



# REFUspeed RS51

## Drive control devices for high-speed grinding spindles

Operating Instructions

<b>Title</b>	REFUspeed RS51 Drive control devices for high-speed grinding spindles
<b>Type of Documentation</b>	Operating Instructions
<b>Document Typecode</b>	DOK-RD500*-RS51*****-IB02-EN-P
<b>Internal File Reference</b>	120-1950-B320-02/EN
<b>Purpose of Documentation</b>	This documentation provides information on: <ul style="list-style-type: none"> <li>• Planning the mechanical cabinet construction</li> <li>• Planning the electrical/electronics part of the cabinet</li> <li>• Commissioning the drives</li> <li>• Fault messages with information about the cause and remedy</li> </ul>

**Record of Revisions**

Description	Release Date	Notes
DOK-RD500*-RS51*****-IB01-EN-P	07.2001	First edition
DOK-RD500*-RS51*****-IB02-EN-P	02.2002	Modifications

**Copyright** © 2000 Indramat Refu GmbH

Copying this document, giving it to others and the use or communication of the contents thereof without express authority, are forbidden. Offenders are liable for the payment of damages. All rights are reserved in the event of the grant of a patent or the registration of a utility model or design (DIN 34-1).

**Validity** The specified data is for product description purposes only and may not be deemed to be guaranteed unless expressly confirmed in the contract. All rights are reserved with respect to the content of this documentation and the availability of the product.

**Published by** Indramat Refu GmbH  
Uracher Strasse 91 • D-72555 Metzingen  
Telephone +49 (0)71 23/9 69-0 • Fax +49 (0)71 23/9 69-2 60  
<http://www.boschrexroth.de/>  
Dept. Development ENG (jr/ah)

**Note** This document has been printed on chlorine-free bleached paper.

# List of contents

<b>1</b>	<b>Important information on the use of the product</b>	<b>1-1</b>
1.1	Correct use.....	1-1
	Introduction .....	1-1
	Application areas .....	1-2
1.2	Non-correct use.....	1-2
<b>2</b>	<b>Safety Instructions for Electric Drives and Controls</b>	<b>2-1</b>
2.1	Introduction .....	2-1
2.2	Explanations.....	2-1
2.3	Hazards due to inappropriate use .....	2-2
2.4	General information.....	2-3
2.5	Protection against contact with electrical parts .....	2-4
2.6	Protection against electrical shock by protective low voltage (PELV) .....	2-5
2.7	Protection against dangerous movements .....	2-6
2.8	Protection against magnetic and electromagnetic fields during operation and mounting .....	2-8
2.9	Protection against contact with hot parts .....	2-9
2.10	Protection during handling and installation .....	2-9
2.11	Battery safety .....	2-10
2.12	Protection against pressurized systems .....	2-10
2.13	Precautionary measures when handling components which can be destroyed by electrostatic discharge (ESDS) .....	2-11
<b>3</b>	<b>Description</b>	<b>3-1</b>
3.1	The REFUdrive 500 drive series.....	3-1
	Handling.....	3-1
	Electromagnetic compatibility .....	3-1
	Technical features.....	3-1
3.2	Rating plate .....	3-2
3.3	Technical data.....	3-3
	Technical data.....	3-3
3.4	Circuit principle.....	3-4
3.5	Type code .....	3-7
	Type code, basic drive .....	3-7
	Type code, configuration.....	3-8
	Type code, firmware .....	3-9
<b>4</b>	<b>Mounting</b>	<b>4-1</b>
4.1	Storage and installation.....	4-1
	Storage.....	4-1

Minimum requirements placed on the installation location .....	4-1
Installation altitudes above 1000 meters sea level: .....	4-1
4.2 Mounting, drives sizes J to M.....	4-2
Minimum clearance.....	4-2
Dimension drawings, front view, sizes J to M.....	4-3
Dimension drawing, side view, sizes J to M .....	4-4
<b>5 Electrical installation</b>	<b>5-1</b>
5.1 10 rules for EMC-correct installation of drives .....	5-1
5.2 Warnings and information .....	5-3
5.3 Cable cross-sections.....	5-4
5.4 Power terminals RS51, Sizes J-M .....	5-5
Terminal layout diagram, sizes J - M .....	5-5
Overview, power terminals.....	5-10
5.5 Connection circuit diagram .....	5-12
5.6 Control terminals .....	5-14
Terminal layout diagram SR17000 .....	5-14
Description of the control terminals .....	5-14
Providing the Reference Potential when Operating Several RD500s .....	5-16
5.7 RS232 service interface (X11) .....	5-17
5.8 Standard RS485 interface (X12).....	5-18
5.9 Standard SS6 interface (X13).....	5-19
5.10 Standard terminal assignment of the REFU <i>speed</i> RS51 .....	5-19
Recommended terminal assignment with good compatibility to the REFU 316F.....	5-19
Deviations to REFU 316F .....	5-21
<b>6 Operator control and visualization</b>	<b>6-1</b>
6.1 Operator control possibilities.....	6-1
6.2 Operator control using the operator panel .....	6-1
Operation with the operator panel .....	6-1
Monitoring (monitor) using the operator panel.....	6-2
Parameterization using the operator panel.....	6-3
Load Standard Values .....	6-4
Copy Function .....	6-4
Fault acknowledgement.....	6-5
6.3 Monitoring .....	6-6
Monitor .....	6-6
Operating display .....	6-7
Warning display.....	6-7
Fault display .....	6-7
LED display .....	6-8
<b>7 Basic parameterization</b>	<b>7-1</b>
7.1 Parameterizing .....	7-1
Structure of the basic parameterization .....	7-1
Overview .....	7-2

7.2	Password levels .....	7-4
7.3	Quick-Setup .....	7-4
7.4	Guided parameterization.....	7-6
	Drive control / setpoints .....	7-6
	Standard terminal assignment .....	7-9
	Functions.....	7-13
	Drive setting .....	7-21
	Serial communications.....	7-23
	Diagnostics / drive data.....	7-25
	Options.....	7-25
7.5	Numerical list.....	7-25
<b>8</b>	<b>Start-up</b>	<b>8-1</b>
8.1	Steps to prepare for commissioning .....	8-1
8.2	Procedure when first commissioning the drive system.....	8-1
8.3	Motor optimization / motor evaluation .....	8-3
	Motor running under no-load conditions .....	8-3
	Running-up / accelerating under load.....	8-3
8.4	General information.....	8-3
<b>9</b>	<b>Troubleshooting</b>	<b>9-1</b>
9.1	Self-test - error messages.....	9-1
9.2	Alarms .....	9-1
9.3	Faults.....	9-1
	Fault acknowledgement.....	9-1
9.4	List of the alarm and fault messages .....	9-2
9.5	Alarm and fault messages – cause and remedy / comment.....	9-3
<b>10</b>	<b>Index</b>	<b>10-1</b>
<b>11</b>	<b>Service &amp; Support</b>	<b>11-1</b>
11.1	Indramat Refu GmbH.....	11-1
11.2	Internet .....	11-1
11.3	Vor der Kontaktaufnahme... - Before contacting us.....	11-1
11.4	Kundenbetreuungsstellen - Sales & Service Facilities .....	11-2



# 1 Important information on the use of the product

## 1.1 Correct use

### Introduction

Products from Indramat Refu are developed and manufactured in-line with state-of-the-art technology. Before the drives are shipped, they are checked to ensure that they are in an operationally safe condition.

The products may only be used for the application for which they were originally designed. If the drive products are not correctly used, for the purpose for which they were originally intended, then this can result in human injury or material damage.

---

**Note:** Indramat Refu as manufacturer does not accept any claims regarding warranty, liability or other claims for damage caused by the use of the products other than the original intended use. The risks which are incurred when incorrectly using the products lie entirely with the user.

---

Before you use products from the Indramat Refu company, the following prerequisites must be fulfilled in order to guarantee that the products are correctly used, in conformance with what they were originally intended to do:

- Every person who is in some way involved with handling our products must read and understand the appropriate safety regulations and how the product is correctly used.
- If it involves a hardware product, then this must be left in its original condition; this means that it is not permissible to make any mechanical modifications to it. It is not permissible to de-compile software products and their source codes may not be changed.
- It is neither permissible to install nor commission damaged or faulty products.
- It must be guaranteed that the products are installed in compliance with the regulations specified in the documentation.

## Application areas

Drive control devices from Indramat Refu are intended to control electric motors and monitor their operation.

It may be necessary to connect additional sensors and actuators for the control and monitoring of the motor.

---

**Note:** The drive control devices may only be used with the accessories and mounted components specified in this documentation. Components, which are not expressly specified, may neither be mounted nor connected. The same applies for cables and conductors.

Operation is only permissible in the configurations and combination of components which are expressly specified and with the software and firmware specified in the relevant function description.

---

For commissioning, every drive control device must be programmed so that the motor executes the functions specific for its particular application.

The REFUspeed drive control devices from the REFUdrive 500 family have been developed for high-speed grinding spindles.

Devices with different drive outputs and different interfaces are available for specific applications.

Typical applications for REFUspeed drive control devices include:

- Machine tools,

The drive control device may only be operated when mounted and installed, as specified in this documentation, in the specified position and under the specified ambient conditions (temperature, degree of protection, humidity, EMC etc.).

## 1.2 Non-correct use

When using drive control devices for applications other than those specified in the appropriate documentation or under operating conditions other than those specified in the documentation and specified technical data then this is considered to be "Non-correct use".

The drive control devices may not be used if ...

- they are subject to operating conditions which do not fulfill the specified ambient conditions. For example, the following are prohibited: Operation under water, under extreme temperature fluctuations or extreme maximum temperatures.
- the particular application has not been expressly released by Indramat Refu. Please observe the statements in the general safety information!



## 2 Safety Instructions for Electric Drives and Controls

### 2.1 Introduction

Please 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 of the 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 In-dramat Refu representative to send this documentation immediately to the person or persons responsible for the safe operation of this equipment.

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



**WARNING**

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

### 2.2 Explanations

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

Warning symbol with text	Classes of danger acc. to ANSI The degree of hazard seriousness describes the consequences resulting from non-compliance with the safety guidelines:
 <b>DANGER</b>	Death or severe bodily harm will occur.
 <b>WARNING</b>	Death or severe bodily harm may occur.
 <b>CAUTION</b>	Bodily harm or product damage may occur.

Abb. 2-1: Classes of danger according to ANSI

## 2.3 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!**

---

## 2.4 General information

- Indramat Refu GmbH is not liable for damages resulting from failure to observe the warnings given in these documentation.
- Read all of the operating, maintenance and safety instructions in your language before starting up the machine. If you find that due to a translation error you can not completely understand the documentation for your product, please ask your supplier to clarify.
- Proper and correct transport, storage, assembly and installation as well as care in operation and maintenance are prerequisites for optimal and safe operation of this equipment.
- Trained and qualified personnel in electrical equipment:  
Only trained and qualified personnel may work on this equipment or in its proximity. Personnel are qualified if they have sufficient knowledge of the assembly, installation and operation of the product as well as an understanding of all warnings and precautionary measures noted in these instructions.  
Furthermore, they should be trained, instructed and qualified to switch electrical circuits and equipment on and off, to ground them and to mark them according to the requirements of safe work practices and common sense. They must have adequate safety equipment and be trained in first aid.
- Only use spare parts and accessories approved by the manufacturer.
- Follow all safety regulations and requirements for the specific application as practiced in the country of use.
- The equipment is designed for installation on commercial machinery.  
European countries: see directive 89/392/EC (Machinery Directive)
- The ambient conditions specified in the product documentation must be observed.
- Use only safety features that are clearly and explicitly approved in the Project Planning manual.  
For example, the following areas of use are not allowed: Cranes and hoisting equipment, elevators used for people or freight, devices and vehicles to transport people, medical applications, refinery plants, the transport of hazardous goods, radioactive or nuclear applications, applications sensitive to high frequency, mining, control of protection equipment (also in a machine).
- Start-up is only permitted once it is ensured that the machine, in which the product is installed, complies with the requirements of national safety regulations and safety specifications of the application.
- Operation is only permitted if the national EMC regulations for the application are met.  
The machine builder is responsible for compliance with the limiting values as prescribed in the national regulations and specific EMC regulations for the application.  
European countries: see Directive 89/336/EC (EMC Directive).  
US: Refer to the National Electrical Code (NEC), National Electrical Manufacturers Association (NEMA), and local building codes. The user of this equipment must observe the above noted items at all times.
- Technical data, connections and operational conditions are specified in the product documentation and must be followed at all times.

## 2.5 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 protective conductor must be permanently connected to all electrical units according to the connection diagram.
- ⇒ Do not operate electrical equipment at any time if the protective conductor is not permanently connected, even for brief measurements or tests.
- ⇒ Before working with electrical parts with voltage potentials higher than 50 V, the equipment must be disconnected from the line supply or power supply.
- ⇒ The following should be observed with electrical drives, power supplies, and filter components:  
Wait five (5) minutes after switching off power to allow capacitors to discharge before beginning work. Measure the voltage at the capacitors before beginning work to make sure that the equipment is safe to touch.
- ⇒ Never touch the electrical connection points of a component while power is turned on.
- ⇒ Install the covers and guards provided with the equipment properly before switching the equipment on. Prevent contact with live parts at any time.
- ⇒ A residual-current-operated protective device (r.c.d.) must not be used on an electric drive! Indirect contact may be prevented by other means, for example, by an overcurrent protective device.
- ⇒ Equipment that is built into machines must be secured 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-mentioned 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 mm<sup>2</sup> cross section over its entire course for this protective connection!
- ⇒ Prior to start-ups, 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.

## 2.6 Protection against electrical shock by protective low voltage (PELV)

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

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



**WARNING**

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

- ⇒ Only equipment, electrical components and cables of the protective low voltage type (PELV = Protective Extra Low Voltage) may be connected to all terminals and connections with 0 to 50 Volts.
- ⇒ Only safely isolated voltages and electrical circuits may be connected. Safe isolation is achieved, for example, with an isolating transformer, a safe opto-electronic coupler or when battery-operated.

## 2.7 Protection against dangerous movements

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

- Incorrect wiring or 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 monitoring functions 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 integrated monitoring functions 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 start-up. 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.
- 

## 2.8 Protection against magnetic and electromagnetic fields during operation 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 behaviour 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.
-



## 2.9 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!
- 

## 2.10 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.
-

## 2.11 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.

## 2.12 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.

## 2.13 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:

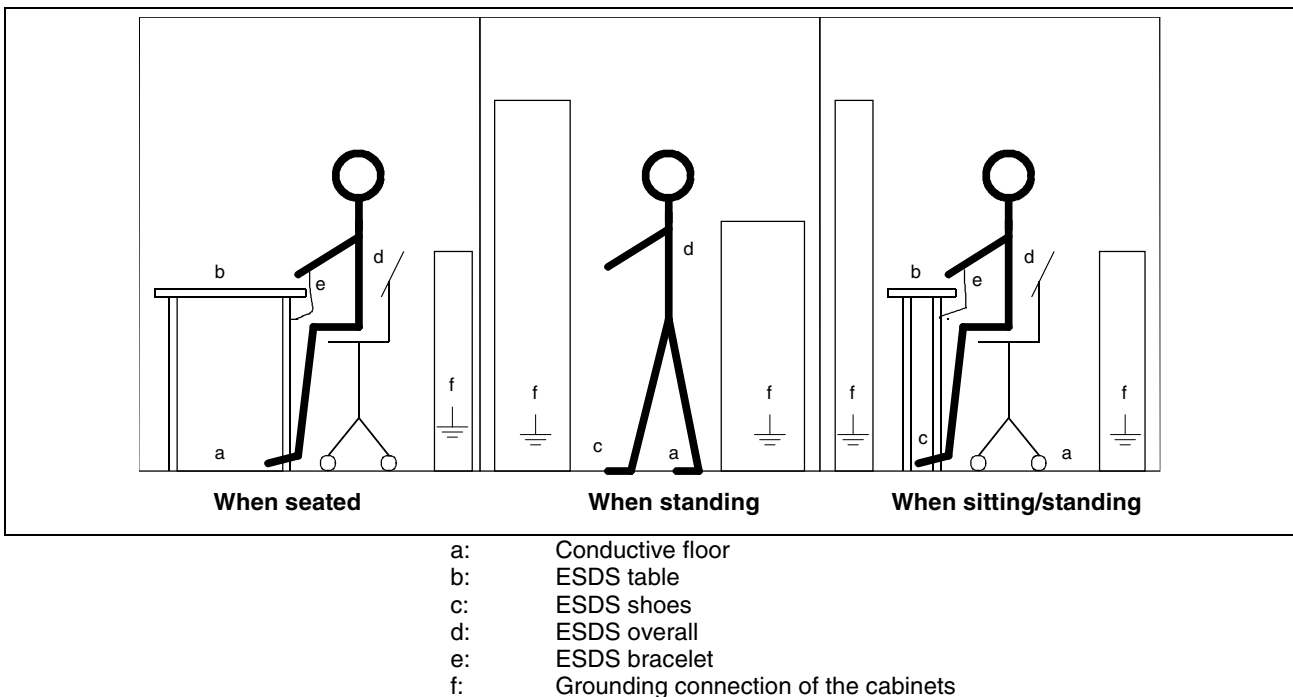


Fig.. 2-2: ESDS protective measures



## 3 Description

### 3.1 The REFUdrive 500 drive series

REFUdrive 500 is a state-of-the-art, universal AC drive system for synchronous and induction motors encompassing a wide range of construction types. The drive can be flexibly adapted to the drive task as a result of the modular hardware and software.

The system includes AC drive converters in various versions (with/without braking chopper, line contactor etc.), inverters for DC feed as well as rectifier and regenerative drive converters. The modules can either be individually purchased, or as combination completely wired in the cabinet.

The power sections are designed for rear cooling. This also means that the units can be force ventilated also outside the cabinet with a high degree of protection (mounted so that the heatsink extends through the rear of the panel or heat transfer plate). There are also versions with liquid cooling with integrated or external heat exchangers.

### Handling

Special significance was placed on simple handling, e.g. straightforward start-up using Quick-Setup.

Prompted start-up using an operator panel with graphic display or with the highest degree of user friendliness using a PC with the high-performance REFUwin software package, in accordance with EN 61000-6-2.

### Electromagnetic compatibility

The AC drive converters have integrated radio interference suppression filter and line reactor to reduce the harmonics. REFUdrive 500 completely fulfill the EMC Guidelines with reference to noise immunity and noise emission in compliance with the EMC product standard for electric drives EN 61800-3. REFUdrive 500 fulfills the required degree of noise immunity

### Technical features

- AC supply
- Forced air cooling
- Removable RZB01.2 operator panel with copy function
- 4-line graphics display
- Various interfaces which permit the drive system to be controlled, visualized and parameterized ("download" parameterization):
  - SERCOS
  - Profibus DP
  - Interbus S
  - CAN-Bus
  - CANopen
  - RS232 / RS485
- Peer-to-peer coupling for fast communications between several drives

- Expanded freely inter-connectable technological functions
  - PID, PI controllers, AND, OR, XOR, RS flip-flop and D latch and many more
  - Mathematical function elements
  - Timers, counters, comparators, ramp-function generators
- 150% overload capability for 60 sec

## 3.2 Rating plate

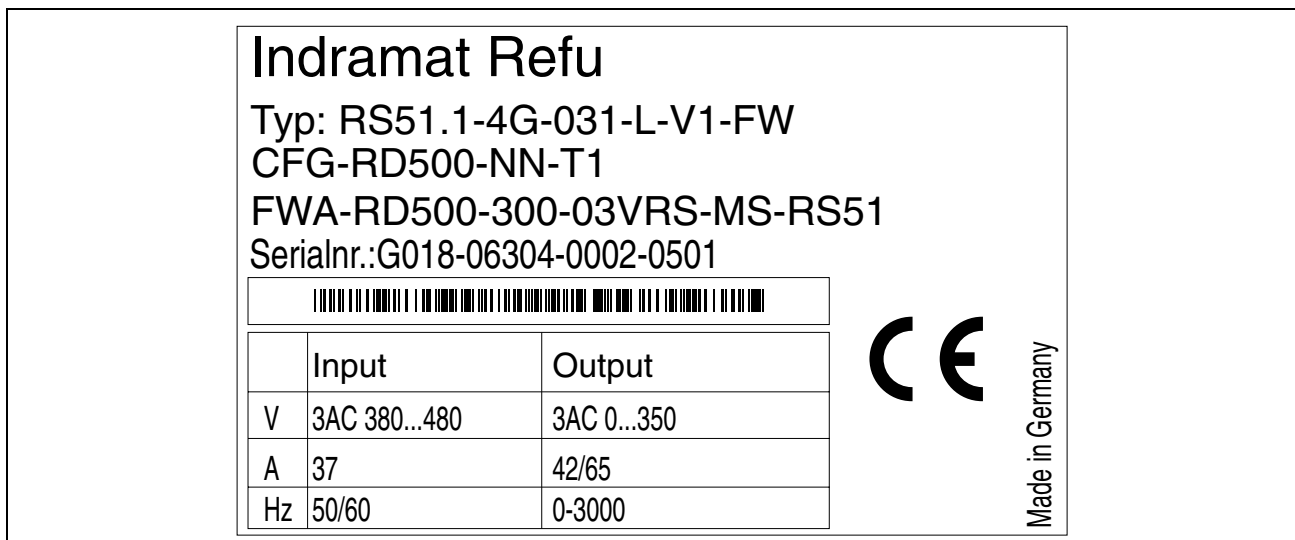


Fig. 3-1: Rating plate

### 3.3 Technical data

#### Technical data

RS51	003	006	014	024	031	050
Rated output [kVA]	3	6	14	24	31	50
Supply voltage, 3-ph. 380 ... 480 V AC ( $\pm 10\%$ )						
Output frequency [Hz]	0 - 2000 Hz					0-1000
Nominal current S1 [A]	4.0	8.0	19	32	42	66
Rated current S6 [A]	5.0	10	23	40	52	83
Peak current for t=60 s [A]	6.5	13	29	50	65	104
Continuous output $S_{NS6}$ S6 [kVA]	2.5	5.0	11	19	25	41
Rated output $S_{NS6}$ S6 [kVA]	3	6	14	24	31	50
Peak output for t=60s [kVA]	4	7.5	18	30	39	63
Supply voltage 3-ph. 300 ... 480 V AC ( $\pm 10\%$ )						
Output frequency [Hz]	0 - 3000 Hz					0-2000
Nominal current S1 [A]	4.0	8.0	19	24	32	50
Rated current S6 [A]	5.0	10	23	30	39	62
Peak current for t=60 s [A]	6.5	13	29	38	49	78
Continuous output $S_{NS6}$ S6 [kVA]	2.5	5.0	11	14	19	31
Rated output $S_{NS6}$ S6 [kVA]	3	6	14	18	23	38
Peak output for t=60s [kVA]	4	7.5	18	23	29	47
Ambient conditions, degree of radio interference suppression, noise immunity						
Environmental class	3K3 acc. to DIN IEC 721-3-3 (ambient temperature 0 ... 40 °C)					
Cooling airflow [m <sup>3</sup> /s]	0.03	0.03	0.1	0.2	0.3	0.4
Radio interference suppression degree / noise immunity	A 1 acc. to EN 55011 / EN 61800-3					
Mechanical system						
Sizes	J	J	K	L	L	M
Degree of protection	IP 20 acc. to EN 60529 (without connecting terminals)					
Weight of the drive converter						
All cooling types [kg]	20	20	33	55	55	80
Brake resistor RZW01.1						
Peak output for t=1s.....[kW]	4.8	9.6	11,4	38,4	49,6	80
Continuous braking power [kW]	0.3	0.3	0.6	0.6	0.9	1.2
Resistance value.....[Ω]	60	60	30	20	13,3	10
Continuous power of the chopper [kW]	2.4	4.8	11,2	19,2	24,8	40
Minimum resistance.....[Ω]	54	54	27	18	12	9

### 3.4 Circuit principle

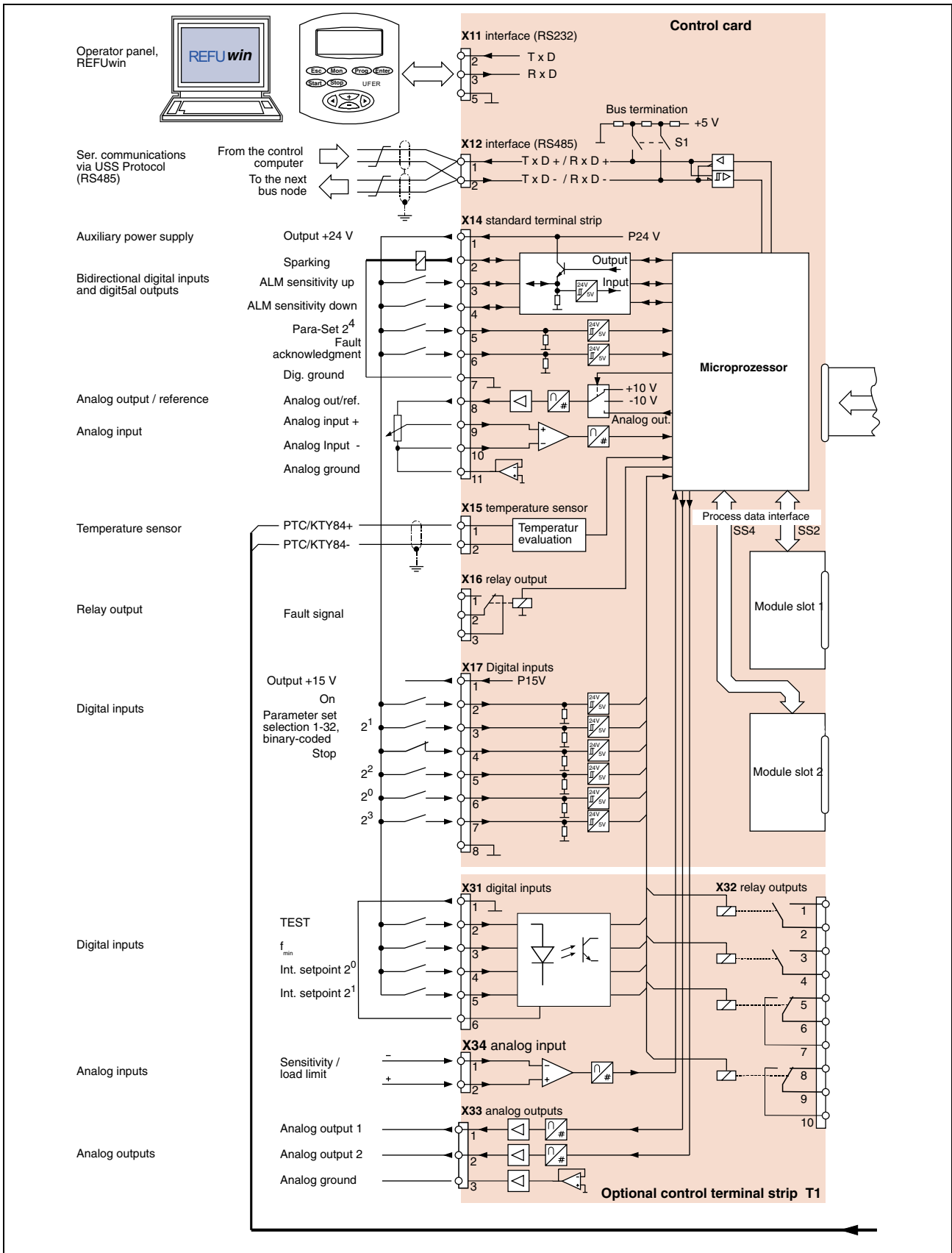


Fig. 3-2: Circuit principle, electronics section



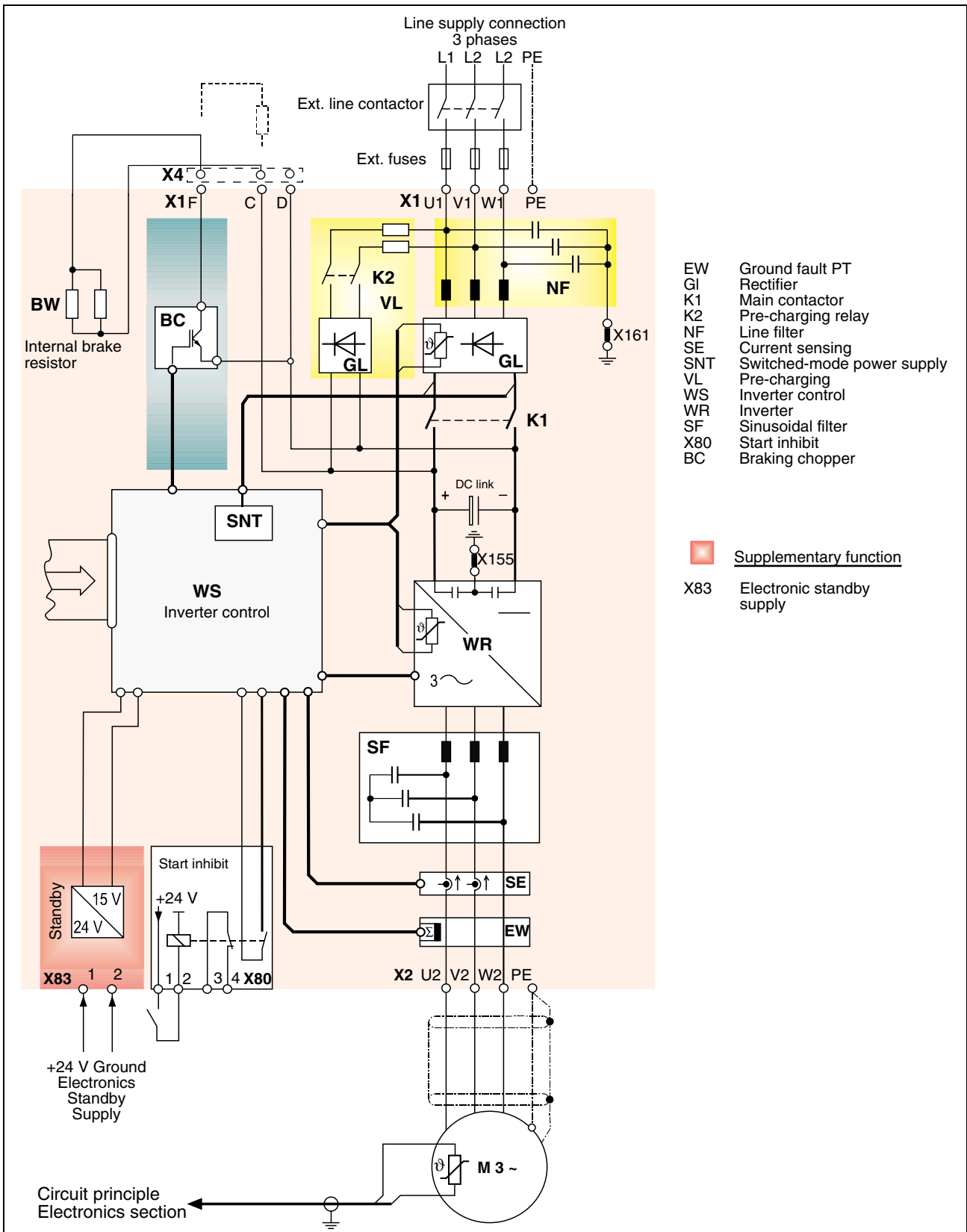


Fig. 3-3: Circuit principle, power section GK J and K

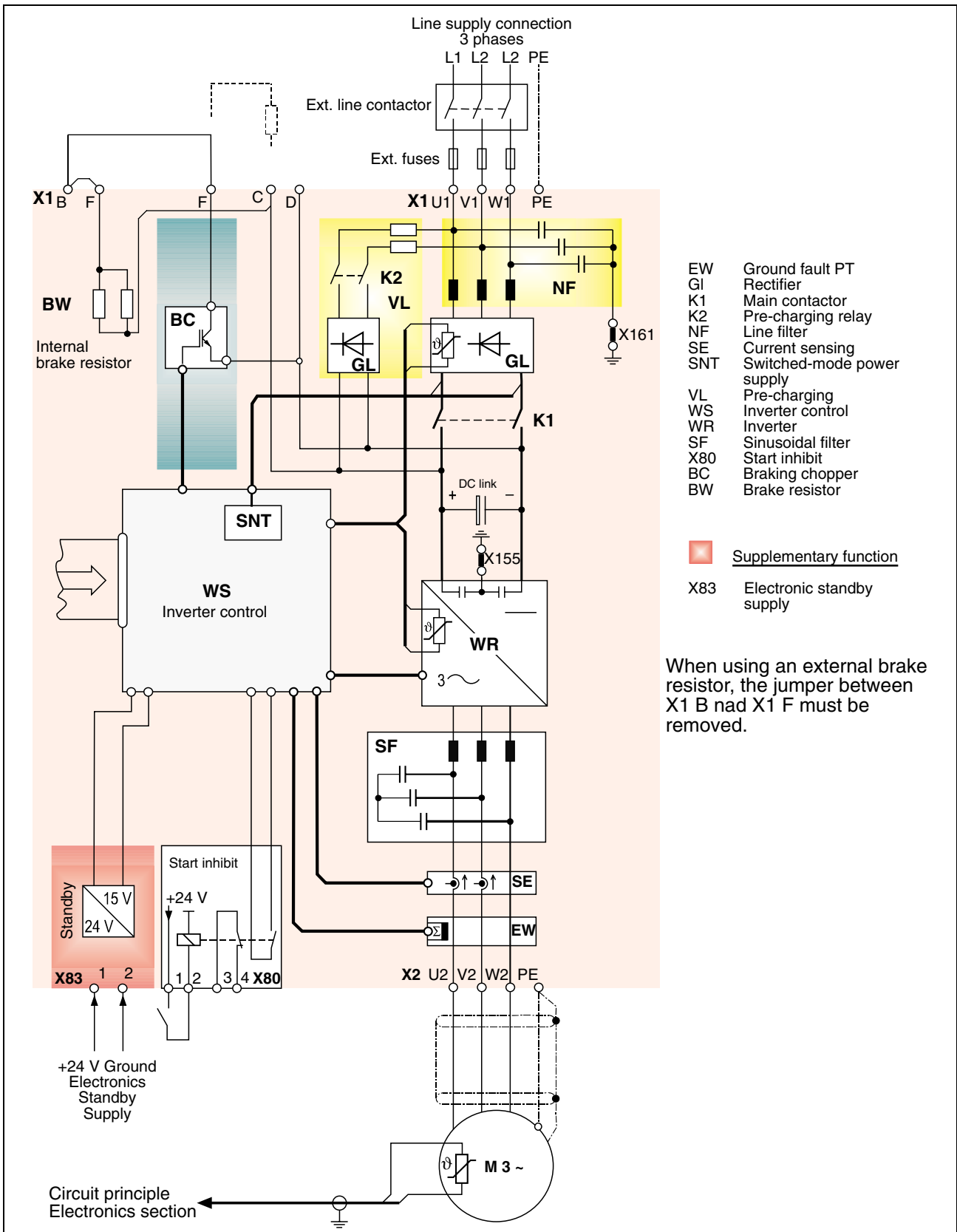


Fig. 3-4: Circuit principle, power section GK L and M



# Type code, configuration

	Moduleslot																				
	1									2											
Abbrev-Column →	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1
Example:	C	F	G	-	R	D	5	0	0	-	N	N	-	N	N						

**1. Object**

1.1 Configuration... = CFG

**2. Product**

2.1 RD500 ..... = RD500

**3. Modulslot 1 and 2**

**3.1 RD51.1 / RR51.1**

3.1.1	B1-B1	B1-L2	B1-NN	B1-T1
3.1.2	C1-C1	C1-L2	C1-NN	C1-T1
3.1.3	-	K1-L2	K1-NN	K1-T1
3.1.4	-	-	L2-NN	L2-T1
3.1.5	-	-	NN-NN	NN-T1
3.1.6	P1-P1	P1-L2	P1-NN	P1-T1

**3.2 RD52.1 / RR52.1**

3.2.1	B1-B1	B1-G1	B1-G2	B1-G3	B1-L1	B1-L2	B1-NN	B1-T1
3.2.2	C1-C1	C1-G1	C1-G2	C1-G3	C1-L1	C1-L2	C1-NN	C1-T1
3.2.3	-	-	-	-	G1-L1	G1-L2	G1-NN	G1-T1
3.2.4	-	-	-	-	G2-L1	G2-L2	G2-NN	G2-T1
3.2.5	-	-	-	-	G3-L1	G3-L2	G3-NN	G3-T1
3.2.6	-	K1-G1	K1-G2	K1-G3	K1-L1	K1-L2	K1-NN	K1-T1
3.2.7	-	-	-	-	-	-	L1-NN	L1-T1
3.2.8	-	-	-	-	-	-	L2-NN	L2-T1
3.2.9	-	-	-	-	-	-	NN-NN	NN-T1
3.2.10	P1-P1	P1-G1	P1-G2	P1-G3	P1-L1	P1-L2	P1-NN	P1-T1

**3.3 RS51.1**

3.3.1	B1-L2	B1-NN	B1-T1
3.3.2	C1-L2	C1-NN	C1-T1
3.3.3	-	L2-NN	L2-T1
3.3.4	-	NN-NN	NN-T1
3.3.5	P1-L2	P1-NN	P1-T1

**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 = CAN interface (without galvanic isolation)
- L1 = SynchroLink (fiber optic cable)
- L2 = Peer-to-Peer coupling via fiber optic cable
- NN = not equipped
- P1 = PROFIBUS-DP slave interface
- T1 = expanded control terminal strip

= only available for RD5X.1  
 = only available for RR5X.1  
 = available for RD5X.1 and RR5X.1

Fig. 3-6: Type code, configuration

# Type code, firmware

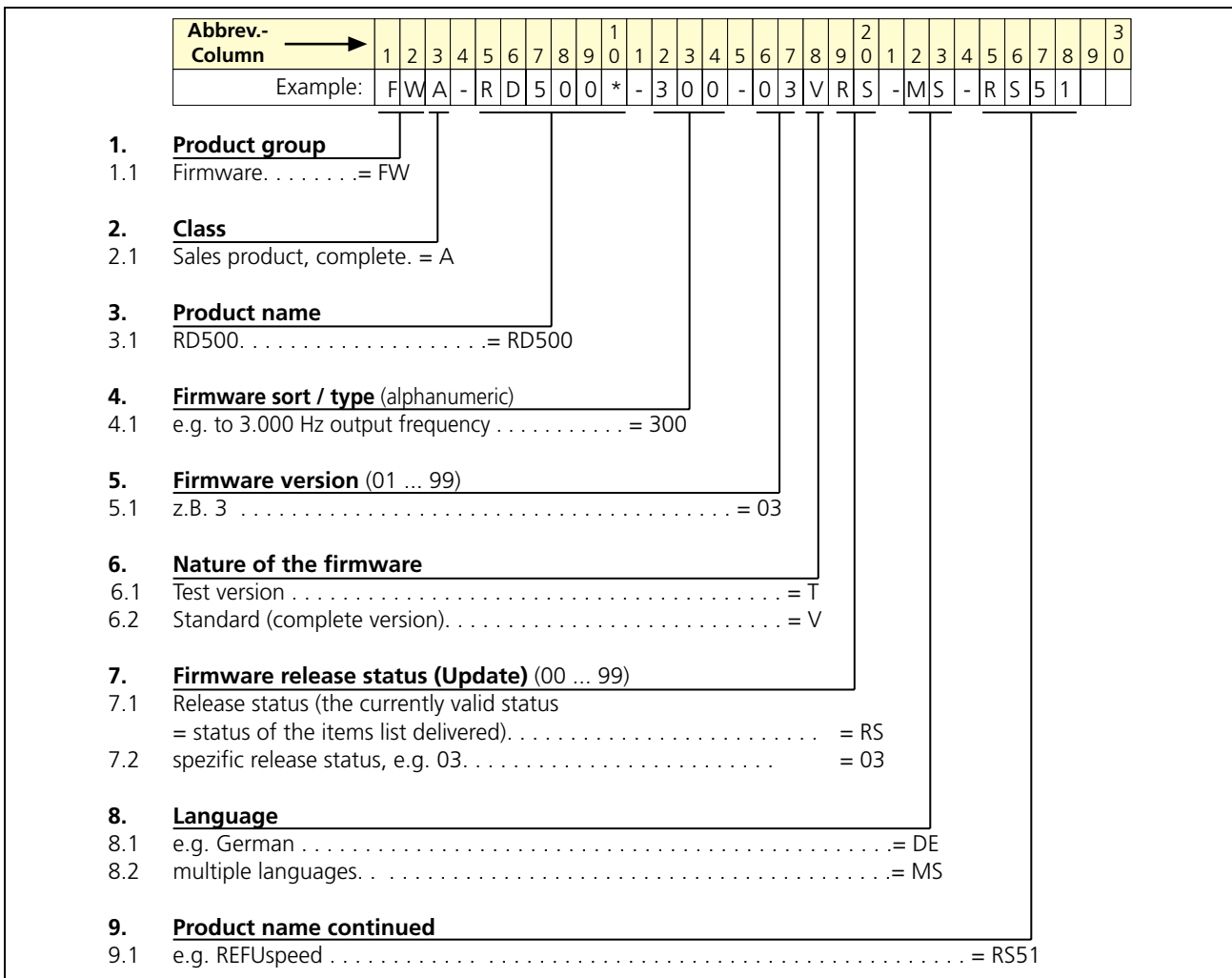


Fig. 3-7: Type code, firmware



## 4 Mounting

### 4.1 Storage and installation

#### Storage

The drive units must be stored in dry, clean rooms. The storage temperature must lie between  $-25^{\circ}\text{C}$  and  $+70^{\circ}\text{C}$ . Temperature fluctuations greater than 20 K per hour are not permissible.

**Note:** AC drive converters and rectifier converters use aluminum Elko capacitors as DC link capacitors. They can be stored for a maximum of 2 years in a no-voltage condition at a storage temperature of  $\leq 40^{\circ}\text{C}$ .



#### Minimum requirements placed on the installation location

- The drives should be operated in dust-free rooms. Dust-laden air must be filtered (3K3 according to DIN IEC 721-3-3).
- The ambient temperature must lie in the range  $0\dots40^{\circ}\text{C}$ .
- The relative air humidity may not exceed 90%, moisture condensation is not permissible.
- It is not permissible that the air drawn in contains gases which could have a negative impact on the function; the air may neither contain aggressive nor electrically conductive gases.
- The airflow through the ventilators may not be restricted. The minimum clearances, specified for the various sizes for air intake and air discharge may not be obstructed as a result of other mounted components.
- The drive dissipates power in the form of heat which heats up its environment. This means that there must be sufficient clearance to heat-sensitive equipment and devices.

#### Installation altitudes above 1000 meters sea level:

For installation altitudes exceeding 1000 meters above sea level, the drive converter or inverter must be de-rated in accordance with the diagram below.

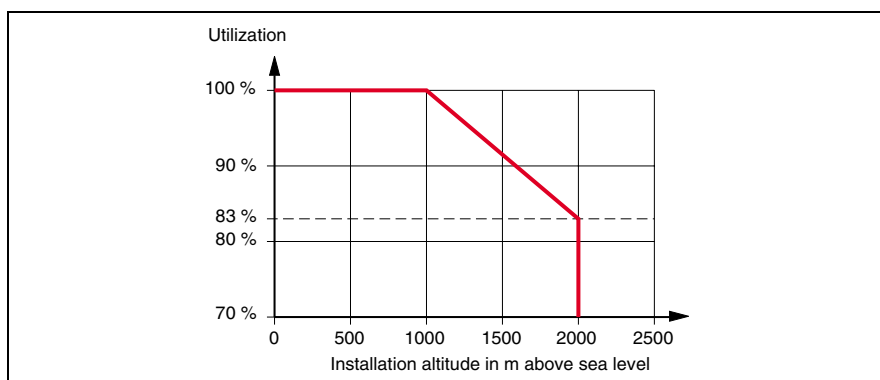


Fig. 4-1: De-rating as a function of the installation altitude

## 4.2 Mounting, drives sizes J to M

- The REFUdrive 500 drives, sizes J to M are module and are designed for installation in cabinets.
- The drive units have mechanical grid dimensions of 22.5 mm. Several drive units can be mounted next to one another without any intermediate space when using mounting rails with threaded holes with the dimension grid (also refer to the mounting example).
- The drives must be mounted vertically onto a flat surface.
- A minimum clearance of 100 mm above and below the drives must be maintained to ensure an unrestricted cooling airflow.
- When mounted in cabinets, the cooling airflow requirement of the installed drives must be calculated and the cabinet ventilation appropriately dimensioned.
- The mounting bolts are specified in the drilling templates of the dimension drawings.

### Minimum clearance

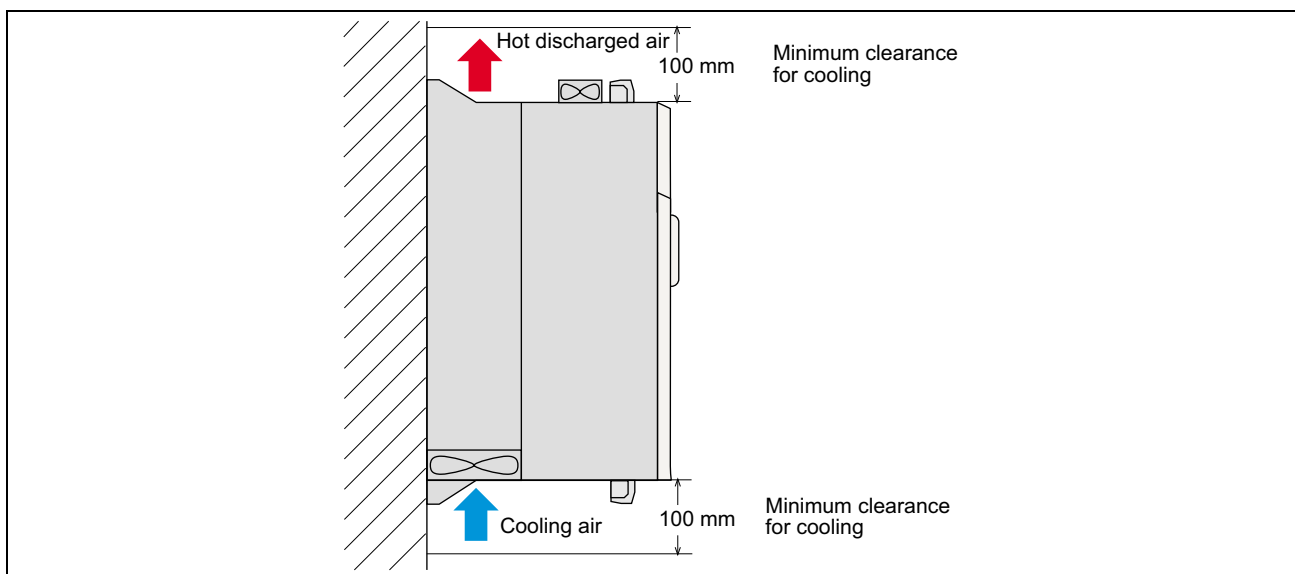


Fig. 4-2: Minimum clearance for cooling



Dimension drawings, front view, sizes J to M

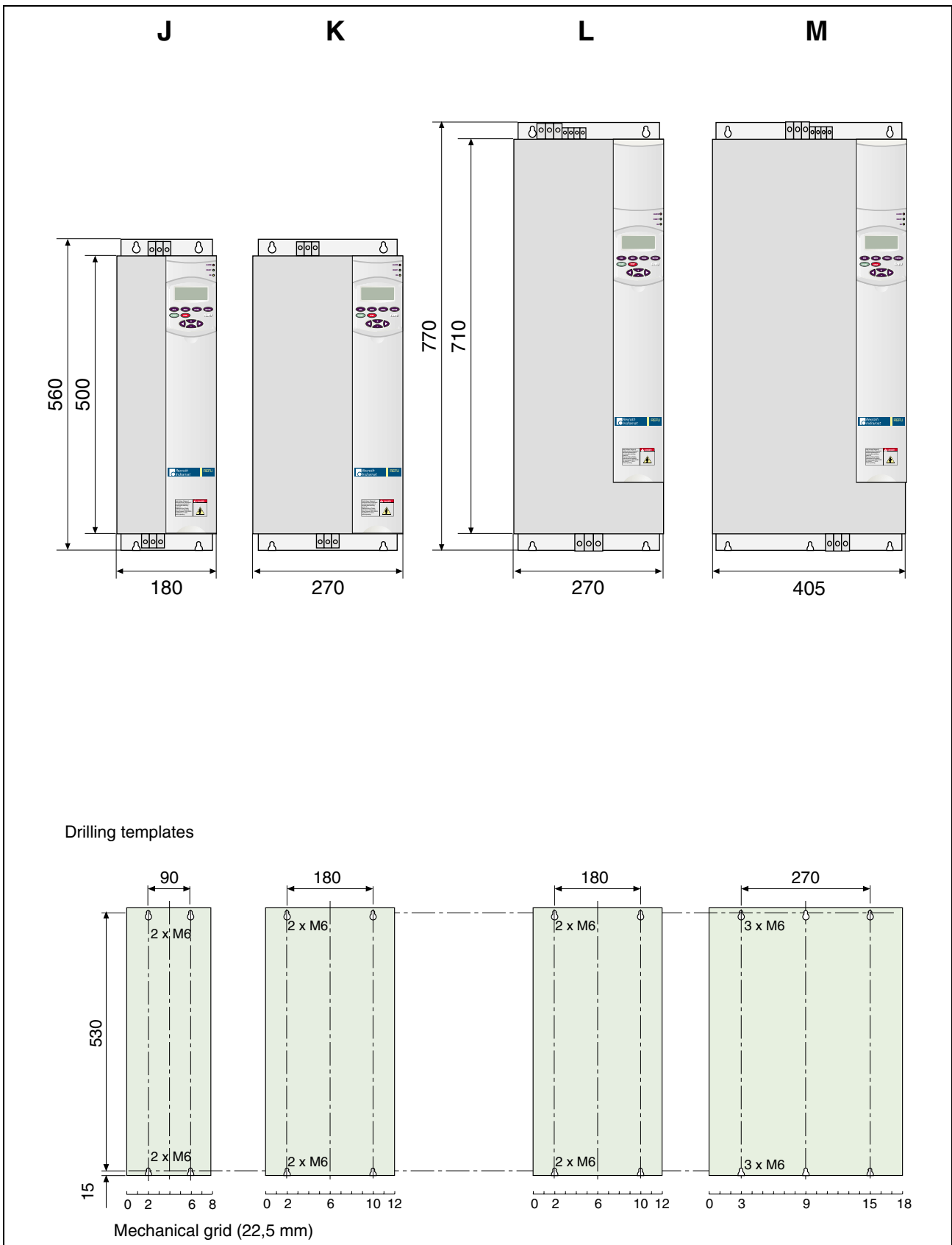


Fig. 4-3: Dimension drawing, front view GK J to M

## Dimension drawing, side view, sizes J to M

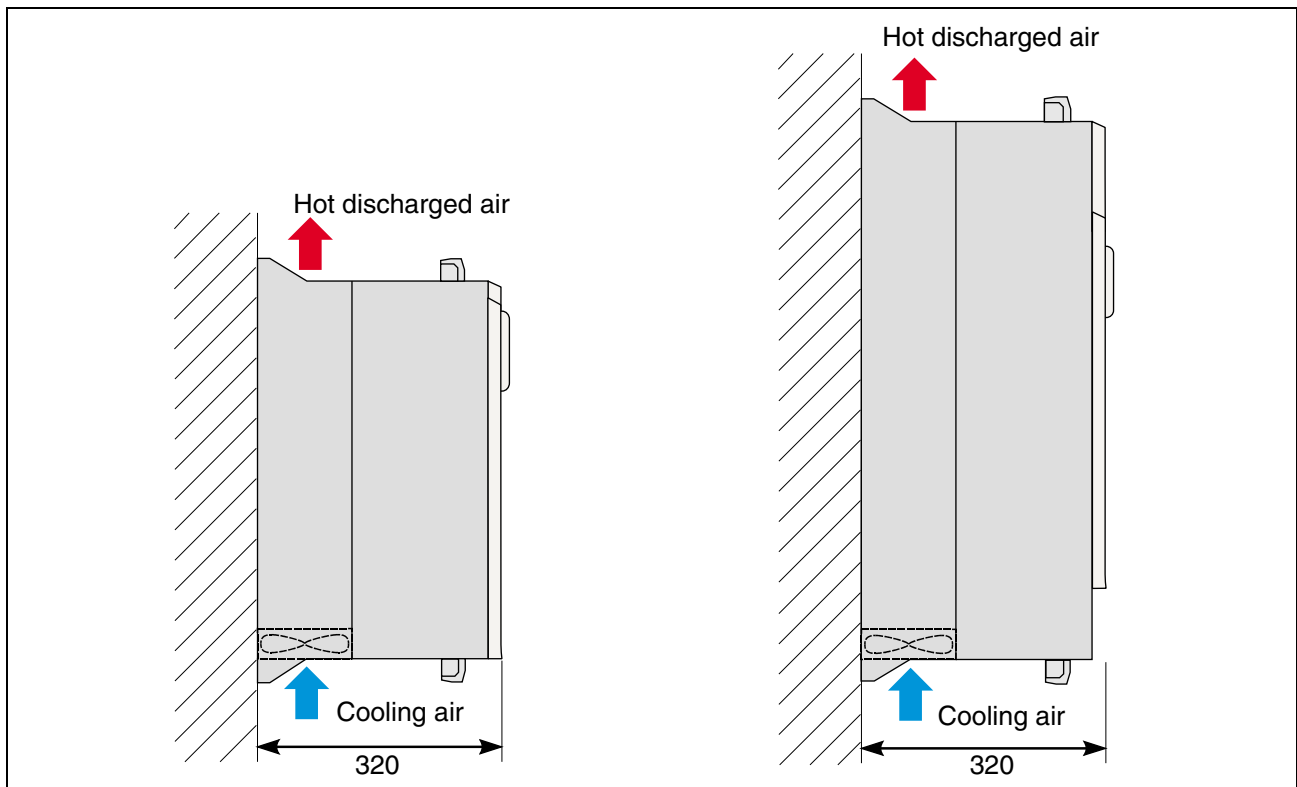


Fig. 4-4: Dimension drawing, side view GK J to M

## 5 Electrical installation

### 5.1 10 rules for EMC-correct installation of drives

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 cabinet should be connected with one another through the largest possible surface area so that the best electrical connection is established (not paint on paint!). If required, use serrated washers which cut through the paint surface. 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 close as possible to grounded sheet steel panels. For this reason, cables and wires should not be routed freely in the cabinet, but as close as possible to the cabinet itself and the mounting panels. This is also true for reserve cables.
- Regel 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, to reduce the shield current, an additional potential bonding conductor with a cross-section of at least 10 mm<sup>2</sup> should be connected in parallel with the shield. The shield can be connected to ground (=cabinet housing) at several locations. This is also true outside the cabinet. 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 at one end to the drive converter in order to prevent low-frequency noise being injected into the screen (50 Hz)..
- Rule 8** Always locate a radio interference suppression filter close to the noise source. The filter should be connected through the largest possible surface area with the cabinet housing, mounting panel etc. The best solution is a bare metal mounting panel (e.g. manufactured from stainless steel, galvanized steel), as 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. Suitable motor cables are, for example, Siemens PROTOFLEX-EMV-CY (4 x 2.5 mm<sup>2</sup> ... 4 x 120 mm<sup>2</sup>) with Cu shield.

Cables with steel shield 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 AC drive converter may not be interrupted by installing components such as output reactors, sinusoidal filters, motor filters, fuses, contactors. The components must be mounted on mounting panels which also simultaneously serve as shield connection for the incoming and outgoing motor cables. If required, metal barriers may be required to shield the components.

## 5.2 Warnings and information



**GEFAHR**

### Lethal shock as a result of live components at voltage levels exceeding 50V!

- ⇒ REFUdrive 500 drive units are operated at high voltage levels. Any work must always be carried-out with the drive converter powered-down (the drive converter must be in a no-voltage condition) and locked-out against accidental re-closure!
- ⇒ Only qualified, trained personnel may carry-out any work!
- ⇒ If this warning information is not observed, this can result in death, severe bodily injury or significant material damage.
- ⇒ The drive unit has hazardous voltage levels up to 5 minutes after it has been powered-down as a result of the DC link capacitors. This means that it is only permissible to work on the unit or the DC link terminals after the appropriate time and after a careful check has been made to ensure that the equipment really is in a no-voltage condition.
- ⇒ The power and control terminals can be live (at a dangerous voltage level), even when the motor is stationary.
- ⇒ If the DC link voltage is centrally supplied, it must be ensured that the inverter is reliably isolated from the DC link voltage!
- ⇒ When working on drive units which are open, it should be noted that personnel could come into contact with live components (components at a dangerous voltage level).
- ⇒ The user is responsible in ensuring that all of the units are installed, mounted and connected in compliance with the recognized regulations in the particular country as well as all other regional regulations which may apply. Especially important are cable dimensioning, fusing, grounding, disconnection, isolation and overcurrent protection.



**CAUTION**

### Damage to the drive units as a result of an incorrect supply voltage!

- ⇒ The REFUdrive 500 units are designed for various supply voltages! This is the reason that supply voltages are not specified in the drawings and tables for the terminal strips.
- ⇒ When connecting-up the drive 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 10mm<sup>2</sup> Cu or a second protective conductor must be routed in parallel (VDE 0160, Section 6.5.2) 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). The discharge current 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 57100 Part 540 / VDE 0100 Part 540 Table 2. The line-side circuit of the drive converter corresponds to circuit 7 (DIN VDE 0160-5.5.3.4.2 Fig. 8).

An e.l.c.b. device (residual current-operated device) may not be used as protective measure.

## 5.3 Cable cross-sections

The cable cross-sections refer to the rated drive converter current.

The associated protective conductor cross-section must be a minimum of 10 mm<sup>2</sup> (if power cables, with cable cross-sections >10 mm<sup>2</sup> are used, then the protective conductor must have the same cross-section).

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

- The cross-sections are valid for one phase for multi-stranded conductors, and were defined in accordance with VDE0298.
- Up to 35 mm<sup>2</sup>, individual conductors in a cable duct.
- Above 50 mm<sup>2</sup>, 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 mm<sup>2</sup>, routed in the cable duct, without any cable bundling.
- Above 50 mm<sup>2</sup>, freely routed in the cabinet without any contact to other cables.

Drive unit output	Power supply connection			Motor connection	
	Recommended minimum cross-section	Cable cross-section which can be connected 1)	Maximum fusing, type Typ gL	Recommended minimum cross-section	Cable cross-section which can be connected 1)
[kVA]	[mm <sup>2</sup> ]	[mm <sup>2</sup> ]	[A]	[mm <sup>2</sup> ]	[mm <sup>2</sup> ]
3	1.5	0.2 - 4	5	1.5	0.5 - 10
6	2.5	0.2 - 4	10	2.5	0.5 - 10
14	4	0.2 - 4	20	4	0.5 - 10
24	10	6 - 25	35	10	10 - 25
31	16	6 - 25	50	16	10 - 25
50	35	25 - 50	80	35	16 - 50

1): As a result of the terminal size

Fig. 5-1: Cable cross-sections for line supply, DC link and motor feeder cables

## 5.4 Power terminals RS51, Sizes J-M

### Terminal layout diagram, sizes J - M

**Note:**



The supplementary function P24V, electronics standby supply (terminal X83) is only mounted if it was actually ordered. It can only be retrofitted by extremely well-trained personnel.

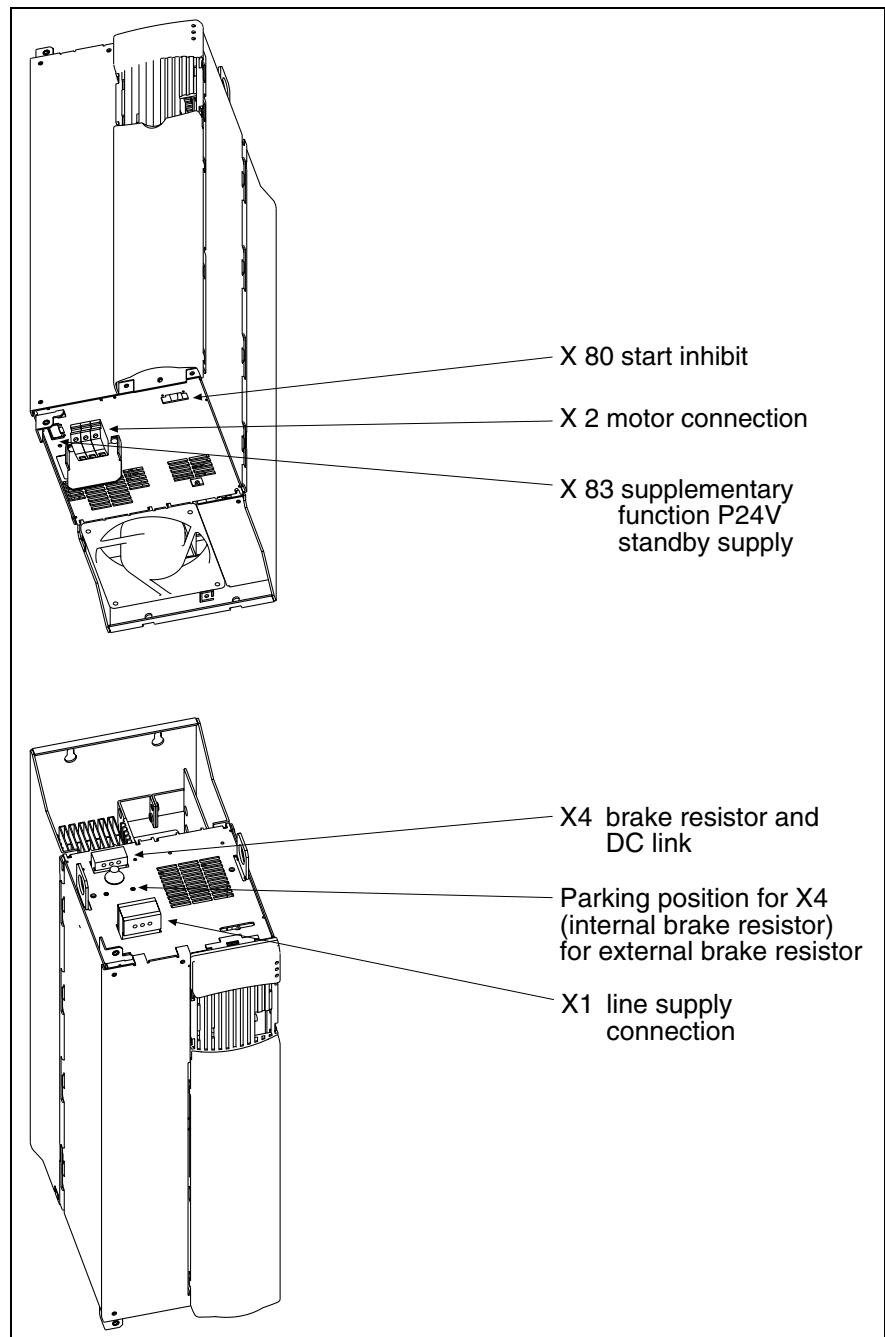


Fig. 5-2: Terminal layout diagram GK J



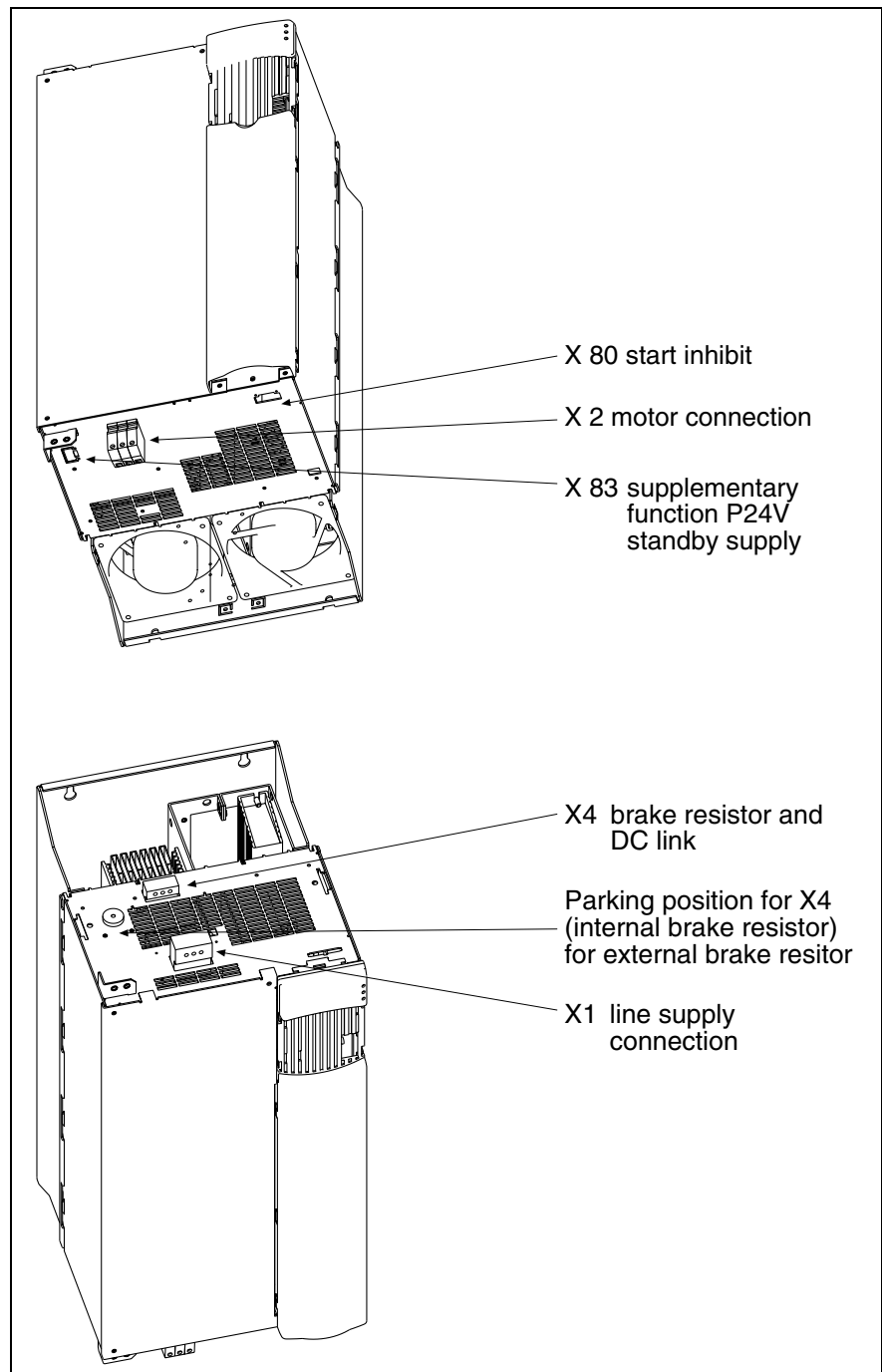


Fig. 5-3: Terminal layout diagram GK K

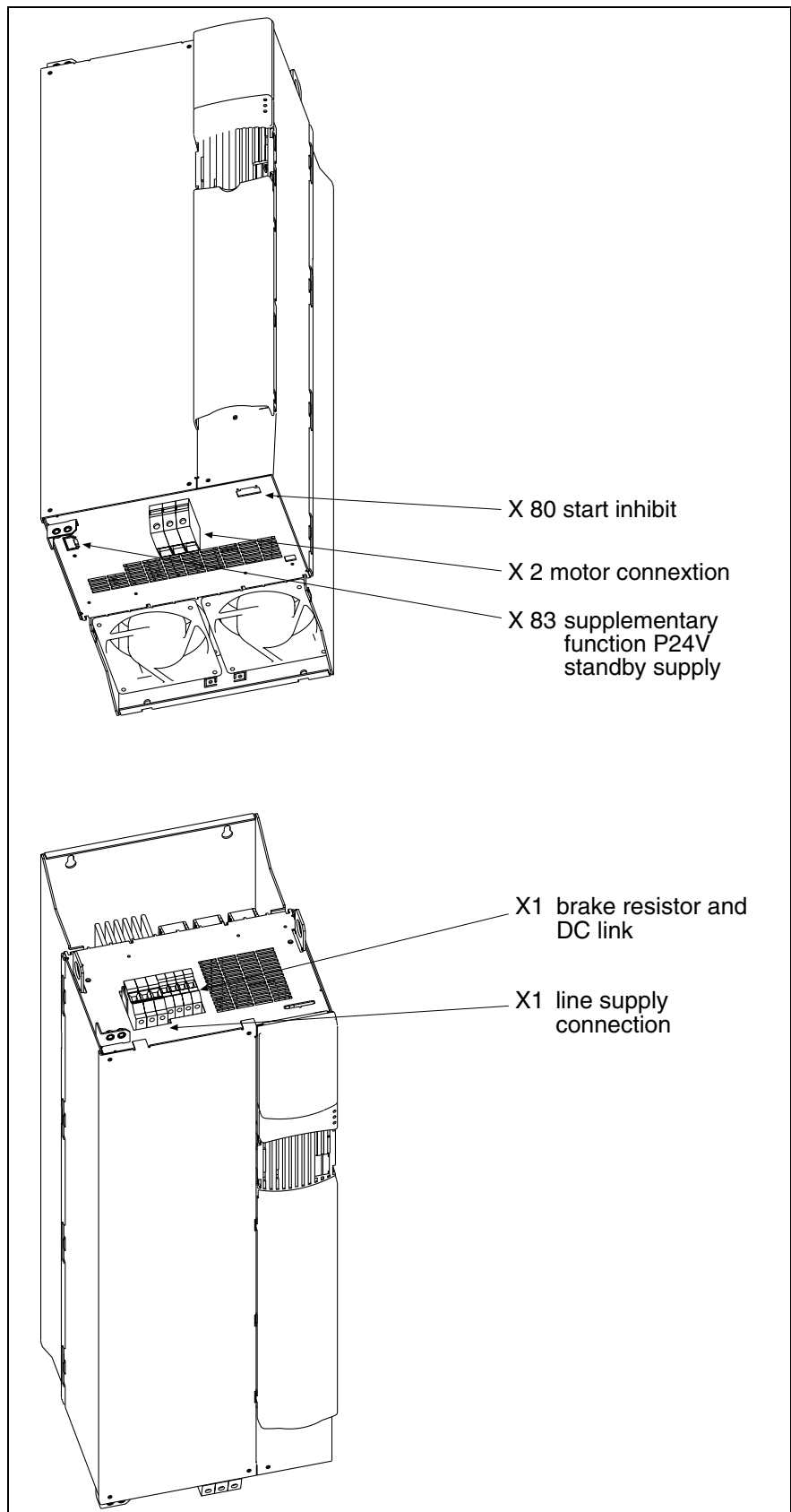


Fig. 5-4: Terminal layout diagram GK L

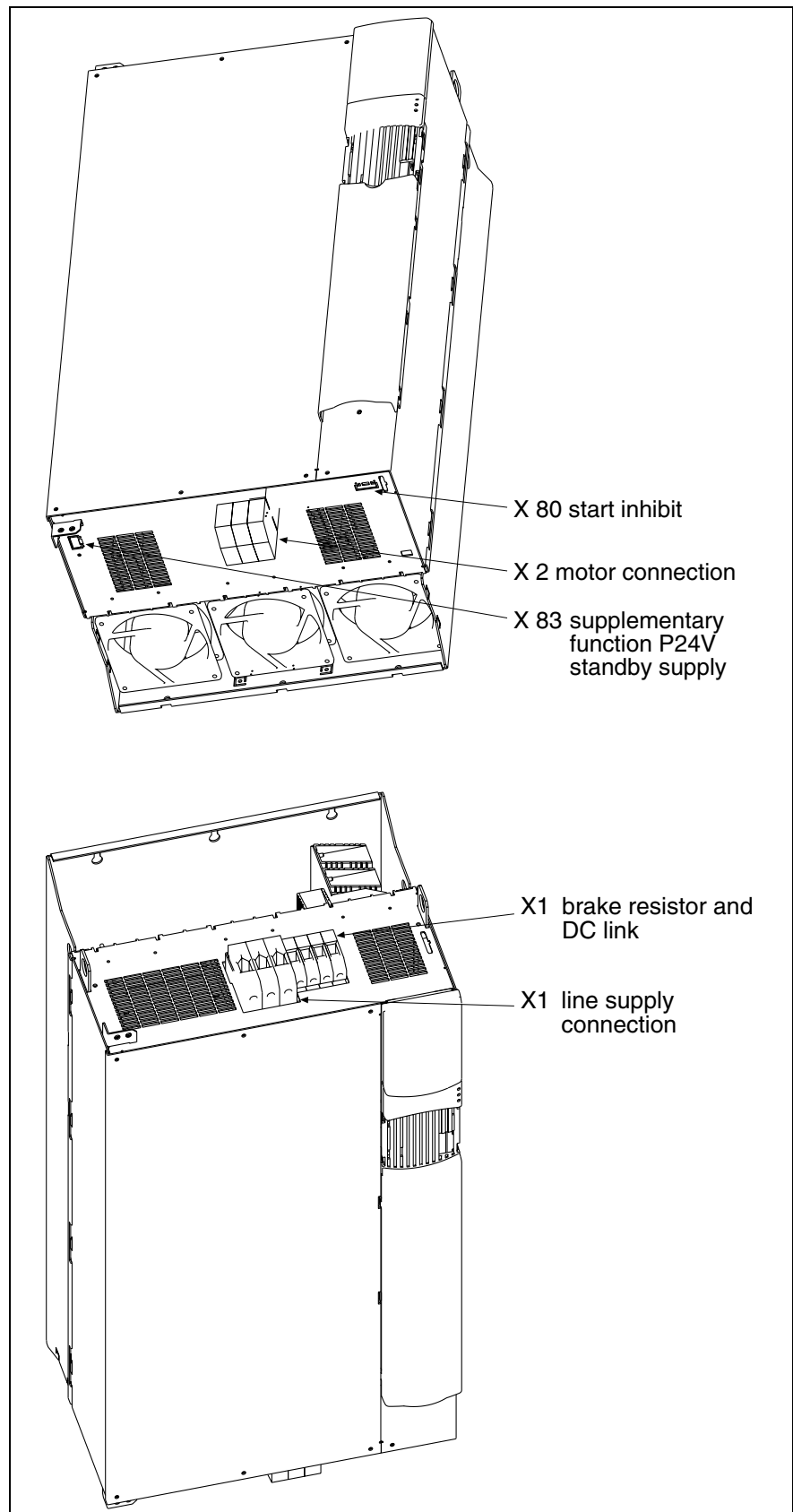


Fig. 5-5: Terminal layout diagram GK M

## Overview, power terminals

### Sizes J and K

Terminal	Comment	Cross-section which can be connected	
		J	K
<b>X1</b>	<b>Line supply connection</b>		
PE	Protective-conductor connection; Metal lug at the enclosure with captive nut, for sizes J and K = M 5.	10 mm <sup>2</sup>	
L1 / U1	Line supply connection, 3 phases L1, L2, L3	0.2 ... 4 mm <sup>2</sup>	
L2 / U2	Permissible line supply voltage, refer to the rating plate on the upper side of the drive unit.		
L3 / W1			
<b>X4</b>	<b>DC link connection</b>		
C	DC link + / internal brake resistor / external brake resistor	0.2 ... 2.5 mm <sup>2</sup>	
D	DC link -		
F	Connection, external / internal brake resistor		

<b>X2</b>	<b>Motor connection</b>		
U2	Motor connection U, V, W	0.5 ... 10 mm <sup>2</sup>	
V2			
W2			
PE	Protective conductor connection, motor and shield connection for the motor cable; metal lug at the enclosure with captive nut, M5	10 mm <sup>2</sup>	

<b>X80</b>	<b>Start inhibit</b>		
1	Function: Start inhibit In operation, terminals 1 – 2 must be closed; when open, the motor cannot be started	0.14 ... 1.5 mm <sup>2</sup>	
2			
3	Checkback signal, start inhibit, floating contact, NC contact 30V DC / 1A		
4			

<b>X83</b>	<b>Supplementary function, P24V standby supply for the electronics (the terminal is only mounted for drive units with integrated supplementary function)</b>		
1	P24V 24V DC –15/+20%, ripple, max 5%, power drain ~ 40 W, in compliance with VDE 0411/500	0.2 ... 2.5 mm <sup>2</sup>	
2	Ground		

## Sizes L and M

Terminal	Comment	Cross-section which can be connected	
		L	M
<b>X1</b>	<b>Line supply, DC link connection</b>		
PE	Protective-conductor connection; Metal lug at the enclosure with captive nut, for sizes L and M = M6.	≥10 mm <sup>2</sup>	
L1 / U1	Line supply connection 3 phases L1, L2, L3 Permissible line supply voltage, refer to the rating plate on the upper side of the drive unit.	1.5 ... 16 mm <sup>2</sup>	25 ... 50 mm <sup>2</sup>
L2 / V1			
L3 / W1			
D	DC link connection L -	0.5 ... 10 mm <sup>2</sup>	4 ... 35 mm <sup>2</sup>
B	Connection, external / internal brake resistor		
F	Connection, external / internal brake resistor		

X2	Motor connection	L	M
		U2	10 ... 25 mm <sup>2</sup>
V2			
W2			
PE	Protective conductor connection, motor and shield connection for the motor cable; metal lug at the enclosure with captive nut, M5	≥10 mm <sup>2</sup>	

X80	Start inhibit	
1	Function: Start inhibit	0.14 ... 1.5 mm <sup>2</sup>
2	In operation, terminals 1 – 2 must be closed; when open, the motor cannot be started	
3	Checkback signal, start inhibit, floating contact, NC contact 30 V DC / 1 A	
4		

X83	Supplementary function, P24V standby supply for the electronics (the terminal is only mounted for drive units with integrated supplementary function)	
1	P24V 24V DC –15/+20%, ripple, max 5%, power drain ~ 40 W, in compliance with VDE 0411/500	0.14 ... 1.5mm <sup>2</sup>
2	Ground	

### 5.5 Connection circuit diagram

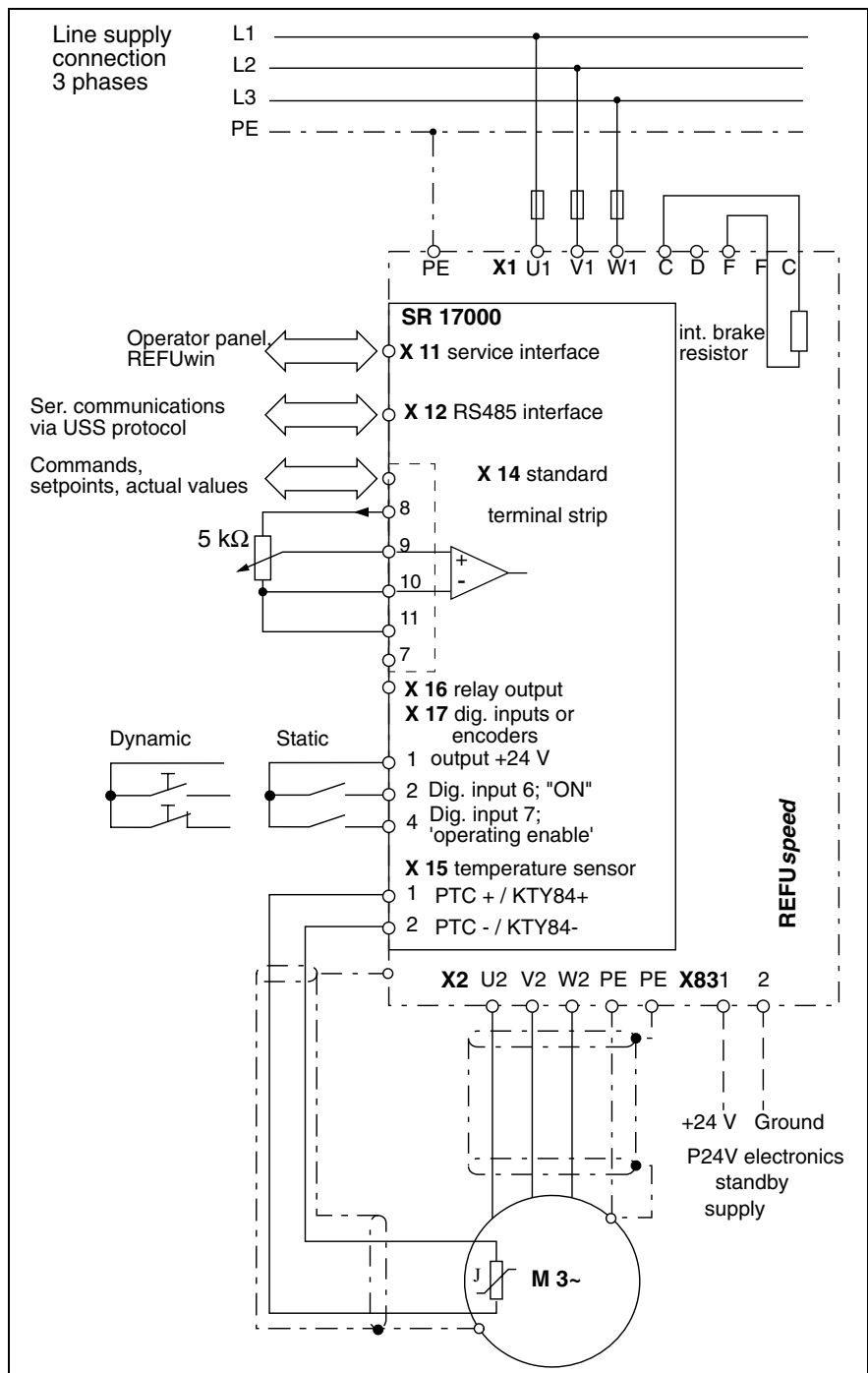


Fig. 5-6: Connection circuit-diagram for AC drive converters (standalone drive)

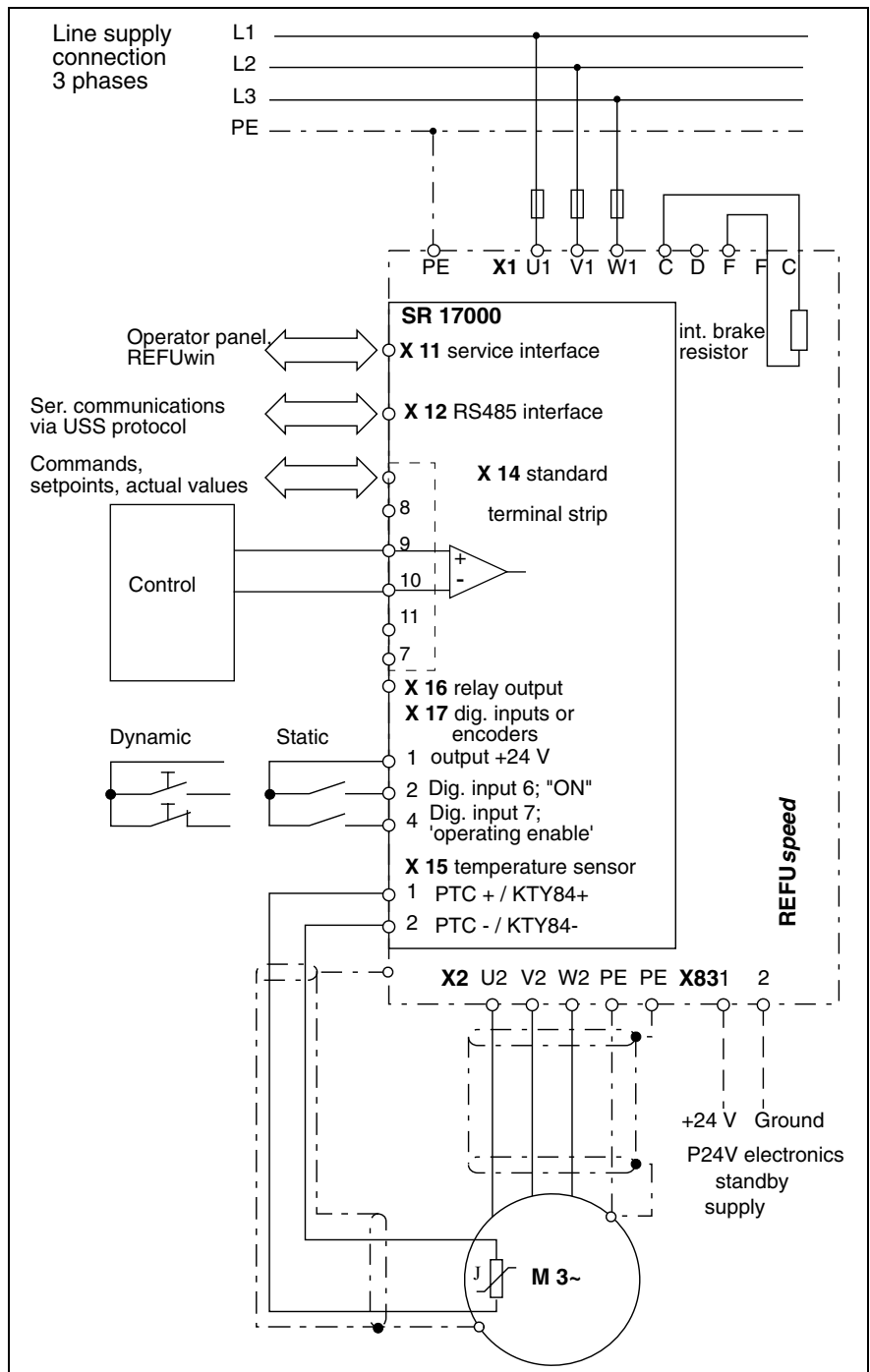


Fig. 5-7: Connection circuit diagram for AC drive inverters (setpoint generated from the control)

## 5.6 Control terminals

### Terminal layout diagram SR17000

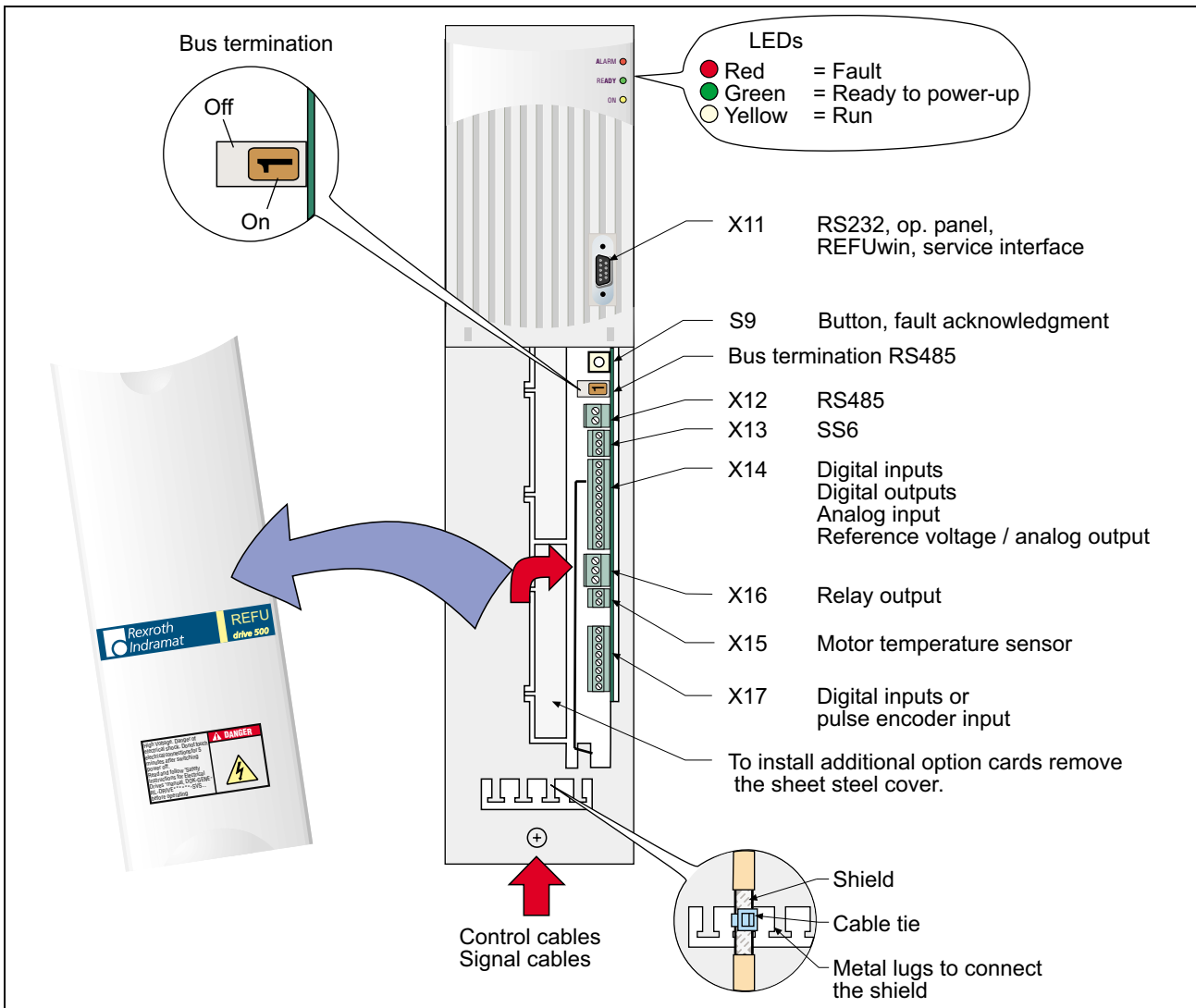
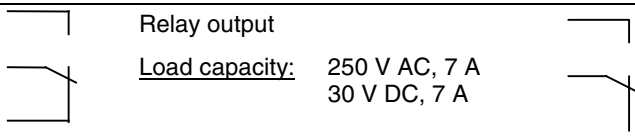


Fig. 5-8: Control terminals on the SR17000 control board

### Description of the control terminals

Terminal	Designation	Comment
<b>X11</b>	<b>Service interface</b>	
3	R x D	RS232 service interface;
2	T x D	To insert the operator panel
5	Ground	To connect a PC with the REFUwin operator control interface
<b>X12</b>	<b>RS485 interface</b>	
1	R x D+ / T x D+	RS485 interface; communications with the USS protocol
2	R x D- / T x D-	



Terminal	Designation	Comment	
X13	SS6	Only for internal use	
X14	Standard terminal strip		
1	P24V output	Load capacity, max. 50 mA	
2	Dig. input 1 Dig. output 1	<p>Digital inputs without electrical isolation: Input current at 24 V: 8.6 mA H signal: +13 V ... +33 V L signal: -3 V ... +5V or open terminal</p> <p>Digital outputs H signal: +21 V, max. 20 mA L signal: 0 V</p>	
3	Dig. input 2 Dig. output 2		Optional, input / output; function can be selected using P0875
4	Dig. input 3 Dig. output 3		Optional, input / output; function can be selected using P876
5	Dig. input 4		Optional, input / output; function can be selected using P0877
6	Dig. input 5		Function can be selected using P0878
7	Digital ground	Reference ground of the P24V (X14.1) if the digital inputs are switched from a control system, the ground cable from X14.7 to the ground reference point must be removed.	
8	Reference ±10 V Analog output	Optional function, can be switched-over using P0890 (5 mA load capacity, short-circuit proof): Reference voltage +10 V Reference voltage -10 V Analog output 0 ... ±10 V	
9	Analog input+	<p>Differential input can be optionally selected: ±10 V; A/D converter ±9 bit; resolution 20 mV, R<sub>e</sub> = 40 kΩ</p> <p>0 ... 20 mA; A/D converter 10 bit; resolution 0.02 mA, R<sub>e</sub> = 150 Ω</p> <p>4 ... 20 mA; A/D converter 10 bit; resolution 0.02 mA, R<sub>e</sub> = 150 Ω</p>	
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+	Motor temperature sensor connection (PTC or KTY84). Observe the polarity when connecting a KTY84!	
2	PTC- / KTY-		
X16	Relay output		
1	NO contact	 <p>Relay output</p> <p>Load capacity: 250 V AC, 7 A 30 V DC, 7 A</p>	
2	Common contact		
Dig. input 9	NC contact		

Terminal	Designation	Comment	
<b>X17</b>	<b>Digital inputs / incremental encoder</b>		
1	P15V output	Load capacity, max. 60 mA	
2	Dig. input 6 encoder track A+	<b>Selectable function:</b> Digital input The standard function of the terminal is a digital input; the technical data is the same as digital inputs 1 to 5. <b>Digital inputs</b> without electrical isolation  Input current at 24 V: 8.6 mA H signal: +13 V ... +33 V L signal: -3 V ... +5V or open terminal	Digital input 6: Function "On"
3	Dig. input 9 encoder track A-		Function can be selected using P0893
4	Dig. input 7 encoder track B+		Digital input 7: Function "Operating enable"
5	Dig. input 10 encoder track B-		Function can be selected using P0894
6	Dig. input 8 encoder track R+		Function can be selected using P0880
7	Dig. input 11 encoder track R-	Function can be selected using P0895	
8	Dig. Ground P15V	Reference ground, to +15 V (X17.1)	

Fig. 5-9: Description of the control terminals on the SR17000

### Providing the Reference Potential when Operating Several RD500s

If devices of the RD500 series are potentially connected with each other and/or to an external control, a central connection must be established between the reference ground and the PE. To do this, proceed as follows:

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

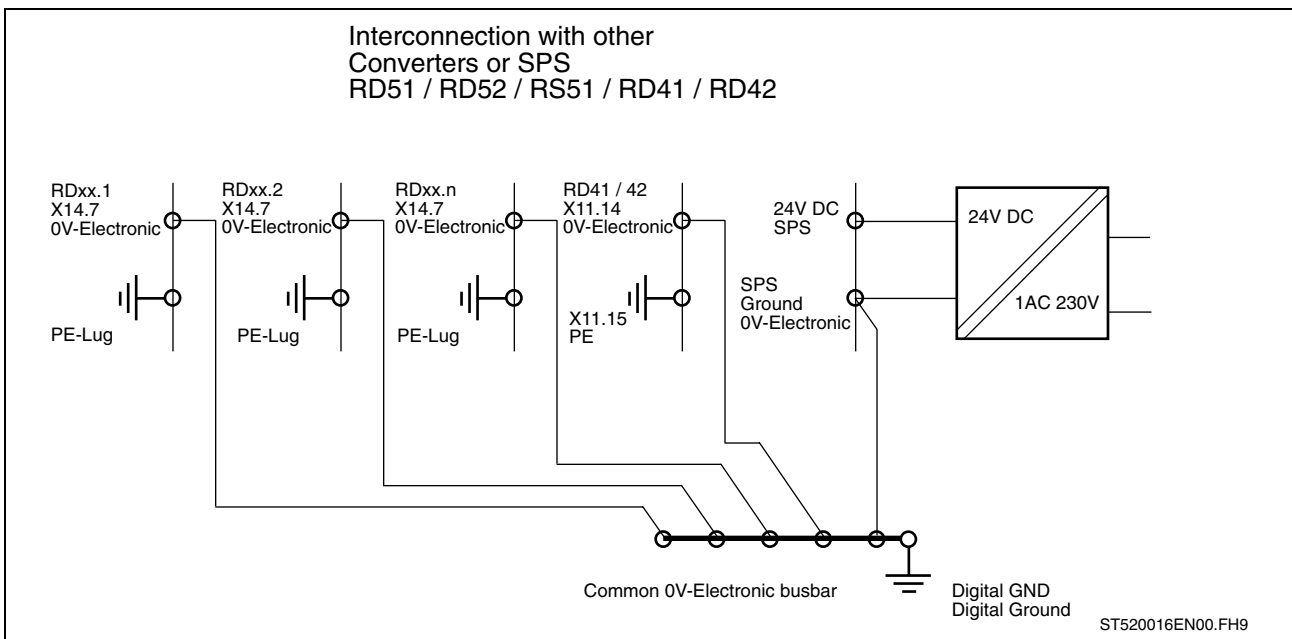


Abb. 5-10: Central connection of reference ground to PE

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

**Note:** When delivered, RD500 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)

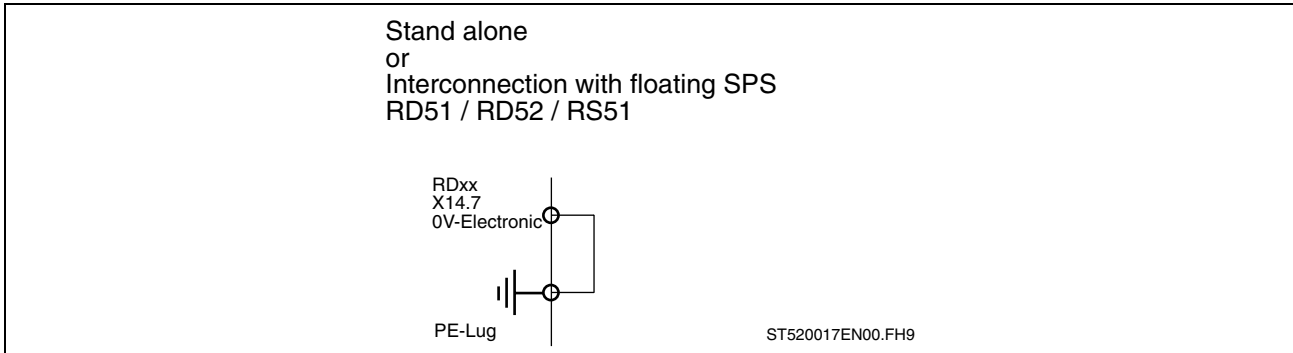


Abb. 5-11: Direct connection between reference ground and PE in RD51, RS51 and RD52

## 5.7 RS232 service interface (X11)

This interface is used to connect an operator panel or a PC with REFU-*win*. A pre-assembled standard extension cable can be obtained from Indramat Refu to connect the drive units (Order No. 0013456, length 5 m).

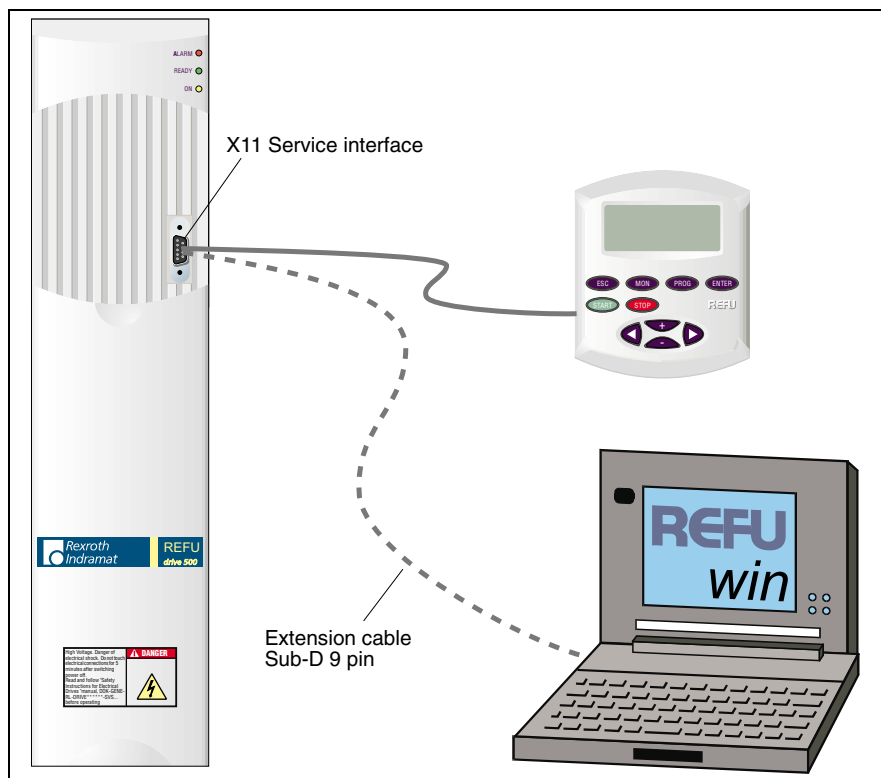


Fig. 5-12: Connection at the service interface

## Connecting the operator panel

The operator panel can either be inserted directly at connector X11 can be connected using the above specified cable.

## Connecting a PC

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

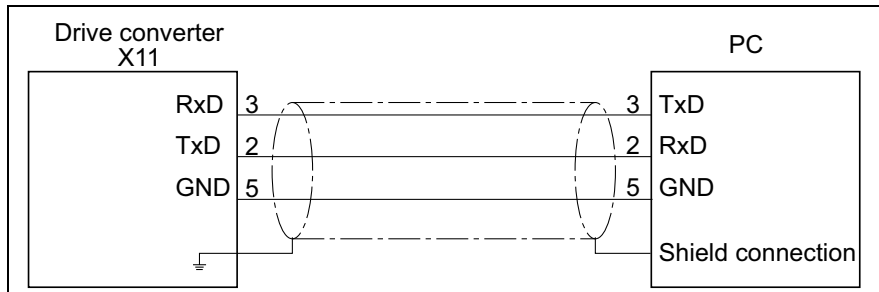


Fig. 5-13: Connecting cable for the PC

Alternatively, the operator panel cable can be used.

### The following settings must be observed:

<b>Baud rate:</b>	Can be set with P0499: 1200, 2400, 4800, <b>9600</b> (factory setting), 19200, 38400, 57600, 76800 baud
<b>Data bits:</b>	8
<b>Parity:</b>	Even
<b>Stop bits:</b>	1
<b>Protocol type:</b>	USS protocol, 4/6 words

## 5.8 Standard RS485 interface (X12)

The RS485 interface supports the USS protocol,, which is used to control the drive converter via a PLC. The USS protocol (Universal Serial Interface protocol) defines an access technique according to the master-slave principle for communications via a serial bus.

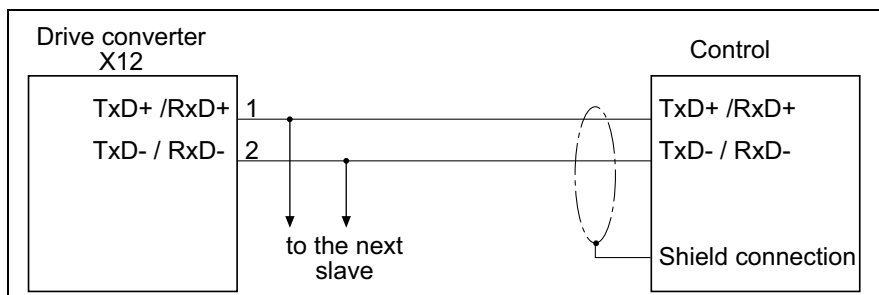


Fig. 5-14: Connecting the standard interface

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

**Exception:** "SS1 slave address" - in this case, every bus node has its own address.

### Bus termination

The last node of a bus system must terminate the bus to protect against the influence of noise. The bus termination is switched-in using a switch on the control card (refer to Section 5.6, Control terminals).

## 5.9 Standard SS6 interface (X13)

---

**Note:** Only for internal use.

---

## 5.10 Standard terminal assignment of the REFUspeed RS51

### Recommended terminal assignment with good compatibility to the REFU 316F

For this recommended assignment, a KL17037 must be inserted at option slot 2.

---

**Note:** This means, that there is only 1 option slot available for other modules!

---

REFUspeed RS51			REFU 316 F		Function
Terminal	Designation	Module	Terminal	Module	
X11		SR17000	X16	IO4004	Operator panel
X11	SR17000	-	-		RS232 service interface
-		-	X21	RS4012	RS232 interface
X12		SR17000	-	-	RS485 interface
X14.1		SR17000	X2.32	Terminal	24V / 50mA control voltage output
X14.7		SR17000	X2.		0V digital reference point
X17.1		SR17000	X2.11	Terminal	15V / 50mA control voltage output
X17.8		SR17000	X2.48	Terminal	0V digital reference point
X14.2	Dig In/Out 1	SR17000	X56.11/1 2	WM4034	Dig. output for WM signal "Sparking" signal or signal "Load limit"
X14.3	Dig In/Out 2	SR17000			Motpot. active load monitor sensitivity up / (can be freely configured)
X14.4	Dig In/Out 3	SR17000			Motpot. active load monitor sensitivity down / (can be freely configured)
X14.5	Dig In 4	SR17000	X2.10	Terminal	Par. set selection, weighting 2 <sup>4</sup>
X14.6	Dig In 5	SR17000	X2.9	Terminal	External fault acknowledgement
X17.2	Dig In 6	SR17000	X2.33	Terminal	Start NO contact
X17.3	Dig In 9	SR17000	X2.13	Terminal	Par. set selection, weighting 2 <sup>1</sup>
X17.4	Dig In 7	SR17000	X2.31	Terminal	Stop NC contact
X17.5	Dig In 10	SR17000	X2.14	Terminal	Par. set selection, weighting 2 <sup>2</sup>

REFUspeed RS51			REFU 316 F		Function
Terminal	Designation	Module	Terminal	Module	
X17.6	Dig In 8	SR17000	X2.12	Terminal	Par. set selection, weighting $2^0$
X17.7	Dig In 11	SR17000	X2.15	Terminal	Par. set selection, weighting $2^3$
X14.8	An Out	SR17000	X2.16	Terminal	+10V reference voltage for the potentiometer
X14.9	An In+	SR17000	X2.17	Terminal	Analog setpoint +
X14.10	An In-	SR17000	X2.18	Terminal	Analog setpoint -
X14.11		SR17000	X2.19	Terminal	Reference point 0V reference voltage
X16.1 S	Rel Out	SR17000	X2.27	Terminal	Fault signal, relay 250V / 1A
X16.2 C	Rel Out	SR17000	X2.26	Terminal	
X16.3 Ö	Rel Out	SR17000	X2.25	Terminal	
X15.1 +	PTC/KTY+	SR17000	X2.20	Terminal	Motor protection, PTC evaluation
X15.2 -	PTC/KTY-	SR17000	X2.21	Terminal	
X31.1		KL17037		Terminal	0V digital reference point
X31.6		KL17037		Terminal	free reference point for X31.2..5 possibly connect with X31.1.
X31.2	Opt Dig In 1	KL17037	X2.42	Terminal	Source block changeover TEST / NORMAL
X31.3	Opt Dig In 2	KL17037	X2.37	Terminal	f min selection
X31.4	Opt Dig In 3	KL17037	X2.7	Terminal	Setpoint voltage selection2 (A..D) $2^0$
X31.5	Opt Dig In 4	KL17037	X2.40	Terminal	Setpoint voltage selection2 (A..D) $2^1$
X32.1 S	Opt Rel Out 1	KL17037			Relay 1, can be freely configured
X32.2 C	Opt Rel Out 1	KL17037			Relay 1
X32.3 S	Opt Rel Out 2	KL17037			Relay 2, can be freely configured
X32.4 C	Opt Rel Out 2	KL17037			Relay 2
X32.5 Ö	Opt Rel Out 3	KL17037			Relay 3, can be freely configured
X32.6 C	Opt Rel Out 3	KL17037			Relay 3
X32.7 S	Opt Rel Out 3	KL17037			Relay 3
X32.8 Ö	Opt Rel Out 4	KL17037			Relay 4, can be freely configured
X32.9 C	Opt Rel Out 4	KL17037			Relay 4
X32.10 S	Opt Rel Out 4	KL17037			Relay 4
X33.1	Opt An Out 1	KL17037			Analog output 1, can be freely configured
X33.2	Opt An Out 2	KL17037			Analog output 2, can be freely configured
X33.3		KL17037			0V analog reference point
X34.2	Opt An In+	KL17037	X56.7	WM4034	Sensitivity or load limit +
X34.1	Opt An In-	KL17037	X56.8	WM4034	Sensitivity or load limit -

## Deviations to REFU 316F

For REFU316F, the control terminal functions are permanently assigned. The recommended terminal assignment above, with good compatibility to the REFU 316 F, indicates that a good match can be achieved using RS51. However, this is not absolutely necessary. The possibilities of free terminal assignment using appropriate parameterization should remain open in order to permit new solutions in this market.

- Direction of rotation selection:** Only 1 input is provided to reduce the number of terminals to a minimum. REFU316F has 1 terminal for counter clockwise direction of rotation and 1 for a clockwise direction of rotation. (the reason is safety requirements, is no longer in the standard, but can be parameterized. For example, terminals instead of a motorized potentiometer function).
- Closed-loop speed control and selecting 32 parameter sets:** Closed-loop speed control with IGR interface cannot be used in conjunction with the selection of 32 parameter sets!
- Perm. assigned analog outputs:** Instead of the previous 4 permanently assigned analog outputs (0 ... 10V), there are now 2 parameterizable outputs (20 mA with electrical insulation).
- Differences for the signaling relays:** 250V AC can only be used with the relay on the SR (X16). In most cases, this is used for a fault signal. The other 4 relays on the KL17037 are not permitted for a line supply voltage on the PC board due to the insulating clearances. For 2 of the 4 relays, only the NO contact is fed to terminals.
- No positioning:** This is a pure spindle drive unit. Positioning was only used for milling spindles to change the tool.
- Programming the spindle current:** The programming resistor in the spindle connector cannot be measured for current limiting. This limit value can be subsequently derived from the spindle ID data.
- Fdig output:** RS51 has no Fdig output. If the customer requires a speed display, this can be realized using an analog output and an analog display instrument.
- Display languages:** French and Spanish are not supported!





## 6 Operator control and visualization

### 6.1 Operator control possibilities

The following are available to control, visualize and parameterize the REFU<sup>speed</sup> drives: The RZB01.2 or RZB03.2 (option) operator panels, the REFU<sup>win</sup> PC operator interface and several interfaces.

The serial RS232 and RS485 interfaces are provided on the control card as standard. In addition, the optional interface cards for Profibus DP, Interbus S, CAN bus, CANopen and peer-to-peer coupling are available.



Fig. 6-1: Operator panel with graphics display (option)

### 6.2 Operator control using the operator panel

#### 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
	Starts the drive	The On/Off command must be set to "Terminal steady-state + operator panel" or "Operator panel, dynamic"; refer to Section 5.4.1, Drive control/setpoints.
	Stops the drive	
	Motorized potentiometer: Increases the setpoint <b>or</b> increases the Active Load Monitor (ALM) sensitivity	Motorized potentiometer setpoint: The setpoint must be set to "Motorized potentiometer"; refer to Section 5.4.1, Drive control /setpoints. <b>or</b> active load monitor sensitivity - motorized potentiometer up / down: The setpoint may not be set to "Motorized potentiometer"; refer to Section 5.4.1 Drive control /setpoints.
	Motorized potentiometer: Decreases the setpoint <b>or</b> reduces the Active Load Monitor (ALM) sensitivity	
	Toggles between the NORMAL and TEST modes	Password level 2 must be selected and the inverter must be inhibited (refer to Section 4.2.2, Operating display).

Fig. 6-2: 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).

### Monitoring (monitor) using the operator panel







Key	Menu levels
	Return jump to the previous menu item
	Change into the monitor
	Change in the parameterization
	Accept the selected menu item
	To the previous menu item
	To the next menu item

Fig. 6-3: Key functions of the operator panel in the monitor mode

## Parameterization using the operator panel

The basic parameterization is described in more detail in Section 7.









Key	Menu level	Parameterizing level
	Return jump to the previous menu item	The modified value is rejected
	Changes into the monitor	
	Changes into parameterization	The value is initially accepted. All of the values are only accepted after the "Enter" key has been pressed.
	Accepts the selected menu item	Accepts the modified value
	To the previous menu item	Increases the value
	To the next menu item	Decreases the value
	Jump to the end of the list	Cursor position to the right
	Jump to the beginning of the list	Cursor position to the left

Fig. 6-4: Key functions of the operator panel when parameterizing

### Fast parameterizing using key combinations


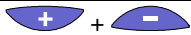




Key	Response
	The first selection parameter is directly selected for text parameters.
	When these keys are simultaneously pressed: <ul style="list-style-type: none"> <li>– the complete parameter number is set to zero (numerical list).</li> <li>– the complete parameter value is set to zero (for numerical parameters).</li> <li>– the text selection is scrolled in steps of ten (this is practical, e.g. parameter P0875 with almost 100 selection texts).</li> </ul>
	The last selected text is selected for text parameters.
	When these keys are simultaneously pressed, the active value is set to the factory setting.
	If these keys are simultaneously pressed, the system changes from the Mon or Prog area into a temporary actual value display. When the ESC key is pressed again, the display switches-back to the selected menu. In order that the operator can differentiate between the normal operating display and the temporary actual value display, the temporary actual value display has a flashing frame.

Fig. 6-5: Key combinations

### Error messages when parameterizing

Error message	Cause	Solution
Parameter is not accessible in the basic parameterization.	Parameter numbers which are not accessible have been entered into the numerical list.	Only pre-defined parameters are available in the basic parameterization. Only parameter numbers from the Tables in Section 5 can be entered.
Please select basic parameterization	The selected parameter is a macro parameter and is not accessible in the free parameterization.	Change into the basic parameterization. <b>Caution! Data could be lost.</b>
Parameter inhibited	Drive is operational.	Inhibit the inverter and then change the parameter.
Data conflict (general)	Some parameter settings are dependent on others. If a parameter is changed and is acknowledged with  , then data conflicts can occur.	

Error message	Cause	Solution
Data conflict e.g. P0182 with P0183	The V/Hz characteristics are not correct. The frequencies must have a minimum 1 Hz clearance between them.	Initially accept the value of the first parameter change with <b>Prog</b> after the second parameter change acknowledge with <b>Enter</b> to save.
Data conflict e.g. P0870 steady-state<==>dynam	Changing the “steady-state” into the “dynamic On/Off command” or vice versa. Steady-state / dynamic On/Off operation for the test / normal operating modes cannot be selected, mixed.	Initially accept the value of the first parameter change with <b>Prog</b> , after the second parameter change acknowledge with <b>Enter</b> to save.

Fig. 6-6: Error messages when parameterizing

## Load Standard Values

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

### SET PARAMETERS

Prompted parameterization

Unit setting

P0071 Load factorySetting

No action

Basic parametrizat.

Free parametrizat.

NAMUR applic. basic

Sercos applic. free

---


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

---

## 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.

---

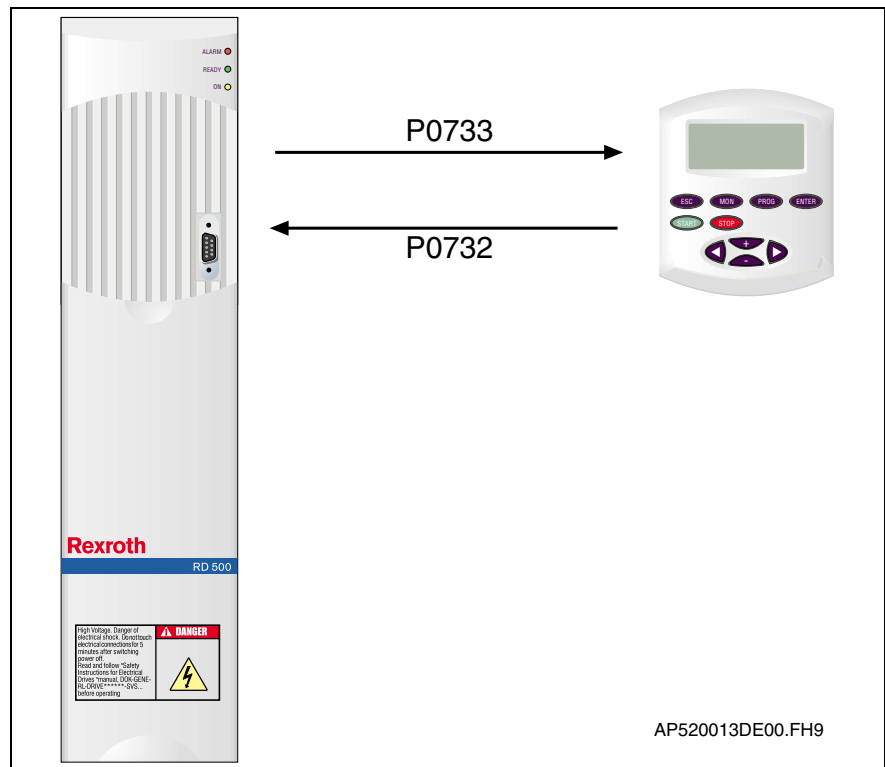


Fig. 6-7: Copy function

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

## Fault acknowledgement

After a fault/error occurs, "Fault" is displayed in the operating display. The cause of the fault and the fault time are displayed below this. The **Esc** key on the operator panel can be used to acknowledge the fault after the cause of the fault has been removed.

## 6.3 Monitoring

### Monitor

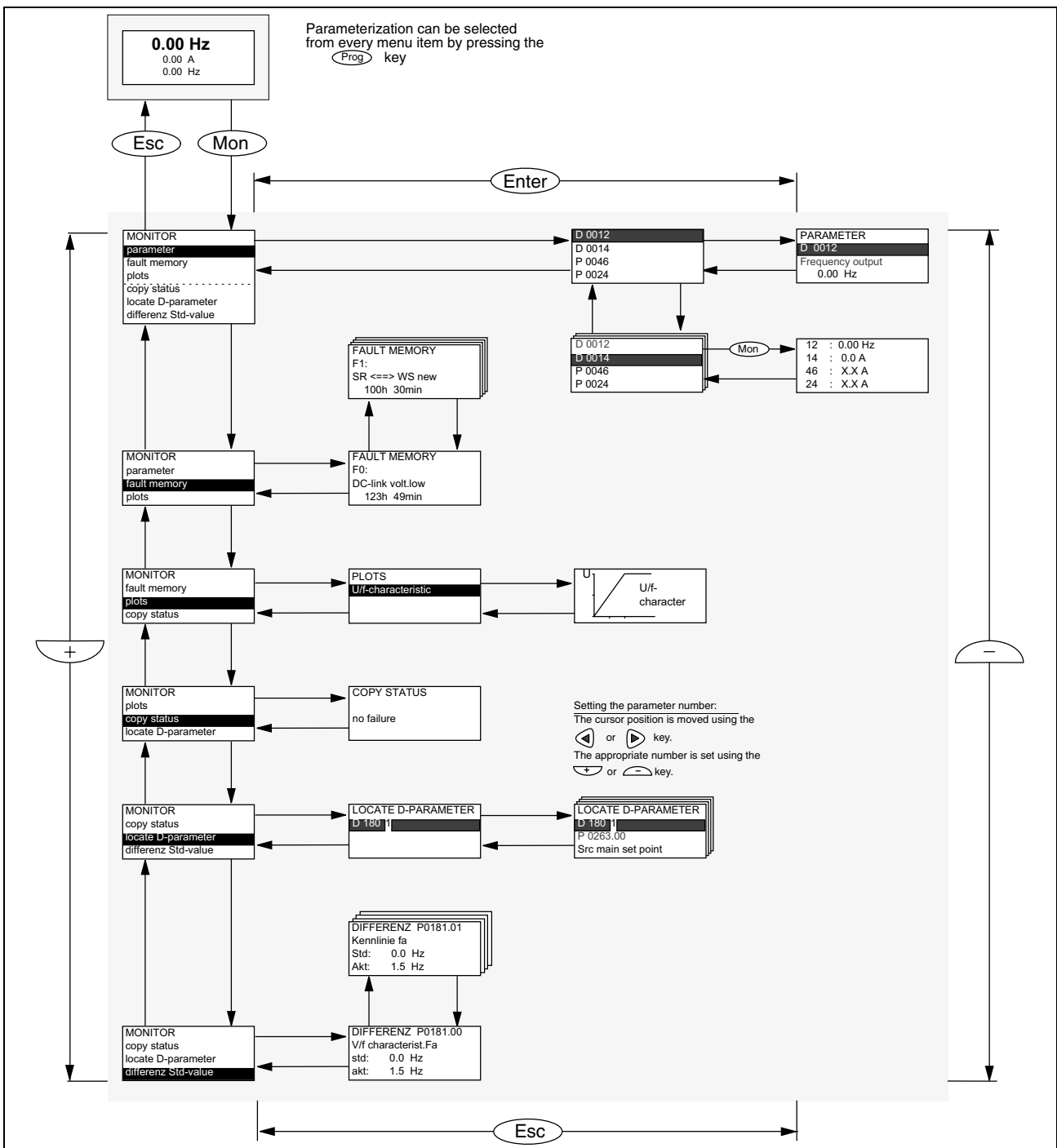


Fig. 6-8: Monitor program structure

#### Monitor functions

**Parameter** Any four selected parameters are simultaneously displayed. The parameter monitor can be advantageously used during commissioning, e.g. the frequency setpoint route can be tracked using the parameterizable functions of the drive. In this case, use the D parameters from the function charts.

**Note:** The terms “D parameter” and “Variable parameter source” are explained in the legend for the function charts, refer to the documentation “Function charts and parameter list”.

- Fault memory** The last 10 faults are saved in the fault memory. The youngest fault is in memory location S0, the oldest in S9. A new fault is always saved at memory location S0. All of the older faults are shifted upwards by one position in the memory. This means that the fault at memory location S9 is lost.
- Graphic display** The existing V/Hz characteristic is graphically displayed in this menu.
- Search for D parameter** Using “Search for D parameter” a list of “Variable parameter sources” is displayed in which the selected D parameter is connected. You can scroll through the list using the Enter key. If the selected D parameter is not linked to a “Variable parameter source”, the following is displayed: “Is not linked”. For a more detailed explanation, refer to the function charts with legend.

## Operating display

From ten display values, three can be selected for display in the operating display, refer to P0037.0x in the drive setting.

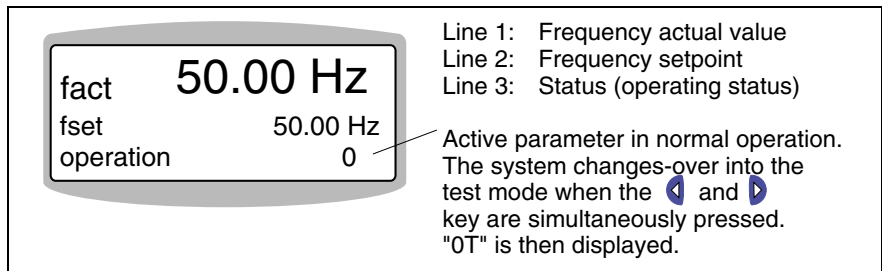


Fig. 6-9: Operating display

## Warning display

If a critical operating status occurs, then the warning message and the operating display are displayed alternating until the critical status has been resolved.

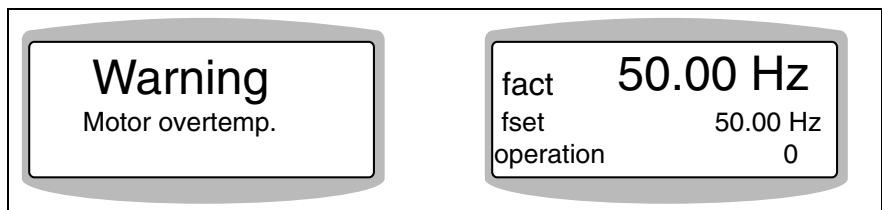


Fig. 6-10: Warning display

## Fault display

The fault display replaces the operating display when an operating status occurs which initiates a fault.

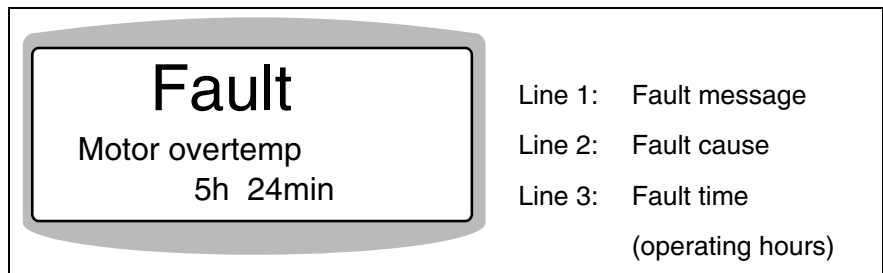


Fig. 6-11: Fault display

### LED display

LED display		Significance
<ul style="list-style-type: none"> <li>○</li> <li>○</li> <li>○</li> </ul>	No LED bright	Operating status: Power-up inhibit Not ready to power-up
<ul style="list-style-type: none"> <li>○</li> <li>○</li> <li>●</li> </ul>	Green LED bright	Operating status: Ready to power-up
<ul style="list-style-type: none"> <li>○</li> <li>●</li> <li>●</li> </ul>	Green and yellow LEDs bright	Operating status: Ready
<ul style="list-style-type: none"> <li>○</li> <li>●</li> <li>○</li> </ul>	Yellow LED bright	Operating status: Operation (run)
<ul style="list-style-type: none"> <li>●</li> <li>○</li> <li>○</li> </ul>	Red LED bright	Operating status: Fault
<ul style="list-style-type: none"> <li>●</li> <li>○</li> <li>●</li> </ul>	Red and green LEDs bright	Operating status: After the power supply is switched-on, during the power-on initialization

Fig. 6-12: LEDs



## 7 Basic parameterization

### 7.1 Parameterizing


The REFUdrive 500 drives can be parameterized in two ways:

1. **Basic parameterization:** In this case, the operator has menu-prompted, pre-defined functions to facilitate simple and fast commissioning. The possibilities are numerous; for example, control and set-point source can be configured, status messages, analog values can be called and important basic functions can be parameterized. The basic parameterization is selected when the equipment is shipped (default setting). Only the basic parameterization is described in the remainder of this Section.
2. **Free parameterization:** In this case, the complete functional scope of the drive can be utilized. Logic gates, comparators, a technology controller, several multi-function blocks and many more are available. The free parameterization is described in the Manual "Function description: Firmware".

### Structure of the basic parameterization

The basic parameterization comprises three main menus:

- Quick setup:** Selected parameters for fast commissioning (motor adaption, ramp-up/ramp-down time ....)
- Prompted parameterization:** The drive is adapted, menu-prompted to the particular application
- Numerical list:** Adaption possibilities can be directly selected

The main menu of the basic parameterization is displayed by pressing the  key. The main-menu is sub-divided into additional levels. The following diagram shows the structure of the various menu levels.

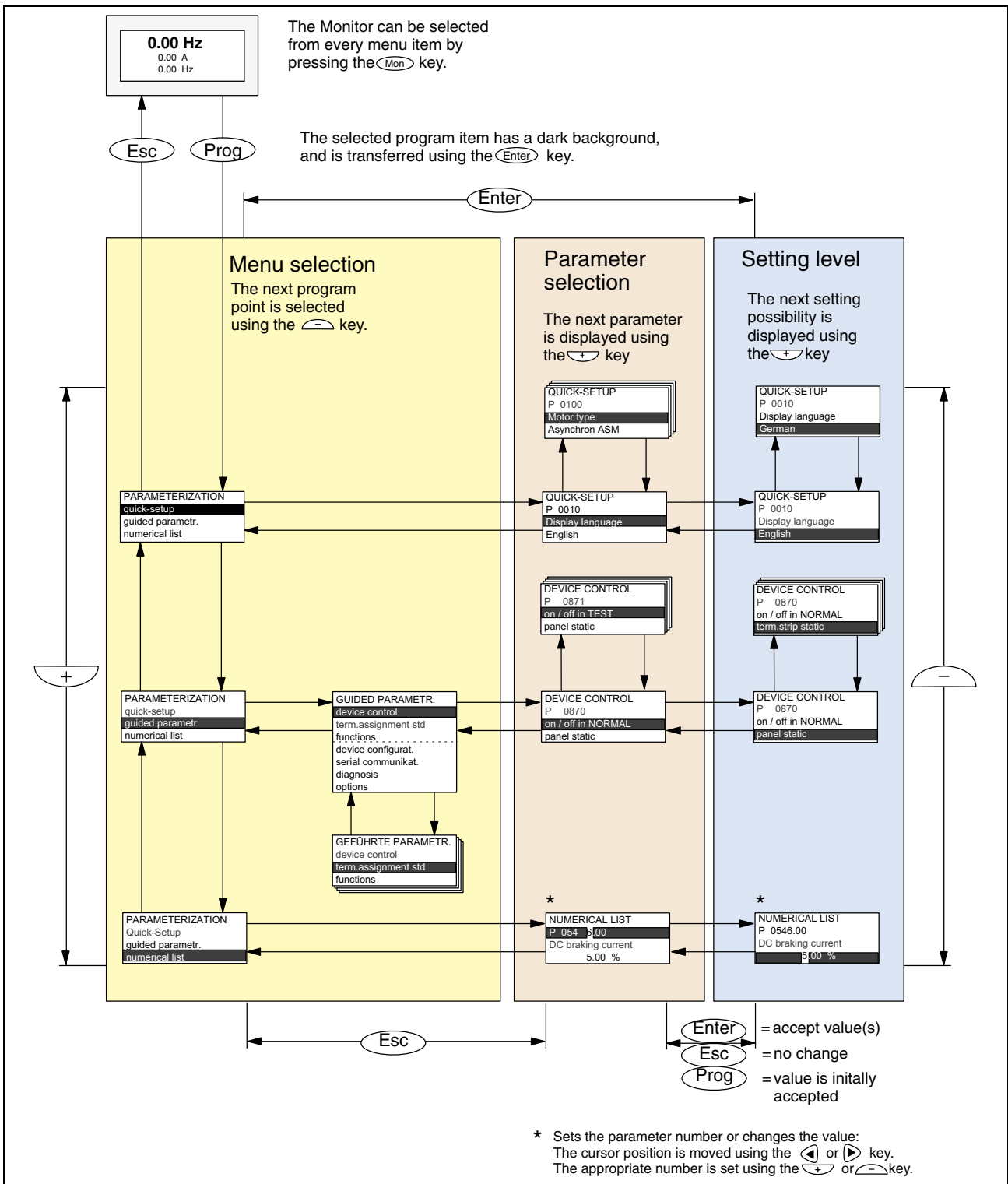


Fig. 7-1: Menu structure of the basic parameterization

## Overview

Refer to Fig. 5-2: Menu overview

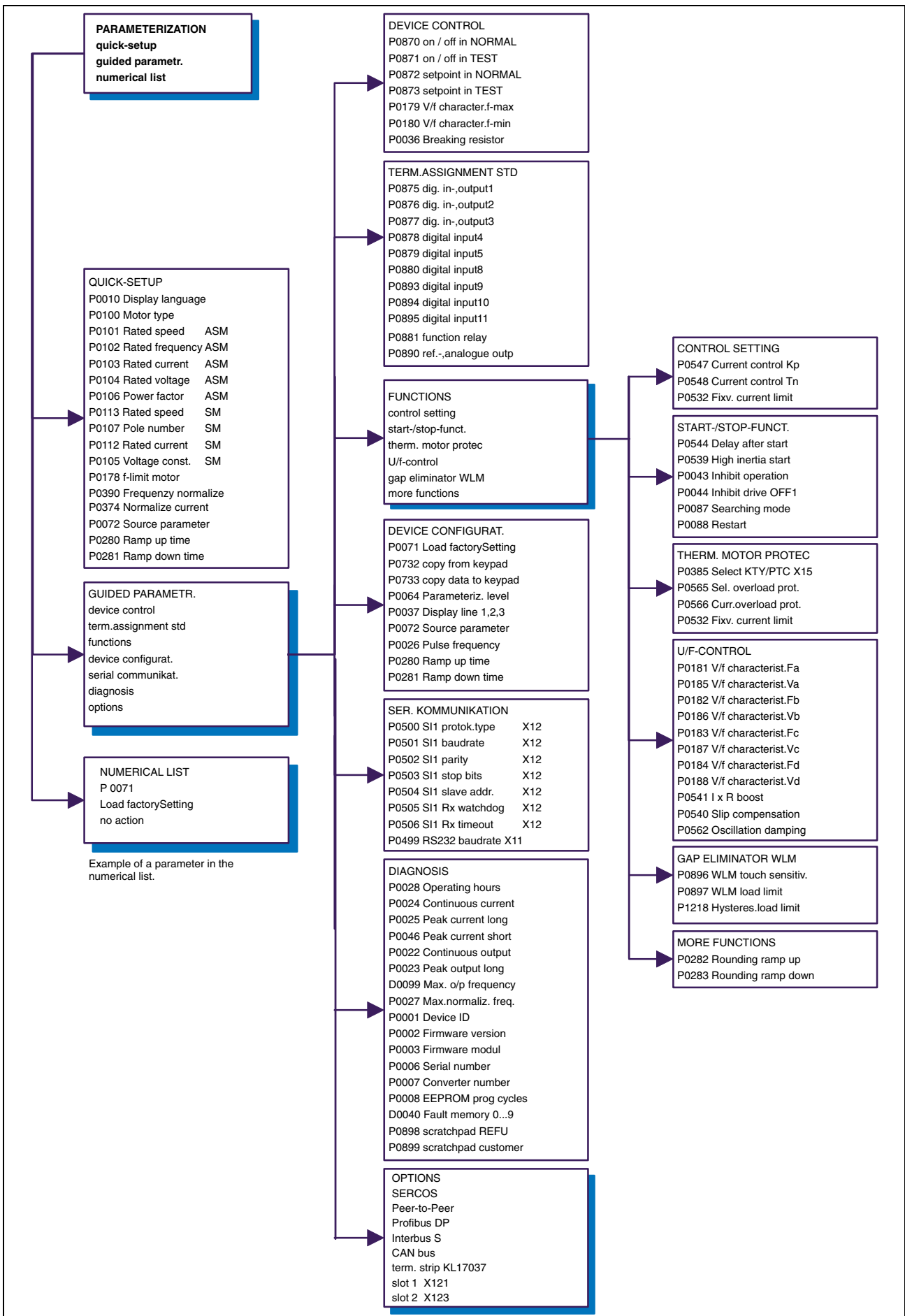


Fig. 7-2: Menu overview

## 7.2 Password levels

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

**Password 0** Password not required

**Password 1**  ,  ,  and then acknowledge with 

**Password 2**  ,  ,  ,  and then acknowledge with 

**Password 3**  ,  ,  ,  and then acknowledge with 

All of the parameters of the lower password level are then acceptable using the selected password.

## 7.3 Quick-Setup

Parameter No.:	Name	Description / explanation selectable options	Factory setting min ... max values	Password
0010	Language	Selects the display language: 0 = German 1 = English	German 0 / 1	0
0100.XX	Motor type	Selects the motor type: 0 = Induction motor ASM 1 = Synchronous motor SM	Induction motor ASM 0 / 1	2
0101.XX	Rated speed ASM	Rated speed from the motor rating plate. <sup>2)</sup>	1) 100 ... 95000 RPM	2
0102.XX	Rated frequency ASM	Rated frequency from the motor rating plate. <sup>2)</sup>	1) 10.0 Hz... P0099	2
0103.XX	Rated current ASM	Rated current from the motor rating plate. <sup>2)</sup>	1) 1.00 A... P0033	2
0104.XX	Rated voltage ASM	Rated voltage from the motor rating plate. <sup>2)</sup>	1) 10 ... 600 V	2
0106.XX	cos-phi ASM	cos-phi from the motor rating plate. <sup>2)</sup>	1) 0.50 ... 0.98	2
0112.XX	Rated current SM	Rated current from the motor rating plate. <sup>3)</sup>	1) 1.00 A... P0033	2
0113.XX	Rated speed SM	Rated speed from the motor rating plate. <sup>3)</sup>	1) 100 ... 95000 RPM	2
0105.XX	Voltage constant SM	Voltage constant from the motor rating plate. <sup>3)</sup>	1) 0.01 ... 50.00 V/Hz	2
0107.XX	Pole number SM	Pole number from the motor rating plate. <sup>3)</sup>	1 ... 64	2
0178.XX	f limit, motor	Highest permissible motor frequency (protection against centrifugal force). The maximum output frequency is limited, as a function of the pulse frequency, to the value of P0027. When changing the motor rating plate data, P0178 is set to the rated motor frequency plus 5%.	50.00 Hz 0.0 Hz ...P0027	2

Parameter No.:	Name	Description / explanation selectable options	Factory setting min ... max values	Pass word
0778				
0390.XX	Frequency normalization	Reference value for frequency setpoints and actual values. This parameter is set to 50 Hz in the factory. To operate the motor with 50 Hz, a setpoint of 100% must be entered.	50.00 Hz 15.0 Hz ... P0027	2
0374.XX	Current normalization	Reference value for current setpoints and actual values. is set to the value of the drive current in the factory (P0024).	P0024 0.5 ... 6553.5	2
0072.XX	Param. setting	Enters from which source the parameter can be set. 0 = Operator panel , 1 = Bus SS1 , 2 = Bus SS2 , 3 = Bus SS4 , 4 = All buses , 5 = Bus SS6	Operator panel, PC 0...5	2
0280.YY	Ramp-up time	Refer to Fig. 5-3: Up and down ramp Ramp-up time of the ramp-function generator. The entered time is valid for a setpoint change from 0 % to 100 %. XX=The index, in which a value can be saved, is selected in parameters P0875, P0876; P0877; P0878, P0879 or P0880 (function: Setpoint memory, bits 20 ... 23).	5.000 s 0.000 ... 3200.000 s	1
0281.YY	Ramp-down time	Refer to Fig. 5-3: Up and down ramp Ramp-down time of the ramp-function generator. The entered time is valid for a setpoint change normalized for 100%. XX=The index, in which a value can be saved, is selected in parameters P0875, P0876; P0877; P0878, P0879 or P0880 (function: Setpoint memory, bits 20 ... 23).	5.000 s 0.000 ... 3200.000 s	1

- 1: The motor data of a typical motor are set as factory setting for each drive output class.
- 2: This menu item is only displayed, if an induction motor was selected as motor type.
- 3: This menu item is only displayed if a synchronous motor was selected as motor type.
- XX: The index, shown in the display, is defined by the currently active parameter set.
- YY: The index, shown in the display, is determined by the currently active setpoint memory.

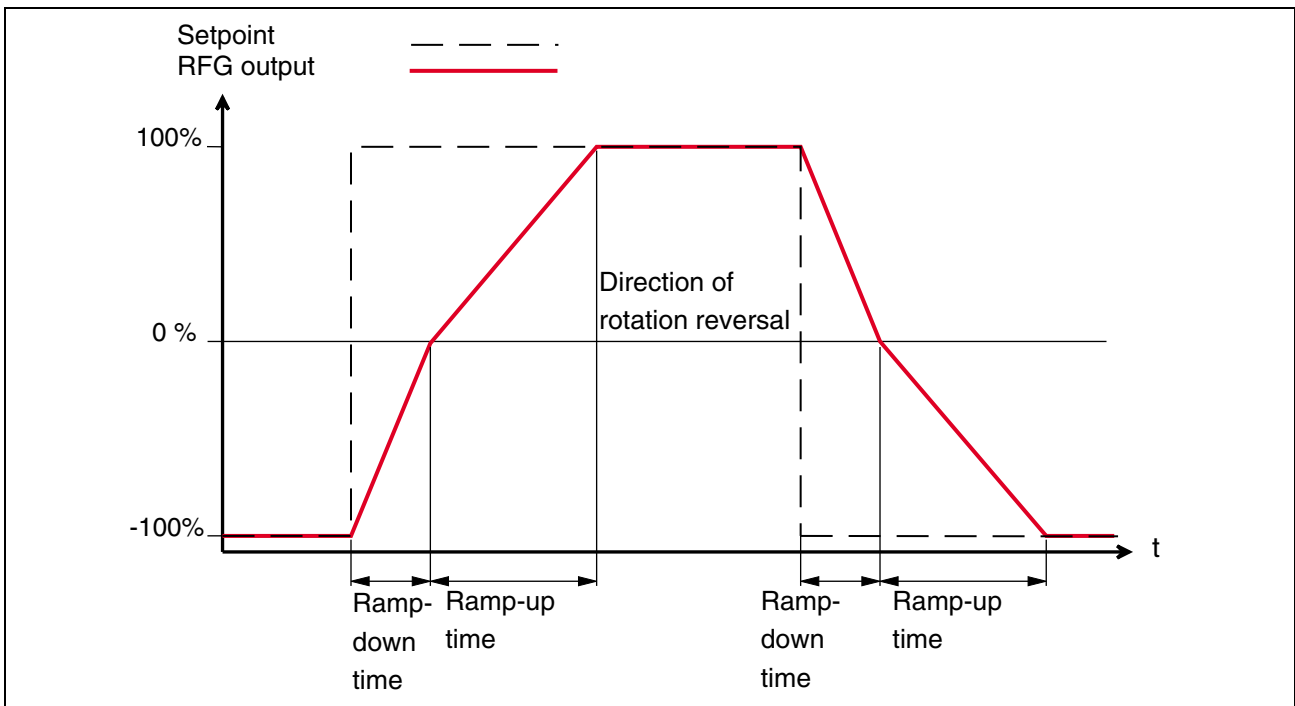


Fig. 7-3: Up and down ramps

## 7.4 Guided parameterization

### Drive control / setpoints

Parameter No.:	Name	Description / explanation selectable options	Factory setting min ... max values	Password
0870	On/off for NORMAL	Enters On/off for NORMAL operation 0 = Term. steady-st. (steady-st. corr. to a switch function) 1 = T. stat.+OP (T=terminals OP=operator panel) 2 = T. stat.+PC (PC w/ RE FUwin via service-interface) 3 = T. stat.+bus SS1 (SS = serial interface) 4 = T. stat.+bus SS2 (if available) 5 = T. stat.+bus SS4 (if available) 6 = T. dyn. (OFF always) (dyn.=dynamic) 7 = OP dyn. (OFF always) 8 = T. dynamic (dynamic corr. to a pushbutton funct.) 9 = OP dynamic 10 = OP static 11 = T. stat.+bus SS6	Terminal dynamic 0...11	1

Parameter No.:	Name	Description / explanation selectable options	Factory setting min ... max values	Pass word
0871	On/off in TEST	Enters On/off for TEST operation. As for parameter 0870.	OP (Operator panel) dynamic 0...11	1
0872	Setpoint in NORMAL	Enters the setpoint for NORMAL operation  0 = Motorized potentiometer 1 = Fixed setpoint 2 = Analog input 0..±10V 3 = Analog input 0..+20mA 4 = Analog input 4..+20mA 5 = Opt. an. input 0..±10V (opt. optional) = 6 = Opt. an. input 0..+20mA 7 = Opt. an. input 4..+20mA 8 = PC (PC with REFUwin via service interface) 9 = Bus SS1 10 = Bus SS2 11 = Bus SS4 12 = Analog input 2..+10V 13 = Bus SS6	Analog input 0..±10V 0...13	1
0873	Setpoint in TEST	Enters the setpoint for TEST operation As for parameter 0872.	Motorized potentiometer 0...13	1
0196	Mot. pot. mode	Supplementary parameter for "motorized potentiometer". For <b>Start f set</b> , the motorized potentiometer setpoint, which was set the last after the off command, is approached. For <b>Start f min</b> , the actual f min (P0180.XX) is approached. Furthermore, the rate-of-change of the motorized potentiometer can be set using the parameter: linear = Uniform change corresponding to the selected step width expon. = The rate-of-change increases the longer that the button remains pressed  0 = Start f set, linear 1 = Start f min, linear 2 = Start f set, exponential 3 = Start f min, exponential	Start f set, expon. 0 ... 3	1
0195	Mot. pot. step value	Supplementary parameter for "motorized potentiometer". The motorized potentiometer rate-of-change is set using the step width.	0.01 0.01 ... 10.00 Hz	1
0265.YY	Fix value main s/p	Supplementary parameter for "fixed setpoint". Parameter P0390 is the reference value for the frequency setpoints and actual values. P0390 is set to 50 Hz in the factory. This means that to operate the motor with 50 Hz, a setpoint of 100% must be entered.  YY = The index which is displayed is determined by the presently active setpoint memory.	5.00 % -199.99 ... 199.99 %	1

Parameter No.:	Name	Description / explanation selectable options	Factory setting min ... max values	Pass word
0297.00	Analog input window	Supplementary parameter for "analog input". The analog setpoint smoothing is specified in a window width in %. For example: Window width = 1 %. A change in the actual setpoint is only transferred, if a change greater than 0.99 % of the possible final value is detected at the analog input.	0.50 % 0.00 ... 20.00 %	1
0200.00	Analog input norm.	Supplementary parameter for "analog input". The analog input normalization refers to the frequency normalization P0390.	100 % -199.99 ... 199.99 %	2
0202.00	Analog input offs.	Supplementary parameter for "analog input". Analog input offset	0.00 % -199.99 ... 199.99 %	2
0203.00	Analog input sign.	Supplementary parameter for "analog input". Analog input signal 0 = direct 1 = absolute value 2 = inverted 3 = absolute value, inverted	Direct 0 ... 3	2
0204.00	Analog input filtr.	Supplementary parameter for "analog input". Analog input, filter time to smooth the analog signal.	2 ms 0 ... 10000 ms	2
0564.nn	Reaction on $I < 4\text{mA}$	Supplementary parameter for "analog input 4...+20 mA". Response for " $I < 4\text{mA}$ " 0 = no reaction 1 = warning 2 = fault  nn = 00 for STANDARD mode nn = 01 for TEST	Warning 0 ... 2	2
0179.YY	V/f character. Fmax	YY = The index which is displayed is determined by the currently active setpoint memory.	100.00 % P0180 ... 199.99 %	2
0180.YY	V/f character. Fmin	YY = The index which is displayed is determined by the currently active setpoint memory.	0.00 % 0.00 % ... P0179	2
0036	Braking resistor	0 = REFU standard 1 = switched-out 2 = no protection 3 = can be externally programmed	REFU internal 0 ... 3	1
0623	Ext. BR: Resistance	Supplementary parameters for brake resistor (P0036) "can be externally programmed"	199.9 W 0.1 ... 199.9 W	2
0624	Ext. BR: Rated power	Supplementary parameters for brake resistor (P0036) "can be externally programmed"	1.0 kW 0.1 ... 199.9 kW	2
0625	Ext. BR: heatup time	Supplementary parameters for brake resistor (P0036) "can be externally programmed"	1.0 sec 1.0 ... 655.4 sec	2



## Standard terminal assignment

Parameter No.:	Name	Description / explanation selectable options	Factory setting min ... max values	Pass word
0875	Dig. input, output1	<p>Combined digital input and output</p> <p>0 = I no function (I=input)            2 = I no alarm ext. (alarm)            3 = I no fault ext. (fault)            4 = I fault reset            5 = I fmin select            6 = I direct. rotat. (direction of rotation reversal)            7 = I no volt. disc. (power disconnected)            8 = I no fast stop (fast stop)            9 = I RFG park (RFG=ramp-funct.gener.)            10 = I RFG-up stop            11 = I motp. faster (motp.=motorized potentiometer)            12 = I motp. slower            13 = I ALM sensitivity up            14 = I ALM sensitivity down            15 = I ALM autom. sensitivity adjust. start / stop            16 = I ALM inhibit, sparking            17 = I ALM inhibit, load limit</p> <p>20 = I setp. mem. bit4 (weighting 2<sup>4</sup>: Changes-over the f set, f min, f max memory and the ramp-function generator)            21 = I TEST/STANDARD (toggles between the TEST and STANDARD modes, simultaneously disables the changeover from the operator panel.)            22 = I setp. mem. bit0 (weighting 2<sup>0</sup>: Changes-over the f set, f min, f max memory and the ramp-function generator)            23 = I setp. mem. bit1 (weighting 2<sup>1</sup>: Changes-over the f set, f min, f max memory and the ramp-function generator)            24 = I setp. mem. bit2 (weighting 2<sup>2</sup>: Changes-over the f set, f min, f max memory and the ramp-function generator)            25 = I setp. mem. bit3 (weighting 2<sup>3</sup>: Changes-over the f set, f min, f max memory and the ramp-function generator)            26 = I parblock bit0 (weighting 2<sup>0</sup>: Changes-over the specific motor data)            27 = I parblock bit1 (weighting 2<sup>1</sup>: Changes-over the specific motor data)            28 = I parblock bit2 (weighting 2<sup>2</sup>: Changes-over the specific motor data)</p>	<p>0 ALM sparking signal            0...97</p>	1

Parameter No.:	Name	Description / explanation selectable options	Factory setting min ... max values	Password
		<p>29 = <b>I</b> parblock bit3 (weighting 2<sup>3</sup>: Changes-over the specific motor data</p> <p>30 = <b>I</b> parblock bit4 (weighting 2<sup>4</sup>: Changes-over the specific motor data</p> <p>32 = <b>IN</b> no alarm. ext. (<b>IN</b>=input which is only active in the "STANDARD" mode)</p> <p>33 = <b>IN</b> no fault ext.</p> <p>34 = <b>IN</b> fault reset</p> <p>35 = <b>IN</b> fmin select</p> <p>36 = <b>IN</b> direct. rotat.</p> <p>37 = <b>IN</b> no volt. disc.</p> <p>38 = <b>IN</b> no fast stop</p> <p>39 = <b>IN</b> RFG parking</p> <p>40 = <b>IN</b> RFG-up stop</p> <p>41 = <b>IN</b> motp. faster</p> <p>42 = <b>IN</b> motp. slower</p> <p>43 = <b>IN</b> ALM sensitivity up</p> <p>44 = <b>IN</b> ALM sensitivity down</p> <p>45 = <b>IN</b> ALM autom. sensitive adjust. start / stop</p> <p>46 = <b>IN</b> ALM inhibit, sparking</p> <p>47 = <b>IN</b> ALM inhibit, load limit</p> <p>52 = <b>IT</b> no alarm. ext. (<b>IT</b>=input which is only active in the "TEST" mode)</p> <p>53 = <b>IT</b> no fault ext.</p> <p>54 = <b>IT</b> fault reset</p> <p>55 = <b>IT</b> fmin select</p> <p>56 = <b>IT</b> direct. rotat.</p> <p>57 = <b>IT</b> no volt. disc.</p> <p>58 = <b>IT</b> no fast stop</p> <p>59 = <b>IT</b> RFG park</p> <p>60 = <b>IT</b> RFG-up stop</p> <p>61 = <b>IT</b> motp. faster</p> <p>62 = <b>IT</b> motp. slower</p> <p>63 = <b>IT</b> ALM sensitivity up</p> <p>64 = <b>IT</b> ALM sensitivity down</p> <p>65 = <b>IT</b> ALM autom. sensitive adjust. start / stop</p> <p>66 = <b>IT</b> ALM inhibit, sparking</p> <p>67 = <b>IT</b> ALM inhibit, load limit</p> <p>70 = <b>O</b> no function</p> <p>71 = <b>O</b> ready to switch-on (<b>O</b>=output)</p> <p>72 = <b>O</b> status: Ready to switch-on</p> <p>73 = <b>O</b> ready</p> <p>74 = <b>O</b> status: Ready</p> <p>75 = <b>O</b> operation (run)</p> <p>76 = <b>O</b> no fault</p> <p>77 = <b>O</b> power-on inhibit</p> <p>78 = <b>O</b> no alarm</p> <p>79 = <b>O</b> motor rotating 1 (on &amp; ((t &lt;x.x sec) or (i&gt;x.xx %)))</p> <p>80 = <b>O</b> motor rotating 2 (on &amp; (fact &gt; fmin) &amp; (i&gt; x.xx %))</p> <p>81 = <b>O</b> direction of rotation, clockwise</p> <p>82 = <b>O</b> current limiting</p> <p>83 = <b>O</b> not mot. alarm temp. (alarm: Motor temperature)</p> <p>84 = <b>O</b> not motovertemp (fault: Motor temperature)</p>		

Parameter No.:	Name	Description / explanation selectable options	Factory setting min ... max values	Password
		85 = <input type="radio"/> RFG up 86 = <input type="radio"/> RFG down 87 = <input type="radio"/> RFG reached 88 = <input type="radio"/> setpoint reached 89 = <input type="radio"/> setpoint in tolerance 90 = <input type="radio"/> fmin limiting 91 = <input type="radio"/> fmax limiting 92 = <input type="radio"/> TEST selected 93 = <input type="radio"/> control line contactor 94 = <input type="radio"/> $f_{act} \leq f_{min}$ 95 = <input type="radio"/> ALM sparking signal 96 = <input type="radio"/> ALM load limit 97 = <input type="radio"/> open mechanical brake		
0461	Mode dig. output	Supplementary parameter for P0875 for all output functions  0 = output, direct 1 = output, inverted	Output, direct  0...1	1
0289	Fast stop, ramp-down time	Supplementary parameter for "I fast stop".  Ramp-down time for fast stop	5.000 sec  0.000 ... 3200.000 sec	1
0739	Motpot cycl. time ext.	Supplementary parameter for "I motp. faster" and "E motp. slower"  Step cycle time when energized via digital input	0.90 sec  0.01 ... 5.00 sec	1
1210	ALM cycle time sensitivity up / down	Supplementary parameter for "I ALM sensitivity up" and "I ALM sensitivity down"  Step cycle time when energized via digital input	0.50 sec  0.05 ... 5.00 sec	1
1209	ALM step width sensitivity up / down	Supplementary parameter for "I ALM sensitivity up" and "I ALM sensitivity down"  Step cycle time when energized via digital input	0.02 %  0.01 ... 100.00 %	1
0756	Time, timer	Supplementary parameter for "O motor rotating 1".  Time for the timer	1.0 sec  0.0 ... 650.0 sec	1
0435.00	Fixed value for Dxxxx	Supplementary parameter for "O motor rotating 1".  Current threshold (100% = I <sub>rated</sub> motor)	0.00 %  -199.99 ... 199.99 %	1
0757	Hysteresis x:xs	Supplementary parameter for "O motor rotating 1".  Hysteresis for current	1.00 %  0.00 ... 100.00 %	1
0759.00	Hysteresis x:xs	Supplementary parameter for "O motor rotating 2".  Hysteresis for frequency	1.00 %  0.00 ... 100.00 %	1
0759.01	Hysteresis x:xs	Supplementary parameter for "O motor rotating 2".  Hysteresis for current	1.00 %  0.00 ... 100.00 %	1
0435.01	Fixvalue for Dxxxx	Supplementary parameter for "O motor rotating 2".  Current threshold (100% = I <sub>rated</sub> motor)	0.00 %  -199.99 ... 199.99 %	1
0760	Fixvalue xs input	Supplementary parameter for "setpoint reached" and "setpoint within the tolerance bandwidth".  Tolerance value for the frequency	2.00 %  0.10 ... 100.00 %	1
0761	Hysteresis x:xs	Supplementary parameter for "setpoint reached" and "setpoint within the tolerance bandwidth".  Hysteresis for frequency	1.00 %  0.00 ... 90.00 %	1

Parameter No.:	Name	Description / explanation selectable options	Factory setting min ... max values	Pass word
0762	Time, timer	Supplementary parameter for "setpoint in the tolerance bandwidth". Time for the timer	1.0 sec 0.0 ... 650.0 sec	2
1206	ALM sparking	Supplementary parameter for "O ALM sparking signal" 0 = direct 1 = inverted	Inverted 0...1	2
1220	ALM load limit	Supplementary parameter for "O ALM load limit" 0 = direct 1 = inverted	Inverted 0...1	2
0876	Dig. in-, output2	As for parameter 0875	I WLM sensitivity up 0...97	1
0463	Mode dig. output	Supplementary parameter for P0876 for all output functions 0 = output direct 1 = output inverted	Output, direct 0...1	1
0877	Dig. in-, output3	As for parameter 0875	I WLM sensitivity down 0...97	1
0465	Mode dig. output	Supplementary parameter for P0877 for all output functions 0 = output direct 1 = output inverted	Output, direct 0...1	1
0878	Digital input4	As for parameter 0875, from value 0 bis 69.	I parset bit4 0...67	1
0879	Digital input5	As for parameter 0875, from value 0 to 69.	Fault acknow- ledgement 0...67	1
0880	Digital input8	As for parameter 0875, from value 0 to 69.	I parset bit0 0...67	1
0893	Digital input9	As for parameter 0875, from value 0 to 69.	I parset bit1 0...67	1
0894	Digital input10	As for parameter 0875, from value 0 to 69.	I parset bit2 0...67	1
0895	Digital input11	As for parameter 0875, from value 0 to 69.	I parset bit3 0...67	1
0881	Function, relay	As for parameter 0875, from value 70 to 97.	O no fault 70...97	1
0467	Mode, relay output	Supplementary parameter for P0881 0 = relay direct 1 = relay inverted	Relay, direct 0...1	1

Parameter No.:	Name	Description / explanation selectable options	Factory setting min ... max values	Pass word
0890	Ref., analogue output	Reference, analogue output  0 = +10V reference output 1 = -10V reference output 2 = fact output frequency 3 = lact output current (apparent current) 4 = Isq torque-generating (active current) 5 = Vact output voltage 6 = Pact output power 7 = Pactive active power	+10V reference output 0...7	1
0221.00	PT1 filt. timeconst	Supplementary parameter for "analog output". To smooth any value which is connected at the analog output.	0 ms 0 ... 10000 ms	1
0559	Pactual PT1 time	Supplementary parameter for "analog output". Only to smooth the Pact value.	50 ms 0 ... 10000 ms	1
0560	Ptrue PT1 filter time	Supplementary parameter for "analog output". Only to smooth the Pactive value.	50 ms 0 ... 10000 ms	1
0411	Output-block signal	Supplementary parameter for "analog output". Defines how a signal is transferred.  0 = direct 1 = absolute value 2 = inverted 3 = absolute value, inverted	Direct 0...3	1
0413	Output-block, norm.	Supplementary parameter for "analog output". Normalization of the analog output 10 V correspond to the value set here.	100.00 % 6.26 ... 200.00 %	1
0561	Output-block	Supplementary parameter for "analog output".  0 = 0 ... ±100 % 1 = + 20 ... +100 %	0.. ±100 % 0 / 1	2
0412	Output-block offs.	Supplementary parameter for "analog output". Offset	0.00 % -100.00 ... 100.00 %	1

## Functions

- Controller setting
- Start/stop function
- Thermal motor protection
- V/Hz control (open loop)
- Active load monitor
- Additional functions

### Controller setting

Parameter No.:	Name	Description / explanation selectable options	Factory setting min ... max values	Password
0547.XX	Current control Kp	Current controller gain factor.	0.10 0.01 ... 128.00	1
0548.XX	Current control Tn	Current controller integral action time.	10 ms 0 ... 5000 ms	1
0532.XX	Fixv., current limit	Enters the current limit 100% corresponds to the contents of parameter P0374 (factory setting: Continuous output current of the drive).	100.00 % 0.00 ... 199.99 %	1

### Start/stop functions

Parameter No.:	Name	Description / explanation selectable options	Factory setting min ... max values	Password
0544.XX	Delay after start	After the start, the delay time fa (P0181) is entered after which, the drive accelerates to the selected setpoint.	0.3 sec 0.0 ... 100.0 sec	1
0539	High inertia start	For the first run-up after start, twice the current limiting is enabled. 0=no 1=yes	No 0 / 1	2
0043	Inhibit operation	0=braking 1=coast-down	Coast-down 0 / 1	2
0044	Inhibit drive	0=braking 1=coast-down	Coast-down 0 / 1	2
0546	DC braking current	Supplementary parameter for "braking operation" from P0043 and P0044: 100% corresponds to the contents of parameter P0374 (factory setting: Continuous output current of the drive).	5.00 % 1.00 ... 100.00 %	1
0545	DC braking time	Supplementary parameter for "braking operation" from P0043 and P0044:	0.0 sec 0.0 ... 100.0 sec	1
0087	Searching mode	0=no: The drive starts as normal after an on command without a search run. 1=after on: After the on command, the drive starts with the last direction of rotation and searches for the motor which is coasting down from f max towards 0 Hz. If the motor frequency is found, or for f = 0 Hz, the actual setpoint is approached via the ramp-function generator. 2=after on ±: After the on command, the drive starts with the last direction of rotation and searches for the motor which is coasting down from f max towards 0 Hz. If the motor is not found by f = 0 Hz, then a search is made from f max towards 0 Hz with the other direction of rotation. If the motor frequency is found, or for f = 0 Hz, the actual setpoint is approached via the ramp-function generator.	No 0 ... 2	2

Parameter No.:	Name	Description / explanation selectable options	Factory setting min ... max values	Password
0088	Restart	Restart after power failure: 0=no: The drive only starts after the line supply voltage returns if the drive detects a rising edge of the on command. 1=yes: The drive automatically starts if, when the line supply voltage returns, the drive as an on command.	No 0 / 1	2

### Thermal motor protection

Parameter No.:	Name	Description / explanation selectable options	Factory setting min ... max values	Password
0385	Select KTY / PTC X15	Selects the thermistor protection. 0=without , 1=KTY , 2=PTC	PTC 0 ... 2	2
0386	KTY alarm X15	Supplementary parameter for KTY in P0385 Enters the motor temperature to initiate the alarm.	135 °C 30 ... 180 °C	1
0387	KTY fault X15	Supplementary parameter for KTY in P0385 Enters the motor temperature to initiate the fault.	155 °C 30 ... 195 °C	1
0388	PTC evaluation X15	Supplementary parameter for PTC in P0385 The following options can be selected when the selected PTC switching value (P389) is reached: 0=alarm (alarm, motor temperature) 1=fault (fault, motor temperature)	Fault 0 / 1	2
0389	PTC switch value X15	Supplementary parameter for PTC in P0385 Enters the resistance switching threshold to initiate the response set using P388 (PTC evaluation).	4000 W 1000 .. 4500 W	1
0565	Sel. overload prot.	The overload protection function is implemented corresponding to the SIEMENS 3UB1 overload relay, setting Class 10. The following options can be selected for the response of the IxT overload protection function: 0=no action 1=alarm 2=fault	No response 0 ... 2	2
0566.XX	Curr. overload prot.	Refer to Fig. 5-4: Emulation, thermal overload trip. Current threshold for the Ixt overload protection function. When the Ixt threshold is reached, the response, set using P565, is initiated. Emulates the thermal overload response When the motor rating plate data is changed, P0566 is set to the rated motor current.	0.5 A 0.5 ... 6553.5 A	1
0532.XX	Fixv. current limit	Enters the current limit 100% correspond to the contents of parameter P0374 (factory setting: Continuous output current of the drive).	100.00 % 0.00 ... 199.99 %	1

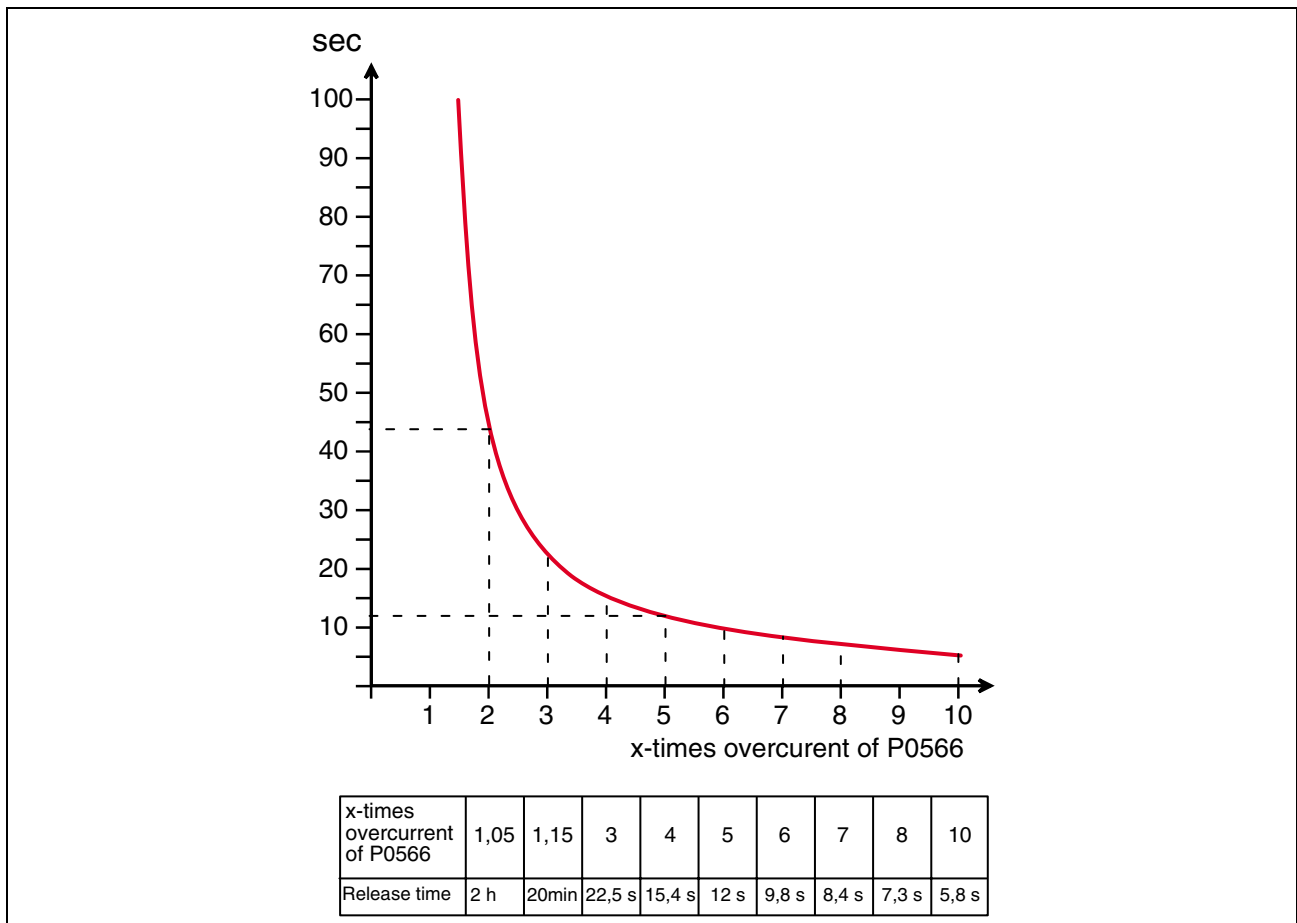



Fig. 7-4: Emulation of the thermal overload release



## V/Hz control

Parameter No.:	Name	Description / explanation selectable options	Factory setting min ... max values	Password
0181.XX	V/f characteristic fa	Refer to Fig. 5-5: V/Hz characteristic diagram The V/Hz characteristic data is calculated by the drive converter from the entered motor rating plate data.	0.0 Hz ... (P0182-1 Hz)	2
0185.XX <sup>1)</sup>	V/f characteristic Ua	The characteristic values can then be changed and optimized.	<sup>2)</sup> 0 V ... 3000 V	2
0182.XX <sup>1)</sup>	V/f characteristic fb	If the rating plate data are re-entered, a new calculation is made and manually entered characteristic data is overwritten.	<sup>2)</sup> (P0181+1 Hz) ... (P0183-1 Hz)	2
0186.XX <sup>1)</sup>	V/f characteristic Ub	Select the monitor by pressing the  key. You can then display the V/Hz characteristics in the "Graphic display" sub-menu.	<sup>2)</sup> 0 V ... 3000 V	2
0183.XX <sup>1)</sup>	V/f characteristic fc		<sup>2)</sup> (P0182+1 Hz) ... (P0184-1 Hz)	2
0187.XX <sup>1)</sup>	V/f characteristic Uc		<sup>2)</sup> 0 V ... 3000 V	2
0184.XX <sup>1)</sup>	V/f characteristic fd		<sup>2)</sup> (P0183+1 Hz) ... 6000 Hz	2
0188.XX <sup>1)</sup>	V/f characteristic Ud		<sup>2)</sup> 0 V ... 3000 V	2
0541.XX <sup>1)</sup>	I x R boost	I x R compensation factors. The I x R compensation is disabled by entering 0.00%. The I x R compensation can be used to compensate the voltage drop across the ohmic component of the stator winding which is proportional to the actual apparent current (I act).	0.00 % 0.00 ... 20.00 %	1
0540.XX <sup>1)</sup>	Slip compensation	Enters the factors for slip compensation. The slip compensation is disabled by entering 0.00%. The slip compensation can be used to compensate the speed loss for induction motors, which is approximately proportional to the load torque.	0.00 % 0.00 ... 199.99 %	1
0562.XX <sup>1)</sup>	Oscillation damping	For machines, which have a tendency to oscillate, a factor can be set here, which counter-acts this oscillation tendency using the oscillation damping. Oscillation damping is disabled by entering a factor of 0.	0 -127 ... 127	2

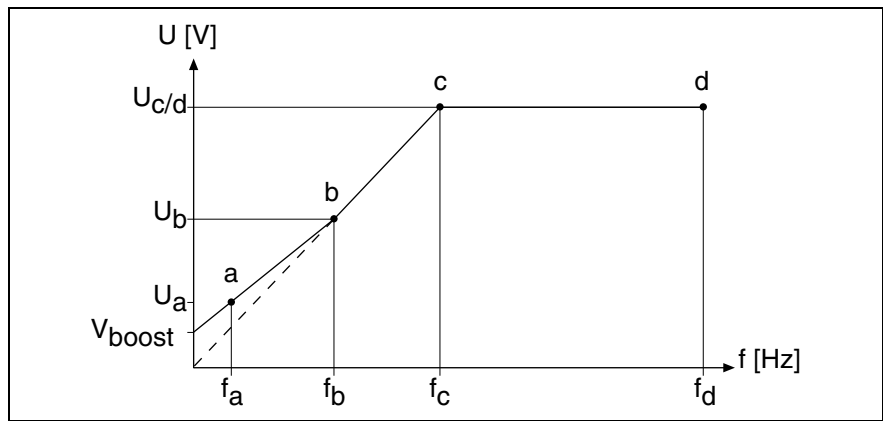


Fig. 7-5: V/Hz characteristic diagram

$$V_{boost} = R_S (P0120.XX) \times I_{sdrated} (P0117.X)$$

**Active load monitor WLM**

Parameter No.:	Name	Description / explanation selectable options	Factory setting min ... max values	Pass word
0896	ALM sparking sensitivity	1 = Fixed values 2 = Analog input 0..±10V 3 = Analog input 0..+20mA 4 = Analog input 4..+20mA 5 = Opt. an.inp 0..±10V (opt. = optional) 6 = Opt. an.inp 0..+20mA 7 = Opt. an.inp 4..+20mA 8 = PC (PC with REFUwin via the service interface) 9 = Bus SS1 10 = Bus SS2 11 = Bus SS4 12 = Analog input 2..+10V 13 = Bus SS6	Fixed values 1 ... 13	1
0897	ALM load limit	1 = Fixed values 2 = Analog input 0..±10V 3 = Analog input 0..+20mA 4 = Analog input 4..+20mA 5 = Opt. an.inp 0..±10V (opt. = optional) 6 = Opt. an.inp 0..+20mA 7 = Opt. an.inp 4..+20mA 8 = PC (PC with REFUwin via the service interface) 9 = Bus SS1 10 = Bus SS2 11 = Bus SS4 12 = Analog input 2..+10V 13 = Bus SS6	Fixed values 1 ... 13	1
1203.XX	Fixed value sensitivity	Supplementary parameter for “fixed values” from P0896 The appropriate sparking sensitivity is manually set	0.30 % 0.00 ... 100.00 %	1
1216.XX <sup>1)</sup>	Fixed value load limit	Supplementary parameter for “fixed values” from P0897 Sets the corresponding load limit	80.00 % 0.00 ... 190.00 %	1

Parameter No.:	Name	Description / explanation selectable options	Factory setting min ... max values	Password
0297.00	Analog input window	Supplementary parameter for "analog input". The analog setpoint smoothing is specified in a window as a%. For example: Window width = 1 %. A change of the actual setpoint is only accepted if a change greater than 0.99 % of the possible final value is detected at the analog input.	0.50 % 0.00 ... 20.00 %	1
0200.00	Analog input norm.	Supplementary parameter for "analog input". The analog input normalization refers to the frequency normalization P0390.	100 % -199.99 ... 199.99 %	2
0202.00	Analog input offs.	Supplementary parameter for "analog input". Analog input offset	0.00 % -199.99 ... 199.99 %	2
0203.00	Analog input sign.	Supplementary parameter for "analog input". Analog input signal 0 = direct 1 = absolute value 2 = inverted 3 = absolute value, inverted	Direct 0 ... 3	2
0204.00	Analog input filter.	Supplementary parameter for "analog input". Analog input filter time to smooth the analog signal.	2 ms 0 ... 10000 ms	2
0564.nn	Reaction on I < 4mA	Supplementary parameter for "analog input 4...+20 mA". Response for "I < 4 mA" 0 = no action 1 = warning 2 = fault nn = 00 for NORMAL nn = 01 for TEST	Warning 0 ... 2	2
1218	Hysteresis, load limit	Hysteresis of the load limit comparator. This hysteresis is effective in both directions of the selected load limit.	5.00 % 0.00 % ... 100.00 %	1

### Additional functions

Parameter No.:	Name	Description / explanation selectable options	Factory setting min ... max values	Password
0282.YY	Rounding ramp up	Rounding-off times UP for the ramp-function generator. This is used for jerk limiting when starting; this is generally not more than 1/10 of the ramp time.	0.000 s 0.000 ... 800.00 s	1
0283.YY <sup>2)</sup>	Rounding ramp down	Diagram, ramp-up/ramp-down ramp with rounding-off	0.000 s 0.000 ... 800.00 s	1

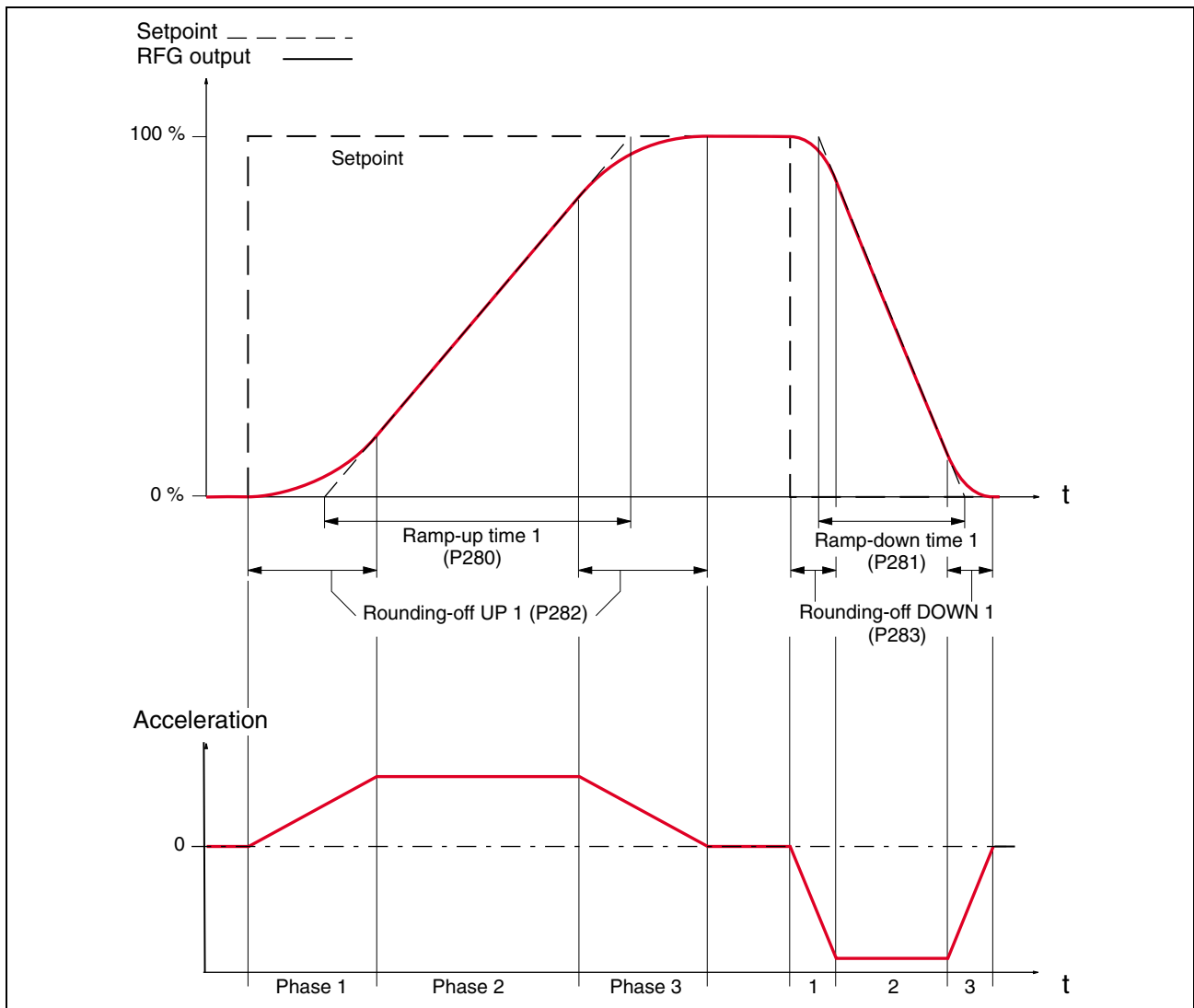


Fig. 7-6: Up and down ramp with rounding-off

## Drive setting

Parameter No.:	Name	Description / explanation selectable options	Factory setting min ... max values	Password
0071	Load factorySetting	<p>0 = no action</p> <p>1 = basic, standard values are loaded Parameters, with a password level less than or the same as the entered password level are set to the standard value of the basic parameterization. P0064 0 = Basic parametrization P0057 0 = not active</p> <p>2 = free standard values are loaded Parameters with a password level less than or equal to the entered password level are set to the standard value of the free parameterization. P0064 1 = Free parametrization P0057 0 = not active</p> <p>3 = standard values for NAMUR applications are loaded Parameters, with a password level less than or the same as the entered password level are set to the standard value of the basic parameterization with activated NAMUR functions. P0064 0 = Basic parametrization P0057 1 = active</p> <p>4 = standard values for Sercos applications are loaded Parameters, with a password level less than or the same as the entered password level are set to the standard value of the free parameterization for Sercos applications. P0064 1 = Free parametrization P0057 0 = not active</p> <p>The parameters with are relevant for applications with Sercos option interface are set.</p>	No action 0 ... 4	0
0732	Copy from keypad	<p>Caution: Only those parameters are copied which are enabled as a result of the selected password. The data set, saved in the operator panel is copied into the drive.</p> <p>0 = no 1 = yes 2 = designation (the saved data set designation can be viewed here)</p>	No 0 ... 2	
0733	Copy data to keypad	<p>The complete drive converter data set is copied into the operator panel.</p> <p>0 = no 1 = yes</p> <p>A data set name can be entered after the data transfer. You can scroll through the ASCII code using the + and - keys (the system goes to the start of the following ranges by simultaneously pressing the + and - keys: A, a, 0 and the blank symbol). You can move the cursor to the right or left using the &lt; or &gt; key.</p>	No 0 / 1	0

Parameter No.:	Name	Description / explanation selectable options	Factory setting min ... max values	Pass word
0064	Parameteriz. level	<p>0 = basic parameterization: The operator has access to the pre-defined parameters of the basic parameterization, menu-prompted or via the numerical list.</p> <p>1 = free parameterization: The operator can access all of the parameters associated with the free parameterization.</p> <p>Caution: Data can be lost when changing the parameterizing modes! Please carefully read the Section, 1.4 Working with basic parameterization and the free parameterization in the Manual, Function charts and parameter list.</p>	Basic parameterization: 0 / 1	23
0037.00	Display, lines 1,2,3	<p>Selects the operating display for line 1.</p> <p>0 = status (drive status message) 1 = actual speed (electrical) 2 = output effective current 3 = output current (actual apparent current) 4 = output voltage 5 = DC link voltage 6 = frequency actual value 7 = frequency setpoint 8 = P act (actual apparent power) 9 = P active (active power which the motor takes)</p>	f actual 0 ... 9	0
0037.01	Display, lines 1,2,3	<p>Selects the operating display for line 2. As for parameter 0037.00.</p>	Frequency setpoint 0 ... 9	0
0037.02	Display, lines 1,2,3	<p>Selects the operating display for line 3. As for parameter 0037.00.</p>	Status 0 ... 9	0
0734	Display contrast	Sets the contrast for the operator panel display	11 10 ... 20	0
0072	Source parameter	<p>Specifies from which source parameters can be set.</p> <p>0 = Keypad, PC (RS232), 1 = Bus SS1, 2 = Bus SS2, 3 = Bus SS4, 4 = All busses, 5 = Bus SS6</p>	Keypad, PC 0 ... 5	2

## Serial communications

Sub-menu to set standard RS485 interfaces.

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

## Parameter for the serial interface SI6

**Note:** Only for internal use.

1270	SI6 baud rate X13	<p>4 = 125 kbaud  5 = 250 kbaud  6 = 500 kbaud  7 = 1 Mbaud</p>	500 kbaud 4 ... 7	2
1271.00	SI6 Tx ID No. X13	<p>Sets the send identifier (address) and the priority.  The lower the identifier (number), then the higher the priority.</p> <p>0516.00 = For PZD 1 ... 4  0516.01 = For PZD 5 ... 8  0516.02 = For PZD 9 ... 12  0516.03 = For PKW response</p>	513, 208, 272, 784 1 ... 2047	2
1272.00	SI6 Rx ID No. X13	<p>Sets the send identifier (address) and the priority.  The lower the identifier (number), then the higher the priority.</p> <p>1272.00 = for PZD 1 ... 4  1272.01 = for PZD 5 ... 8  1272.02 = for PZD 9 ... 12  1272.03 = for PKW response</p>	512, 192, 256, 768 1 ... 2047	2
1273.00	SI6 Tx PZD clock X13	<p>Sets the automatic return send rate for the PZD protocol</p> <p>1273.00 = for PZD 1 ... 4  1273.01 = for PZD 5 ... 8  1273.02 = for PZD 9 ... 12</p> <p>Significance of the parameter values:  0 = Do not send  1...253 = Automatic send clock cycle in ms  254 = Special function: The node sends its process data (actual values) after the process data (setpoints) have been received.  255 = Reserved for additional special function</p>	1, 0, 0 0 ... 255	2
1274	SI6 Rx watchdog	<p>0 = No response  1 = Warning  2 = Fault</p>	Fault 0 ... 2	2
1275	SI6 Rx timeout	<p>Timeout (monitoring time) for the standard SS6 interface. If the interface does not receive an error-free protocol within this time, the response, selected in P01274 is initiated.</p>	0.1 s 0.01 ... 60.0 s	2
0499	RS232 baud rate X11	<p>0 = 1200 baud  1 = 2400 baud  2 = 4800 baud  3 = 9600 baud  4 = 19200 baud  5 = 38400 baud  6 = 57600 baud  7 = 76800 baud</p>	9600 baud 0 ... 7	2



## Diagnostics / drive data

Parameter No.:	Name	Description / explanation selectable options	Factory setting min ... max values	Password
0028	Operating hours	Operating hours with the inverter enabled.	0 h 0 ... 2147483647 h	-
0024	Continuous current	Device data correspond to the drive converter performance data		0
0025	Peak current, long			
0046	Peak current, short			
0022	Continuous output			
0023	Peak output, long			
0099	Max. o/p frequency			
0027	Max. normaliz. freq.			
0001	Device ID	Firmware data	501	0
0002	Firmware version		e.g. 2	
0003	Firmware module		e.g. 2	
0006	Serial number		e.g. 3	
0007	Converter number		e.g. 1	
0008	EEPROM prog. cycles	Displays the EEPROM programming cycles	1 -1 ... 100000	-
0040.0n	Fault memory	n = 0 ... 9 (the last 10 faults)	No fault 0 ... 64	0
0898	Scratchpad REFU	Can be used to save any number.	0.000 0.000 ... 2147483.647	2
0899	Scratchpad customer	Can be used to save any number.	0.000 0.000 ... 2147483.647	2

## Options

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

## 7.5 Numerical list

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



## 8 Start-up

### 8.1 Steps to prepare for commissioning

The power terminals should be connected-up as specified in Section 5.4, Power terminals RS51, Sizes J-M and the control terminals as specified in Section 5.6, Control terminals.

Check whether the star / delta jumpers have been correctly connected at the motor terminal board.

Observe the “Hazardous voltage warning information” in Section Fehler! Verweisquelle konnte nicht gefunden werden.!

It should also be ensured that signal, line supply and motor feeder cables have been separately routed with a minimum clearance between them! The setpoint cables must be shielded. Please refer to Section Fehler! Verweisquelle konnte nicht gefunden werden., Fehler! Verweisquelle konnte nicht gefunden werden..

Before commissioning the electrical system for the first time, a qualified electrician or engineer should first check that the equipment corresponds, both electrically and mechanically, to the safety requirements (5 Paragraph 1 No. 1 VBG 4), specified by

- the accident prevention regulations,
- and the general electrical regulations.

Check whether a rotating motor could cause human injury or material damage!

The power and control voltages can be switched-in after all of the control, setpoint and power supply cables have been connected. The operator panel displays the “Switch-on enable” message after approx. 10 seconds.

### 8.2 Procedure when first commissioning the drive system

The factory setting is always assumed regarding the parameterization in the “Commissioning” section.

The following diagram guides you through the simplest start-up using the Quick-Setup and starting the drive with the factory settings.

The second route represents, as an example, several settings per “Prompted parameterization”. Please refer to Section 7 in these Operating Instructions for all other possibilities of parameterizing the drive.

The factory settings of the parameterization are also provided in Section 7 in the tables.

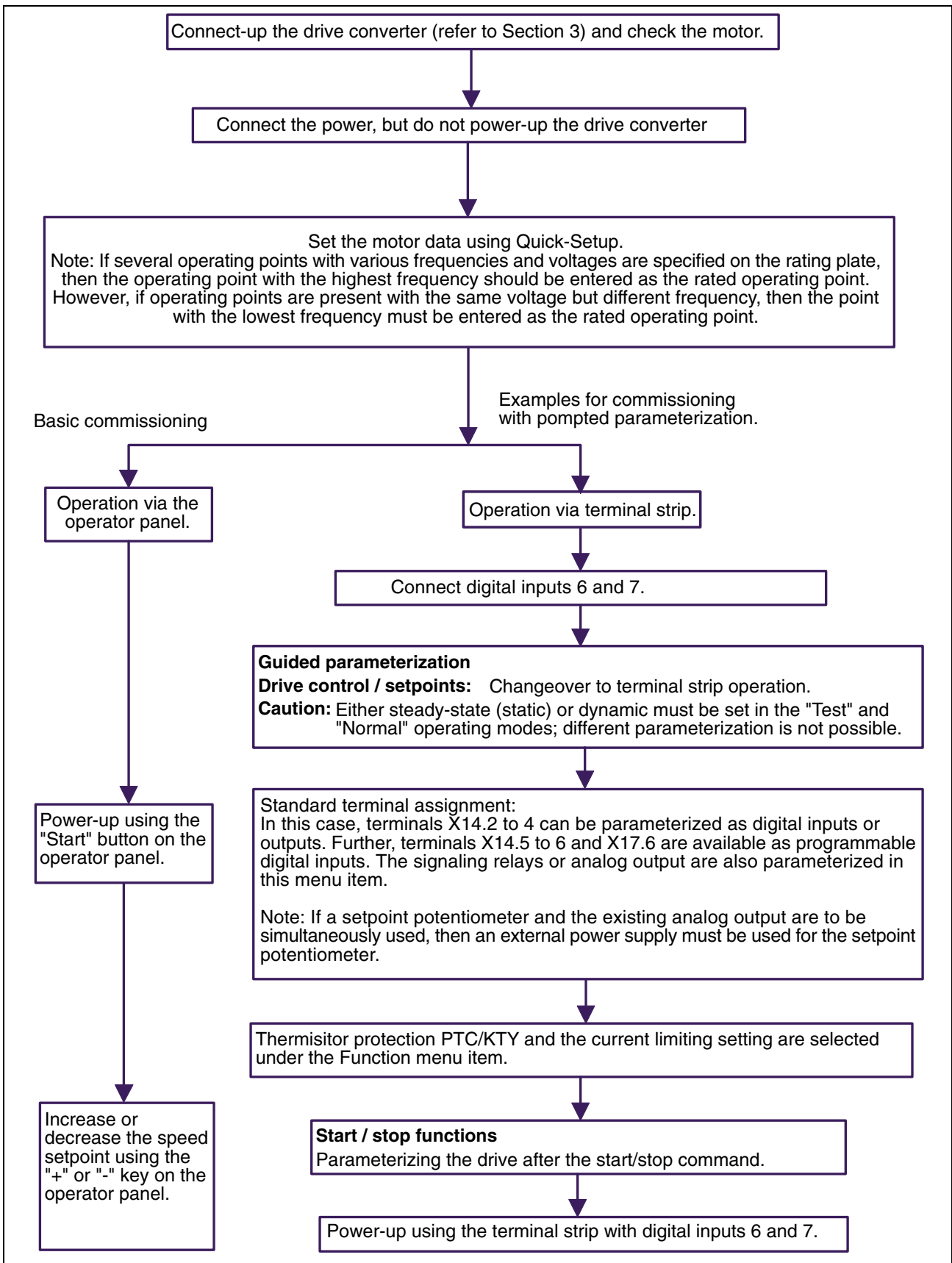


Fig. 8-1: Commissioning flowchart

## 8.3 Motor optimization / motor evaluation

### Motor running under no-load conditions

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

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

### Running-up / accelerating under load

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

#### Procedure

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

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

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

## 8.4 General information

- If you wish to reset all of the parameters to the factory setting due to, for example, incorrect programming, then use the "Load parameter set" with parameter P0071.
- Fault acknowledgement: There are three ways to acknowledge a fault.
  - using the "Esc" button on the operator panel.
  - pressing the "RESET" button S9 on the control card (the cover must be removed)
  - controlling/energizing a configured digital input with the "Fault acknowledgement" function.
- Comment: If a fault develops during operation, and a fault is acknowledged, the "Power-on inhibit" message is displayed. This means that the drive converter has gone into fault condition. A "Stop" command must be entered in order to enter the "Switch-on enable" status.



## 9 Troubleshooting

### 9.1 Self-test - error messages

After the initialization routine, the system executes a self-test. The individual components of the microcomputer system are tested, e.g. the EEPROM and the data from the power control board is read-in.

### 9.2 Alarms

If an alarm is output, the alarm message is displayed, alternating with the programmed operating display. The alarm bit can be output at a digital input. If the drive converter is to be prevented from being powered-up, the alarm bit must be interlocked in the free parameterization.

### 9.3 Faults

During operation, permanently-programmed and parameterizable limit values are continuously monitored. In order to protect the power module against damage, when a limit value is exceeded, the drive converter is always powered-down and the appropriate fault message is displayed.

For REFU*drive 500* drive converters with three-phase supply, when a fault occurs, the main contactor is de-energized, and the power module goes into a no-voltage condition. The appropriate fault message is displayed.


The fault is displayed using the red LED "ALARM" on the front panel of the drive.

Fault messages are saved in the fault memory so that they are not lost when the power fails. The fault memory is called-up in the monitor (operator control, refer to Section 6). The last 10 faults are saved in the fault memory. The last fault is S0 in the memory location, the oldest in S9. A new fault is always saved in memory location S0. All of the older faults in the memory are shifted one position upwards. This means that the fault at memory location S9 is lost.

### Fault acknowledgement

After a fault trip, the drive converter cannot be powered-up again until the fault has been acknowledged. The fault cannot be acknowledged as long as the fault still exists. If the cause of the fault has been removed, the fault can be acknowledged after a timer has expired (P0093, factory setting 1 sec.).

There are several ways of acknowledging a fault message:

- Pressing the  button on the operator panel.
- Pressing the button S9 "Fault acknowledgement" on the control card.
- Using a digital input: Connect an H signal at the digital input, connect non-inverted D parameters of the selected digital inputs to P0050.07.
- Via the serial RS485 interface; transfer control word with bit 7 set to "high".

## 9.4 List of the alarm and fault messages

No.	Messages	Alarm	Fault
0	No fault, no alarm	x	x
1	External	x	x
3	DC link voltage too high		x
4	DC link voltage too low	x	x
7	Device overtemperature	x	x
8	Brake resistor		x
9	Main contactor		x
10	Pre-charging		x
11	New EEPROM		x
12	Clock1 <==> Clock2		x
13	Power section		x
14	Inverter		x
15	Power supply		x
17	Overspeed	x	x
18	Ground fault		x
19	EEPROM data	x	x
21	Internal WS comm.		x
22	NTC power section		x
24	SI1 timeout	x	x
25	SI2 function	x	x
26	SI2 timeout	x	x
27	Analog input: I < 4 mA	x	x
28	Motor overtemperature	x	x
30	SR Release		x
31	Brake resistor overload	x	x
32	Overcurrent		x
34	Safety OFF	x	x
35	Motor overload	x	x
39	On for start inhibit		x
40	Switched-mode power supply		x
41	SR <==> WS new		x
44	SI4 function	x	x
45	SI4 timeout	x	x
47	Start inhibit active	x	
59	SS6 timeout	x	x
61	FUS power supply		x
62	Resonance		x

Fig. 9-1: Fault messages





No.	Designation Cause	Message Remedy / comments
10	<p>Pre-charging After the drive has been powered-up, the DC link voltage charging over time is monitored. If illegal deviations occur, pre-charging is stopped. Short-circuit between terminals C and D (DC link voltage) or C-PE or D-PE. Only for the option W, brake resistor: Short-circuit between F and C. Only for the option V, electronics standby: The "On" command was connected while the standby supply is active but there is no line supply voltage.</p>	<p>Fault Check the following, whether the line supply voltage is available whether there is a short-circuit between terminals C and D or C-PE and D-PE. Comment: After the "Pre-charging" fault has been acknowledged, it is only permissible to power-up again after 30 seconds. This protects the pre-charging resistors against overheating.</p>
11	<p>New EEPROM The processor control did not recognize the bit pattern, factory-loaded in the EEPROM.</p>	<p>Fault Please contact your customer service.</p>
12	<p>Clock1 &lt;==&gt; Clock2 The frequencies of the two clock generators provided on the control card are checked with one another for plausibility (overspeed protection). This fault trip is output for deviations exceeding <math>\pm 1\%</math>.</p>	<p>Fault One of the two clock generators is defective, replace the module.</p>
13	<p>Power section Power section fault which cannot be described in detail.</p>	<p>Fault Please contact your customer service.</p>
14	<p>Inverter This fault is initiated when the overcurrent threshold is exceeded.</p>	<p>Fault</p>
	<p>Causes outside the drive converter: - Defective motor, invalid load, defective motor cable  - Setpoint step which is too fast</p>	<p>Disconnect the motor cable, enable the inverter. If the fault no longer occurs, then it is highly likely that the cause is outside of the drive converter.  Measure using the REFUwin "Oscilloscope function": Parameter D1981 "f act from normalization".</p>
	<p>Cause in the parameterization: The incorrect motor data were parameterized. Only for option S sinusoidal filter: The pulse frequency (P0026) is set to less than 8 kHz; thus, the sinusoidal filter can oscillate and conduct high currents.</p>	<p>Check the motor data in the Quick-Setup. Set the pulse frequency in Quick-Setup (P0026) to 8 kHz or greater.</p>
	<p>Cause inside the drive converter: Defective power section transistor.</p>	<p>Please contact your customer service.</p>
15	<p>Power supply The voltages of the switched-mode power supply lie outside the limit values: Limit value for   +15 V   =       +13.5 V                          -15 V   =       -13.5 V</p>	<p>Fault The switched-mode power section is defective or the load is too high as a result of a defective module (also refer to the comments on Fault 40, switched-mode power supply).</p>
17	<p>Overspeed The actual speed exceeds the speed limit of the parameter "f limit machine".</p>	<p>Alarm / fault Check P0178 (f limit machine) for the correct setting. An excessive slip compensation (P0540) may have been selected. Check P0390 (frequency normalization) for a correct value and, if required, change. Either alarm or fault can be selected using P0449 (response to overspeed).</p>
18	<p>Ground fault Ground fault at the inverter output terminals (U2, V2, W2) or excessive capacitance with respect to ground as a result of long motor cables.</p>	<p>Fault</p>

No.	Designation Cause	Message Remedy / comments
19	<p>EEPROM data Cause in the parameterization: The control card was replaced and, after initialization, detects a new power section, which for example, cannot supply the parameterized currents. This means, that one or several parameters lie outside the tolerance range. When the fault is acknowledged, the associated parameters are reset to the standard drive converter values.</p> <p>Cause in the drive converter: This fault can also occur if the power fails during operation. In this case, the power section could send incorrect data to the control card.</p>	<p>Alarm / fault</p> <p>The appropriate parameter numbers can be viewed using P0061.XX, and the erroneous parameter values using P0062.XX. The fault can be removed using a special acknowledgement with P0060 (password level 3 [Esc], [Mon], [Prog] and [+]). It must then be checked, whether the modified parameters match the particular application. When parameterization is exited, the values are transferred into the Eeprom.</p> <p>The fault may be able to be removed by powering-up and powering-down the line supply voltage or the standby supply. If this is not successful, then please call customer service.</p>
21	<p>Internal WS comm. Communications between the processor board and the power section are faulted. If the fault occurs after power-up during the self-test, it cannot be acknowledged.</p>	<p>Fault Check the plug connection between the PC boards or replace the modules.</p>
22	<p>NTC power section Wire broken/interrupted to the NTC on the heatsink in the power section or rectifier; NTC defective; excessive resistance (high ohmic connection) or the connector does not have a contact.</p>	<p>Fault Check the plug connector; replace the connector, cable or NTC.</p>
24	<p>SS1 timeout The control computer does not send data within the parameterized response time (P0506).</p>	<p>Alarm / fault Check the plug connection SS1 (RS485), extend the response time (P0506), select another response type (P0505).</p>
25	<p>SS2 function Only for option interface cards at option slot 1. The drive converter detects a physical fault on the interface cable from the higher-level control computer. Erroneous data transfer along the fieldbus.</p>	<p>Alarm / fault Check that the PPO type (protocol type), baud rate, parity, stop bit and slave address are correct. If a bus error occurs in the form of an alarm or fault, then the alarm or the fault or both messages can be suppressed using parameter P0509; this means that the system can continue to operate!</p> <p>Only for the CAN bus option: The protocols sent on the CAN bus interface are monitored. If a bus error occurs more than 127x, an alarm is output. If a bus error occurs more than 255x, a fault is signaled. The alarm or fault, or both messages can be masked in parameter P0509; this means that the system can continue to operate. Only for the Profibus option: Either "No action" or "Fault" can be selected in parameter P0524 when receiving Clear Data. Caution: In this case, P0509 should be set to the "All active" function! This means that the control computer sends Clear Data if there is an invalid protocol or a bus error. Only for the Interbus S option: The response type can be set in parameter P0518 and the monitoring time when a bus error occurs, in P0519. Index 0 = process data, index 1 = PKW range.</p>
26	<p>SS2 timeout Only for option interface cards at option slot 1. Within the parameterized response time (P0527), the higher-level control computer does not send any data.</p>	<p>Alarm / fault Check plug connection SS2</p> <p>Extend the response time (P0527), select another response type (P0526).</p>

No.	Designation Cause	Message Remedy / comments
27	<p>Analog input 1: <math>I &lt; 4 \text{ mA}</math> Cause external to the drive converter: Short-circuit or interrupted cable on the setpoint line to the analog input or to the optional analog inputs (only for operating mode 4-20 mA or 2-10 V). Cause in the parameterization: Erroneous response type Incorrect operating mode</p>	<p>Alarm / fault</p> <p>Check the setpoint line.</p> <p>Check the response type in P0564.0X or P0752.0X. Check the operating mode in P0201.0x or P0735.0X.</p>
28	<p>Motor overtemperature The drive converter detects an excessive resistance at terminals X15.1 and 2. The motor temperature is too high, temperature sensor defective, sensor cable defective. Erroneous parameterization.</p>	<p>Alarm / fault</p> <p>Replace the sensor or sensor cable.</p> <p>Check the temperature evaluation parameters (P0385 – P0389) to ensure that they are correctly set. If a KTY84 has been selected, the actual motor can be displayed in °C in the monitor using D1872; if a PTC has been selected, the actual ohmic value can be displayed using D1871.</p>
30	<p>SR Release? The control card and the firmware (Flash Eprom) do not match.</p>	<p>Fault</p> <p>Please contact your customer service.</p>
31	<p>Brake resistor overload For the parameterized brake resistor, the drive converter computes a temperature image. If the brake resistor is controlled, the drive converter calculates the assigned temperature. If a threshold is exceeded, the drive converter signals a brake resistor overload condition. Cause external to the drive converter: Only for the option W brake resistor: The brake resistor which is being used has an excessive ohmic value. A brake resistor has not been connected. The connected brake resistor is too low for the energy which is fed-back into the DC link when braking. Cause in the parameterization: The down-ramp was set too fast. An incorrect brake resistor was selected.</p> <p>Only for an external programmable brake resistor: The values for the resistance, continuous output and/or thermal time constant were incorrectly parameterized.</p>	<p>Alarm / fault</p> <p>Check the brake resistor.</p> <p>Check the down-ramp in P0280.0X.</p> <p>In P0038 check whether the correct brake resistor was selected. Information regarding REFU Standard: Every drive converter output class is assigned a specific brake resistor. Check the values in P0623 to P06256.</p> <p>Maintain the max. braking duration and the required no-load times to the next braking operation. The load diagram in the instructions for the brake resistor option can be used to calculate the braking and no-load times.</p>

No.	Designation Cause	Message Remedy / comments
32	Overcurrent	Fault
	1. Current limiting is active for a time which is longer than that parameterized.	<ul style="list-style-type: none"> <li>Check the setting of P0574! The time duration of the uninterrupted current limiting (D1678 = 1) can be set between 1 second and 100 seconds in 11 steps using P0574. If current limiting is interrupted before the parameterized time has expired (D1678 = 0), the time counter is reset to 0 and then restarts at the next current limiting. If P0574 has been set to 0 (= continuous), then the "Overcurrent" fault is output.</li> </ul>
	The peak current of the drive converter was exceeded	
	Causes outside the drive converter: - Defective motor, invalid load, defective motor cable  - Setpoint step which is too fast	Disconnect the motor cable, enable the inverter. If the fault no longer occurs, then it is highly likely that the cause is outside of the drive converter.  Measure using the REFUwin "Oscilloscope function": Parameter D1981 "f act from normalization".
	Cause in the parameterization: The incorrect motor data were parameterized. Only for option S sinusoidal filter: The pulse frequency (P0026) is set to less than 8 kHz; thus, the sinusoidal filter can oscillate and conduct high currents.	Check the motor data in the Quick-Setup. Set the pulse frequency in Quick-Setup (P0026) to 8 kHz or greater.
	Cause inside the drive converter: Defective power section transistor.	Please contact your customer service.
34	Safety Off (NAMUR) The "Safety Off" fault message has been introduced so that the drive converter fulfills the Namur Standard (Namur is a Standards Committee for instrumentation and control in the chemical industry). It is only activated when P0057 is set to 1. The fault or alarm is selected using P0571. The fault is initiated using an external control signal, which is connected to the digital input of the drive converter. The D parameter of the digital input is connected to P0050.1. The external control signal is used to positively disconnect the drive from the line supply (1 = operation; 0 = disconnected from the line supply).	Alarm / fault
35	Motor overload The electronic overload relay has responded (refer to the function diagram "Modulation, measured value sensing" or in the Operating Instructions Section 5 of the basic programming "Thermal motor protection").	Alarm / fault Check P0566 "Overload protection threshold" to ensure that it has been correctly set. The type of response of the electronic overload relay can be set using P0565: Disabled / Alarm / Fault.
39	On for start inhibit The message only occurs when the start inhibit option is installed. Sizes A to E: Contacts X80.1 and 2 were opened during operation, or an on command was output with the terminal open. Sizes G and H: Contacts X80.170 and 171 were opened during operation, or an on command was issued with the terminals open.	Fault

No.	Designation Cause	Message Remedy / comments
40	Switched-mode power supply The switched-mode power supply for the electronics supply does not output a checkback signal.	Fault Replace the defective switched-mode power supply. Depending on the drive converter version, the switched-mode power section is on the PC board: LT (power section), WS (inverter control) or SV (power supply).
41	SR <==> WS new If the control card is replaced in another drive converter with a higher or lower output or drive converter index, this entry is made in the fault memory (the drive converter does not go into a fault condition!). A fault is issued if the parameters lie outside the limit values (refer to fault 19).	
44	SS4 function Only for option interface cards at option slot 2. The drive converter detects a physical fault on the interface cable from the higher-level control computer. Erroneous data transfer along the fieldbus.	Alarm / fault Check that the PPO type (protocol type), baud rate, parity, stop bit and slave address are correct. If a bus error occurs in the form of an alarm or fault, then the alarm or the fault or both messages can be suppressed using parameter P0745, this means that the system can continue to operate! Only for the CAN bus option: The protocols sent on the CAN bus interface are monitored. If a bus error occurs more than 127x, an alarm is output. If a bus error occurs more than 255x, a fault is signaled. The alarm or fault or both messages can be masked in parameter P0745; this means that the system can continue to operate. Only for the Profibus option: Either "No action" or "Fault" when receiving Clear Data can be selected in parameter P0524. Caution: In this case, P0745 should be set to the "All active" function! This means that the control computer sends Clear Data if there is an invalid protocol or a bus error. Only for the Interbus S option: The response type can be set in parameter P0518 and the monitoring time, when a bus error occurs, in P0519. Index 0 = process data, index 1 = PKW range.
45	SS4 timeout Error of the internal interface between drive converter and sinusoidal filter.	Alarm / fault Verify the parameter P1274, 1275 and 1276 for factory setting.
47	Start inhibit active Only for the start inhibit option: The start inhibit was activated, while the drive converter was not operational.	Alarm
59	SS6 timeout Within the parameterized response time (P1275) the higher-level control computer does not send any data.	Alarm / fault Check plug connector X13 Extend the response time (P1275), select another response type (P1276).
61	FUS power supply The power supply on the KB21004 coupling module is not operating correctly	Fault Replace module KB21004
62	Resonance Current resonance (oscillations) occur at an operating point between the motor and output filter of the drive converter.	Fault Set the operating point differently in the V/Hz characteristic, or: Cancel the filter P1224.xx = 0 Disable the output filter for the appropriate parameter set (P1224.XX)

# 10 Index

## A

Air humidity 4-1  
Alarms 9-1  
Ambient temperature 4-1  
Analog input 5-15  
Analog output 5-15

## B

Basic parameterization 7-1  
Bus termination 5-18

## C

Cable cross-sections 5-4  
Cable cross-sections 5-4  
Circuit principle 3-4  
Connecting a PC 5-18  
Connecting cable for the PC 5-18  
Connecting the standard interface 5-18  
Connection circuit diagram 5-13  
Connection circuit-diagram 5-12  
Control terminals 5-14  
Copy function 6-4  
Correct use  
    Applications 1-2  
    Introduction 1-1

## D

DC feeder cables 5-4  
De-rating 4-1  
Description of the control terminals 5-14  
Digital inputs 5-15  
Digital outputs 5-15  
Dimension drawing, side view 4-4  
Dimension drawings, front view 4-3

## E

Electromagnetic compatibility 3-1  
EMC correct installation of drives 5-1  
Error messages when parameterizing 6-3

## F

Fault acknowledgement 9-1  
Fault display 6-7  
Fault messages  
    Main contactor 9-3  
    Pre-charging 9-4  
Fault messages  
    Analog input 1  
        I < 4 mA 9-6  
    Brake resistor 9-3  
    Brake resistor overload 9-6  
    Clock1 <==> Clock2 9-4  
    DC link voltage too high 9-3  
    DC link voltage too low 9-3  
    Drive overtemperature 9-3  
    EEPROM data 9-5  
    External 9-3  
    FUS power supply 9-8  
    Ground fault 9-4

- Internal WS comm. 9-5
- Inverter 9-4
- Motor overload 9-7
- Motor overtemperature 9-6
- New EEPROM 9-4
- NTC power section 9-5
- On for start inhibit 9-7
- Overcurrent 9-7
- Overspeed 9-4
- Power section 9-4
- Power supply 9-4
- Resonance 9-8
- Safety Off (NAMUR) 9-7
- SR <==> WS new 9-8
- SR Release? 9-6
- SS1 timeout 9-5
- SS2 function 9-5
- SS2 timeout 9-5
- SS4 function 9-8
- SS4 timeout 9-8
- SS6 timeout 9-8
- Start inhibit active 9-8
- Switched-mode power supply 9-8
- Fault messages 9-2
  - List of the alarm and fault messages 9-2
- Fault messages
  - Cause and remedy / comment 9-3
- Faults 9-1
- Free parameterization 7-1
- Function of the operator panel in 6-2

## G

- Guided parameterization 7-6

## I

- Installation altitudes 4-1

## K

- Key combinations 6-3
- Key functions of the operator panel in the monitor mode 6-2
- Key functions of the operator panel when parameterizing 6-3

## L

- LED display 6-8
- Line supply connection 5-11
- Line supply feeder cables 5-4
- Load standard parameters 6-4
- Load standard values 6-4

## M

- Menu overview 7-3
- Menu structure of the basic parameterization 7-2
- Minimum requirements placed on the installation location 4-1
- Monitor 6-6
- Monitor functions 6-6
- Monitor program structure 6-6
- Motor connection 5-11
- Motor feeder cables 5-4
- Motor temperature sensor 5-15
- Mounting, drives sizes A to M 4-2

## N

- Non-correct use 1-2



consequences, exclusion of liability 1-1  
Normal and test operation 6-2  
Numerical list 7-25

## O

Operating display 6-7  
Operator control possibilities 6-1  
Operator control using the operator panel 6-1

## P

Parameterization  
Active load monitor 7-18  
Additional functions 7-19  
Controller setting 7-14  
Diagnostics / drive data 7-25  
Drive control 7-6  
Drive setting 7-21  
Options 7-25  
Serial communications 7-23  
Setpoints 7-6  
Start/stop functions 7-14  
Terminal assignment 7-9  
Thermal motor protection 7-15  
V/Hz control 7-17  
Parameterization using the operator panel 6-3  
Password 7-4  
Power terminals 5-10  
Power terminals RS51 5-5  
Power terminals, sizes J and K 5-10  
Power terminals, sizes L and M 5-11  
Protective conductor cross-section 5-4

## Q

Quick-Setup 7-4

## R

Rating plate 3-2  
Reference  $\pm 10$  V 5-15  
REFUdrive 500 drive series 3-1  
Relay output 5-15  
RS232 5-17  
RS485 5-18

## S

Safety Instructions for Electric Drives 2-1  
Service interface 5-17  
SS6 5-19  
Standard interface 5-18, 5-19  
Storage 4-1  
Storage and installation 4-1  
Storage temperature 4-1  
Structure of the basic parameterization 7-1

## T

Technical data 3-3  
Technical features 3-1  
Terminal layout diagram SR17000 5-14  
Type code 3-7  
Type code, basic drive 3-7  
Type code, firmware 3-9

**U**

Up and down ramps 7-6  
Use *Refer to Correct use and refer to Non-correct use*  
USS protocol 5-18

**V**

V/Hz characteristic 7-18

**W**

Warning display 6-7

**X**

X11 5-17  
X12 5-18  
X13 5-19  
X14 5-15  
X15 5-15  
X16 5-15  
X17 5-16

# 11 Service & Support

## 11.1 Indramat Refu GmbH

**Adresse:** Indramat Refu GmbH  
Uracher Straße 91  
72555 Metzingen

**Postadresse:** 72545 Metzingen – Postfach 1554

**Telefon:** +49 (0)7123/969-0

**Telefax:** +49 (0)7123/969-120

### Kundendienst - Service

**Service Hotline:** +49 (0)7123/969-200 (an Werktagen von 8 – 17 Uhr)

**Service Telefax:** +49 (0)7123/969-220

**E-Mail:** service.brc-mg@boschrexroth.de

## 11.2 Internet

Unter [www.boschrexroth.de](http://www.boschrexroth.de) 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.de](http://www.boschrexroth.de) 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.

## 11.3 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.

## 11.4 Kundenbetreuungsstellen - Sales & Service Facilities

### Deutschland – Germany

**vom Ausland:**

(0) nach Landeskennziffer weglassen!

from abroad:

don't dial (0) after country code!

<b>Vertriebsgebiet Mitte</b> Germany Centre Rexroth Indramat GmbH Bgm.-Dr.-Nebel-Str. 2 / Postf. 1357 97816 Lohr am Main / 97803 Lohr <b>Kompetenz-Zentrum Europa</b> Tel.: +49 (0)9352 40-0 Fax: +49 (0)9352 40-4885	<b>SERVICE</b> <b>CALL ENTRY CENTER</b> <b>MO – FR</b> <b>von 07:00 - 18:00 Uhr</b>  from 7 am – 6 pm  <b>Tel. +49 (0) 9352 40 50 60</b> <a href="mailto:service@boschrexroth.de">service@boschrexroth.de</a>	<b>SERVICE</b> <b>HOTLINE</b> <b>MO – FR</b> <b>von 17:00 - 07:00 Uhr</b> from 5 pm - 7 am <b>+ SA / SO</b>  <b>Tel.: +49 (0)172 660 04 06</b> oder / or <b>Tel.: +49 (0)171 333 88 26</b>	<b>SERVICE</b> <b>ERSATZTEILE / SPARES</b> verlängerte Ansprechzeit - extended office time - ♦ nur an Werktagen - only on working days - ♦ von 07:00 - 18:00 Uhr - from 7 am - 6 pm -  <b>Tel. +49 (0) 9352 40 42 22</b>
<b>Vertriebsgebiet Süd</b> Germany South Rexroth Indramat GmbH Landshuter Allee 8-10 80637 München Tel.: +49 (0)89 127 14-0 Fax: +49 (0)89 127 14-490	<b>Vertriebsgebiet West</b> Germany West Bosch Rexroth AG Regionalzentrum West Borsigstrasse 15 40880 Ratingen Tel.: +49 (0)2102 409-0 Fax: +49 (0)2102 409-406	<b>Gebiet Südwest</b> Germany South-West Bosch Rexroth AG Service-Regionalzentrum Süd-West Siemensstr. 1 70736 Fellbach Tel.: +49 (0)711 51046-0 Fax: +49 (0)711 51046-248	<b>Gebiet Südwest</b> Germany South-West Bosch Rexroth AG Regionalzentrum Südwest Ringstrasse 70 / Postfach 1144 70736 Fellbach / 70701 Fellbach Tel.: +49 (0)711 57 61-100 Fax: +49 (0)711 57 61-125
<b>Vertriebsgebiet Nord</b> Germany North Bosch Rexroth AG Walsroder Str. 93 30853 Langenhagen Tel.: +49 (0) 511 72 66 57-0 Service: +49 (0) 511 72 66 57-256 Fax: +49 (0) 511 72 66 57-93 Service: +49 (0) 511 72 66 57-95	<b>Vertriebsgebiet Mitte</b> Germany Centre Bosch Rexroth AG Regionalzentrum Mitte Waldecker Straße 13 64546 Mörfelden-Walldorf Tel.: +49 (0) 61 05 702-3 Fax: +49 (0) 61 05 702-444	<b>Vertriebsgebiet Ost</b> Germany East Bosch Rexroth AG Beckerstraße 31 09120 Chemnitz Tel.: +49 (0)371 35 55-0 Fax: +49 (0)371 35 55-333	<b>Vertriebsgebiet Ost</b> Germany East Bosch Rexroth AG Regionalzentrum Ost Walter-Köhn-Str. 4d 04356 Leipzig Tel.: +49 (0)341 25 61-0 Fax: +49 (0)341 25 61-111

## Europa (West) - Europe (West)

**vom Ausland:** (0) nach Landeskennziffer weglassen, **Italien:** 0 nach Landeskennziffer mitwählen  
**from abroad:** don't dial (0) after country code, **Italy:** dial 0 after country code

<b>Austria - Österreich</b> Bosch Rexroth GmbH Bereich Indramat Stachegasse 13 1120 Wien Tel.: +43 (0)1 985 25 40 Fax: +43 (0)1 985 25 40-93	<b>Austria – Österreich</b> Bosch Rexroth GmbH Gesch.ber. Rexroth Indramat Industriepark 18 4061 Pasching Tel.: +43 (0)7221 605-0 Fax: +43 (0)7221 605-21	<b>Belgium - Belgien</b> Bosch Rexroth AG Electric Drives & Controls Industrielaan 8 1740 Ternat Tel.: +32 (0)2 5830719 - service: +32 (0)2 5830717 Fax: +32 (0)2 5830731 <a href="mailto:indramat@boschrexroth.be">indramat@boschrexroth.be</a>	<b>Denmark - Dänemark</b> BEC A/S Zinkvej 6 8900 Randers Tel.: +45 (0)87 11 90 60 Fax: +45 (0)87 11 90 61
<b>Great Britain – Großbritannien</b> Bosch Rexroth Ltd. Rexroth Indramat Division Broadway Lane, South Cerney Cirencester, Glos GL7 5UH Tel.: +44 (0)1285 863000 Fax: +44 (0)1285 863030 <a href="mailto:sales@boschrexroth.co.uk">sales@boschrexroth.co.uk</a> <a href="mailto:service@boschrexroth.co.uk">service@boschrexroth.co.uk</a>	<b>Finland - Finnland</b> Bosch Rexroth Oy Rexroth Indramat division Ansatie 6 017 40 Vantaa Tel.: +358 (0)9 84 91-11 Fax: +358 (0)9 84 91-13 60	<b>France - Frankreich</b> Bosch Rexroth S.A. Division Rexroth Indramat Avenue de la Trentaine (BP. 74) 77503 Chelles Cedex Tel.: +33 (0)164 72-70 00 Fax: +33 (0)164 72-63 00 <b>Hotline:</b> +33 (0)608 33 43 28	<b>France - Frankreich</b> Bosch Rexroth S.A. Division Rexroth Indramat ZI de Thibaud, 20 bd. Thibaud (BP. 1751) 31084 Toulouse Tel.: +33 (0)5 61 43 61 87 Fax: +33 (0)5 61 43 94 12
<b>France - Frankreich</b> Bosch Rexroth S.A. Division Rexroth Indramat 91, Bd. Irène Joliot-Curie 69634 Vénissieux – Cedex Tel.: +33 (0)4 78 78 53 65 Fax: +33 (0)4 78 78 53 62	<b>Italy - Italien</b> Bosch Rexroth S.p.A. Via G. Di Vittoria, 1 20063 Cernusco S/N.MI Tel.: +39 02 92 365 1 +39 02 92 365 326 Fax: +39 02 92 365 500 +39 02 92 365 516378	<b>Italy - Italien</b> Bosch Rexroth S.p.A. Via Paolo Veronesi, 250 10148 Torino Tel.: +39 011 224 88 11 Fax: +39 011 224 88 30	<b>Italy - Italien</b> Bosch Rexroth S.p.A. Via del Progresso, 16 (Zona Ind.) 35020 Padova Tel.: +39 049 8 70 13 70 Fax: +39 049 8 70 13 77
<b>Italy - Italien</b> Bosch Rexroth S.p.A. Via Mascia, 1 80053 Castellammare di Stabia NA Tel.: +39 081 8 71 57 00 Fax: +39 081 8 71 68 85	<b>Italy - Italien</b> Bosch Rexroth S.p.A. Viale Oriani, 38/A 40137 Bologna Tel.: +39 051 34 14 14 Fax: +39 051 34 14 22	<b>Netherlands – Niederlande/Holland</b> Bosch Rexroth B.V. Kruisbroeksestraat 1 (P.O. Box 32) 5281 RV Boxtel Tel.: +31 (0)411 65 19 51 Fax: +31 (0)411 65 14 83 <a href="http://www.boschrexroth.nl">www.boschrexroth.nl</a>	<b>Netherlands - Niederlande/Holland</b> Bosch Rexroth Services B.V. Technical Services Kruisbroeksestraat 1 (P.O. Box 32) 5281 RV Boxtel Tel.: +31 (0)411 65 19 51 Fax: +31 (0)411 67 78 14 <a href="mailto:services@boschrexroth.nl">services@boschrexroth.nl</a>
<b>Norway - Norwegen</b> Bosch Rexroth AS Rexroth Indramat Division Berghagan 1 or: Box 3007 1405 Ski-Langhus 1402 Ski Tel.: +47 (0)64 86 41 00 Fax: +47 (0)64 86 90 62 <a href="mailto:jul.ruud@rexroth.no">jul.ruud@rexroth.no</a>	<b>Spain - Spanien</b> Bosch Rexroth S.A. División Rexroth Indramat Centro Industrial Santiga Obradors s/n 08130 Santa Perpetua de Mogoda Barcelona Tel.: +34 9 37 47 94 00 Fax: +34 9 37 47 94 01	<b>Spain – Spanien</b> Goimendi S.A. División Rexroth Indramat Parque Empresarial Zuatzu C/ Francisco Grandmontagne no.2 20018 San Sebastian Tel.: +34 9 43 31 84 21 - service: +34 9 43 31 84 56 Fax: +34 9 43 31 84 27 - service: +34 9 43 31 84 60 <a href="mailto:sat.indramat@goimendi.es">sat.indramat@goimendi.es</a>	<b>Sweden - Schweden</b> Rexroth Mecman Svenska AB Rexroth Indramat Division - Varuvägen 7 (Service: Konsumentvägen 4, Älfsjö) 125 81 Stockholm Tel.: +46 (0)8 727 92 00 Fax: +46 (0)8 647 32 77
<b>Sweden - Schweden</b> Rexroth Mecman Svenska AB Indramat Support Ekvändan 7 254 67 Helsingborg Tel.: +46 (0) 42 38 88 -50 Fax: +46 (0) 42 38 88 -74	<b>Switzerland West - Schweiz West</b> Bosch Rexroth Suisse SA Département Rexroth Indramat Rue du village 1 1020 Renens Tel.: +41 (0)21 632 84 20 Fax: +41 (0)21 632 84 21	<b>Switzerland East - Schweiz Ost</b> Bosch Rexroth Schweiz AG Geschäftsbereich Indramat Hemrietstrasse 2 8863 Buttikon Tel. +41 (0) 55 46 46 111 Fax +41 (0) 55 46 46 222	

## Europa (Ost) - Europe (East)

**vom Ausland:** (0) nach Landeskenziffer weglassen  
**from abroad:** don't dial (0) after country code

<b>Czech Republic - Tschechien</b> Bosch -Rexroth, spol.s.r.o. Hviezdoslavova 5 627 00 Brno Tel.: +420 (0)5 48 126 358 Fax: +420 (0)5 48 126 112	<b>Czech Republic - Tschechien</b> DEL a.s. Strojírenská 38 591 01 Zdar nad Sázavou Tel.: +420 566 64 3144 Fax: +420 566 62 1657	<b>Hungary - Ungarn</b> Bosch Rexroth Kft. Angol utca 34 1149 Budapest Tel.: +36 (1) 422 3200 Fax: +36 (1) 422 3201	<b>Poland – Polen</b> Bosch Rexroth Sp.zo.o. ul. Staszica 1 05-800 Pruszków Tel.: +48 22 738 18 00 – service: +48 22 738 18 46 Fax: +48 22 758 87 35 – service: +48 22 738 18 42
<b>Poland – Polen</b> Bosch Rexroth Sp.zo.o. Biuro Poznan ul. Dabrowskiego 81/85 60-529 Poznan Tel.: +48 061 847 64 62 /-63 Fax: +48 061 847 64 02	<b>Romania - Rumänien</b> East Electric S.R.L. B-dul Basarabie, nr.250, sector 3 73429 Bucuresti Tel./Fax: +40 (0)21 255 35 07 +40 (0)21 255 77 13 Fax: +40 (0)21 725 61 21 <a href="mailto:est@mb.roknet.ro">est@mb.roknet.ro</a>	<b>Romania - Rumänien</b> Bosch Rexroth Sp.zo.o. Str. Drobety nr. 4-10, app. 14 70258 Bucuresti, Sector 2 Tel.: +40 (0)1 210 48 25 +40 (0)1 210 29 50 Fax: +40 (0)1 210 29 52	<b>Russia - Russland</b> Bosch Rexroth OOO Wjatskaja ul. 27/15 127015 Moskau Tel.: +7-095-785 74 78 +7-095 785 74 79 Fax: +7 095 785 74 77 <a href="mailto:laura.kanina@boschrexroth.ru">laura.kanina@boschrexroth.ru</a>
<b>Russia - Russland</b> ELMIS 10, Internationalnaya 246640 Gomel, Belarus Tel.: +375/ 232 53 42 70 +375/ 232 53 21 69 Fax: +375/ 232 53 37 69 <a href="mailto:elmis ltd@yahoo.com">elmis ltd@yahoo.com</a>	<b>Turkey - Türkei</b> Bosch Rexroth Otomasyon San & Tic. A..S. Fevzi Cakmak Cad No. 3 34630 Sefaköy Istanbul Tel.: +90 212 541 60 70 Fax: +90 212 599 34 07	<b>Slowenia - Slowenien</b> DOMEL Otoki 21 64 228 Zelezniki Tel.: +386 5 5117 152 Fax: +386 5 5117 225 <a href="mailto:brane.ozebek@domel.si">brane.ozebek@domel.si</a>	

## Africa, Asia, Australia – incl. Pacific Rim

<p>Australia - Australien</p> <p>AIMS - Australian Industrial Machinery Services Pty. Ltd. 28 Westside Drive Laverton North Vic 3026 Melbourne</p> <p>Tel.: +61 3 93 243 321 Fax: +61 3 93 243 329 Hotline: +61 4 19 369 195 <a href="mailto:terryobrien@aimservices.com.au">terryobrien@aimservices.com.au</a></p>	<p>Australia - Australien</p> <p>Bosch Rexroth Pty. Ltd. No. 7, Endeavour Way Braeside Victoria, 31 95 Melbourne</p> <p>Tel.: +61 3 95 80 39 33 Fax: +61 3 95 80 17 33 <a href="mailto:mel@rexroth.com.au">mel@rexroth.com.au</a></p>	<p>China</p> <p>Shanghai Bosch Rexroth Hydraulics &amp; Automation Ltd. Waigaoqiao, Free Trade Zone No.122, Fu Te Dong Yi Road Shanghai 200131 - P.R.China</p> <p>Tel.: +86 21 58 66 30 30 Fax: +86 21 58 66 55 23 <a href="mailto:richard.vang_sh@boschrexroth.com.cn">richard.vang_sh@boschrexroth.com.cn</a> <a href="mailto:gf.zhu_sh@boschrexroth.com.cn">gf.zhu_sh@boschrexroth.com.cn</a></p>	<p>China</p> <p>Shanghai Bosch Rexroth Hydraulics &amp; Automation Ltd. 4/f, Marine Tower No.1, Pudong Avenue Shanghai 200120 - P.R.China</p> <p>Tel.: +86 21 68 86 15 88 Fax: +86 21 58 40 65 77</p>
<p>China</p> <p>Bosch Rexroth China Ltd. 15/F China World Trade Center 1, Jianguomenwai Avenue Beijing 100004, P.R.China</p> <p>Tel.: +86 10 65 05 03 80 Fax: +86 10 65 05 03 79</p>	<p>China</p> <p>Bosch Rexroth China Ltd. Guangzhou Repres. Office Room 1014-1016, Metro Plaza, Tian He District, 183 Tian He Bei Rd Guangzhou 510075, P.R.China</p> <p>Tel.: +86 20 8755-0030 +86 20 8755-0011 Fax: +86 20 8755-2387</p>	<p>China</p> <p>Bosch Rexroth (China) Ltd. A-5F., 123 Lian Shan Street Sha He Kou District Dalian 116 023, P.R.China</p> <p>Tel.: +86 411 46 78 930 Fax: +86 411 46 78 932</p>	<p>China</p> <p>Melchers GmbH BRC-SE, Tightening &amp; Press-fit 13 Floor Est Ocean Centre No.588 Yanan Rd. East 65 Yanan Rd. West Shanghai 200001</p> <p>Tel.: +86 21 6352 8848 Fax: +86 21 6351 3138</p>
<p>Hongkong</p> <p>Bosch Rexroth (China) Ltd. 6<sup>th</sup> Floor, Yeung Yiu Chung No.6 Ind Bldg. 19 Cheung Shun Street Cheung Sha Wan, Kowloon, Hongkong</p> <p>Tel.: +852 22 62 51 00 Fax: +852 27 41 33 44 <a href="mailto:alexis.siu@boschrexroth.com.hk">alexis.siu@boschrexroth.com.hk</a></p>	<p>India - Indien</p> <p>Bosch Rexroth (India) Ltd. Rexroth Indramat Division Plot. A-58, TTC Industrial Area Thane Turbhe Midc Road Mahape Village Navi Mumbai - 400 701</p> <p>Tel.: +91 22 7 61 46 22 Fax: +91 22 7 68 15 31</p>	<p>India - Indien</p> <p>Bosch Rexroth (India) Ltd. Rexroth Indramat Division Plot. 96, Phase III Peenya Industrial Area Bangalore - 560058</p> <p>Tel.: +91 80 41 70 211 Fax: +91 80 83 94 345 <a href="mailto:mohanvelu.t@boschrexroth.co.in">mohanvelu.t@boschrexroth.co.in</a></p>	<p>India - Indien</p> <p>Bosch Rexroth (India) Ltd. 1st Floor, S-10 Green Park ext. Market New Delhi – 110016</p> <p>Tel.: +91 1 16 56 68 88 Fax: +91 1 16 56 68 87</p>
<p>Indonesia - Indonesien</p> <p>PT. Rexroth Wijayakusuma Building # 202, Cilandak Commercial Estate Jl. Cilandak KKO, Jakarta 12560</p> <p>Tel.: +62 21 7891169 (5 lines) Fax: +62 21 7891170 - 71</p>	<p>Japan</p> <p>Bosch Rexroth Automation Corp. Service Center Japan Yutakagaoka 1810, Meito-ku, NAGOYA 465-0035, Japan</p> <p>Tel.: +81 52 777 88 41 +81 52 777 88 53 +81 52 777 88 79 Fax: +81 52 777 89 01</p>	<p>Japan</p> <p>Bosch Rexroth Automation Corp. Rexroth Indramat Division 1F, I.R. Building Nakamachidai 4-26-44, Tsuzuki-ku YOKOHAMA 224-0041, Japan</p> <p>Tel.: +81 45 942 72 10 Fax: +81 45 942 03 41</p>	<p>Korea</p> <p>Bosch Rexroth-Korea Ltd. Electric Drives and Controls Bongwoo Bldg. 7FL, 31-7, 1Ga Jangchoong-dong, Jung-gu Seoul, 100-391</p> <p>Tel.: +82 234 061 813 Fax: +82 222 641 295</p>
<p>Korea</p> <p>Bosch Rexroth-Korea Ltd. 1515-14 Dadae-Dong, Saha-Ku Rexroth Indramat Division Pusan Metropolitan City, 604-050</p> <p>Tel.: +82 51 26 00 741 Fax: +82 51 26 00 747 <a href="mailto:gyhan@rexrothkorea.co.kr">gyhan@rexrothkorea.co.kr</a></p>	<p>Malaysia</p> <p>Bosch Rexroth Sdn.Bhd. 11, Jalan U8/82, Seksyen U8 40150 Shah Alam Selangor, Malaysia</p> <p>Tel.: +60 3 78 44 80 00 Fax: +60 3 78 45 48 00 <a href="mailto:hockhwa@hotmail.com">hockhwa@hotmail.com</a> <a href="mailto:rexroth1@tm.net.my">rexroth1@tm.net.my</a></p>	<p>Singapore - Singapur</p> <p>Bosch Rexroth Pte Ltd 15D Tuas Road Singapore 638520</p> <p>Tel.: +65 68 61 87 33 Fax: +65 68 61 18 25 <a href="mailto:saniay.nemade@boschrexroth.com.sg">saniay.nemade@boschrexroth.com.sg</a></p>	<p>South Africa - Südafrika</p> <p>TECTRA Automation (Pty) Ltd. 71 Watt Street, Meadowdale Edenvale 1609</p> <p>Tel.: +27 11 971 94 00 Fax: +27 11 971 94 40 Hotline: +27 82 903 29 23 <a href="mailto:georgv@tectra.co.za">georgv@tectra.co.za</a></p>
<p>Taiwan</p> <p>Rexroth Uchida Co., Ltd. No.17, Alley 24, Lane 737 Cheng Bei 1 Rd., Yungkang Tainan Hsien</p> <p>Tel.: +886 6 25 36 565 Fax: +886 6 25 34 754 <a href="mailto:indra.charlie@msa.hinet.net">indra.charlie@msa.hinet.net</a></p>	<p>Thailand</p> <p>NC Advance Technology Co. Ltd. 59/76 Moo 9 Ramintra road 34 Tharang, Bangkhen, Bangkok 10230</p> <p>Tel.: +66 2 943 70 62 +66 2 943 71 21 Fax: +66 2 509 23 62 <a href="mailto:sonkawin@hotmail.com">sonkawin@hotmail.com</a></p>		

## Nordamerika – North America

<b>USA</b> <b>Headquarters - Hauptniederlassung</b>  Bosch Rexroth Corporation Rexroth Indramat Division 5150 Prairie Stone Parkway Hoffman Estates, IL 60192-3707  Tel.: +1 847 6 45 36 00 Fax: +1 847 6 45 62 01 <a href="mailto:servicebrc@boschrexroth-us.com">servicebrc@boschrexroth-us.com</a> <a href="mailto:repairbrc@boschrexroth-us.com">repairbrc@boschrexroth-us.com</a>	<b>USA Central Region - Mitte</b>  Bosch Rexroth Corporation Rexroth Indramat Division Central Region Technical Center 1701 Harmon Road Auburn Hills, MI 48326  Tel.: +1 248 3 93 33 30 Fax: +1 248 3 93 29 06	<b>USA Southeast Region - Südwest</b>  Bosch Rexroth Corporation Rexroth Indramat Division Southeastern Technical Center 3625 Swiftwater Park Drive Suwanee, Georgia 30124  Tel.: +1 770 9 32 32 00 Fax: +1 770 9 32 19 03	<b>USA SERVICE-HOTLINE</b>  - 7 days x 24hrs -  <b>+1-800-860-1055</b>
<b>USA East Region – Ost</b>  Bosch Rexroth Corporation Rexroth Indramat Division Charlotte Regional Sales Office 14001 South Lakes Drive Charlotte, North Carolina 28273  Tel.: +1 704 5 83 97 62 +1 704 5 83 14 86	<b>USA Northeast Region – Nordost</b>  Bosch Rexroth Corporation Rexroth Indramat Division Northeastern Technical Center 99 Rainbow Road East Granby, Connecticut 06026  Tel.: +1 860 8 44 83 77 Fax: +1 860 8 44 85 95	<b>USA West Region – West</b>  Bosch Rexroth Corporation 7901 Stoneridge Drive, Suite 220 Pleasant Hill, California 94588  Tel.: +1 925 227 10 84 Fax: +1 925 227 10 81	
<b>Canada East - Kanada Ost</b>  Bosch Rexroth Canada Corporation Burlington Division 3426 Mainway Drive Burlington, Ontario Canada L7M 1A8  Tel.: +1 905 335 55 11 Fax: +1 905 335-41 84 <a href="mailto:michael.moro@boschrexroth.ca">michael.moro@boschrexroth.ca</a>	<b>Canada West - Kanada West</b>  Bosch Rexroth Canada Corporation 5345 Goring St. Burnaby, British Columbia Canada V7J 1R1  Tel.: +1 604 205-5777 Fax: +1 604 205-6944 <a href="mailto:david.gunby@boschrexroth.ca">david.gunby@boschrexroth.ca</a>	<b>Mexico</b>  Bosch Rexroth Mexico S.A. de C.V. Calle Neptuno 72 Unidad Ind. Vallejo 07700 Mexico, D.F.  Tel.: +52 5 754 17 11 +52 5 754 36 84 +52 5 754 12 60 Fax: +52 5 754 50 73 +52 5 752 59 43 <a href="mailto:mariofelipe.hernandez@boschrexroth.com.mx">mariofelipe.hernandez@boschrexroth.com.mx</a>	<b>Mexico</b>  Bosch Rexroth S.A. de C.V. Calle Argentina No 3913 Fracc. las Torres 64930 Monterrey, N.L.  Tel.: +52 8 333 88 34...36 +52 8 349 80 91...93 Fax: +52 8 346 78 71 <a href="mailto:mario.quiroga@boschrexroth.com.mx">mario.quiroga@boschrexroth.com.mx</a>

## Südamerika – South America

<b>Argentina - Argentinien</b>  Bosch Rexroth S.A.I.C. "The Drive & Control Company" Acassuso 48 41/47 1605 Munro Provincia de Buenos Aires  Tel.: +54 11 4756 01 40 Fax: +54 11 4756 01 36 <a href="mailto:victor.jabif@boschrexroth.com.ar">victor.jabif@boschrexroth.com.ar</a>	<b>Argentina - Argentinien</b>  NAKASE Servicio Tecnico CNC Calle 49, No. 5764/66 B1653AOX Villa Balester Provincia de Buenos Aires  Tel.: +54 11 4768 36 43 Fax: +54 11 4768 24 13 <a href="mailto:nakase@usa.net">nakase@usa.net</a> <a href="mailto:nakase@nakase.com">nakase@nakase.com</a> <a href="mailto:gerencia@nakase.com">gerencia@nakase.com</a> (Service)	<b>Brazil - Brasilien</b>  Bosch Rexroth Ltda. Av. Tégula, 888 Ponte Alta, Atibaia SP CEP 12942-440  Tel.: +55 11 4414 56 92 +55 11 4414 56 84 Fax sales: +55 11 4414 57 07 Fax serv.: +55 11 4414 56 86 <a href="mailto:alexandre.wittwer@rexroth.com.br">alexandre.wittwer@rexroth.com.br</a>	<b>Brazil - Brasilien</b>  Bosch Rexroth Ltda. R. Dr.Humberto Pinheiro Vieira, 100 Distrito Industrial [Caixa Postal 1273] 89220-390 Joinville - SC  Tel./Fax: +55 47 473 58 33 Mobil: +55 47 9974 6645 <a href="mailto:prochnow@zaz.com.br">prochnow@zaz.com.br</a>
<b>Columbia - Kolumbien</b>  Reflutec de Colombia Ltda. Calle 37 No. 22-31 Santafé de Bogotá, D.C. Colombia  Tel.: +57 1 368 82 67 +57 1 368 02 59 Fax: +57 1 268 97 37 <a href="mailto:reflutec@neutel.com.co">reflutec@neutel.com.co</a> <a href="mailto:reflutec@007mundo.com">reflutec@007mundo.com</a>			







200436