Electric Drives and Controls | Hydraulics | Linear Motion and Assembly Technologies | Pneumatics | Service

Rexroth
Bosch Group

Rexroth RD 500 RD52 Drive Control Device Field-oriented Vector Control

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Edition 05

Application Manual

Title
Rexroth RD 500 RD52
Drive Control Device
Field-oriented Vector Control

Type of Documentation
Application Manual

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Purpose of Documentation
This documentation explains the frequency converters of the drive series RD 500 RD52. 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
DOK-RD500*-RD52*******-IB01-EN-P	03.2000	First edition
DOK-RD500*-RD52*******-IB02-EN-P	01.2001	Revision
DOK-RD500*-RD52*******-IB03-EN-P	01.2003	Revision
DOK-RD500*-RD52*******-IB04-EN-P	10.2003	Revision
DOK-RD500*-RD52*******-IB05-EN-P	10.2004	Revision

Validity
The data specified above only serve to describe the product. No statements concerning a certain condition or suitablility for a certain application can be derived from our information. The given information does not release the user from the obligation of own judgement and verification. It must be remembered that our products are subject to a natural process of wear and aging.

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Note
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Contents

5 Inverter Technical Data 5-1

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 Bosch Rexroth 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

- Bosch Rexroth 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 (30) 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 Bosch Rexroth 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.

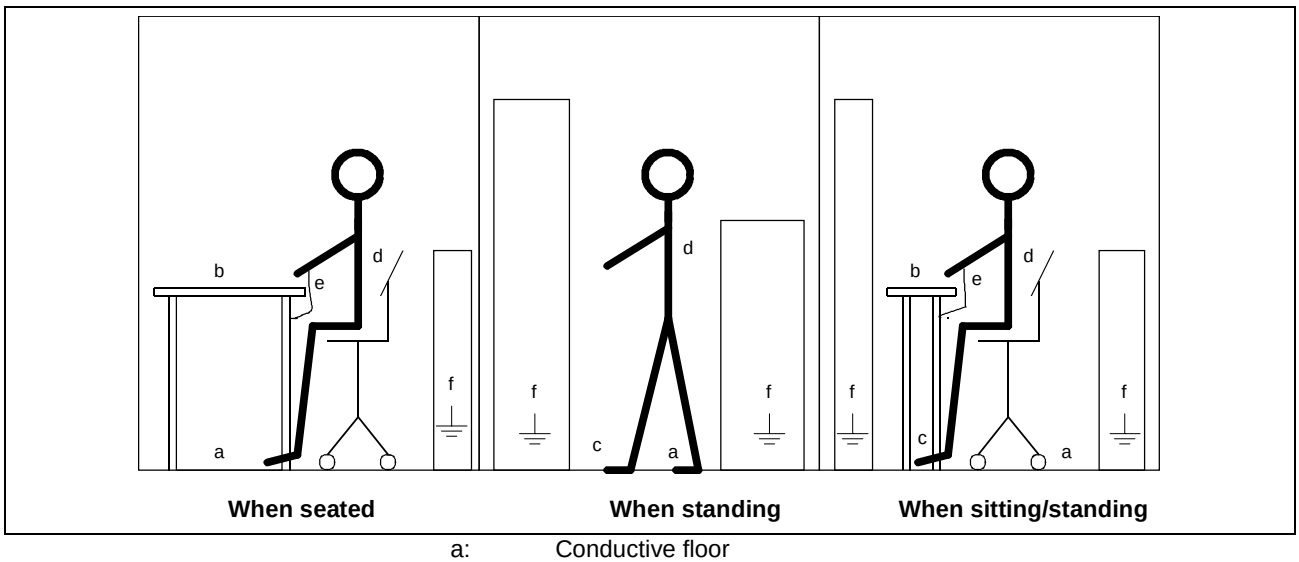
1.13 Precautionary measures when handling components which can be destroyed by electrostatic discharge (ESDS)

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 RD52

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
- earth-fault-, short-circuit- and idling-proof
- 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
-

Technical Characteristics RD 500 SFT

The model line RD 500 SFT (Sinus Frontend Technology) was built as extension of the RD 500 model line in order to turn these units into a drive system which is able to work as energy recovery, too.

Its functionality as well as its technical specifications correspond to the RD 500 model line except the differences quoted in the following:

1. GK A - G

- the fact that the potential of the intermediate circuit's centre lacks of any capacitive connection to ground , since this arrangement is connected to a sinusoidal feeder/negative feeder disposition (skipping intermediate circuit potentials towards ground).
- Adapted power indications

2. GK G only

- External 24 V and 230 V supply
- No internal control transformer incorporated
- Adapted power indications

All restrictions of the accessory functions as well as the diverse cooling modes available can be verified on the type key.

2.2 Type Label

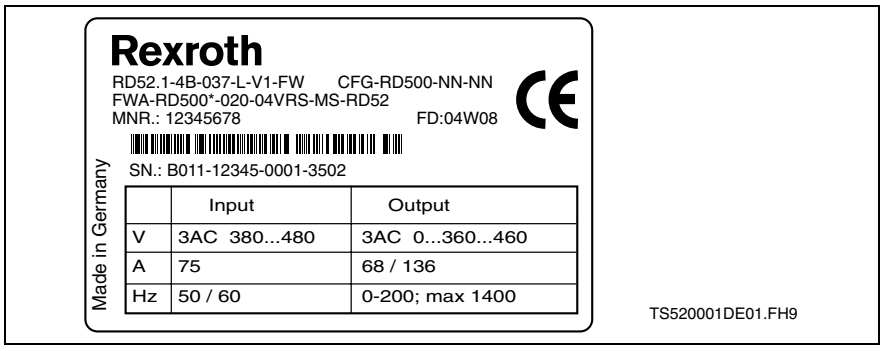


Fig.: 2-1 RD52.1 type label (size classes C - H)

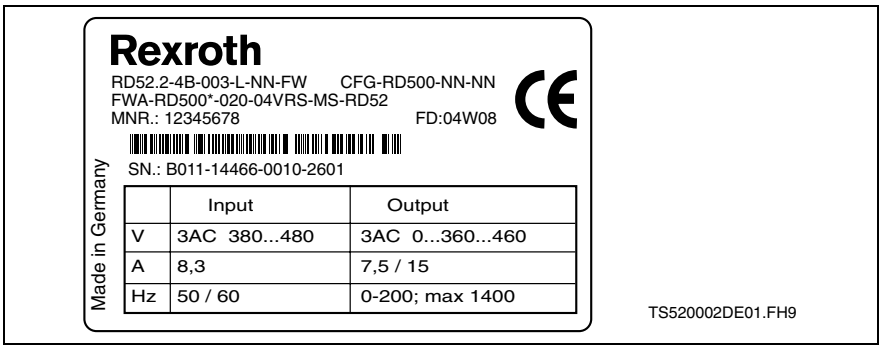


Fig.: 2-2 RD52.2 type label (size classes A - B)

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	2	.	2	-	4	B	-	0	0	3	-	L	-	N	N	-	F	W									

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

2. Line
2.1 field oriented vector control= 52

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

4. Unit type / ① Nominal connecting voltage
4.1 Converter3 x AC 200 to 230 V, ±15 %= 2
4.2 Converter3 x AC 380 to 480 V, ±10 %= 4
4.3 Converter. . . . . 3 x AC 500 V, ±10 %= 5

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

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 plug-throug cooler. . . . . = D
7.2 forced air cooling. . . . . = L
7.3 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 not equipped . . . . . = NN

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 function "A1"
② Values in bracket 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

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	2	.	1	-	4	B	-	0	3	7	-	L	-	N	N	-	F	W									

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

2. Line
2.1 field oriented regulation = 52

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

4. Unit type / (1)
Nominal connecting voltage
4.1 Converter3 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

5. Brake chopper
5.1 **Converter**
5.1.1 with built-in brake chopper. . . . . = B
5.1.2 without built-in brake chopper. . . . . = N
5.2 **Inverter (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 Liquid cooling with internal pump . . . . . (≥ 132 kW) = R
7.5 Liquid cooling . . . . . = W (4)

8. Additional functions (5)
8.1 Feedback of current filter (U6, V6, W6). . . . . .= F1
8.2 Feedback of cable damping (C3, D3). . . . . = L1
8.3 Frequency converter > 150 Hz, without output chokes(≥ 132 kW) = M1
8.4 not equipped. . . . . .= NN
8.5 24 V stand-by power. . . . . = V1 (6)
8.6 95 mm² terminals "C" and "F". . . . . (≥ 132 kW) = W1
8.7 Operating on IT mains only with unit type/mains connecting 4. . . .= Y1
8.8 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	2	.	1	-	4	B	-	0	3	7	-	L	-	N	N	-	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 315 and 400 kW are not available

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

(4) Cooloing mode "W" is only available with
- Unit type / nominal connecting voltage "4" and "5" for rated output "022" till "110"
- Unit type / nominal connecting voltage inverter "7N" for rated output "055" till "075"

(5) permissible combinations of additional functions

Additional function			Code
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**

(6) Additional function "V1" is available for devices 110kW as Stand-by-power supply and for devices≥132 kW as complete power supply.

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

Type Key SFT inverter

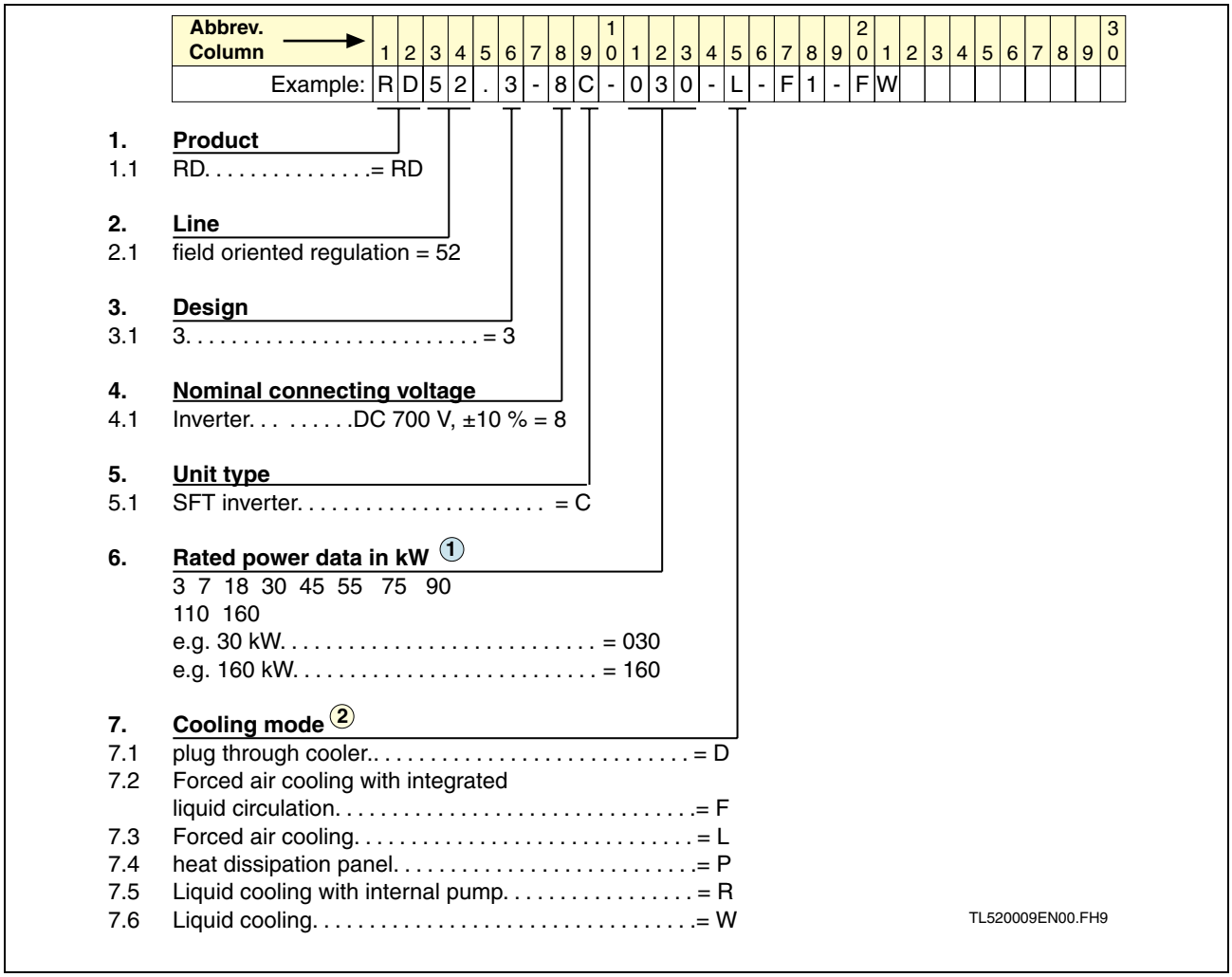


Fig.: 2-6 Type Key SFT inverter (page 1)

Kurztext-Spalte →	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
Beispiel:	R	D	5	2	.	3	-	8	C	-	0	3	0	-	L	-	F	1	-	F	W									

8. Additional function ②

8.1 24 V Stand-by power supply external,
starting lock out, feedback of filter current. . . . . = A1
8.2 24 V Stand-by power supply external, starting lock out. . . . . = A2
8.3 feedback of filter current (U6, V6, W6). . . . . .= F1
8.4 feedback of cable damping (C3, D3). . . . . .= L1
8.5 inverter > 150 Hz, without output chokes. . . . . .= M1
8.6 not equipped . . . . . .= NN
8.7 24 V Stand-by power supply . . . . . .= V1

9. Firmware

9.1 Denotes that firmware must be ordered as separate supposition = FW

Note:

① These three codes supply information about typical rated power of a 4-pole standard AC motor with 500 V connecting voltage

② Available combinations
- unti type / SFT-inverter "8C" see table 1

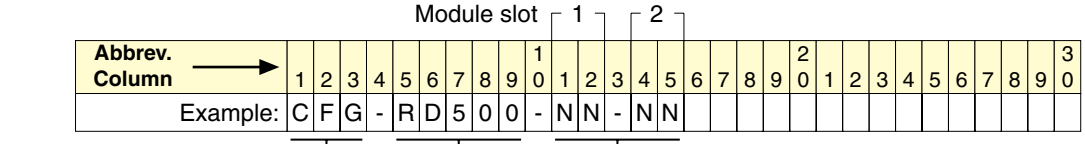
Table 1

Rated power data	003	007	018	030	045	055	075	090	110	160
Cooling mode	D	D	D	D	D	D	D	D	D	F
	L	L	L	L	L	L	L	L	L	R
	P	P	P	-	-	W	W	-	-	W
Additional function	A1	A1	A1	F1	F1	F1	F1	F1	F1	F1
	A2	A2	A2	L1	L1	L1	L1	L1	L1	L1
	NN	NN	NN	NN	NN	NN	NN	NN	NN	M1
	-	-	-	V1	V1	V1	V1	V1	V1	NN
	-	-	-	FV	FV	FV	FV	FV	FV	FM
	-	-	-	LV	LV	LV	LV	LV	LV	LM

TL520010EN00.FH9

Fig.: 2-7 Type Key SFT inverter (page 2)

Type Key Configuration



1. Object
1.1 Configuration . . . = CFG

2. Product
2.1 RD500 . . . . . = RD500

3. Module slot 1 and 2
3.1 **RD52.1 / RD52.2**

3.1.1	B1-B1	B1-G1	G2-B1	B1-G3	B1-L1	B1-L2	B1-NN	B1-T1	B1-T3
3.1.2	C1-C1	C1-G1	G2-C1	C1-G3	C1-L1	C1-L2	C1-NN	C1-T1	C1-T3
3.1.3	-	-	-	-	G1-L1	G1-L2	G1-NN	G1-T1	G1-T3
3.1.4	-	-	-	-	G2-L1	G2-L2	G2-NN	G2-T1	G2-T3
3.1.5	-	-	-	-	G3-L1	G3-L2	G3-NN	G3-T1	G3-T3
3.1.6	-	K1-G1	G2-K1	K1-G3	K1-L1	K1-L2	K1-NN	K1-T1	K1-T3
3.1.7	-	-	-	-	-	-	L1-NN	L1-T1	L1-T3
3.1.8	-	-	-	-	-	-	L2-NN	L2-T1	L2-T3
3.1.9	-	-	-	-	-	-	NN-NN	NN-T1	NN-T3
3.1.10	P2-P2	P2-G1	G2-P2	P2-G3	P2-L1	P2-L2	P2-NN	P2-T1	P2-T3
3.1.11	-	S1-G1	S1-G2	S1-G3	S1-L1	S1-L2	S1-NN	S1-T1	S1-T3

= only available for RD52.1
= available for RD52.1, RD52.2 and RD52.3

Note:
B1 = INTERBUS-S slave, remote bus interface
C1 = CANopen interface (with galvanic isolation)
G1 = Incremental encoder emulation with resolver evaluation
G2 = Input for toothed wheel encoder 1 Vpp, TTL, sin/cos and incremental encoder emulation
G3 = Incremental encoder emulation
K1 = CANpur interface (without galvanic isolation)
L1 = SynchroLink (fiber optic cable)
L2 = Peer-to-Peer coupling via fiber optic cable
NN = not equipped
P2 = PROFIBUS-DP slave interface + DSUB
S1 = SERCOS interface
T1 = expanded control terminal strip
T3 = expanded control terminal strip solid state O / P

TL520006EN03.FH9

Fig.: 2-8 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

Bosch Rexroth 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, Bosch Rexroth 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 Bosch Rexroth 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

Bosch Rexroth 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 Bosch Rexroth. 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 / 8 kHz (3AC 380 ... 480 V)

			4 kHz					8 kHz				
RD52.2			**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 = 60 s	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 = 60 s	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 operation, to 50 °C power reduction at 2.5 % per K)									
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		kW	0.17	0.24	0.33	0.46	0.57	0.17	0.26	0.32	0.51	0.63
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												
D plug through cooler		kg	5.5	5.5	5.5	10.3	10.3	5.5	5.5	5.5	10.3	10.3
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	5.0	5.0	5.0	9.8	9.8	5.0	5.0	5.0	9.8	9.8

		4 kHz					8 kHz				
RD52.2		**003**	**005**	**007**	**015**	**018**	**003**	**005**	**007**	**015**	**018**
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.

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

		12 kHz				
RD52.2		**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 operation, to 50 °C power reduction at 2.5 % per K)				
Cooling air requirement	m³ / s	0.03	0.03	0.03	0.05	0.05
Power loss	kW	0.17	0.26	0.32	0.51	0.63
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						
D plug through cooler	kg	5.5	5.5	5.5	10.3	10.3
L Forced air cooling	kg	6.5	6.5	6.5	11.3	11.3
P heat dissipation panel	kg	5.0	5.0	5.0	9.8	9.8
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 ... 230 V)

			4 kHz					8 kHz				
RD52.2			**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% 150W									
Ambient conditions, noise suppression level, interference immunity												
Environmental class			3K3 according to DIN IEC 721-3-3 (ambient temperature 0 – 40 °C operation, to 50 °C power reduction at 2.5 % per K)									
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		kW	0.17	0.24	0.33	0.46	0.57	0.17	0.26	0.32	0.51	0.63
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												
D plug through cooler		kg	5.5	5.5	5.5	10.3	10.3	5.5	5.5	5.5	10.3	10.3
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	5.0	5.0	5.0	9.8	9.8	5.0	5.0	5.0	9.8	9.8
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

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

			12 kHz				
RD52.2			**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	kV	3.4	6.0	8.6	16	18
Supply voltage SNT- connection C1 / D1			DC530 ... 670 V ±10 % 100 W				
Ambient conditions, noise suppression level, interference immunity							
Environmental class			3K3 according to DIN IEC 721-3-3 (ambient temperature 0 – 40 °C operation, to 50 °C power reduction at 2.5 % per K)				
Cooling air requirement		m³ / s	0.03	0.03	0.03	0.05	0.05
Power loss		kW	0.17	0.26	0.32	0.51	0.63
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							
D plug through cooler		kg	5.5	5.5	5.5	10.3	10.3
L Forced air cooling		kg	6.5	6.5	6.5	11.3	11.3
P heat dissipation panel		kg	5.0	5.0	5.0	9.8	9.8
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							
RD52.1			**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 = 60 s	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 = 60 s	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 operation, to 50 °C power reduction at 2.5 % per K)							
Cooling air requirement		m^3 / s	0.1	0.1	0.2	0.2	0.4	0.4	0.4	0.4
Power loss		kW	0.9	1.1	1.0	1.3	1.8	2.3	2.7	3.1
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.

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

			8 kHz							6 kHz
RD52.1			**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 = 60 s	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 operation, to 50 °C power reduction at 2.5 % per K)							
Cooling air requirement		m³/s	0.1	0.1	0.2	0.2	0.4	0.4	0.4	0.4
Power loss		kW	0.9	1.0	1.1	1.4	1.9	2.2	3.2	3.5
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							
RD52.1			**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 = 60 s	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 operation, to 50 °C power reduction at 2.5 % per K)							
Cooling air requirement		m^3 / s	0.1	0.1	0.2	0.2	0.4	0.4	0.4	0.4
Power loss		kW	0.9	1.0	1.1	1.4	1.9	2.2	3.2	3.5
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.

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

			4 kHz					8 kHz				
RD52.1			**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 = 60 s	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 = 60 s	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 operation, to 50 °C power reduction at 2.5 % per K)									
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		kW	5.2	6.5	7.7	11.8	15.0	4.4	5.2	6.5	9.5	11.8
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

			4 kHz					8 kHz				
RD52.1			**132**	**160**	**200**	**315**	**400**	**132**	**160**	**200**	**315**	**400**
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 >150 Hz 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				
RD52.1			**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 operation, to 50 °C power reduction at 2.5 % per K)				
Cooling air requirement		m^3 / s	0.4	0.4	0.6	0.8	1.2
Power loss		kW	3.0	3.7	4.6	6.8	8.6
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	370	270	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 >150 Hz the additional function M1 is required (without integrate Motor filter)

3.10 Circuit Principle

Circuit Principle of Electronics Section

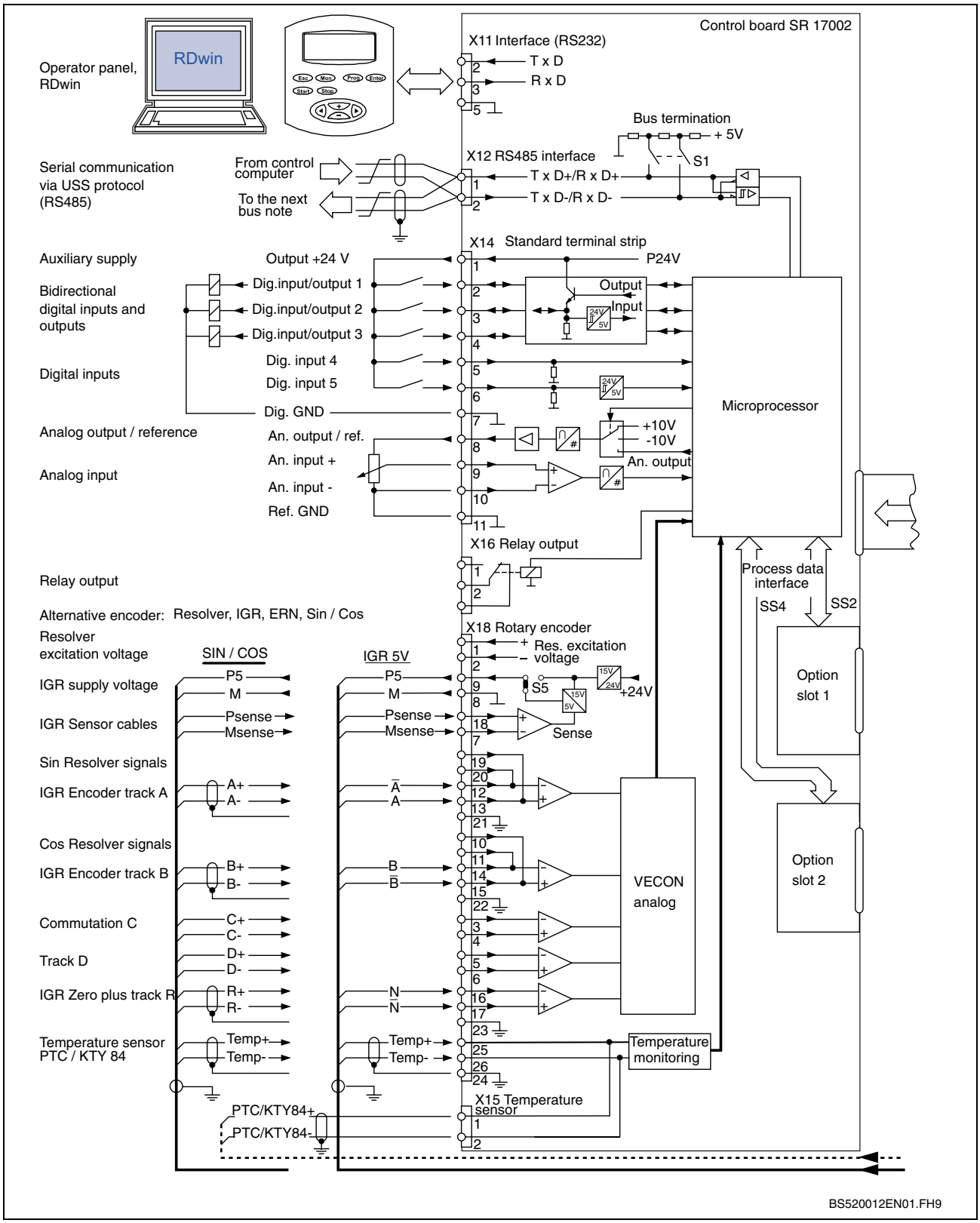


Fig.: 3-1 Circuit principle of electronics section

Circuit Principle of Power Section, Size Classes A and B

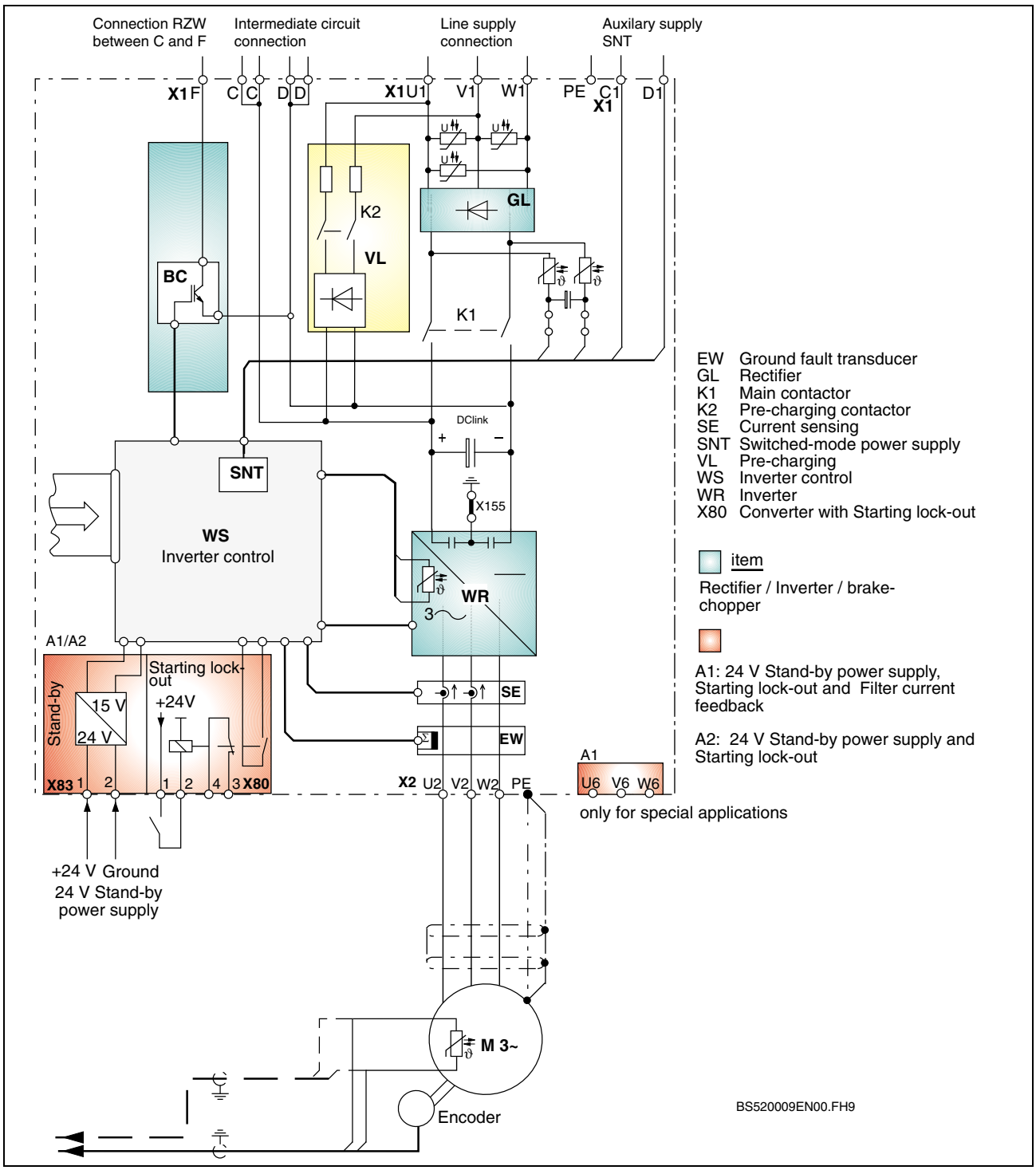


Fig.: 3-2 Circuit principle of power section, converter classes A and B

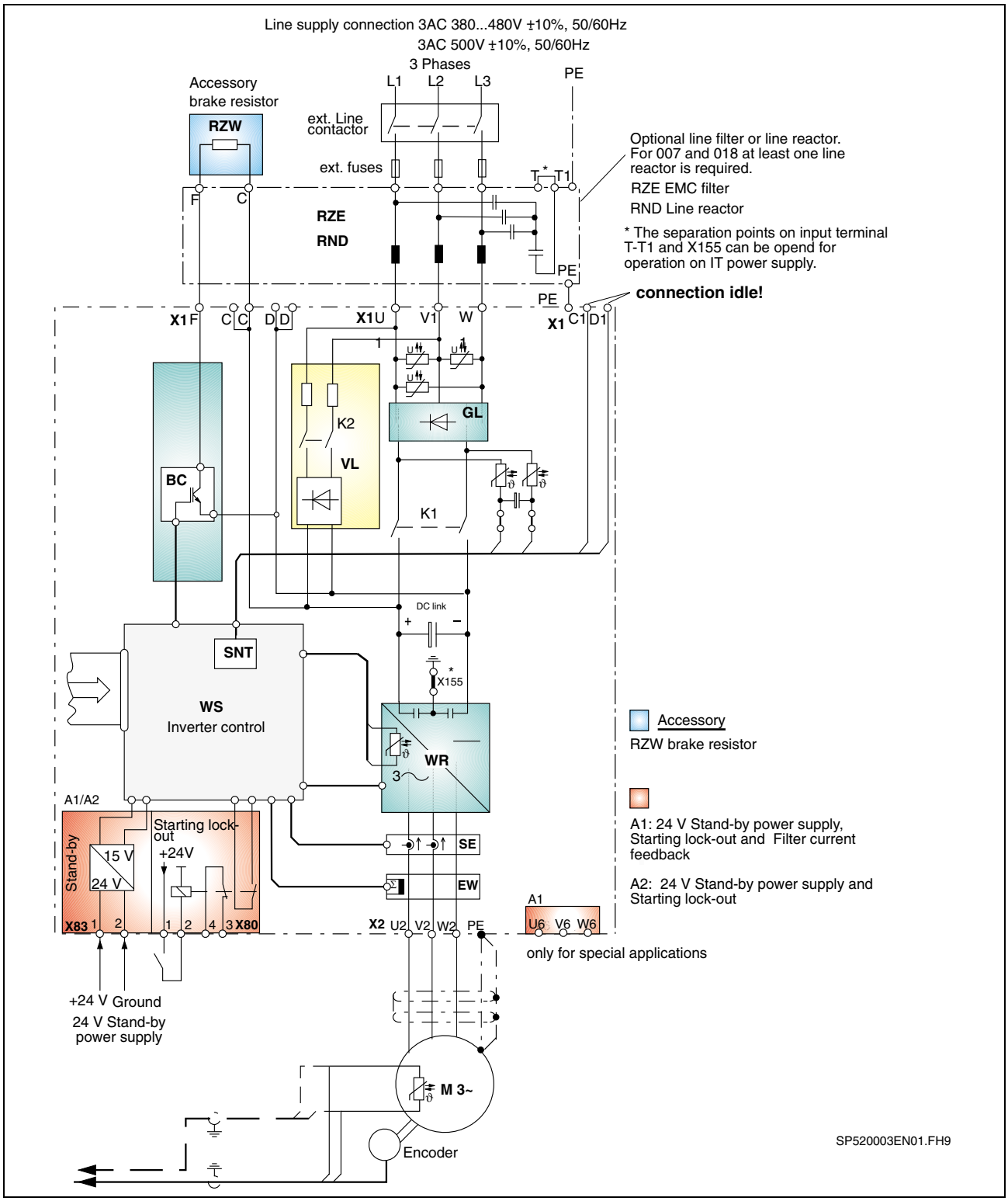


Fig.: 3-3 Sample connection of classes A – B, 3AC 380 – 480 V / 3AC 500 V

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!

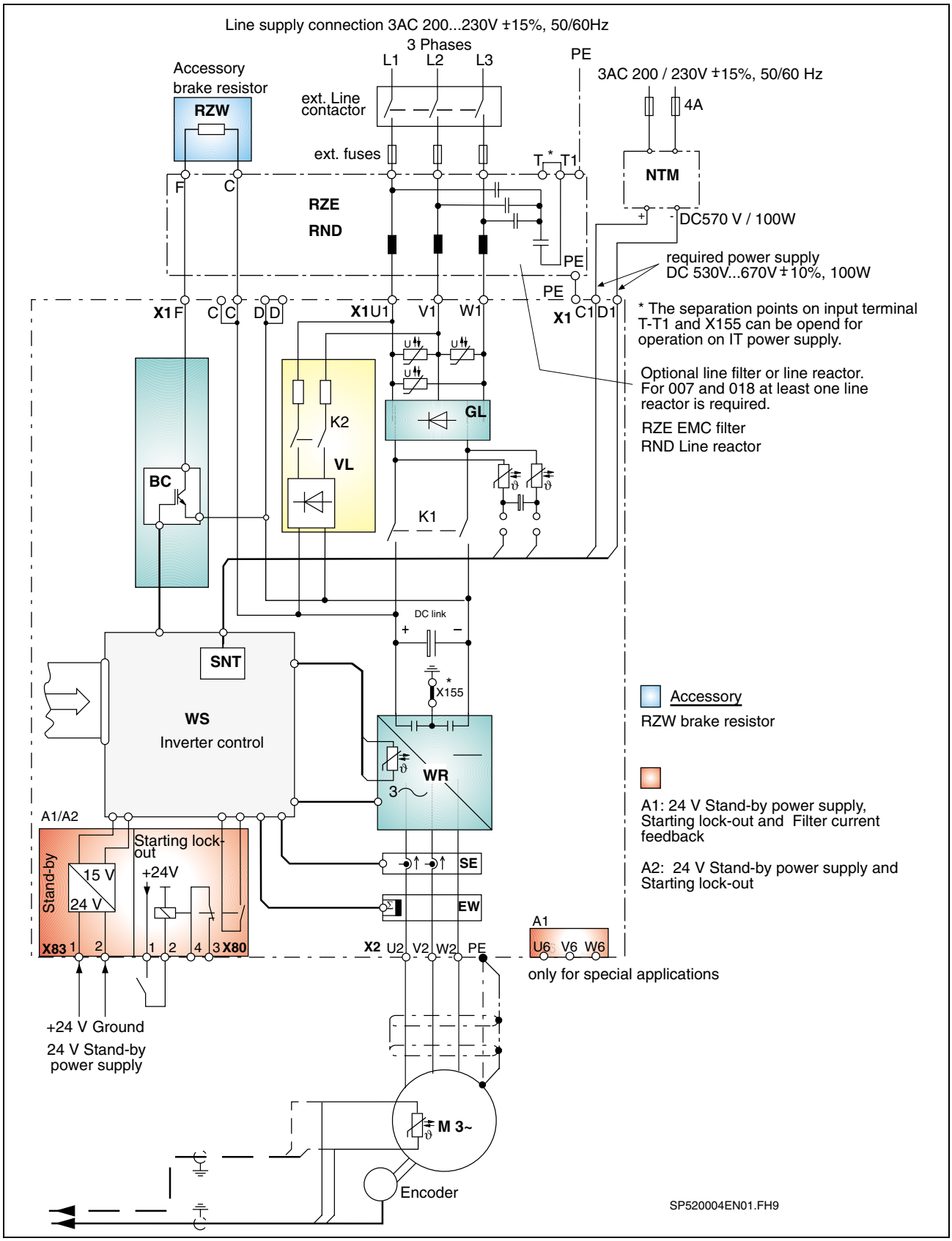


Fig.: 3-4 Sample connection of classes A - B, 3AC 200 – 230 V

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

EMC- Filter

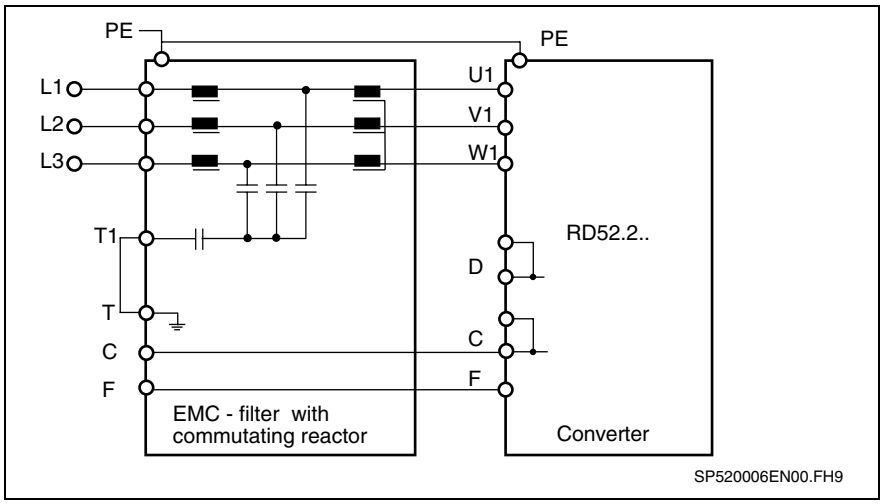
EMC standard EN61800-3 A2 is maintained using the upstream EMC-filter.

The devices in device series RD52.2 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

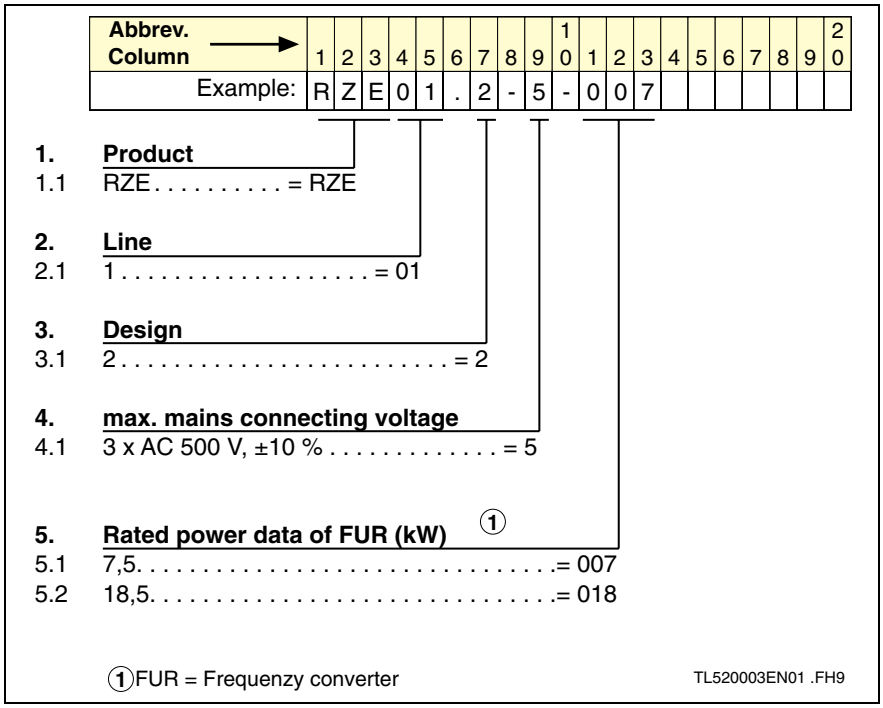


Fig.: 3-6 Type key of RZE01.2 EMC-filter with integrated line

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 500 V ±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 500 V ±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

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

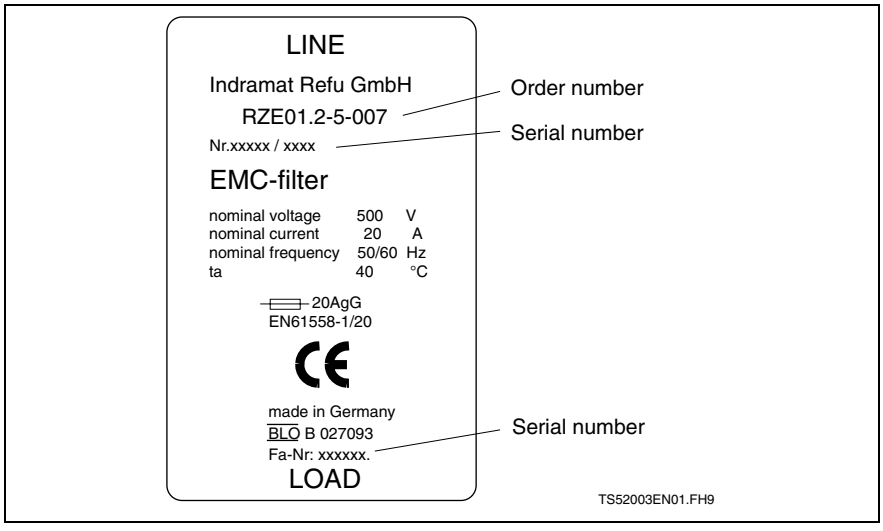
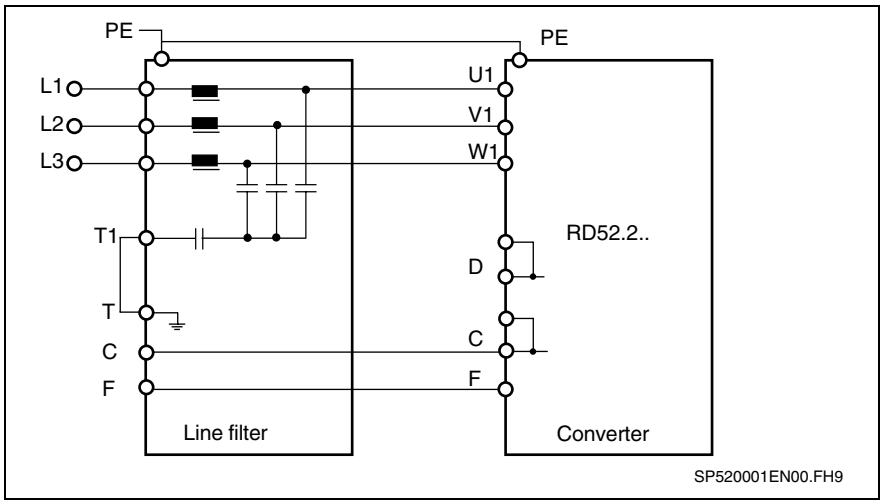


Fig.: 3-8 Type label of RZE01.2 EMC-filter with integrated line reactor

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 commutation reactor

Type Key

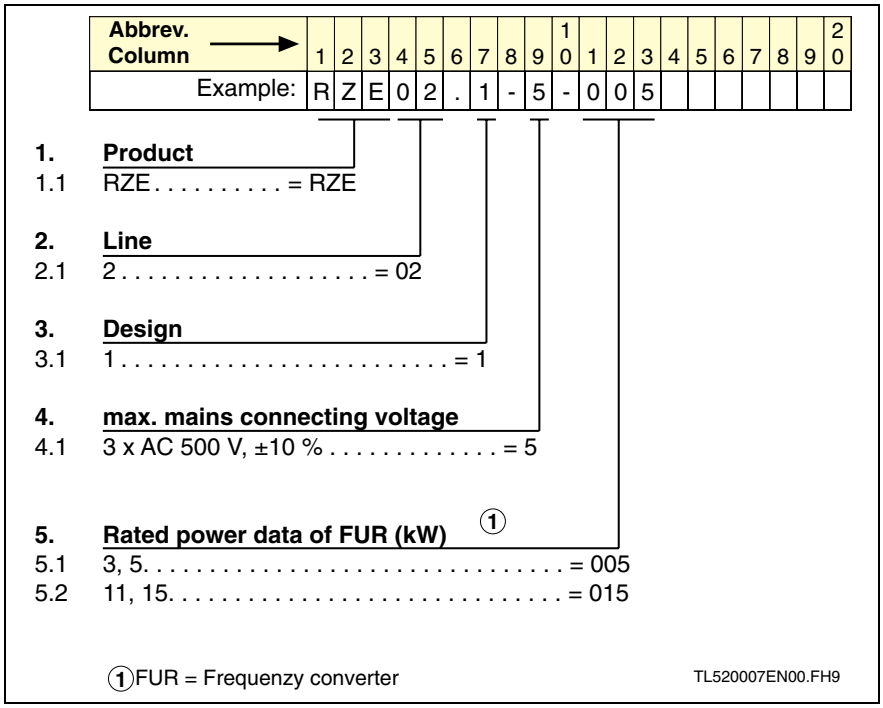


Fig.: 3-10 Type key of RZE02.1 EMC-filter without commutation reactor

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** **mm²**	**Max. ambient temperature during transport, storage and operation, ta °C**	**Weight** **kg**	**Designation**
005	A	3AC 500 V ±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 500 V ±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

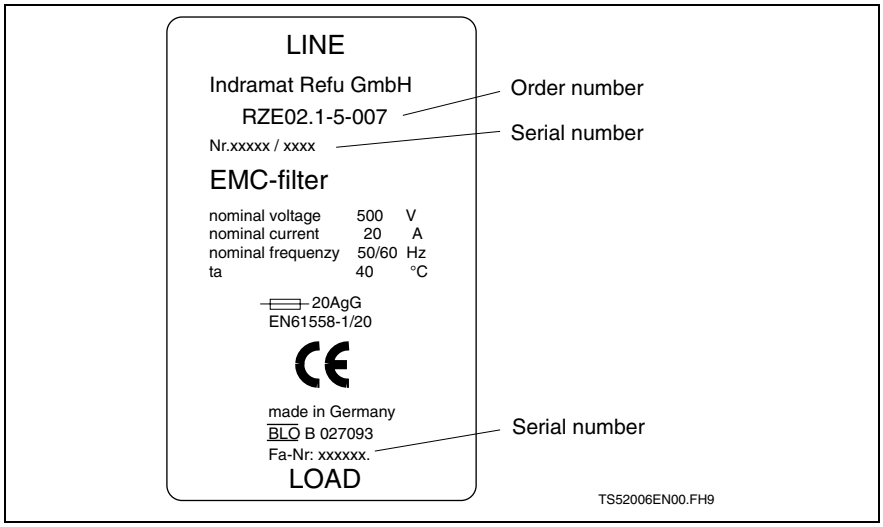
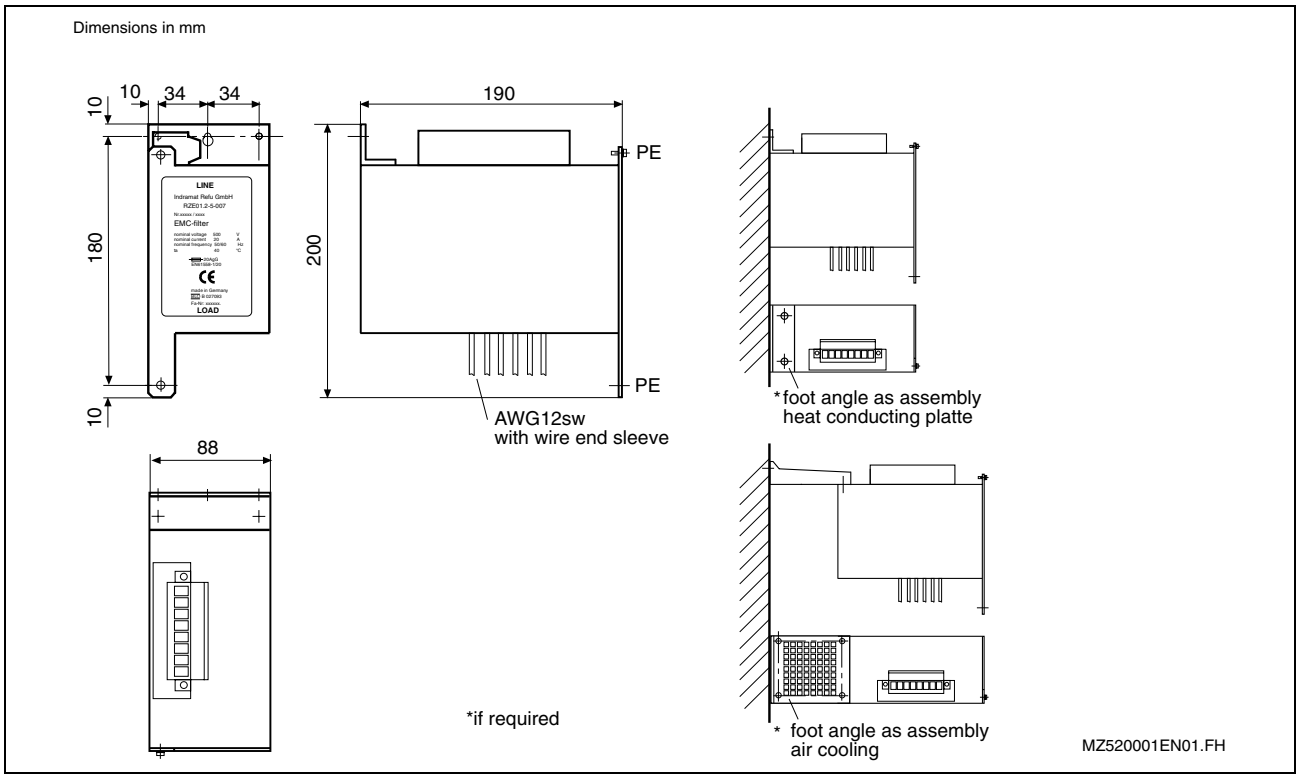


Fig.: 3-12 Type label of RZE02.1 EMC-filter without commutation reactor

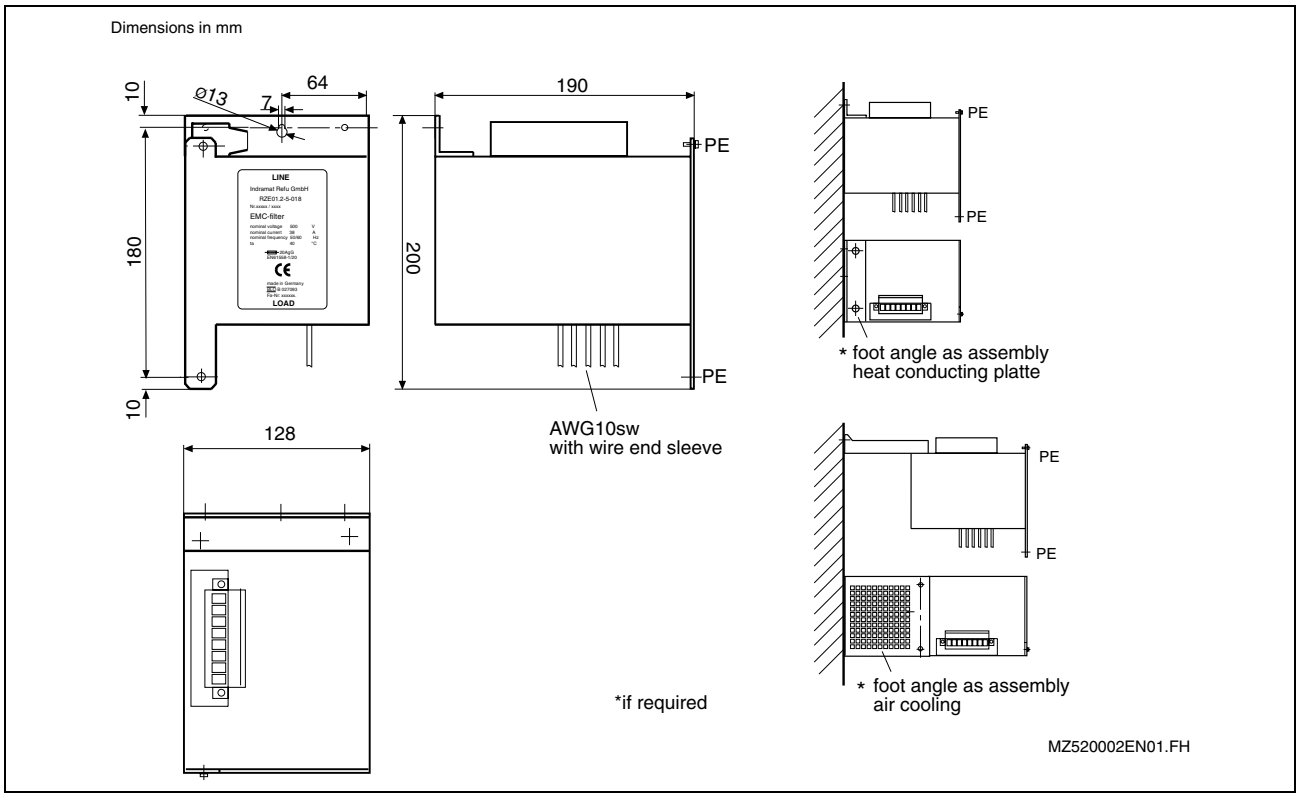
Mechanical Assembly RZE01.2 and RZE02.1

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

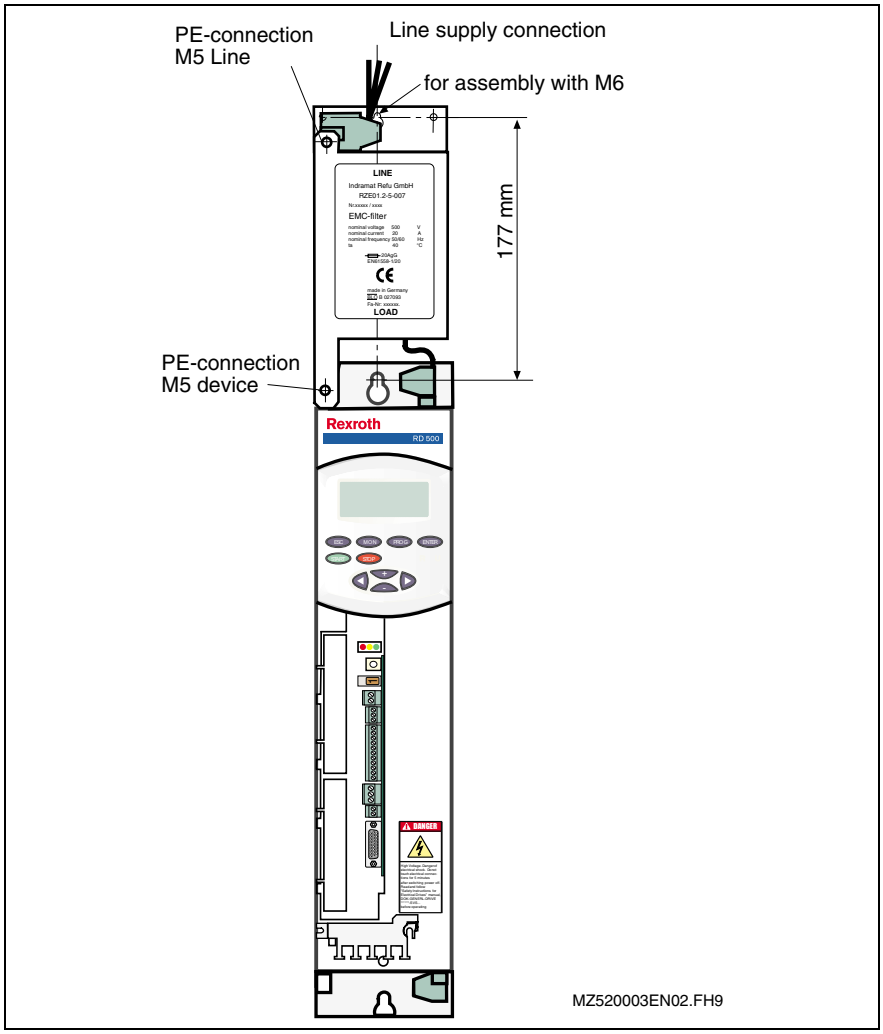


Fig.: 3-15 Assembly example for EMC filter RZE01.2 / RZE02.1

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.

Description of RND01.1 Line Reactor

Presentation of Principle

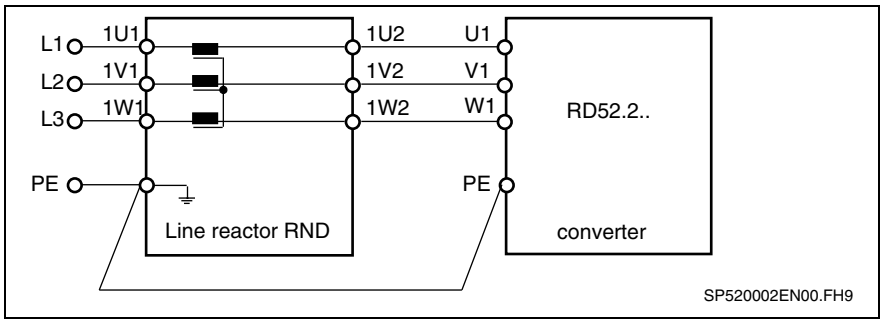


Fig.: 3-16 Circuit principle of line reactor RND

Type Key

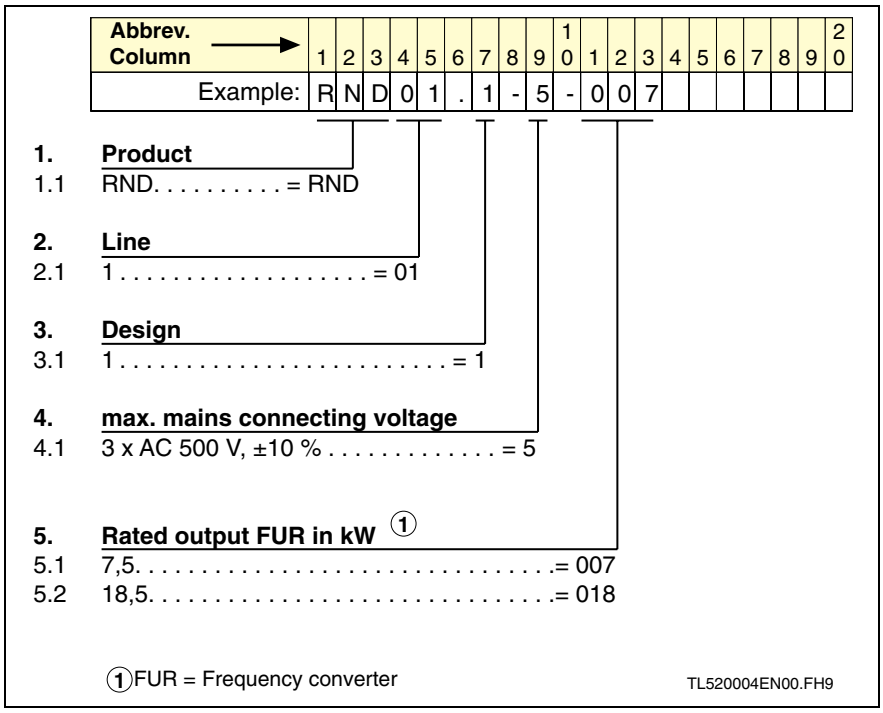


Fig.: 3-17 Type key of line reactor RND

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 500 V +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 500 V +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

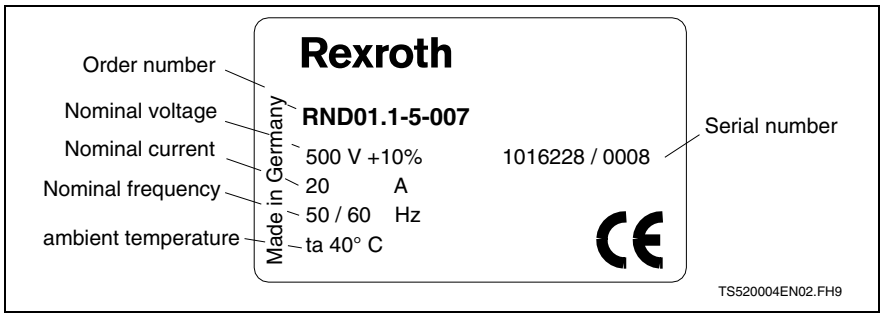


Fig.: 3-19 Type label of line reactor RND

Mechanical Assembly line reactor RND

Dimension Drawing

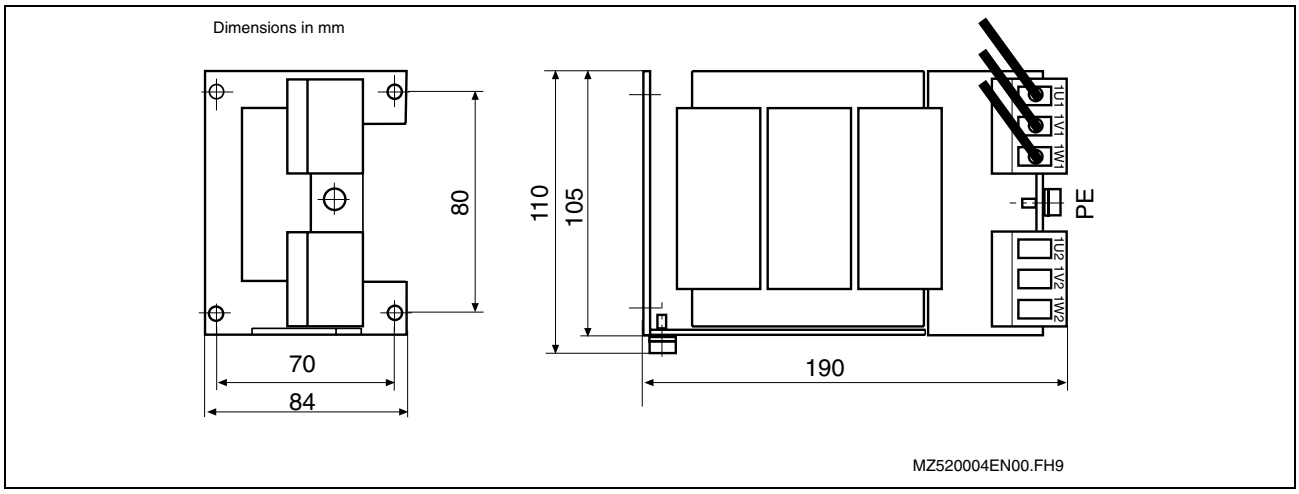


Fig.: 3-20 Line reactor RND01.1-5-007 / 018

Assembly Example

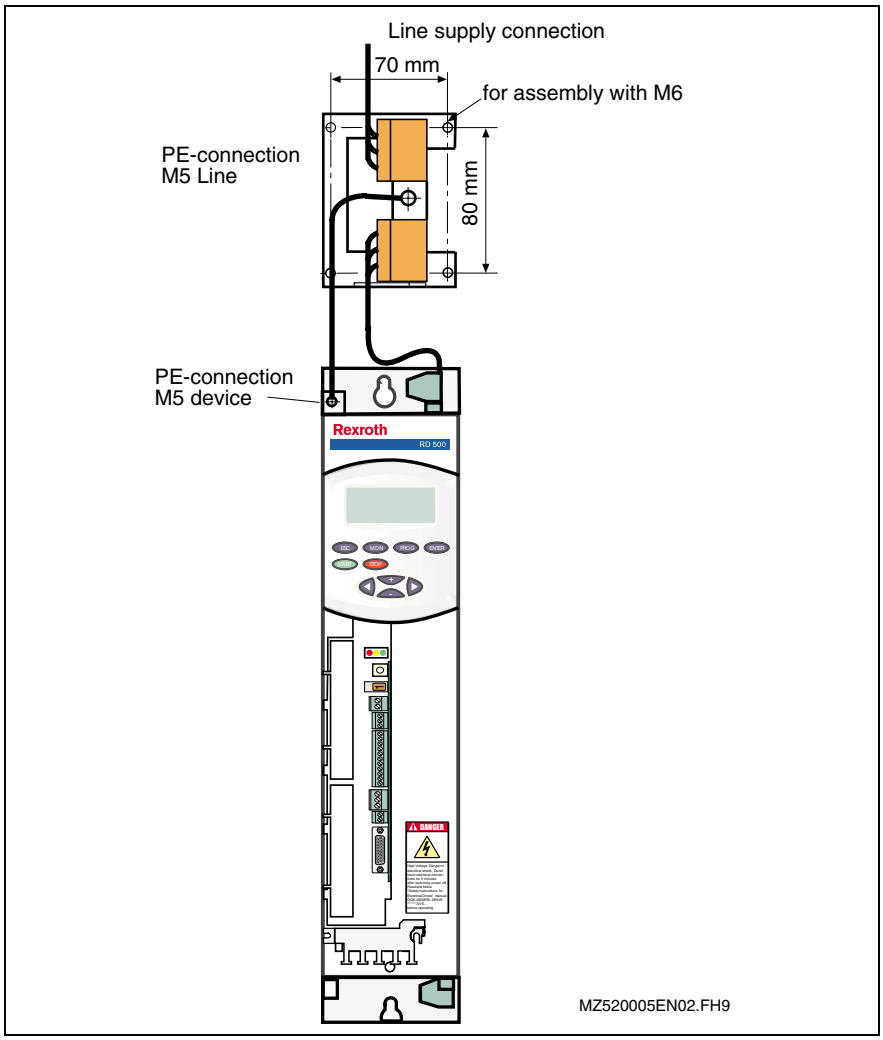


Fig.: 3-21 Assembly example of line reactor RND01.1

Description of NTM02.1power pack module

When converters with a 3AC 200 - 230 V 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 / 230 V AC input voltage.

Presentation of Principle

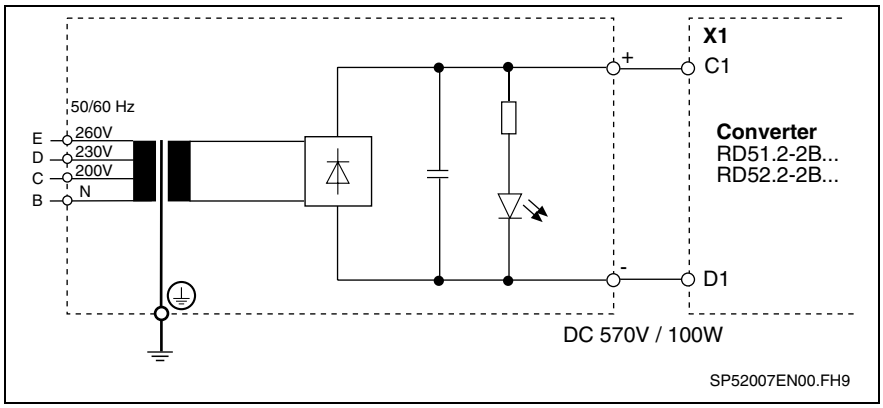


Fig.: 3-22 Presentation of Principle NTM02.1 power pack module

Type Key

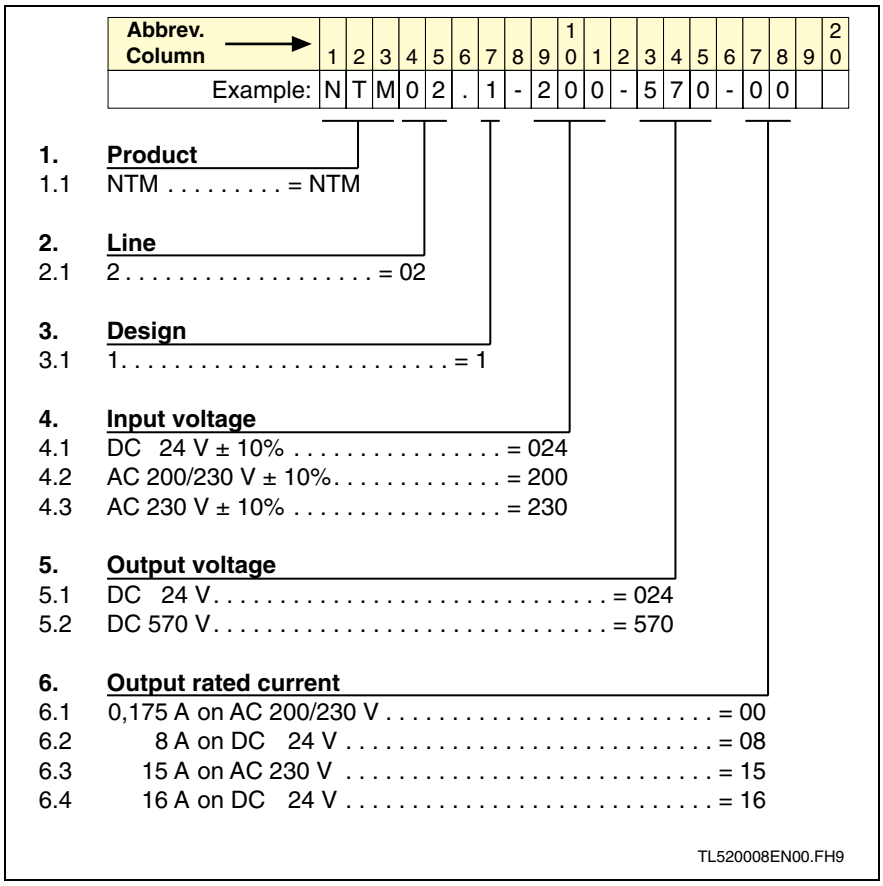


Fig.: 3-23 Type key of NTM02.1 power pack module

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 °C, 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 50 V is present at the outlet terminals.

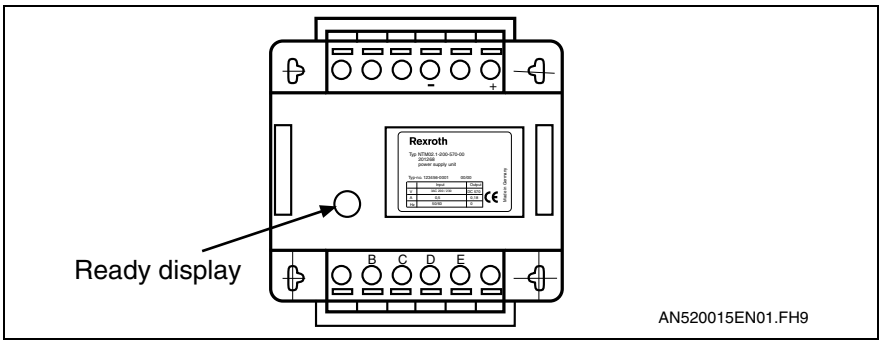


Fig.: 3-25 Ready display NTM02.1 power pack module

Overload protection using locking temperature switch in the primary circuit.

CAUTION

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

⇒ The power supply contains capacitors whose terminals can have a dangerous voltage up to 30 minutes after the device is switched off!

Type Label

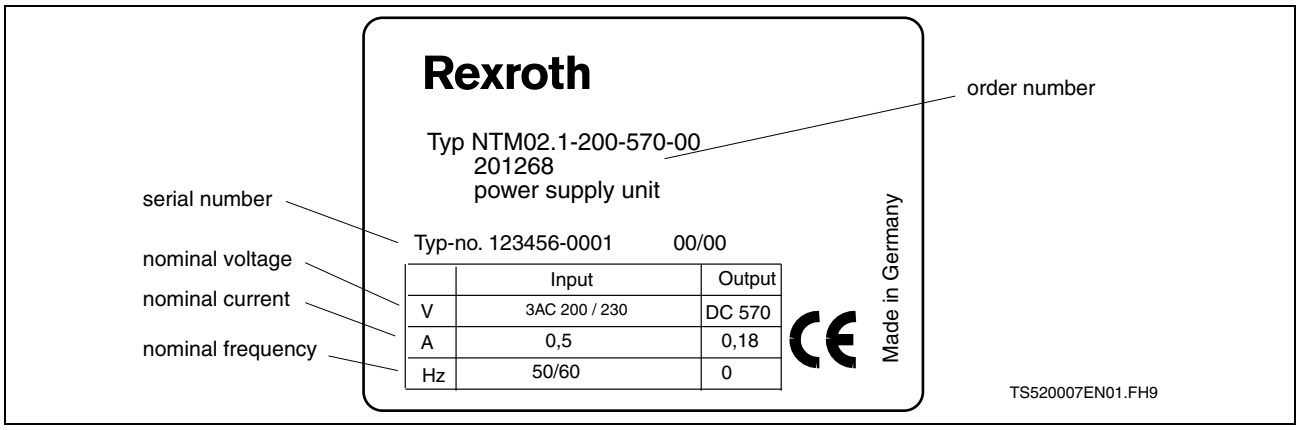


Fig.: 3-26 Type label NTM02.1 power pack module

Mechanical Assembly NTM02.1 power pack module

Dimension Drawing

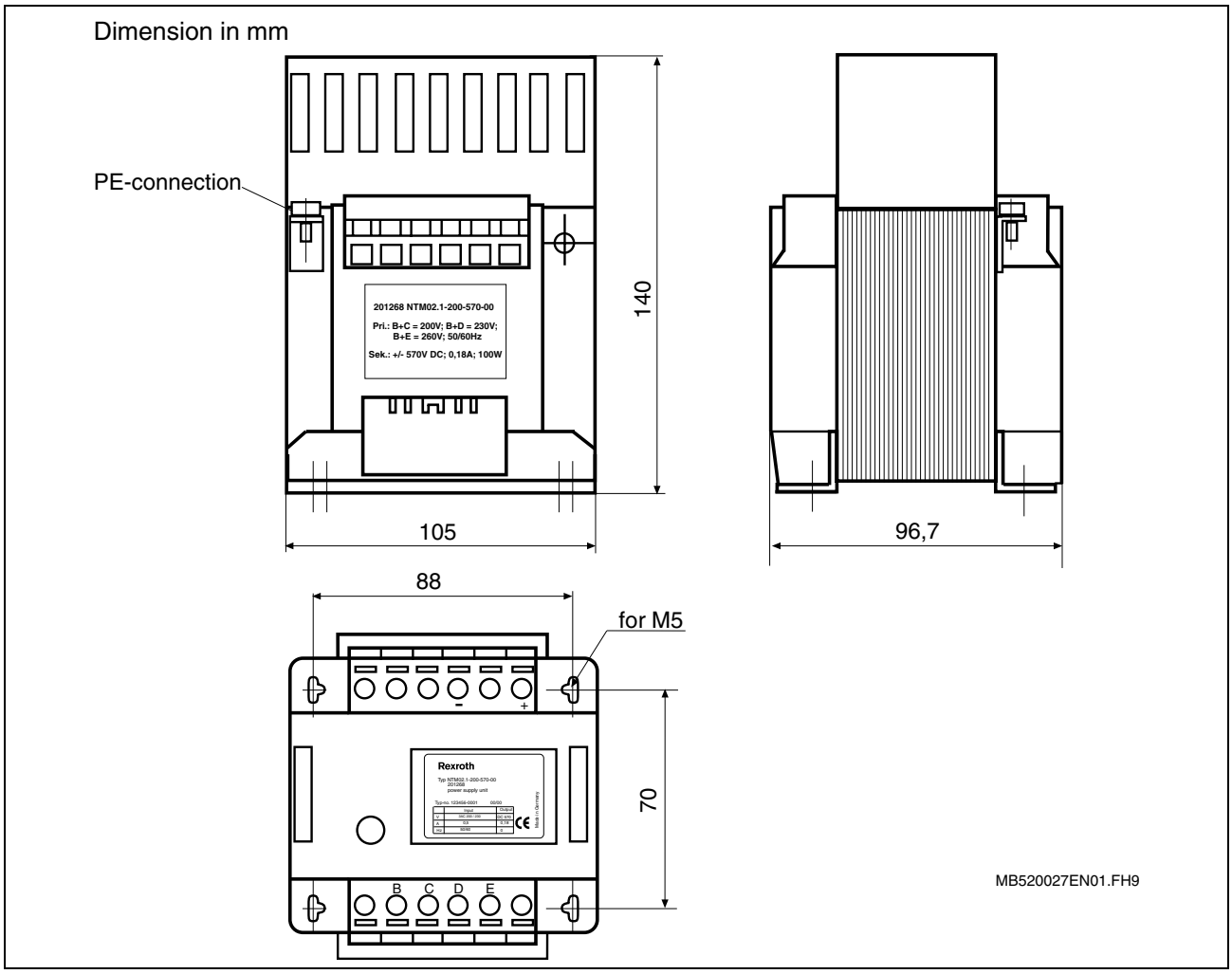


Fig.: 3-27 Dimension Drawing NTM02.1 power pack module

Circuit Principle of Power Section, Size Classes C - E

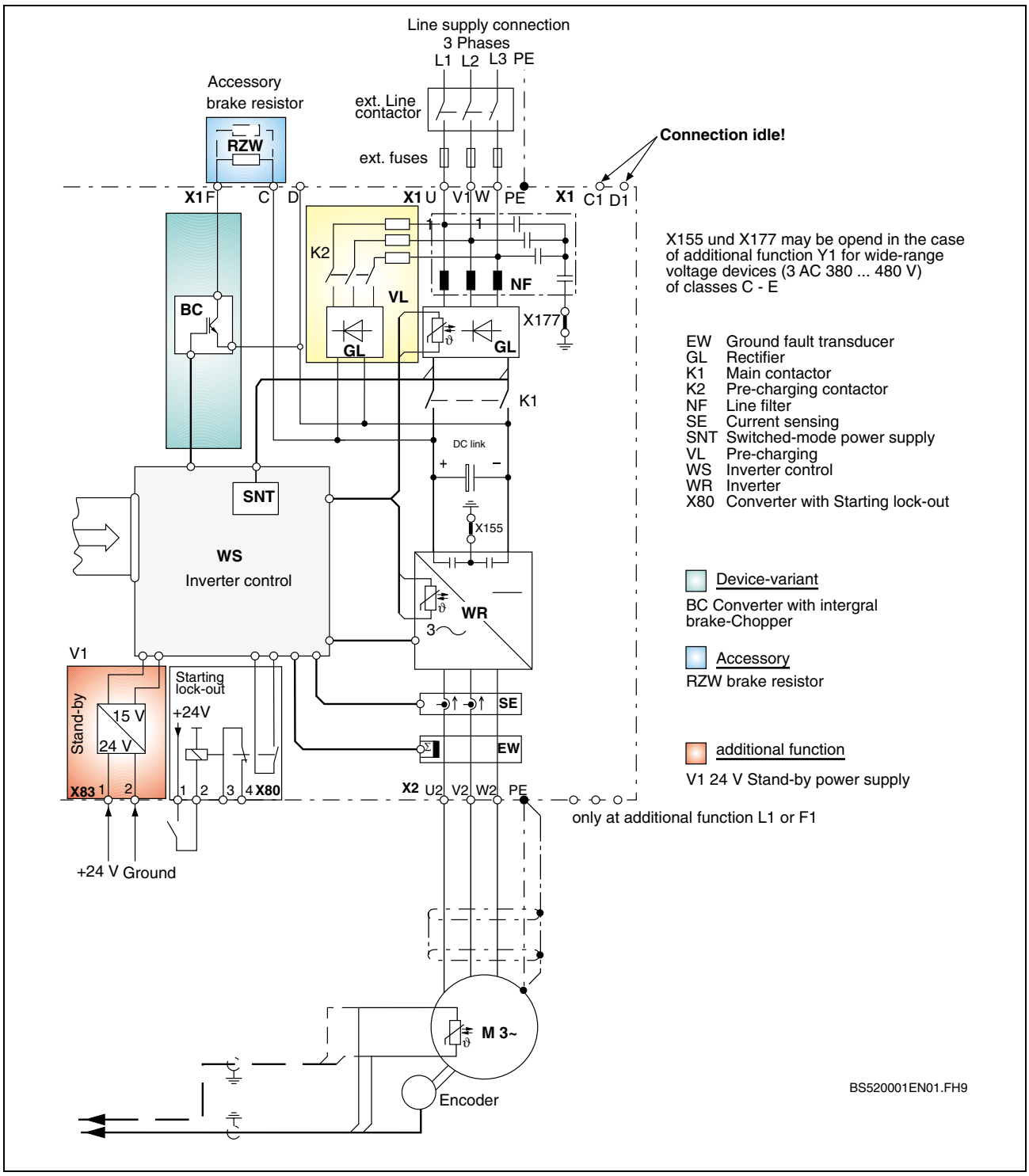


Fig.: 3-28 Circuit principle of power section, converter classes C - E

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

Note: The connections C1 and D1 are never assign!

Circuit Principle of Power Section, Size Classes G - H

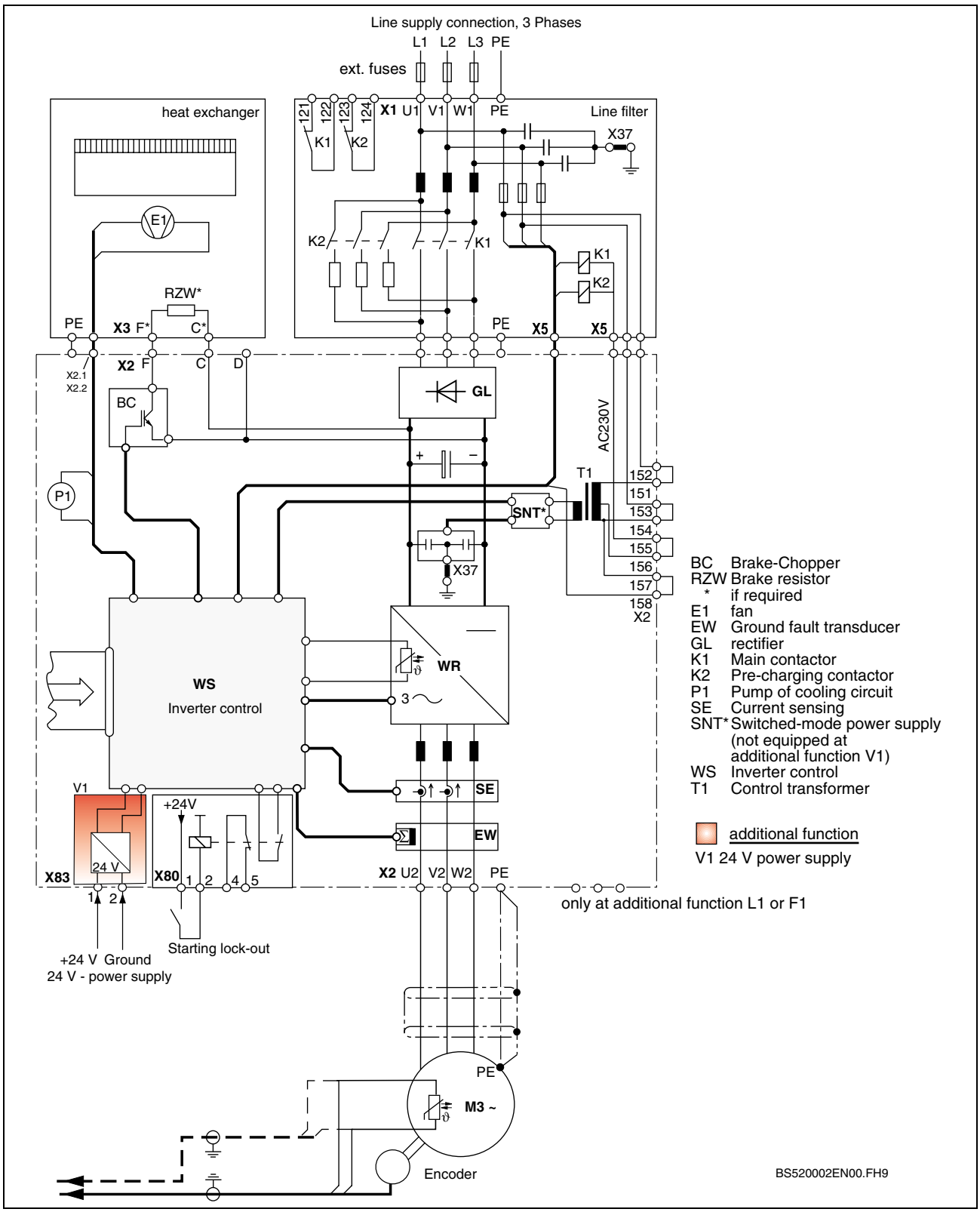


Fig.: 3-29 Circuit principle of power section, converter size classes G - H

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°C

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.

Utilization

With mounting conditions diverging from those specified above, the following rating data will be reduced in accordance with the diagrams (see "Fig. 3-30: Utilization at a higher ambient temperatureFig.: 3-31 Derating depending on setup elevation"):

- Drive controller:
  - permissible DC bus continuous rating
  - braking resistor continuous rating
  - continuous current
- Motor:
  - performance
  - continuous torque at standstill
  - S1 continuous torques

With deviating ambient temperatures together with higher setup elevations, both utilization factors must be multiplied. Setup elevation is to be considered only once. Deviating ambient temperatures are to be considered separately for the motor and the drive controller.

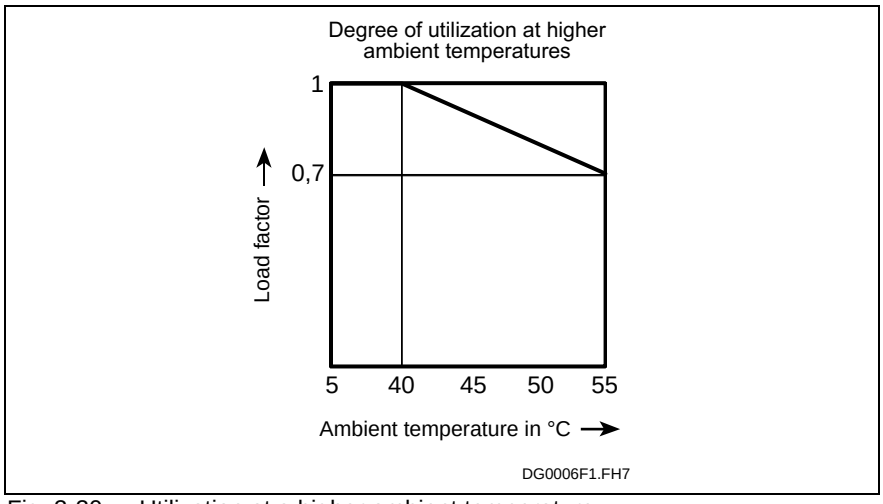


Fig. 3-30: Utilization at a higher ambient temperature

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.

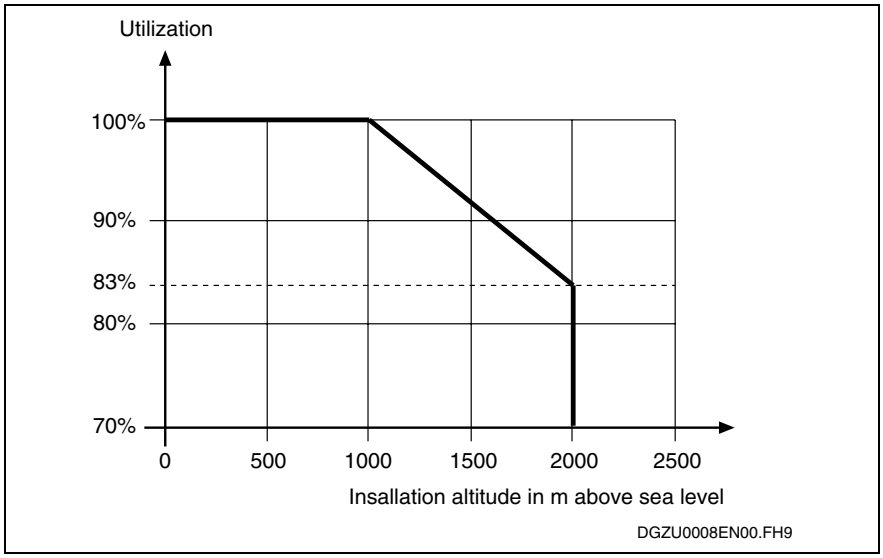


Fig.: 3-31 Derating depending on setup elevation

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

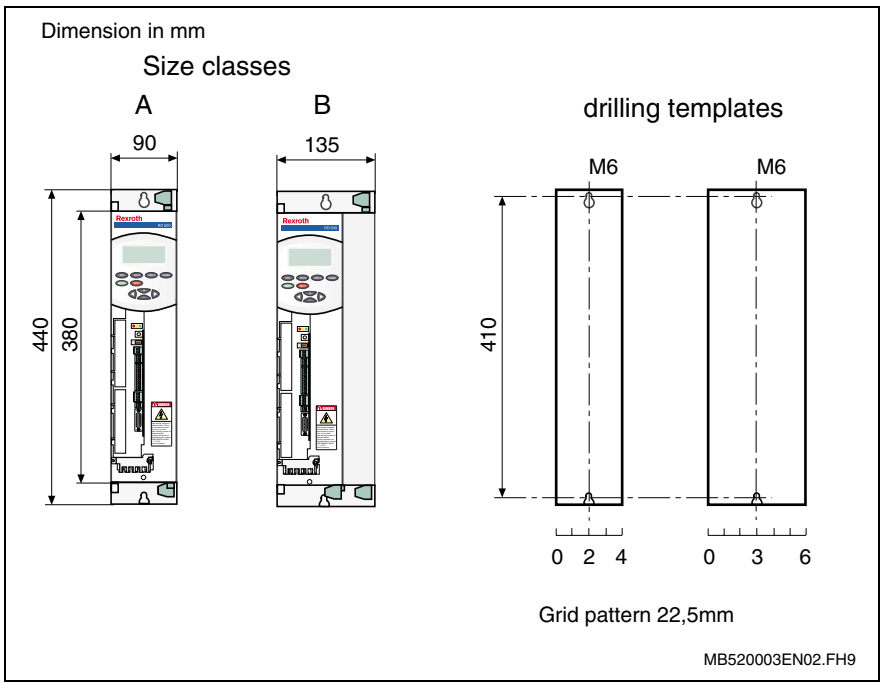


Fig.: 3-32 Dimension sheet, size classes A - B

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.: 3-33 Cooling types, L and P size classes A - B.

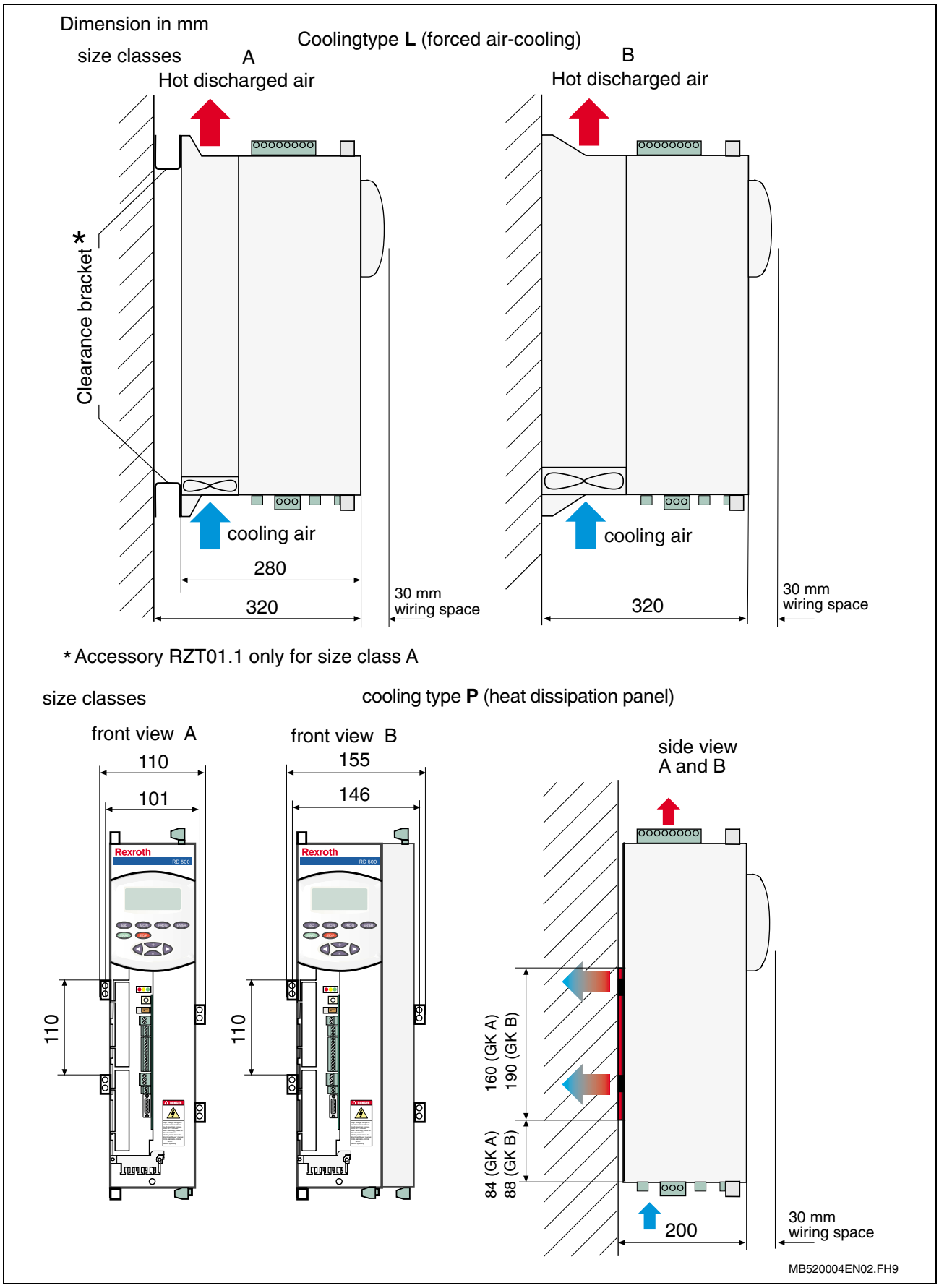


Fig.: 3-33 Cooling types, L and P size classes A - B

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

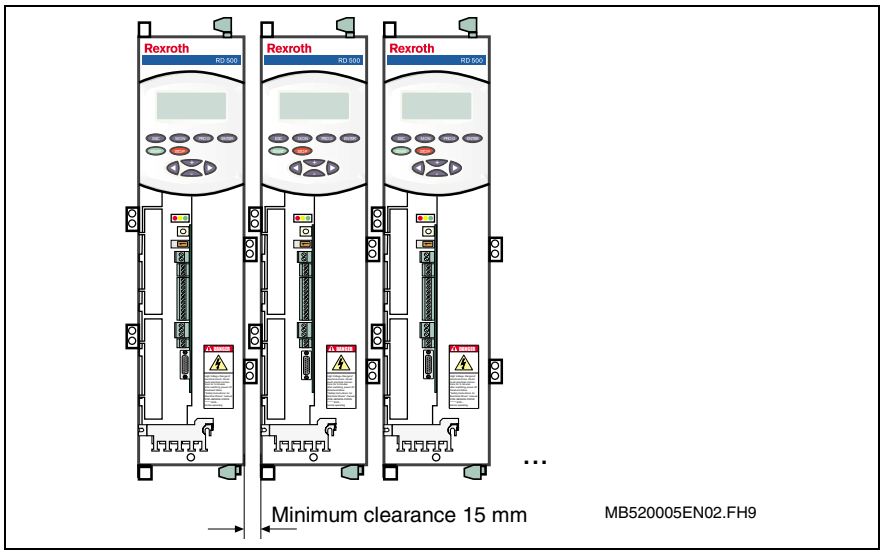


Fig.: 3-34 Arrangement of several converters next to each other for cooling type P

Dimension Drawings for Cooling Types D for Size Classes A - B

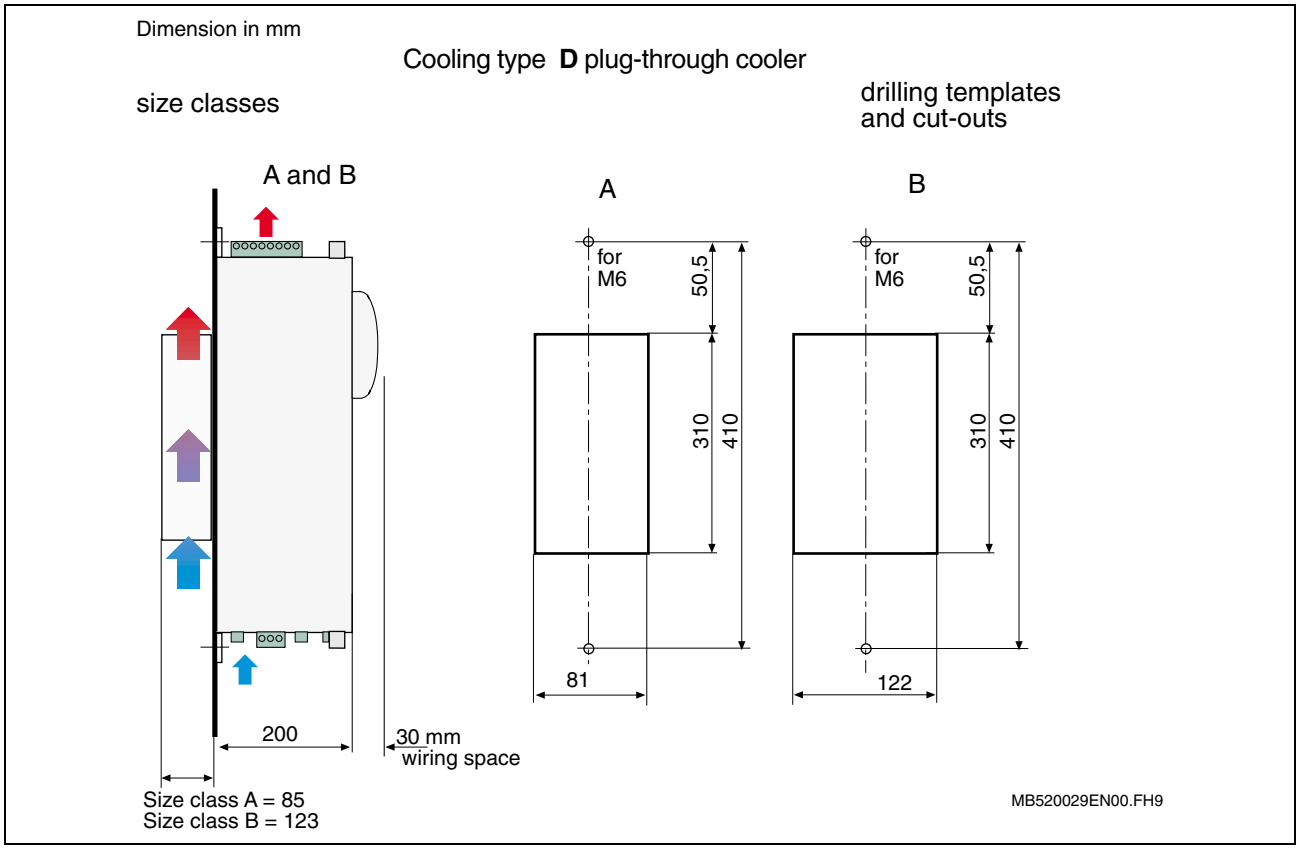


Abb. 3-35: Dimension Drawings for Cooling Types D for Size Classes A - B

Minimum Spacing for Cooling for Cooling Type L, P and D

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

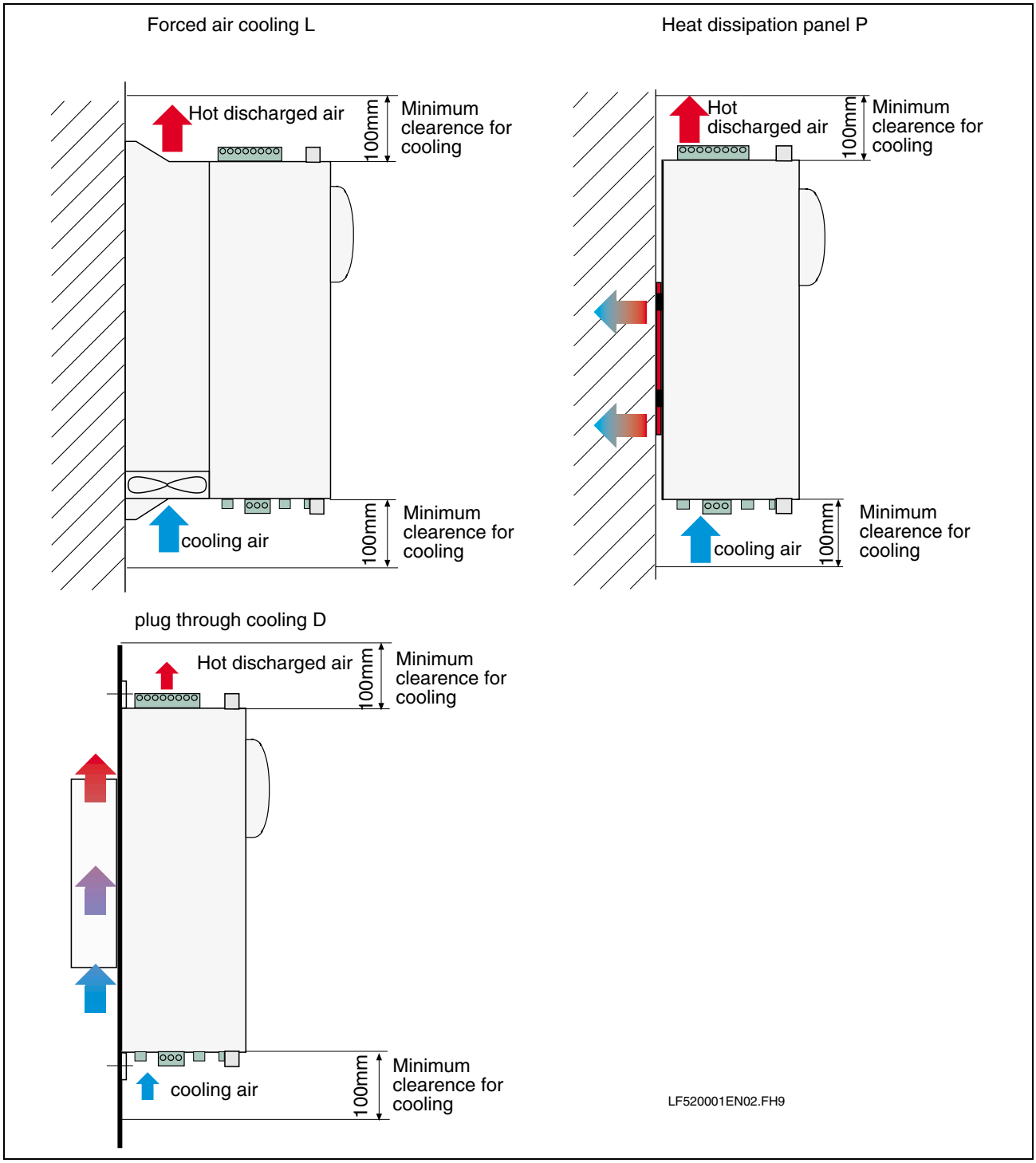


Fig.: 3-36 Minimum spacing for assembly

Dimension Drawing, Size Classes C, D, E

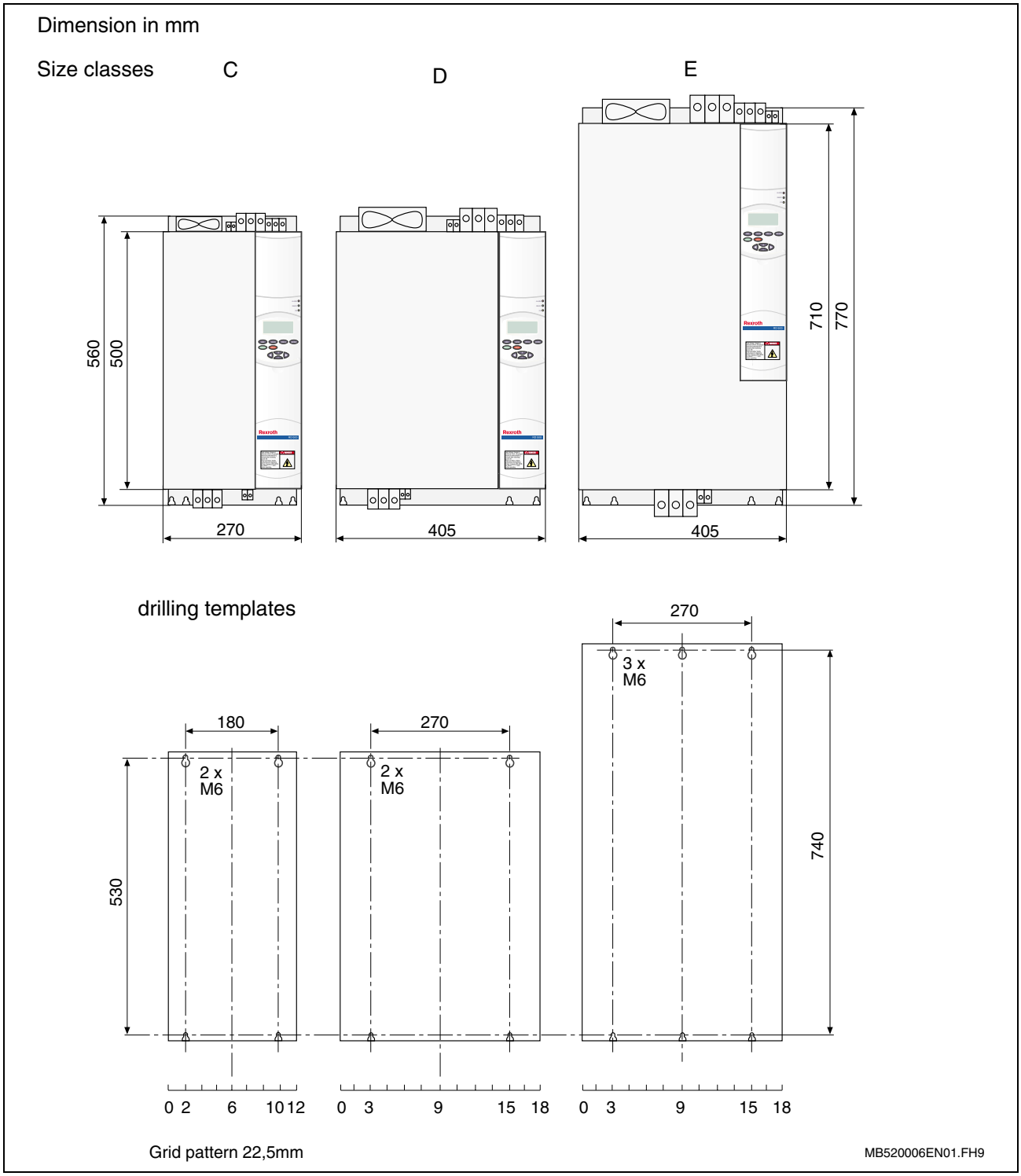


Fig.: 3-37 Dimension sheet, size classes C, D, E

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

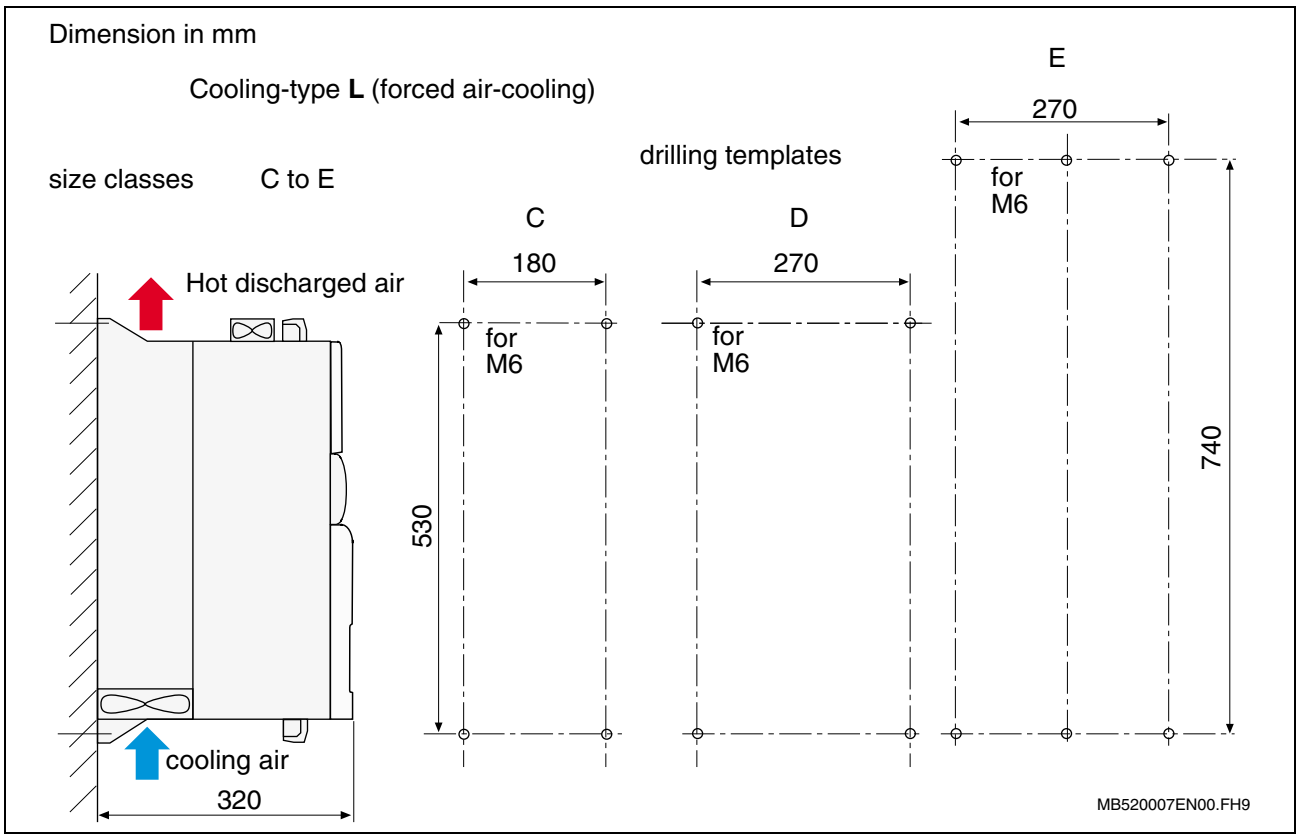


Fig.: 3-38 Dimension sheet for cooling type L, size classes C, D, E

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.

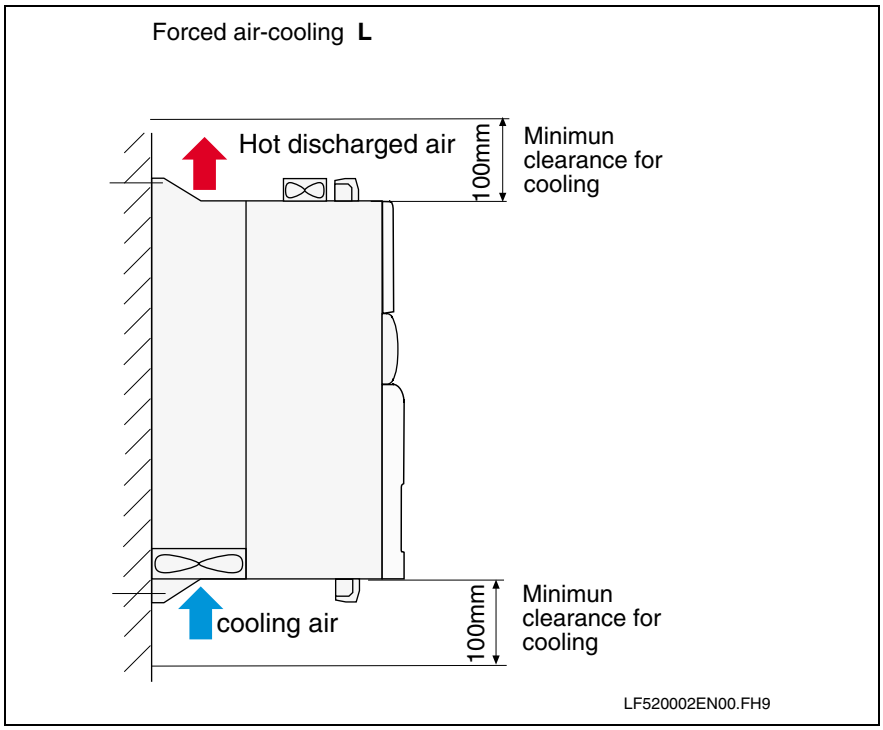


Fig.: 3-39 Minimum spacing for assembly

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

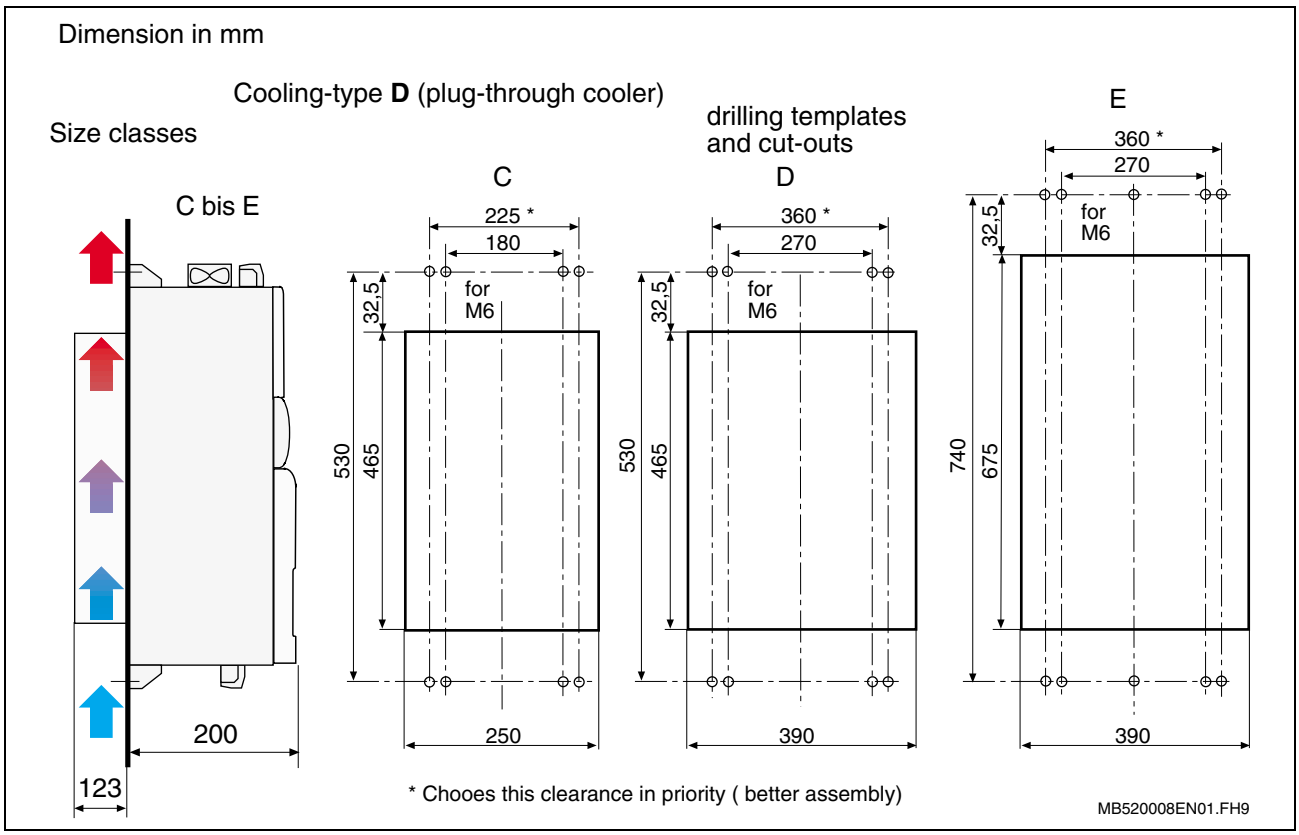


Fig.: 3-40 Dimension sheet for cooling type D, size classes C, D, E

Several Converters next to Each Other with Plug-through cooler Size Classes A to E

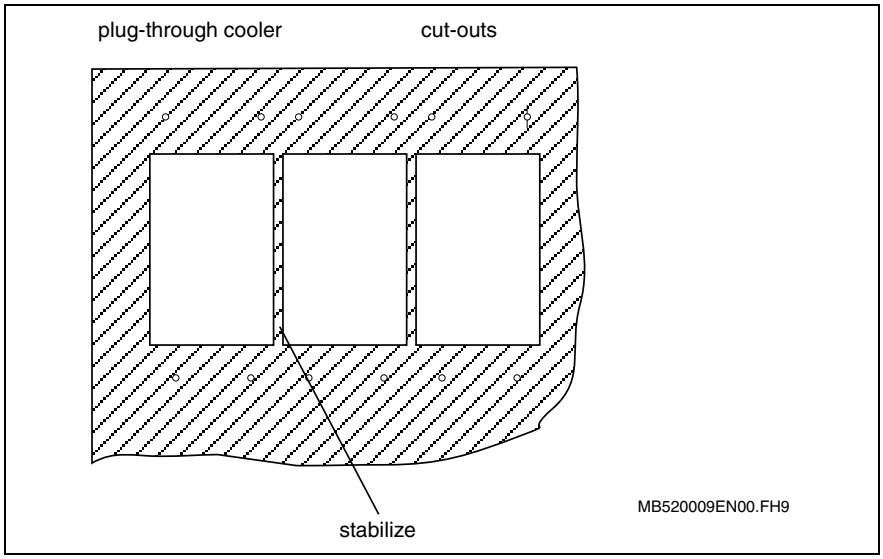


Fig.: 3-41 Cut-outs for devices with plug-through cooler

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

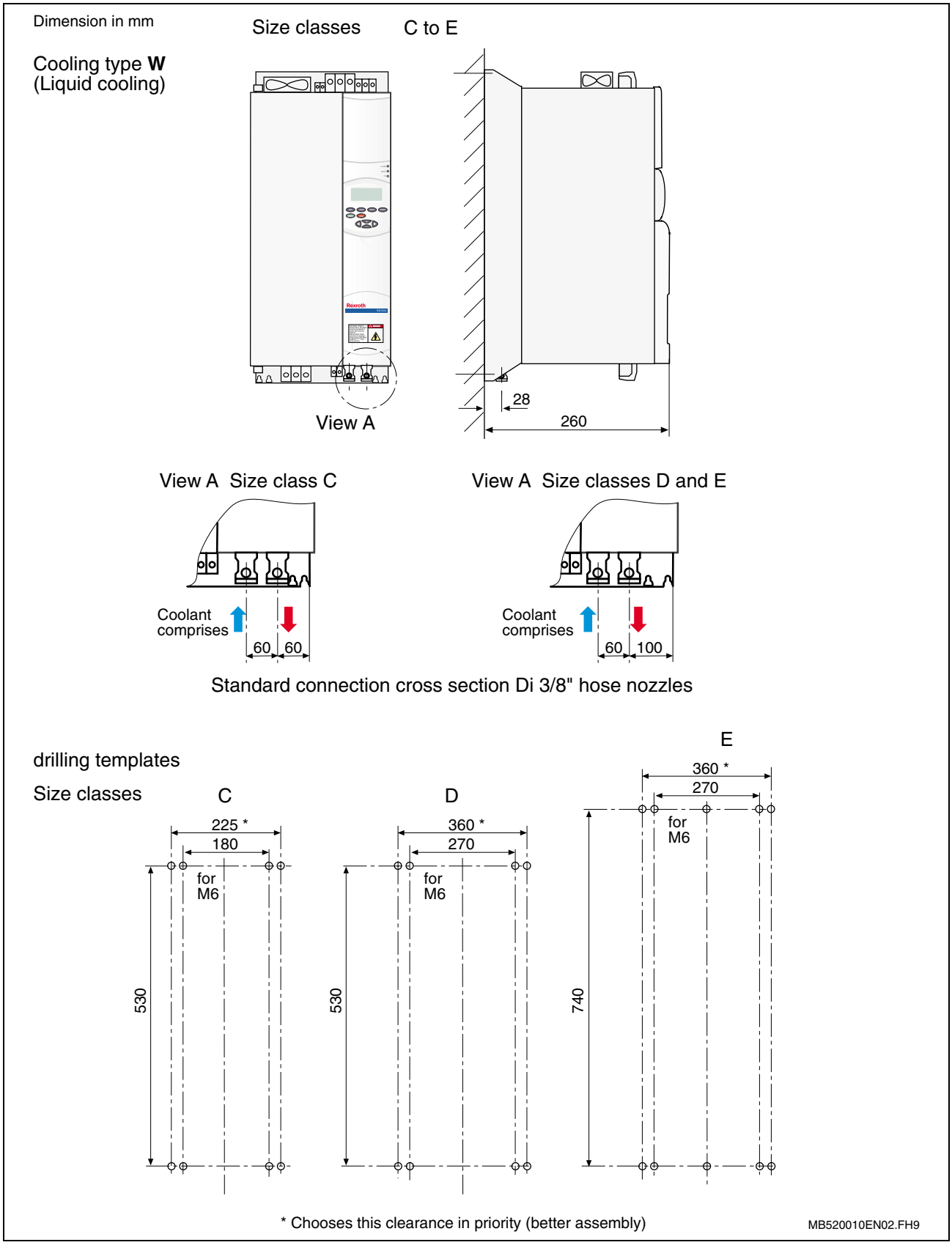


Fig.: 3-42 Dimension sheet for cooling type W, size classes C, D, E

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 classes	Volume, cm³
C	120
D	150
E	190

Fig.: 3-43 Volume

The coolant comprises tap water and antifreeze, type Antifrogen N (Clariant). It is mixed in the ratio 1 : 1. This guarantees frost protection down to -30 °C.

Dynamic Pressure and Coolant Temperature / Volume Flow, Class C

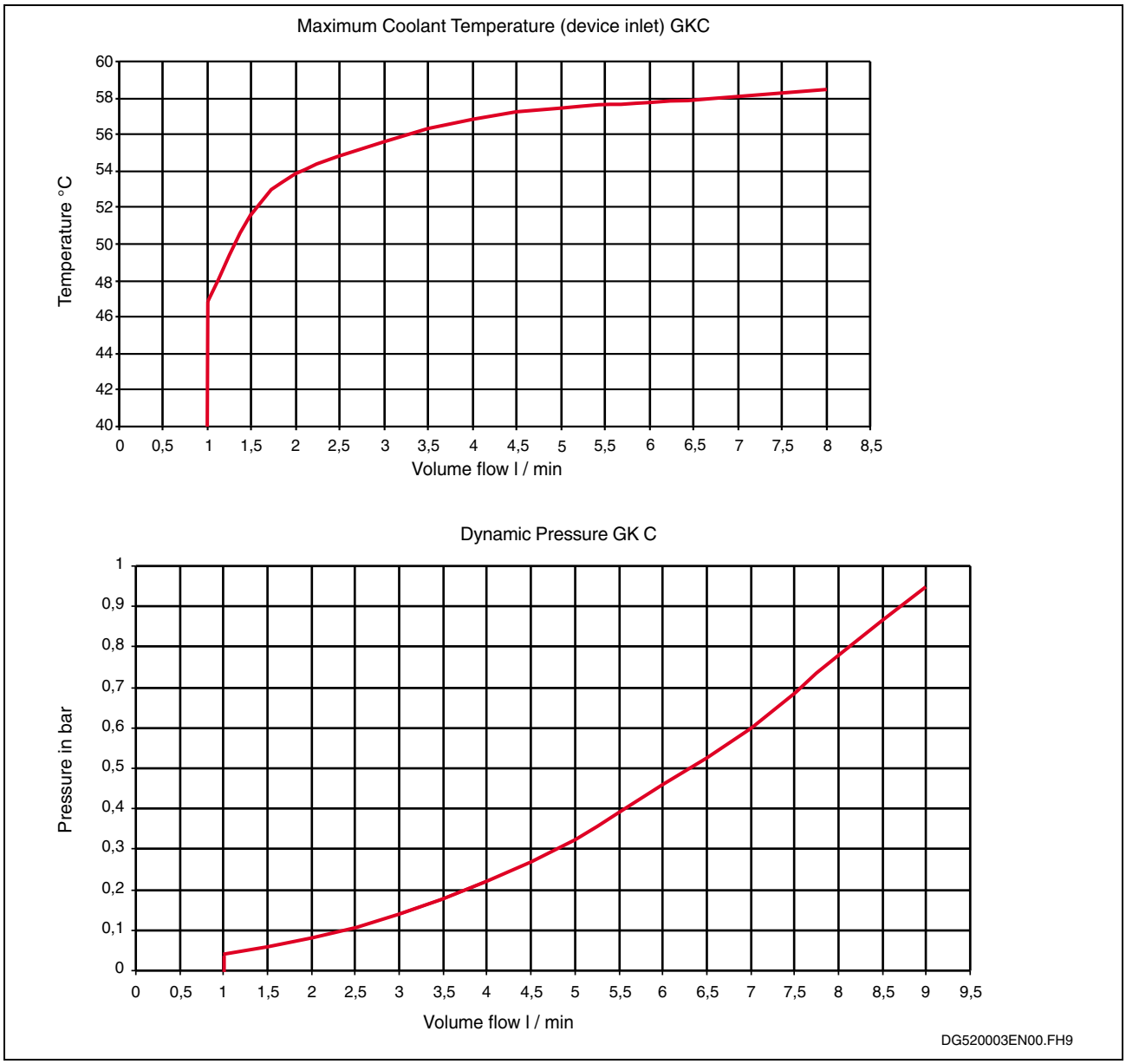


Fig.: 3-44 Dynamic pressure and coolant temperature / volume flow, class C

Dynamic Pressure and Coolant Temperature / Volume Flow, Class D

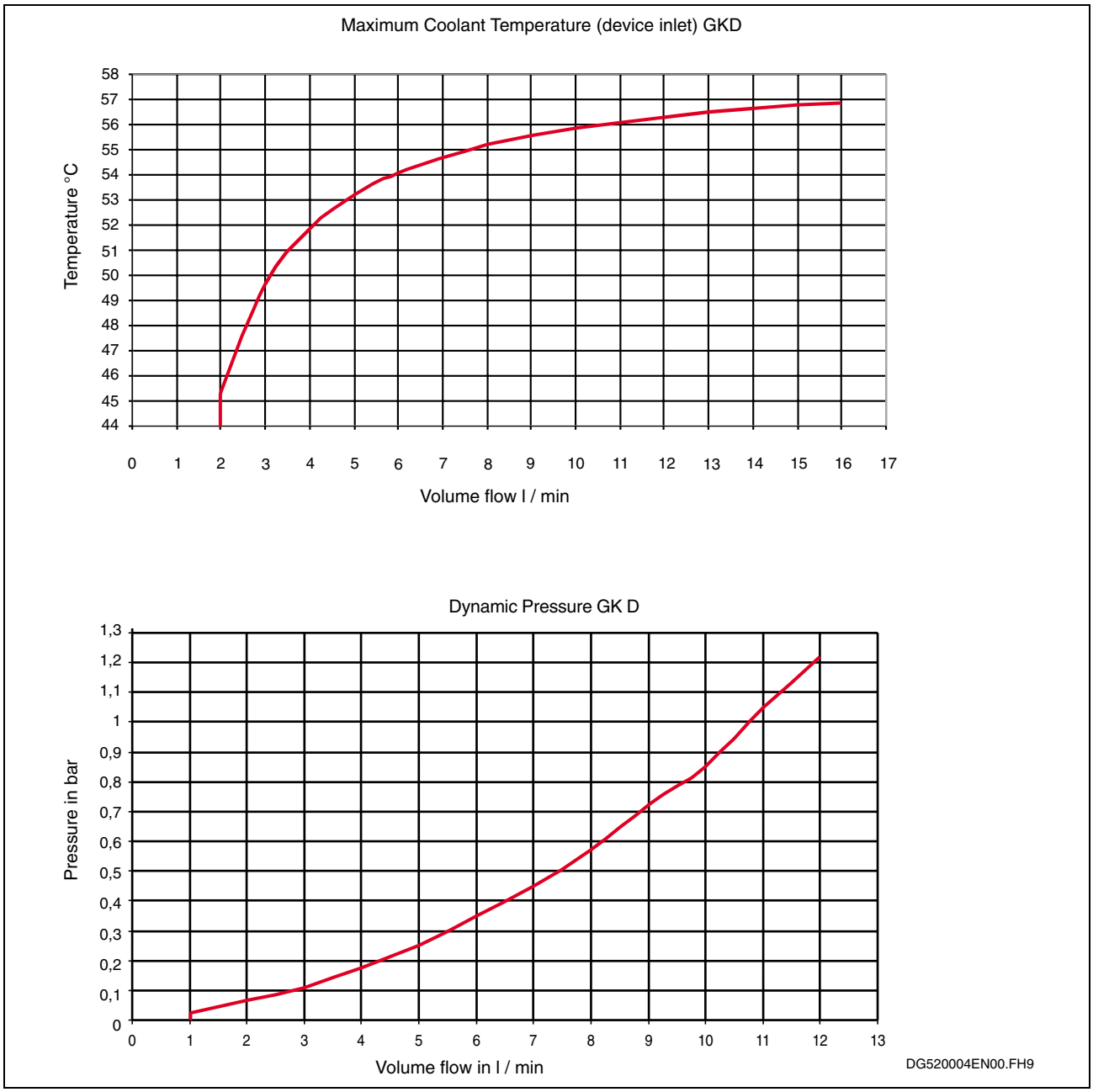


Fig.: 3-45 Dynamic pressure and coolant temperature / volume flow, class D

Dynamic pressure and coolant temperature / volume flow, Class E

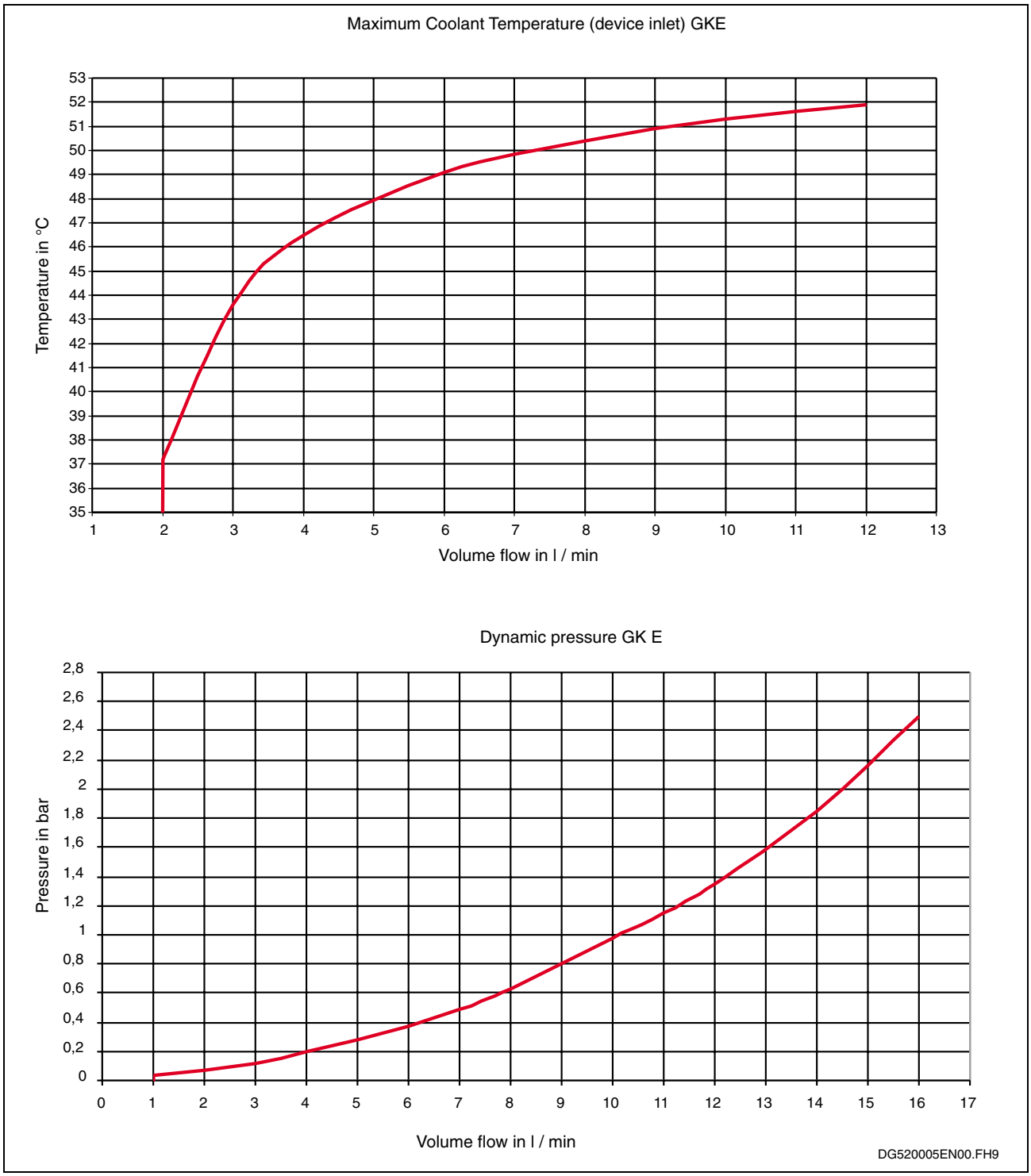


Fig.: 3-46 Dynamic pressure and coolant temperature / volume flow, class E

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

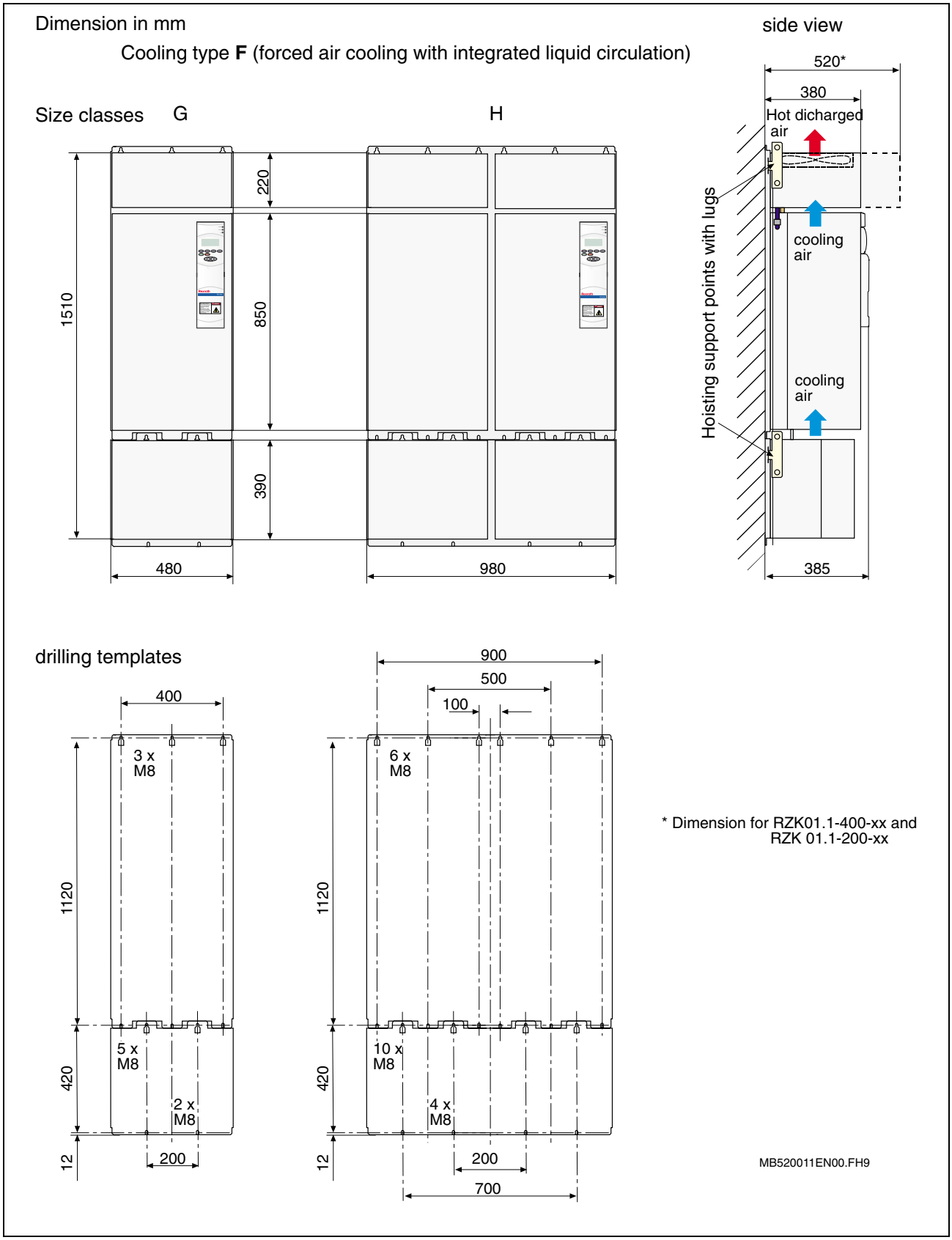


Fig.: 3-47 Dimension sheet of converter, size classes G and H, with cooling type F

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.: 3-51 Dimension sheet for cabinet roof mounting, size class G Fig.: 3-53 Dimension sheet for wall mounting. 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 Working on the Coolant Circulation System Size Classes G and H. 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.

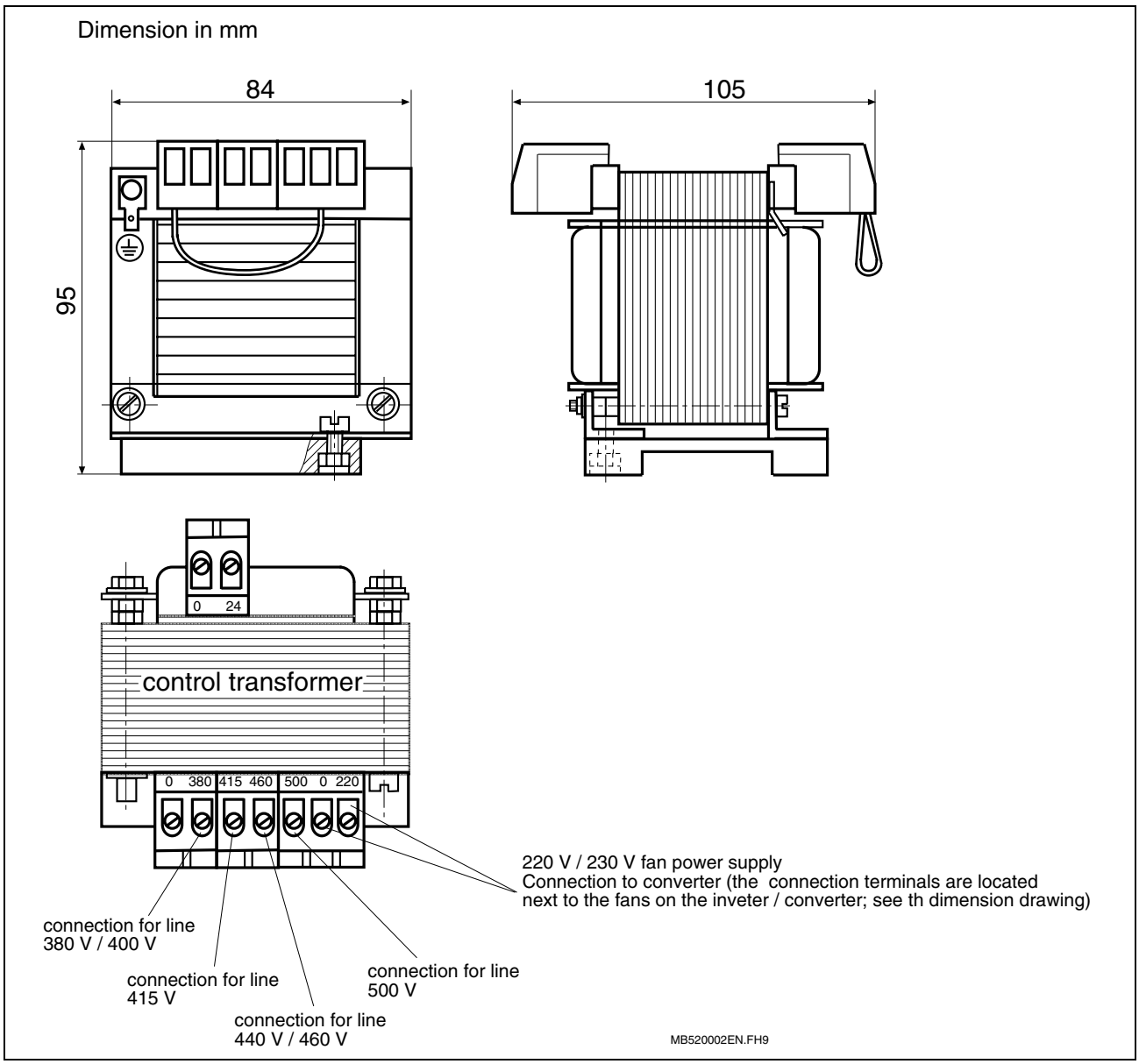


Fig.: 3-48 Separate fan transformer for 200 kW and 400 kW devices

Note: 220 V / 230 V fan power supply

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

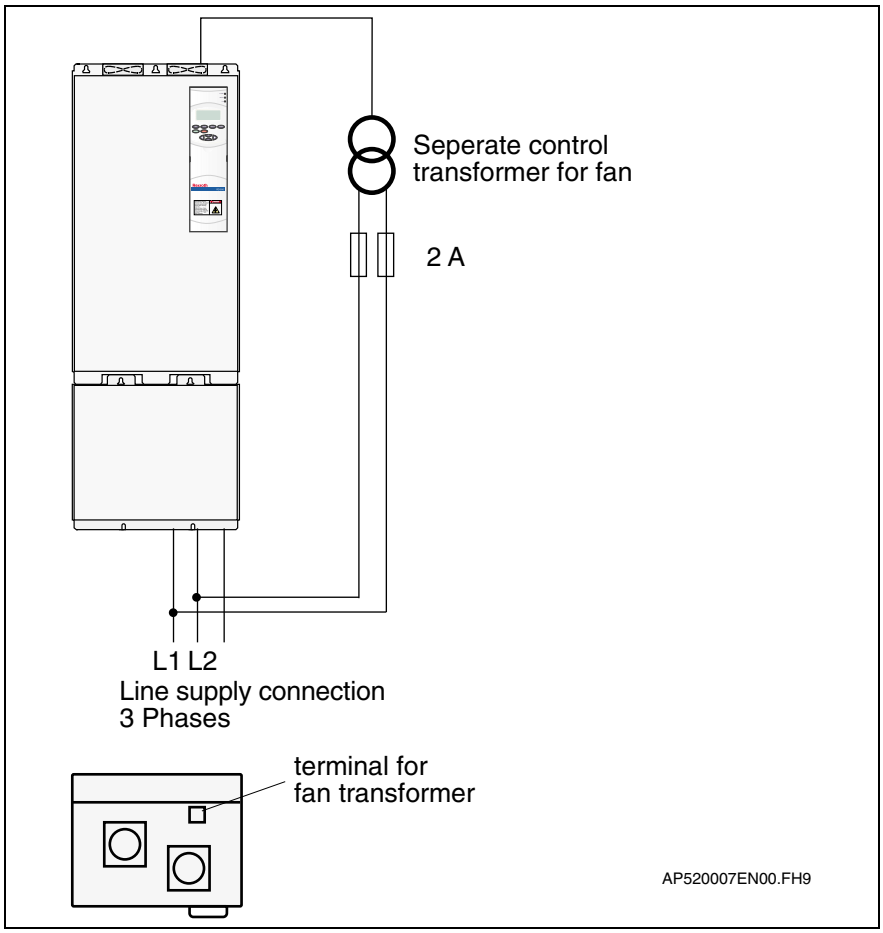


Fig.: 3-49 Connection plan for separate fan transformer for size classes G and H with cooling type R

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

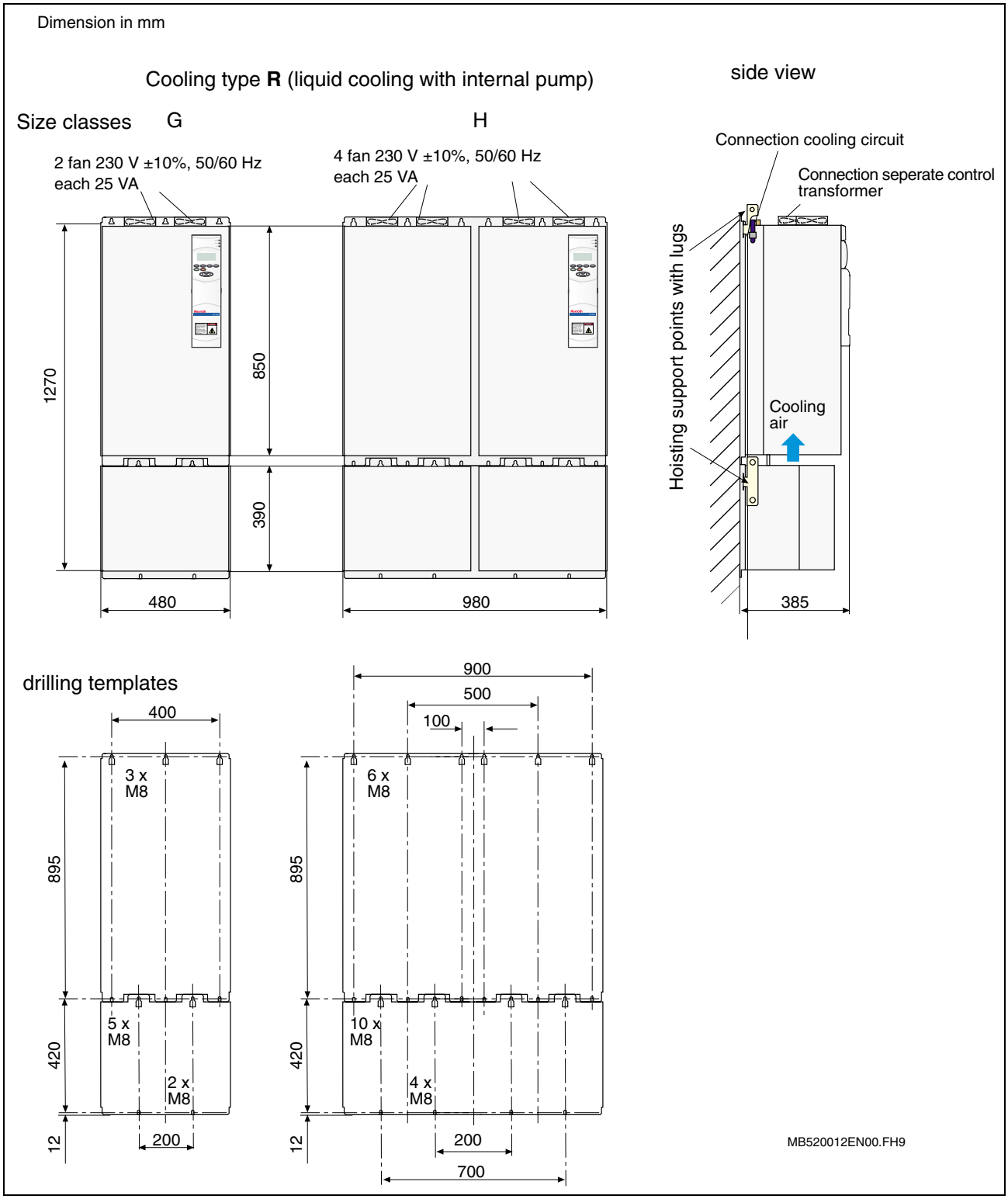


Fig.: 3-50 Dimension sheet of converter, size classes G and H, with cooling type R

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

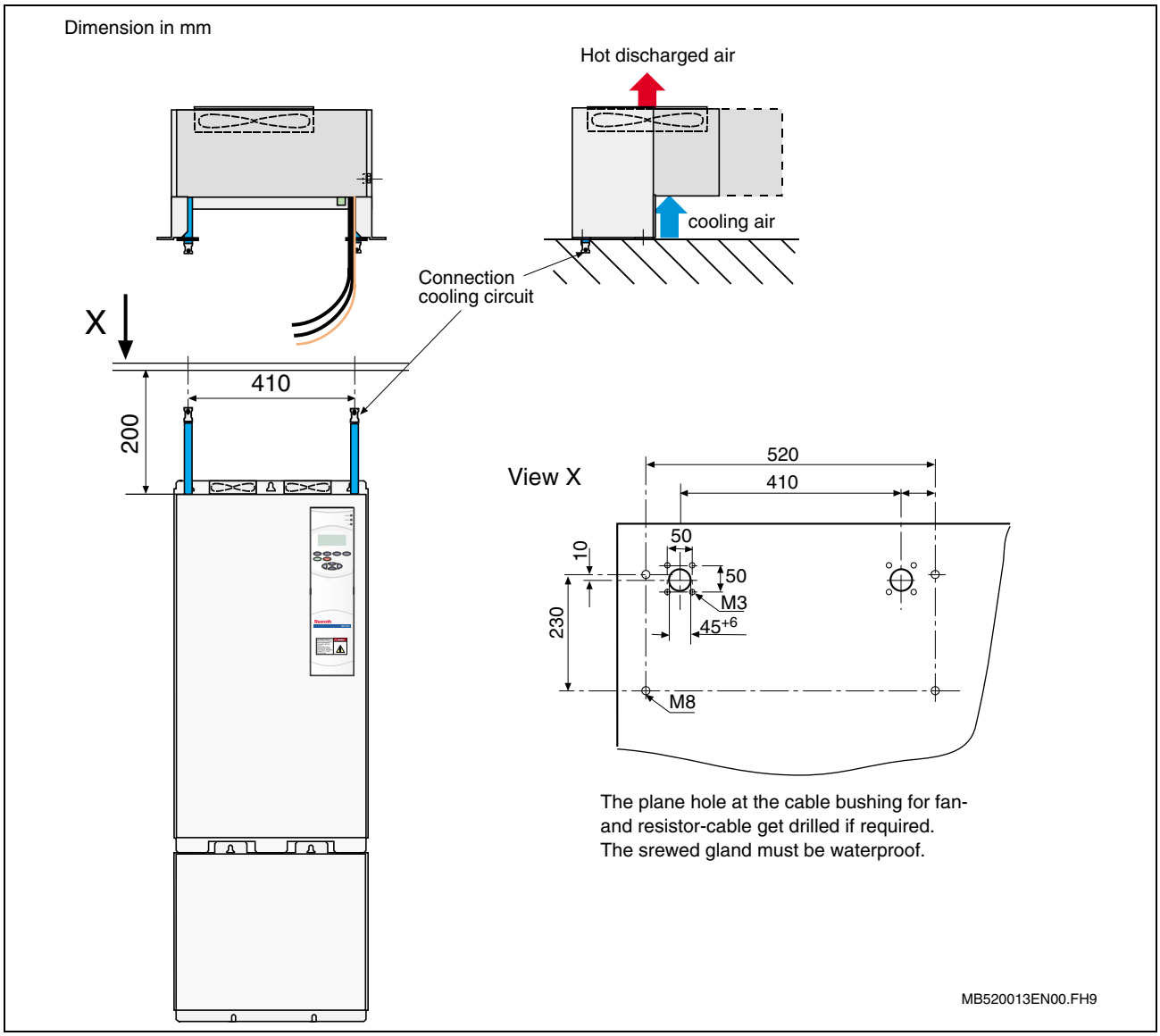


Fig.: 3-51 Dimension sheet for cabinet roof mounting, size class G

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

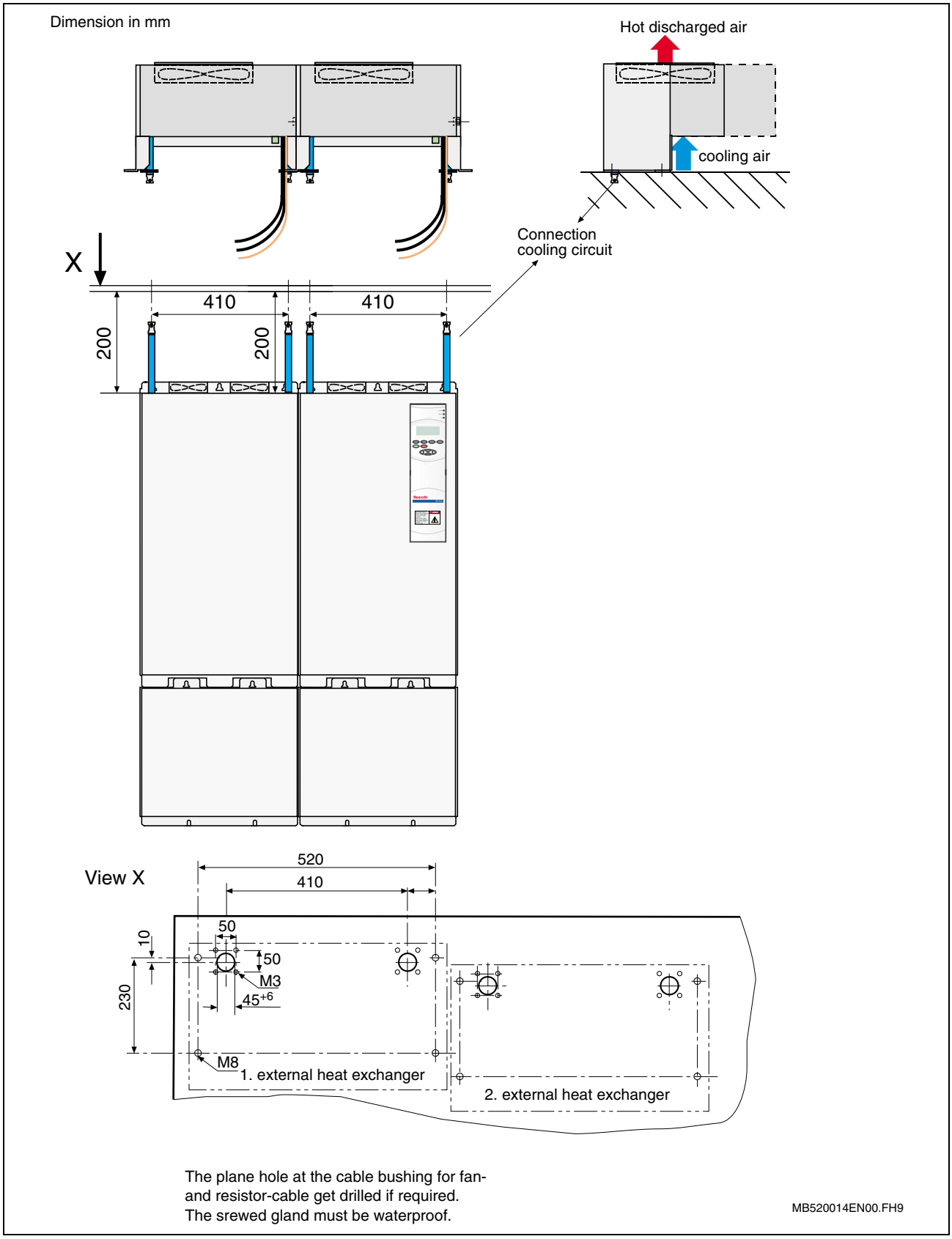


Fig.: 3-52 Dimension sheet for cabinet roof mounting, size class G

Mounting Drawing for Devices with External Heat Exchanger for Wall Mounting

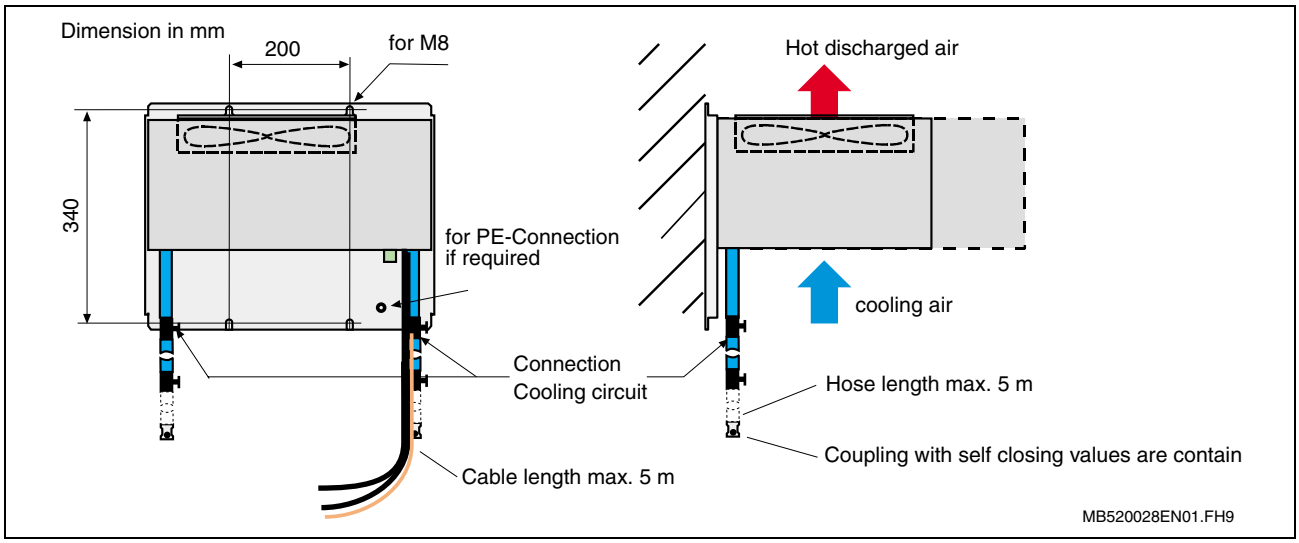


Fig.: 3-53 Dimension sheet for wall mounting

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. 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.

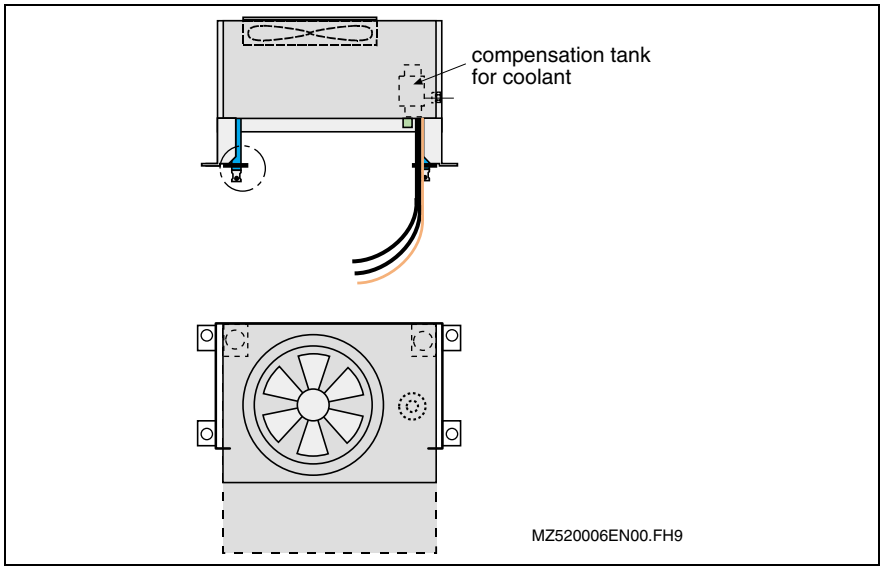


Fig.: 3-54 Compensation tank in external heat exchanger

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 50 V!

⇒ 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 30 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 mm² (AWG 6) (if power cables with cable cross-sections >10 mm² (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

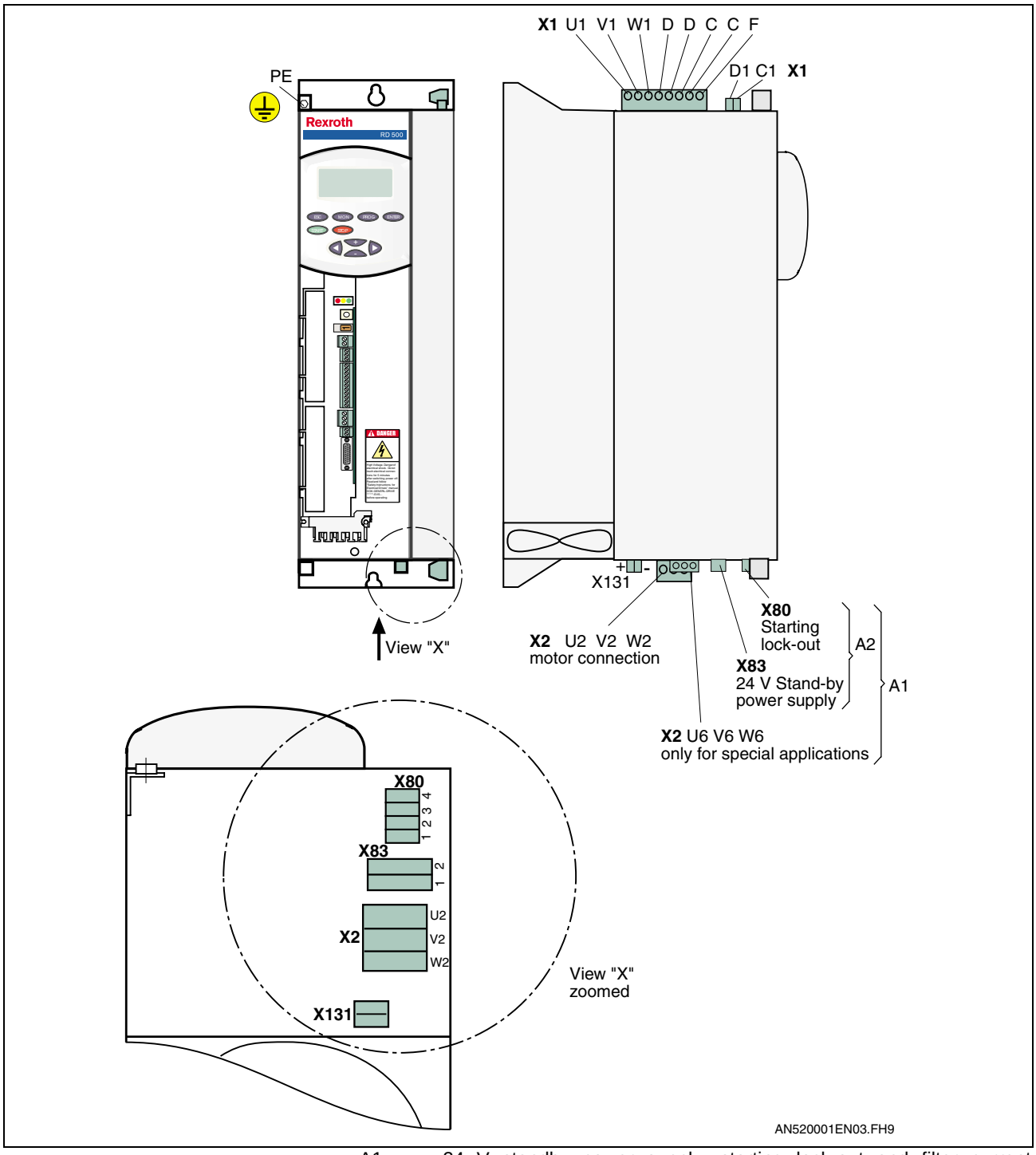
The following is assumed for motor feeder cables:

- 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 90° C (194 °F) cables are used.

4.4 Power Terminals 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

X1, Power supply connection and Dc link connection

Execution

RD52.2-x-	Type	pole number	Execution
003	Sub-unit	8	Plug on device
005	Sub-unit	8	Plug on device
007	Sub-unit	8	Plug on device
015	Sub-unit	8	Plug on device
018	Sub-unit	8	Plug on device

Tab. 4-1 Execution

Identification single connection

Identification	signification	
U1	Phase L1	for permissible line supply voltage, refer to the rating plate on the upper side of the drive unit
V1	Phase L2	
W1	Phase L3	
C	DC link connection L+	
C		
D	DC link connection L-	
D		
F	Connection, external brake resistor (RZW) between C and F	

Tab. 4-2 Identification single connection

Protective conductor connection

- Cross section (PE) min 10 mm² (AWG 6)
- steel plate lug on the housing with captive nut M5 (torque 2.5 – 3.0 Nm)

Connection cross-section

RD52.2-x-	Cable cross-section which can be connected 1), mm²	AWG
003	0.5 - 6	20 - 10
005	0.5 - 6	20 - 10
007	0.5 - 6	20 - 10
015	0.5 - 10	20 - 10
018	0.5 - 10	20 - 10

1): As a result of the terminal size

Tab. 4-3 Connection cross-section

Torque 1.2 – 1.5 Nm

X1, SNT supply

Execution

RD52.2-x-	Type	pole number	Execution
003	plug-in connection	2	Plug on device
005	plug-in connection	2	Plug on device
007	plug-in connection	2	Plug on device
015	plug-in connection	2	Plug on device
018	plug-in connection	2	Plug on device

Tab. 4-4 Execution

Identification single connection

Identification	signification	
C1	External SNT supply +[1)] DC530 ... 670 V ±10 % 100 W	only for device type 2 (RD52.2-2Bxxx)
D1	External SNT supply -[1)] DC530 ... 670 V ±10 % 100 W	on device type 4 and 5 **never** assigned

1): External fuse required (4 A)

Tab. 4-5 Identification single connection

Connection cross-section

RD52.2-x-	Cable cross-section which can be connected 1), mm²	AWG
003	0.5 – 2.5	20 - 14
005	0.5 – 2.5	20 - 14
007	0.5 – 2.5	20 - 14
015	0.5 – 2.5	20 - 14
018	0.5 – 2.5	20 - 14

1): As a result of the terminal size

Tab. 4-6 Connection cross-section

Torque 0.5 – 0.6 Nm

Fuses Converter Size classes A and B

Fuses

RD52.2-x-	Maximum series fuse, type gL, A 1)
003	10
005	16
007	20
015	35
018	50

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

Tab. 4-7 Series fuse

X2, Motor connection

Execution

RD52.2-x-	Type	pole number	Execution
003	plug-in connection	3	Plug on device
005	plug-in connection	3	Plug on device
007	plug-in connection	3	Plug on device
015	plug-in connection	3	Plug on device
018	plug-in connection	3	Plug on device

Tab. 4-8 Execution

Identification single connection

Identification	signification
U2	Motor connection U
V2	Motor connection V
W2	Motor connection W

Tab. 4-9 Identification single connection

Protective conductor connection

Motor and shield connection for motor feeder cables

- Cross section (PE) min. 10 mm² (AWG 6)
- steel plate lug on the housing with captive nut M5 (torque 2.5 – 3.0 Nm)

Connection cross-section

RD52.2-x-	Cable cross-section which can be connected 1), mm²	AWG
003	0.5 - 6	20 - 10
005	0.5 - 6	20 - 10
007	0.5 - 6	20 - 10
015	0.5 - 6	20 - 10
018	0.5 - 6	20 - 10

1): As a result of the terminal size

Tab. 4-10 Connection cross-section

Torque 1.2 – 1.5 Nm

X2, Filter current feedback (only in A1)

Execution

RD52.2-x-	Type	pole number	Execution
003	plug	3	Plug on device
005	plug	3	Plug on device
007	plug	3	Plug on device
015	plug	3	Plug on device
018	plug	3	Plug on device

Tab. 4-11 Execution

Identification single connection

Identification	signification
U6	Operation possible only with the original Bosch Rexroth filter
V6	
W6	

Tab. 4-12 Identification single connection

Connection cross-section

RD52.2-x-	Cable cross-section which can be connected mm²	AWG
003	0.2 - 4	24 - 12
005	0.2 - 4	24 - 12
007	0.2 - 4	24 - 12
015	0.2 - 4	24 - 12
018	0.2 - 4	24 - 12

Tab. 4-13 Connection cross-section

Torque 0.22 – 0.4 Nm

X80 Starting lock-out (only in A1 and A2)

Execution

RD52.2-x-	Type	pole number	Execution
003	plug-in connection	4	Plug on device
005	plug-in connection	4	Plug on device
007	plug-in connection	4	Plug on device
015	plug-in connection	4	Plug on device
018	plug-in connection	4	Plug on device

Tab. 4-14 Execution

Identification single connection

Identification	signification
1	During operation, terminals 1 - 2 must be closed; when they are opened, the start of the connected motor is inhibited.
2	
3	Starting lock-out floating acknowledge contact, 30 V DC / 1 A N / C contact
4	

Tab. 4-15 Identification single connection

Connection cross-section

RD52.2-x-	Recommended minimum cross-section mm²	AWG	Cable cross-section which can be connected, mm²	AWG
003	1	18	0.08 – 1.5	28 - 16
005	1	18	0.08 – 1.5	28 - 16
007	1	18	0.08 – 1.5	28 - 16
015	1	18	0.08 – 1.5	28 - 16
018	1	18	0.08 – 1.5	28 - 16

Tab. 4-16 Connection cross-section

Torque 0.22 – 0.25 Nm

X83, 24 V Stand-by power supply for the electronics (only in A1 and A2)

Execution

RD52.2-x-	Type	pole number	Execution
003	plug	2	Plug on device
005	plug	2	Plug on device
007	plug	2	Plug on device
015	plug	2	Plug on device
018	plug	2	Plug on device

Tab. 4-17 Execution

Identification single connection

Identification	signification
1	P24 V 24V DC –15 / +20 %, ripple, max 5 % (VDE0411 / 500), power consumption ~40 W, startup current 5 A
2	ground

Tab. 4-18 Identification single connection

Connection cross-section

RD52.2-x-	Recommended minimum cross-section mm²	AWG	Cable cross-section which can be connected, mm²	AWG
003	1.5	16	0.2 – 2.5	24 - 14
005	1.5	16	0.2 – 2.5	24 - 14
007	1.5	16	0.2 – 2.5	24 - 14
015	1.5	16	0.2 – 2.5	24 - 14
018	1.5	16	0.2 – 2.5	24 - 14

Tab. 4-19 Connection cross-section

Torque 0.22 – 0.4 Nm

X131 Internal fan supply

Identification single connection

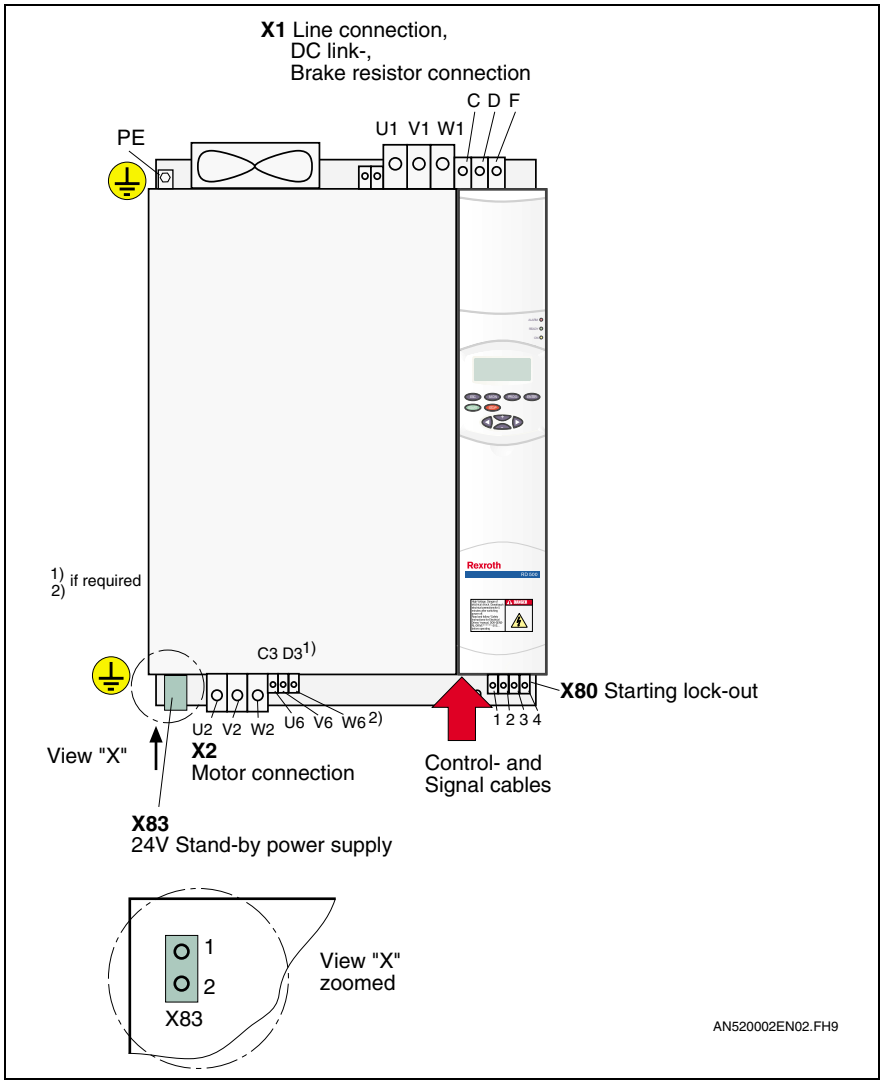
Identification	signification
+	Internal fan supply
-	

Tab. 4-20 Identification single connection

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 24 V Stand-by power supply (terminal X83) is only mounted if it was actually ordered.

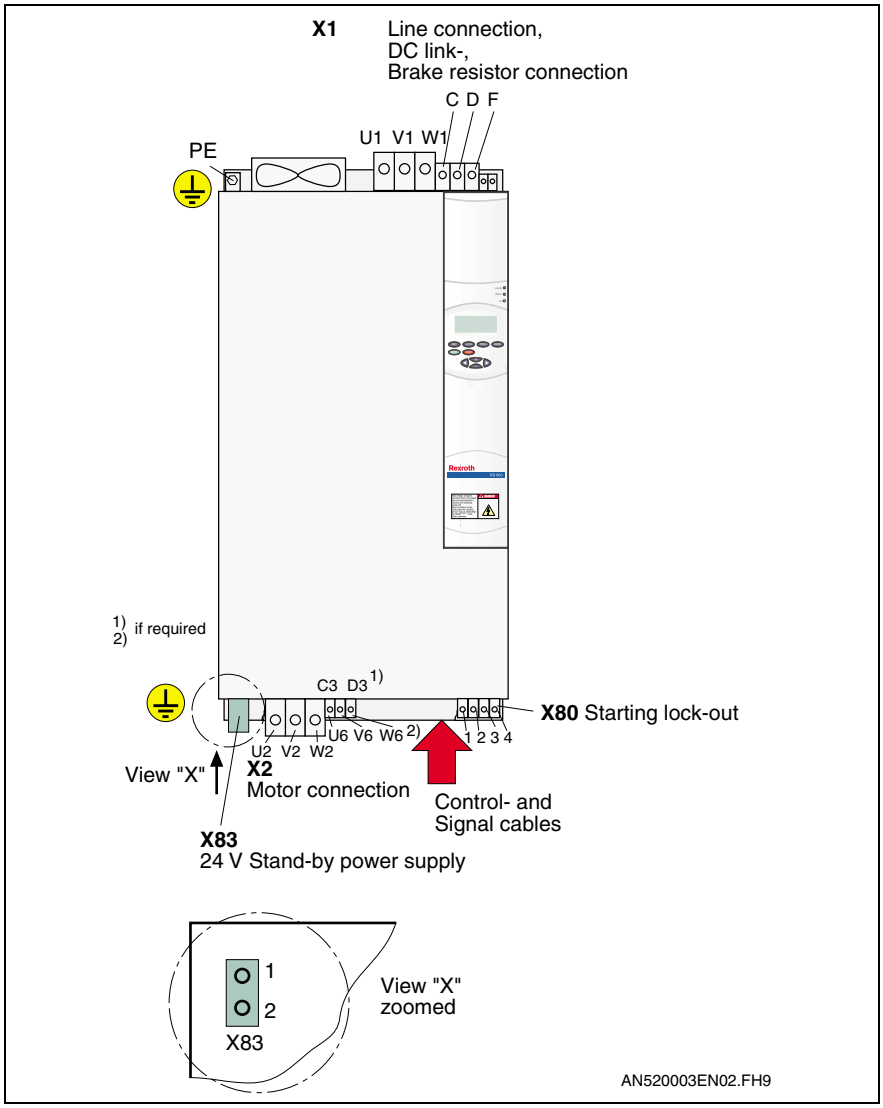


1): Only with additional function L1
2): Only with additional function F1

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

Terminal Layout Diagram, Size Class E

Note: The additional function 24 V 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

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

Description of Converter Power Terminals, Size Classes C - E

X1, Line supply

Execution

RD52.1-x-	Type	number	Execution
022	High current terminal	3	Terminal on mounting rail
030	High current terminal	3	Terminal on mounting rail
037	High current terminal	3	Terminal on mounting rail
045	High current terminal	3	Terminal on mounting rail
055	High current terminal	3	Terminal on mounting rail
075	High current terminal	3	Terminal on mounting rail
090	High current terminal	3	Terminal on mounting rail
110	High current terminal	3	Terminal on mounting rail

Tab. 4-21 Execution

Identification single connection

Identification	signification	
U1	Phase L1	for permissible line supply voltage, refer to the rating plate on the upper side of the drive unit
V1	Phase L2	
W1	Phase L3	

Tab. 4-22 Identification single connection

Protective conductor connection

- Cross section (PE) min. 10 mm² (AWG 6)
- steel plate lug on the housing with captive nut
  - ... M6 at size class C and D (torque 4.2 – 5.0 Nm)
  - ... M8 at size class E (torque 12 Nm)

Connection cross-section

RD52.1-x-	Cable cross-section which can be connected 1), mm²	AWG	Torque in Nm
022	25 – 50	3 – 1/0	6.0 – 8.0
030	25 – 50	3 – 1/0	6.0 – 8.0
037	25 – 50	3 – 1/0	6.0 – 8.0
045	25 – 50	3 – 1/0	6.0 – 8.0
055	35 – 95	2 – 4/0	15.0 – 20.0
075	35 – 95	2 – 4/0	15.0 – 20.0
090	50 – 150	1/0 – 300MCM	25.0 – 30.0
110	50 – 150	1/0 – 300MCM	25.0 – 30.0

1): As a result of the terminal size

Tab. 4-23 Connection cross-section

Torque See table.

X1, DC link

Execution

RD52.1-x-	Type	number	Execution
022	Universal terminal	3	With mounting foot
030	Universal terminal	3	With mounting foot
037	Universal terminal	3	With mounting foot
045	Universal terminal	3	With mounting foot
055	Universal terminal	3	With mounting foot
075	Universal terminal	3	With mounting foot
090	High current bushing terminal	3	Terminal on mounting rail
110	High current bushing terminal	3	Terminal on mounting rail

Tab. 4-24 Execution

Identification single connection

Identification	signification
C	DC link connection L+
D	DC link connection L-
F	Accessory: connection of external brake resistor between C and F

Tab. 4-25 Identification single connection

Connection cross-section

RD52.1-x-	Cable cross-section which can be connected, mm²	AWG	Torque in Nm
022	0.75 – 35	8 - 2	3.2 – 3.7
030	0.75 – 35	8 - 2	3.2 – 3.7
037	0.75 – 35	8 - 2	3.2 – 3.7
045	0.75 – 35	8 - 2	3.2 – 3.7
055	25 – 50	3 – 1/0	6 - 8
075	25 – 50	3 – 1/0	6 - 8
090	35 – 95	2 – 4/0	15 - 20
110	35 – 95	2 – 4/0	15 - 20

Tab. 4-26 Connection cross-section

Torque See table.

X1, C1 and D1 (connection idle)

Execution

RD52.1-x-	Type	number	Execution
022	Universal terminal	2	Screw terminal
030	Universal terminal	2	Screw terminal
037	Universal terminal	2	Screw terminal
045	Universal terminal	2	Screw terminal
055	Universal terminal	2	Screw terminal
075	Universal terminal	2	Screw terminal
090	High current bushing terminal	2	Screw terminal
110	High current bushing terminal	2	Screw terminal

Tab. 4-27 Execution

Identification single connection

Identification	signification
C1	**connection idle!**
D1	

Tab. 4-28 Identification single connection

Connection cross-section

RD52.1-x-	Cable cross-section which can be connected, mm²	AWG	Torque in Nm
022	0.2 – 4	24 – 12	0.6 – 0.8
030	0.2 – 4	24 – 12	0.6 – 0.8
037	0.2 – 4	24 – 12	0.6 – 0.8
045	0.2 – 4	24 – 12	0.6 – 0.8
055	0.2 – 4	24 – 12	0.6 – 0.8
075	0.2 – 4	24 – 12	0.6 – 0.8
090	0.5 – 10	20 – 8	2.0 – 2.3
110	0.5 – 10	20 – 8	2.0 – 2.3

Tab. 4-29 Connection cross-section

Torque See table.

Fuses Converter Size class C, D and E

Fuses

RD52.1-x-	Maximum series fuse, type gL, A 1)
022	50
030	63
037	80
045	100
055	125
075	160
090	250
110	250

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

Tab. 4-30 Series fuse

X2, Motor connection

Execution

RD52.1-x-	Type	number	Execution
022	High current terminal	3	Terminal on mounting rail
030	High current terminal	3	Terminal on mounting rail
037	High current terminal	3	Terminal on mounting rail
045	High current terminal	3	Terminal on mounting rail
055	High current terminal	3	Terminal on mounting rail
075	High current terminal	3	Terminal on mounting rail
090	High current terminal	3	Terminal on mounting rail
110	High current terminal	3	Terminal on mounting rail

Tab. 4-31 Execution

Identification single connection

Identification	signification
U2	Motor connection U
V2	Motor connection V
W2	Motor connection w

Tab. 4-32 Identification single connection

Protective conductor connection

- Cross section (PE) min. 10 mm² (AWG 6)
- steel plate lug on the housing with captive nut...
  - ...M6 at size class C and D (torque 4.2 – 5.0 Nm)
  - ...M8 at size class E (torque 12 Nm)

Connection cross-section

RD52.1-x-	Cable cross-section which can be connected 1), mm²	AWG	Torque in Nm
022	25 – 50	3 – 1/0	6.0 – 8.0
030	25 – 50	3 – 1/0	6.0 – 8.0
037	25 – 50	3 – 1/0	6.0 – 8.0
045	25 – 50	3 – 1/0	6.0 – 8.0
055	35 – 95	2 – 4/0	15.0 – 20.0
075	35 – 95	2 – 4/0	15.0 – 20.0
090	50 – 150	1/0 – 300MCM	25.0 – 30.0
110	50 – 150	1/0 – 300MCM	25.0 – 30.0

1): As a result of the terminal size

Tab. 4-33 Connection cross-section

Torque See table.

X2, cable damping L1

Execution

RD52.1-x-	Type	number	Execution
022	High current bushing terminal	2	Screw terminal
030	High current bushing terminal	2	Screw terminal
037	High current bushing terminal	2	Screw terminal
045	High current bushing terminal	2	Screw terminal
055	High current bushing terminal	2	Screw terminal
075	High current bushing terminal	2	Screw terminal
090	High current bushing terminal	2	Screw terminal
110	High current bushing terminal	2	Screw terminal

Tab. 4-34 Execution

Identification single connection

Identification	signification
C3	Feedback cable damping
D3	

Tab. 4-35 Identification single connection

Connection cross-section

RD52.1-x-	Cable cross-section which can be connected 1), mm²	AWG	Torque in Nm
022	0.5 – 10	20 – 8	1.5 – 1.8
030	0.5 – 10	20 – 8	1.5 – 1.8
037	0.5 – 10	20 – 8	1.5 – 1.8
045	0.5 – 10	20 – 8	1.5 – 1.8
055	0.5 – 16	20 – 6	2.0 – 2.3
075	0.5 – 16	20 – 6	2.0 – 2.3
090	0.5 – 16	20 – 6	2.0 – 2.3
110	0.5 – 16	20 – 6	2.0 – 2.3

1): As a result of the terminal size

Tab. 4-36 Connection cross-section

Torque See table.

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.

X2, Filter current feedback

Execution

RD52.1-x-	Type	number	Execution
022	High current bushing terminal	3	Screw terminal
030	High current bushing terminal	3	Screw terminal
037	High current bushing terminal	3	Screw terminal
045	High current bushing terminal	3	Screw terminal
055	High current bushing terminal	3	Screw terminal
075	High current bushing terminal	3	Screw terminal
090	High current bushing terminal	3	Screw terminal
110	High current bushing terminal	3	Screw terminal

Tab. 4-37 Execution

Identification single connection

Identification	signification
U6	Operation possible only with the original Bosch Rexroth filter
V6	
W6	

Tab. 4-38 Identification single connection

Connection cross-section

RD52.2-x-	Cable cross-section which can be connected, mm²	AWG	Torque in Nm
022	0.5 – 10	20 – 8	1.5 – 1.8
030	0.5 – 10	20 – 8	1.5 – 1.8
037	0.5 – 10	20 – 8	1.5 – 1.8
045	0.5 – 10	20 – 8	1.5 – 1.8
055	0.5 – 16	20 – 6	2.0 – 2.3
075	0.5 – 16	20 – 6	2.0 – 2.3
090	0.5 – 16	20 – 6	2.0 – 2.3
110	0.5 – 16	20 – 6	2.0 – 2.3

Tab. 4-39 Connection cross-section

Torque See table.

X80, Starting lock-out

Execution

RD52.1-x-	Type	pole number	Execution
022	plug-in connection	4	Plug on device
030	plug-in connection	4	Plug on device
037	plug-in connection	4	Plug on device
045	plug-in connection	4	Plug on device
055	plug-in connection	4	Plug on device
075	plug-in connection	4	Plug on device
090	plug-in connection	4	Plug on device
110	plug-in connection	4	Plug on device

Tab. 4-40 Execution

Identification single connection

Identification	signification
1	During operation, terminals 1 - 2 must be closed; when they are opened, the start of the connected motor is inhibited.
2	
3	Starting lock-out floating acknowledge contact, 30 V DC / 1 A N / C contact
4	

Tab. 4-41 Identification single connection

Connection cross-section

RD52.1-x-	Recommended minimum cross-section mm²	AWG	Cable cross-section which can be connected, mm²	AWG
022	1	18	0.08 – 1.5	28 - 16
030	1	18	0.08 – 1.5	28 - 16
037	1	18	0.08 – 1.5	28 - 16
045	1	18	0.08 – 1.5	28 - 16
055	1	18	0.08 – 1.5	28 - 16
075				
090	1	18	0.08 – 1.5	28 - 16
110	1	18	0.08 – 1.5	28 - 16

Tab. 4-42 Connection cross-section

Torque 0,22 – 0,25 Nm

X83, 24 V Stand-by power supply for the electronics (only in A1 and A2)

Execution

RD52.1-x-	Type	pole number	Execution
022	plug	2	Plug on device
030	plug	2	Plug on device
037	plug	2	Plug on device
045	plug	2	Plug on device
055	plug	2	Plug on device
075	plug	2	Plug on device
090	plug	2	Plug on device
110	plug	2	Plug on device

Tab. 4-43 Execution

Identification single connection

Identification	signification
1	P24 V 24 V DC –15 / +20 %, ripple, max 5 % (VDE0411 / 500), power consumption ~40 W, startup current 5 A
2	ground

Tab. 4-44 Identification single connection

Connection cross-section

RD52.1-x-	Recommended minimum cross-section mm²	AWG	Cable cross-section which can be connected, mm²	AWG
022	1.5	16	0.2 – 2.5	24 - 14
030	1.5	16	0.2 – 2.5	24 - 14
037	1.5	16	0.2 – 2.5	24 - 14
045	1.5	16	0.2 – 2.5	24 - 14
055	1.5	16	0.2 – 2.5	24 - 14
075	1.5	16	0.2 – 2.5	24 - 14
090	1.5	16	0.2 – 2.5	24 - 14
110	1.5	16	0.2 – 2.5	24 - 14

Tab. 4-45 Connection cross-section

Torque 0.22 – 0.25 Nm

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 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 page 4-34).

Terminal Layout Diagram Converter Size Class G

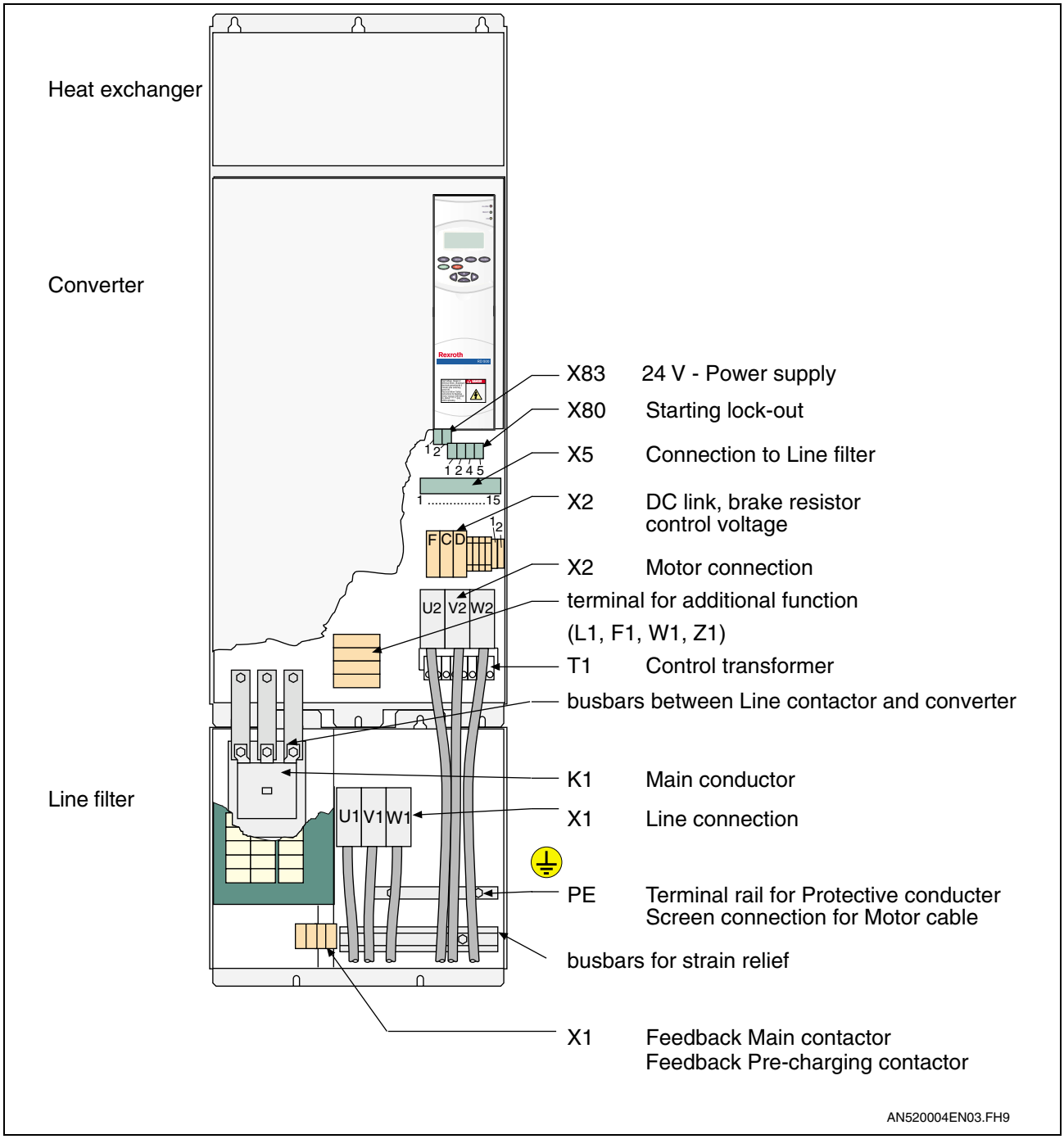


Fig.: 4-4 Terminal layout diagram, converter size class G

Terminal Layout Diagram Converter Size Class H

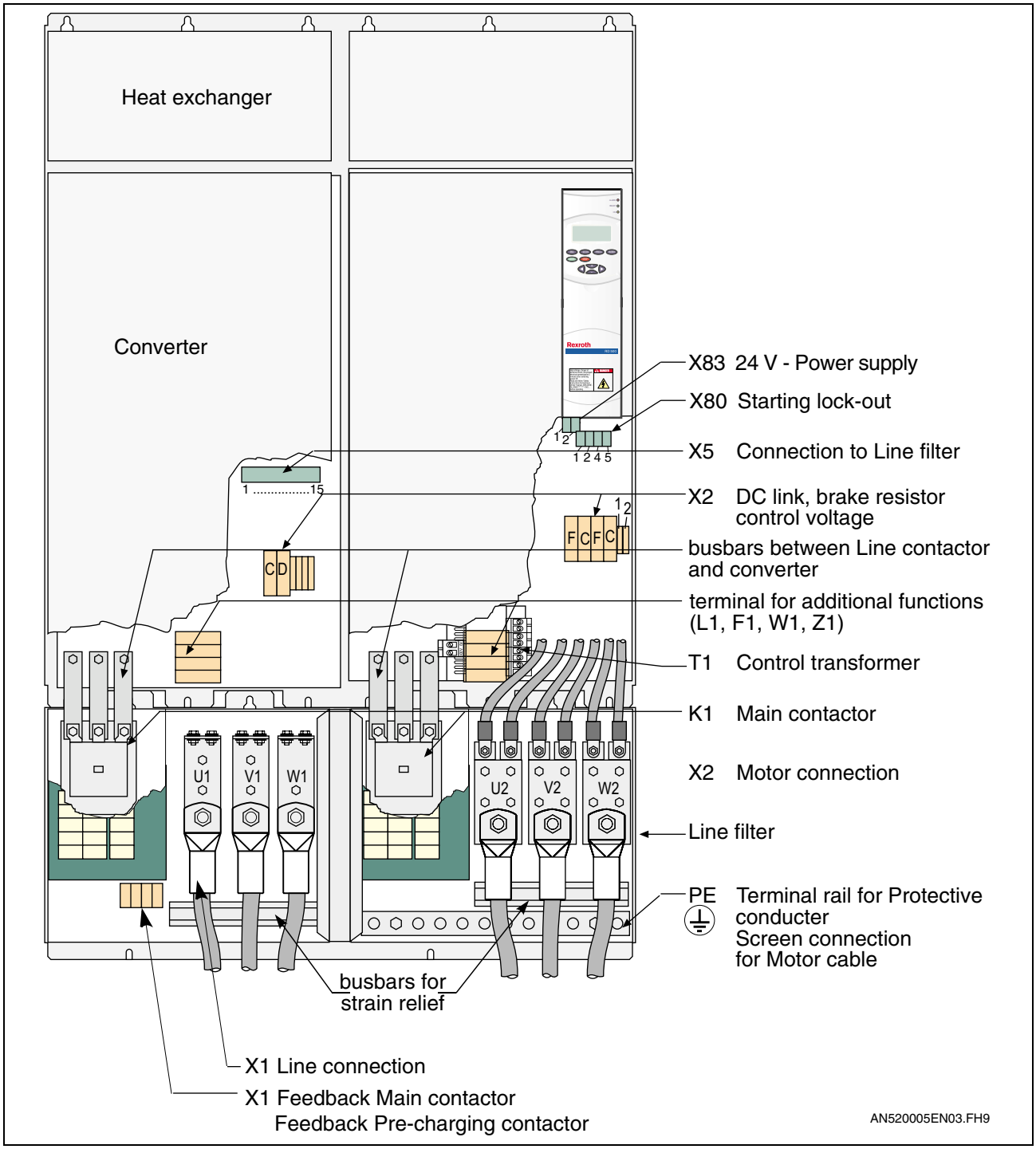


Fig.:4-5 Terminal layout diagram, converter size class H

Description of Power Terminals, Converter Size Classes G - H

X1, Line supply connection

Execution

RD52.1-x-	Type	number	Execution
132	High current terminal	3	Terminal on mounting rail
160	High current terminal	3	Terminal on mounting rail
200	High current terminal	3	Terminal on mounting rail
315	Stud connection	3	rail
400	Stud connection	3	rail

Tab. 4-46 Execution

Identification single connection

Identification	signification	
U1	Phase L1	for permissible line supply voltage, refer to the rating plate on the upper side of the drive unit
V1	Phase L2	
W1	Phase L3	

Tab. 4-47 Identification single connection

Protective conductor connection

- terminal rail with cable clamp size G (stud M8 torque 12.0 Nm)
- with M16 and M12 screws size H (torque 120.0 Nm, 50Nm)

Connection cross-section

RD52.1-x-	Cable cross-section which can be connected 1), mm²	AWG	Torque in Nm
132	50 – 100	1/0 – 300MCM	25 - 30
160	50 – 100	1/0 – 300MCM	25 - 30
200	50 – 100	1/0 – 300MCM	25 - 30
315	M16		120
400	M16		120

1): As a result of the terminal size

Tab. 4-48 Connection cross-section

Torque

See table.

X1, 121 per 124

Execution

RD52.1-x-	Type	Pole number	Execution
132	Terminal strip	4	Slip-on terminal
160	Terminal strip	4	Slip-on terminal
200	Terminal strip	4	Slip-on terminal
315	Terminal strip	4	Slip-on terminal
400	Terminal strip	4	Slip-on terminal

Tab. 4-49 Execution

Identification single connection

Identification	signification
121	Feedback signal contact (NC contact) from main contactor
122	
123	Feedback signal contact (NC contact) from pre-charging contactor
124	

Tab. 4-50 Identification single connection

Protective conductor connection

- terminal rail with cable clamp size class G (stud M8 torque 12.0 Nm)
- with M16 and M12 screws size class H (torque 120.0 Nm , 50 Nm)

Connection cross-section

RD52.1-x-	Cable cross-section which can be connected 1), mm²	AWG
132	0.5 - 6	20 - 10
160	0.5 - 6	20 - 10
200	0.5 - 6	20 - 10
315	0.5 - 6	20 - 10
400	0.5 - 6	20 - 10

1): As a result of the terminal size

Tab. 4-51 Connection cross-section

Torque 0.5 – 1.0 Nm.

Fuses Converter Size class G and H

Fuses

RD52.1-x-	Maximum series fuse, type gL, A 1)
132	250
160	315
200	400
315	630
400	1000

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

Tab. 4-52 Series fuse

X2, DC link Size class G

Execution

RD52.1-x-		number	Execution
132	feed-through terminal	3	terminal block
160	feed-through terminal	3	terminal block
200	feed-through terminal	3	terminal block

Tab. 4-53 Execution

Identification single connection

Identification	signification
C	DC link terminal L+
D	DC link terminal L -
F	Internal brake resistor connected in the heat exchanger between C and F

Tab. 4-54 Identification single connection

Protective conductor connection

- terminal rail with cable clamp (stud M8 torque 12.0 Nm)

Connection cross-section

RD52.1-x-	Cable cross-section which can be connected 1), mm²	AWG
132	10 – 35	8 - 12
160	10 – 35	8 - 12
200	10 – 35	8 - 12

1): As a result of the terminal size

Tab. 4-55 Connection cross-section

Torque 4.0 – 6.0 Nm.

X2, DC link Size class H

Execution

RD52.1-x-		number	Execution
315	feed-through terminal	2 + 4	terminal block
400	feed-through terminal	2 + 4	terminal block

Tab. 4-56 Execution

Identification single connection

Identification	signification
C	DC link terminal L+
D	DC link terminal L -

Tab. 4-57 Identification single connection

Identification single connection

Identification	signification
C	Internal brake resistor connected in the heat exchanger between C and F
C	
F	
F	

Tab. 4-58 Identification single connection

Protective conductor connection

terminal rail with M12 and M16 (torque 50.0 Nm, 120 Nm)

Connection cross-section

RD52.1-x-	Cable cross-section which can be connected 1), mm²	AWG	Torque
315	16 - 70	4 – 2/0	6.0 – 12.0
315	10 – 35	8 - 12	4.0 – 6.0
400	16 - 70	4 – 2/0	6.0 – 12.0
400	10 – 35	8 - 12	4.0 – 6.0

1): As a result of the terminal size

Tab. 4-59 Connection cross-section

Torque

See table.

X2, Motor connection

Execution

RD52.1-x-	Type	number	Execution
132	High current terminal	3	Terminal on mounting rail
160	High current terminal	3	Terminal on mounting rail
200	High current terminal	3	Terminal on mounting rail
315	Stud connection	3	rail
400	Stud connection	3	rail

Tab. 4-60 Execution

Identification single connection

Identification	signification
U2	Motor connection U
V2	Motor connection V
W2	Motor connection W

Tab. 4-61 Identification single connection

Protective conductor connection

- terminal rail with cable clamp size G (stud M8 torque 12.0 Nm)
- with M16 and M12 screws size H (torque 120.0 Nm, 50 Nm)

Connection cross-section

RD52.1-x-	Cable cross-section which can be connected 1), mm²	AWG	Torque in Nm
132	50 – 100	1/0 – 300MCM	25 - 30
160	50 – 100	1/0 – 300MCM	25 - 30
200	70 – 240	2/0 – 500MCM	25 - 30
315	M16 or 2 x M12		50 or 120
400	M16 or 2 x M12		50 or 120

1): As a result of the terminal size

Tab. 4-62 Connection cross-section

Torque See table.

X2, line supply isolation

Execution

RD52.1-x-	Type	number	Execution
132	feed-through terminal	4	double level terminal
160	feed-through terminal	4	double level terminal
200	feed-through terminal	4	double level terminal
315	feed-through terminal	4	double level terminal
400	feed-through terminal	4	double level terminal

Tab. 4-63 Execution

Identification single connection

Identification	signification
151 152 153 154	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.
155 156 157 158	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.

Tab. 4-64 Identification single connection

Connection cross-section

RD52.1-x-	Cable cross-section which can be connected 1), mm²	AWG
132	0.5 – 4	20 - 12
160	0.5 – 4	20 - 12
200	0.5 – 4	20 - 12
315	0.5 – 4	20 - 12
400	0.5 – 4	20 - 12

1): As a result of the terminal size

Tab. 4-65 Connection cross-section

Torque 0.5 – 1 Nm.

X2, Connection fan

Execution

RD52.1-x-	Type	number	Execution
132	feed-through terminal	2	terminal block
160	feed-through terminal	2	terminal block
200	feed-through terminal	2	terminal block
315	feed-through terminal	2	double level terminal
400	feed-through terminal	2	double level terminal

Tab. 4-66 Execution

Identification single connection

Identification	signification
1 (L / P)	Connection for the heat exchanger fan
2 (0 V AC)	

Tab. 4-67 Identification single connection

Connection cross-section

RD52.1-x-	Cable cross-section which can be connected 1), mm²	AWG
132	0.5 – 6	20 - 10
160	0.5 – 6	20 - 10
200	0.5 – 6	20 - 10
315	0.5 – 4	20 - 12
400	0.5 – 4	20 - 12

1): As a result of the terminal size

Tab. 4-68 Connection cross-section

Torque 0.5 – 1.0 Nm.

X5, Control voltage for the line filter

Execution

RD52.1-x-	Type	Pole-number	Execution
132	plug	13	With Srew flange
160	plug	13	With Srew flange
200	plug	13	With Srew flange
315	plug	13	With Srew flange
400	plug	13	With Srew flange

Tab. 4-69 Execution

Identification single connection

Identi-fication	signification	
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		

1) See Example Control transformer page 4-34

Tab. 4-70 Identification single connection

Connection cross-section

RD52.1-x-	Cable cross-section which can be connected 1), mm²	AWG
132	0.2 – 2.5	24 - 12
160	0.2 – 2.5	24 - 12
200	0.2 – 2.5	24 - 12
315	0.2 – 2.5	24 - 12
400	0.2 – 2.5	24 - 12

1): As a result of the terminal size

Tab. 4-71 Connection cross-section

Torque 0.5 – 0.6 Nm.

X2, cable damping L1

Execution

RD52.1-x-	Type	Number	Execution
132	Universal terminal	2	Terminal on mounting rail
160	Universal terminal	2	Terminal on mounting rail
200	Universal terminal	2	Terminal on mounting rail
315	Universal terminal	4	Terminal on mounting rail
400	Universal terminal	4	Terminal on mounting rail

Tab. 4-72 Execution

Identification single connection

Identification	signification
C3	Feedback cable damping
D3	

Tab. 4-73 Identification single connection

Connection cross-section

RD52.1-x-	Cable cross-section which can be connected 1), mm²	AWG
132	0.75 – 35	18 – 2
160	0.75 – 35	18 – 2
200	0.75 – 35	18 – 2
315	0.75 – 35	18 – 2
400	0.75 – 35	18 – 2

1): As a result of the terminal size

Tab. 4-74 Connection cross-section

Torque 3.2 – 3.7 Nm.

X2, Filter current feedback

Execution

RD52.1-x-	Type	number	Execution
132	High current terminal	3	Terminal on mounting rail
160	High current terminal	3	Terminal on mounting rail
200	High current terminal	3	Terminal on mounting rail
315	High current terminal	6	Terminal on mounting rail
400	High current terminal	6	Terminal on mounting rail

Tab. 4-75 Execution

Identification single connection

Identification	signification
U6	Operation possible only with the original Refu filter
V6	
W6	

Tab. 4-76 Identification single connection

Connection cross-section

RD52.1-x-	Cable cross-section which can be connected 1), mm²	AWG
132	25 – 50	3 – 1/0
160	25 – 50	3 – 1/0
200	25 – 50	3 – 1/0
315	25 – 50	3 – 1/0
400	25 – 50	3 – 1/0

1): As a result of the terminal size

Tab. 4-77 Connection cross-section

Torque 6 – 8 Nm.

X80, Starting lock-out

Execution

RD52.1-x-	Type	pole number	Execution
132	plug-in connection	4	Plug on device
160	plug-in connection	4	Plug on device
200	plug-in connection	4	Plug on device
315	plug-in connection	4	Plug on device
400	plug-in connection	4	Plug on device

Tab. 4-78 Execution

Identification single connection

Identification	signification
1	During operation, terminals 1 - 2 must be closed; when they are opened, the start of the connected motor is inhibited.
2	
3	Starting lock-out floating acknowledge contact, 30 V DC / 1 A N / C contact
4	

Tab. 4-79 Identification single connection

Connection cross-section

RD52.1-x-	Recommended minimum cross-section mm²	AWG	Cable cross-section which can be connected, mm²	AWG
132	1	18	0.08 – 1.5	28 - 16
160	1	18	0.08 – 1.5	28 - 16
200	1	18	0.08 – 1.5	28 - 16
315	1	18	0.08 – 1.5	28 - 16
400	1	18	0.08 – 1.5	28 - 16

Tab. 4-80 Connection cross-section

Torque 0.22 – 0.25 Nm

X83, 24 V power supply for the electronics (only in A1 and A2)

Execution

RD52.1-x-	Type	pole number	Execution
132	plug	2	Plug on device
160	plug	2	Plug on device
200	plug	2	Plug on device
315	plug	2	Plug on device
400	plug	2	Plug on device

Tab. 4-81 Execution

Identification single connection

Identification	signification
1	P24 V 24 V DC –15 / +20 %, ripple, max 5 % (VDE0411 / 500), power consumption ~80 W, startup current 15 A
2	ground

Tab. 4-82 Identification single connection

Connection cross-section

RD52.1-x-	Recommended minimum cross-section mm²	AWG	Cable cross-section which can be connected, mm²	AWG
132	1.5	16	0.2 – 2.5	24 - 14
160	1.5	16	0.2 – 2.5	24 - 14
200	1.5	16	0.2 – 2.5	24 - 14
315	1.5	16	0.2 – 2.5	24 - 14
400	1.5	16	0.2 – 2.5	24 - 14

Tab. 4-83 Connection cross-section

Torque 0.22 – 0.25 Nm

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: 3AC 380 V – 480 V, 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 500 V, 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

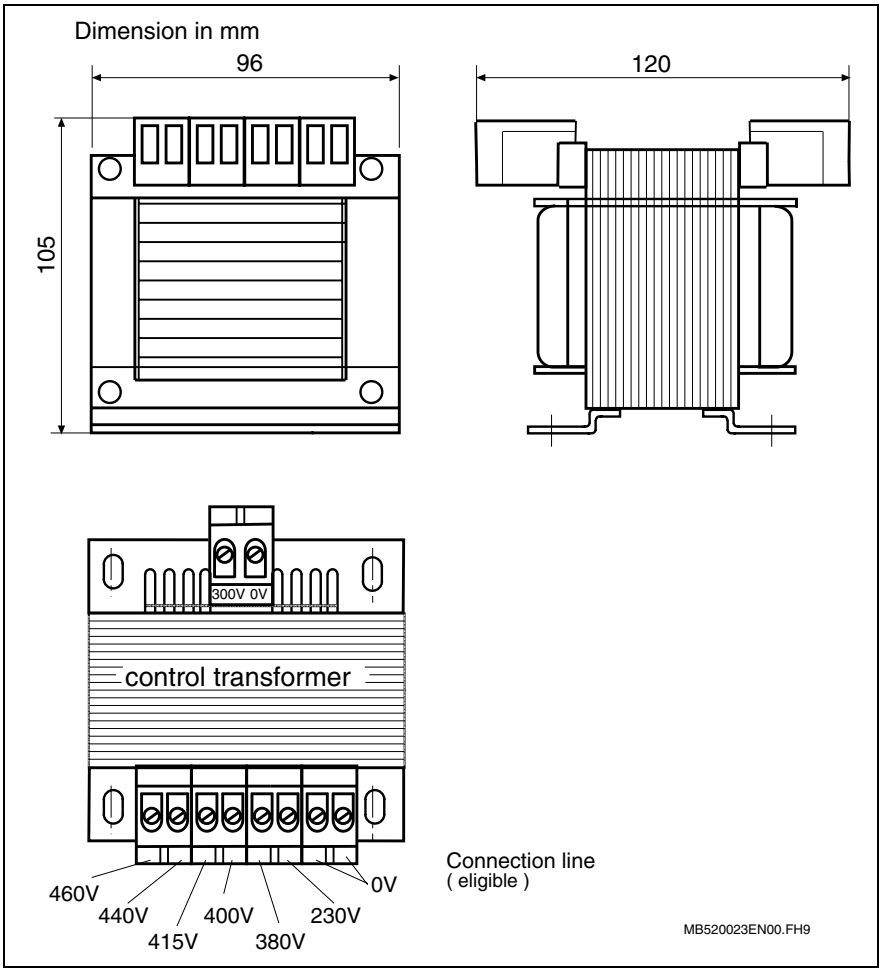
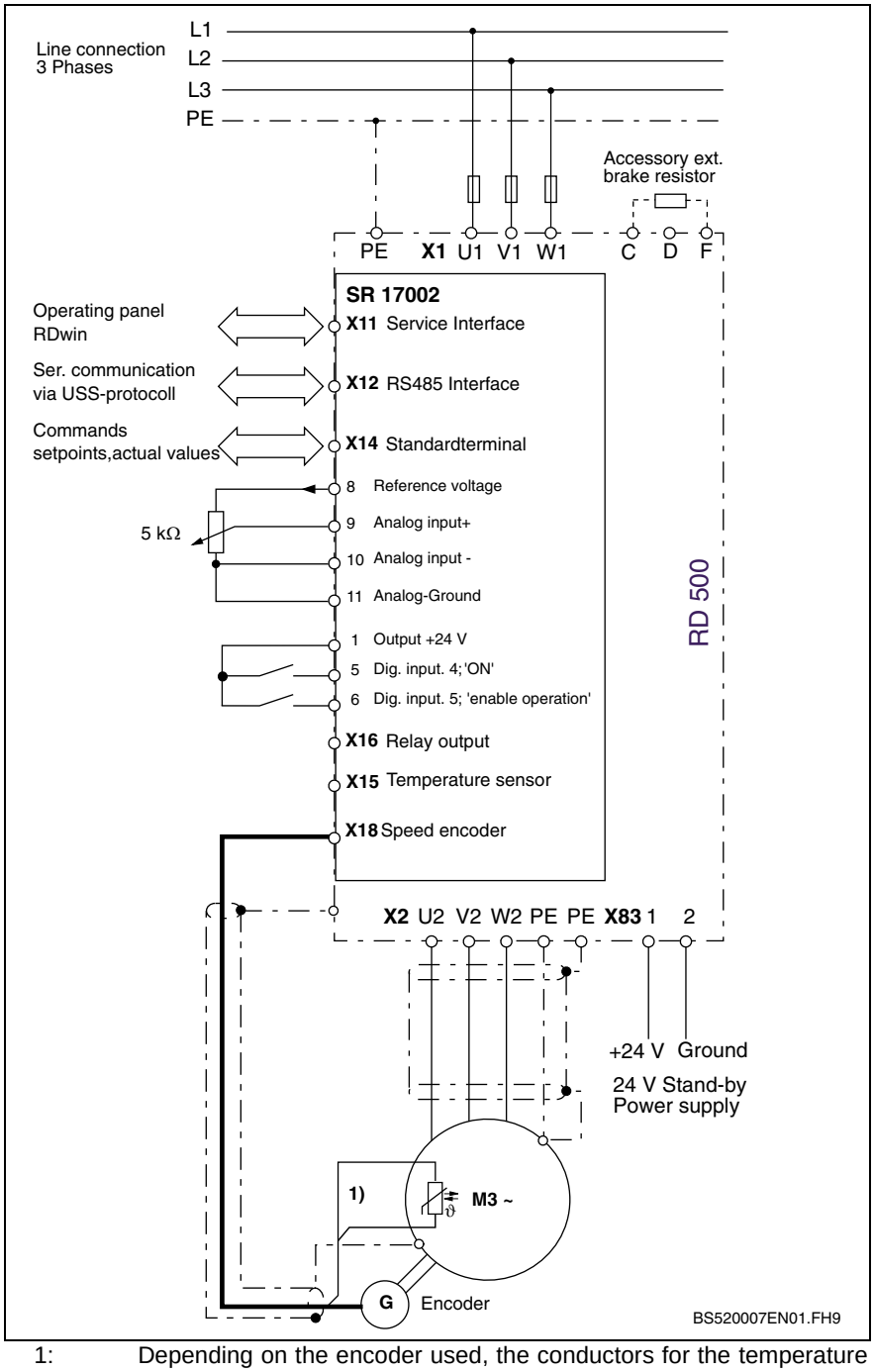


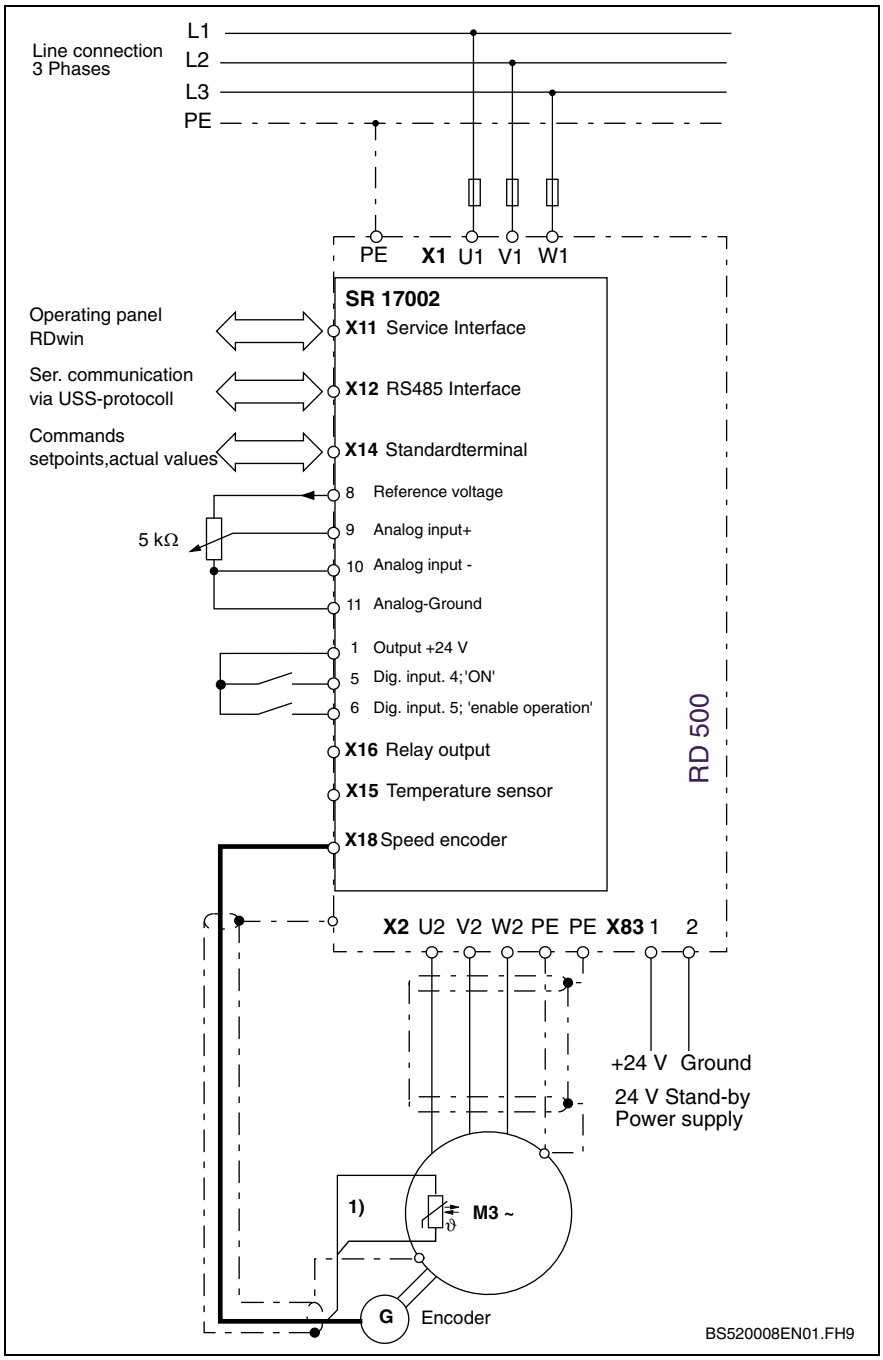
Fig.: 4-6 Control transformer T1

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



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 SR17002 Size classes A - B

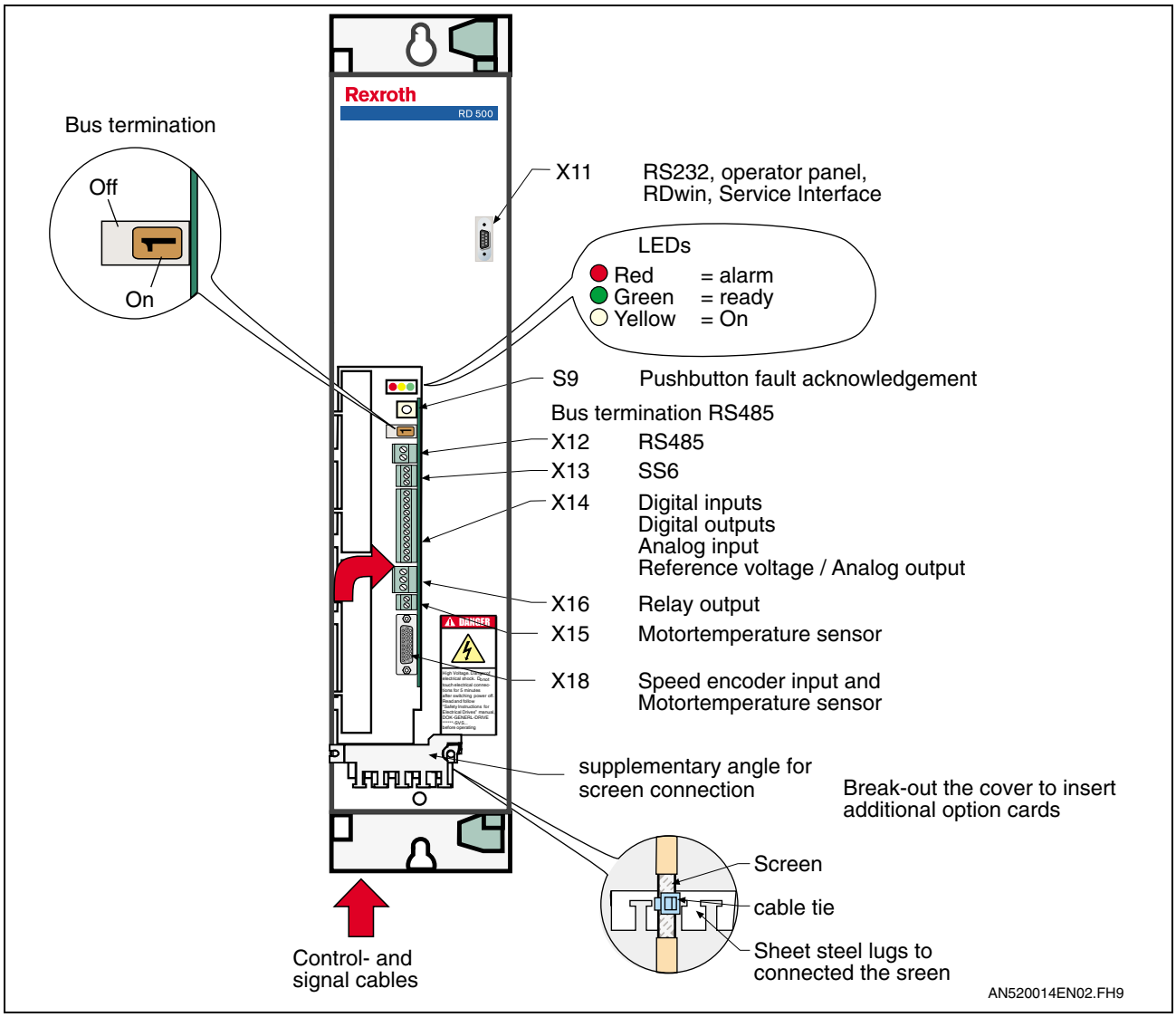


Fig.:4-9 Control terminals on the SR17002 logic and control board

Terminal Layout Diagram SR17002 Size class C - H

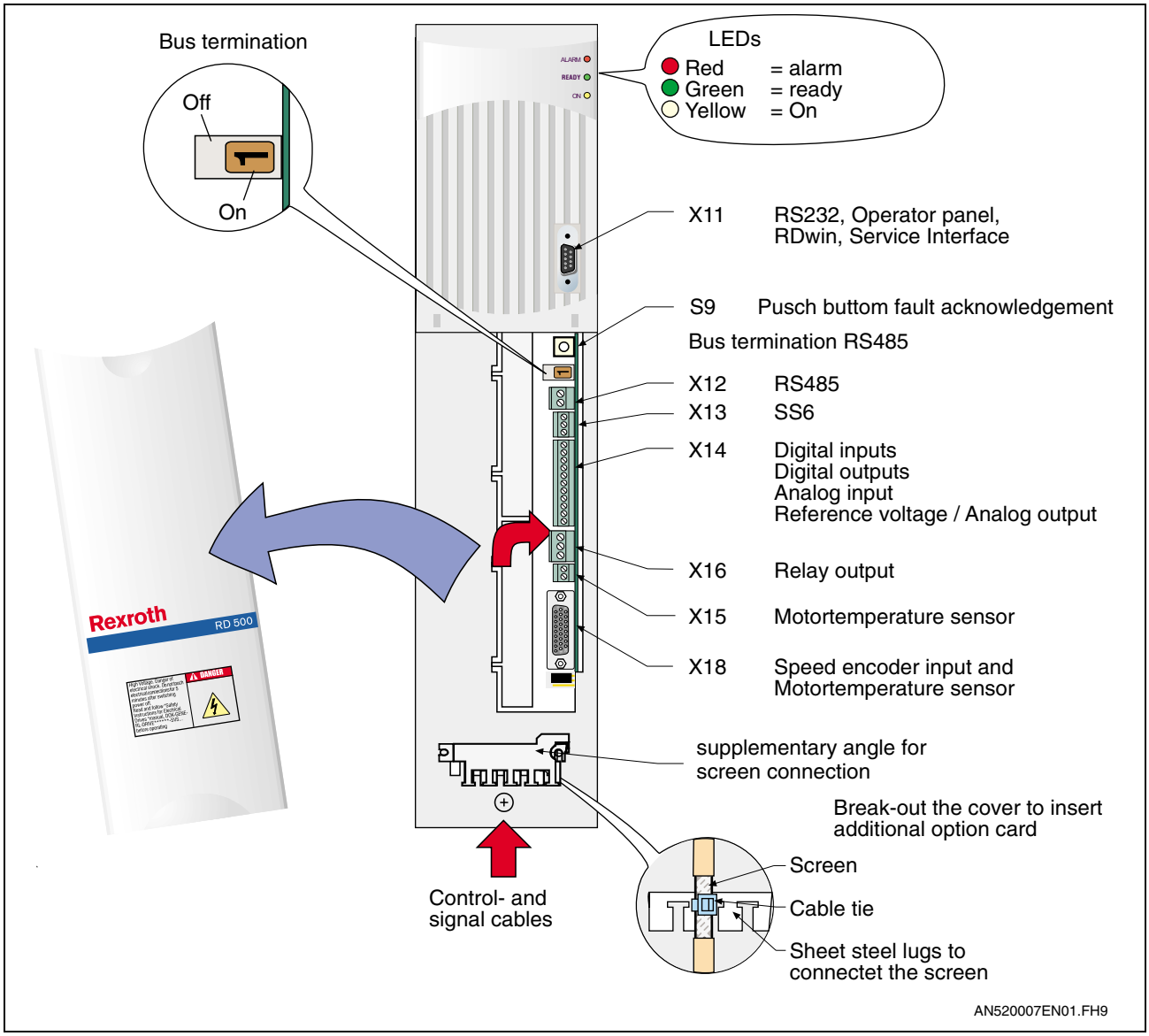


Fig.:4-10 Control terminals on the SR17002 logic and control board

Description of Control Terminals

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

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 RD52 and RD52 with internal bus termination. The lines from X13.1 of the first RD52 to X13.1 of the second RD52 and X13.2 of the first and X13.2 of the second RD52 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 Operating enablement	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		Factory setting ON / OFF
6	Dig. input 5		Factory setting Operating enablement
7	Digital ground	Reference ground, P24 V (X14.1)	
8	Reference ±10 V Analog output	Optional function, can be selected using P0436 (5 mA load capability, short-circuit-proof): Reference voltage +10 V Reference voltage -10 V Analog output 0 - ±10 V	
9	Analog input+	Differential input can be optionally set: (P0201) ±10 V; A / D converter ±11 bit; resolution 20 mV, R_e = 40 kΩ 0 - 20 mA; A / D converter 11 bit; resolution 0.02 mA, R_e = 150 Ω 4 - 20 mA; A / D converter 11 bit; resolution 0.02 mA, R_e = 150 Ω	
10	Analog input -		
11	Analog ground	Reference ground of the reference voltage or the analog output (X14.8)	

X15	Motor temperature sensor	
1	PTC / KTY+	Connecting a motor temperature sensor (PTC or KTY84). When connecting a KTY84, observe the correct polarity! (selected using P0385 - P0389)
2	PTC / KTY -	

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

Terminal	Designation	Comment
X18	The terminal assignment depends on the particular encoder type, refer to section 4.8	

Tab.:4-11 Description of control terminals on SR17002

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 RD 500 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)

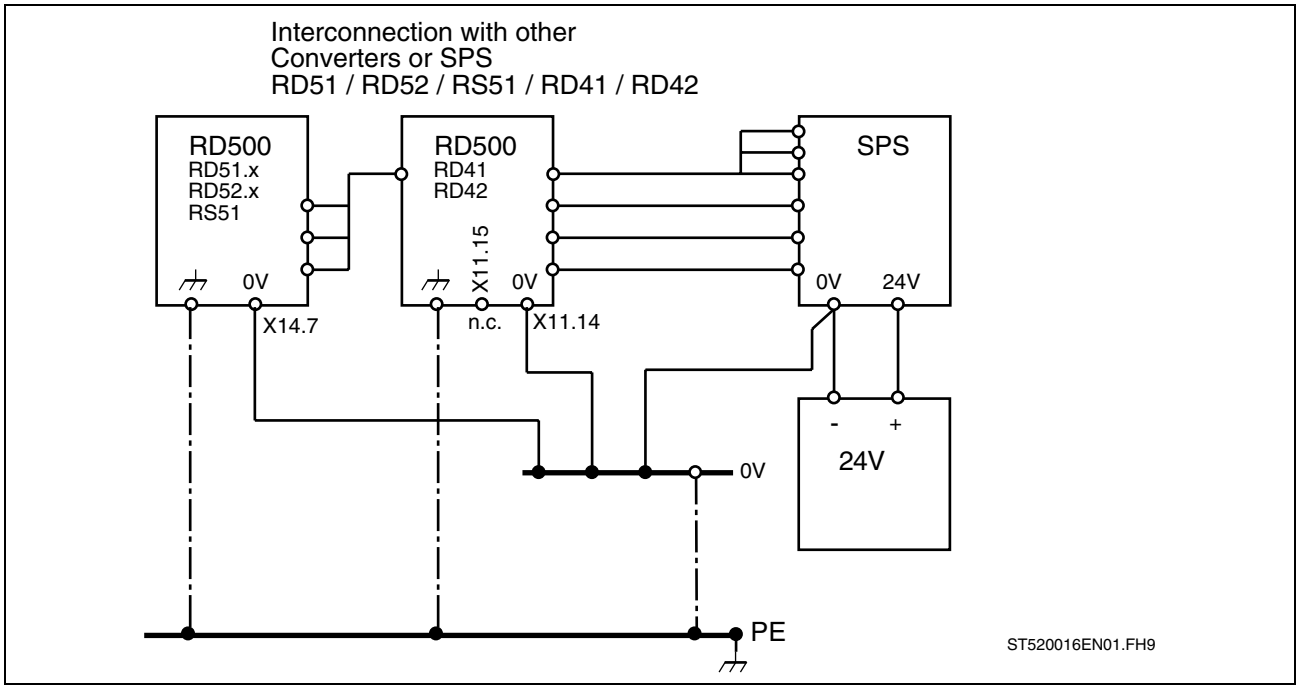


Fig.:4-12 Central Connection reference ground to PE

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).

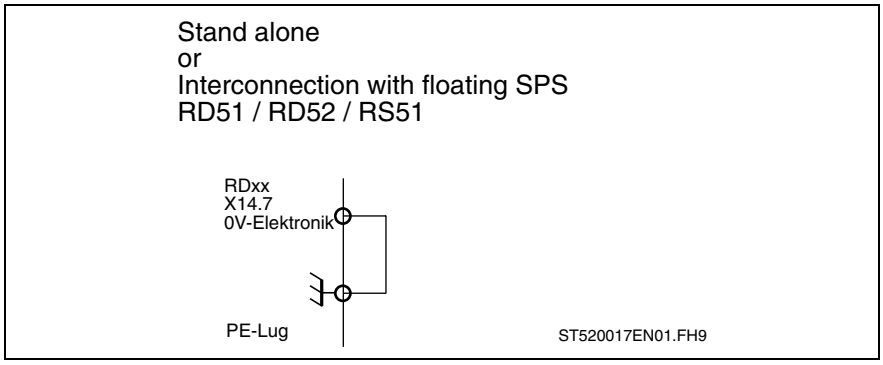


Fig.:4-13 Central connection between reference ground PE in RD51, RS51 and RD52

4.8 Encoder Connection

The following encoder types can be connected to the RD 500 RD52 unit series:

- TTL incremental encoders, U_B = 5 V, with inverted tracks in accordance with RS422
- TTL incremental encoders (type R), U_B = 9 to 30 V, with inverted tracks in accordance with RS422
- HTL incremental encoders, U_B = 9 to 30 V, with / without inverted tracks
- Sine / cosine encoders, U_B = 5 V, signal voltage 1 V_{PP}
- Sine / cosine encoders, U_B = 5 V, with rotor position sensing, e.g. ERN 1387
- Resolver
- Flux-controlled resistor

The encoder is connected to the logic and control card at X18 (sub-D socket / 26 pin) (refer to section 4.7, SR17002 terminal diagram). The 26-pin sub-D connector to connect the encoder is included with the RD52 units. Preassembled encoder cables are available for all encoder types.

General Design Information

- All of the encoders specified above can be used with induction motors.
- Sine / cosine encoders with rotor position sensing ,for example ERN1387 or a resolver, can be used as encoders for synchronous motors.
- The maximum encoder length essentially depends on the signal frequency, the cable capacitance and the signal voltage and is specified by the encoder manufacturer.
- Unused wires of the encoder cable should be connected to the enclosure ground at the encoder and drive converter side.
- The motor temperature sensor conductors can either be routed in the encoder cable or using a separate cable to connector X15 of the logic control card (refer to Fig.:4-9; Fig.:4-10 , SR17002 terminal diagram).

Note: To ensure safe and long-term contact, the Combicon and Mini-Combicon male connectors with spring-loaded contact contained in the scope of delivery require a certain length of the stripped conductor or the used wire end sleeve. The male connectors are suitable for both stripped cables and for the use of wire end sleeves.

Recommendation

5.08 mm Combicon male connectors FKC grid

X12, X16, X45

Cross-section, mm²	Stripped length, mm	Length of wire end sleeve, mm	Article designation / article number Phönix Contact
2.5	10	10	Al 2.5 -10BU / 3202533

Fig.: 4-14 Combicon male connector FKC grid

3.81 mm Combicon male connector FK-MCP grid

X13, X14, X15, X17, X31, X32; X33, X34, X38, X47

Cross-section, mm²	Stripped length, mm	Length of wire end sleeve, mm	Article designation / article number Phönix Contact
1.5	9	10	Al 1.5 -10BU / 3200195

Fig. 4-15: Combicon male connector FK-MCP grid

Parameterizing the Encoder

Parameter No.:	Name	Description / explanation of selectable options	Factory setting min / max values	Pass-word
0130	Encoder selection	0 = resolver 1 = incremental encoder 2 = sin / cos & commutation 3 = sine / cosine encoder 4 = without encoder	1 0 - 4	2
0131	Resolver pin number	The pole number can be freely set between 2 and 64 pins.	2 2 - 64	2
0132	Encoder pulse number	The pulse number can be freely set between 64 and 10.000 pulses.	1024 64 – 10,000	2
0133	Encoder delta phi	Electrical encoder adjustment	0° -180 - 180°	3
0189	Operating mode	0 = current control 1 = voltage mode 2 = Motor identification 3 = Encoder optimize	0	3

Fig.:4-16 Parameterizing the incremental encoder

More illustration in documentation DOK-RD500*-RD52*06VRS*-FKxx-EN-P

Switching the Supply Voltage

The supply voltage can be switched using jumper S5 on the logic and control board. The jumper is inserted in 5 V in the initial state. Proceed as follows to switch the jumper:

Note: Observe the warnings and information in Chapter 1 .

- Power down the drive unit.
- Remove the front cover of the unit.
- To connect encoders with a 15 V power supply voltage, carefully change the jumper from the +5 V setting (factory setting) to +15 V using tweezers.

CAUTION

Damage to the units caused by an incorrect supply voltage!

⇒ Please observe the documentation of the encoder manufacturer.

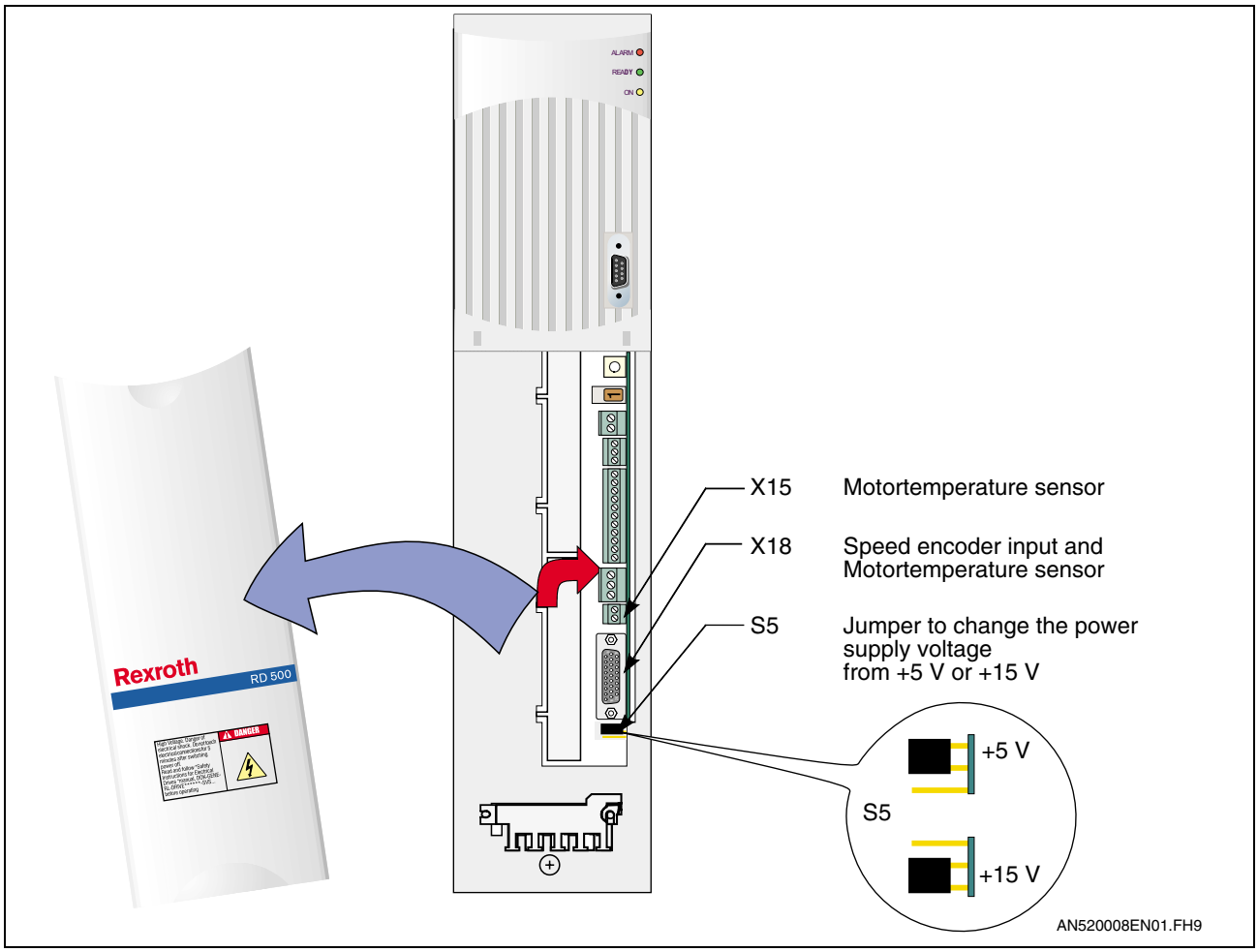


Fig.:4-17 Setting the encoder power supply voltage

Encoder Cable

We recommend using Bosch Rexroth encoder cables to connect the encoder to the converter. The following diagrams apply only when using this cable. Bosch Rexroth bulk cable number INK0691 (order number: R911291021) for:

- HTL and TTL incremental encoders
- Sine / cosine encoders

Bosch Rexroth bulk cable number INK0690 (order number: R911291101) for:

- resolver

Ordering example

Select the required connection (e.g. IKS5008/xxx.x). Add the cable length to the order type. (cables can be supplied in lengths of 2 - 75 m, in steps of 0.5 m).

Order text for a cable length of 5.5 m: **IKS5008/005.5**

Note: The maximum total length of the cable connection from the motor to the drive control device, with two intermediate sockets, is 75 m. If there are more sockets, the maximum total length may be reduced. This requires testing using measurements.

HTL and TTL Incremental Encoders (for Operation with Induction Motors)

Signal display for clockwise direction of rotation when viewing the motor drive shaft end

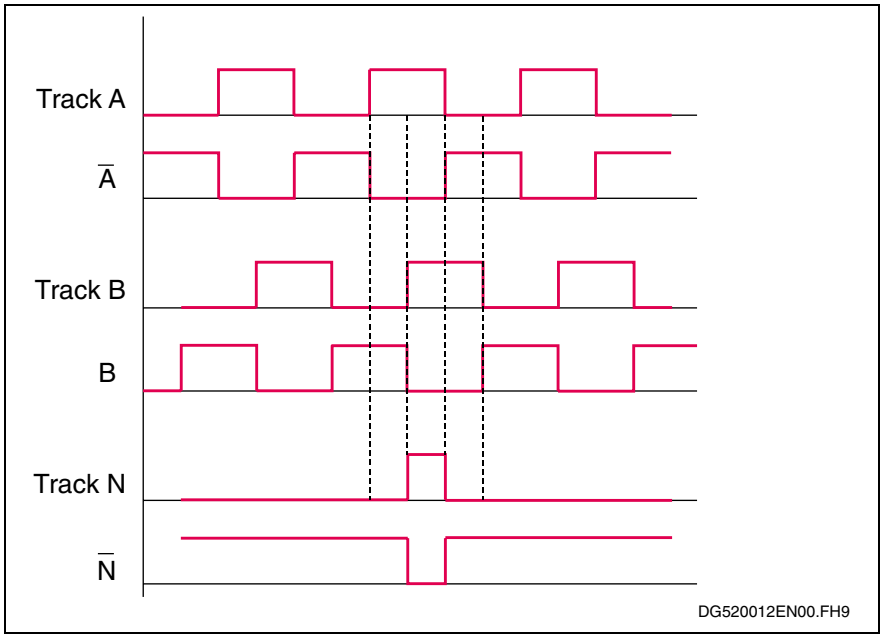


Fig.:4-18 Signal display, HTL and TTL incremental encoders

Connecting an HTL Encoder with Inverted Tracks

X18	Speed encoder	
3	N	Zero pulse N (no evaluation)
4	$\overline{N}$	Zero pulse N, inverted (no evaluation)
8	M	0 V (ground)
9	P 15 V	Insert the + 15 V power supply (set jumper S5 to the – 15 V setting; refer to Fig.:4-17 Setting the encoder power supply voltage)
10	B	Pulse track B
11	$\overline{B}$	Pulse track B, inverted
19	A	Pulse track A
20	$\overline{A}$	Pulse track A, inverted

Fig.:4-19 Connecting an HTL encoder with inverted tracks

Note: The zero pulse is only evaluated for TTL encoders. For applications with positioning functionality, it is therefore not possible to use HTL encoders.

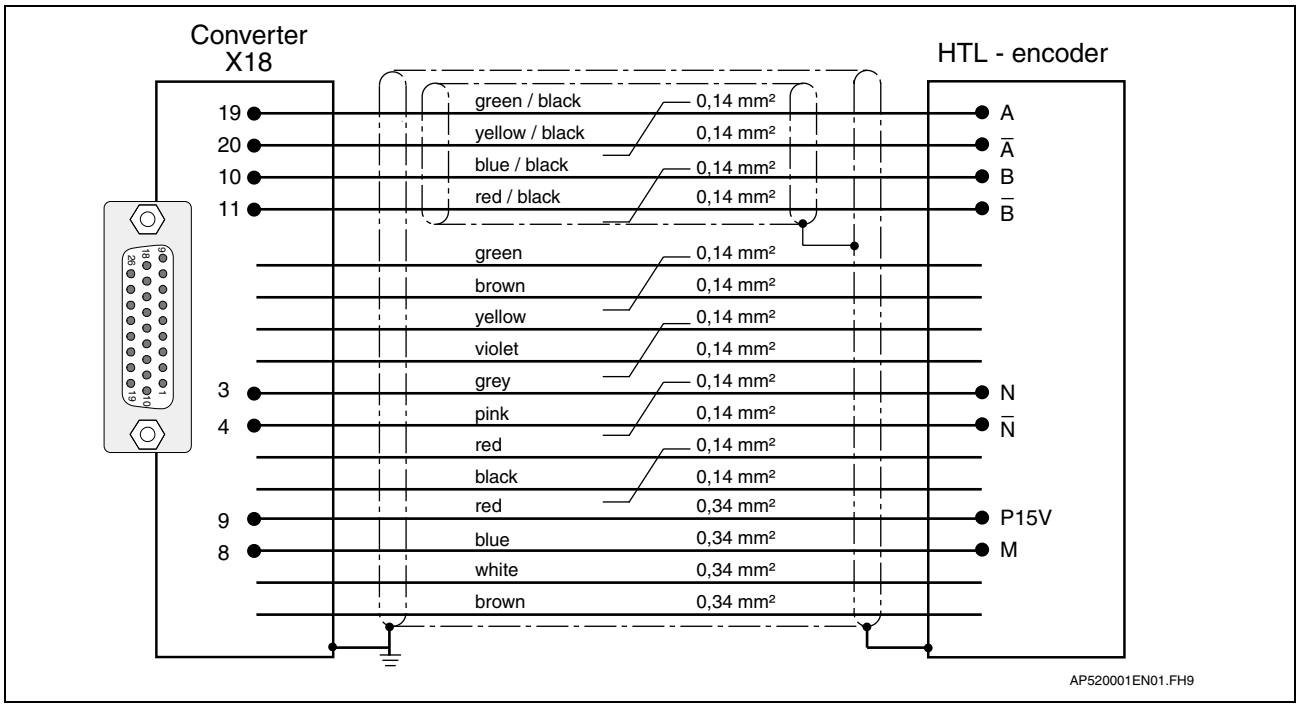


Fig.:4-20 Connecting an HTL encoder with inverted tracks (e.g. IKS 5010)

Connecting an HTL Encoder without Inverted Tracks

X18	Speed encoder	
3	N	Zero pulse N (no evaluation)
8	M	0 V (ground)
9	P 15 V	Insert the + 15 V power supply (set jumper S5 to the – 15 V setting; refer to Fig.:4-17 Setting the encoder power supply voltage)
10	B	Pulse track B
19	A	Pulse track A
1	bridge	
20		
11	bridge	
2		

Fig.:4-21 Connecting an HTL encoder without inverted tracks

Note: The zero pulse is only evaluated for TTL encoders. For applications with positioning functionality, it is therefore not possible to use HTL encoders.

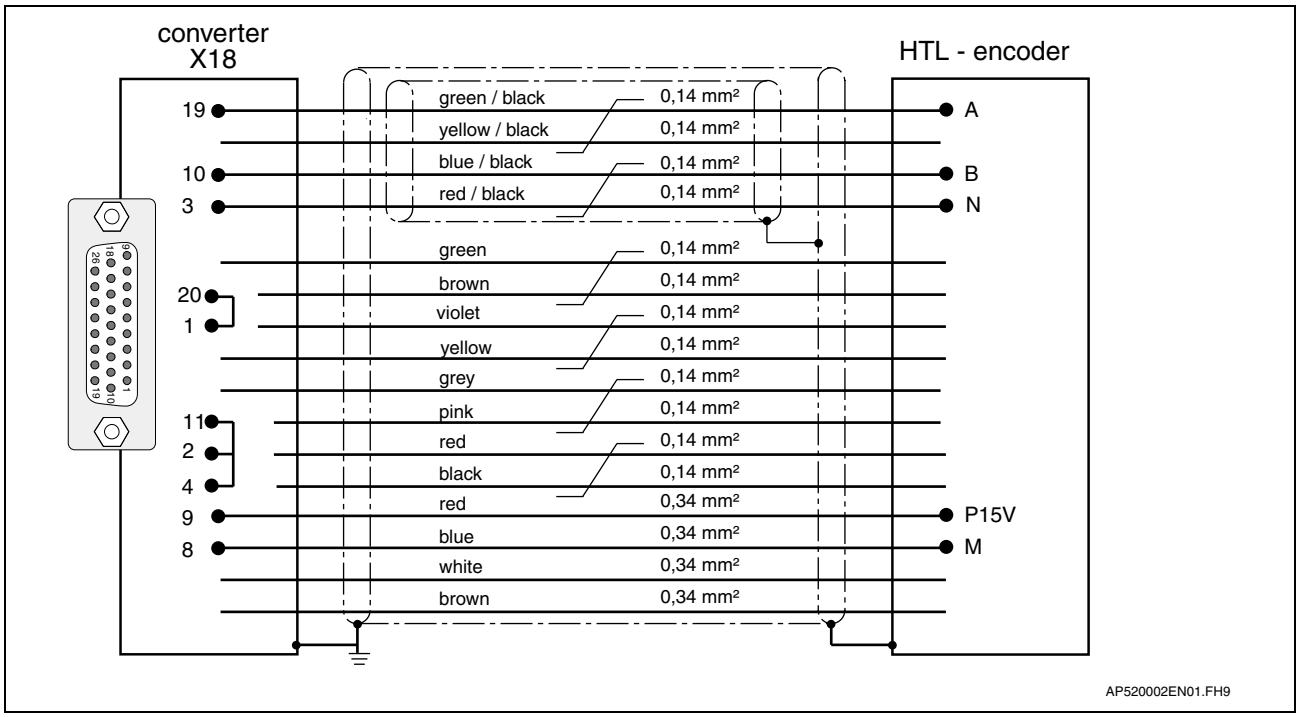


Fig.: 4-22 Connecting an HTL encoder without inverted tracks (e.g. IKS 5009)

Technical Data of HTL Encoder Evaluation

Power supply voltage U_B (DC) 15 V (jumper S5; refer to Fig.:4-17 Setting the encoder power supply voltage)

Max. output current I_{max} = 175 mA

Limiting frequency 150 kHz without inverted tracks
300 kHz with inverted tracks

Parameterization P0130: Incremental encoder
P0132: Pulse number

Connecting a TTL Encoder

X18	Speed encoder	
7	M sense	Sensor line 0 V
8	M	0 V (ground)
9	P 5 V	+5 V power supply voltage, refer to Fig.:4-17 Setting the encoder power supply voltage
12	$\overline{A}$	Pulse track A, inverted
13	A	Pulse track A
14	B	Pulse track B
15	$\overline{B}$	Pulse track B, inverted
16	N	Zero pulse N
17	$\overline{N}$	Zero pulse N, inverted
18	P sense	Sensor line +5 V

Fig.: 4-23 Connection assignment on X18 for TTL encoders

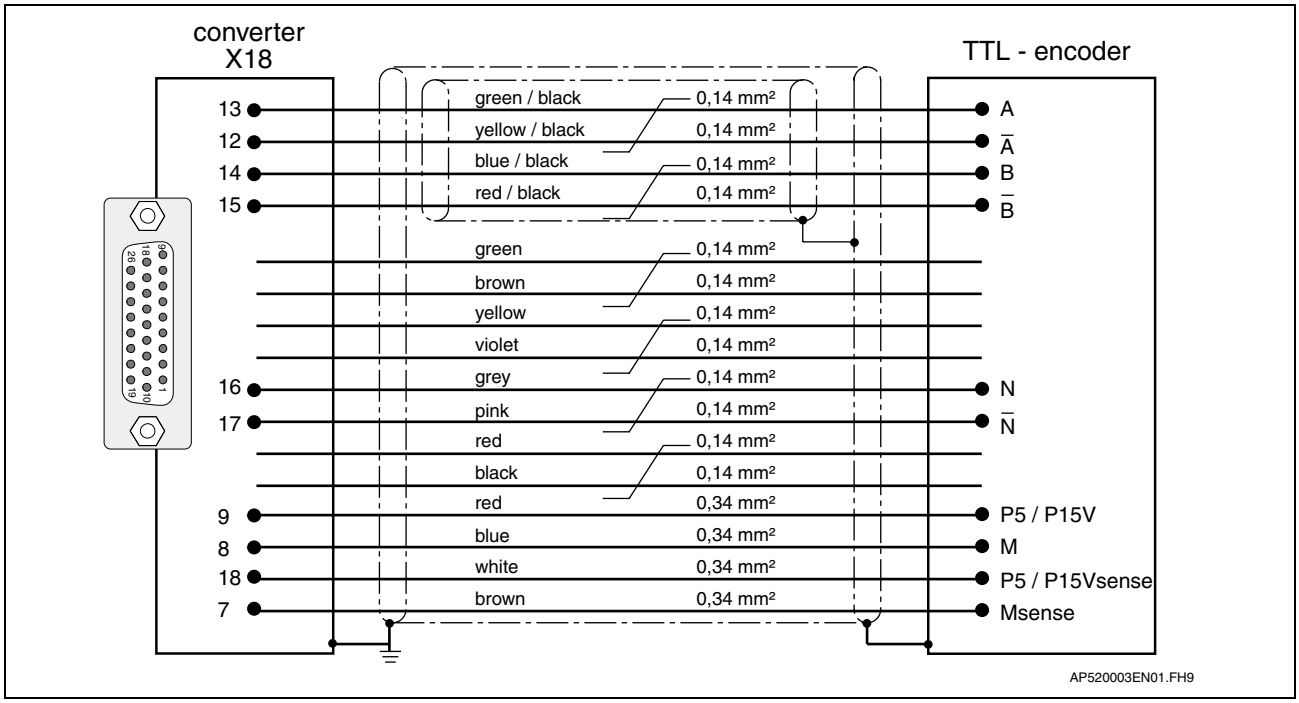


Fig.: 4-24 Connection circuit diagram for TTL encoder (e.g. IKS 5008)

Technical Data of TTL Encoder Evaluation

Power supply voltage U_B (DC) 5 V ± 2.5 % (jumper S5, refer to Fig.:4-17 Setting the encoder power supply voltage)

Max. output current I_{max} = 200 mA

Limiting frequency 300 kHz

Input resistance 120 Ω

Parameterization P0130: Incremental encoder
P0132: Pulse number

Sine / Cosine Encoder $1V_{PP}$ and Flux-Controlled Resistor

For operation with induction motors.

Signal display for clockwise direction of rotation when viewing the motor drive shaft end

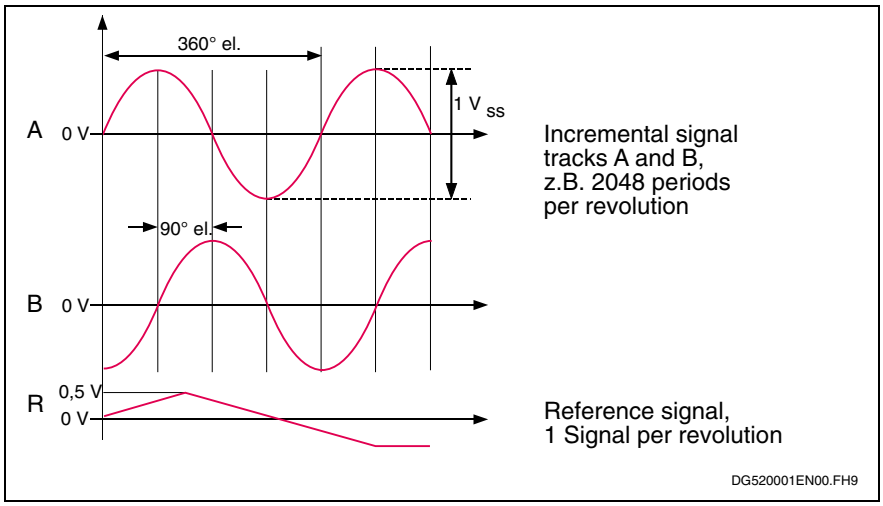


Fig.:4-25 Signal display for clockwise direction of rotation when viewing the motor drive shaft end

Sine / Cosine Encoder Connection

X18	Speed encoder and temperature sensor	
7	M sense	Sensor line 0 V
8	M	0 V (ground)
9	P 5 V	+5 V power supply voltage (jumper S5, refer to Fig.:4-17 Setting the encoder power supply voltage)
12	A-	Incremental signal A (sine)
13	A+	
14	B+	Incremental signal B (cosine)
15	B-	
16	R+	Reference signal R
17	R-	
18	P sense	Sensor line +5 V
25	Motor temp. +	Connecting a motor temperature sensor (PTC or KTY84) When connecting a KTY84, observe the polarity!
26	Motor temp. -	

Fig. 4-26: Connections, sine / cosine and flux-controlled resistor

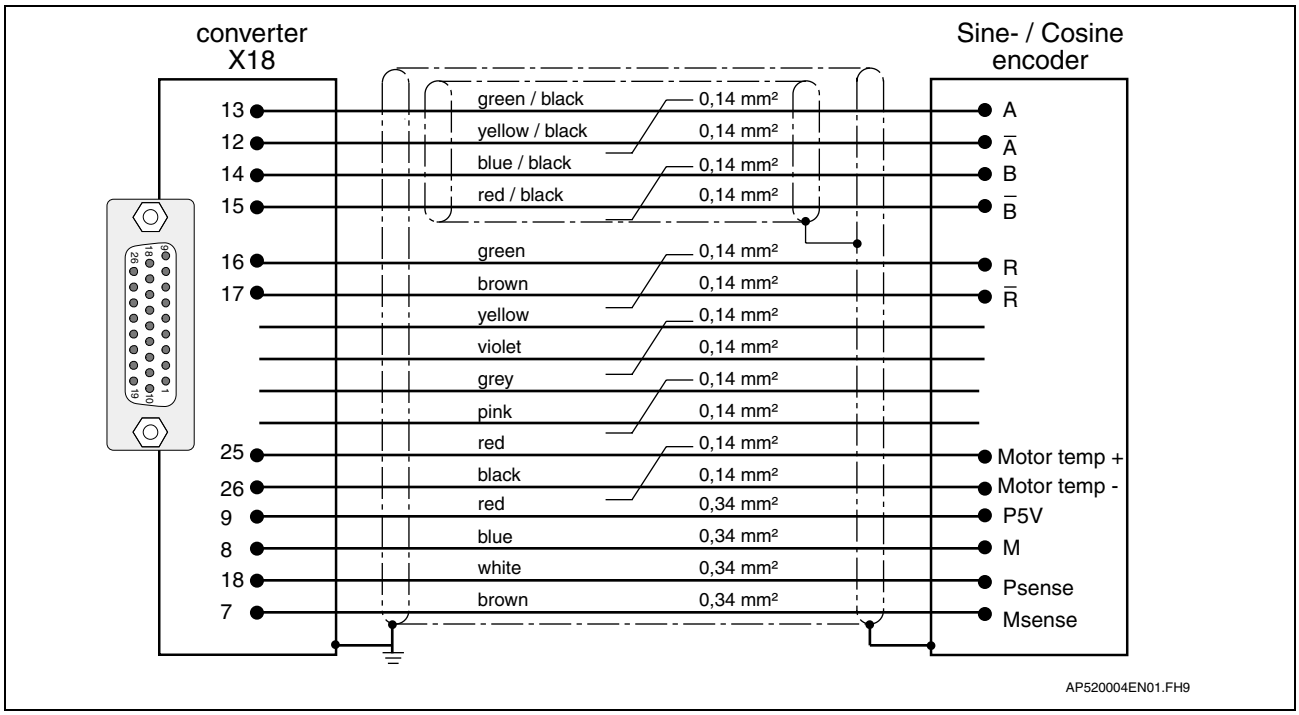


Fig.: 4-27 Connection circuit diagram for sine / cosine and flux-controlled resistor (e.g. IKS 5001)

Technical Data of Sine / Cosine Encoder Evaluation

Power supply voltage U_B (DC)	5 V ± 2.5 % (jumper S5, refer to Fig.:4-17 Setting the encoder power supply voltage)
Max. output current	I_{max} = 200 mA
Limiting frequency	300 kHz
Terminating resistance, input	120 Ω
Parameterization	P0130: Sine / cosine encoder P0132: Pulse number

1 V_{PP} Sine / Cosine Encoder with Commutation (Rotor Position Sensing)

For operation with induction and synchronous motors.

Signal Display for Clockwise Direction of Rotation when Viewing the Motor Drive Shaft End

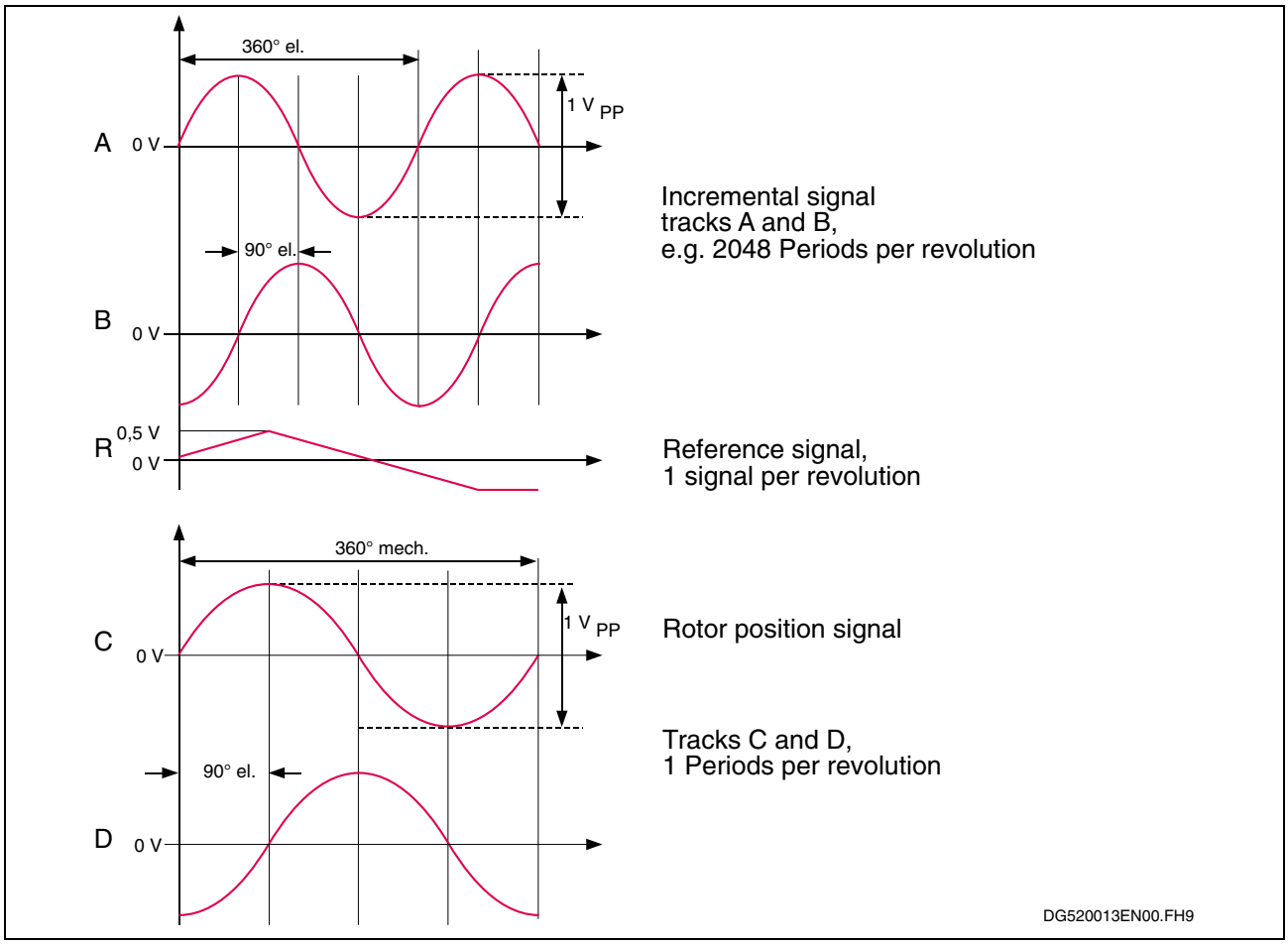


Fig.: 4-28 Signal display, sine / cosine encoders with rotor position sensing

Connection Assignment for 1 V_{PP} Sine / Cosine Encoders with Commutation

X18	Speed encoder and temperature sensor	
3	C+	Signal track C, rotor position
4	C-	
5	D+	Signal track D, rotor position
6	D-	
7	M sense	Sensor line 0 V
8	M	0 V (ground)
9	P 5 V	+ 5 V power supply voltage, refer to Fig.:4-17 Setting the encoder power supply voltage
12	A+	Incremental signal A (sine)
13	A-	
14	B+	Incremental signal B (cosine)
15	B-	
16	R+	Reference signal R
17	R-	
18	P sense	Sensor line + 5 V
25	Motor temp.+	Connecting a motor temperature sensor (PTC or KTY84) When connecting a KTY84, observe the polarity!
26	Motor temp. -	

Fig.:4-29 Connection,1 V_{PP} sine / cosine encoder with commutation

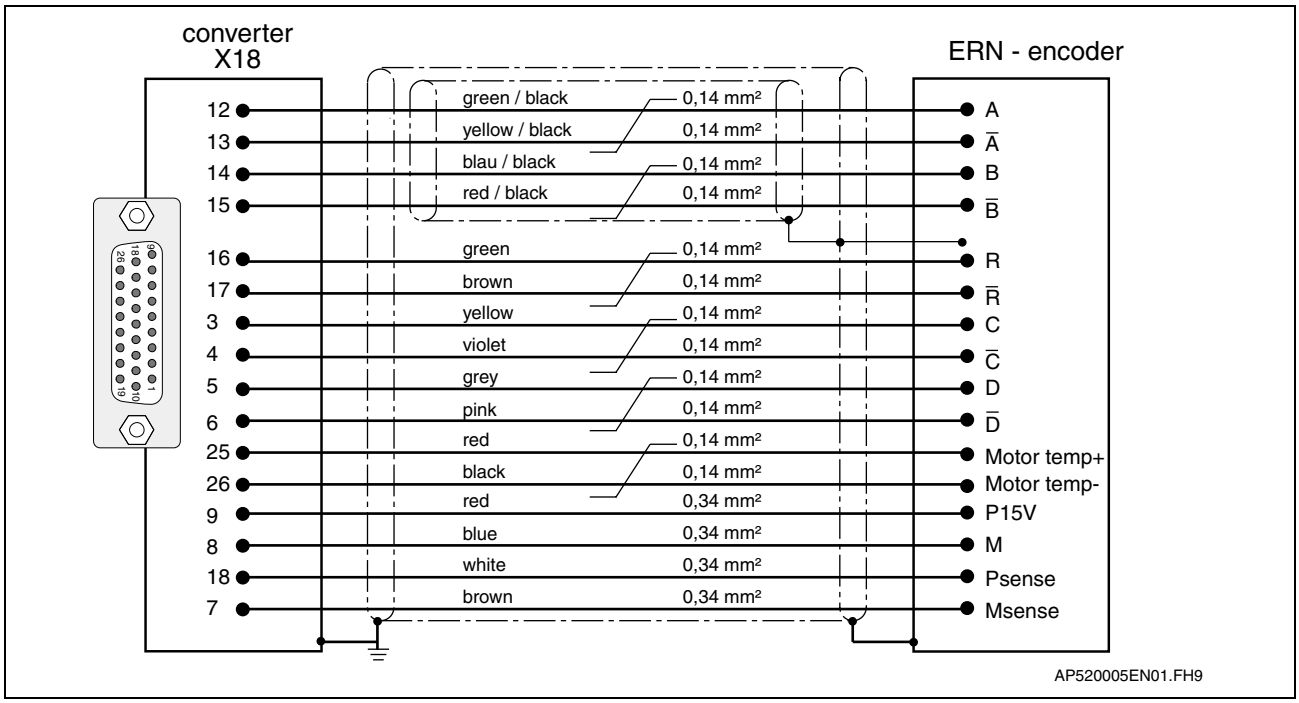


Fig.: 4-30 Connection circuit diagram, 1 V_{PP} sine / cosine encoder with commutation, e.g. ERN 5007

Technical Data for 1 V_{PP} Sine / Cosine Encoder with Commutation

Power supply voltage U_B (DC)	5 V ± 2.5 (jumper S5, refer to Fig.:4-17 Setting the encoder power supply voltage)
Max. output current	I_{max} = 200 mA
Limiting frequency	300 kHz
Terminating resistance, input	120 Ω
Parameterization	P0130: Sin / cos & commutation P0132: Pulse number

- P0130: Sin / cos & commutation
- P0132: Pulse number
- P0133: Encoder delta phi (a possible mechanical misadjustment of the encoder can be corrected using this parameter. This is required only for synchronous motors. Also refer to Fig. 9-2: Flow diagram, commissioning a synchronous motor drive.

When using a Siemens encoder or an encoder with a round connector having a Siemens-compatible pin assignment, a pre-assembled cable can be purchased from Bosch Rexroth.

Resolver (for Operation with Induction and Synchronous Motors)

Signal Display for Clockwise Direction of Rotation when Viewing the Motor Drive Shaft End

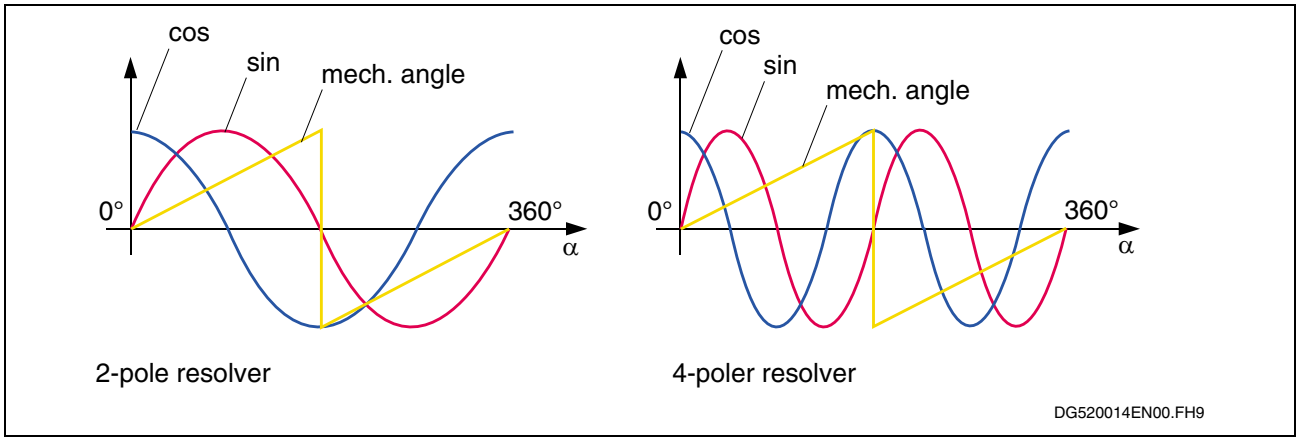


Fig.: 4-31 Signal display, resolver

The signals can be displayed using the RDwin oscilloscope function.

- Sine: D1086
- Cosine: D1087
- Mechanical angle: D1890

Resolver connection

X18	Speed encoder and temperature sensor	
1	R1	Excitation voltage +
2	R2 (R3)	Excitation voltage -
10	S1	cos +
11	S3	cos -
19	S2	sin +
20	S4	sin -
25	Motor temp. +	Connecting a motor temperature sensor (PTC or KTY84) When connecting a KTY84, observe the polarity!
26	Motor temp. -	

Fig.: 4-32 Connection assignment, resolver

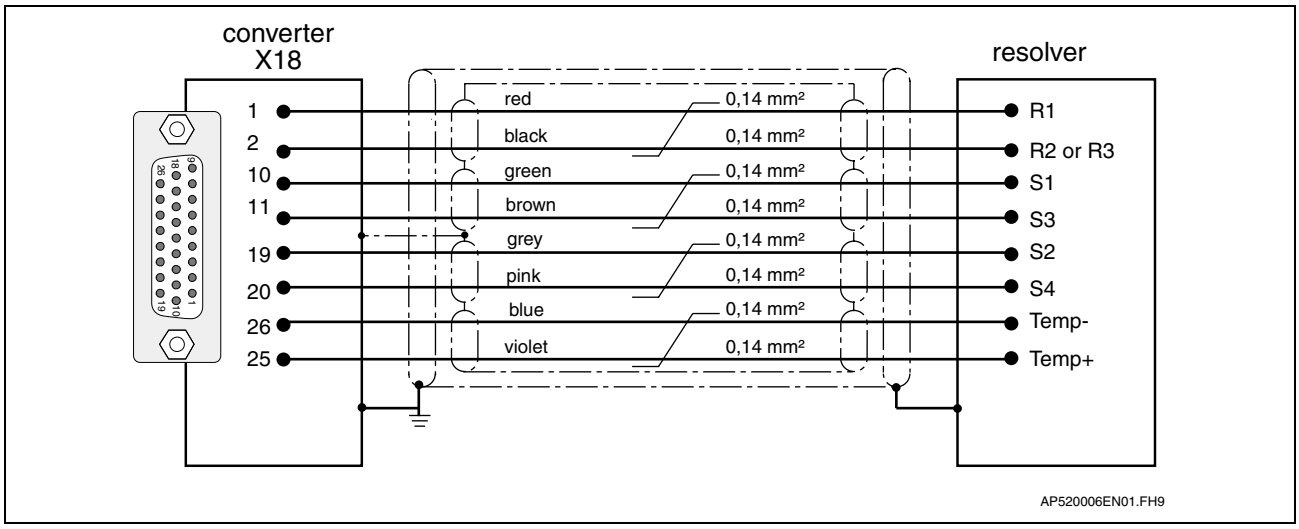


Fig. 4-33: Connection circuit diagram for resolver (e.g. IKS5014)

We recommend that an 8-pin twisted-pair cable with additional outer shield is used to connect the resolver to the drive converter. The cable cross-section should be at least 0.14 mm^2 (Bosch Rexroth bulk cable number INK0690).

The resolver cable should be kept as short as possible, and should not exceed 75 m.

Technical Data of Resolver Evaluation

Power supply voltage U_B (AC) 7 V_{RMS}, f_{exc} (excitation frequency)

Max. output current I_{max} = 100 mA

Parameterization

- P0130: resolver
- P0131: pin number

f_p [kHz]	4	6	8	10	12
f_{err} [kHz]	8	12	8	10	12

L: f_p = pulse frequency (P0026)

Fig.: 4-34: Frequency selection

- P0133: Encoder delta phi (a possible mechanical misadjustment of the encoder can be corrected using this parameter. This is required only for synchronous motors. Also refer to Fig. 9-2: Flow diagram, commissioning a synchronous motor drive.

Recommended Resolver Parameters

Transformation ratio 0.4 - 0.6

Max. phase shift ±15°

Max. electrical error ±10 angular minutes

Max. output impedance Z_{PP} (180 + j500) Ω

Zero voltage < 30 mV

Resolver Mounting

Center offset between rotor and stator max. 0.05 mm

Axial offset between rotor and stator max. ±0.25 mm

Assignment of Motor Pin Number to Resolver Pin Number

The ratio between the pin number of the motor and of the resolver must always be an integer!

Pin number = pin pair number ∗ 2.

Pin No., resolver	Pin number, motor				Manufacturer	
	2	4	6	8	Siemens	Tamagawa
2	X	X	X	X	V23401-H2009-B202	TS2018 N 431 E41
4		X		X	V23401-H2012-B201	TS2018 N 532 E41
6			X		V23401-H2002-B209	TS2018 N 543 E41
8				X	V23401-H2003-B209	

Fig.:4-35 Assignment, motor pin number - resolver pin number

When using a Siemens encoder or an encoder with a round connector (20° coded) having a Siemens-compatible pin assignment, a pre-assembled cable (IKS 5014) can be purchased from Bosch Rexroth.

First Encoder Test

Connect the motor with mounted encoder to the converter.

With the converter disabled, manually rotate the motor shaft clockwise (when viewing the drive end, i.e. PTO side).

A positive speed must be displayed on the user panel.

A negative speed must be displayed when rotating the motor shaft in the counterclockwise direction.

4.9 Service Interface RS232 (X11)

This interface is used to connect the user panel or a PC with RDwin. A preassembled standard extension cable can be obtained from Bosch Rexroth to connect the devices (Order No.: R911200239, length 5 m).

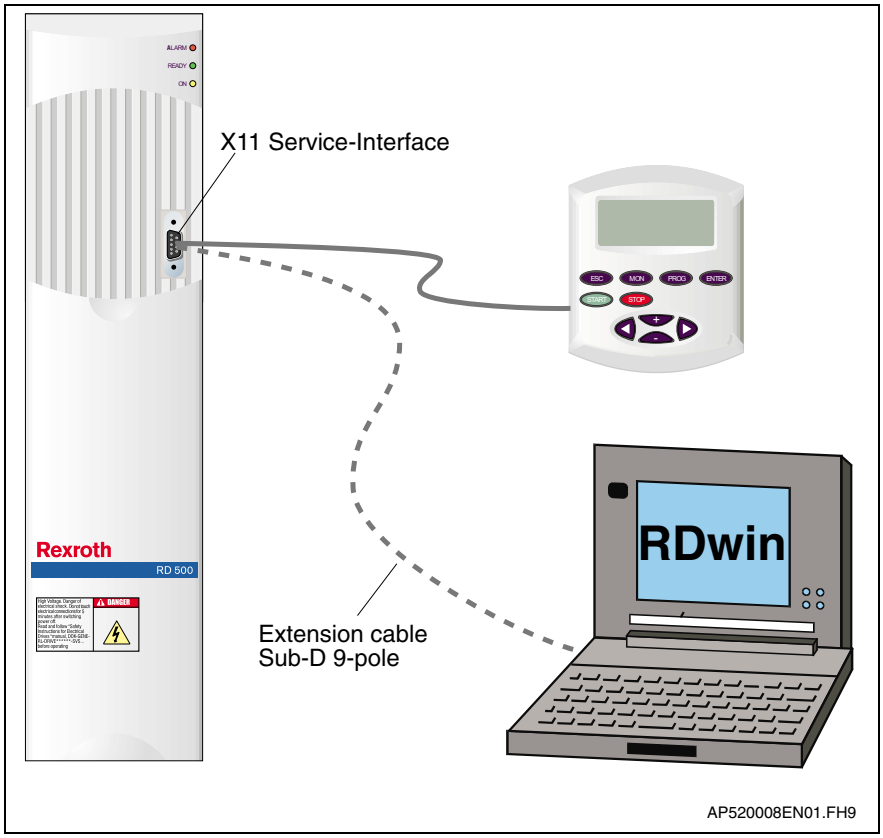


Fig.: 4-36: Possibilities of connecting to the service interface

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:

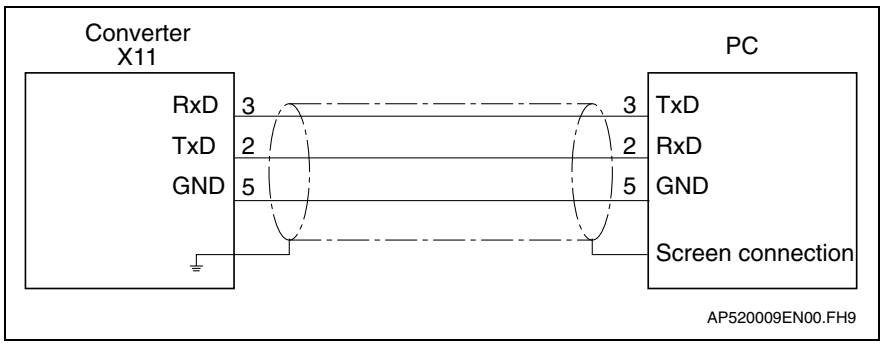


Fig.:4-37 Connecting cable for PC

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-RD52*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.:4-38 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

4.10 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-RD52*xxVRS*-FKxx-EN-P.

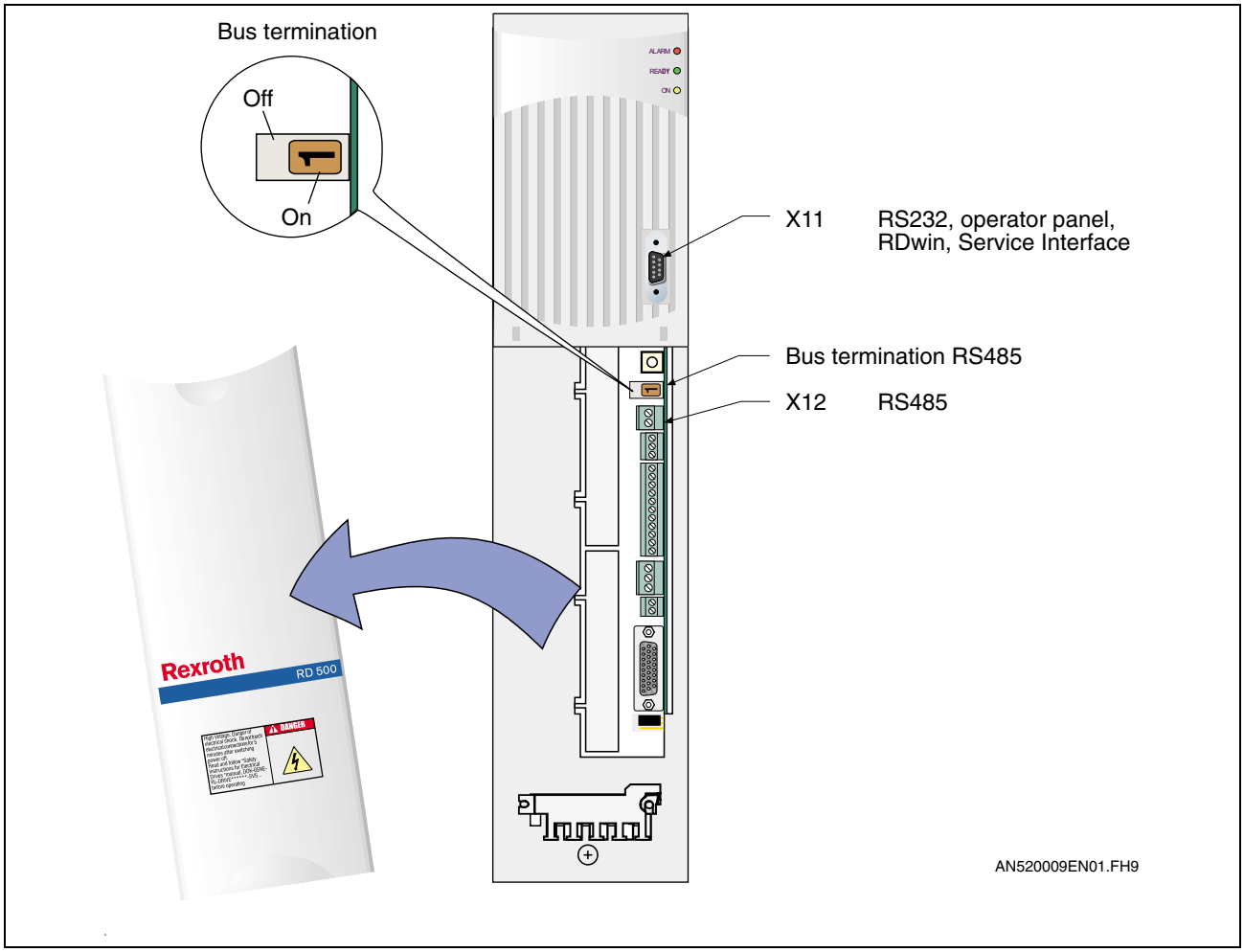


Fig.: 4-39 Terminal diagram, SR17002

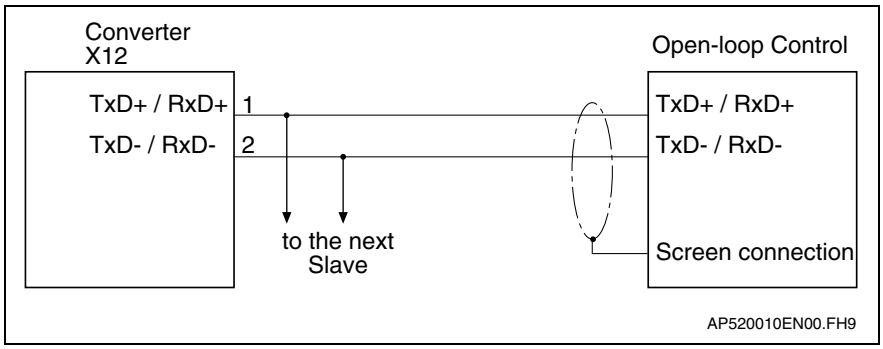


Fig.: 4-40 Connection, standard interface

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.: 4-39 Terminal diagram, SR17002).

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. :4-41 Parameters for RS485

5 Inverter Technical Data

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

			4 kHz					8 kHz				
RD52.2			**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 = 60 s	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 = 60 s	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 operation, to 50 °C power reduction at 2.5 % per K)									
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		kW	0.15	0.20	0.26	0.37	0.42	0.16	0.23	0.27	0.43	0.50
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												
D plug-through cooler		kg	5.5	5.5	5.5	10.3	10.3	5.5	5.5	5.5	10.3	10.3
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	5.0	5.0	5.0	9.8	9.8	5.0	5.0	5.0	9.8	9.8

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.

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

		12 kHz				
RD52.2		**003**	**005**	**007**	**015**	**018**
Supply voltage DC 530 ... 670 V (± 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 operation, to 50 °C power reduction at 2.5 % per K)				
Cooling air requirement	m³ / s	0.03	0.03	0.03	0.05	0.05
Power loss	kW	0.16	0.23	0.27	0.43	0.50
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						
D plug-through cooler	kg	5.5	5.5	5.5	10.3	10.3
L Forced air cooling	kg	6.5	6.5	6.5	11.3	11.3
P heat dissipation panel	kg	5.0	5.0	5.0	9.8	9.8

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							
RD52.1			**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 = 60 s	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 operation, to 50 °C power reduction at 2.5 % per K)							
Cooling air requirement		m^3 / s	0.1	0.1	0.2	0.2	0.4	0.4	0.4	0.4
Power loss		kW	0.6	0.9	0.8	0.95	1.4	1.7	2.2	2.5
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.

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

			8 kHz							6 kHz
RD52.1			**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 = 60 s	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 = 60 s	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 operation, to 50 °C power reduction at 2.5 % per K)							
Cooling air requirement		m^3 / s	0.1	0.1	0.2	0.2	0.4	0.4	0.4	0.4
Power loss		kW	0.8	0.9	1.0	1.1	1.6	2.1	2.8	2.9
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							
RD52.1			**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 = 60 s	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 operation, to 50 °C power reduction at 2.5 % per K)							
Cooling air requirement		m^3 / s	0.1	0.1	0.2	0.2	0.4	0.4	0.4	0.4
Power loss		kW	0.8	0.9	1.0	1.1	1.6	2.1	2.87	2.9
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

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

			4 kHz			8 kHz		
RD52.1			**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 = 60 s	kVA	197	248	299	166	197	240
Supply voltage DC 700 V (±10 %)[2]								
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 operation, to 50 °C power reduction at 2.5 % per K)					
Cooling air requirement		m³/s	0.4	0.4	0.6	0.4	0.4	0.6
Power loss			5.2	6.5	7.7	4.4	5.2	6.5
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 >150 Hz 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		
RD52.1			**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 operation, to 50 °C power reduction at 2.5 % per K)		
Cooling air requirement		m³ / s	0.4	0.4	0.6
Power loss		kW	3.0	3.7	4.6
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 >150 Hz the additional function M1 is required (without integrate Motor filter)

5.8 Technical Data SFT Motor inverter for Size Classes A and B with Pulse frequency f_p = 4 kHz / 8 kHz

			4 kHz			8 kHz		
RD52.3			**003**	**007**	**018**	**003**	**007**	**018**
Rated motor output[1)]		kW	3.0	7.5	18.5	2.2	5.5	15
Supply voltage DC 750 V (-15 % +5 %)								
Output frequency		Hz	0 - 250			0 - 500		
Rated current		A	5.5	13.5	27	4.3	9.5	23
Peak current for	t = 60 s	A	7.0	17.5	35	5.5	12.5	30
	t = 1 s	A	9.3	23	46	7.3	16	39
	t = 0.5 s	A	11	27	54	8.6	19	46
Rated output S_N		kVA	4.9	12	24	3.8	8.4	20
Peak power for	t = 60 s	kVA	6.2	15	31	4.9	11	26
Ambient conditions, noise suppression level, interference immunity								
Environmental class			3K3 according to DIN IEC 721-3-3 (ambient temperature 0 – 40 °C operation, to 50 °C power reduction at 2.5 % per K)					
Cooling air requirement		m³ / s	0.03	0.03	0.05	0.03	0.03	0.05
Power loss		kW	0.15	0.26	0.42	0.16	0.27	0.50
Radio int. sup. level / noise immunity			A 2 according to EN 55011 / EN 61800					
Mechanical design								
Size classes			A	A	B	A	A	B
Degree of protection			IP 20 according to EN 60529 with connected plug					
Weight of inverter for the various cooling types								
D plug-through cooler		kg	5.5	5.5	10.3	5.5	5.5	10.3
L Forced air cooling		kg	6.5	6.5	11.3	6.5	6.5	11.3
P heat dissipation panel		kg	5.0	5.0	9.8	5.0	5.0	9.8

1): Max. permissible motor power based on 4-pin standard induction motor 500 V

5.9 Technical Data SFT Motor inverter for Size Classes C, D and E with Pulse frequency f_p = 4 kHz

			4 kHz					
RD52.3			**030**	**045**	**055**	**075**	**090**	**110**
Rated motor output[1)]		kW	30	45	55	75	90	110
Supply voltage DC 750 V (-15 % +5 %)								
Output frequency		Hz	0 - 250					
Rated current		A	44	64	77	104	126	155
Peak current for	t = 60 s	A	57	83	100	135	164	201
	t = 1 s	A	74	108	131	177	214	263
	t = 0.5 s	A	87	128	155	209	252	310
Rated output S_N		kVA	39	56	68	92	111	137
Peak power for	t = 60 s	kVA	50	73	88	119	145	178
Ambient conditions, noise suppression level, interference immunity								
Environmental class			3K3 according to DIN IEC 721-3-3 (ambient temperature 0 – 40 °C operation, to 50 °C power reduction at 2.5 % per K)					
Cooling air requirement		m³ / s	0.1	0.2	0.4	0.4	0.4	0.4
Power loss		kW	0.8	1.17	1.37	1.85	2.25	2.81
Radio int. sup. level / noise immunity			A 2 according to EN 55011 / EN 61800-3					
Mechanical design								
Size classes			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	32	32	44	44
D Plug-through cooler		kg	20	20	30	30	42	42
W Liquid cooling		kg	-	-	See DOK-RD500*SFT********-PR0x-EN-P		-	-

1): Max. permissible motor power based on 4-pin standard induction motor 500 V

5.10 Technical Data SFT Motor inverter for Size Classes C, D and E with Pulse frequency f_p = 8 kHz

			8 kHz					
RD52.3			**030**	**045**	**055**	**075**	**090**	**110**
Rated motor output[1)]		kW	22	37	45	55	75	90
Supply voltage DC 750 V (-15 % +5 %)								
Output frequency		Hz	0 - 500					
Rated current		A	33	52	64	77	104	126
Peak current for	t = 60 s	A	43	69	83	100	135	163
	t = 1 s	A	56	91	108	131	177	213
	t = 0.5 s	A	66	107	128	155	209	252
Rated output S_N		kVA	29	46	56	68	92	111
Peak power for	t = 60 s	kVA	38	61	73	88	119	144
Ambient conditions, noise suppression level, interference immunity								
Environmental class			3K3 according to DIN IEC 721-3-3 (ambient temperature 0 – 40 °C operation, to 50 °C power reduction at 2.5 % per K)					
Cooling air requirement		m^3 / s	0.1	0.2	0.4	0.4	0.4	0.4
Power loss		kW	0.8	1.17	1.37	1.85	2.25	2.81
Radio int. sup. level / noise immunity			A 2 according to EN 55011 / EN 61800-3					
Mechanical design								
Size classes			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	32	32	44	44
D Plug-through cooler		kg	20	20	30	30	42	42
W Liquid cooling					See DOK-RD500*SFT********-PR0x-EN-P			

1): Max. permissible motor power based on 4-pin standard induction motor 500 V

5.11 Technical Data SFT Motor inverter for Size Class G with Pulse frequency f_p = 4 kHz / 8 kHz

			4 kHz	8 kHz
RD52.3			160	
Rated motor output 1)		kW	160	126
Supply voltage DC 750 V (-15 % +5 %)				
Output frequency 2)		Hz	0 - 150	0 - 250
Rated current		A	233	184
Peak current for	t = 60 s	A	302	240
	t = 1 s	A	395	313
Rated output S_N		kVA	205	162
Peak power for	t = 60 s	kVA	267	212
Ambient conditions, noise suppression level, interference immunity				
Environmental class			3K3 according to DIN IEC 721-3-3 (ambient temperature 0 – 40 °C operation, to 50 °C power reduction at 2.5 % per K)	
Cooling air requirement		m^3 / s	0.4	
Power loss		kW	3.5	
Radio int. sup. level / noise immunity			A 2 according to EN 55011 / EN 61800-3	
Mechanical design				
Size classes			G	
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	128	
D Plug-through cooler		kg	105	
W Liquid cooling			See DOK-RD500*SFT*******-PR0x-EN-P	

1): Max. permissible motor power based on 4-pin standard induction motor 500 V

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

5.12 Circuit Principle

Circuit Principle of Electronics Section

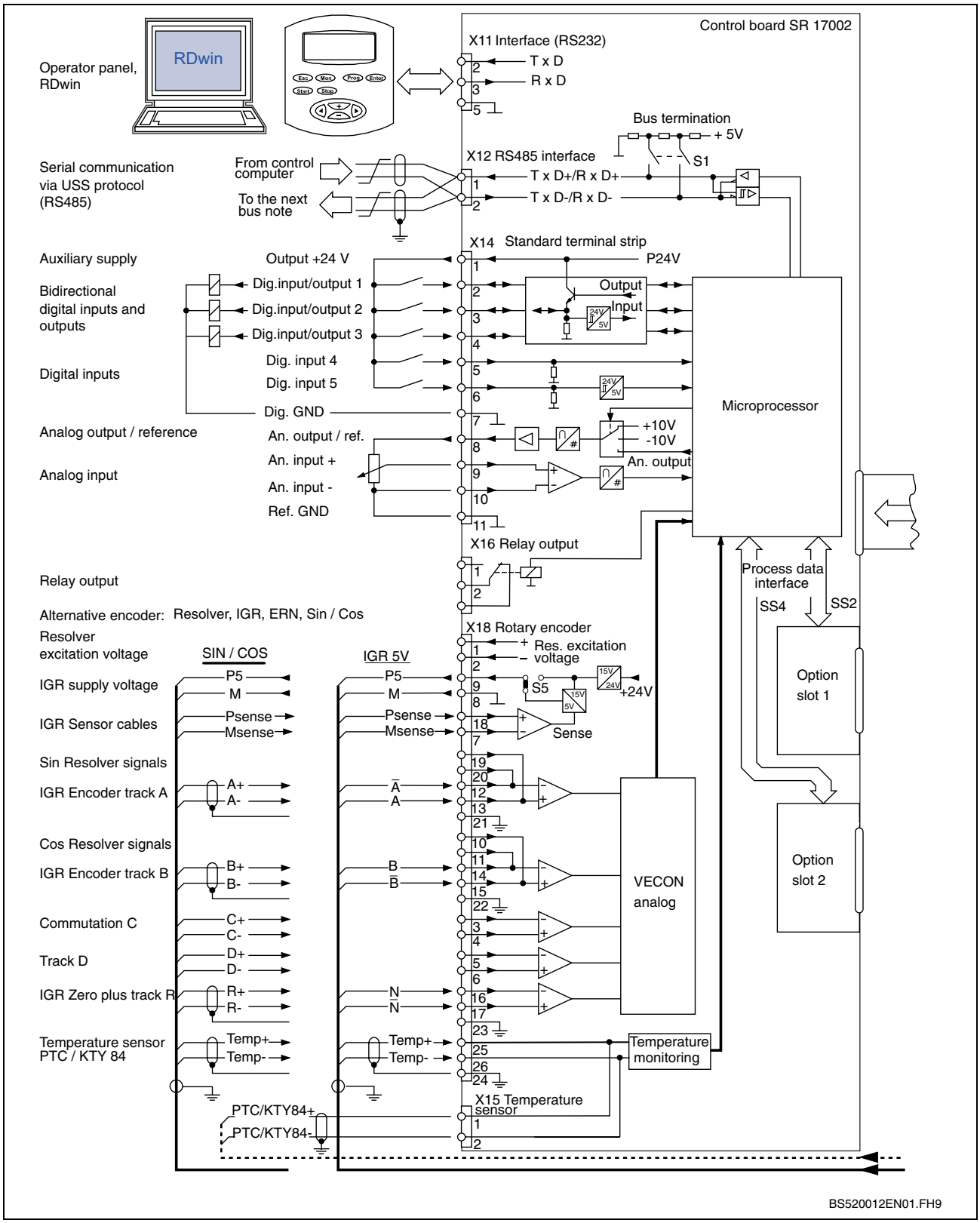


Fig.: 5-1 Circuit principle of electronics section

Circuit Principle of Power Section, Size Classes A and B

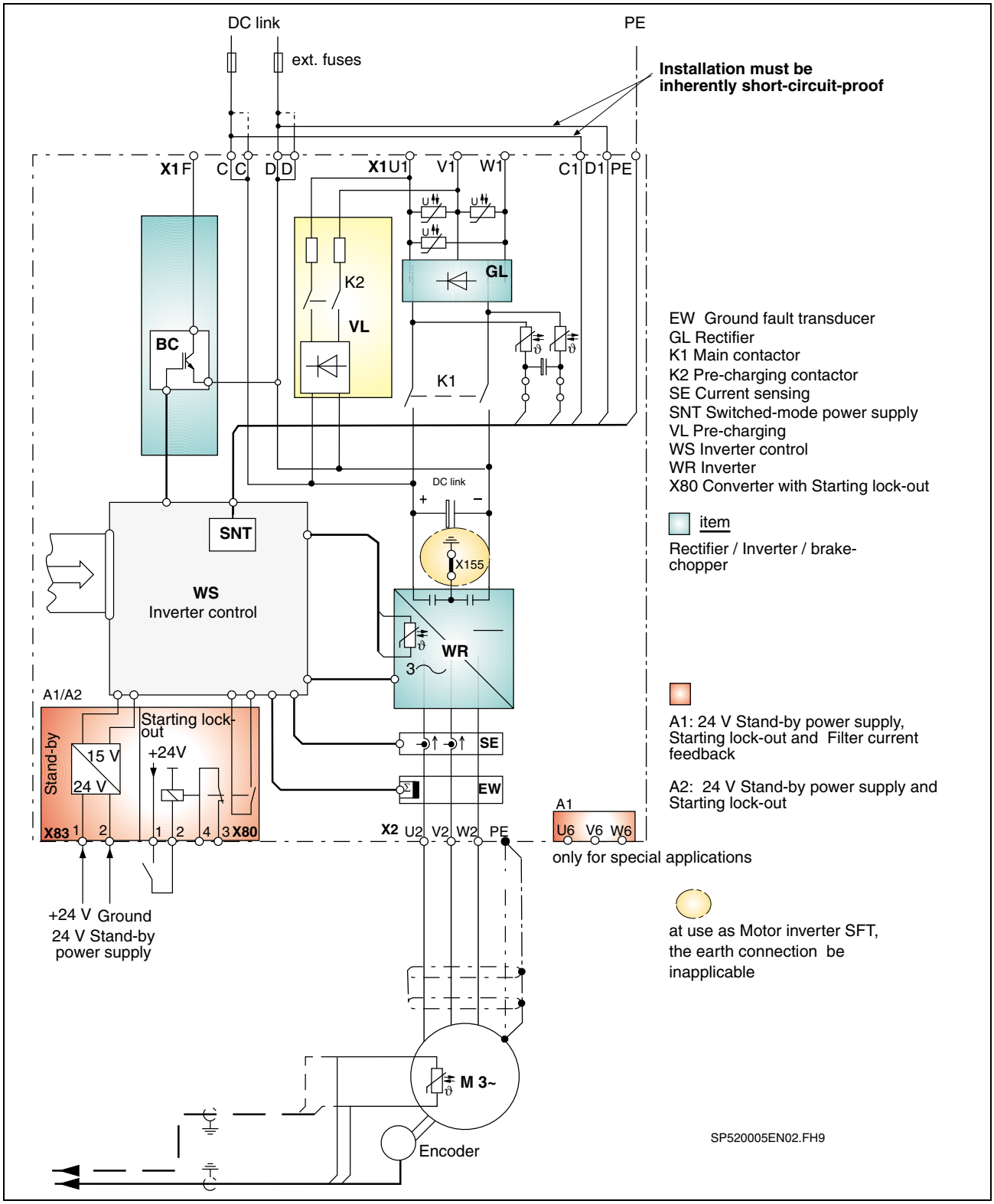


Fig.: 5-2 Sample connection of classes A – B when using inverter

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

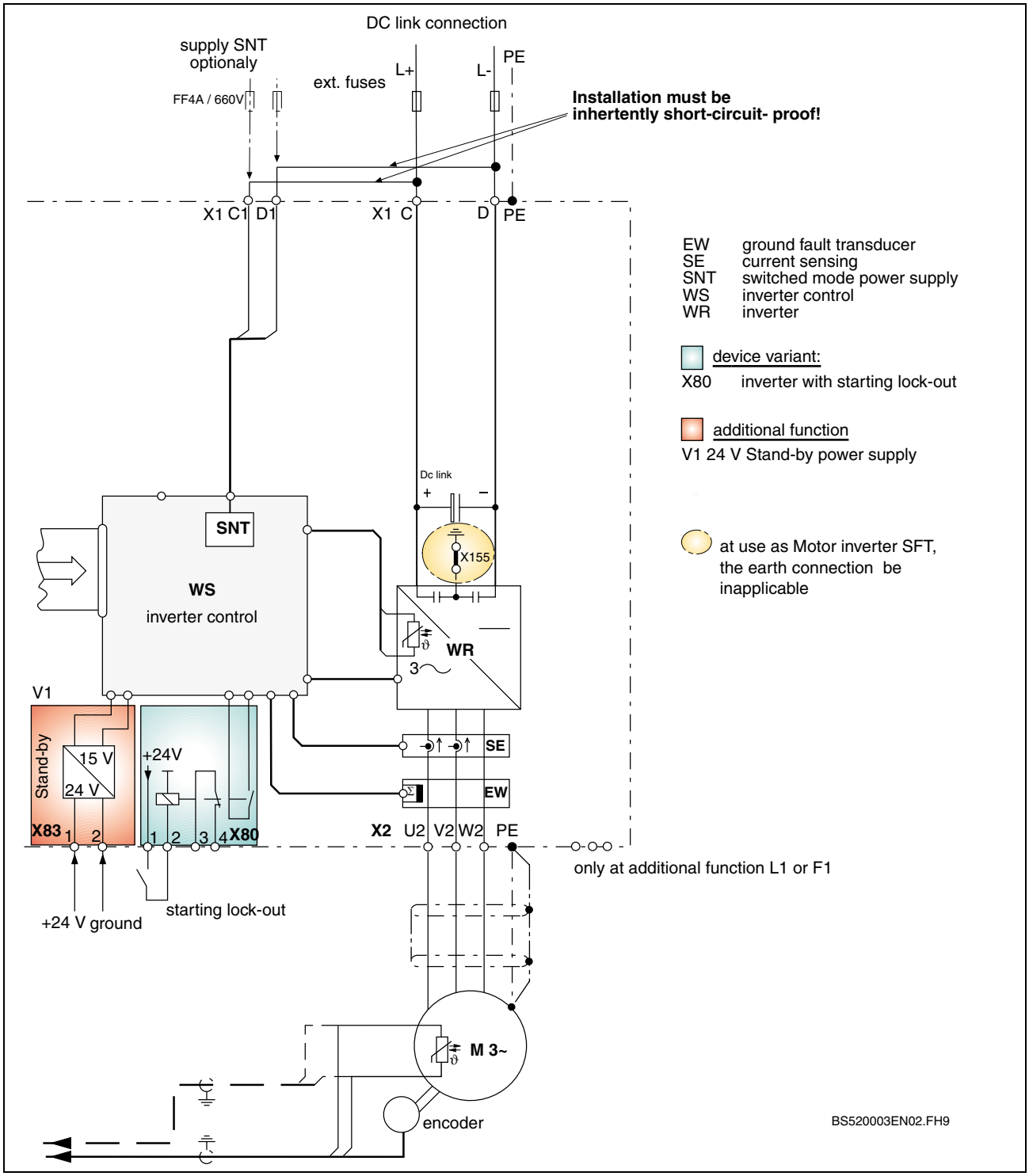


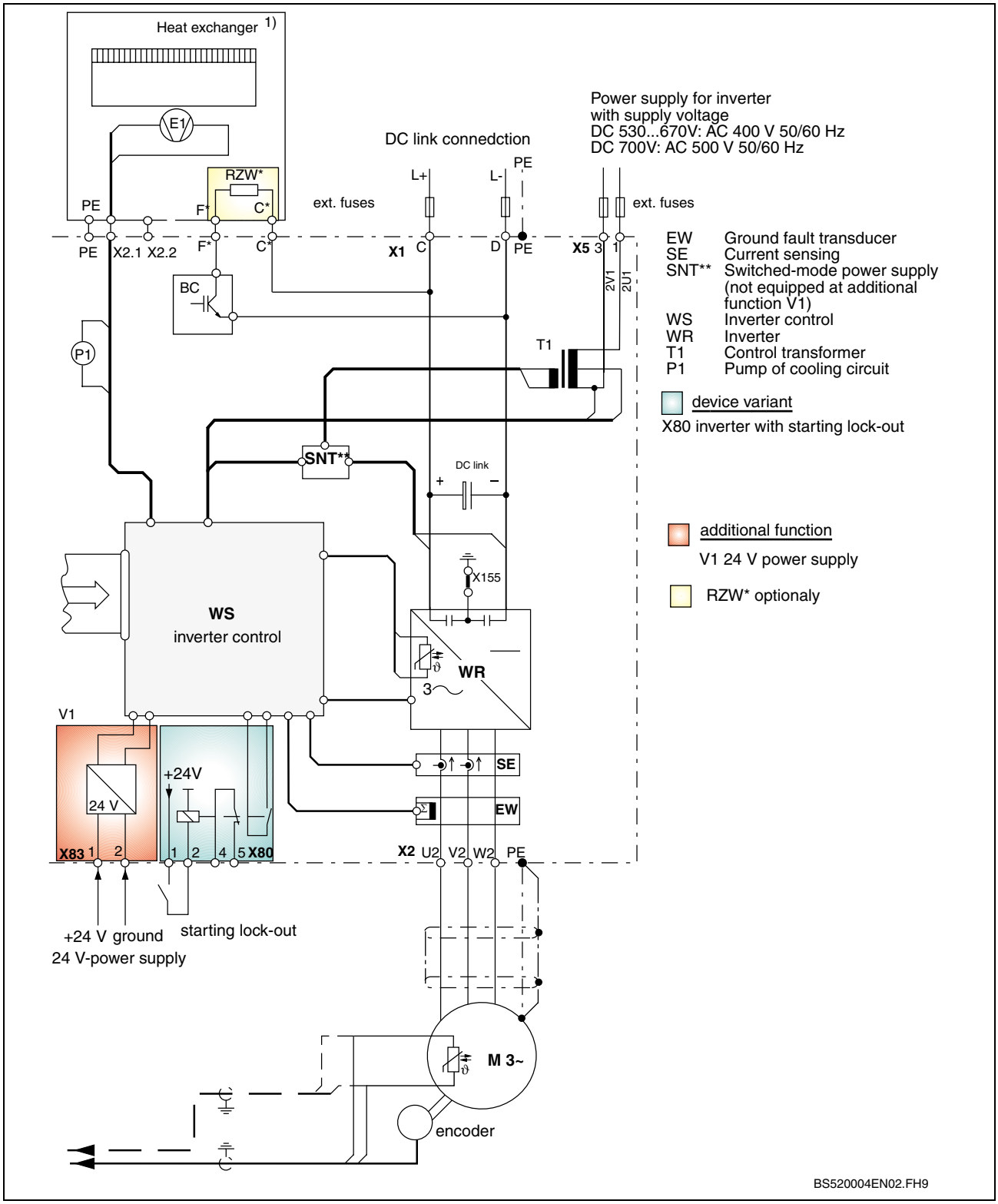
Fig.: 5-3 Circuit principle of power section, inverter classes C - E

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

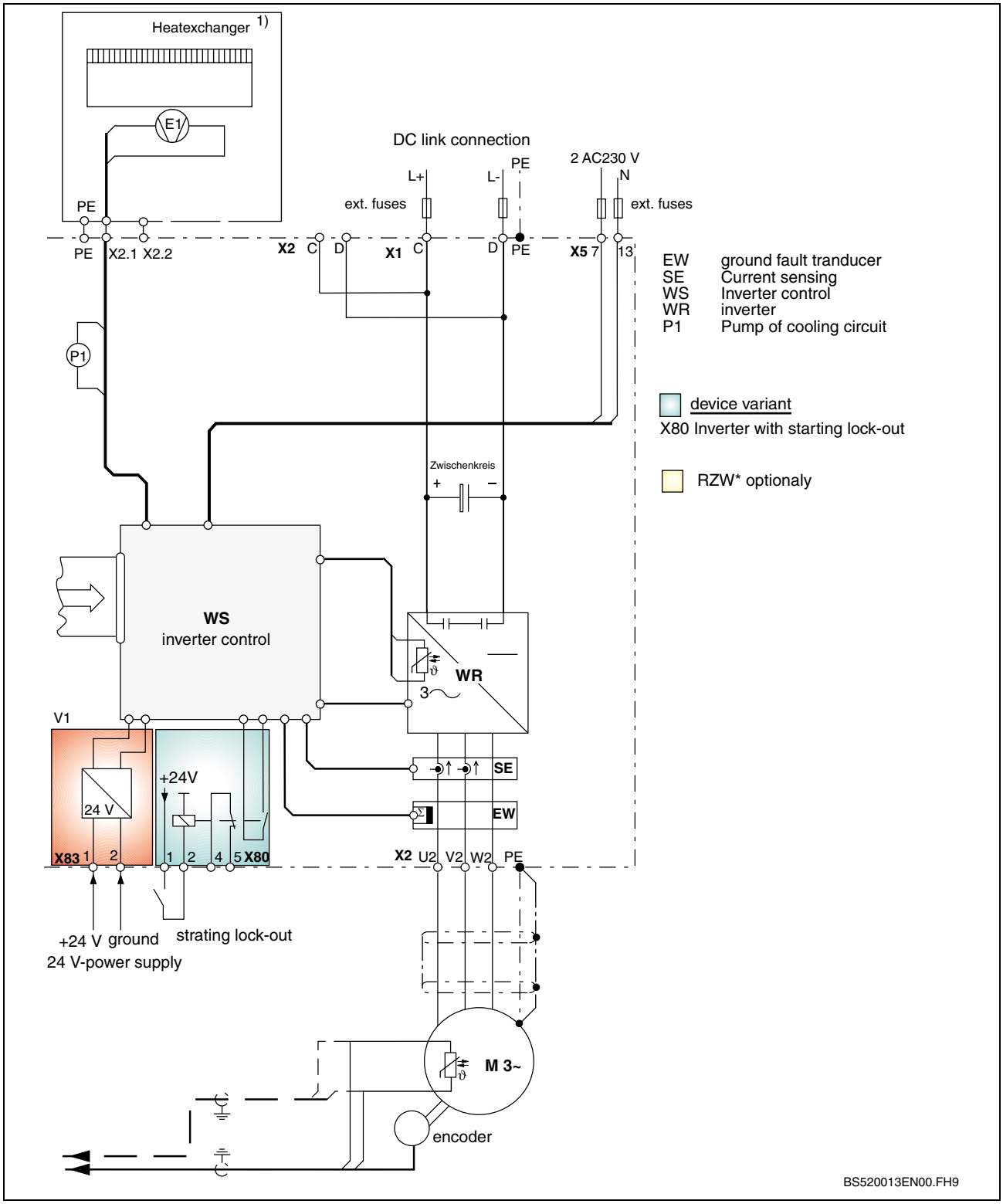


1): only at cooling type F

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).

Circuit Principle of Power Section, inverter SFT Size Class G



P1): pump is not equipped at cooling type W
1): heat exchanger is not equipped at cooling type R and W

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

5.13 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 °C.

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 y
- 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.

Utilization

With mounting conditions diverging from those specified above, the following rating data will be reduced in accordance with the diagrams (see "Fig. 5-6: Utilization at a higher ambient temperature, Fig.: 5-7 Derating depending on setup elevation"):

- Drive controller:
  - permissible DC bus continuous rating
  - braking resistor continuous rating
  - continuous current
- Motor:
  - performance
  - continuous torque at standstill
  - S1 continuous torques

With deviating ambient temperatures together with higher setup elevations, both utilization factors must be multiplied. Setup elevation is to be considered only once. Deviating ambient temperatures are to be considered separately for the motor and the drive controller.

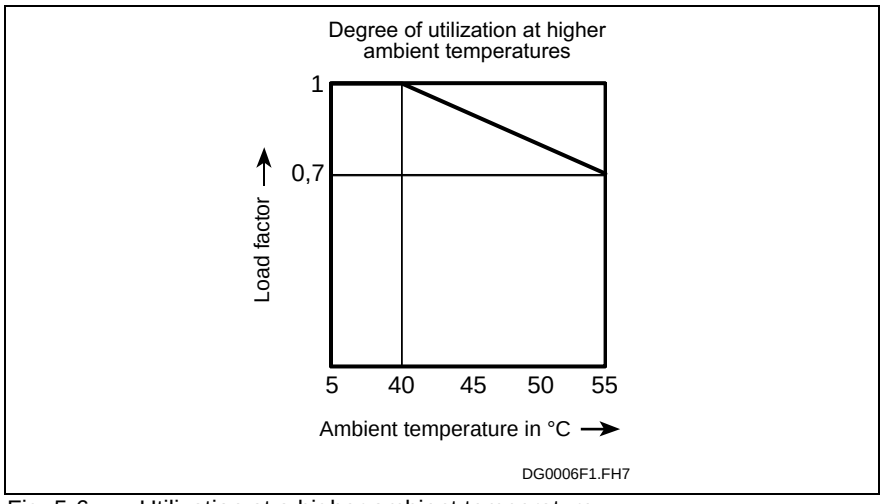


Fig. 5-6: Utilization at a higher ambient temperature

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.

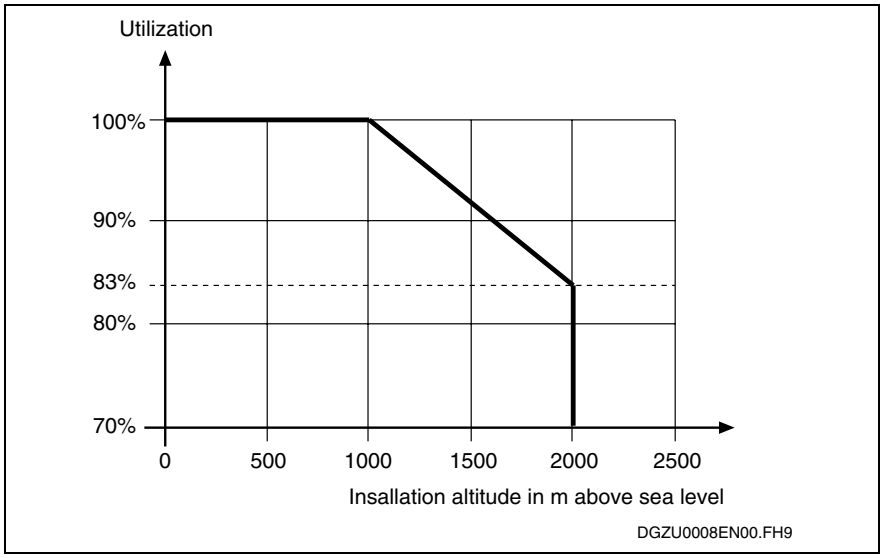


Fig.: 5-7 Derating depending on setup elevation

5.14 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

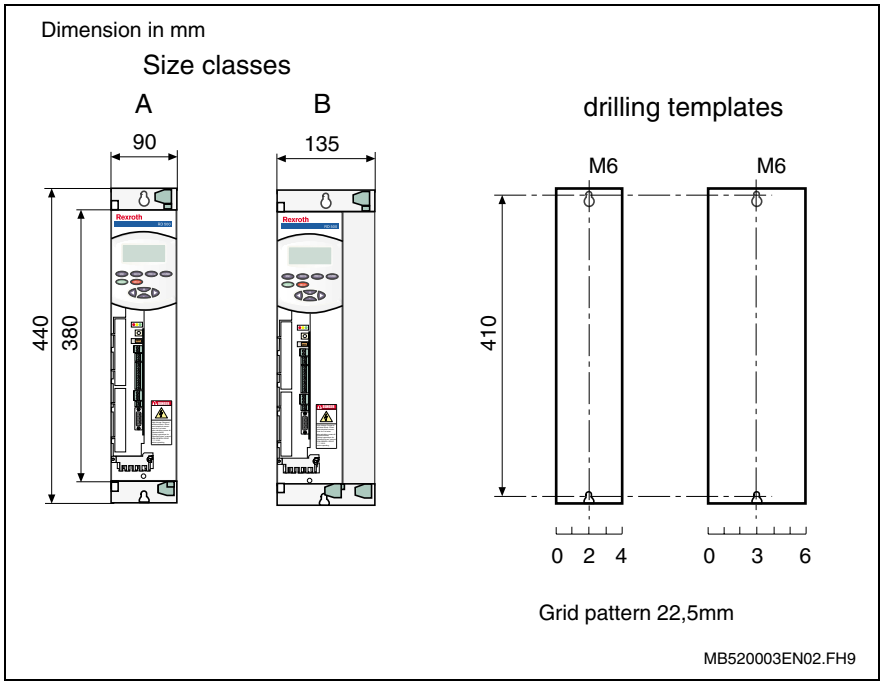


Fig.: 5-8 Dimension sheet, size classes A - B

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.: 5-9 Cooling types, size classes A - B.

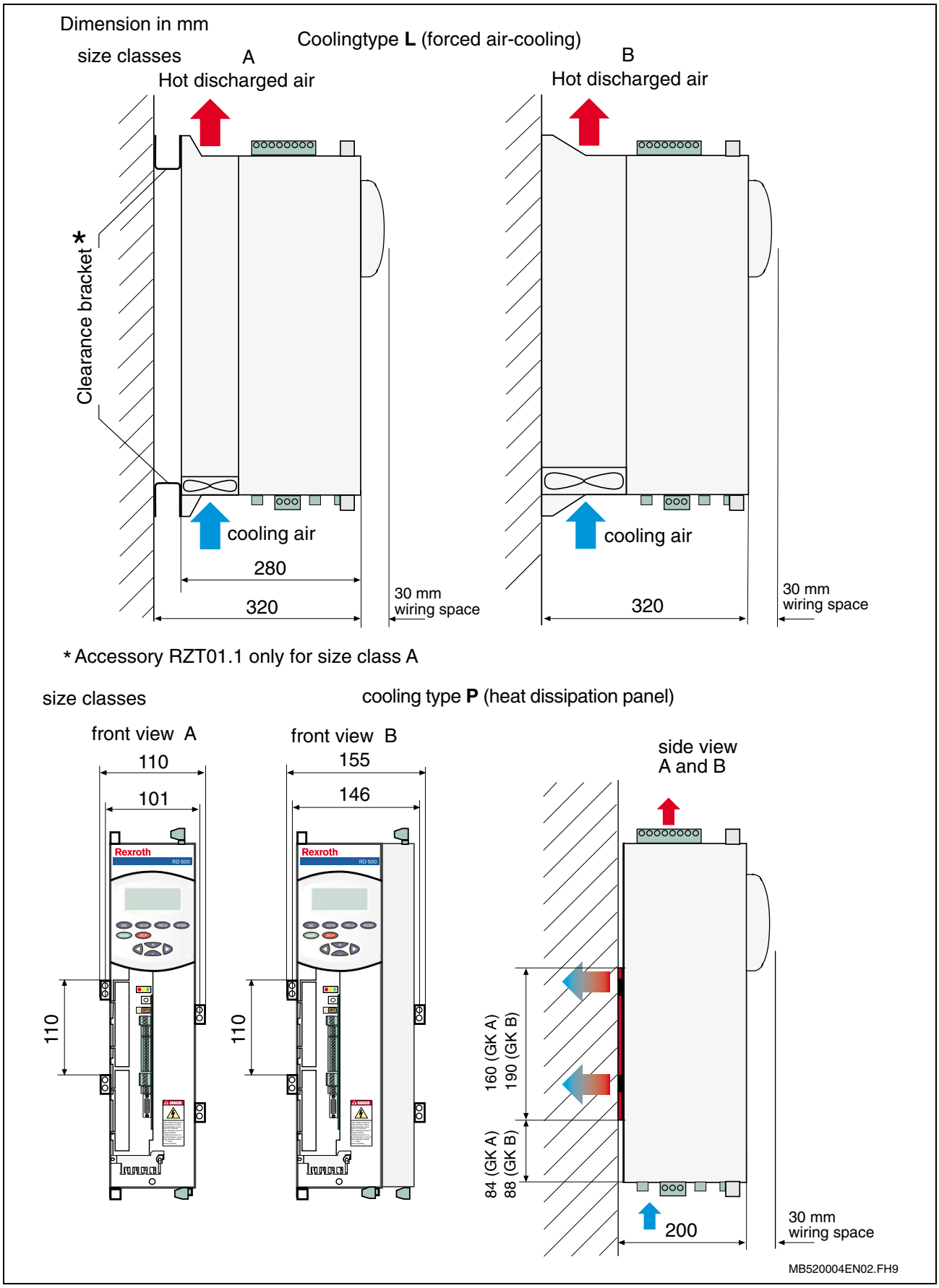


Fig.: 5-9 Cooling types, size classes A - B

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

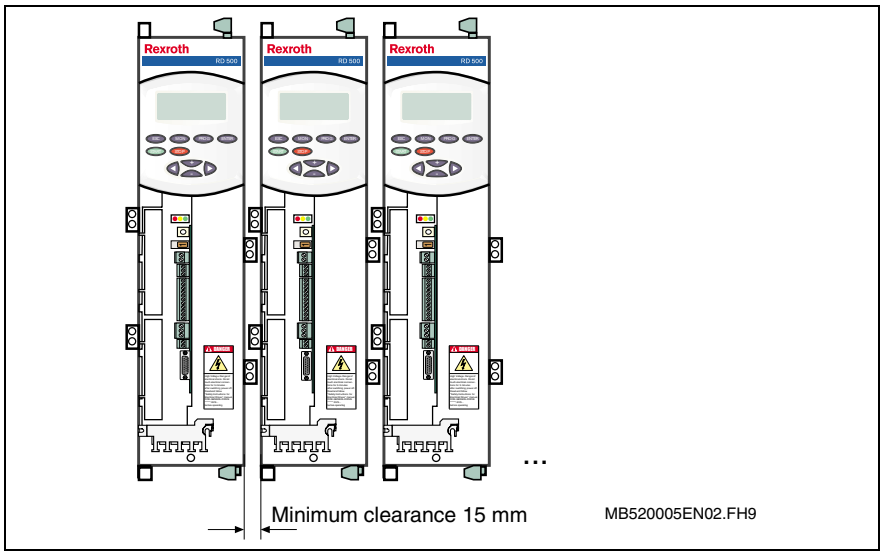


Fig.: 5-10 Arrangement of several devices next to each other for cooling type P

Dimension Drawings for Cooling Type D Size Classes A - B

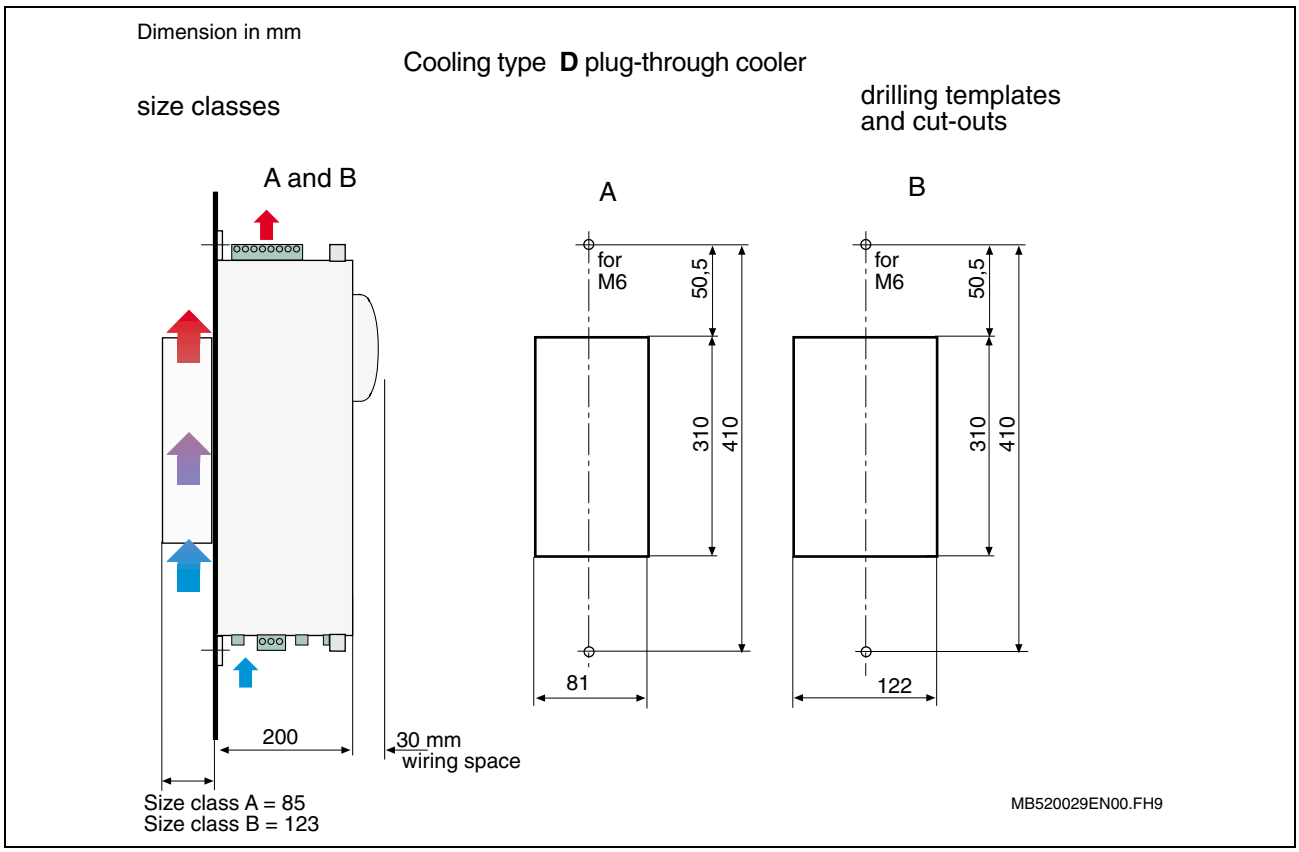


Abb. 5-11: Dimension Drawings for Cooling Type D Size Classes A - B

Minimum Cooling Spacing for Cooling Type L, P and D

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

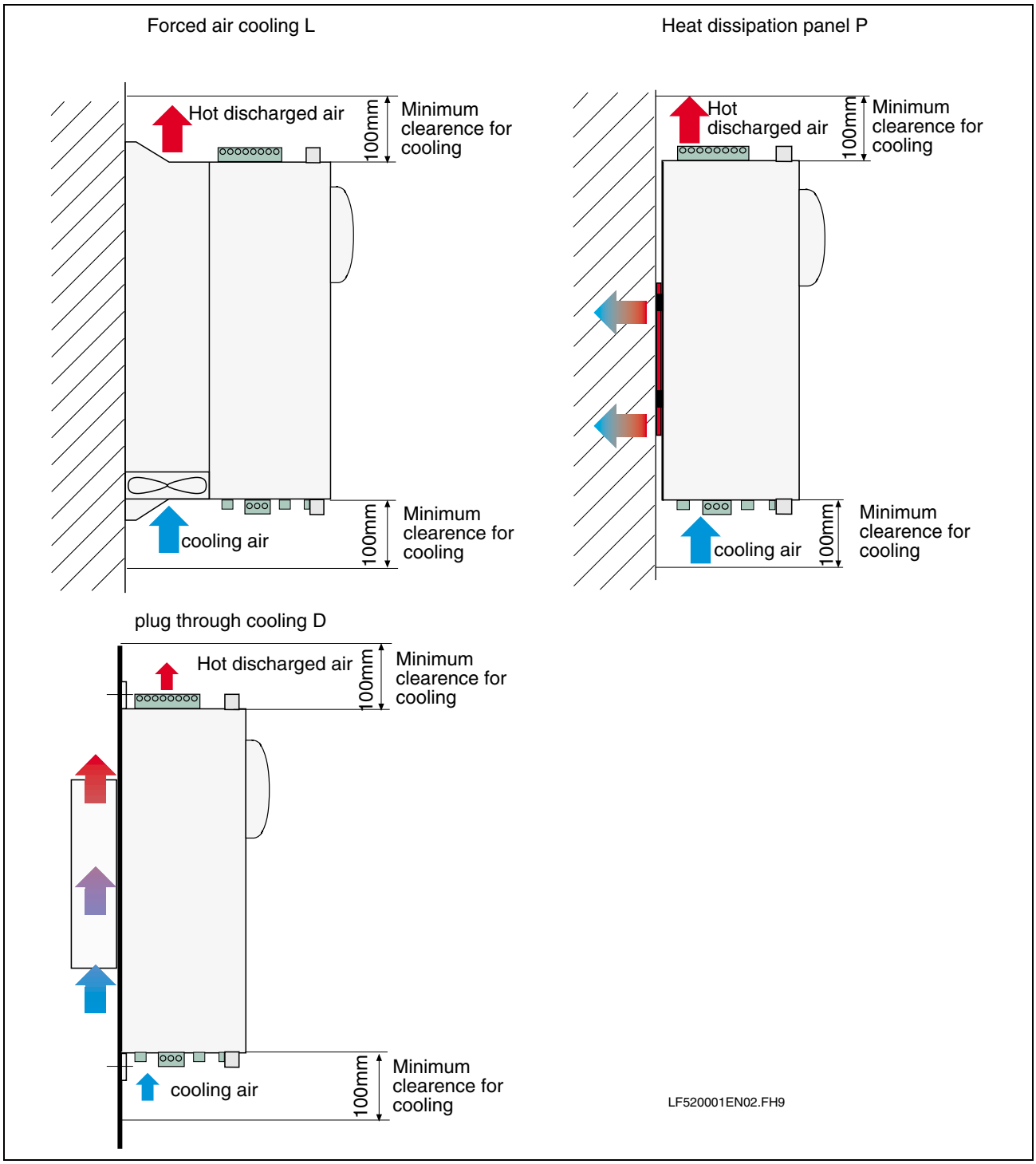


Fig.: 5-12 Minimum spacing for assembly

Dimension Drawing, Size Classes C, D, E

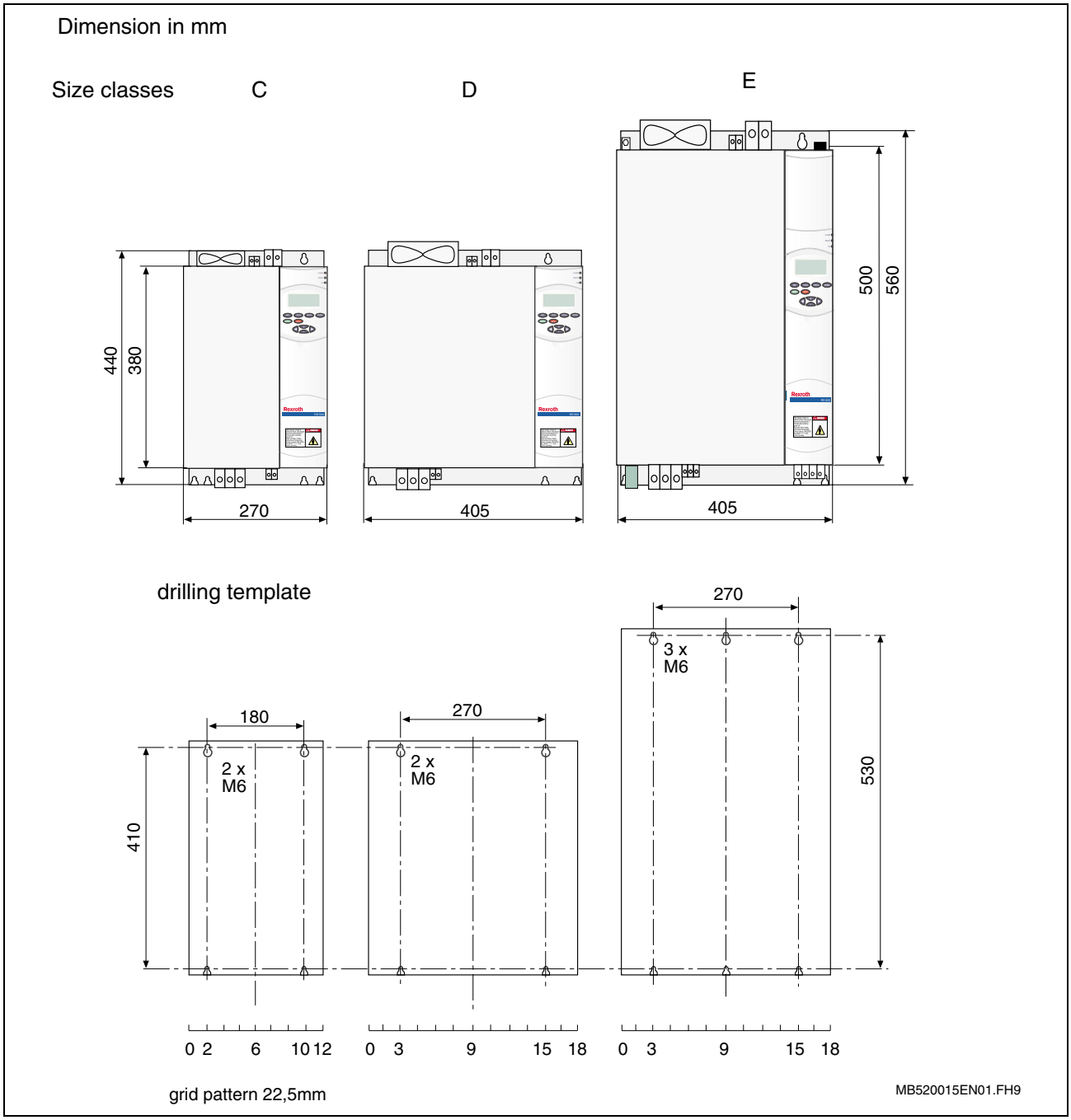


Fig.: 5-13 Dimension sheet, size classes C, D, E

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

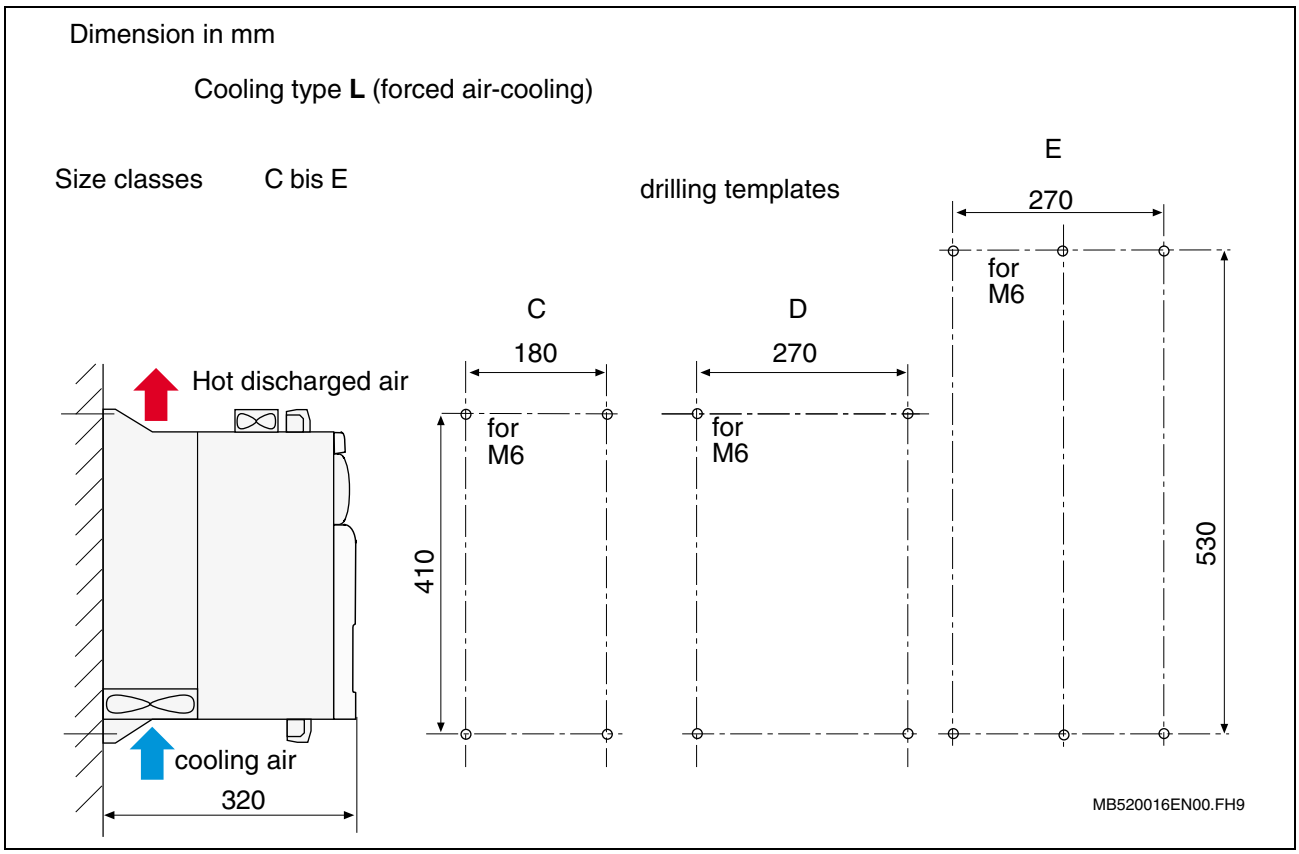


Fig.: 5-14 Dimension sheet for cooling type L, size classes C, D, E

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.

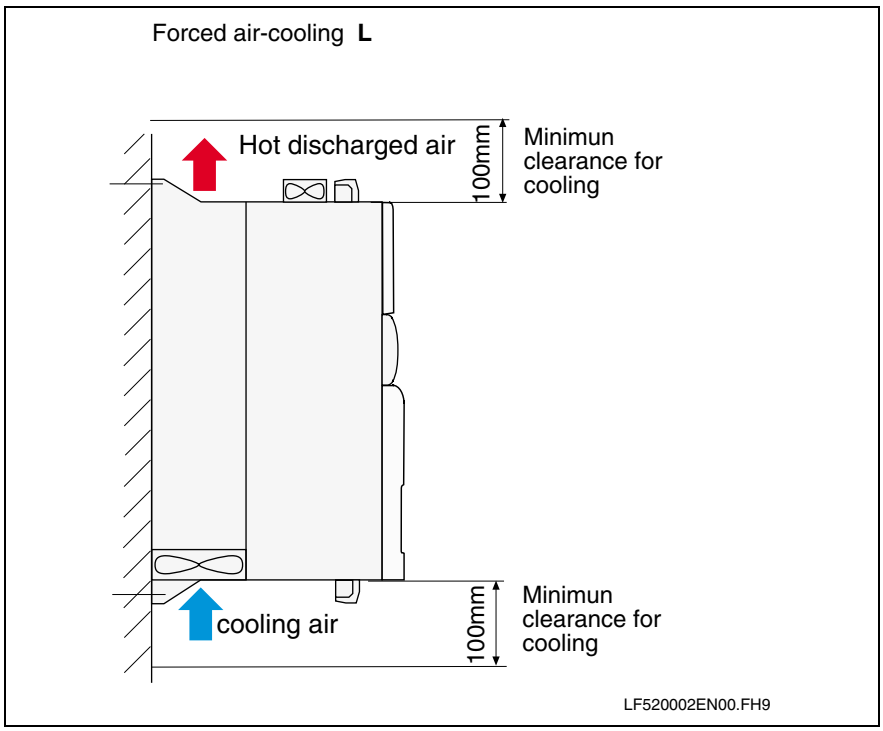


Fig.: 5-15 Minimum spacing for assembly

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

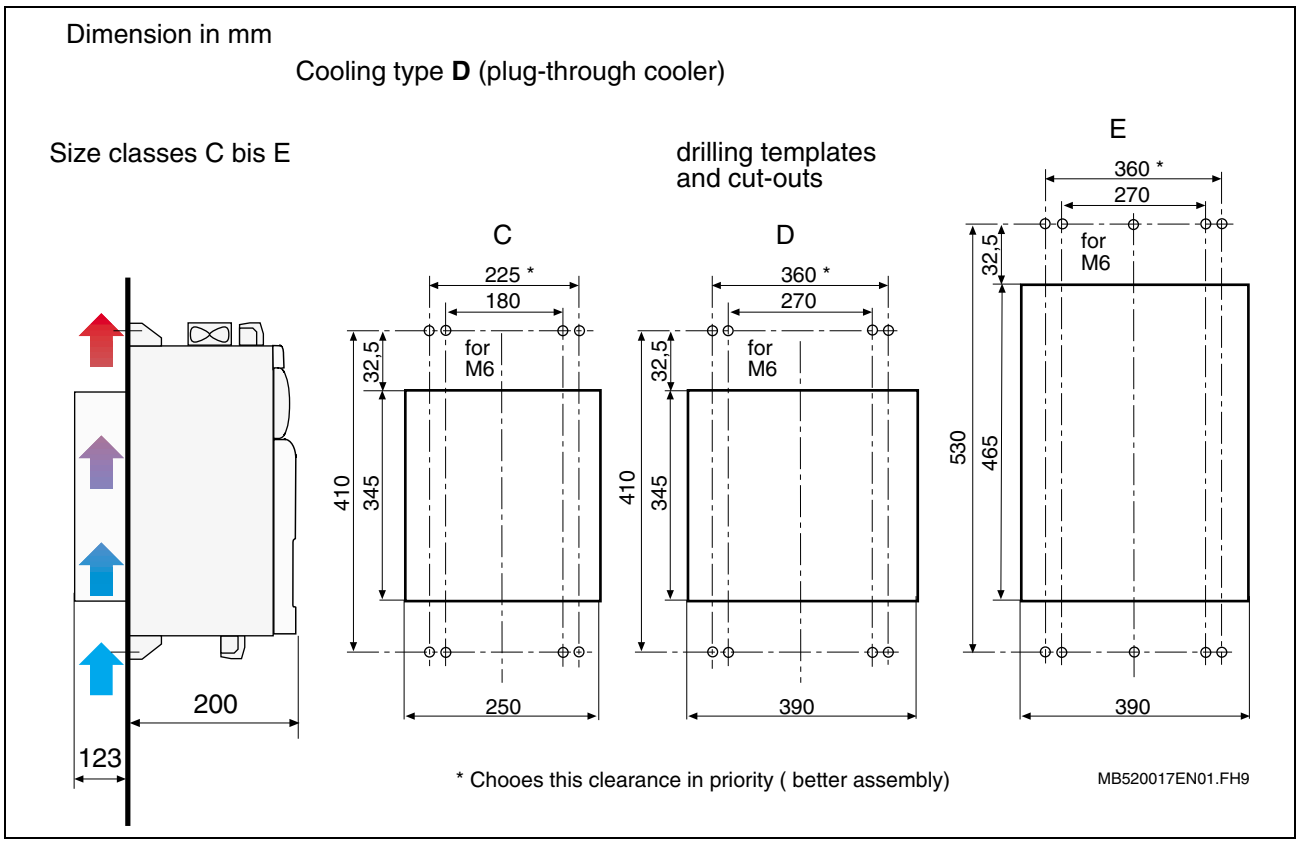


Fig.: 5-16 Dimension sheet for cooling type D, size classes C, D, E

Several Inverters next to Each Other with Through-Hole Cooling Size classes A - E

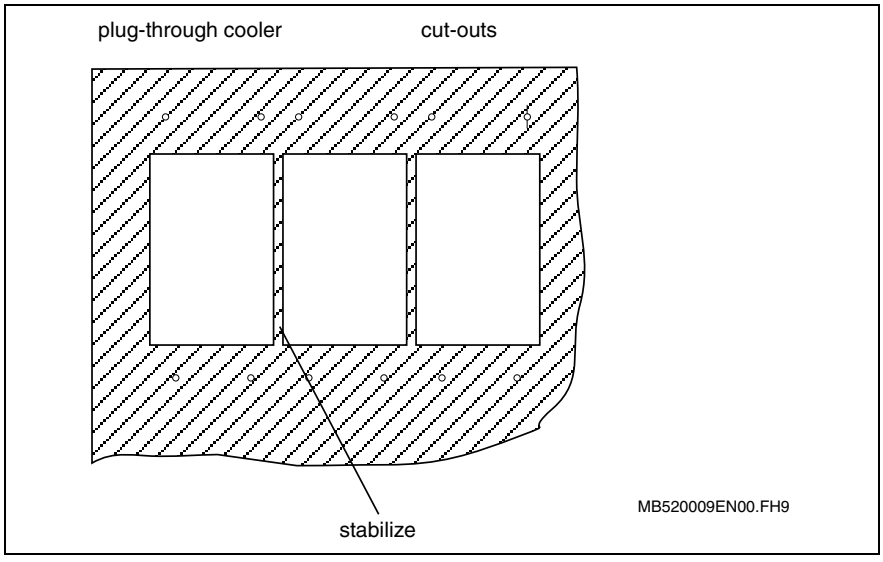


Fig.: 5-17 Cut-outs for devices with plug - through cooler

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

5.15 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.
- Connect the cooling circuit of the inverter RD52 hoses. More information in the next chapter.

Dimension Drawing, Size Class G with Cooling Type F

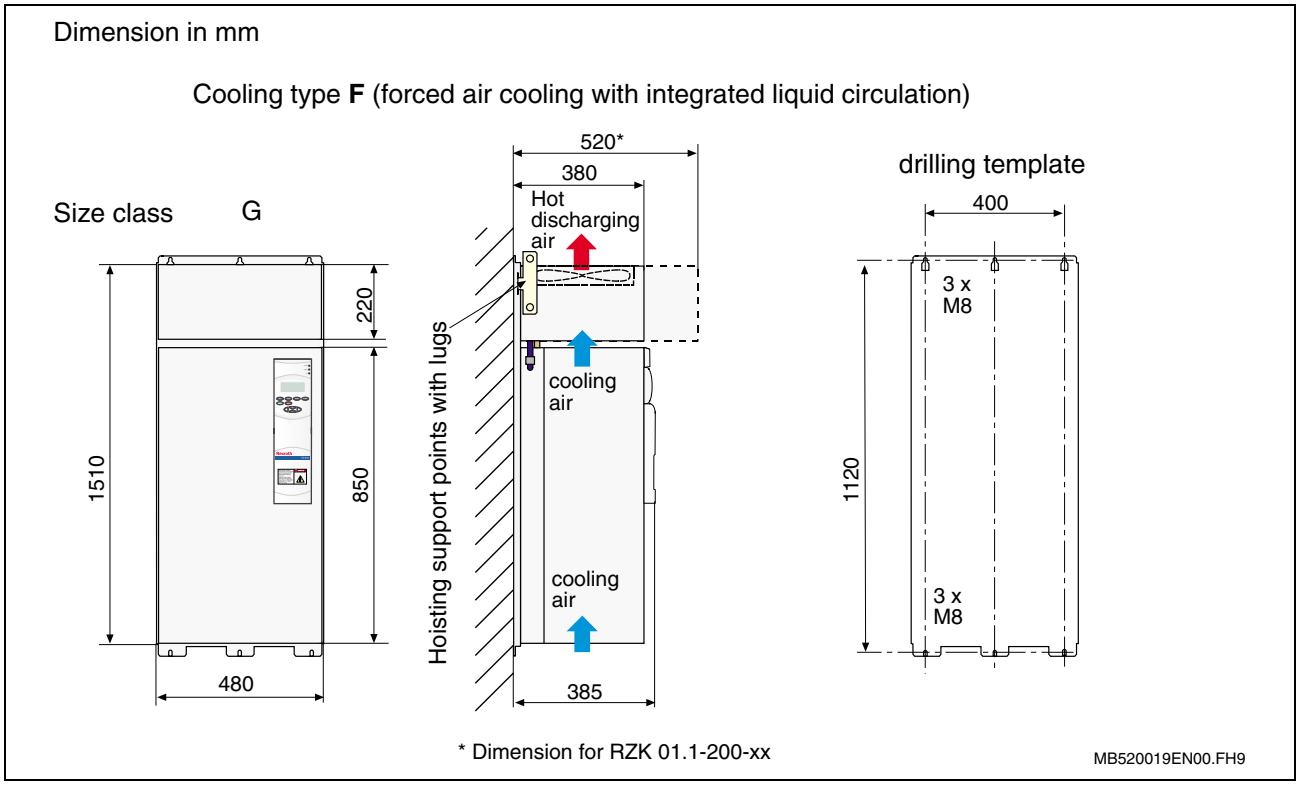


Fig.: 5-18 Dimension sheet of inverter, size class G with cooling type F

5.16 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.: 5-22 . 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.5.17 Depending on the requirements, the heat exchanger hoses must be ordered together with the inverter.

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.

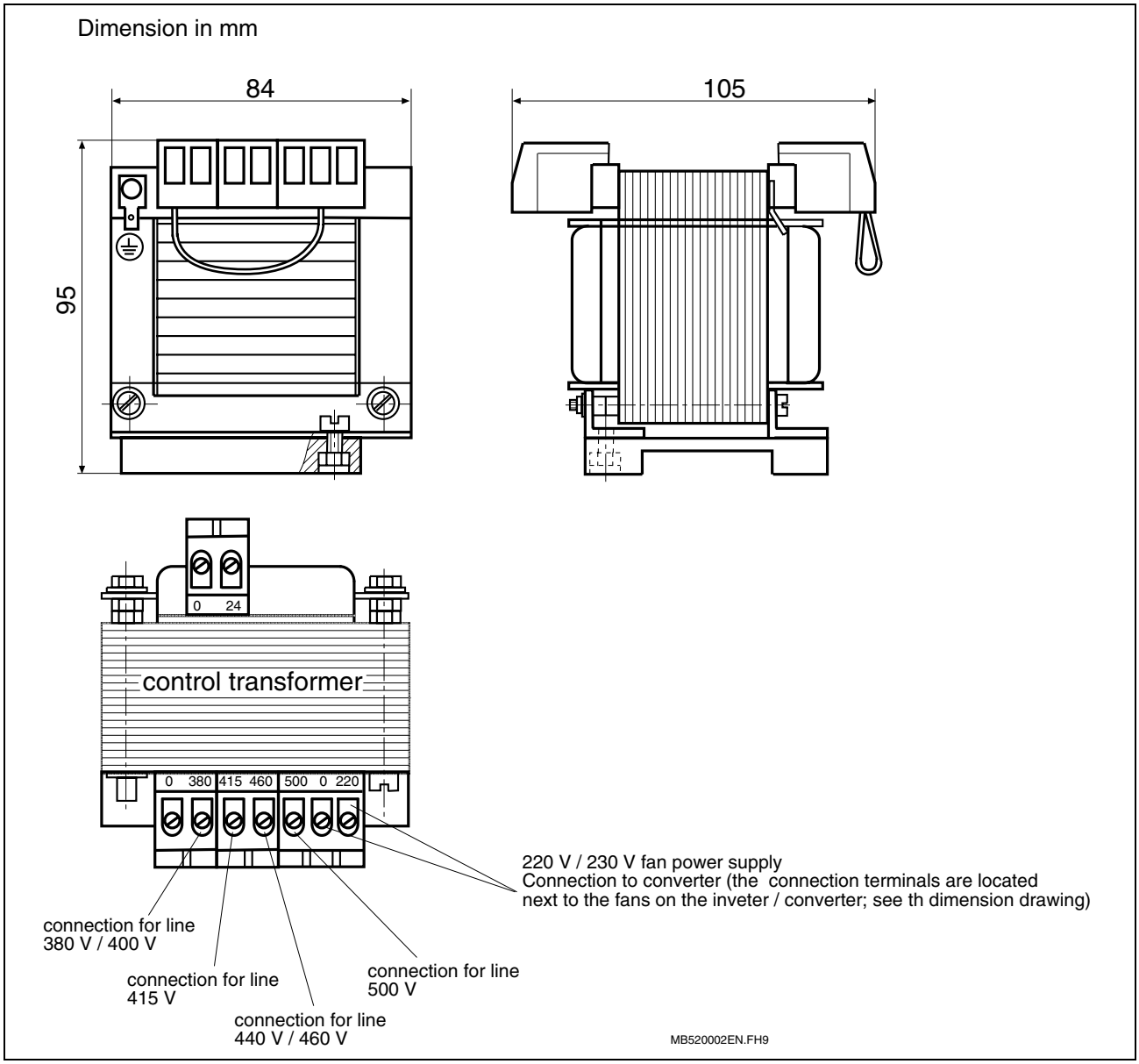


Fig.: 5-19 Separate fan transformer for 200 kW devices

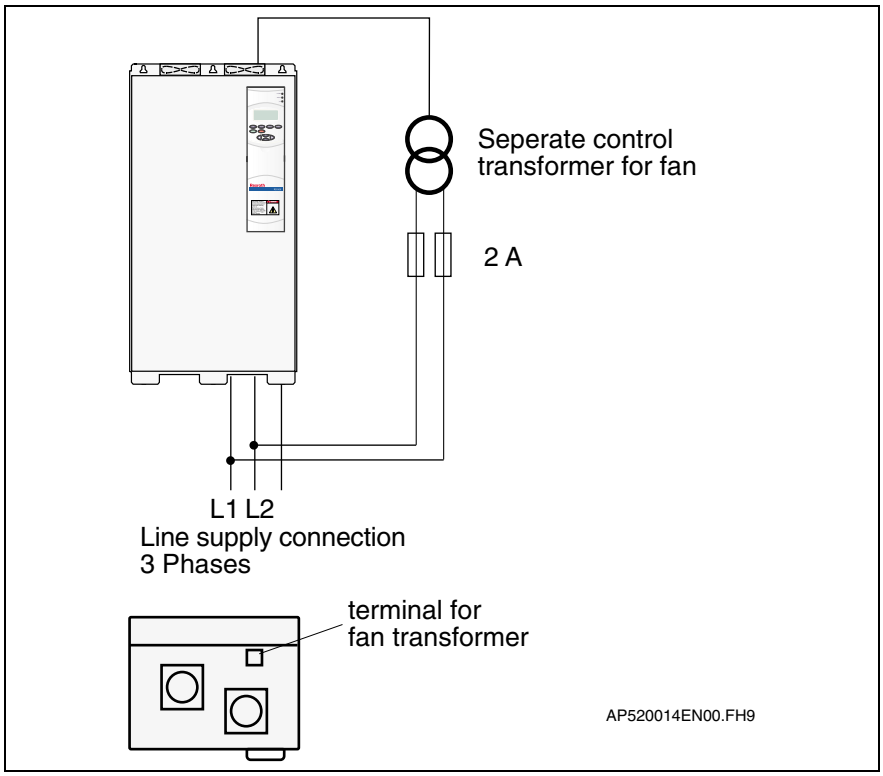


Fig.: 5-20 Connection plan for separate fan transformer for size class G with cooling type R

Dimension Drawing, Size Classes G with Cooling Type R

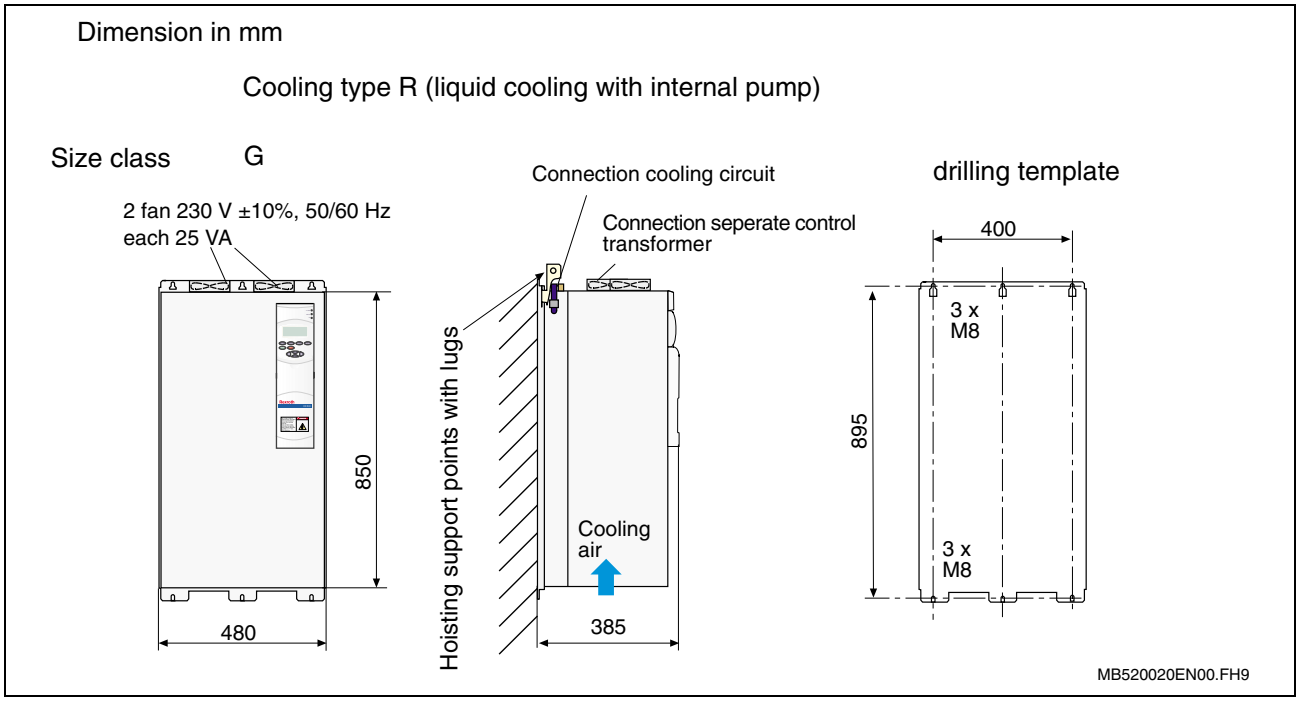


Fig.: 5-21 Dimension sheet of inverter, size classes G with cooling type R

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

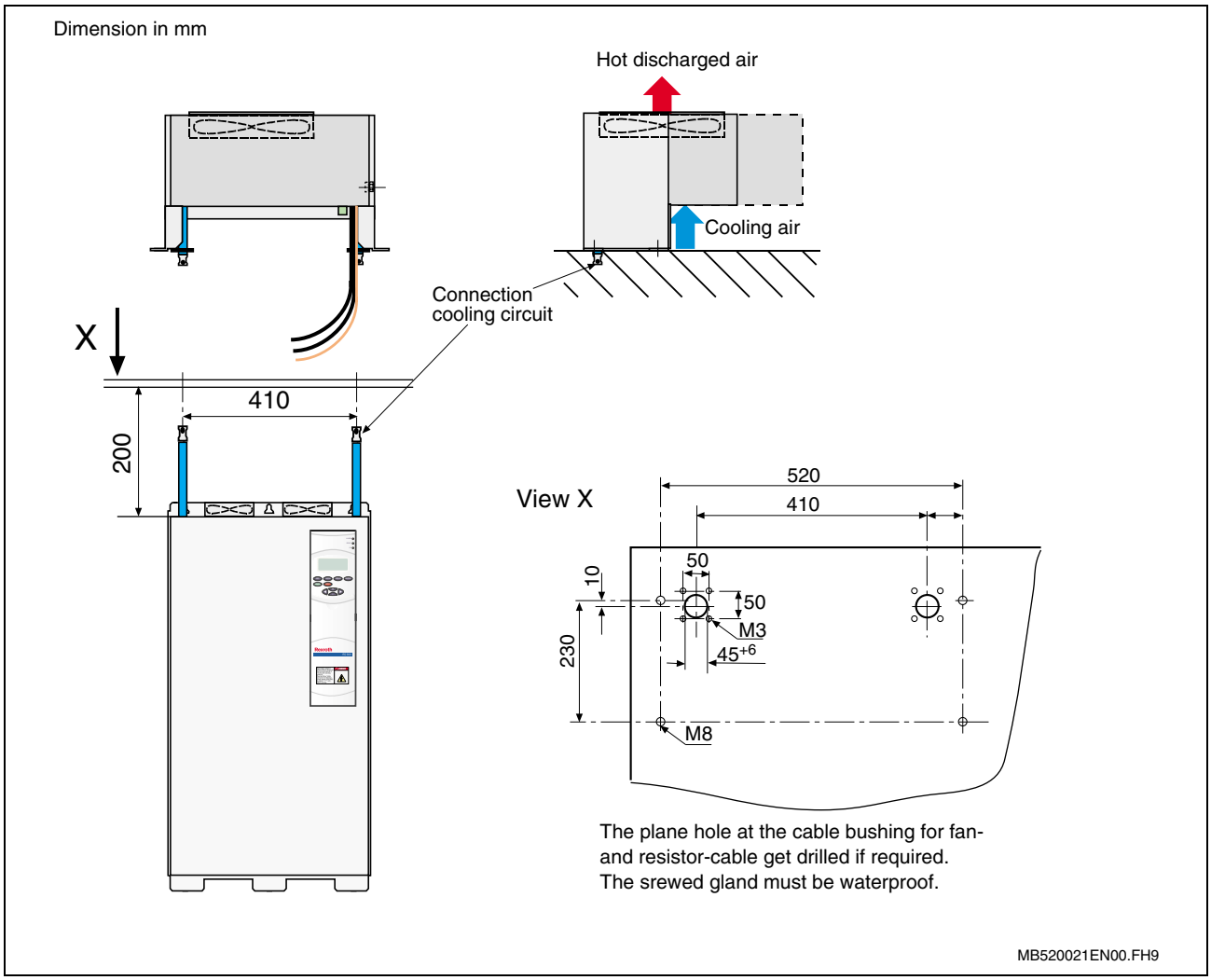


Fig.: 5-22 Dimension sheet for cabinet roof mounting, size class G

Mounting Drawing for Devices with External Heat Exchanger for Wall Mounting

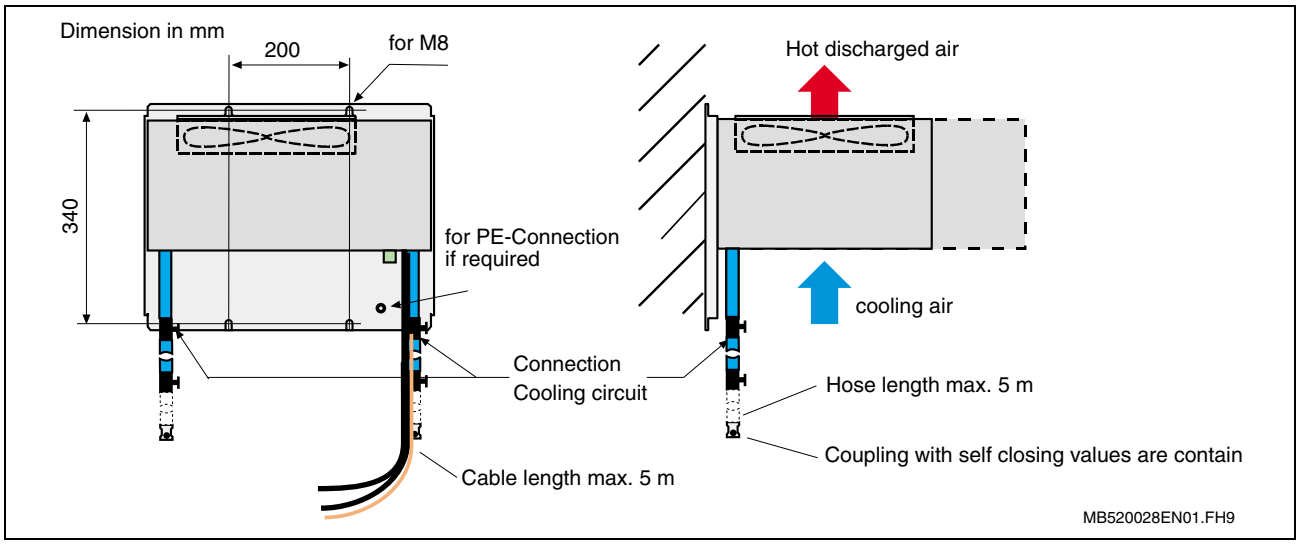


Fig.: 5-23 Dimension sheet for wall mounting, size class G

5.17 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. 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.

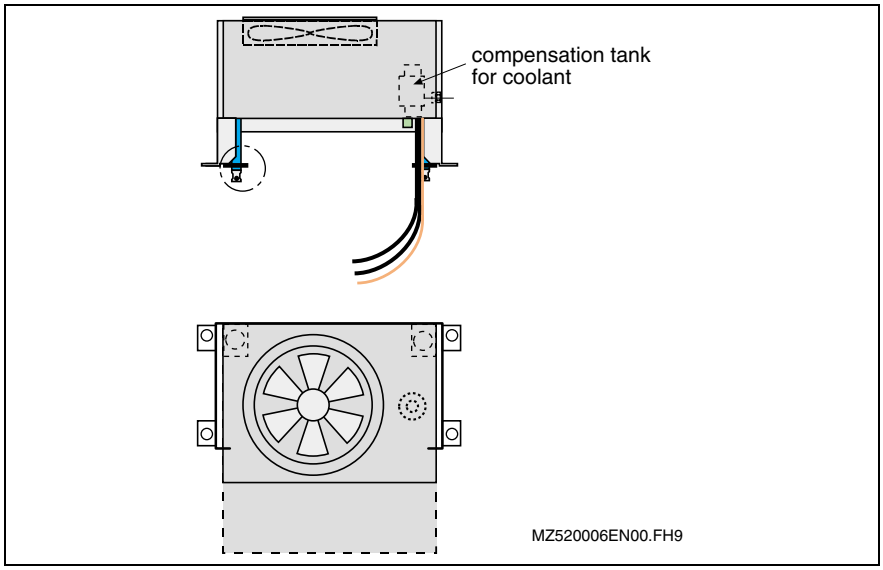


Fig.: 5-24 Compensation tank in external heat exchanger

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 50 V!

⇒ 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 30 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 10 mm^2 (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).

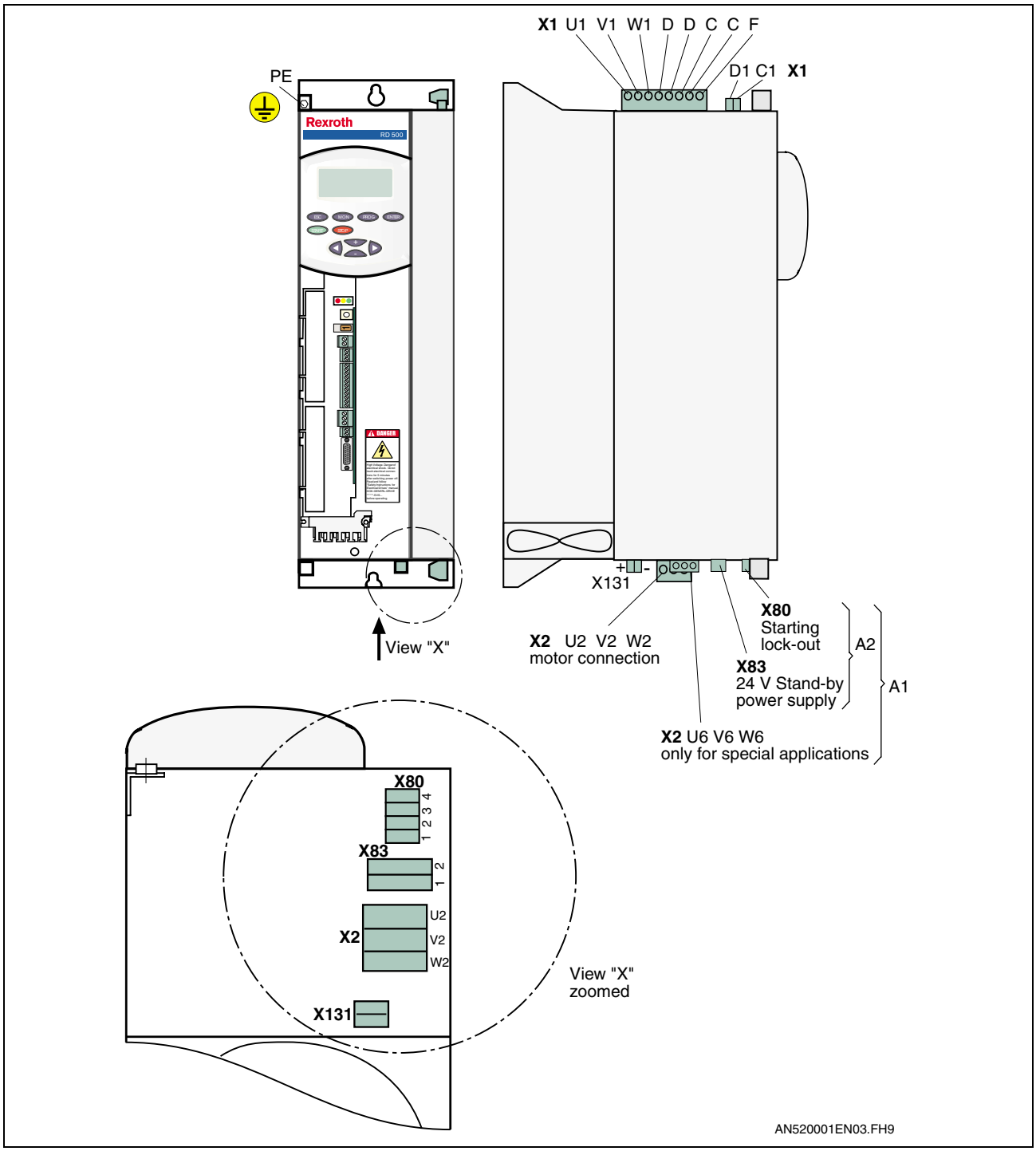
The following is assumed for the line supply feeder cables / DC link cables:

- 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 °F (90 °C) cables are used.

6.4 Power Terminals Size Classes A - E

Terminal Layout Diagram, Size Classes A - B



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

A2: 24 V Stand-by power supply and start inhibitor

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

Description of Inverter Power Terminals Size Classes A – B

X1, Line supply, DC link connection

Execution

RD52.2-xx- RD52.3-xx-	Type	pole number	Execution
003	Sub-unit	8	Plug on device
005	Sub-unit	8	Plug on device
007	Sub-unit	8	Plug on device
015	Sub-unit	8	Plug on device
018	Sub-unit	8	Plug on device

Tab. 6-1 Execution

Identification single connection

Identification	signification
U1	-
V1	-
W1	-
C	DC link connection (IC) L+
C	
D	DC link connection (IC) L-
D	
F	

Tab. 6-2 Identification single connection

Protective conductor connection

- Cross section (PE) min 10 mm² (AWG 6)
- steel plate lug on the housing with captive nut M5 (torque 2.5 – 3.0 Nm)

Connection cross-section

RD52.2-xx- RD52.3-xx-	Cable cross- section which can be connected 1), mm²	AWG
003	0.5 - 6	20 - 10
005	0.5 - 6	20 - 10
007	0.5 - 6	20 - 10
015	0.5 - 6	20 - 10
018	0.5 - 6	20 - 10

1): As a result of the terminal size

Tab. 6-3 Connection cross-section

Torque 1.2 – 1.5 Nm

X1, DC link connection

Execution

RD52.2-xx- RD52.3-xx-	Type	pole number	Execution
003	plug-in connection	2	Plug on device
005	plug-in connection	2	Plug on device
007	plug-in connection	2	Plug on device
015	plug-in connection	2	Plug on device
018	plug-in connection	2	Plug on device

Tab. 6-4 Execution

Identification single connection

Identification	signification		
C1	SNT supply +	Bridge to connection C	**Installation must be inherently short-circuit-proof**
D1	SNT supply -	Bridge to connection D	

Tab. 6-5 Identification single connection

Connection cross-section

RD52.2-xx- RD52.3-xx-	Cable cross- section which can be connected 1), mm²	AWG
003	0.5 – 2.5	20 - 14
005	0.5 – 2.5	20 - 14
007	0.5 – 2.5	20 - 14
015	0.5 – 2.5	20 - 14
018	0.5 – 2.5	20 - 14

1): As a result of the terminal size

Tab. 6-6 Connection cross-section

Torque 0.5 – 0.6 Nm

Fuses Inverter Size Classes A and B

Fuses

RD52.2-xx-	Maximum series fuse, type gL, A 1)
003	16
005	20
007	25
015	40
018	50

1): Safety values are provided for the DC 560 V input voltage and for the rated output X1 of the device. If the input voltage differs, the safety value must be changed.

Tab. 6-7 Series fuse

Fuses Motor Inverter SFT Size Classes A and B

Fuses

RD52.3-xx-	Maximum series fuse, type gL, A 1)
003	16
007	25
018	50

1): or AC-fuses with min. 750 V at L / R = 20 ms.

Tab. 6-8 Series fuse

X2, Motor connection

Execution

RD52.2-xx- RD52.3-xx-	Type	pole number	Execution
003	plug-in connection	3	Plug on device
005	plug-in connection	3	Plug on device
007	plug-in connection	3	Plug on device
015	plug-in connection	3	Plug on device
018	plug-in connection	3	Plug on device

Tab. 6-9 Execution

Identification single connection

Identification	signification
U2	Motor connection U
V2	Motor connection V
W2	Motor connection W

Tab. 6-10 Identification single connection

Protective conductor connection

Motor and shield connection for motor feeder cables

- Cross section (PE) min. 10 mm² (AWG6)
- steel plate lug on the housing with captive nut M5 (torque 2.5 – 3.0 Nm)

Connection cross-section

RD52.2-xx- RD52.3-xx-	Cable cross- section which can be connected 1), mm²	AWG
003	0.5 - 6	20 - 10
005	0.5 - 6	20 - 10
007	0.5 - 6	20 - 10
015	0.5 - 6	20 - 10
018	0.5 - 6	20 - 10

1): As a result of the terminal size

Tab. 6-11 Connection cross-section

Torque 1.2 – 1.5 Nm

X80 Starting lock-out (only in A1 and A2)

Execution

RD52.2-xx- RD52.3-xx-	Type	pole number	Execution
003	plug-in connection	4	Plug on device
005	plug-in connection	4	Plug on device
007	plug-in connection	4	Plug on device
015	plug-in connection	4	Plug on device
018	plug-in connection	4	Plug on device

Tab. 6-12 Execution

Identification single connection

Identification	signification
1	During operation, terminals 1 - 2 must be closed; when they are opened, the start of the connected motor is inhibited.
2	
3	Starting lock-out floating acknowledge contact, 30 V DC / 1 A N / C contact
4	

Tab. 6-13 Identification single connection

Connection cross-section

RD52.2-xx- RD52.3-xx-	Recommended minimum cross-section, mm²	AWG	Cable cross-section which can be connected, mm²	AWG
003	1	18	0.08 – 1.5	28 - 16
005	1	18	0.08 – 1.5	28 - 16
007	1	18	0.08 – 1.5	28 - 16
015	1	18	0.08 – 1.5	28 - 16
018	1	18	0.08 – 1.5	28 - 16

Tab. 6-14 Connection cross-section

Torque 0.22 – 0.25 Nm

X83, 24 V Stand-by power supply for the electronics (only in A1 and A2)

Execution

RD52.2-xx- RD52.3-xx-	Type	pole number	Execution
003	plug	2	Plug on device
005	plug	2	Plug on device
007	plug	2	Plug on device
015	plug	2	Plug on device
018	plug	2	Plug on device

Tab. 6-15 Execution

Identification single connection

Identification	signification
1	P24 V 24 V DC –15 / +20 %, ripple, max 5 % (VDE0411 / 500), power consumption ~40 W, startup current 5 A
2	ground

Tab. 6-16 Identification single connection

Connection cross-section

RD52.2-xx- RD52.3-xx-	Recommended minimum cross-section mm²	AWG	Cable cross-section which can be connected, mm²	AWG
003	1.5	16	0.2 – 2.5	24 - 14
005	1.5	16	0.2 – 2.5	24 - 14
007	1.5	16	0.2 – 2.5	24 - 14
015	1.5	16	0.2 – 2.5	24 - 14
018	1.5	16	0.2 – 2.5	24 - 14

Tab. 6-17 Connection cross-section

Torque 0.22 – 0.25 Nm

X2, Filter current feedback F1 (only in A1)

Execution

RD52.2-xx- RD52.3-xx-	Type	pole number	Execution
003	plug	3	Plug on device
005	plug	3	Plug on device
007	plug	3	Plug on device
015	plug	3	Plug on device
018	plug	3	Plug on device

Tab. 6-18 Execution

Identification single connection

Identification	signification
U6	Operation possible only with the original Refu filter
V6	
W6	

Tab. 6-19 Identification single connection

Connection cross-section

RD52.2-xx- RD52.3-xx-	Cable cross- section which can be connected mm²	AWG
003	0.2 - 4	24 - 12
005	0.2 - 4	24 - 12
007	0.2 - 4	24 - 12
015	0.2 - 4	24 - 12
018	0.2 - 4	24 - 12

Tab. 6-20 Connection cross-section

Torque 0.22 – 0.4 Nm

X131 Internal fan supply

Identification single connection

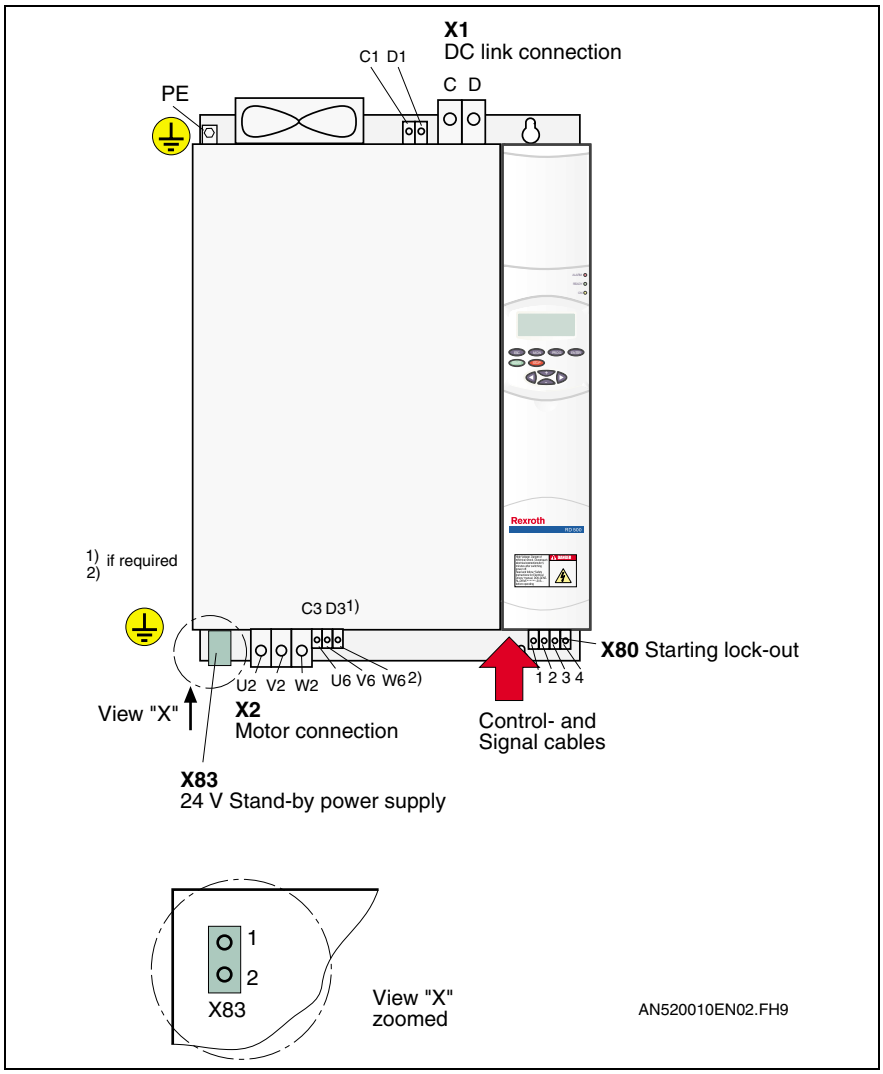
Identification	signification
+	Internal fan supply
-	

Tab. 6-21 Identification single connection

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 24 V Stand-by power supply (terminal X83) is only mounted if it was actually ordered.

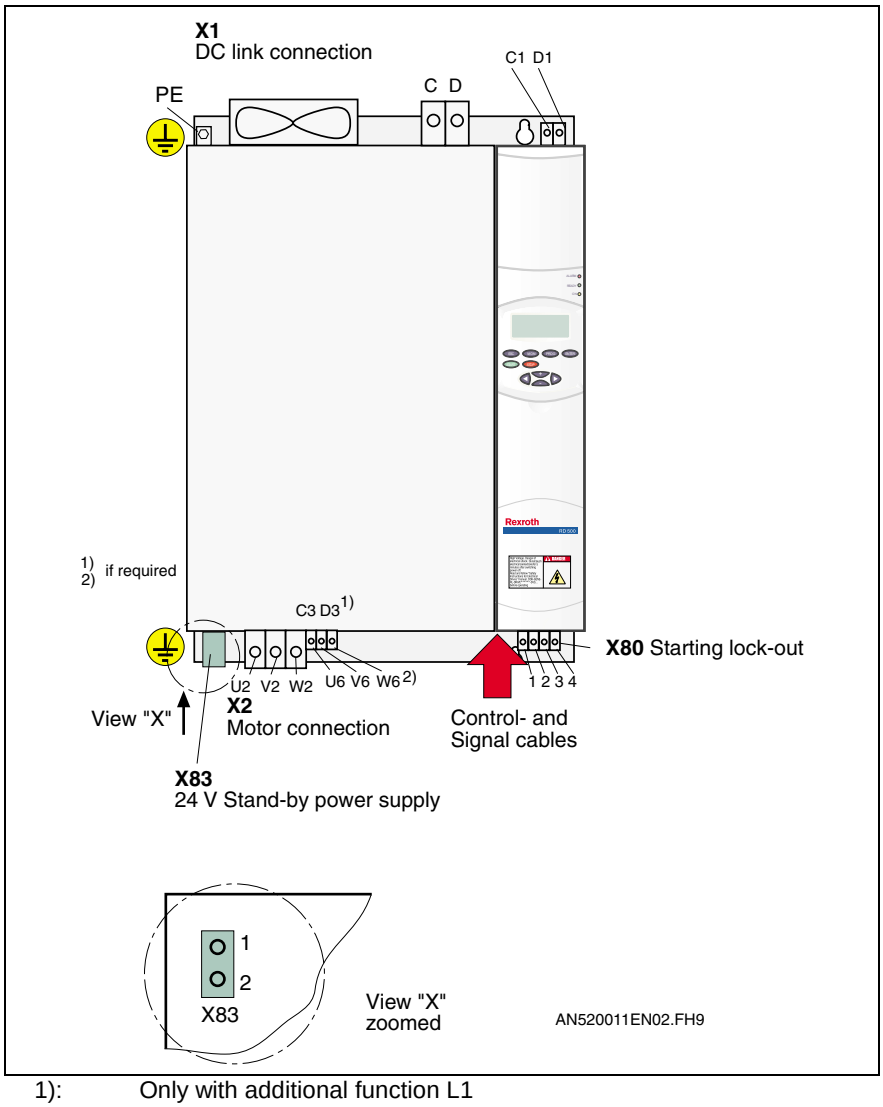


1): Only with additional function L1
2): Only with additional function F1

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

Terminal Layout Diagram Size Class E

Note: The additional function 24 V 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

Fig.: 6-3 Terminal layout diagram class E

Description of Inverter Power Terminals Size Classes C - E

X1 DC link connection

Execution

RD52.1-xx- RD52.3-xx-	Type	number	Execution
022	High current terminal	2	Terminal on mounting rail
030	High current terminal	2	Terminal on mounting rail
037	High current terminal	2	Terminal on mounting rail
045	High current terminal	2	Terminal on mounting rail
055	High current terminal	2	Terminal on mounting rail
075	High current terminal	2	Terminal on mounting rail
090	High current terminal	2	Terminal on mounting rail
110	High current terminal	2	Terminal on mounting rail

Tab. 6-22 Execution

Identification single connection

Identification	signification
C	DC link connection (IC) L+
D	DC link connection (IC) L-

Tab. 6-23 Identification single connection

Protective conductor connection

- Cross section (PE) min. 10 mm² (AWG 6)
- steel plate lug on the housing with captive nut
  - ... M6 at Size class C and D (torque 4.2 – 5.0 Nm)
  - ... M8 at Size class E (torque 12 Nm)

Connection cross-section

RD52.1-xx- RD52.3-xx-	Cable cross-section which can be connected 1), mm²	AWG	Torque in Nm
022	25 – 50	3 – 1/0	6.0 – 8.0
030	25 – 50	3 – 1/0	6.0 – 8.0
037	25 – 50	3 – 1/0	6.0 – 8.0
045	25 – 50	3 – 1/0	6.0 – 8.0
055	35 – 95	2 – 4/0	15.0 – 20.0
075	35 – 95	2 – 4/0	15.0 – 20.0
090	50 – 150	1/0 – 300MCM	25.0 – 30.0
110	50 – 150	1/0 – 300MCM	25.0 – 30.0

1): As a result of the terminal size

Tab. 6-24 Connection cross-section

Torque See table.

X1, SNT supply

Execution

RD52.1-xx- RD52.3-xx-	Type	Num- ber	Execution
022	Universal terminal	2	With mounting foot
030	Universal terminal	2	With mounting foot
037	Universal terminal	2	With mounting foot
045	Universal terminal	2	With mounting foot
055	Universal terminal	2	With mounting foot
075	Universal terminal	2	With mounting foot
090	High current bushing terminal	2	Screw connection
110	High current bushing terminal	2	Screw connection

Tab. 6-25 Execution

Identification single connection

Identification	signification		
C1	SNT supply +	Bridge to connection C	**Installation must be inherently short-circuit-proof**
D1	SNT supply -	Bridge to connection D	

Tab. 6-26 Identification single connection

Connection cross-section

RD52.1-xx- RD52.3-xx-	Cable cross-section which can be connected, mm²	AWG	Torque in Nm
022	0.2 – 4	24 – 12	0.6 – 0.8
030	0.2 – 4	24 – 12	0.6 – 0.8
037	0.2 – 4	24 – 12	0.6 – 0.8
045	0.2 – 4	24 – 12	0.6 – 0.8
055	0.2 – 4	24 – 12	0.6 – 0.8
075	0.2 – 4	24 – 12	0.6 – 0.8
090	0.5 – 10	20 – 8	2.0 – 2.3
110	0.5 – 10	20 – 8	2.0 – 2.3

Tab. 6-27 Connection cross-section

Torque See table.

Fuses Inverter Size classes C, D and E

Fuses

RD52.1-xx-	Maximum series fuse, type gL, A 1)
022	63
030	80
037	100
045	125
055	160
075	200
090	250
110	250

1): Safety values are provided for the DC 560 V input voltage and for the rated output X1 of the device. If the input voltage differs, the safety value must be changed.

Tab. 6-28 Series fuse

Fuses Motor Inverter SFT Size classes C, D and E

Fuses

RD52.3-xx-	Maximum series fuse, type gL, A 1)
030	63
045	100
055	125
075	160
090	200
110	250

1): or AC-fuses with min. 750 V at L / R = 20 ms.

Tab. 6-29 Series fuse

X2, Motor connection

Execution

RD52.1-xx- RD52.3-xx-	Type	Num- ber	Execution
022	High current bushing terminal	3	Screw connection
030	High current bushing terminal	3	Screw connection
037	High current bushing terminal	3	Screw connection
045	High current bushing terminal	3	Screw connection
055	High current bushing terminal	3	Screw connection
075	High current bushing terminal	3	Screw connection
090	High current bushing terminal	3	Screw connection
110	High current bushing terminal	3	Screw connection

Tab. 6-30 Execution

Identification single connection

Identification	signification
U2	Motor connection U
V2	Motor connection V
W2	Motor connection w

Tab. 6-31 Identification single connection

Protective conductor connection

- Cross section (PE) min. 10 mm² (AWG 6)
- steel plate lug on the housing with captive nut...
  - ...M6 at Size class C and D (torque 4.2 – 5.0 Nm)
  - ...M8 at Size class E (torque 12 Nm)

Connection cross-section

RD52.1-xx- RD52.3-xx-	Cable cross- section which can be connected 1), mm²	AWG	Torque in Nm
022	25 – 50	3 – 1/0	6.0 – 8.0
030	25 – 50	3 – 1/0	6.0 – 8.0
037	25 – 50	3 – 1/0	6.0 – 8.0
045	25 – 50	3 – 1/0	6.0 – 8.0
055	35 – 95	2 – 4/0	15.0 – 20.0
075	35 – 95	2 – 4/0	15.0 – 20.0
090	50 – 150	1/0 – 300MCM	25.0 – 30.0
110	50 – 150	1/0 – 300MCM	25.0 – 30.0

1): As a result of the terminal size

Tab. 6-32 Connection cross-section

Torque See table.

X2, cable damping L1

Execution

RD52.1-xx- RD52.3-xx-	Type	Num- ber	Execution
022	High current bushing terminal	2	Screw connection
030	High current bushing terminal	2	Screw connection
037	High current bushing terminal	2	Screw connection
045	High current bushing terminal	2	Screw connection
055	High current bushing terminal	2	Screw connection
075	High current bushing terminal	2	Screw connection
090	High current bushing terminal	2	Screw connection
110	High current bushing terminal	2	Screw connection

Tab. 6-33 Execution

Identification single connection

Identification	signification
C3	DC link L+
D3	DC link L-

Tab. 6-34 Identification single connection

Connection cross-section

RD52.1-xx- RD52.3-xx-	Cable cross- section which can be connected 1), mm²	AWG	Torque in Nm
022	0.5 – 10	20 – 8	1.5 – 1.8
030	0.5 – 10	20 – 8	1.5 – 1.8
037	0.5 – 10	20 – 8	1.5 – 1.8
045	0.5 – 10	20 – 8	1.5 – 1.8
055	0.5 – 16	20 – 6	2.0 – 2.3
075	0.5 – 16	20 – 6	2.0 – 2.3
090	0.5 – 16	20 – 6	2.0 – 2.3
110	0.5 – 16	20 – 6	2.0 – 2.3

1): As a result of the terminal size

Tab. 6-35 Connection cross-section

Torque See table.

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, Filter current feedback

Execution

RD52.1-xx- RD52.3-xx-	Type	number	Execution
022	High current bushing terminal	3	Screw connection
030	High current bushing terminal	3	Screw connection
037	High current bushing terminal	3	Screw connection
045	High current bushing terminal	3	Screw connection
055	High current bushing terminal	3	Screw connection
075	High current bushing terminal	3	Screw connection
090	High current bushing terminal	3	Screw connection
110	High current bushing terminal	3	Screw connection

Tab. 6-36 Execution

Identification single connection

Identification	signification
U6	Operation possible only with the original Bosch Rexroth filter
V6	
W6	

Tab. 6-37 Identification single connection

Connection cross-section

RD52.1-xx- RD52.3-xx-	Cable cross-section which can be connected, mm²	AWG	Torque in Nm
022	0.5 – 10	20 – 8	1.5 – 1.8
030	0.5 – 10	20 – 8	1.5 – 1.8
037	0.5 – 10	20 – 8	1.5 – 1.8
045	0.5 – 10	20 – 8	1.5 – 1.8
055	0.5 – 16	20 – 6	2.0 – 2.3
075	0.5 – 16	20 – 6	2.0 – 2.3
090	0.5 – 16	20 – 6	2.0 – 2.3
110	0.5 – 16	20 – 6	2.0 – 2.3

Tab. 6-38 Connection cross-section

Torque See table.

X80, Starting lock-out

Execution

RD52.1-xx- RD52.3-xx-	Type	pole number	Execution
022	plug-in connection	4	Plug on device
030	plug-in connection	4	Plug on device
037	plug-in connection	4	Plug on device
045	plug-in connection	4	Plug on device
055	plug-in connection	4	Plug on device
075	plug-in connection	4	Plug on device
090	plug-in connection	4	Plug on device
110	plug-in connection	4	Plug on device

Tab. 6-39 Execution

Identification single connection

Identification	signification
1	During operation, terminals 1 - 2 must be closed; when they are opened, the start of the connected motor is inhibited.
2	
3	Starting lock-out floating acknowledge contact, 30 V DC / 1 A N / C contact
4	

Tab. 6-40 Identification single connection

Connection cross-section

RD52.1-xx- RD52.3-xx-	Recommended minimum cross-section mm²	AWG	Cable cross-section which can be connected, mm²	AWG
022	1	18	0.08 – 1.5	28 - 16
030	1	18	0.08 – 1.5	28 - 16
037	1	18	0.08 – 1.5	28 - 16
045	1	18	0.08 – 1.5	28 - 16
055	1	18	0.08 – 1.5	28 - 16
075				
090	1	18	0.08 – 1.5	28 - 16
110	1	18	0.08 – 1.5	28 - 16

Tab. 6-41 Connection cross-section

Torque 0.22 – 0.25 Nm

X83, 24 V Stand-by power supply for the electronics (only in A1 and A2)

Execution

RD52.1-xx- RD52.3-xx-	Type	pole number	Execution
022	plug	2	Plug on device
030	plug	2	Plug on device
037	plug	2	Plug on device
045	plug	2	Plug on device
055	plug	2	Plug on device
075	plug	2	Plug on device
090	plug	2	Plug on device
110	plug	2	Plug on device

Tab. 6-42 Execution

Identification single connection

Identification	signification
1	P24 V 24 V DC –15 / +20 %, ripple, max 5 % (VDE0411 / 500), power consumption ~40 W, startup current 5 A
2	ground

Tab. 6-43 Identification single connection

Connection cross-section

RD52.1-xx- RD52.3-xx-	Recommended minimum cross-section mm²	AWG	Cable cross-section which can be connected, mm²	AWG
022	1.5	16	0.2 – 2.5	24 - 14
030	1.5	16	0.2 – 2.5	24 - 14
037	1.5	16	0.2 – 2.5	24 - 14
045	1.5	16	0.2 – 2.5	24 - 14
055	1.5	16	0.2 – 2.5	24 - 14
075	1.5	16	0.2 – 2.5	24 - 14
090	1.5	16	0.2 – 2.5	24 - 14
110	1.5	16	0.2 – 2.5	24 - 14

Tab. 6-44 Connection cross-section

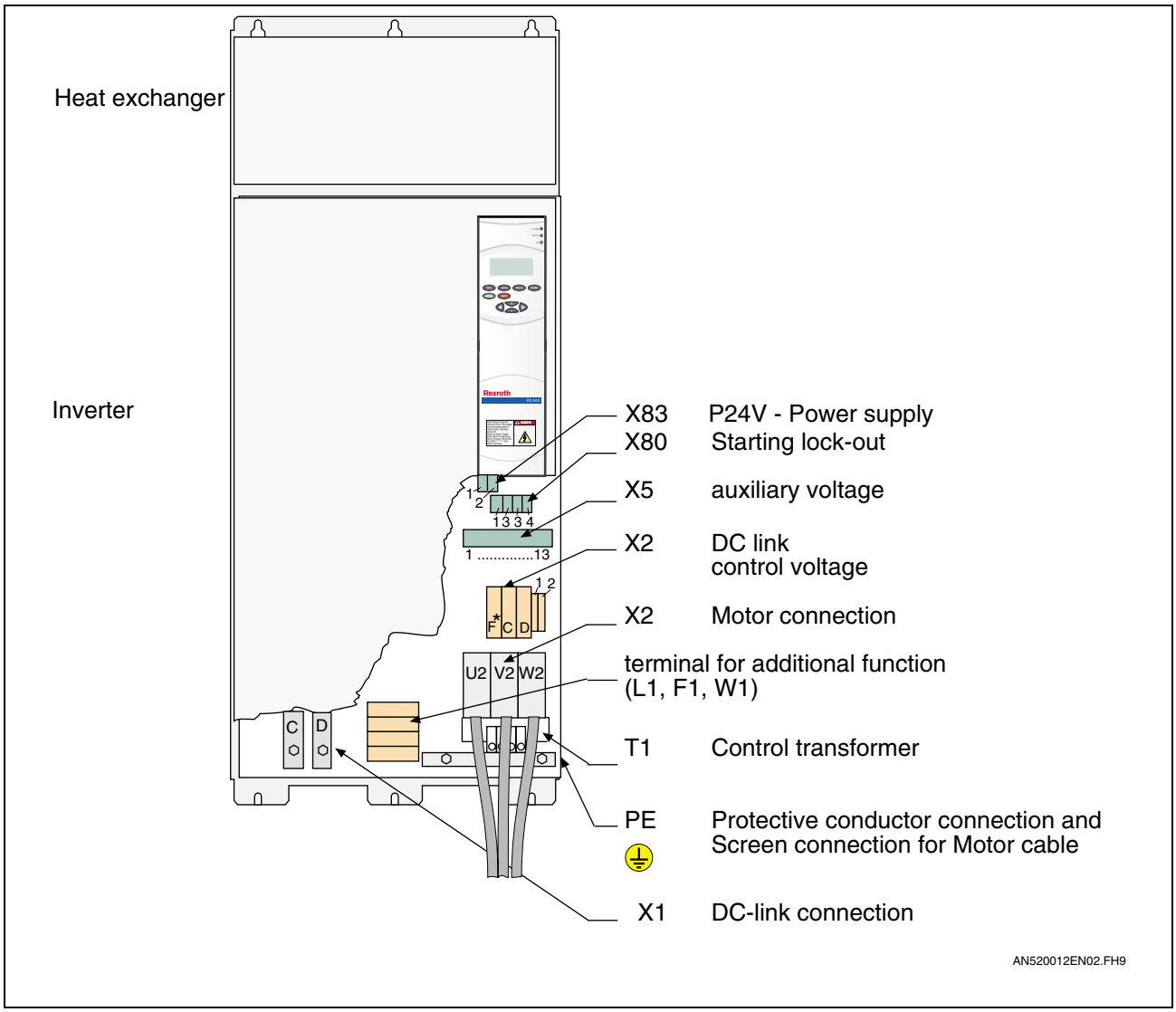
Torque 0.22 – 0.25 Nm

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 Size Class G

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

Terminal Layout Diagram Inverter Size Class G



*) optionaly

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

Description of Power Terminals Inverter Size Class G

X1, DC link connection

Execution

RD52.1-xx-	Type	number	Execution
132	Stud connection	2	rail
160	Stud connection	2	rail
200	Stud connection	2	rail

Tab. 6-5: Execution

Identification single connection

Identification	signification
C	DC link connection L+
D	DC link connection L-

Tab. 6-6: Identification single connection

Protective conductor connection

- Stud M8 (torque 12.0 Nm).

Connection cross-section

RD52.1-xx-	Cable cross-section which can be connected mm²
132	M12
160	M12
200	M12

Tab. 6-7: Connection cross-section

torque 50 Nm.

X1, DC link connection SFT

Execution

RD52.3-xx-	Type	number	Execution
160	Stud connection	2	rail

Tab. 6-8: Execution

Identification single connection

Identification	signification
C	DC link connection L+
D	DC link connection L-

Tab. 6-9: Identification single connection

Protective conductor connection Stud M8 (torque 12.0 Nm).

Connection cross-section

RD52.33-xx-	Recommended cross-section mm²	AWG
160	95	2 x 4/0

Tab. 6-10: Connection cross-section

torque 50 Nm.

X2, DC link, control terminal

Execution

RD52.1-xx- RD52.3-xx-	Type	number	Execution
132	feed-through terminal	2 + 1*	terminal block
160	feed-through terminal	2 + 1*	terminal block
200	feed-through terminal	2 + 1*	terminal block

*): at additional function Brake resistor

Tab. 6-11: Execution

Identification single connection

Identification	signification
C	DC link terminal L+
D	DC link terminal L-
F*	Brake resistor

*): at additional function Brake resistor

Tab. 6-12: Identification single connection

Connection cross-section

RD52.1-xx- RD52.3-xx-	Cable cross-section which can be connected mm²	AWG
132	10 – 35	8 - 2
160	10 – 35	8 - 2
200	10 – 35	8 - 2

Tab. 6-13: Connection cross-section

torque 4.0 – 5.0 Nm

X2, fan connection

Execution

RD52.1-xx- RD52.3-xx-	Type	number	Execution
132	feed-through terminal	2	terminal block
160	feed-through terminal	2	terminal block
200	feed-through terminal	2	terminal block

Abb. 6-14: Execution

Identification single connection

Identification	signification
1 (L / P)	Connection for the heat exchanger fan
2 (0 V AC)	

Tab. 6-15: Identification single connection

Connection cross-section

RD52.1-xx- RD52.3-xx-	Cable cross-section which can be connected mm²	AWG
132	0.5 - 6	20 - 10
160	0.5 - 6	20 - 10
200	0.5 - 6	20 - 10

Tab. 6-16: Connection cross-section

torque 0.5 – 1.0 Nm.

Fuses inverter Size class G

fuses

RD52.1-xx-	Maximum series fuse, type gL, A 1)
132	250
160	315
200	400

1): Safety values are provided for the DC 560 V input voltage and for the rated output X1 of the device. If the input voltage differs, the safety value must be changed.

Tab. 6-17: series fuses

Fuses motor inverter SFT- Operation Size class G

fuses

RD52.3-xx-	Maximum series fuse Type gL at 750 V in A 1)
160	315

1): or AC-fuses with min. 750 V at L / R = 20 ms.

Tab. 6-18: series fuses

X2, Motor connection

Execution

RD52.1-xx- RD52.3-xx-	Type	number	Execution
132	High current terminal	3	Terminal on mounting rail
160	High current terminal	3	Terminal on mounting rail
200	High current terminal	3	Terminal on mounting rail

Tab. 6-19: Execution

Identification single connection

Identification	signification
U2	Motor connection U
V2	Motor connection V
W2	Motor connection W

Tab. 6-20: Identification single connection

Protective conductor connection

- Stud M8 (torque 12.0 Nm)

Connection cross-section

RD52.1-xx- RD52.3-xx-	Cable cross-section which can be connected 1) mm²	AWG
132	50 - 150	1/0 – 6/0
160	50 - 150	1/0 – 6/0
200	70 - 240	2/0 – 500MCM

1): As a result of the terminal size

Tab. 6-21: Connection cross-section

torque 25 – 30 Nm.

X5, control voltage

Execution

RD52.1-xx-	Type	Pole-number	Execution
132	plug	13	Plug on device
160	plug	13	Plug on device
200	plug	13	Plug on device

Tab. 6-22: Execution

Identification single connection

Identification	signification	
1	Supply voltage	Voltage class 7: AC 400 V 50 / 60 Hz Voltage class 8: AC 500 V 50 / 60 Hz
3	Supply voltage	

Tab. 6-23: Identification single connection

Connection cross-section

RD52.1-xx-	Cable cross-section which can be connected [1] in mm²	AWG
132	0.2 – 2.5	24 - 12
160	0.2 – 2.5	24 - 12
200	0.2 – 2.5	24 - 12

1): As a result of the terminal size

Tab. 6-24: Connection cross-section

torque 0.5 – 0.6 Nm.

X5, control voltage SFT- Operation

Execution

RD52.3-xx-	Type	Pole-number	Execution
160	plug	13	Plug on device

Tab. 6-25: Execution

Identification single connection

Identification	signification	power consumption
7	AC 230 V ± 10 % 50/60 Hz	Cooling mode F: 250 VA Cooling mode R: 150 VA Cooling mode W: 60 VA
13	N	

Tab. 6-26: Identification single connection

Connection cross-section

RD52.3-xx-	Cable cross-section which can be connected [1] in mm²	AWG
160	0.2 – 2.5	24 - 12

1): As a result of the terminal size

Tab. 6-27: Connection cross-section

torque 0.5 – 0.6 Nm.

X2, L1 cable damping (additional function)

Execution

RD52.1-xx- RD52.3-xx-	Type	number	Execution
132	Universal terminal	2	Terminal on mounting rail
160	Universal terminal	2	Terminal on mounting rail
200	Universal terminal	2	Terminal on mounting rail

Tab. 6-28: Execution

Identification single connection

Identification	signification
C3	Feedback cable damping
D3	

Tab. 6-29: Identification single connection

Connection cross-section

RD52.1-xx- RD52.3-xx-	Cable cross-section which can be connected [1)] in mm²	AWG
132	0.75 – 35	18 - 2
160	0.75 – 35	18 - 2
200	0.75 – 35	18 - 2

1): As a result of the terminal size

Abb. 6-30: Connection cross-section

torque 3.2 – 3.7 Nm.

X2, F1 Filter current feedback (additional function)

Execution

RD52.1-xx- RD52.3-xx-	Type	number	Execution
132	High current terminal	3	Terminal on mounting rail
160	High current terminal	3	Terminal on mounting rail
200	High current terminal	3	Terminal on mounting rail

Tab. 6-31: Execution

Identification single connection

Identification	signification
U6	Operation possible only with the original Refu filter
V6	
W6	

Tab. 6-32: Identification single connection

Connection cross-section

RD52.1-xx- RD52.3-xx-	Cable cross-section which can be connected in mm²	AWG
132	25 - 50	3 – 1/0
160	25 - 50	3 – 1/0
200	25 - 50	3 – 1/0

Tab. 6-33: Connection cross-section

torque 6 – 8 Nm.

X2, W1 95 mm² terminal C and F (additional function)

Execution

RD52.1-xx-	Type	number	Execution
132	High current terminal	3	Terminal on mounting rail
160	High current terminal	3	Terminal on mounting rail
200	High current terminal	3	Terminal on mounting rail

Tab. 6-34: Execution

Identification single connection

Identification	signification
C	Forced terminal for brake resistor
F	

Tab. 6-35: Identification single connection

Connection cross-section

RD52.1-xx-	Cable cross-section which can be connected in mm²	AWG
132	35 - 95	2 – 4/0
160	35 - 95	2 – 4/0
200	35 - 95	2 – 4/0

Tab. 6-36: Connection cross-section

torque 15 – 20 Nm.

X80, starting lock-out

Execution

RD52.1-xx- RD52.3-xx-	Type	Pole number	Execution
132	Plug-in connection	4	Plug on device
160	Plug-in connection	4	Plug on device
200	Plug-in connection	4	Plug on device

Tab. 6-37: Execution

Identification single connection

Identification	signification
1	During operation, terminals 1 - 2 must be closed; when they are opened, the start of the connected motor is inhibited.
2	
3	Starting lock-out floating acknowledge contact, 30 V DC / 1 A N / C contact
4	

Tab. 6-38: Identification single connection

Connection cross-section

RD52.1-xx- RD52.3-xx-	Recommended minimum cross-section mm²	AWG	Cable cross-section which can be connected, mm²	AWG
132	1	18	0.08 – 1.5	28 - 16
160	1	18	0.08 – 1.5	28 - 16
200	1	18	0.08 – 1.5	28 - 16

Tab. 6-39: Connection cross-section

torque 0.22 – 0.25 Nm.

X83, 24 V-power supply for the electronics

Execution

RD52.1-xx- RD52.3-xx-	Type	Pol number	Execution
132	plug	2	Plug on device
160	plug	2	Plug on device
200	plug	2	Plug on device

Tab. 6-40: Execution

Identification single connection

Identification	signification
1	P24 V 24 V DC –15 / +20 %, ripple, max 5 % (VDE0411 / 500), power consumption ~80 W, startup current 15 A
2	ground

Tab. 6-41: Identification single connection

Connection cross-section

RD52.1-xx- RD52.3-xx-	Recommended minimum cross-section mm²	AWG	Cable cross-section which can be connected, mm²	AWG
132	1.5	16	0.2 – 2.5	24 - 14
160	1.5	16	0.2 – 2.5	24 - 14
200	1.5	16	0.2 – 2.5	24 - 14

Tab. 6-42: Connection cross-section

torque 0.22 – 0.25 Nm.

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 530 V ... 670 V – 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 700 V – the control transformer is designed for AC 500 V on the primary side.

For devices SFT- operation: control transformer inapplicable.

CAUTION

Material damage due to overload of the component!

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

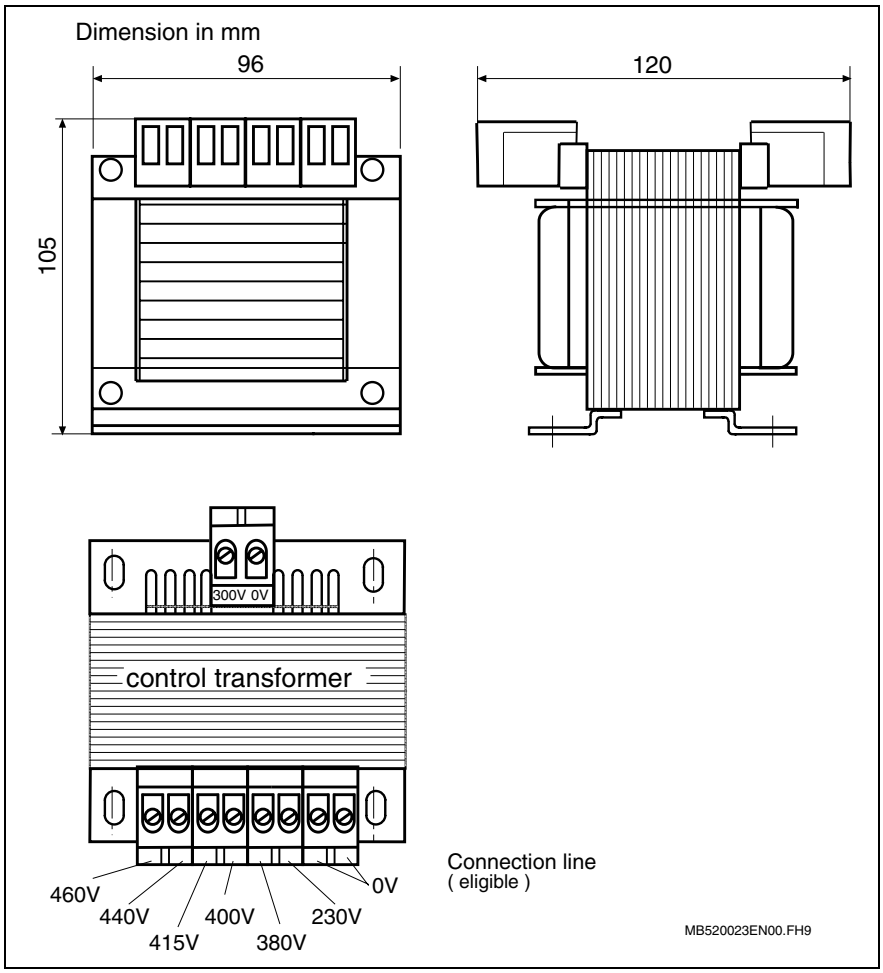
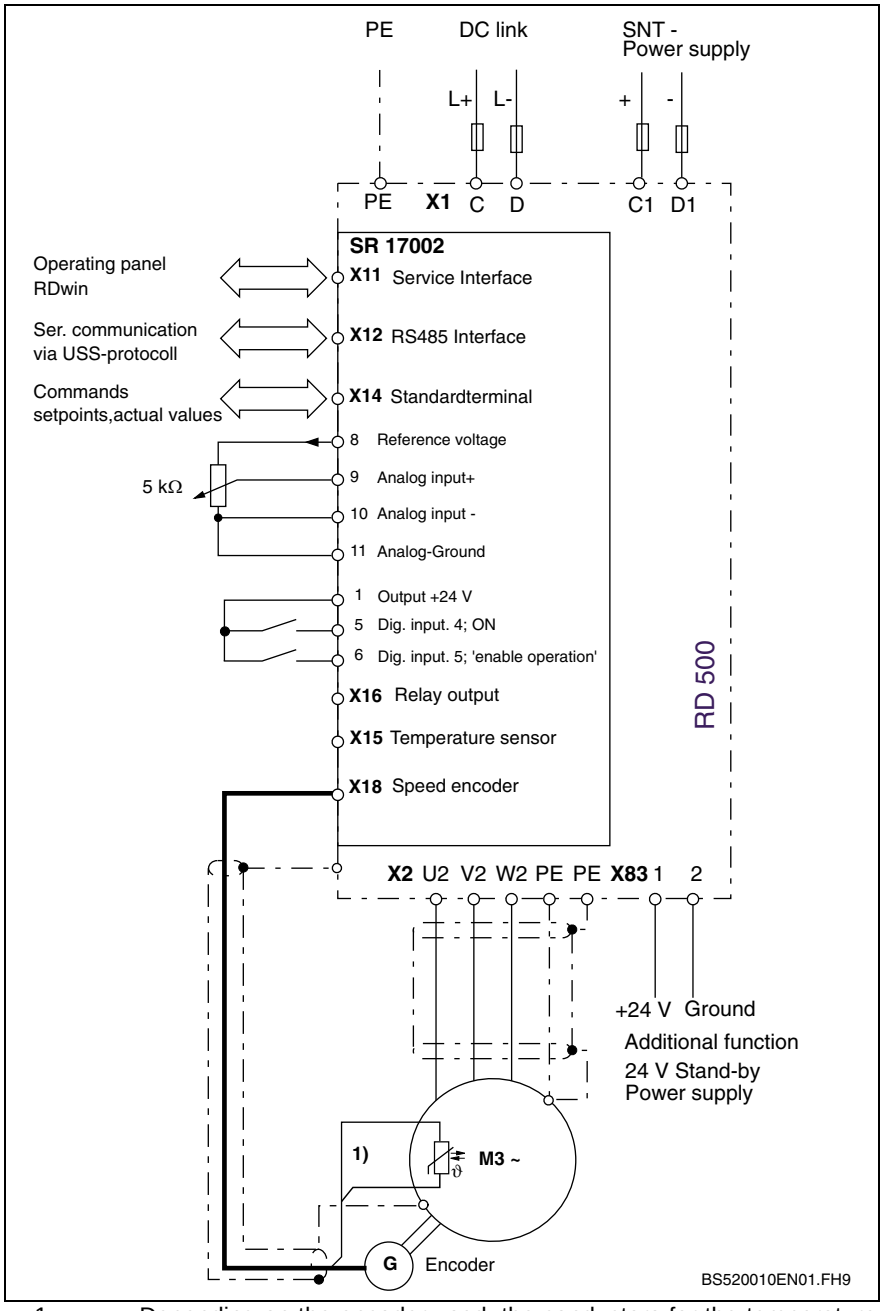


Fig.: 6-43 Control Transformer T1

6.6 Connection Diagram

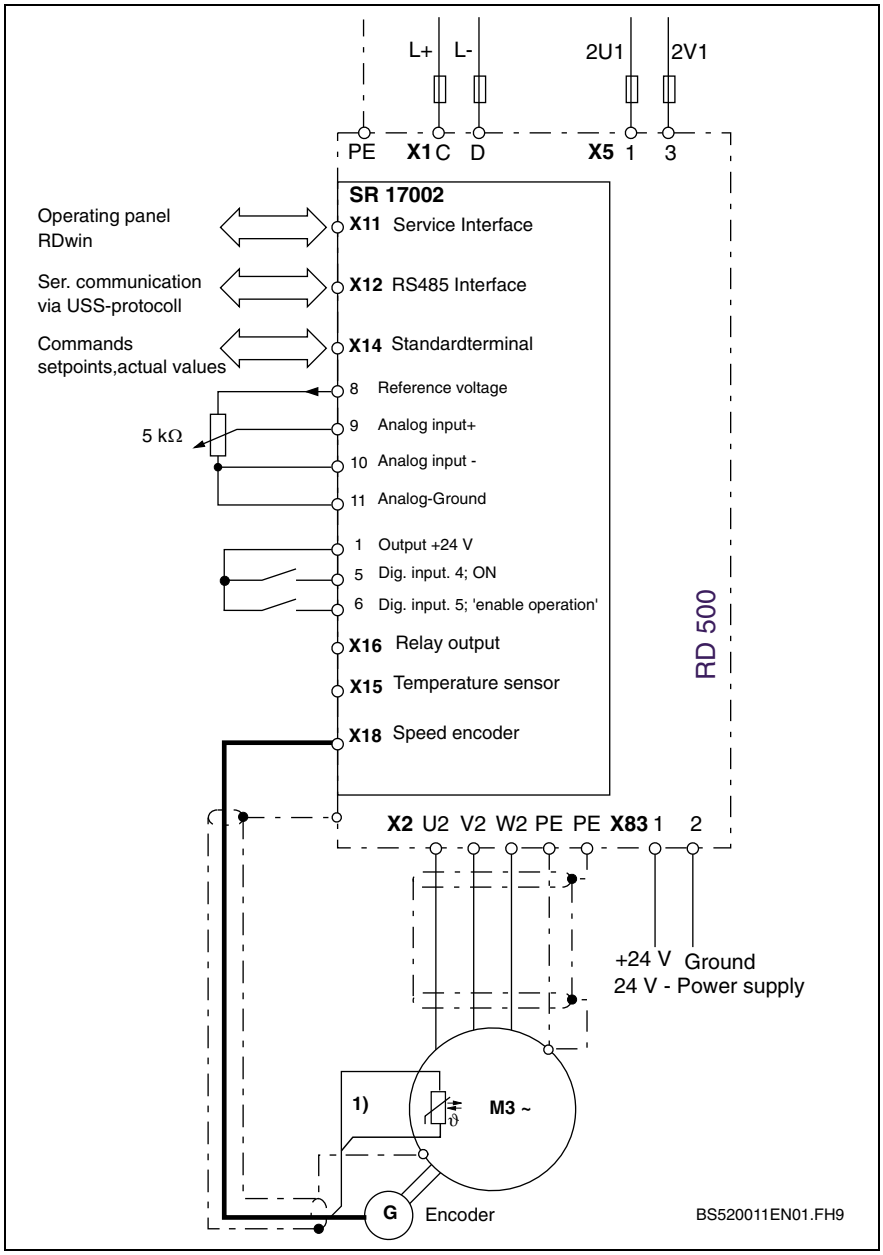
Connection Diagram Inverter size classes A - E



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.: 6-44 Connection diagram for inverter size classes A - E

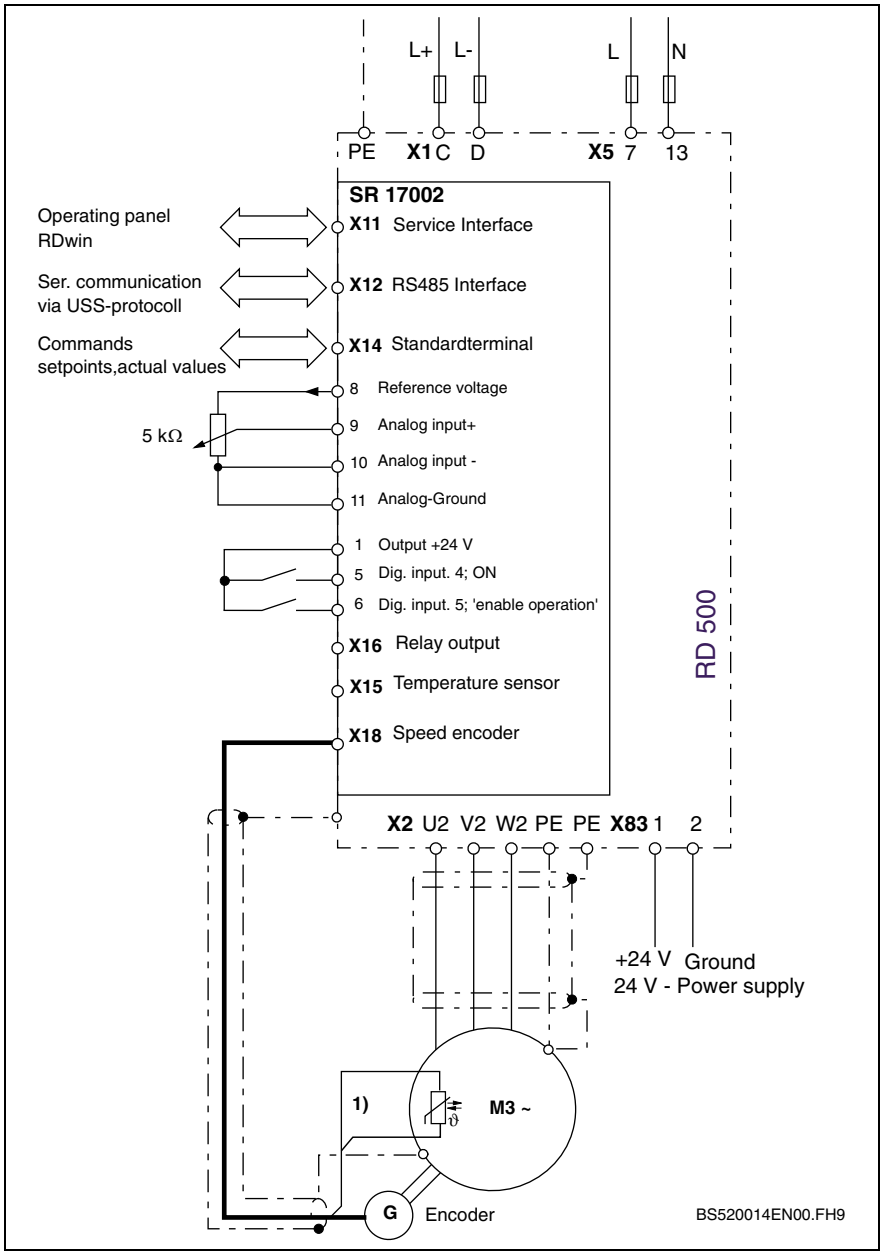
Connection Diagram Inverter size class G (RD52.1)



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.:6-45 Connection diagram for inverter size class G

Connection Diagram Inverter SFT size class G (RD52.3)



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.:6-46 Connection diagram for inverter SFT size class G

6.7 Control terminals see Chapter 4.7

6.8 Encoder connection see Chapter 4.8

6.9 Service Interface (RS232) see Chapter 4.9

6.10 Standard Interface (RS482) see Chapter 4.10

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 and CAN bus are available for setting parameters.

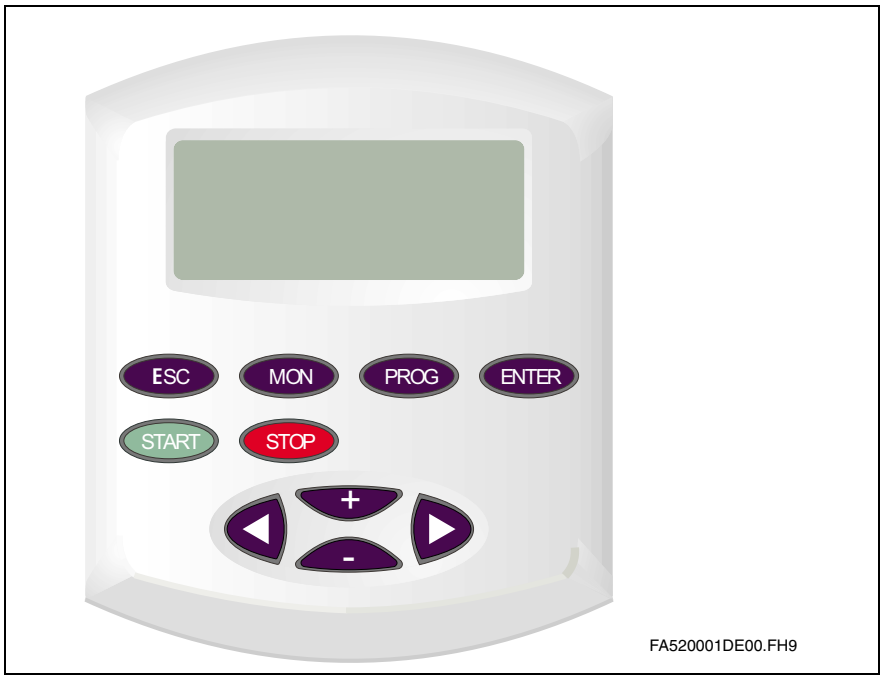


Fig. 7-1: User panel with graphics display (accessory)

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

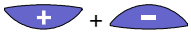
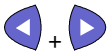
Key	Response
	If these keys are simultaneously pressed: – the complete parameter number is set to zero (numerical list). – the complete parameter value is set to zero (for numerical parameters).
	If these two keys are pressed simultaneously, the factory setting of the active value is set.
	If these keys 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

Standard values

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

Fault message	Cause	Solution
Parameter inhibited	Device is operational.	Inhibit the inverter and then change the parameter.
Data conflict (general)	Some parameter settings are dependent on others. If a parameter value is changed and acknowledged with Enter, this can result in a data conflict.	
Data conflict, e.g. P0109.00 with P0046	The specified current limit in P0109.00 is too high for this device for the selected pulse frequency (P0026).[1]	The value of the first parameter change is temporarily accepted with Prog; after the second parameter change, acknowledge both values with Enter - they are then saved.

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.

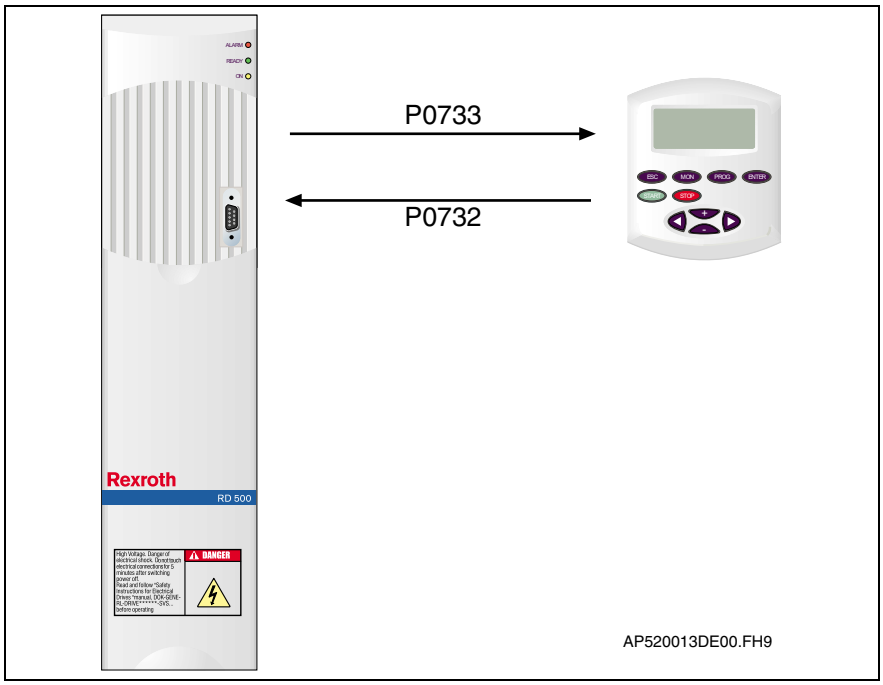


Fig. 7-8: Copy function

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

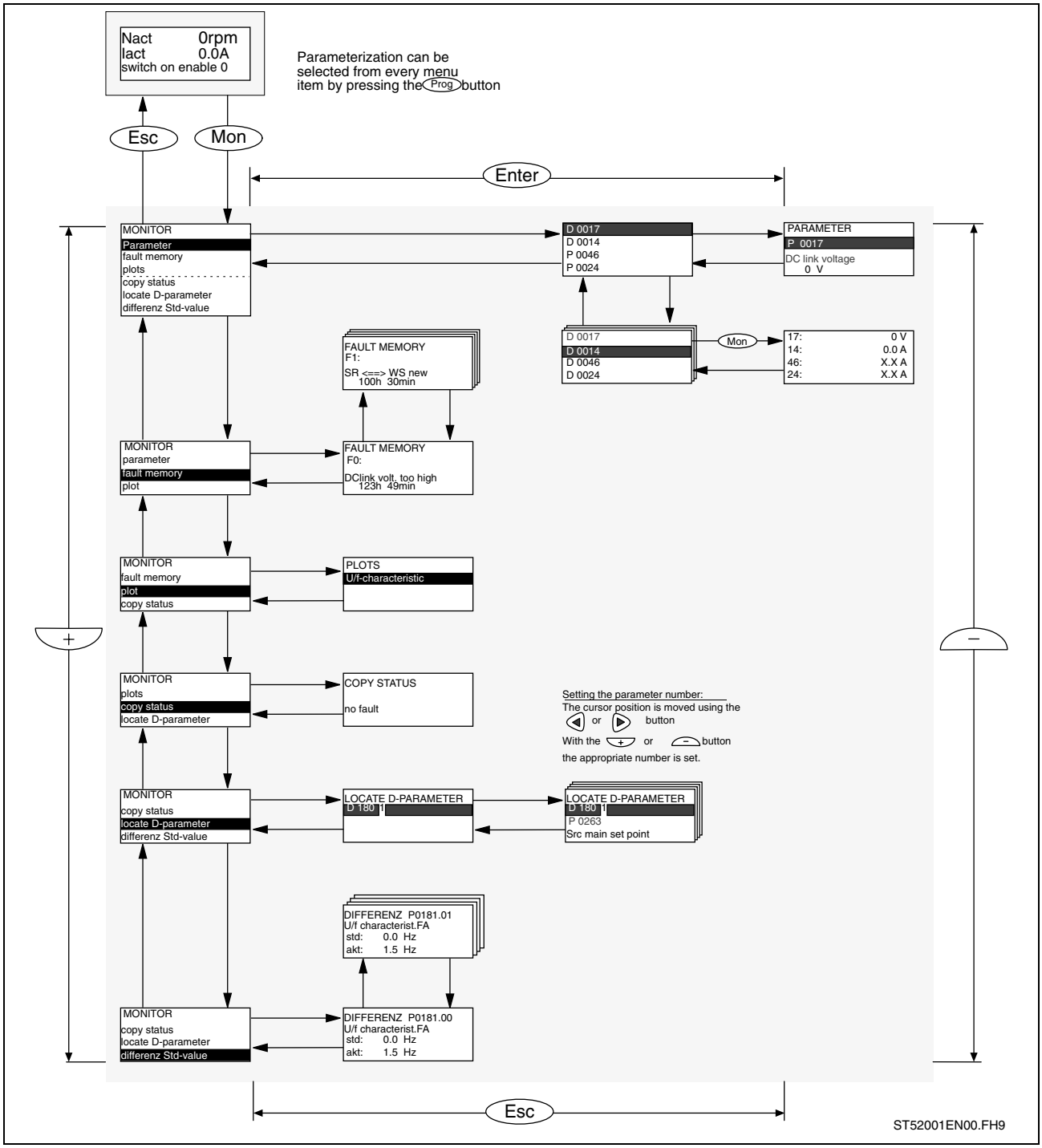


Fig.: 7-9 Monitor program structure

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. (This characteristic is only relevant in operating mode P0189 = voltage-controlled.)

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.

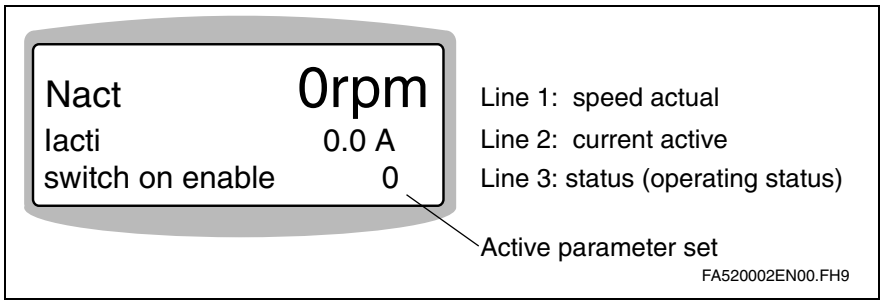


Fig.: 7-10 Operating display

Warning Display

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

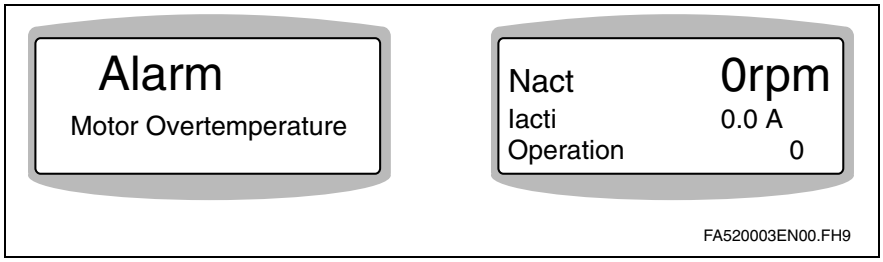
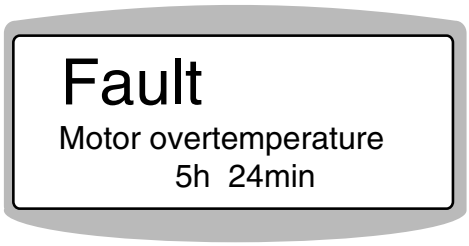


Fig.: 7-11 Warning display

Fault Display

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



Line 1: fault message
Line 2: fault cause
Line 3: fault time (operating hours)

FA520004EN00.FH9

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, using menu prompts on the user panel:

Parameter value assignment

The operator has at his disposal menu-prompted, pre-defined functions for simple and fast start-up.

In addition to the basic functions, logic gates, comparators, a technology controller, several multi-function blocks, etc. are provided. The description of the complete parameterization is provided in the documentation “RD 500 RD52 – 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.

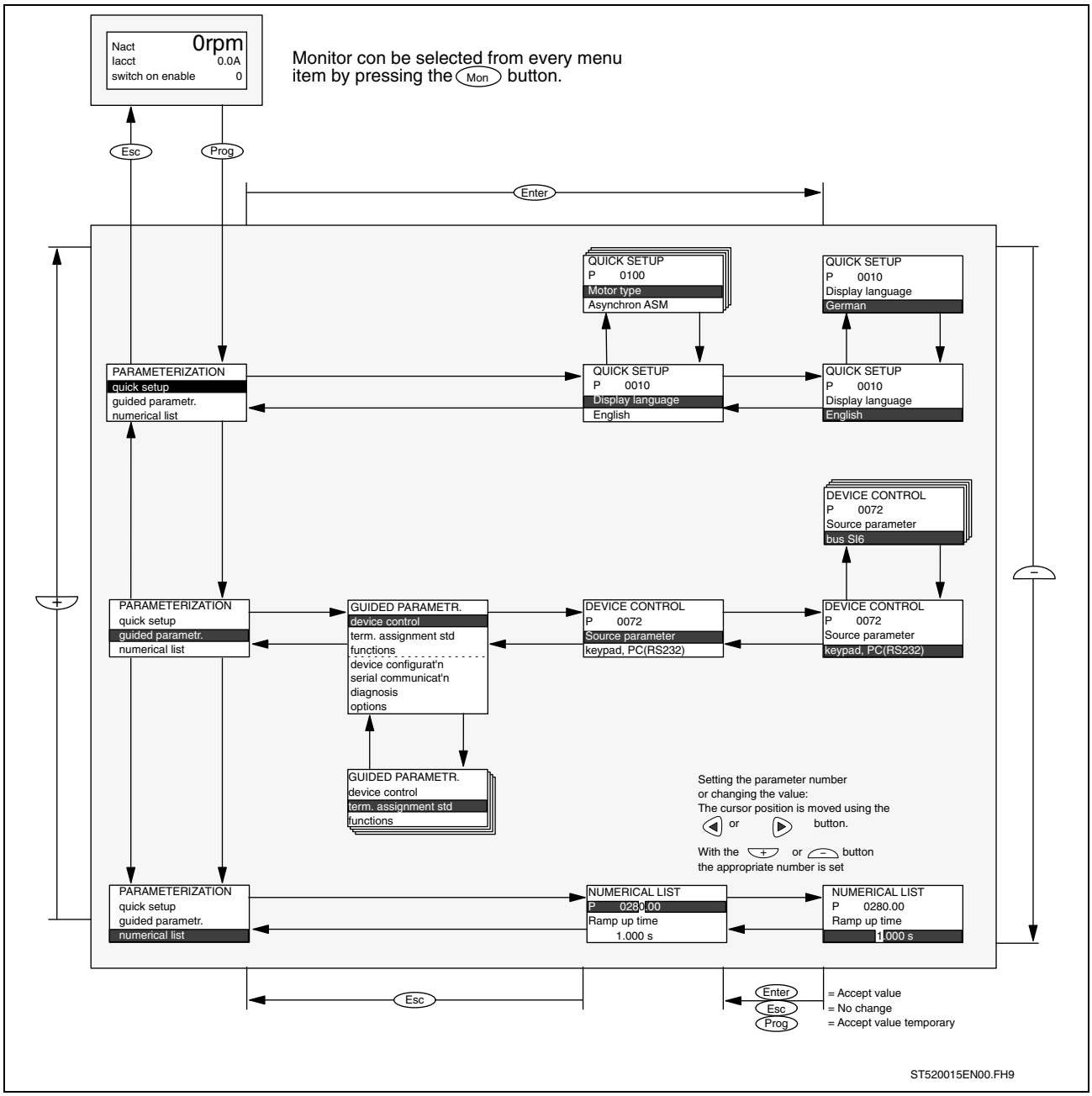


Fig. 8-1: Parameterization menu structure

Overview

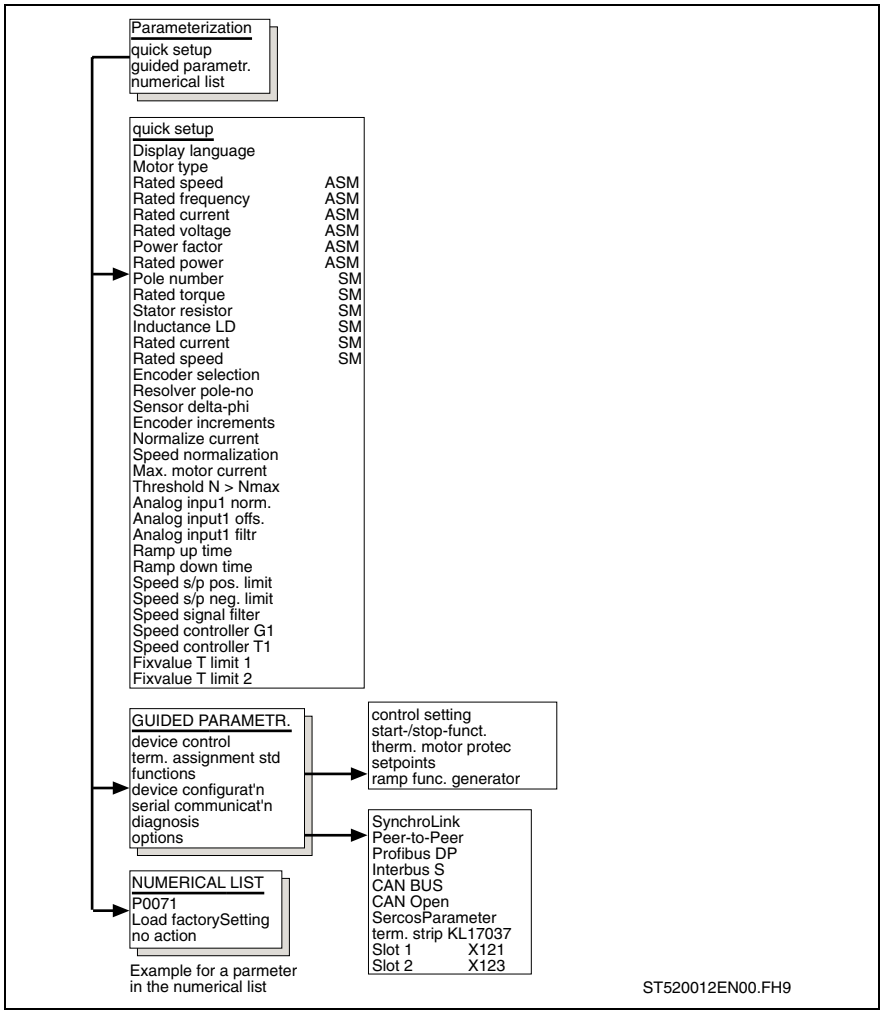


Fig. 8-2: Menu overview

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.

Note: **Please , change the higher password level only through trained and qualified user. Wrong Parameterization from Parameter level 2, especially Parameter level 3 may be the cause of defects on the connected motor. (example: Overloading by wrong current limit, Selection wrong motor type, Selection wrong motor temperature sensor).**

8.3 Quick Setup

Parameter No.:	Name	Description/explanation of selectable options	Factory setting min / max values	Pass-word level
0010	Language	Language selection 0 = German 1 = English	German 0 / 1	0
0100	Motor type	Selects the motor type: 0 = Asynchronous motor ASM 1 = Synchronous motor SM	Asynchronous motor ASM 0 / 1	2
0101	Rated speed, ASM	Rated speed from the motor rating plate (only if the motor is an induction motor)	Depending on the output class 100 ... 90.000 rpm	2
0102	Rated frequency, ASM	Rated frequency from the motor rating plate (only if the motor is an induction motor)	Depending on the output class 10.0 Hz ... 1500.0 Hz	2
0103	Rated current, ASM	Rated current from the motor rating plate (only if the motor is an induction motor)	Depending on the output class 0.1 ... 3000.0 Hz	2
0104	Rated voltage, ASM	Rated voltage from the motor rating plate (only if the motor is an induction motor)	Depending on the output class 10 ... 550 V	2
0106	cos-phi, ASM	cos-phi from the motor rating plate (only if the motor is an induction motor)	Depending on the output class 0.50 ... 0.98	2
0119	Rated output, ASM	Rated output from the motor rating plate (only if the motor is an induction motor)	Depending on the output class 0.0 ... 6553.5 kW	2
0107	Pin number, SM	Pin number from the motor rating plate (only if the motor is a synchronous motor)	Depending on the output class 2 ... 64	2
0108	Rated torque, SM	Rated torque from the motor rating plate (only if the motor is a synchronous motor)	Depending on the output class 0.1 ... 500000.0 Nm	2
0110	Stator resistance, SM	Stator resistance from the motor rating plate (only if the motor is a synchronous motor)	Depending on the output class 0.001 ... 10.000 Ω	2
0111	Rotating field of inductively, SM	Rotating field inductively from the motor rating plate (only if the motor is a synchronous motor)	Depending on the output class 0.05 ... 650.00 mH	2
0112	Rated current, SM	Rated current from the motor rating plate (only if the motor is a synchronous motor)	Depending on the output class 0.1 A ... 3000.0 A	2
0113	Rated speed, SM	Rated speed from the motor rating plate (only if the motor is a synchronous motor)	Depending on the output class 50 ... 90000 rpm	2

Parameter No.:	Name	Description/explanation of selectable options	Factory setting min / max values	Pass-word level
0130	Encoder selection	0 = resolver 1 = incremental encoder 2 = sine / cos & commutation 3 = sine / cosine encoder 4 = without encoder 5 = external from P145	1 = incremental encoder 0 ... 5	2
0131	Resolver pin number	Per revolution (only if the selected encoder = resolver)	2 2 ... 100	2
0133	Encoder delta phi	(Only if the selected encoder = resolver) or sine / cosine & commutation	0 - 180° ...+180°	3
0132	Encoder pulse number	Number of signal periods	1024 64 ... 10000	2
0374	Current normalization	Reference value for the current setpoint and actual values.	P0024 0.0 ... P0033	2
0390	n_{act} normalization	Reference value for the speed setpoint and actual value	1500 rpm 10 ... 80.000 rpm	2
0109	Motor I_{max}	Motor current limit (peak value)	P0025 0.0A ... P0033	2
0395	n_{max} (fault)	Limit, excess speed protection	2000 rpm 0 ... 100.000 rpm	2
0200	Analog input 1 normalization	Ref. value for analog setpoint normalization	100 % 0.00 ... 199.99 %	2
0202	Analog input 1 offset	Analog setpoint offset	0.00% -199.99 % ... +199.99 %	2
0204	Analog input 1 filter time	Analog setpoint smoothing	0 0 ... 10,000 ms	2
0280	Ramp-up time	Ramp-function generator ramp-up time. The entered time is valid for a setpoint change from 0 % to 100 %.	1.000 s 0.000 ... 3200.000 s	1
0281	Ramp-down time	Ramp-function generator ramp-down time. The entered time is valid for a setpoint change of 100 %.	1.000 s 0.000 ... 3200.000 s	1
0303	Pos. setpoint limit	Speed-setpoint limit clockwise rotating field	100.00 % 0.00 ... 190.00 %	2
0304	Neg. setpoint limit	Speed-setpoint limit counter-clockwise rotating field	-100.00 % -190.00 ... 0.00 %	2
0310	N_{act} filter time	Speed controller smoothing factor	2.0 ms 0.0 ... 100.0 ms	1
0335	n controller Kp1	Proportional speed controller gain	5.0 0.0 ... 128.0	1
0336	n controller Tn1	Speed controller integral action time	10 ms 0 ... 5000 ms	1
0367	Fixed value, M_{limit} 1	Torque limit +	100 % -199.99 ... +199.99 %	1
0370	Fixed value, M_{limit} 2	Torque limit -	-100 % -199.99 ... +199.99 %	1

Fig. 8-3: Parameter list of Quick setup

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 and 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.

Check the jumper position!

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.

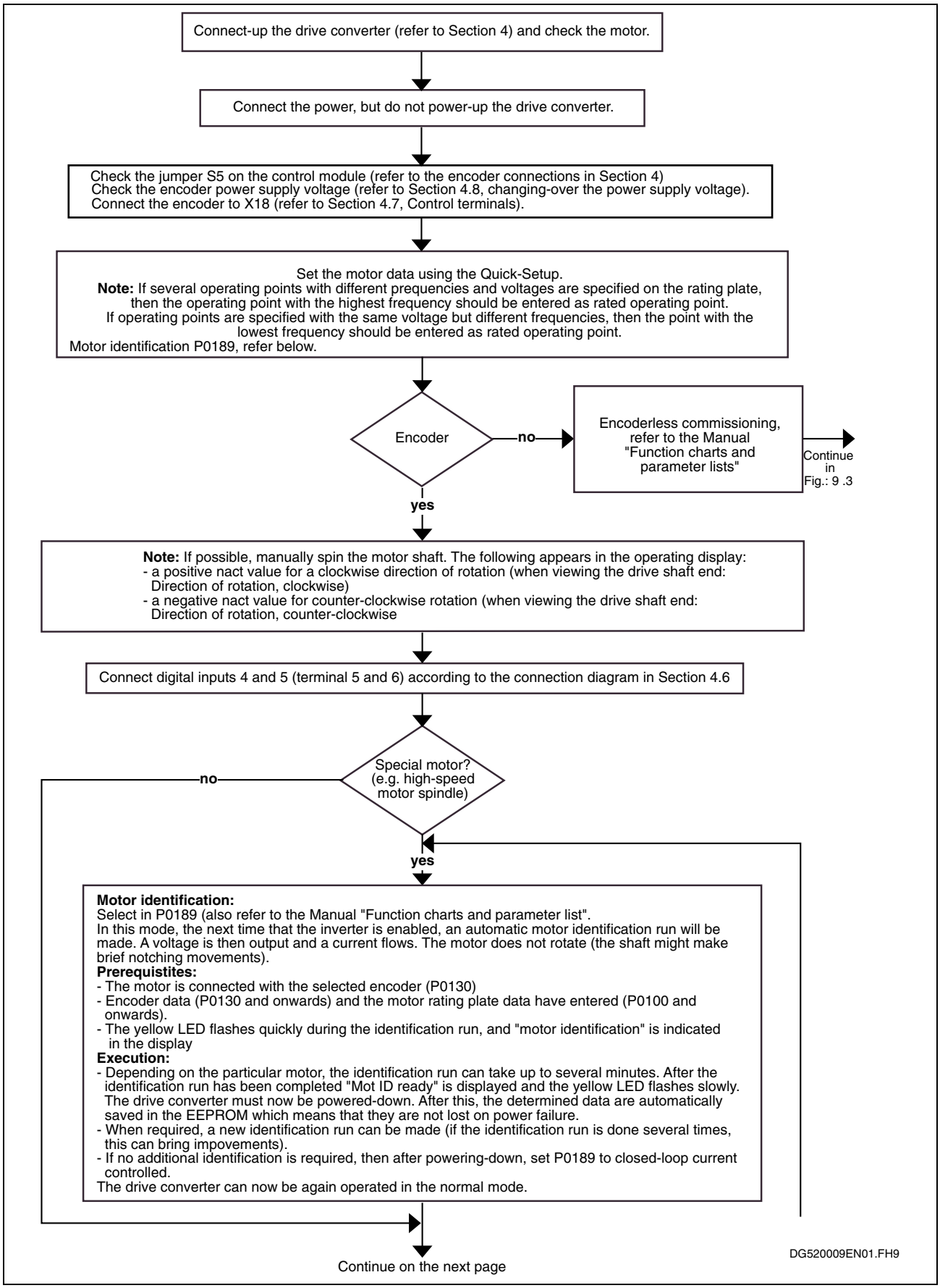


Fig. 9-1: Flow diagram, commissioning

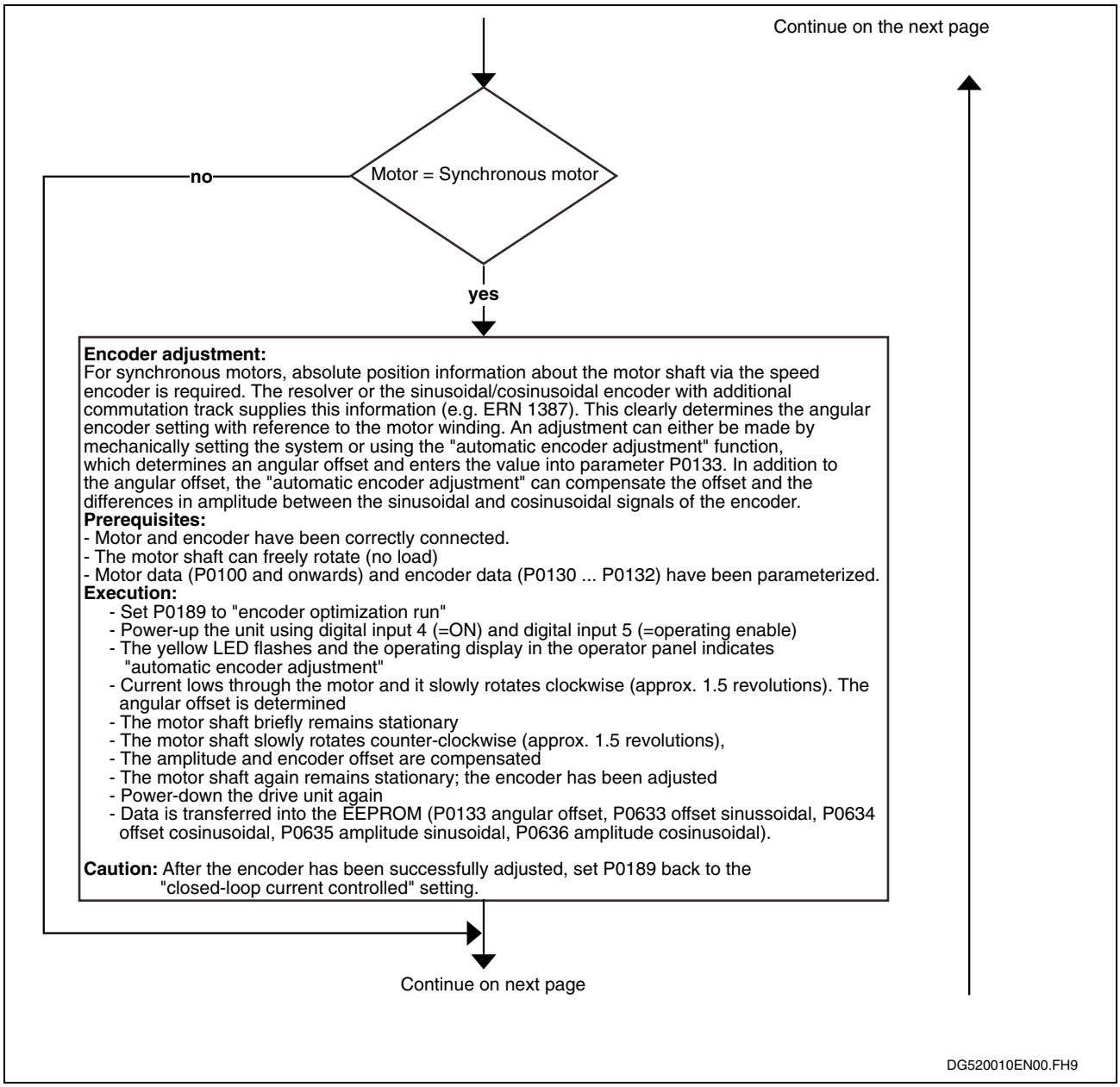


Fig. 9-2: Flow diagram, commissioning a synchronous motor drive

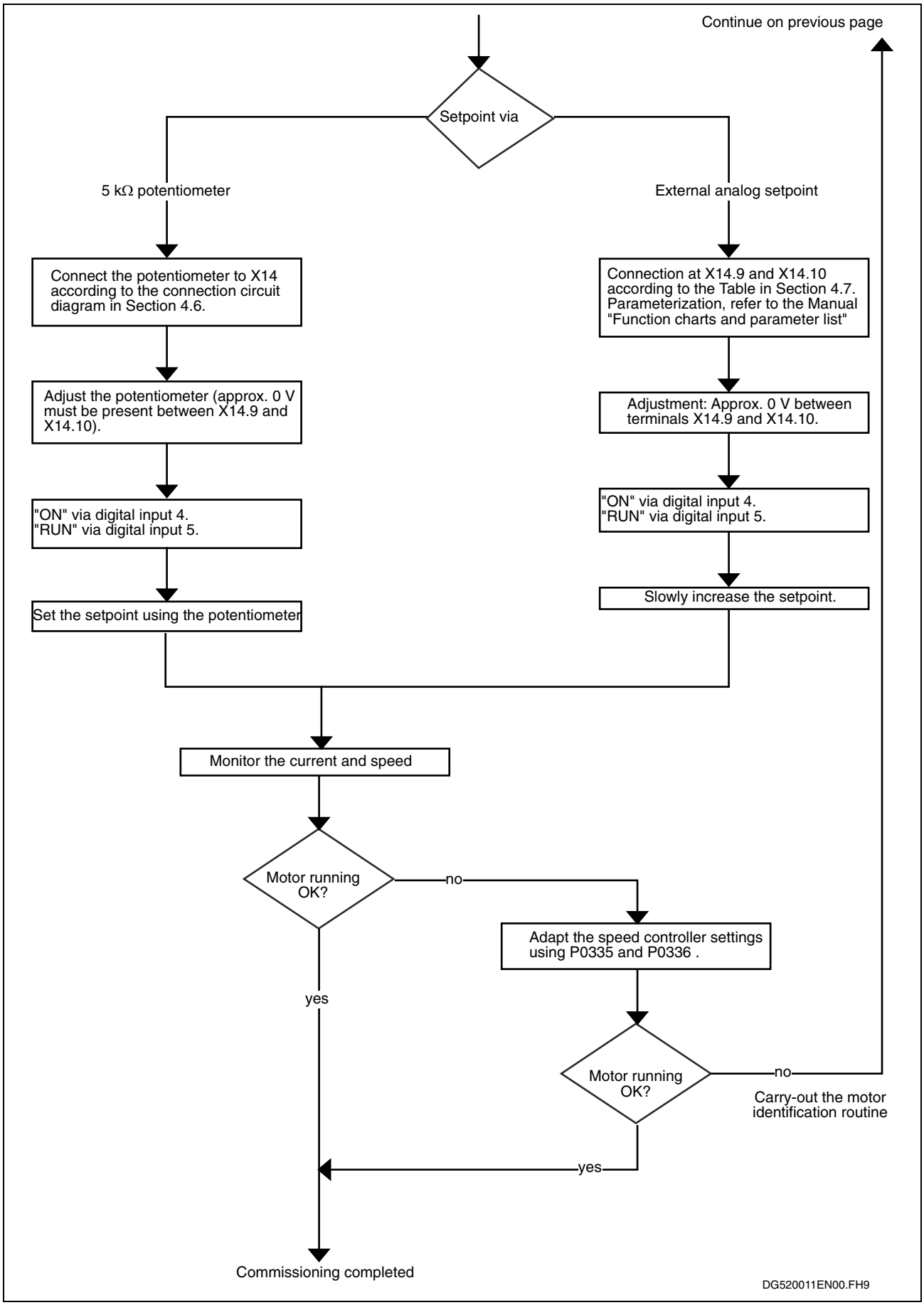


Fig. 9-3: Flow diagram, commissioning, continued

9.3 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.

9.4 Commissioning for Encoderless Field Orientation for Induction Motors

Operation without a speed encoder with field orientation is set using the selection for parameter encoder type P0130. In encoderless operation, the structure of the entire control system is retained. Speed estimation takes the place of speed measurement. This speed estimation contains an observer that is based on the motor model. This observer uses motor currents and flows to provide an advance calculation of the current. The variations between the measured and the estimated current are fed to an identification controller which determines the speed.

Operating Range

The operating range of an encoderless drive is limited compared to operation with an encoder. This is especially due to the fact that there is a dead range around speed “0” in which the drive cannot be operated stationarily. In particular, the full torque is not available in this range. This must be taken into account in the application. This dead range depends on the motor, but generally lies on the order of +/- 2.5 Hz.

Note: **At encoderless field orientation, the max. motor frequency is 670 Hz.**

CAUTION

Damage due to overload of the component!

⇒ The encoderles field-oriented operation in combination with Sinusoidal filter RZS01 is not permissible.

Operation Mode

As a rule, a field-orientated drive can be operated in various operating modes (e.g. torque control, speed control, position control).

Note: Due to the dead range at low speeds, the recommended operating mode is **speed control.**

Commissioning

Commissioning with Motor Identification

For encoderless operation, executing automatic parameter identification (P0189) is recommended. It is important that all motor type label data, as well as the encoder selection, have been set accordingly beforehand. In encoderless operation, automatic parameter identification also determines the following parameters and automatically saves them in the EEPROM so that they are retained in case of a power failure:

Parameter	Meaning	Remarks
P0147.x	Current control dynamics	Fixed to “very high”
P0148.x	Current control amplification	Fixed to 100 %
P0774.x	Estimation control amplification	Calculated based on measured values
P0775.x	Estimation control integral-action time	Calculated based on measured values
P0336, P0338	Speed controller integral action time	Automatically set to 8x value of P0775

Fig.: 9-4 Parameters determined in motor identification with encoderless operation

In addition to these parameters, the other machine parameters are also determined and stored in the EEPROM so that they are retained in case of a power failure (see the explanatory text of P0189). After motor identification has been carried out successfully, the speed control amplification merely needs to be optimized.

Manual Commissioning

If motor identification is not carried out or it its results are not satisfactory, proceed as follows for manual commissioning:

- Preparations

Parameter	Meaning	Comment
P0335, P0337	Amplification	Set relatively low, optimize later if necessary (starting value approx. 2 - 5)
P0336, P0338	Speed control integral-action time	Set relatively high, optimize later if necessary (if possible do not drop below 5x value of P0775); starting value approx. 100 - 200 ms)
P0280ff	Ramp times	Do not set ramps too fast, optimize later if necessary (starting value approx. 5 - 10 s)
P0147.x	Current control dynamics	Set to “very high”
P0148.x	Current control amplification	Set to 100 %

Fig.: 9-5 Basic settings for encoderless operation

- Manual optimization

Based on the listed starting values, the parameters of the estimation control are to be optimized in the following sequence:

Parameter	Meaning	Remarks
P0774.x	Estimation control amplification	Starting value: 3 %; modify value until speed signal no longer shows strong oscillations at idle speed. Test at approx. 20 % - 50 % of nominal speed
P0775.x	Estimation control integral-action time	Starting value 10 ms; modify value until speed changes are also recorded cleanly

Fig.: 9-6 Manual optimization of estimation parameters

Additional Parameters in Encoderless Operation

In encoderless operation, there are additional parameters that must be set only in exceptional cases. It is recommended that the factory setting not be changed.

Parameter	Meaning	Remarks
P0773.x	Observer return factor	Retain factory setting of 1.0
P0776.x	Switching frequency-controlled model	Switches the speed observer from a controlled model to a regulated model. Retain factory setting of 2 Hz.
P0778.x	Switching hysteresis	Switching hysteresis for P0776. Retain factory setting of 2 Hz.

Fig. 9-7: Parameters whose factory settings are to be retained.

9.5 Possible Commissioning Problems (Encoderless)

Considering the multitude of possible applications and motors during the commissioning of encoderless controlled drives, there are certain cases where difficulties or problems could occur. It is important to determine in these cases whether the problems result directly from encoderless operation or whether they have another cause. The information from the notes regarding commissioning must be checked first.

Excess Speed Fault

The switch-off threshold of the speed monitor is specified in P0395. First check whether this value was entered sufficiently high. A safety clearance for any excess oscillations that may occur must be allowed for.

If this is not the case, the fault could result from an incorrectly set estimation control. When RDwin is used for recording, high-frequency (not real) oscillations can then be seen on speed signal D1873.

Note: Reduce the amplification of the estimation control in P0774.x

It is also possible that the integral-action time of the estimation control is set incorrectly.

Note: Modify the integral-action time of estimation control P0775.x until the fault no longer occurs.

If the fault occurs at very low speeds, it may be that model instability is occurring due to imprecision in the parameters. However, this occurs very rarely; the following remedy should be used only if the other measures were not successful.

Note: Increase the switching threshold in P0776.x

Torque Too Low

A torque that is too low can have different causes. First, check whether the drive's size is able to provide the required torque at all. Please note that an encoderless drive can have a somewhat higher power demand compared to a drive with an encoder (approximately 5 %).

Note: Check the power and torque limits in parameters P0109, P0367 – P0374.

If this is not the case, check the following: In certain motors (special designs, high reliance on current for inductivities), it may happen that excitation current P0117 was determined incorrectly. Note that strong heating as well as saturation effects can occur if the excitation current is increased too far. Whenever possible, pay attention to the information of the manufacturer. Generally, the excitation current is increased to increase the torque.

Note: Change the value of excitation current P0117.x to increase the torque.

Another cause could be incorrectly set motor parameters. Especially important here is rotor time constant Tr (P0123), which plays a decisive role in determining the slip of the motor.

Note: Change the value of the rotor time constant (P0123) to increase the torque.

9.6 Possible Commissioning Problems (General)

Speed Oscillations in Basic Setting Area

If there are low-frequency oscillations ("pumping") in the basic setting area, first determine whether these result from current regulation or speed regulation. To help in your determination, reduce the effect of the speed control:

Note: Switch off the integral portion of the speed control (P0336 / 0338 = 0 ms) and reduce the amplification (P0335 / 0337)

If the oscillations disappear as a result, the speed control was the cause. Optimize it by slowly increasing the amplification and switching on the integral portion, starting with a high time constant.

If the oscillations continue to occur, the flow regulator could be the cause:

Note: Switch off the flow regulator (P0129 = 0 %)

If the oscillations disappear, the flow regulator was the cause. Optimize it by slowly increasing the amplification.

If this was not the cause, parameters of the current control may be the cause. This occurs especially in the case of motors with high output (100 kW). However, modify the motor parameters only if the other measures

were unsuccessful. These motor parameter directly influence the speed estimation.

Note:

- Modify stator resistance P0120 (generally, an increase helps)
- Modify main inductivity P0122

Speed Oscillations in Field Weakening Area

First investigate the points from the basic setting area. In the field weakening area, the drive is operated to the voltage limit. The correct excitation current is specified using a characteristic curve and, if necessary, is adapted using the flow correction control.

Note: Reduce the amplification of flow correction control P0128.x

Current Oscillations

Oscillations of the current control generally have a relatively high-frequency (“rattling”) and occur when the amplification of the current control is too high.

Note: Reduce the amplification of current control P0148.

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.
- The safety relay and the subsequent circuit is suitable for the operation at a voltage of P24 V provided by the inverter and an amperage of 6 A DC. The switching rate is 500.000 loops at a repetitive frequency of 0,05 Hz

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).
- The safety relay and the subsequent connection fits for the operation at P24V generated by the inverter as well as at a current of 6 A DC
- Switching rate 500.000 periods, repetitive frequency 0.05 Hz

Sequence and Procedure when Using the Starting lock out

- Withdraw the operating ability (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 start inhibitor
- “Ready” signal, wait a minimum of 2 s
- Issue the operating ability

11 Optional Device Functions

11.1 Additional function 24 V Stand-by 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 24 V Stand-by 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 (for operation, see Chapter 7.3). 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
13	Power section	X	X
14	Inverter		X
15	Power supply		X
16	Internal DSP comm. (communication)		X
17	Excess speed	X	X
18	Ground fault		X
19	EEPROM data	X	X
20	Internal DSP ack. (receipt acknowledgement)		X
21	Internal WS comm. (communication)		X
22	NTC power section		X
23	Motor sensor		X
24	SS1 time monitor	X	X
25	SS2 function	X	X
26	SS2 time monitor	X	X
27	Analog input 1:I<4mA	X	X
28	Motor excess temperature	X	X
30	SR output level		X
31	BR overload	X	X
39	On for starting lock-out		X
40	Switched mode power 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

No.	Messages	Warning	Fault
52, 53, 54, 55, 56, 57, 58	External 1, external 2, external 3, external 4, external 5, external 6, external 7	X	X
59	SS6 time monitor	X	X
60	SynchoLink 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 24 V 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.

No.	Designation	Message
	Cause	Remedy / comments
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.
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.
13	Power section	Fault
	Unspecified error in the power section.	Please call Customer Service.
14	Inverter	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	Remove the motor cable and unlock the inverter. If the fault no longer occurs, the cause is most probably in the motor. Replace the motor. Check the encoder signal using the display or RDwin in Run empty mode or while manually moving the motor shaft. Measuring with RDwin “Oscilloscope function”: Parameter D1850, setpoint of n control and D1873 actual value of n control.
	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.	
15	Power supply	Fault
	The voltages of the switch power pack lie beyond the limit values: Limit value for + 15 V = + 13.5 V - 15 V = - 13.5 V	The switched mode power supply is defective or the load is too high due to a defective module (also see the note regarding fault 40 switched mode power supply).

No.	Designation	Message
	Cause	Remedy / comments
16	Internal DSP comm. (communication)	Fault
	Communication with the digital signal processor on the logic and control card is malfunctioning	Please call Customer Service.
17	Excess speed	Warning / fault
	This fault is triggered if the speed encoder signal exceeds the set threshold (P0395 n_{max} : fault). **Causes outside of the device:** Fault in the encoder system. The machine drives the motor beyond the speed threshold. Only for synchronous machines: phase assignment of motor is incorrect incorrect setting of resolver angle.	Measure the encoder signal using an oscilloscope or with the “Oscilloscope” function in RDwin (D1873)
	Causes in the parameterization: Incorrect scaling of the speed. Incorrect setting of the speed threshold Incorrect setting of the speed regulator (can cause overshooting of the speed).	Check P0390 (Speed scaling) for correct value; change if necessary. Check the speed threshold in P0395. Check the settings of the speed regulator in Quick setup or with the “Oscilloscope” function in RDwin.
18	Ground fault	Fault
	A ground fault has occurred on the outlet terminals of the inverter (U2, V2, W2) or the capacity against ground is too high due to long motor lines.	
19	EEPROM data	Warning / fault
	Causes in the parameterization: The logic and control card has been replaced; after initialization, it detects a new power section that, for example, cannot supply the currents set in the parameters. This means that one or more parameters lie beyond the tolerance range. The affected parameters are reset to the standard values of the device on acknowledgement.	P0061.XX can be used to view the corresponding parameter numbers, P0062.XX to view the incorrect parameter values. The fault can be eliminated using a special acknowledgement with P0060 (password level 3 ▶, Esc, Mon, Prog and confirm with Enter). Then it must be checked whether the modified parameters are suitable for the application. When exiting parameterization, transfer the values to the EEPROM.
	Cause in device: The fault can also occur if the power fails during operation. The power section could then send incorrect data to the logic and control card.	It may be possible to eliminate the fault by switching the power supply on and off or switching to Standby supply. If this is unsuccessful, please call Customer Service.
20	Internal DSP ack. (receipt acknowledgement)	Fault
	The internal processor coupling is malfunctioning.	Acknowledge the fault; if it occurs again, there is a component error – if necessary, replace the logic and control card.
21	Internal WS comm.	Fault
	Communication between the processor board and the power section is malfunctioning. If the error occurs during the self-test immediately after startup, it cannot be acknowledged.	Check the connector between the boards or replace the module.
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.

No.	Designation	Message
	Cause	Remedy / comments
23	Motor encoder	Fault
	The incorrect encoder data have been set Jumper S5 on SR17002 is incorrectly connected (see Fig. 4-9: Control terminals on logic and control board SR17002) The encoder supply line has been interrupted. The encoder is defective	Check if the encoder data in P0130 and P0131 are correct. Check the encoder cable for throughput. Replace the encoder.
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).
25	SS2 function	Warning / fault
	Only if an option interface card is in option slot 1. The inverter detects a physical error on the interface line from the superordinate control computer. The data transfer to the field bus is malfunctioning.	Check whether the PPO type (protocol type), baud rate, parity, stop bit and slave address are correct. If the bus error occurs in the form of a warning or fault, parameter P0509 can be used to suppress the warning, the fault, or both, i.e. the system can continue to be operated.
		Only for CAN bus option: The sent protocols are monitored on the CAN bus interface. If a bus error occurs more than 127 times, a warning is issued. If a bus error occurs more than 255 times, a fault is reported. Parameter P0509 can be used to mask the warning, the fault, or both, i.e. the system can continue to be operated.
	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:** Check the profibus-control to correctly sending characteristic. disturbance indication in parameter P0509 (SS2) / P0745 (SS4) deactiviate.
		Only for Interbus S option: The reaction type can be set in parameter P0518 and the monitoring time in the case of a bus error can be set in parameter P0519. Index 0 = process data, index 1 = PKW area.
26	SS2 time monitor	Warning / fault
	Only if an option interface card is in option slot 1. The superordinate control computer does not send any data within the set reaction time (P0527).	Check connector SS2 Increase the reaction time (P0527) or select another reaction type (P0526).
27	Analog input 1:I<4mA	Warning / fault
	Causes outside of the device: Short-circuit or line break on the setpoint line to the analog input or to the option analog inputs (only for operating mode with 4-20 mA / 2-10 V).	Check the setpoint line
	Causes in the parameterization: Incorrect reaction type Incorrect operating mode	Check the reaction time in P0564 / P0752. Check the operating mode in P0201 / P0735.

No.	Designation	Message
	Cause	Remedy / comments
28	Motor excess temperature	Warning / fault
	The inverter detects that the resistance is too high on terminals X15.1 and X15.2. The motor is overheated, the temperature sensor is defective, or the sensor line is defective. The parameters are incorrectly set.	Replace the sensor or sensor line. Check whether the parameters for temperature evaluation (P0385 – P0389) are correct. If KTY84 is selected, the current motor temperature in °C can be displayed in the monitor using D1872; if PTC is selected, the current ohm value can be displayed using D1871.
30	SR output level?	Fault
	The logic and control card and the firmware (flash Eprom) are not compatible	Please call Customer Service.
31	BR overload	Warning / fault
	The inverter calculates a temperature image for the set braking resistor. If the braking resistor is activated, the inverter calculates the assigned temperature. If the threshold is exceeded, the inverter reports BR overload.	
	Causes outside of the device: Only for option W Braking resistor: The impedance of the connected braking resistor is too high. No braking resistor is connected. The connected braking resistor is too small for the energy that is returned to the DC link during braking.	Check the braking resistor.
	Causes in the parameterization: The set descending ramp is too fast. Incorrect braking resistor selected. Only for externally programmable braking resistor: The parameter values for resistance, continuous power and / or thermal time constant were incorrectly set.	Check the descending ramp in P0280.0X In P0036, check whether the correct braking resistor has been selected. Note regarding standard: Every converter power class is allocated to a certain braking resistor. Check the values in P0623 to P0625. Maintain the max. braking duration and the required pause times until the next braking procedure. The load diagram in the instructions for the braking resistor option can be used to calculate braking and pause times.
39	On for starting lock-out	Fault
	Contacts X80.1 and X80.2 were opened during operation or an On command was issued while a terminal was open.	
40	Switched mode power supply	Fault
	The Switched mode power supply for supplying the electronics does not acknowledge.	Replace the defective Switched mode power supply. Depending on the device design, the Switched mode power supply is located on board: LT (power section), WS (inverter control) or SV (power supply).

No.	Designation	Message
	Cause	Remedy / comments
41	SR <==> WS new	
	If the logic and control card is switched into another device with a larger or smaller power/device index, this entry is made in the fault memory (the device does not malfunction!) A fault occurs if the parameters lie beyond the limit values (see fault 19).	
44	SS4 function	Warning / fault
	Only if an option interface card is in option slot 2. The inverter detects a physical error on the interface line from the superordinate control computer. The data transfer to the field bus is malfunctioning.	Check whether the PPO type (protocol type), baud rate, parity, stop bit and slave address are correct. If a bus error occurs in the form of a warning or fault, parameter P0745 can be used to suppress the warning, the fault, or both, i.e. the system can continue to be operated.
		Only for CAN bus option: The sent protocols are monitored on the CAN bus interface. If a bus error occurs more than 127 times, a warning is issued. If a bus error occurs more than 255 times, a fault is reported. Parameter P0745 can be used to mask the warning, the fault, or both, i.e. the system can continue to be operated.
	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:** Check the profibus-control to correctly sending characteristic. disturbance indication in parameter P0509 (SS2) / P0745 (SS4) deactiviate.
		Only for Interbus S option: The reaction type can be set in parameter P0518 and the monitoring time in the case of a bus error can be set in parameter P0519. Index 0 = process data, index 1 = PKW area.
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).
47	Starting lock out active	Warning
	The starting lock out has been activated.	The device cannot be switched on if this warning exists; when the WR is released, fault “On with starting lock out” occurs
48	Module excess temperature	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

No.	Designation	Message
	Cause	Remedy / comments
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	 Remove the motor cable and unlock the inverter. If the fault no longer occurs, the cause is most probably in the motor. Replace the motor. Check the encoder signal using the display or RDwin in Run empty mode or while manually moving the motor shaft. Measuring with RDwin “Oscilloscope function”: Parameter D1850, setpoint of n control and D1873 actual value of n control
	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.	
52, 53, 54, 55, 56, 57, 58	External 1, external 2, external 3, external 4, external 5, external 6, external 7	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.
59	SS6 time monitor	Warning / fault
	Only for internal interface SS6 (plug X13). No valid protocol has been received within the set reaction time (P1275)	Check connector X13 Increase the reaction time (P1275) or select another reaction type (P1276).
60	SynchroLink time monitor	Warning / fault
	Only for SynchroLink SS7. No valid protocol has been received within the set reaction time (P0497).	Check the connector Increase the reaction time (P0497) or select another reaction type (P0496).
63	Output current EN81 – for future use	
64	DC link discharge – for future use	

13 Service & Support

13.1 Helpdesk

Unser Kundendienst-Helpdesk im Hauptwerk Lohr am Main steht Ihnen mit Rat und Tat zur Seite. Sie erreichen uns

Our service helpdesk at our headquarters in Lohr am Main, Germany can assist you in all kinds of inquiries. Contact us

- telefonisch - by phone: **+49 (0) 9352 40 50 60**
  über Service Call Entry Center Mo-Fr 07:00-18:00
  - via Service Call Entry Center Mo-Fr 7:00 am - 6:00 pm
- per Fax - by fax: **+49 (0) 9352 40 49 41**
- per e-Mail - by e-mail: **service.svc@boschrexroth.de**

13.2 Service-Hotline

Außerhalb der Helpdesk-Zeiten ist der Service direkt ansprechbar unter

After helpdesk hours, contact our service department directly at

+49 (0) 171 333 88 26

oder - or **+49 (0) 172 660 04 06**

13.3 Internet

Unter **www.boschrexroth.com** finden Sie ergänzende Hinweise zu Service, Reparatur und Training sowie die **aktuellen** Adressen *) unserer auf den folgenden Seiten aufgeführten Vertriebs- und Servicebüros.

Verkaufsniederlassungen
Niederlassungen mit Kundendienst

Außerhalb Deutschlands nehmen Sie bitte zuerst Kontakt mit unserem für Sie nächstgelegenen Ansprechpartner auf.

*) Die Angaben in der vorliegenden Dokumentation können seit Drucklegung überholt sein.

At **www.boschrexroth.com** you may find additional notes about service, repairs and training in the Internet, as well as the **actual** addresses *) of our sales- and service facilities figuring on the following pages.

sales agencies
offices providing service

Please contact our sales / service office in your area first.

*) Data in the present documentation may have become obsolete since printing.

13.4 Vor der Kontaktaufnahme... - Before contacting us...

Wir können Ihnen schnell und effizient helfen wenn Sie folgende Informationen bereithalten:

1. detaillierte Beschreibung der Störung und der Umstände.
2. Angaben auf dem Typenschild der betreffenden Produkte, insbesondere Typenschlüssel und Seriennummern.
3. Tel.-/Faxnummern und e-Mail-Adresse, unter denen Sie für Rückfragen zu erreichen sind.

For quick and efficient help, please have the following information ready:

1. Detailed description of the failure and circumstances.
2. Information on the type plate of the affected products, especially type codes and serial numbers.
3. Your phone/fax numbers and e-mail address, so we can contact you in case of questions.

13.5 Kundenbetreuungsstellen - Sales & Service Facilities

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from abroad: don't dial (0) after country code!

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Europa (West) - Europe (West)

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Nordamerika – North America

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Südamerika – South America

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14 Index

F

H

I

K

L

M

N

O

P

Q

R

S

T

U

W

X

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Bosch Group

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