the first time, a professional electrician must check whether the device‘s electrical and mechanical systems satisfy the safety requirements found in

- the accident-prevention regulations and
- the electrical-related rules

(5, parag. 1, No. 1 of Professional Trade Association 4).

Ensure that a rotating motor can neither cause bodily injury nor material damage!

Check whether all cables and busbars have been properly connected.

The line supply and control voltages can be powered-up after all of the control, setpoint and line supply feeder cables have been connected. After approx. 10 seconds, the “Ready to power-up” message appears in the operator panel.

9.2 Procedure during First Commissioning

In this “Commissioning” section, it is always assumed when parameterizing the equipment that the basis is the factory setting.

The following diagrams guide you through the first commissioning.

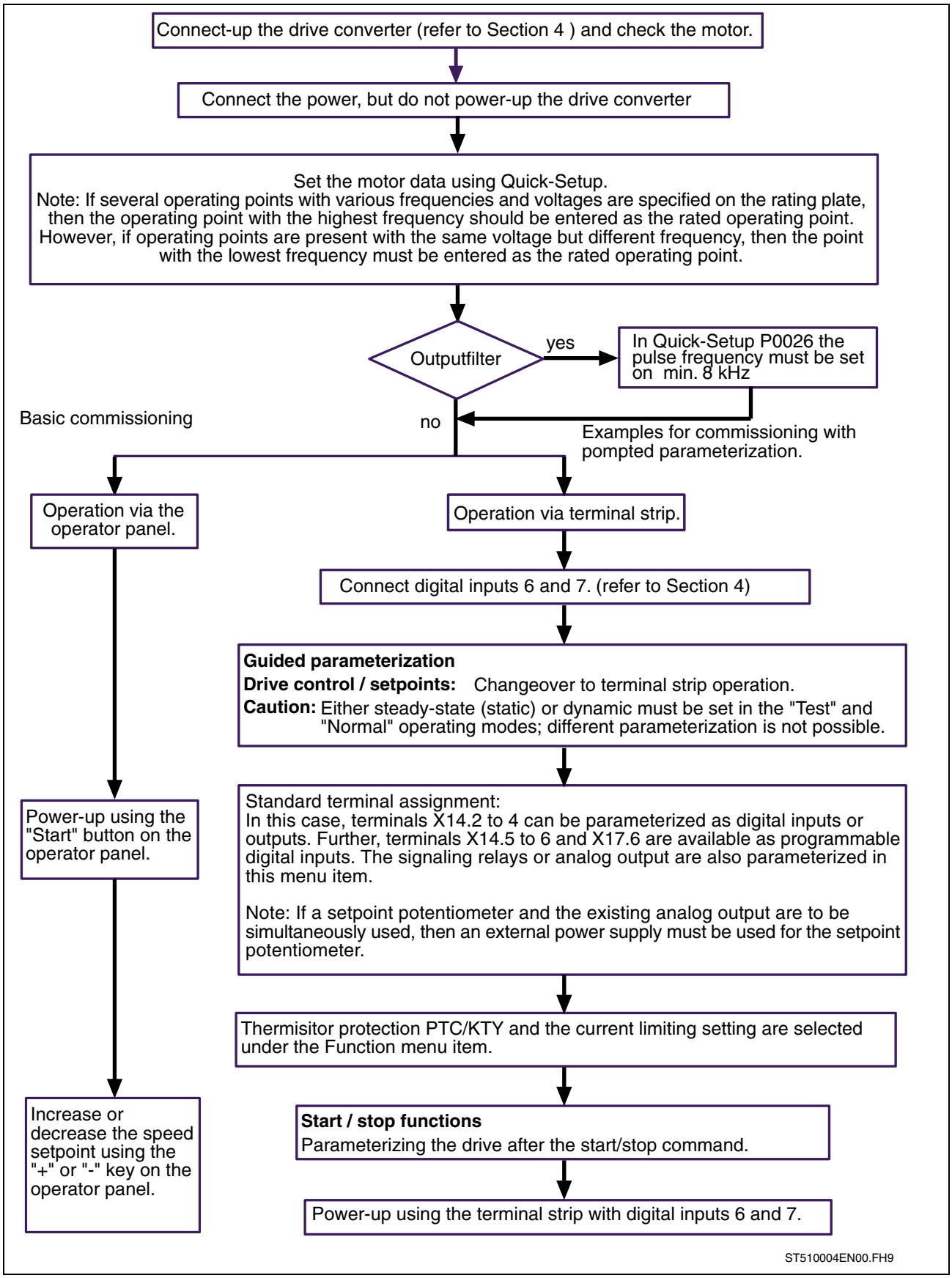


Fig. 9-1: Flow diagram, commissioning

9.3 Motor optimization / motor evaluation

Motor running under no-load conditions

In the steady-state condition, the drive converter current should be approx. 1/3 of the rated motor current.

If a significant deviation is identified, then the motor data, which was entered in Quick-Setup, can be checked to ensure that it is correct, and the mechanical load can be checked to ensure that it moves freely.

Running-up / accelerating under load

If the run-up / accelerating current is too high when the load is coupled, an additional voltage boost can be selected using parameter P0185 U_a. This means, that the point U_a on the characteristic is increased which reduces the accelerating current and increases the available starting torque.

Procedure

Increases the point U_a on the characteristic step-by-step, until the starting current has reached the lowest value. The motor current starts to increase again if the voltage boost is too high.

We also recommend, that when the drive is accelerating, and in steady-state operation, the current limiting does not intervene. When required, the current limit should be increased in parameter P0532, so that the full motor dynamic performance can be utilized and the motor can be prevented from stalling.

Other measures to reduce the starting current include extending the “Accelerating ramp” (P0280) or selecting the “Heavy-duty starting function” (P0539) with a parameterized “Delay time after start” (P0544).

9.4 General Information

- Using the copy function, you can quickly commission several converters (refer to section 7.2)
- If you wish to reset all of the parameters to the factory setting, e.g. as a result of incorrect programming, use the “Load factorySetting” function with parameter P0071.
- Note: If a fault develops during operation, and the fault is acknowledged, then “Start inhibit” is displayed. This means that the converter has locked itself. In order to get to the “Ready to power-up” status, a “Stop” command must be issued.

10 Basic Functions

10.1 Starting lock-out for RD 500 Size Classes A - H

Description

Devices in the RD 500 series are equipped with a start inhibitor function. Using this function, the “Protection against accidental starting” requirement, in compliance with EN 60 204-1, can be implemented. The appropriate circuit section is shown in the block diagram of the power section

Mode of Operation

Relay

When the connection between terminals X80.1 – X80.2 of the drive unit is opened, an internal relay which has two positively-driven contacts drops out.

- The internal control voltage of the power end stages is isolated on the hardware side using the first contact of this relay.
- At the same time, the power semiconductor gating pulses are inhibited.
- The second contact (floating acknowledge contact) is used to signal that the first contact has switched.

Acknowledgment

In order to ensure that the relay really does switch, disablement of the end stage gating is signaled via this additional acknowledge contact X80.3 – X80.4 (sizes G-H, X80.4 – X80.5). This contact is positively driven with the main contact.

The checkback contact recognizes if the relay fails or a wire is broken in the feeder cable to start inhibitor input X80.1 – X80.2. This should initiate an external control system to immediately open the main line contactor.

Application Information

The starting lock out is exclusively used as protection against accidental starting of the connected motor when a fault occurs. If this is actuated with the motor running, this does not automatically guarantee that the drive is safely shut down.

If the connection between X80.1 and X80.2 is opened in operation, then the drive is powered down with a fault message and the motor coasts down.

The starting lock out may only be actuated during the “Ready” status. If the starting lock out is active and the drive is not ready, the drive unit signals “Warning, starting lock out”. If the “Operating enable” command is output with the starting lock out actuated, then the command is not accepted and a fault is output.

As long as the starting lock out is active, the braking resistor is not energized. This means that the DC link is not always discharged.

If the line supply is not connected and the “Standby” additional function is selected, the “Starting lock out” warning message is not displayed.

Furthermore, the starting lock out cannot be used (alone) in the following cases:

- To electrically isolate the motor from the drive module power supply, for example when replacing a motor
- For other service, maintenance and cleaning work on the machine
- For drive converters which have additional inverter modules connected to the DC link (power terminal X1.C and X1.D).

Sequence and Procedure when Using the Starting lock out

- Withdraw the operating enablement (the drive should decelerate along a ramp or coast down)
- Wait until the drive signals “Ready” and it has come to a standstill
- Activate the starting lock out
- Check whether the starting lock out is active (warning, starting lock out)
- Issue the permission to carry out work on the drive

After the work has been completed

- Deactivate the starting lock-out
- “Ready” signal, wait a minimum of 2s
- Issue the operating enablement

11 Optional Device Functions

11.1 Additional function 24V Standby Power Supply

General

The additional function standby allows the control electronics to operate without any line supply voltage connected to the converter. A 24 V DC control power supply voltage is required.

This additional function offers the following advantages:

- Data sets can be parameterized, read and written into although the converter is not connected to the line supply voltage
- Data sets can be parameterized, read and written into although no DC link voltage is connected to the inverter
- Continued operation of field buses with the power supply disconnected

WARNING

Damage due to overload of the component!

⇒ To prevent ground loops, we recommend that the 24V standby power supply voltage be applied to X83 in a floating manner.

WARNING

Damage due to overload of the component!

⇒ If the floating method is not used, X83 is not protected from reverse polarity.

- This applies to additional function V1 for size classes C - E
- This applies to additional function V1 for size classes G - H
- This applies to additional function A1 / A2 for size classes A - B

Technical Data

Necessary control power supply voltage on connector X83

DC 24 V -15 / +20%, ripple, max 5% (VDE0411 / 500).

Size class	A – E	G	H
power consumption W	40	80	160
startup current A	5	15	30

Tab.: 11-1 power consumption

Note: Size classes A to E, the additional function is a stand-by power supply of the control electronics, as the drive is out.

After „drive ON“: DC-link supplies the control electronics.

Size classes G and H, the 24 V power supply is complete power supply and during operation permanently required.

12 Troubleshooting

12.1 Self-Test Error Messages

After the initialization routine, the system carries out a self-test. Here, the individual parts of the microcomputer system, such as the EEPROM, are checked and data are read in from the power control board.

12.2 Warnings

If a warning occurs, the warning message is displayed alternatingly with the programmed operating display. The warning bit can be output on a digital input. If the converter startup is to be prevented, the warning bit must be linked in free parameter assignment.

Note: The warning bit (D1737) is set and can be linked in a digital output or in the device to prevent startup, for example.

12.3 Faults

During operation, permanently programmed limit values whose parameters can be assigned are constantly monitored. To protect the power section from damage, a shutdown always occurs when a limit value is exceeded; the corresponding fault message is then shown in the display.

For the RD 500 converters with a three-phase supply, the main contactor is shut down when a fault occurs so that the power section is switched off. The corresponding fault message is shown in the display.

The fault is displayed by the red "alarm" LED on the front of the device.

Fault messages are stored in the fault memory so that they are retained even if the power supply fails. The fault memory appears in the monitor. The last 10 faults are saved in the fault memory. The most recent fault is in memory location S0, the oldest in S9. A new fault is always saved in memory location S0. All of the older faults are always shifted one position upwards in the memory. This means the fault in memory location S9 is lost.

Fault Acknowledgement

After a shutdown due to a fault, the device cannot be switched back on until the fault is acknowledged. As long as the cause of the fault is still present, acknowledgement is impossible. When the cause of the fault has been eliminated, the fault can be acknowledged after a set timer (P0093, factory setting = 1 sec.) has elapsed.

There are several ways to acknowledge a fault message:

- pressing the Esc key of the control panel.
- pressing the S9 "Fault acknowledgement" key on the logic and control card.
- using a digital input: apply the H signal to the digital input and switch the non-inverted D parameter of the selected digital input in P0050.07.
- using serial interface RS485; transfer the control word with bit 7 set to "high".

12.4 List of Warning and Fault Messages

No.	Messages	Warning	Fault
1	External	X	X
3	DC link voltage too high		X
4	DC link voltage too low	X	X
7	Device excess temperature	X	X
8	Braking resistor		X
9	Main contactor		X
10	Pre-charge		X
11	New EEPROM		X
12	Clock1 <==> Clock2		X
13	Power section	X	X
14	Inverter		X
15	Power supply		X
17	Excess speed	X	X
18	Ground fault		X
19	EEPROM data	X	X
21	Internal WS comm. (communication)		X
22	NTC power section		X
24	SS1 time monitor	X	X
25	SS2 function	X	X
26	SS2 time monitor	X	X
27	Analog input I < 4 mA	X	X
28	Motor excess temperature	X	X
30	SR output level		X
31	BR overload	X	X
32	Overcurrent		X
34	Safety OFF	X	X
35	Motor Overload	X	X
39	On for starting lock-out		X
40	Switched mode supply		X
41	SR <==> WS new		X
44	SS4 function	X	X
45	SS4 time monitor	X	X
47	Starting lock-out active	X	
48	Module excess temperature	X	X
49	Uic asymmetry	X	X
50, 51	Phase V, phase W		X
59	SS6 time monitor	X	X
63	Output current EN81 – for future use		
64	DC link discharge – for future use		

Fig. 12-1: Fault messages

12.5 Warning and Fault Messages– Cause and Remedy / Comments

No.	Designation	Message
	Cause	**Remedy / comments**
1	External	Warning / fault
	If the function “no external fault” is assigned to a digital input and if there is no 24V signal at the digital input, the device shuts down with fault “External” (wire break-proof design).	Determine and eliminate the cause of signal loss in the system.
3	DC link voltage too high	Fault
	Regeneration of the motors in the DC link in the case of dynamic operation. Limit value: U_{ICmax} (P0095) has been exceeded. The set time of the descending ramp is too short.	If the fault occurs during braking, set the descending ramp of the ramp-function generator (P0280) so that it is slower. Check the braking resistor (if option W exists) with the ohmmeter; use a more efficient external braking resistor. Check if the braking resistor is selected (P0036)
4	DC link voltage too low	Warning / fault
	The DC link voltage has dropped below limit value U_{ICmin} (P0094) during operation Slowdown or failure of power supply Contacts of main contactor interrupted. Mains rectifier defective	Check power supply voltage using oscilloscope measurement.
7	Device excess temperature	Warning / fault
	The measured cooler temperature of the power section or of the mains rectifier is too high. The fault causes a shutdown if the temperature has exceeded the value specified in parameter D1036.73 (mains rectifier) or D1036.74 (inverter). The difference in temperature between the warning and the shutdown due to the fault can be changed in parameter P0086. The current cooler temperatures can be displayed using the monitor (power section = D1870 and inverter = D2029). Ambient temperature > 40 °C Fan defective Air filter clogged NTC (temperature sensor) defective Incorrectly set air control	Example of incorrectly set air control in P0034: Function is on “Automatic” and the threshold value in P0035 is set too high. Lower the threshold value.
8	Braking resistor	Fault
	No acknowledgment occurs when the braking resistor is activated. The switching transistor or perhaps the braking resistor is defective.	Check the BR switching transistor between terminals F and D using a multimeter. If the BR switching transistor is OK, the measuring result must be as follows: from F to D: reverse voltage from D to F: diode conduit voltage
9	Master contactor	Fault
	The master contactor does not pick up, drops off during operation or does not acknowledge.	Check the control voltage for the master contactor. Check the auxiliary contact for acknowledgement.

No.	Designation	Message
	Cause	**Remedy / comments**
10	Precharge	Fault
	After startup, the temporal sequence of charging the DC link voltage is checked. If inadmissible variances occur here, precharging is terminated. Short-circuit between terminals C and D (DC link voltage) or C-PE / D-PE. Only for option W Braking resistor: Short-circuit between F and C. Only if option V 24V standby power supply is active, but no power supply is available.	Check: if the power supply is available if there is a short-circuit between terminals C and D or C-PE / D-PE. **Note:** After the “Precharge” fault is acknowledged, the system can be switched back on again only after 30 seconds; this protects the precharge resistors from overheating.
11	New EEPROM	Fault
	The bit pattern loaded into the EEPROM at the factory is not recognized by the processor control.	Please call Customer Service.
12	Clock1 <==> Clock2	Fault
	The frequencies of the two clock generators provided on the control card are checked with one another for plausibility (overspeed protection). This fault trip is output for deviations exceeding ±1 %.	One of the two clock generators is defective, replace the module.
13	Power section	Fault
	Unspecified error in the power section.	Please call Customer Service.
14	Inverter	Fault
	This fault is initiated when the overcurrent threshold is exceeded.	
	Causes outside the drive converter: - Defective motor, invalid load, defective motor cable - Setpoint step which is too fast	Disconnect the motor cable, enable the inverter. If the fault no longer occurs, then it is highly likely that the cause is outside of the drive converter. Measure using the RDwin “Oscilloscope function”: Parameter D1981 “f act from normalization”.
	Cause in the parameterization: The incorrect motor data were parameterized. Only for option S sinusoidal filter: The pulse frequency (P0026) is set to less than 8 kHz; thus, the sinusoidal filter can oscillate and conduct high currents.	Check the motor data in the Quick-Setup. Set the pulse frequency in Quick-Setup (P0026) to 8 kHz or greater.
	Cause inside the drive converter: Defective power section transistor.	Please contact your customer service.
15	Power supply	Fault
	The voltages of the switch power pack lie beyond the limit values: Limit value for + 15V = + 13.5V - 15V = - 13.5V	The switched mode supply is defective or the load is too high due to a defective module (also see the note regarding fault 40 Switch power pack).
17	Overspeed	Warning / fault
	The actual speed exceeds the speed limit of the parameter “f limit machine”.	Check P0178 (f limit machine) for the correct setting. An excessive slip compensation (P0540) may have been selected. Check P0390 (frequency normalization) for a correct value and, if required, change. Either alarm or fault can be selected using P0449 (response to overspeed).

No.	Designation	Message
	Cause	**Remedy / comments**
18	Ground fault	Fault
	Ground fault at the inverter output terminals (U2, V2, W2) or excessive capacitance with respect to ground as a result of long motor cables.	
19	EEPROM data	Warning / fault
	Cause in the parameterization: The control card was replaced and, after initialization, detects a new power section, which for example, cannot supply the parameterized currents. This means, that one or several parameters lie outside the tolerance range. When the fault is acknowledged, the associated parameters are reset to the standard drive converter values.	The appropriate parameter numbers can be viewed using P0061.XX, and the erroneous parameter values using P0062.XX. The fault can be removed using a special acknowledgement with P0060 (password level 3 [Esc], [Mon], [Prog] and [+]). It must then be checked, whether the modified parameters match the particular application. When parameterization is exited, the values are transferred into the Eeprom.
	Cause in the drive converter: This fault can also occur if the power fails during operation. In this case, the power section could send incorrect data to the control card.	The fault may be able to be removed by powering-up and powering-down the line supply voltage or the standby supply. If this is not successful, then please call customer service.
21	Internal WS comm.	Fault
	Communications between the processor board and the power section are faulted. If the fault occurs after power-up during the self-test, it cannot be acknowledged.	Check the plug connection between the PC boards or replace the modules.
22	NTC power section	Fault
	Wire break to the NTC on the heat sink in the power section or the inverter section; NTC is defective – the impedance is too high or the plug has no contact.	Check the connector; replace the plug, cable or NTC.
24	SS1 time monitor	Warning / fault
	The control computer does not send any data within the set reaction time (P0506)	Check connector SS1 (RS485); increase the reaction time (P0506) or select another reaction type (P0505).

No.	Designation	Message
	Cause	**Remedy / comments**
25	SS2 function	Warning / fault
	Only for option interface cards at option slot 1. The drive converter detects a physical fault on the interface cable from the higher-level control computer. Erroneous data transfer along the fieldbus.	Check that the PPO type (protocol type), baud rate, parity, stop bit and slave address are correct. If a bus error occurs in the form of an alarm or fault, then the alarm or the fault or both messages can be suppressed using parameter P0509; this means that the system can continue to operate!
		Only for CAN bus option: The protocols sent on the CAN bus interface are monitored. If a bus error occurs more than 127x, an alarm is output. If a bus error occurs more than 255x, a fault is signaled. The alarm or fault, or both messages can be masked in parameter P0509; this means that the system can continue to operate.
		Only for Profibus option: Either “No action” or “Fault” can be selected in parameter P0524 when receiving Clear Data. Caution: In this case, P0509 should be set to the “All active” function! This means that the control computer sends Clear Data if there is an invalid protocol or a bus error.
		Only for Interbus S option: The response type can be set in parameter P0518 and the monitoring time when a bus error occurs, in P0519. Index 0 = process data, index 1 = PKW range.
26	SS2 time monitor	Warning / fault
	Only for option interface cards at option slot 1. Within the parameterized response time (P0527), the higher-level control computer does not send any data.	Check connector SS2 Extend the response time (P0527), select another response type (P0526).
27	Analog input 1:I<4mA	Warning / fault
	Causes outside of the device: Short-circuit or interrupted cable on the setpoint line to the analog input or to the optional analog inputs (only for operating mode 4-20 mA or 2-10 V).	Check the setpoint cable
	Causes in the parameterization: Incorrect response type Incorrect operating mode	Check the response type in P0564.0X / P0752.0X Check the operating mode in P0201.0X / P0735.0X
28	Motor overtemperature	Warning / fault
	The drive converter detects an excessive resistance at terminals X15.1 and 2. The motor temperature is too high, temperature sensor defective, sensor cable defective. Erroneous parameterization.	Replace the sensor or sensor cable. Check the temperature evaluation parameters (P0385 – P0389) to ensure that they are correctly set. If a KTY84 has been selected, the actual motor can be displayed in °C in the monitor using D1872; if a PTC has been selected, the actual ohmic value can be displayed using D1871.

No.	Designation	Message
	Cause	**Remedy / comments**
30	SR output level?	Fault
	The control card and the firmware (Flash Eprom) do not match.	Please call customer service.
31	BR overload	Warning / fault
	For the parameterized brake resistor, the drive converter computes a temperature image. If the brake resistor is controlled, the drive converter calculates the assigned temperature. If a threshold is exceeded, the drive converter signals a brake resistor overload condition.	
	Causes outside of the device: Only for the option W brake resistor: The brake resistor which is being used has an excessive ohmic value. A brake resistor has not been connected. The connected brake resistor is too low for the energy which is fed-back into the DC link when braking.	Check the brake resistor.
	Causes in the parameterization: The down-ramp was set too fast. An incorrect brake resistor was selected. Only for an external programmable brake resistor: The values for the resistance, continuous output and/or thermal time constant were incorrectly parameterized.	Check the down ramp in P0280.0X In P0038 check whether the correct brake resistor was selected. Information regarding REFU Standard: Every drive converter output class is assigned a specific brake resistor. Check the values in P0623 to P0625. Maintain the max. braking duration and the required no-load times to the next braking operation. The load diagram in the instructions for the brake resistor option can be used to calculate the braking and no-load times.

No.	Designation	Message
	Cause	**Remedy / comments**
32	Overcurrent	Fault
	Current limiting is active for a time which is longer than that parameterized.	Check the setting of P0574! The time duration of the uninterrupted current limiting (D1678 = 1) can be set between 1 second and 100 seconds in 11 steps using P0574. If current limiting is interrupted before the parameterized time has expired (D1678 = 0), the time counter is reset to 0 and then restarts at the next current limiting. If P0574 has been set to 0 (= continuous), then the “Overcurrent” fault is output.
	The peak current of the drive converter was exceeded	
	Causes outside the drive converter: - Defective motor, invalid load, defective motor cable - Setpoint step which is too fast	Disconnect the motor cable, enable the inverter. If the fault no longer occurs, then it is highly likely that the cause is outside of the drive converter. Measure using the RDwin “Oscilloscope function”: Parameter D1981 “f act from normalization”.
	Cause in the parameterization: The incorrect motor data were parameterized. Only for option S sinusoidal filter: The pulse frequency (P0026) is set to less than 8 kHz; thus, the sinusoidal filter can oscillate and conduct high currents.	Check the motor data in the Quick-Setup. Set the pulse frequency in Quick-Setup (P0026) to 8 kHz or greater.
	Cause inside the drive converter: Defective power section transistor.	Please contact your customer service.
34	Safety Off (NAMUR)	Alarm / fault
	The “Safety Off” fault message has been introduced so that the drive converter fulfills the Namur Standard (Namur is a Standards Committee for instrumentation and control in the chemical industry). It is only activated when P0057 is set to 1. The fault or alarm is selected using P0571. The fault is initiated using an external control signal, which is connected to the digital input of the drive converter. The D parameter of the digital input is connected to P0050.1. The external control signal is used to positively disconnect the drive from the line supply (1 = operation; 0 = disconnected from the line supply).	
35	Motor overload	Alarm / fault
	The electronic overload relay has responded (refer to the function diagram “Modulation, measured value sensing” or in the Operating Instructions Section 5 of the basic programming “Thermal motor protection”).	Check P0566 “Overload protection threshold” to ensure that it has been correctly set. The type of response of the electronic overload relay can be set using P0565: Disabled / Alarm / Fault.

No.	Designation	Message
	Cause	**Remedy / comments**
39	On for starting lock-out	Fault
	The message only occurs when the start inhibit option is installed. Sizes A to E: Contacts X80.1 and 2 were opened during operation, or an on command was output with the terminal open. Sizes G and H: Contacts X80.170 and 171 were opened during operation, or an on command was issued with the terminals open.	
40	Switched-mode power supply	Fault
	The switched-mode power supply for the electronics supply does not output a checkback signal.	Replace the defective switched-mode power supply. Depending on the drive converter version, the switched-mode power section is on the PC board: LT (power section), WS (inverter control) or SV (power supply).
41	SR <==> WS new	
	If the control card is replaced in another drive converter with a higher or lower output or drive converter index, this entry is made in the fault memory (the drive converter does not go into a fault condition!). A fault is issued if the parameters lie outside the limit values (refer to fault 19).	
44	SS4 function	Warning / fault
	Only for option interface cards at option slot 2. The drive converter detects a physical fault on the interface cable from the higher-level control computer. Erroneous data transfer along the fieldbus.	Check that the PPO type (protocol type), baud rate, parity, stop bit and slave address are correct. If a bus error occurs in the form of an alarm or fault, then the alarm or the fault or both messages can be suppressed using parameter P0745, this means that the system can continue to operate!
		Only for CAN bus option: The protocols sent on the CAN bus interface are monitored. If a bus error occurs more than 127x, an alarm is output. If a bus error occurs more than 255x, a fault is signaled. The alarm or fault or both messages can be masked in parameter P0745; this means that the system can continue to operate.
	Inside the handicap there Watchdog-time no protocol communication. It´s a fault as reaction on the instruction “Clear Data” in Parameter P0524 and no valide protocol inside the timeout-time receive.	**Only for Profibus option:** Either “No action” or “Fault” when receiving Clear Data can be selected in parameter P0524. Caution: In this case, P0745 should be set to the “All active” function! This means that the control computer sends Clear Data if there is an invalid protocol or a bus error.
		Only for Interbus S option: The response type can be set in parameter P0518 and the monitoring time, when a bus error occurs, in P0519. Index 0 = process data, index 1 = PKW range.
45	SS4 time monitor	Warning / fault
	Only if an option interface card is in option slot 2. The superordinate control computer does not send any data within the set reaction time.	Check connector SS4 Increase the reaction time (P0747) or select another reaction type (P0746).

No.	Designation	Message
	Cause	**Remedy / comments**
47	Starting lock-out active	Warning
	Only for the start inhibit option: The start inhibit was activated, while the drive converter was not operational.	
48	Module overtemperature	Warning / fault
	The measured module temperature of the power transistor or of the mains rectifier is too high. Possible causes: ambient temperature too high fan defective air filter clogged incorrectly set fan control	Example of incorrectly set air control in P0034: Function is on “Automatic” and the threshold value in P0035 is set too high. Lower the threshold value.
49	Uic asymmetry	Warning / fault
	The symmetry monitor of the DC link capacitors has been activated.	Call Customer Service
50, 51	Phase V , phase W	Fault
	This fault is triggered by activating an overload current threshold; it protects the transistors of the power section. **Causes outside of the device:** defective motor defective motor cable defective speed encoder or encoder cable incorrectly connected encoder cable	Disconnect the motor cable, enable the inverter. If a fault no longer occurs, then, it is highly probable that the problem lies on the motor side. Replace the motor. Check the encoder signal using the display or RDwin under no-load operating conditions, or by manually rotating the motor shaft. Measure with RDwin “Oscilloscope function”: Parameter D1850, speed controller setpoint.
	Causes in the parameterization: Incorrect motor data parameters. Incorrect current regulator setting Incorrect encoder setting (P0130) Only for option S Sine filter: the pulse frequency (P0026) is less than 8 kHz; as a result, the sine filter may experience resonance and provide high currents.	Check the motor data in the Quick Setup. Execute a motor identification (P0189); as a result, the current regulator sets itself automatically (see the explanations for the function plan) Set the pulse frequency equal to or greater than 8 kHz in the Quick Setup (P0026).
	Causes within the device: Defective transistor of the power section.	
59	SS6 time monitor	Warning / fault
	Within the parameterized response time (P1275) the higher-level control computer does not send any data.	Check connector X13 Increase the reaction time (P1275) or select another reaction type (P1276).
63	Output current EN81 – for future use	
64	DC link discharge – for future use	

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