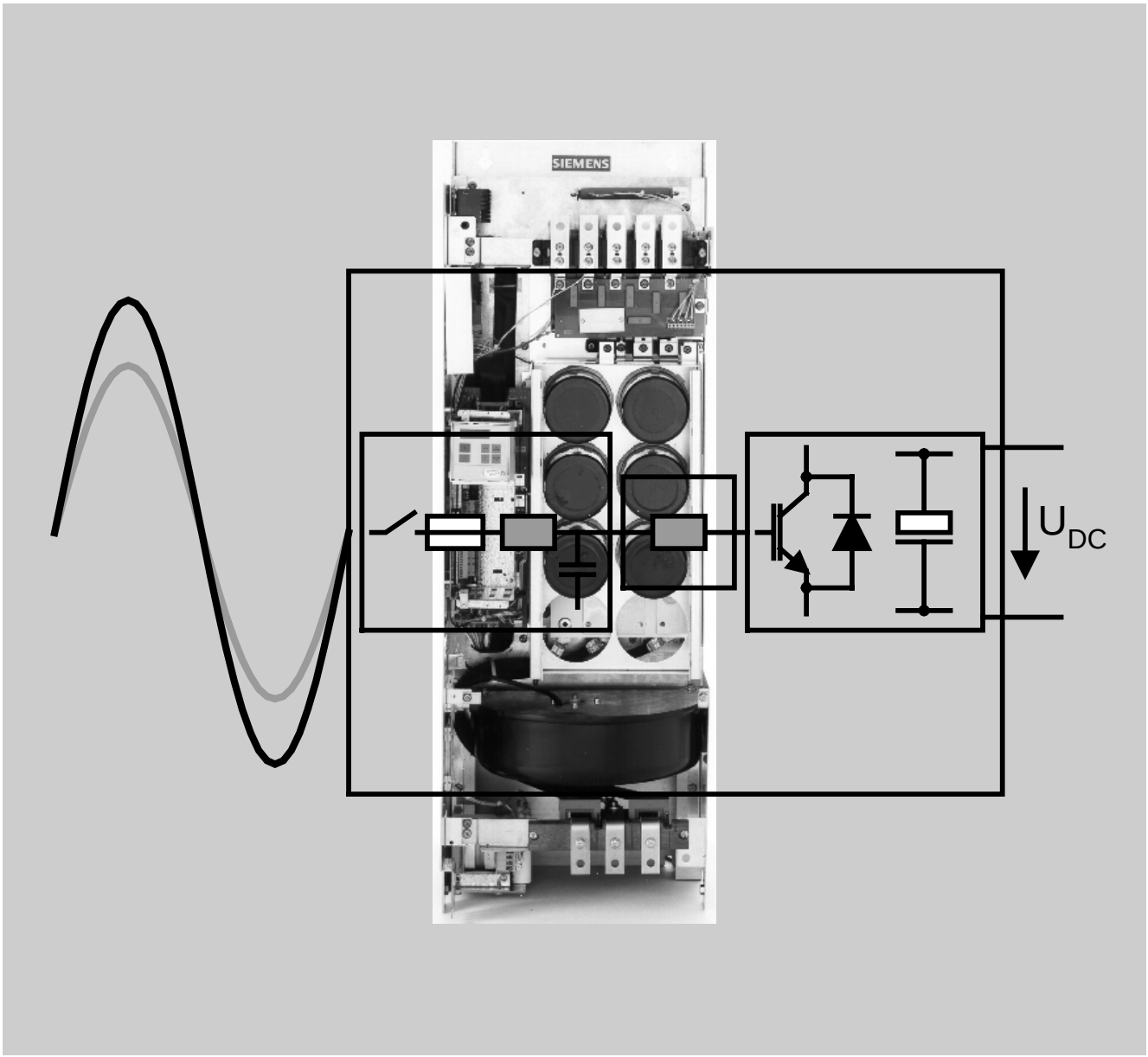
SIEMENS

SIMOVERT MASTERDRIVES

Operating Instructions

Active Front End (AFE)

AFE Rectifier / Regenerative Feedback Unit
Chassis Type E to G
AC - DC



Edition: AB

Order No.: 6SE7087-6CX86-2AA0

These Operating Instructions are valid for software release V2.0 or higher.

We reserve the right to make changes to functions, technical data, standards, drawings and parameters.

We have checked the contents of this document to ensure that they coincide with the described hardware and software. However, differences cannot be completely excluded, so that we do not accept any guarantee for complete conformance. However, the information in this document is regularly checked and necessary corrections will be included in subsequent editions. We are grateful for any recommendations for improvement.

SIMOVERT® Registered Trade Mark

Contents

1 Definitions and Warnings

Qualified personnel

For the purpose of this documentation and the product warning labels, a "Qualified person" is someone who is familiar with the installation, mounting, start-up, operation and maintenance of the product. He or she must have the following qualifications:

- Trained or authorized to energize, de-energize, ground and tag circuits and equipment in accordance with established safety procedures.
- Trained or authorized in the proper care and use of protective equipment in accordance with established safety procedures.
- Trained in rendering first aid.

DANGER

For the purpose of this documentation and the product warning labels, "Danger" indicates death, severe personal injury or substantial property damage will result if proper precautions are not taken.

WARNING

For the purpose of this documentation and the product warning labels, "Warning" indicates death, severe personal injury or property damage can result if proper precautions are not taken.

CAUTION

For the purpose of this documentation and the product warning labels, "Caution" indicates that minor personal injury or material damage can result if proper precautions are not taken.

NOTE

For the purpose of this documentation, "Note" indicates important information about the product or about the respective part of the documentation which is essential to highlight.

WARNING

Hazardous voltages are present in this electrical equipment during operation.

Non-observance of the warnings can thus result in severe personal injury or property damage.

Only qualified personnel should work on or around the equipment

This personnel must be thoroughly familiar with all warning and maintenance procedures contained in this documentation.

The successful and safe operation of this equipment is dependent on correct transport, proper storage and installation as well as careful operation and maintenance.

NOTE

This documentation does not purport to cover all details on all types of the product, nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the local SIEMENS sales office.

The contents of this documentation shall not become part of or modify any prior or existing agreement, commitment or relationship. The sales contract contains the entire obligation of SIEMENS AG. The warranty contained in the contract between the parties is the sole warranty of SIEMENS AG. Any statements contained herein do not create new warranties or modify the existing warranty.

CAUTION

Components which can be destroyed by electrostatic discharge (ESD)

The board contains components which can be destroyed by electrostatic discharge. These components can be easily destroyed if not carefully handled. If you have to handle electronic boards, please observe the following:

Electronic boards should only be touched when absolutely necessary.

The human body must be electrically discharged before touching an electronic board.

Boards must not come into contact with highly insulating materials - e.g. plastic parts, insulated desktops, articles of clothing manufactured from man-made fibers.

Boards must only be placed on conductive surfaces.

Boards and components should only be stored and transported in conductive packaging (e.g. metalized plastic boxes or metal containers).

If the packing material is not conductive, the boards must be wrapped with a conductive packaging material, e.g. conductive foam rubber or household aluminium foil.

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

- a = Conductive floor surface
- b = ESD table
- c = ESD shoes
- d = ESD overall
- e = ESD chain
- f = Cubicle ground connection

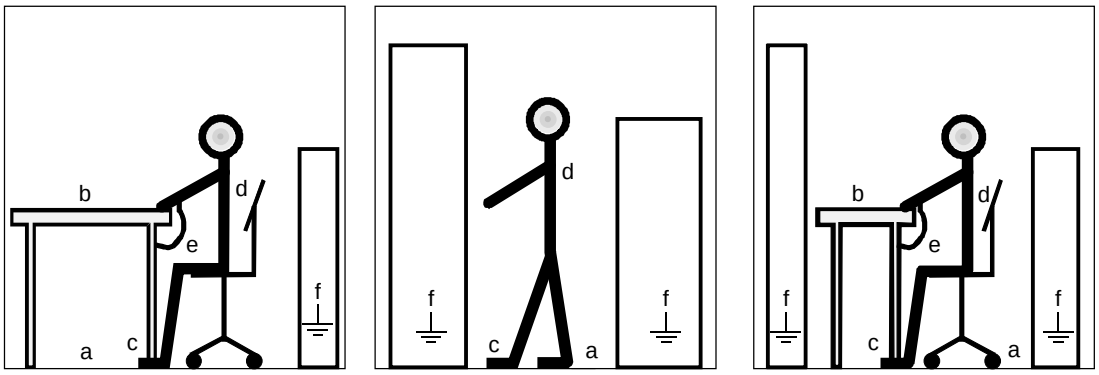


Fig. 1-1 ESD protective measures

Safety and Operating Instructions for Drive Converters

(in conformity with the low-voltage directive 73/23/EEC)

1. General

In operation, drive converters, depending on their degree of protection, may have live, uninsulated, and possibly also moving or rotating parts, as well as hot surfaces.

In case of inadmissible removal of the required covers, of improper use, wrong installation or maloperation, there is the danger of serious personal injury and damage to property.

For further information, see documentation.

All operations serving transport, installation and commissioning as well as maintenance are to be carried out **by skilled technical personnel** (observe IEC 364 or CENELEC HD 384 or DIN VDE 0100 and IEC Report 664 or DIN VDE 0110 and national accident prevention rules).

For the purposes of these basic safety instructions, "skilled technical personnel" means persons who are familiar with the installation, mounting, commissioning and operation of the product and have the qualifications needed for the performance of their functions.

2. Intended use

Drive converters are components designed for inclusion in electrical installations or machinery.

In case of installation in machinery, commissioning of the drive converter (i.e. the starting of normal operation) is prohibited until the machinery has been proved to conform to the provisions of the EC directive 89/392/EEC (Machinery Safety Directive - MSD). Account is to be taken of EN 60204.

Commissioning (i.e. the start of normal operation) is admissible only where conformity with the EMC directive (89/336/EEC) has been established.

The drive converters meet the requirements of the low-voltage directive 73/23/EEC. They are subject to the harmonized standards of the series prEN 50178/DIN VDE 0160 in conjunction with EN 60439-1/DIN VDE 0660 Part 500 and EN 60146/DIN VDE 0558.

The technical data as well as information concerning the supply conditions shall be taken from the rating plate and from the documentation and shall be strictly observed.

3. Transport, storage

The instructions for transport, storage and proper use shall be complied with.

The climatic conditions shall be in conformity with prEN 50178.

4. Installation

The installation and cooling of the appliances shall be in accordance with the specifications in the pertinent documentation.

The drive converters shall be protected against excessive strains. In particular, no components must be bent and/or isolating distances altered in the course of transportation or handling. No contact shall be made with electronic components and contacts.

Drive converters contain electrostatic sensitive components which are liable to damage through improper use. Electronic components must not be mechanically damaged or destroyed (potential health risks).

5. Electrical connection

When working on live drive converters, the applicable national accident prevention rules (e.g. VBG 4) must be complied with.

The electrical installation shall be carried out in accordance with the relevant requirements (e.g. cross-sectional areas of conductors, fusing, PE connection). For further information, see documentation.

Instructions for the installation in accordance with EMC requirements, such as screening, grounding, location of filters and wiring, are contained in the drive converter documentation. They must always be complied with, also for drive converters bearing a CE marking. Observance of the limit values required by the EMC law is the responsibility of the manufacturer of the installation or machine.

6. Operation

Installations which include drive converters shall be equipped with additional monitoring and protective devices in accordance with the relevant applicable safety requirements, e.g. Act respecting technical equipment, accident prevention rules, etc. Changes to the drive converters by means of the operating software are permissible.

After disconnection of the drive converters from the voltage supply, live appliance parts and power terminals must not be touched immediately because of possibly energized capacitors. In this regard, the corresponding signs and markings on the drive converter must be respected.

During operation, all covers and doors shall be kept closed.

7. Maintenance and servicing

The manufacturer's documentation shall be followed.

Keep these safety instructions in a safe place!

2 Description

The AFE (Active Front End) rectifier/regenerative feedback units belonging to the SIMOVERT MASTERDRIVES series are power electronics devices that are available as cabinet and chassis units.

The units can be operated on a 3-phase mains with or without an earthed neutral point.

The series of units is broken down into the following voltage ranges:

- 400 V mains voltage range:
  3AC 380 V (– 20 %) to 460 V (+ 5 %)
- 500 V mains voltage range:
  3AC 500 V (– 20 %) to 575 V (+ 5 %)
- 690 V mains voltage range:
  3AC 660 V (– 20 %) to 690 V (+ 5 %)

The core component of the AFE rectifier/regerative feedback unit consists of a voltage source converter with the CUSA control unit and it generates a controlled DC voltage, the so-called DC link voltage, from a 3-phase mains.

This DC link voltage is kept constant almost independently of the mains voltage (also in the event of regenerative feedback). The prerequisite for this is that the DC voltage setpoint is within the operating range defined below.

DC link voltage operating range

Minimum: 1.5 times the rms value of the applied mains voltage.

Explanation: the DC link voltage of the AFE inverter must at least be greater than the peak rectified value of the applied mains voltage to ensure that the power system is no longer controlled via the freewheeling diodes of the IGBT switches.

Maximum:

for the 400 V mains voltage range:	740 V	DC
500 V mains voltage range:	920 V	DC
690 V mains voltage range:	1100 V	DC

Operating principle

On the 3-phase end, a mains angle-oriented high-speed vector control is subordinate to the DC link voltage control and impresses an almost sinusoidal current on the network so as to minimise system perturbations with the aid of the subsequently connected Clean Power filter.

The vector control also enables setting of the power factor cos phi, and thus reactive power compensation, but the operating current requirement has priority.

The VSB module (Voltage Sensing Board), functions as the network angle sensor, similarly to the principle of an encoder.

For safety reasons, an AFE rectifier/regenerative feedback unit must be connected to the mains via a main contactor; see figure 2-1.

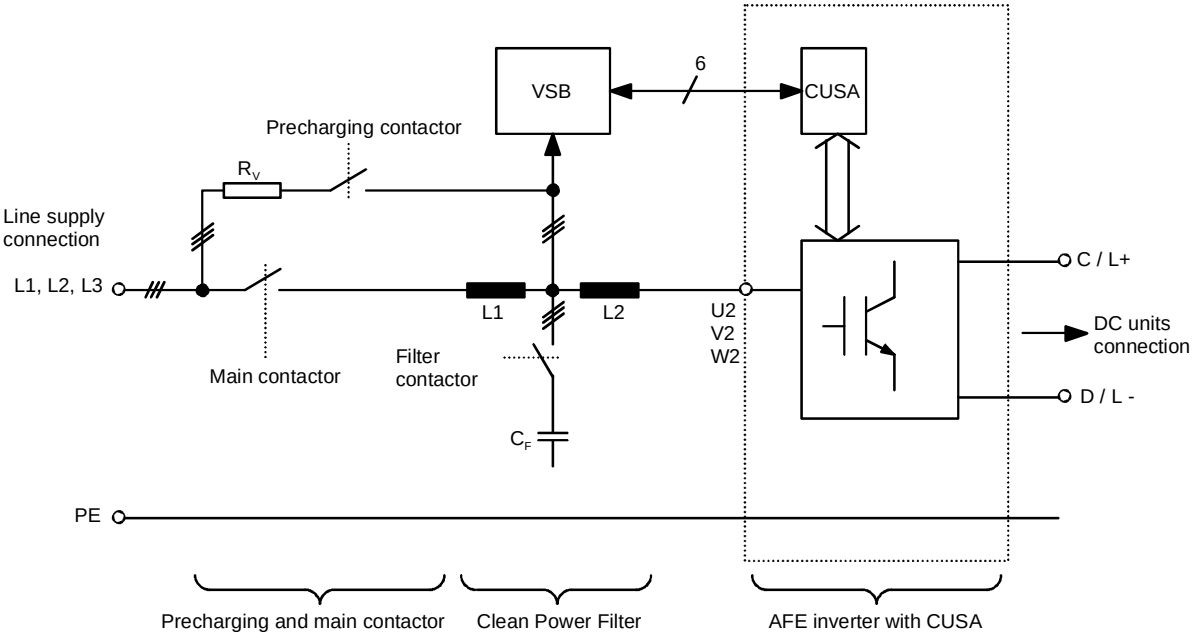


Fig. 2-1 Basic circuit

Configuration

Both one and several inverters can be connected to the output.

The maximum connected power of the inverters may amount to 4 times the rated power of the AFE inverter. The sum of active power extracted from the network must not exceed the rated power of the AFE, and this must be ensured by configuration of the system.

The AFE is suitable for coupling several inverters to a common DC busbar. This allows energy to be transferred between motoring and generating drives, thus providing a power-saving feature.

Line voltage dips can be bridged in voltage step-up operation without altering the DC link voltage value. This can be achieved up to 65 % of rated line voltage without additional components on condition that the power balance defined by Equation 1 can be maintained.

$$\sqrt{3} \cdot V_{line} \cdot I_{max} = V_d \cdot I_d \qquad \text{Equation 1}$$

To bridge line voltage dips below 65 % of rated line voltage, the auxiliary power supply must be supported by an external UPS or similar to prevent the contactors from dropping out.

Operation and control options

The unit can be controlled and operated via

- the parameterization unit (PMU)
- an optional operator control panel (OP1S)
- the terminal strip
- a serial interface

In combination with automation systems, the AFE rectifier/regenerative feedback unit is controlled via optional interfaces and technology boards.

3 Initial start-up

Unpack and check the units	After removing the packaging, check that the unit is intact and undamaged. Only intact units may be started up. Please also check that all the necessary option boards are present and correct.	See section "Transport, Storage, Unpacking"
Fit the main components of the unit and install options that have not already been fitted	Retrofit any optional boards which have not yet been installed, if necessary. Then install the units taking into account the requirements at the point of installation and the EMC instructions.	See section "Installation" and "Installation in Conformance with EMC Regulations"
Wire the main components of the unit and connect the PE conductor and the power cables	Beginning with the PE conductor, connect the power cables and the power wiring of the AFE chokes. It is advisable to not yet connect the DC link module. Use only the included cable harnesses for further internal wiring of the main conponents. In this step, do not yet connect the control and communication cables. Exception: OP1S if the unit is to be parametrized via OP1S.	See chapters "Connecting and wiring" and "Installation in conformance with EMC Regulations"
Form the DC link capacitors, if necessary	If the unit's DC link was de-energized for more than a year, the DC link capacitors must be formed again. .	See section "Forming"
Connect the 230 V AC auxiliary voltage or the 24 V DC and the mains voltage	Note: under no circumstances must the main contactor -K1 and the precharging contactor -K2 be connected in this phase; therefore, check the unit before connecting the mains voltage. After checking the cabling for correct connection and secure attachment, connect the mains voltage or the auxiliary power supply. After the electronics power supply has been started, the unit initializes itself. The action can take several seconds. The drive status is subsequently shown on the PMU.	See chapter entitled "Basic function check"
If necessary, carry out parameter reset to factory setting	If the PMU does not show status °009 after completion of the unit initialization, or if the unit has already been parameterized before, you should carry out a parameter reset to factory setting.	See section "Parameterization"

Carry out the basic function check

WARNING **It must be ensured that no danger for persons and equipment can occur by energizing the power and the unit. You are advised to only connect the invertors after completing the basic function checks of the AFE rectifier/ regenerative feedback unit.**

See chapter entitled "Basic function check"

Further start-up and parameterization according to your specific requirements

4 Transport, Storage, Unpacking

The units and components are packed in the manufacturing plant corresponding to that specified when ordered. A packing label is located on the outside of the packaging. Please observe the instructions on the packaging for transport, storage and professional handling.

Transport

Vibrations and jolts must be avoided during transport. If the unit is damaged, you must inform your shipping company immediately.

Storage

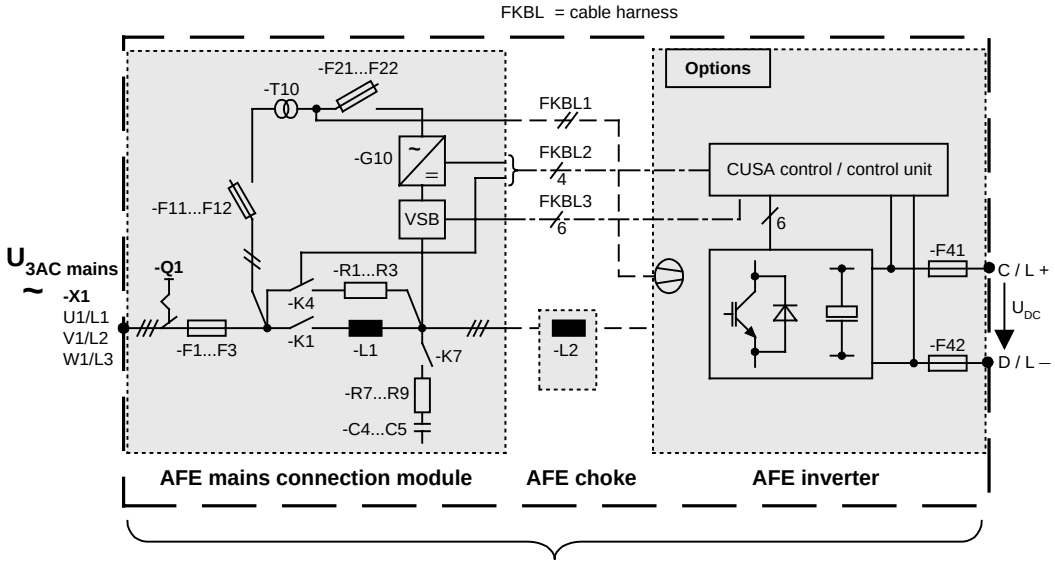
The units and components must be stored in clean, dry rooms. Temperatures between -25 °C (-13 °F) and +70 °C (158 °F) are permissible. Temperature fluctuations must not be more than 30 K per hour.

NOTE

If the storage period of one year is exceeded, the unit must be newly formed.

Unpacking

The packaging comprises board and corrugated paper. It can be disposed of corresponding to the appropriate local regulations for the disposal of board products. The units and components can be installed and commissioned after they have been unpacked and checked to ensure that everything is complete and that they are not damaged.



AFE rectifier/regenerative feedback unit (chassis type)

Scope of delivery

- **AFE mains connection module** with
  - FKBL1 – cable harness 1:
    Internal connection, to be laid by the customer,
    (2.5 m long) from the control transformer -T10 to the fan supply AFE inverter 230 V
    Internal terminals: -X40 1/5 to -X18 1/5
  - FKBL2 – cable harness 2:
    Internal connection, to be laid by the customer,
    (max. length 2.5 m, with extension cable harness,
    Control line from -K4 and 24 V power supply -G10
    to AFE inverter -X9 4/5 1/2
    Terminal: X9 4/5 (contact -K4)
    Terminal: X9 1/2 +24 V /electronic ground
  - AFE choke
    Power wiring to be laid by the customer
    Cable harness is **not** included in the scope of delivery
    See power connections for details of the cross section
- **AFE inverter** with
  - FKBL3 - cable harness 3:
    Internal connection, to be laid by the customer (2.5 m long)
    Signal cable from VSB to the CUSA control module
- **Operating instructions**
  6SE708_-_CX86-2AA0: only included in the scope of delivery if ordered separately.
- **Options**
  Board electronic box, e.g. PROFIBUS

5 Installation

5.1 Installing the units

WARNING

Safe converter operation requires that the equipment is mounted and commissioned by qualified personnel taking into account the warning information provided in these Operating Instructions.

The general and domestic installation and safety regulations for work on electrical power equipment (e.g. VDE) must be observed as well as the professional handling of tools and the use of personal protective equipment.

Death, severe bodily injury or significant material damage could result if these instructions are not followed.

Clearances

When placing the AFE inverter, make sure that the DC link connection is on the upper side of the unit and the AFE choke connection is on the bottom side of the unit.

The mains connection module may only be installed vertically, not overhead.

When mounting in switch cabinets, you must leave a clearance at the top and the bottom of the units for cooling.

The minimum clearances for cooling the built-in units must be observed.

Please refer to the dimension drawings on the following pages for details of these minimum clearances.

When mounting in switch cabinets, the cabinet cooling must be dimensioned according to the dissipated power. Please refer to the Technical Data in this regard.

Requirements at the point of installation

- Foreign particles
  The units must be protected against the ingress of foreign particles as otherwise their function and operational safety cannot be ensured.
- Dust, gases, vapors
  Equipment rooms must be dry and dust-free. Ambient and cooling air must not contain any electrically conductive gases, vapors and dusts which could diminish the functionality. If necessary, filters should be used or other corrective measures taken.
- Ambient climate
  The built-in units must only be operated in an ambient climate conforming to DIN IEC 721-3-3 Class 3K3. For cooling air temperatures of more than 40°C (104°F) and installation altitudes higher than 1000 m, derating is required.

Cabinet ventilation

Notes on cabinet installation (air cooling)

The cabinet ventilation must be designed according to the dissipated power.

Refer to the chapter entitled "Technical data" in the AFE inverter operating instructions and the description of the mains connection module.

5.2 Minimum clearances

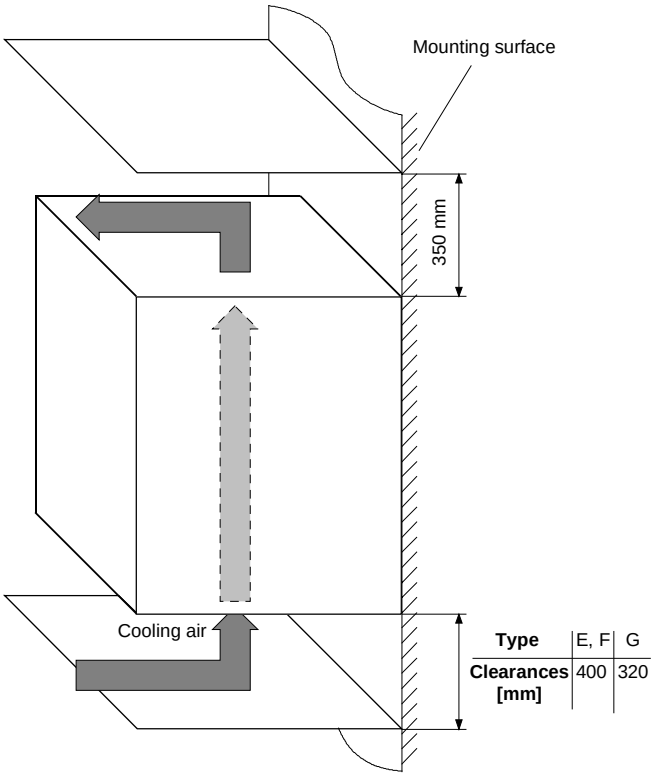
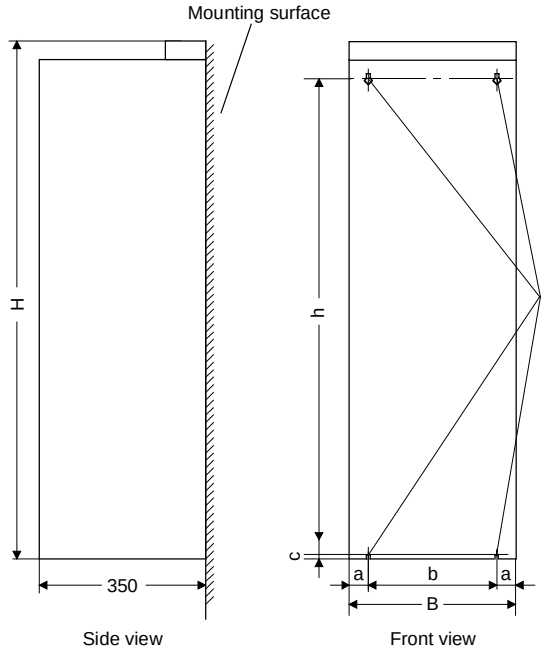


Fig. 5-1 Minimum clearances for cooling air requirement (types E, F, G)

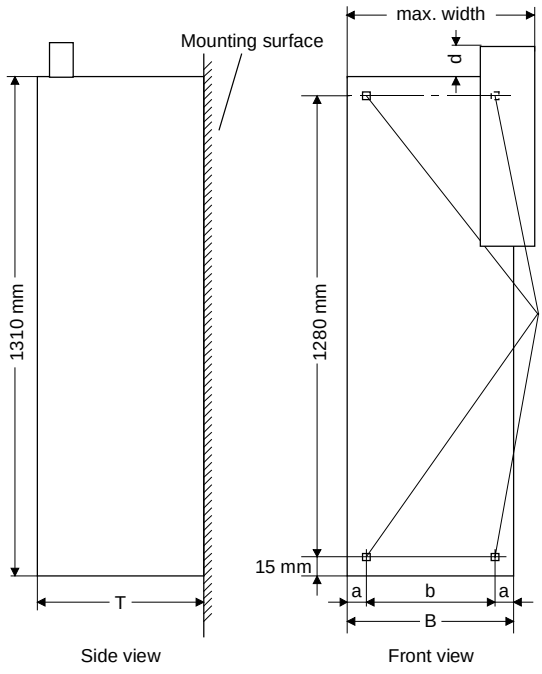
The following are required for mounting:

- Dimension drawing for the relevant construction type
- M8 or M10 screws, refer to dimension drawing for the quantity



Dimensions [mm]	Type E	F	G
a	45	45	119
b	180	270	270
c	10	10	25
B	270	360	508
H	1050	1050	1450
h	1025	1025	1375

Fig. 5-2 Dimension drawing: AFE inverter, types E, F and G



Dimensions [mm]	Type E	F	G
a	33	28,8	28,75
b	173	382,4	444,5
d	-	-	29
B	239	440	502
T	408	440	459
max. width	274	440	580,4

Fig. 5-3 Dimension drawings of the main connection modules

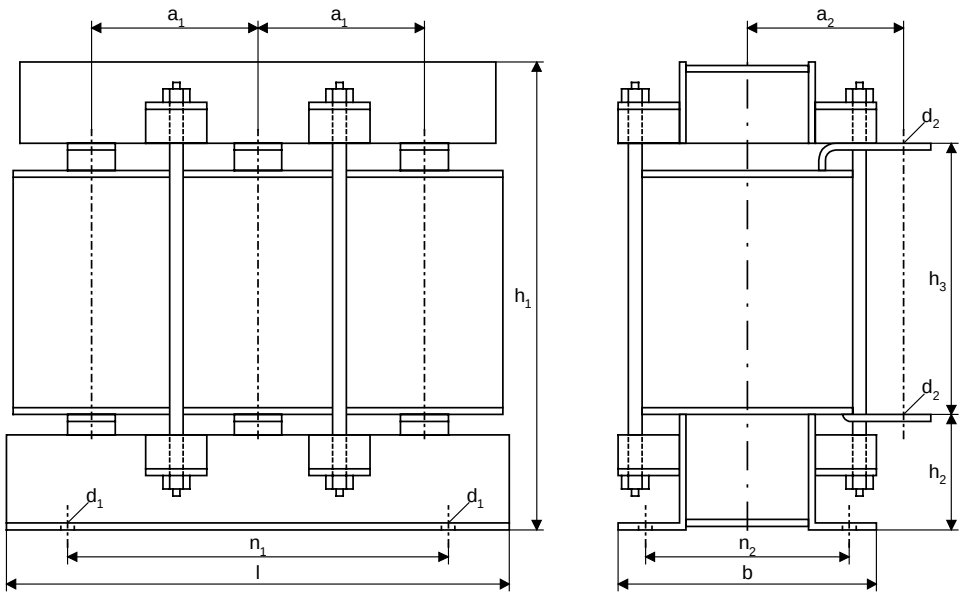


Fig. 5-4 Dimension drawings of the AFE chokes

Type [kW]	Voltage [V]	l [mm]	b [mm]	n1 [mm]	n2 [mm]	h1 [mm]	h2 [mm]	h3 [mm]	a1 [mm]	a2 [mm]	d1	d2
45	460	300	177	240	145	267	62	166	100	106	M10	M8
55	460	355	178	264	140	340	82	190	120	106	M10	M8
75	460	355	193	264	155	335	78	195	120	136	M10	M8
90	460	355	193	264	155	355	78	195	120	139	M10	M8
110	460	420	212	316	170	384	87	228	140	153	M10	M12
132	460	420	212	316	170	384	87	228	140	153	M10	M12
160	460	480	274	400	220	380	95	200	160	185	M12	M12
200	460	480	274	400	220	380	95	200	160	185	M12	M12
37	575	300	177	240	145	267	62	166	100	106	M10	M8
45	575	300	177	240	145	267	62	166	100	106	M10	M8
55	575	355	178	264	140	332	78	190	120	110	M10	M8
75	575	355	193	264	155	332	78	195	120	136	M10	M8
90	575	355	193	264	155	332	78	195	120	139	M10	M12
110	575	420	212	316	170	384	87	228	140	153	M10	M12
132	575	420	212	316	170	384	87	228	140	153	M10	M12
160	575	480	274	400	220	380	95	200	160	185	M12	M12
55	690	355	178	264	140	332	78	190	120	110	M10	M8
75	690	355	193	264	155	330	78	195	120	136	M10	M8
90	690	355	193	264	155	335	78	195	120	139	M10	M12
110	690	420	212	316	170	384	87	228	140	153	M10	M12
132	690	420	212	316	170	384	87	228	140	153	M10	M12
160	690	480	274	400	220	380	95	200	160	185	M12	M12
200	690	480	274	400	220	380	95	200	160	185	M12	M12

Table 5-1 Connection dimensions of the chokes

Copper straps for current connection:

- Strap 20 mm x 3 mm: up to 55 kW
- Strap 30 mm x 5 mm: 75 kW and 90 kW
- Strap 40 mm x 6 mm: from 110 kW

Partition measures

Door/roof openings

An underpressure is created in the openings of the cabinet doors due to the flow of air. This is dependent on the volumetric flow and the hydraulic cross-section of the openings.

The flow causes a build-up (over) pressure in the roof or in the top cover.

As a result of the difference in pressure between the overpressure at the top and the underpressure at the bottom of the cabinet, a flow of air is created inside the unit, a so-called arcing short-circuit. This can be stronger or weaker depending on the volumetric flow and the door/roof opening cross-section.

As a result of the flow inside the unit, air which is already pre-heated enters the heat sinks which causes an excessively high component temperature rise. In addition, a different, more unfavourable operating point is set for the fan.

If the units are operated with an arcing short-circuit, this will result in the failure of the units or in their destruction!

An arcing short-circuit must be prevented by the provision of partitions.

The switch cabinets adjacent to the inverter cabinets must also be taken into consideration in this case.

Partitions should be executed up to the cabinet frame and should be designed in such a way that the discharged air flow is taken around the cabinet beams and not pressed into them.

Partitions are necessary with all types of protection higher than IP20.

Opening cross sections

The necessary **opening cross sections** are 0.26 m^2.

The indicated opening cross-section is made up of several holes. In order to keep the pressure loss here to a minimum, the cross-sectional surface has to be **at least 280 mm^2 per hole** (e.g. 7 mm x 40 mm).

The opening and hole cross-sections ensure functioning even with high types of protection.

These are implemented by using wire-lattices (wire fabric DIN 4189-St-vzk-1x0.28) in front of the openings or the filters indicated in the following. If finer filters are used, the filter surface and thus the opening cross-section (upwards) have to be adapted accordingly.

If filters are used, the intervals for their replacement must be observed!

Filters

The following filter mat is approved for use:
FIBROIDELASTOV made by DELBAG-Luftfilter GMBH

Technical filter data in accordance with DIN 24185:

Design		FIBROID ELASTOV 10
Filter class		EU 2
Volumetric flow V	$(m^3/h) \times m^2$	2500 - 10000
Initial pressure difference Δp_A	Pa	9 - 46
End pressure difference Δp_E	Pa	300
Average degree of separation	%	72
Dust storage capability	g/m^2	-
Fire behaviour (DIN 53438)		F1/K1
Heat resistance max.	°C	80
Humidity resistance (rel. humidity)	%	100

Dimensions: 1000 x 1500 x 10 mm
Order No.: 16 065 81

Manufacturer:
DELBAG-Luftfilter GMBH
Holzhauser Strasse 159
D-13509 Berlin 27
Telephone: (030) 4381-0
Fax: (030) 4381-222

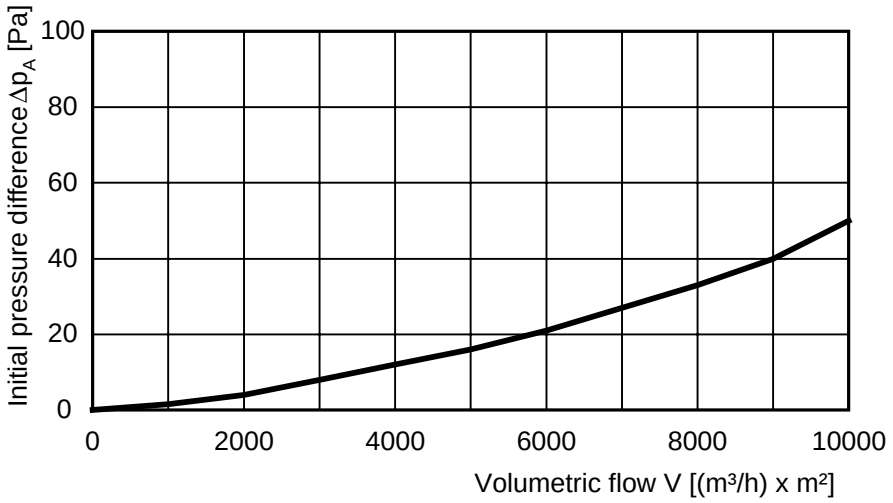


Fig. 5-5 Data sheet of the filter mat

Water cooling

The units with water cooling (MLFB Annex: -1AC0) are suitable for installing in an enclosed cabinet (IP54). The mains filter connection module is identical for water and air cooling. The components not mounted on the heat sink, such as the electronics and the DC link capacitors are cooled by heat transfer at the heat sink fins. To enable this heat transfer to take place, air circulation inside the unit is necessary.

Therefore, when installing the chassis unit in a cabinet, you must make sure that the air being discharged from the fan can flow into the inside of the chassis. The **partitions** to be provided in units with air cooling are a **disturbing factor in this case! They should not be mounted.**

For an application in the types of protection > IP40, a distance of at least 90 mm must be observed between the top of the units and the top of the cabinet.

The units do not require external cooling air.

Additional losses cannot be dissipated!

1-inch internal threads are envisaged for the water connection. The connecting nipples should be made of stainless steel or thick-walled aluminium. Ideally, the connection should have flat seals. If the connecting pieces enclosed with the units are used, these should be sealed with Loctite 542 or with teflon tape.

Cooling water infeed (blue) and return (red) must be connected according to the color scheme! The color markings can be found next to the 1-inch water connection below the heat sink.

Built-in components in the roof section

If components are built into a cabinet roof section (DC bus, DC 24 V supply), these should be placed in the center if possible so that the air leaving the fans can reach the openings in the roof cover unobstructed.

6 Installation in Conformance with EMC Regulations

The following contains a summary of general information and guidelines which will make it easier for you to comply with EMC and CE regulations.

- Pay attention to a good conductive connection between the housing of the mains connection module and the AFE inverters and the mounting surface. The use of mounting surfaces with good conducting properties (e.g. galvanized steel plate) is recommended. If the mounting surface is insulated (e.g. by paint), use contact washers or serrated washers.
- All of the metal cabinet parts must be connected through the largest possible surface area and must provide good conductivity. If necessary, use contact washers or serrated washers.
- Connect the cabinet doors to the cabinet frame using grounding strips which must be kept as short as possible.
- All signal cables must be shielded. Separate the signal cables according to signal groups. Do not route cables with digital signals unshielded next to cables with analog signals. If you use a common signal cable for both, the individual signals must be shielded from each other.
- Power cables must be routed separately away from signal cables (at least 20 cm apart). Provide partitions between signal cables and power cables. The partitions must be grounded.
- Connect the reserve cables/conductors to ground at both ends to achieve an additional shielding effect.
- Lay the cables close to grounded plates as this will reduce the injection of undesired signals.
- Use cables with braided shields. Cables with foil shields have a shielding effect which is worse by a factor of five.
- Contactor operating coils that are connected to the same supply network as the inverter or that are located in close proximity of the inverter must be connected to overvoltage limiters (e.g. RC circuits, varistors).

You will find further information in the brochure "Installation Instructions for EMC-correct Installation of Drives"
(Order No.: 6SE7087-6CX87-8CE0).

7 Connecting-up and wiring

WARNING

SIMOVERT MASTERDRIVES converters are operated at high voltages.
The equipment must always be disconnected from the supply before any work is carried out!
Only qualified personnel should be allowed to work on this equipment!
Non-observance of the safety instructions can result in death, severe personal injury or substantial property damage.

Owing to the DC link capacitors, the equipment may remain at a hazardous voltage for up to 5 minutes after disconnection of the power supply. For this reason, wait for at least 5 minutes before commencing work on the converter or DC link terminals.

Voltage may be present at the power and control terminals even when the motor is stopped.

When working on the open converter, remember that live parts are exposed.

The user is responsible for ensuring that all equipment is installed and connected up in accordance with the approved codes of practice of the country concerned and any other regional or local codes that may apply. Special attention must be paid to proper conductor sizing, fusing, grounding, isolation and disconnection measures and to overcurrent protection.

7.1 Connection overviews

7.1.1 Mains connection modules

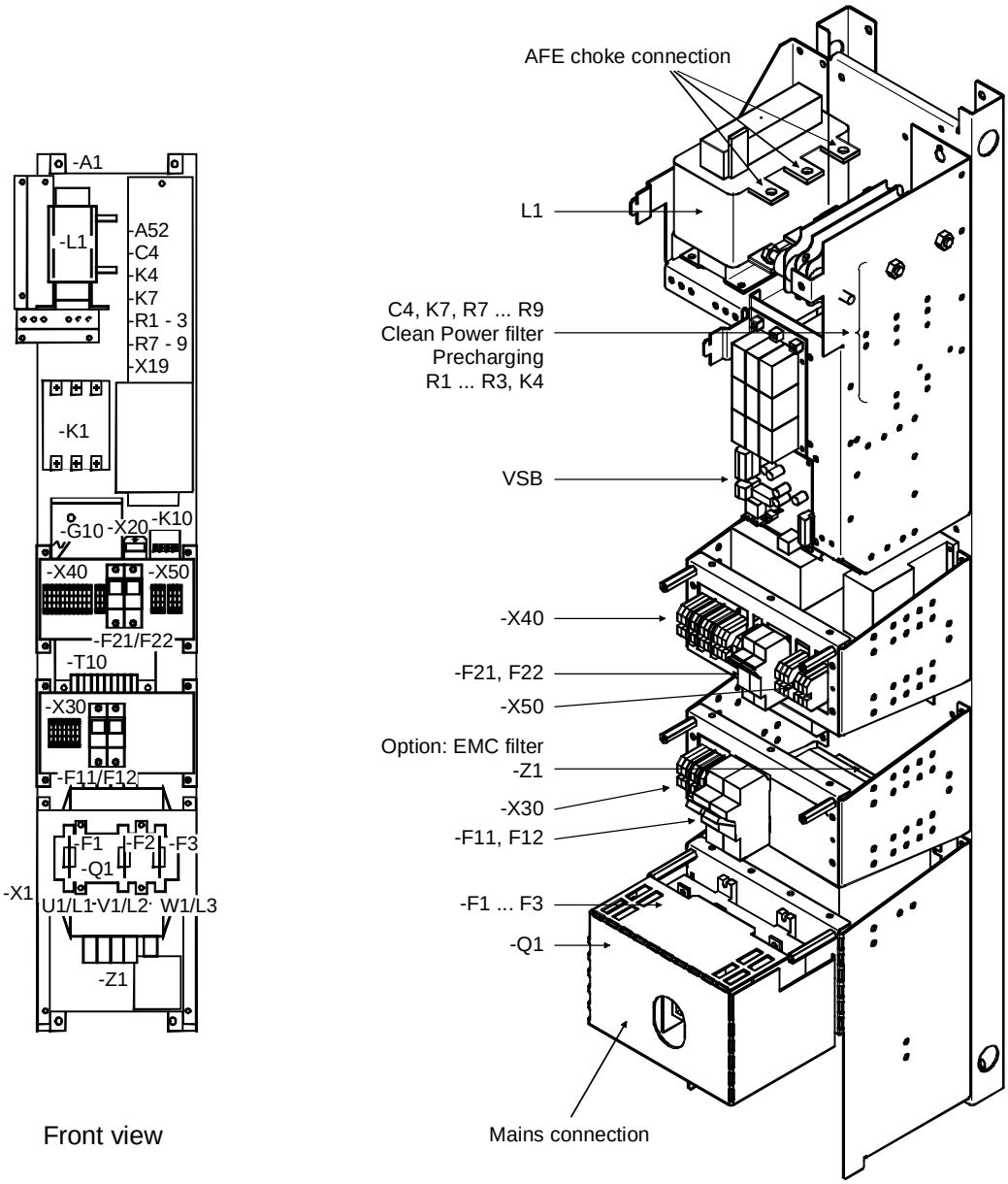


Fig. 7-1 Connection overview: AFE mains connection module, design E

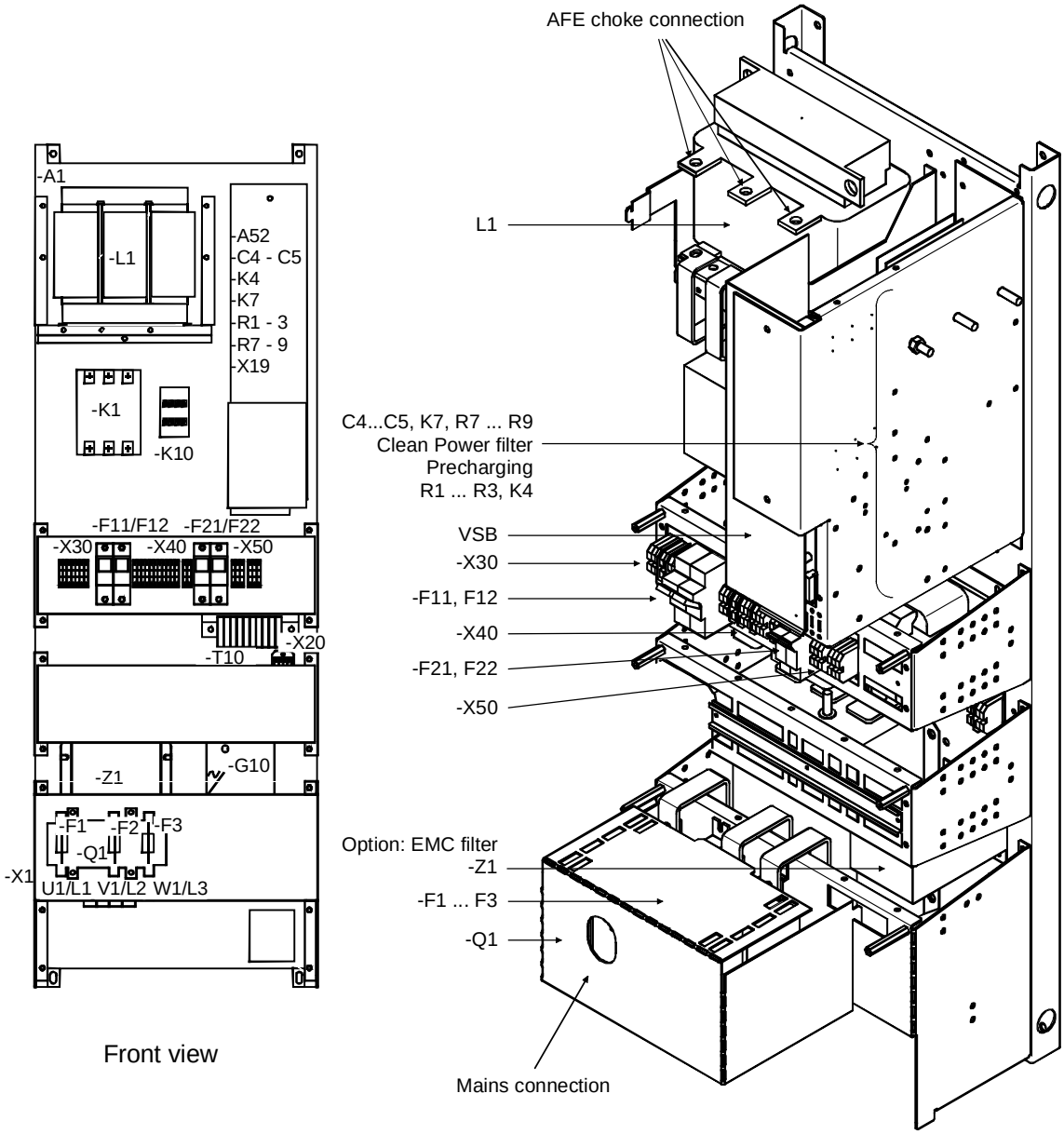


Fig. 7-2 Connection overview: AFE mains connection module, design F

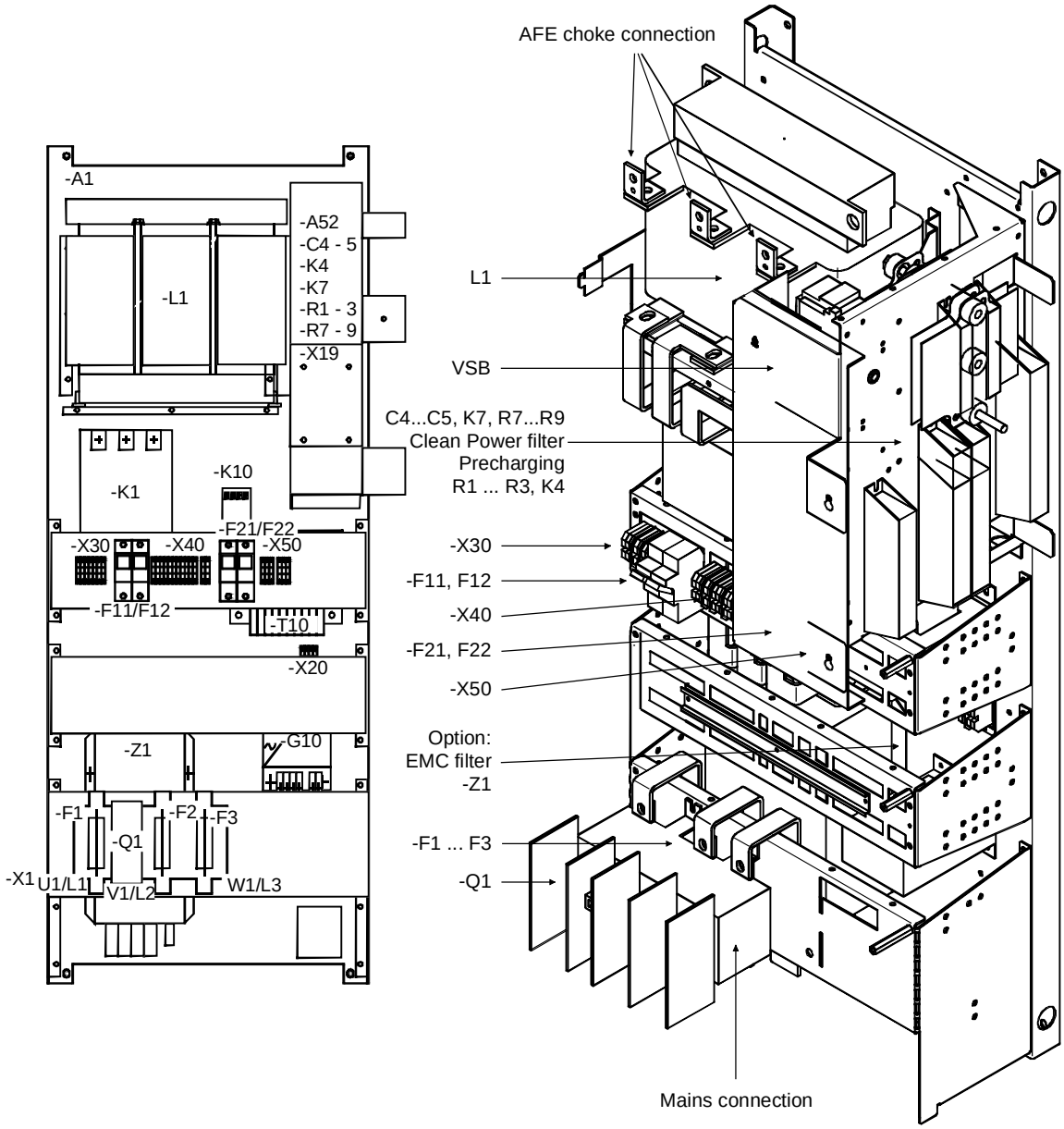


Fig. 7-3 Connection overview: AFE mains connection module, design G

7.1.2 AFE Inverter

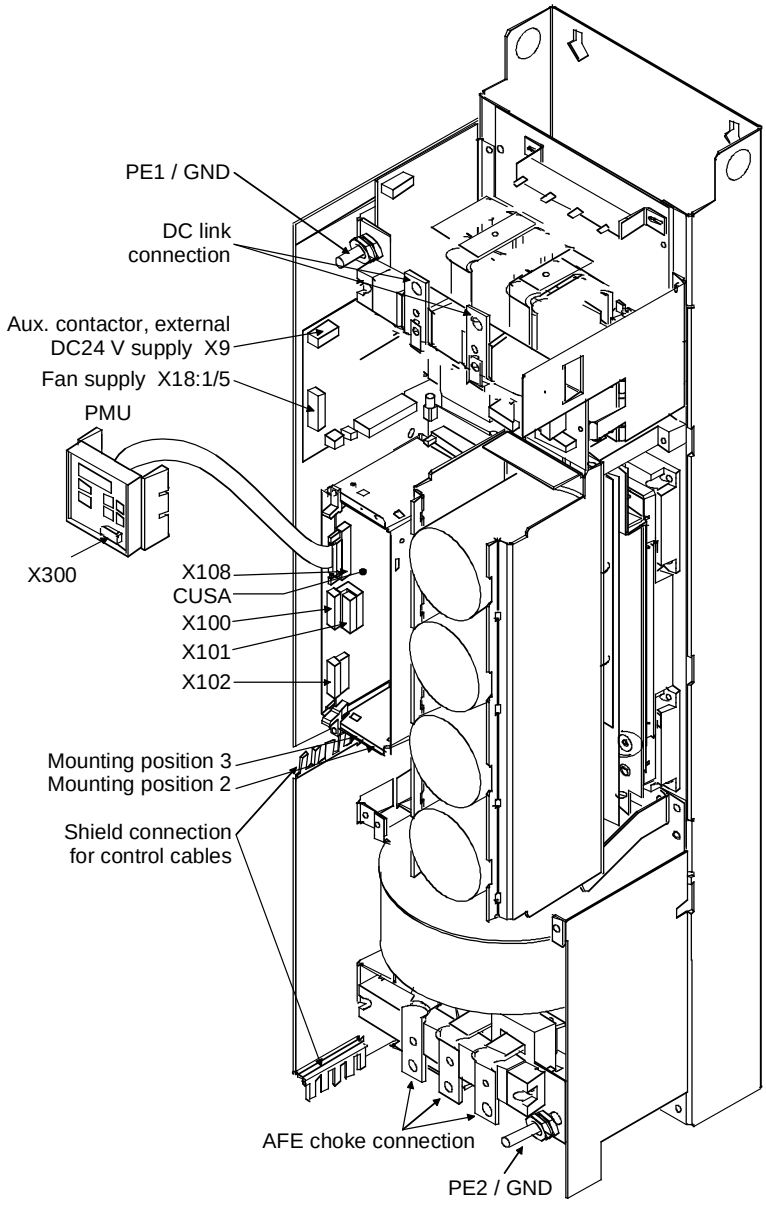


Fig. 7-4 Connection overview: AFE inverter, designs E and F

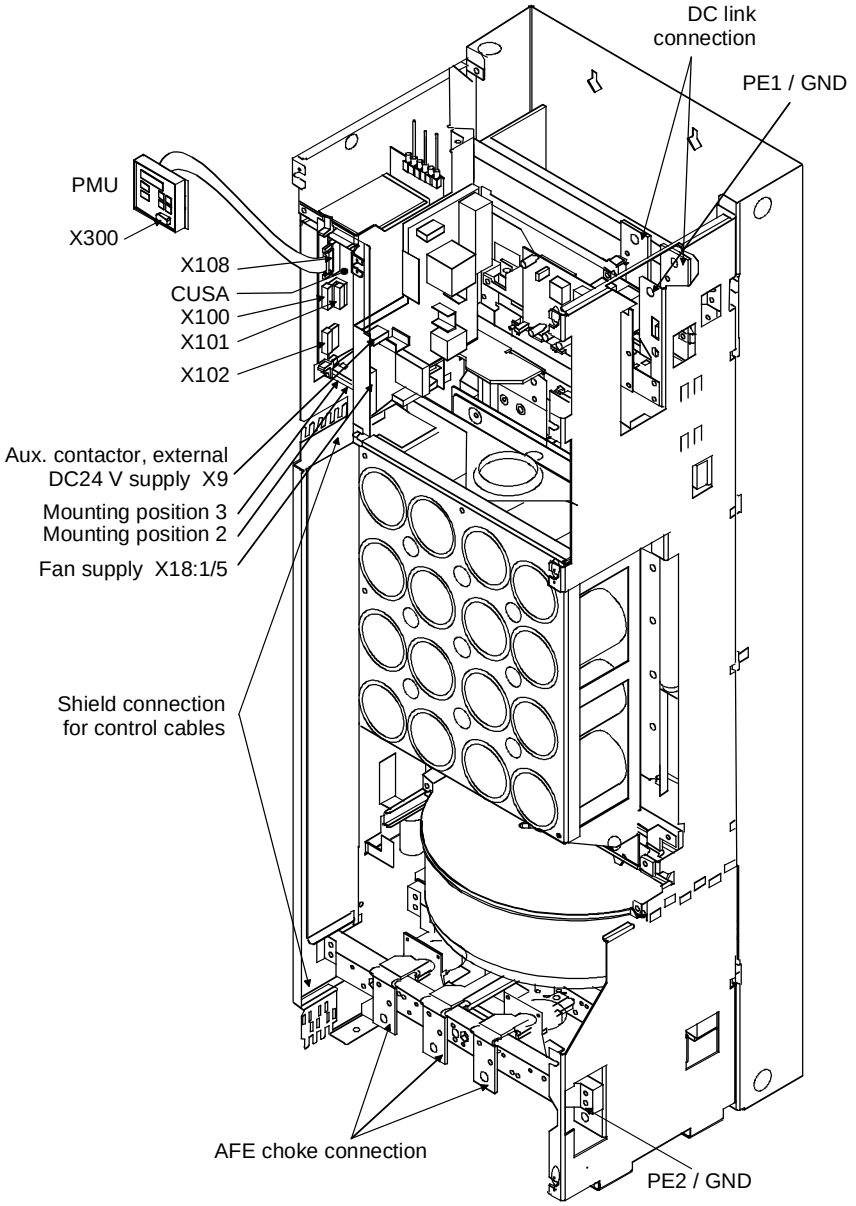


Fig. 7-5 Connection overview: AFE inverter design G

7.1.3 Connection overview of the AFE rectifier/regenerative feedback unit

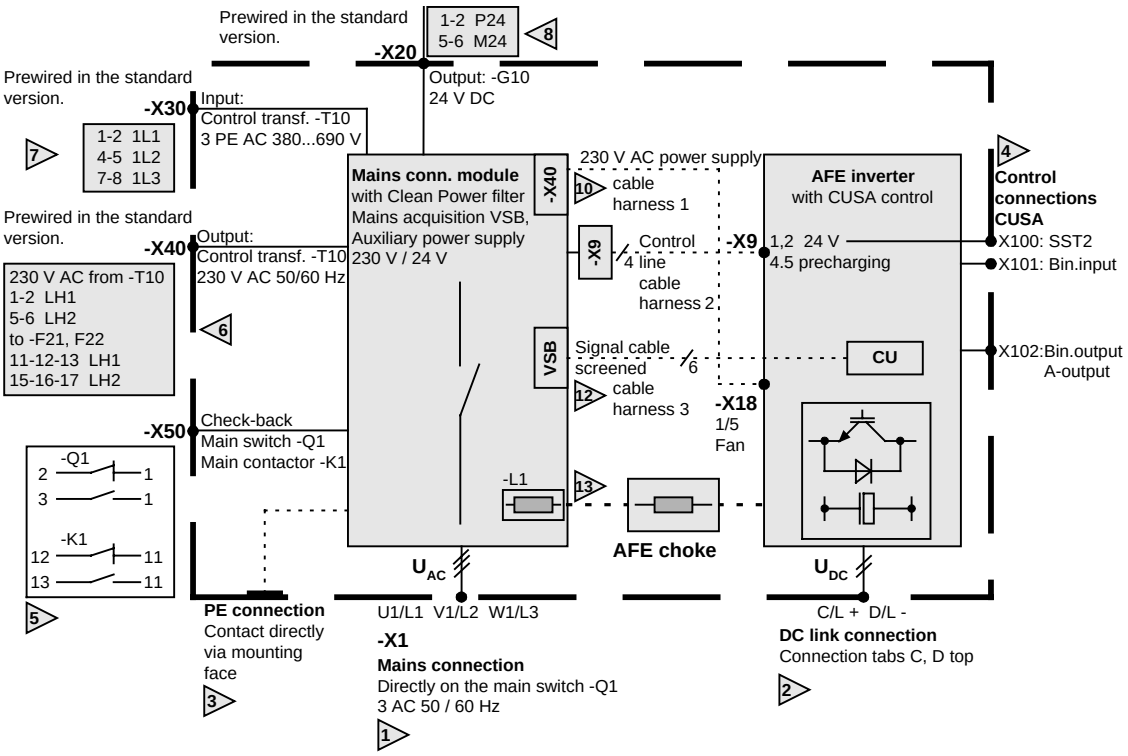


Fig. 7-6 Connection overview: AFE rectifier/regenerative feedback unit

External connections:

1 Mains connection:
See power connections for cross-section
Screw dimensions:

Design	E	F	G
Screw	M6	M10	M10

2 DC link connection:
See power connections for cross-section
Screw dimensions:

Design	E	F	G
Screw	M10	M10	M12

3 PE connection:
see Installation in Conformance with EMC Regulations

4 CUSA control connections:
see Control Connections

5 -X50:
Main switch check-back signal
Main contactor check-back signal

6 Auxiliary power supply connections

7 already wired

8 in the standard versions

Internal connection wiring for on-site assembly

10 AFE inverter fan supply:
2-pole cable harness FKBL1 (2.5 m long) from -X40 1/5 -> -X18 1/5

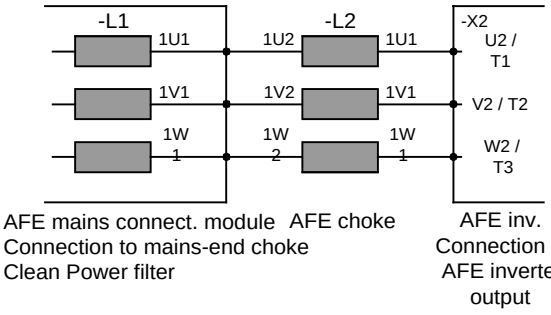
11 24 V power supply and precharging contacter control:
4-pole cable harness FKBL2 with connector -X9 (connector type Phönix 2.5 mm^2), 0.5 m long
If the length is not sufficient, the included extension cable (2.5 m) can be used.

12 Signal connection of mains connection module and AFE inverter:
6-pole screened signal cable (2.5 m) with connectors -X102, -X101, -X100
(connector type Phönix 1.5 mm^2)
Fit the screen on both ends!

13 Power wiring of AFE choke -L2:
See power connectons for the cross-section
Screws:

Design:	E	F	G
Choke -L1:	M10	M10	M12
AFE choke -L2:	M8	M8	M12
AFE inverter -G1:	M10	M10	M12

Connection sketch:



7.2 Power connections

NOTE The connection cross-sections are determined for copper cables at 40 °C (104 °F) ambient temperature (according to DIN VDE 0298 Part 4 / 02.88 Group 5).

Supply terminals The supply terminals are marked as follows:

Mains connections: -X1	U1 / L1	V1 / L2	W1 / L3
DC link connection AFE-inverter:	C / L+	D / L-	
PE connection: directly via mounting surface and/or via	PE1	PE2	

7.2.1 AFE rectifier/regenerative feedback unit

Mains voltage 380 V to 460 V								
Order number for AFE rectifier/regenerative feedback unit		**Type**	**Rated input current**	**Mains connection to main switch-Q1 in the mains connection - module Cross section**		**Output end DC DC link connection**		
Mains connection module	**AFE- inverter**		**3 ph. AC mains end**			**Rated output current**	**Cross section**	
Position 1	**Position 2**			**VDE**	**AWG**		**VDE**	**AWG**
6SE71...	**6SE70...**		**[A]**	**[mm²]**	**MCM**	**[A]**	**[mm²]**	**MCM**
31-0EE83-2NA0	**31-0**EE80	45 kW / 400 V	92	1x35	1x0	105	1x50	1x00
31-2EF83-2NA0	**31-2**EF80	55 kW / 400 V	124	1x50	1x00	140	1x70	1x000
31-5EF83-2NA0	**31-5**EF80	75 kW / 400 V	146	1x70	1x000	165	2x50	2x00
31-8EF83-2NA0	**31-8**EF80	90 kW / 400 V	186	2x50	2x00	215	2x50	2x00
32-1EG83-2NA0	**32-1**EG80	110 kW / 400 V	210	2x50	2x00	240	2x70	2x000
32-6EG83-2NA0	**32-6**EG80	132 kW / 400 V	260	2x70	2x000	300	2x95	2x4/0
33-2EG83-2NA0	**33-2**EG80	160 kW / 400 V	315	2x95	2x4/0	360	2x120	2x300
33-7EG83-2NA0	**33-7**EG80	200 kW / 400 V	370	2x120	2x300	425	2x120	2x300
Mains voltage 500 V to 575 V								
26-1FE83-2NA0	**26-1**FE80	37 kW / 500 V	61	1x25	1x2	66	1x35	1x0
26-6FE83-2NA0	**26-6**FE80	45 kW / 500 V	66	1x25	1x2	75	1x35	1x0
28-0FF83-2NA0	**28-0**FF80	55 kW / 500 V	79	1x35	1x0	90	1x50	1x00
31-1FF83-2NA0	**31-1**FF80	75 kW / 500 V	108	1x50	1x00	120	1x50	1x00
31-3FG83-2NA0	**31-3**FG80	90 kW / 500 V	128	1x50	1x00	145	1x70	1x000
31-6FG83-2NA0	**31-6**FG80	110 kW / 500 V	156	1x95	1x4/0	175	2x50	2x00
32-0FG83-2NA0	**32-0**FG80	132 kW / 500 V	192	2x50	2x00	220	2x70	2x000
32-3FG83-2NA0	**32-3**FG80	160 kW / 500 V	225	2x50	2x00	250	2x70	2x000
Mains voltage 660 V to 690 V								
26-0HF83-2NA0	**26-0**HF80	55 kW / 690 V	60	1x25	1x2	66	1x25	1x2
28-2HF83-2NA0	**28-2**HF80	75 kW / 690 V	82	1x35	1x0	90	1x50	1x00
31-0HG83-2NA0	**31-0**HG80	90 kW / 690 V	97	1x50	1x00	105	1x70	1x000
31-2HG83-2NA0	**31-2**HG80	110 kW / 690 V	118	1x50	1x00	130	2x35	2x0
31-5HG83-2NA0	**31-5**HG80	132 kW / 690 V	145	1x70	1x000	160	2x50	2x00
31-7HG83-2NA0	**31-7**HG80	160 kW / 690 V	171	1x95	1x4/0	190	2x50	2x00
32-1HG83-2NA0	**32-1**HG80	200 kW / 690 V	208	2x50	2x00	230	2x70	2x000

Table 7-1 Conductor cross-sections: AFE rectifier/regenerative feedback unit

7.2.2 AFE choke

AFE choke Type [kW]	Rated current [A]	Connection cross-section VDE [mm²]	Connection cross-section AWG MCM	Securing screw [∅]
Mains voltage 380 V to 460 V				
45	92	1x35	1x0	M8
55	124	1x50	2x00	M8
75	146	1x70	2x000	M8
90	186	2x50	2x00	M8
110	210	2x50	2x00	M12
132	260	2x70	2x000	M12
160	315	2x95	2x4/0	M12
200	370	2x120	2x300	M12
Mains voltage 500 V to 575 V				
37	61	1x25	1x2	M8
45	66	1x25	1x2	M8
55	79	1x35	1x0	M8
75	108	1x50	1x00	M8
90	128	1x50	1x00	M12
110	156	1x95	1x4/0	M12
132	192	2x50	2x00	M12
160	225	2x50	2x00	M12
Mains voltage 660 V to 690 V				
55	60	1x25	1x2	M8
75	82	1x35	1x0	M8
90	97	1x50	1x00	M12
110	118	1x50	1x00	M12
132	145	1x70	1x000	M12
160	171	1x95	1x4/0	M12
200	208	2x50	2x00	M12

Table 7-2 Conductor cross-sections: AFE chokes

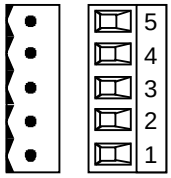
7.2.3 Auxiliary power supply, precharging

X9 - external DC 24 V supply, precharging contactor control

The 5-pole terminal strip is used for connecting up a 24 V voltage supply and for connecting a precharging contactor.

The connections for the contactor control are floating.

The position of the terminal strip can be seen from the connection overviews.



Terminal	Designation	Meaning	Range
5	Precharge contr.	Precharging contactor control	AC 230 V
4	Precharge contr.	Precharging contactor control	1 kVA
3	n.c.	Not connected	
2	0 V	Reference potential	0 V
1	+24 V (in)	24 V voltage supply	DC24 V ≤ 3,5 A

Connectable cross-section: 2,5 mm² (AWG 12)

Table 7-3 Connection of external DC 24 V aux. voltage supply and precharging contactor control

Fan supply

See section "Connection overviews"

A 2-pole cable harness is included, which is connected to one end of the mains connection module -X40 and which is reeled up by approximately 2.50 m. This cable (cross-section 2 x 1.5 mm^2) must be connected to the AFE inverter -X18 1/5 (screwed connection).

7.2.4 Maximum cross-sections

Possible connection cross-sections, screw connection

Type	Order number	Max. connection cross-sections		Screw connection
		mm² to VDE	AWG	
E	6SE703_-__E_0	2 x 70	2 x 00	M10
F	6SE703_-__F_0	2 x 70	2 x 00	M10
G	6SE703_-__G_0	2 x 150	2 x 300	M12

7.2.5 Protective conductor connection

In the case of the mains connection module, directly via the mounting surface.

In the case of the AFE inverter, PE1 and PE2 need not be connected if contact via the mounting surface is insured.

NOTE

Attention must be paid to ensuring that earthing of the mains connection module and of the AFE inverter is at the same potential and, if necessary, equipotential bonding must be provided for.

7.3 Control terminals

7.3.1 Mains connection module

No external control connections except:
- Main switch check-back signal
- Main contacter check-back signal

cf. chapter entitled "Connection overviews"

7.3.2 Standard connections of the AFE inverter

The basic version of the converter features the following control terminals on the CUSA board:

- Control terminal strips X100, X101 and X102 on CUSA electronics board
- Connection for OP1S operator control panel
- One serial interface (USS bus, RS485)
- Serial interfaces RS485 and RS232 (SCom1) on PMU X300

CAUTION

The CUSA board contains components which can be destroyed by electrostatic discharge. These components can be very easily destroyed if not handled with caution.
See also ESD precautions outlined in Section "Definitions and warnings".

Connectors for control terminal strip

Die Stecker für die Steuerklemmenleiste werden mitgeliefert und sind am Formkabel FKBL3 bereits vorverdrahtet (siehe Kapitel "Anschlußschema".

Cables with cross-sections from 0.14 mm^2 to 1.5 mm^2 (AWG: 26 to 16), or 1 mm^2 (AWG: 18) can be connected using stranded wire with lugs to the connectors (recommended: 0.5 mm^2 (AWG: 20)). The connectors can be identified by the pin numbers (Table 7-4), connector positions on the board are shown in Fig. 7-7.

Two screen clamps and four cable ties are required from the loose components supplied to connect the control cables.

Connector X9 is needed to control the pre-charging operation and to connect an external power supply (see Fig. 7-7).

Connector		**Label**								
X100	eight-pin, coded	1	2	3	CU	6	7	8		
X101	eight-pin, coded	13	14	15	CU	18	19	20		
X102	ten-pin	25	26	27	28	CU	31	32	33	34

Table 7-4

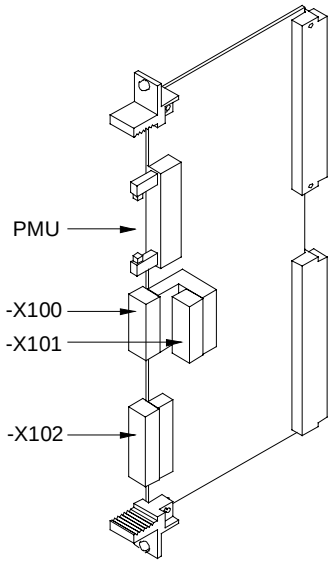


Fig. 7-7 View of CUSA

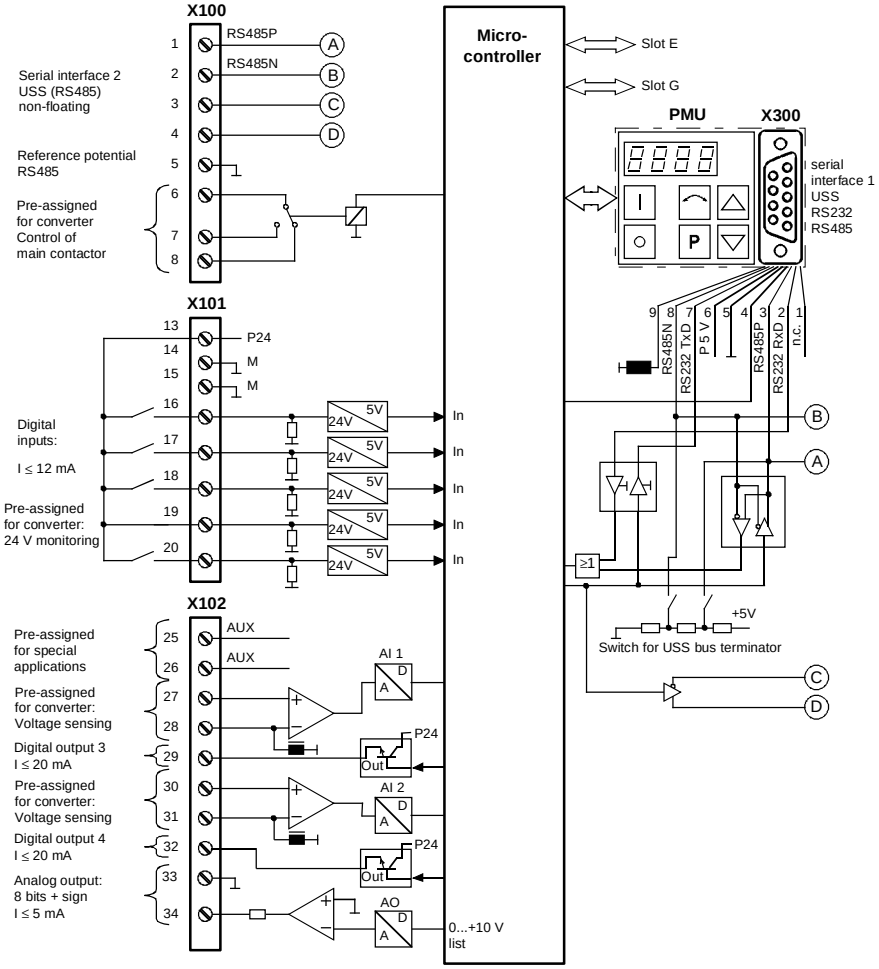


Fig. 7-8 View of standard terminals

7.4 Connecting up control cables

NOTE

Generally, control lines that are connected to the AFE inverter must be shielded to achieve maximum possible interference immunity. The shield must be grounded at both ends.

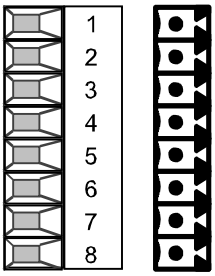
To avoid noise coupling, control wires which are directly connected to the chassis should be separated from power wiring by a minimum distance of 20 cm.

Control and power cables must cross each other at an angle of 90°.

7.5 Terminal assignments

X100 control terminal strip

The terminals on the control terminal strip are as follows:



Terminal	Name	Function
1		Transmit and receive line -RS485, differential input / output, positive (RS485/T+)
2		Transmit and receive line -RS485, differential input / output, negative (RS485/T-)
3		Transmit output RS485 Standard, differential output, positive (RS485T+)
4		Transmit output RS485 Standard, differential output, negative (RS485T-)
5 *)	M RS485	Reference potential RS485
6		Digital output 2, (changeover) reference contact
7		Digital output 2, (changeover) NO contact
8 **)		Digital output 2, (changeover) NC contact

Possible cross-section: 1.5 mm² (AWG 16)

In the assembled state, terminal 1 is at the top.

*) An identical interface to the type on connector -X100 is available on connector -X300 on the parameterizing unit. Only one of these two interfaces may be used, see Section "Interfaces".

Digital output 1 is available on -X9:4,5

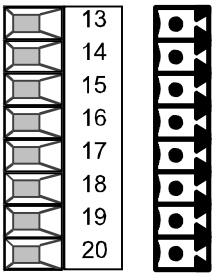
**) Load capability of digital outputs:
AC 60 V, 60 VA, cos φ = 1
AC 60 V, 16 VA, cos φ = 0,4
DC 60 V, 24 W

Inductive loads, e.g. contactors, relays, for DC voltage loads, must be damped using a diode or varistor, and for AC loads, with a varistor or RC element.

Table 7-5 Control terminal strip X100

X101 control terminal strip

The terminals on the control terminal strip are as follows:



Terminal	Name	Function	Range
13	P24 AUX	Aux. voltage supply	DC 24 V / 150 mA
14	M24 AUX	Reference potential	0 V
15		Reference potential for digital inputs 1 to 5 with ext. signal voltage	
16		Digital input 1	Signal sensitivity of digital inputs: • H = 24 V (13 V to 33 V) • I_{max} = 15.7 mA • L = 0 V (– 0.6 V to 3 V)
17		Digital input 2	
18		Digital input 3	
19 *)		Digital input 4	
20		Digital input 5	

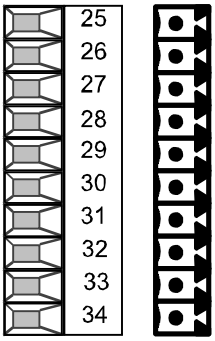
Possible cross-section: 1.5 mm² (AWG 16)

In the assembled state, terminal 1 is at the top.

*) Must be used to monitor the ext. 24 V supply P576.1 = 1004; P576.2 = 1004).

Table 7-6 Control terminal strip X101

X102 -control terminal strip



The terminals on the control terminal strip are as follows:

Terminal	Name	Function	Range
25	Cannot be used	Analog input 3	0 V to 5 V
26	Cannot be used	Analog input 4	0 V to 5 V
27	Assigned	Analog input 1	0 V to ± 10 V
28	Assigned	Reference potential for analog inputs 1, 3	
29		Digital output 3	I_{max} = 20 mA
30	Assigned	Analog input 2	0 V to ± 10 V
31	Assigned	Reference potential for analog inputs 2, 4	
32		Digital output 4	I_{max} = 20 mA
33 *)		Reference potential for analog output 1, digital output 3, digital output 4	
34 *)		Analog output 1	0 V to 10 V Rating ≤ 5 mA equals > 2 kΩ

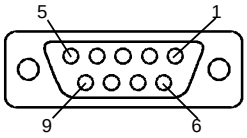
Possible cross-section: 1.5 mm² (AWG 16)

*) NOTE:
To increase the noise immunity of the signals, an isolating amplifier should be connected between the analog output and measuring unit for cables > 4 m.

Table 7-7 Control terminal strip X102

X300 serial interface

A serial connection to an automation unit or PC can be made via connector X300 on the PMU. The unit can therefore be controlled and operated from the central control station or control room.



Pin	Name	Function	Range
1	n.c.	Not assigned	
2	RS232 RxD	Receive data via RS232	RS232
3	RS485 P	Data via RS485	RS485
4	RTS	Request to send, for direction reversal with interface converters	
5	M5V	Reference potential for P5V	0 V
6	P5V	5 V aux. voltage supply	+5 V, Imax = 200 mA
7	RS232 TxD	Transmit data via RS232	RS232
8	RS485 N	Data via RS485	RS485
9		Reference potential for RS232 or RS485 interface (with RF suppression for EMC)	

Table 7-8 Serial interface X300

7.6 Digital inputs/outputs

Digital inputs

Four parameterizable digital inputs (24 V) are available on the control terminal strip (-X101) of the CUSA board. These inputs can be used to input commands, external faults/alarms and for returning status data to the AFE inverter's control word.

Connection: See Section "Connecting up control cables".

Parameterization: See Section "Control and status words".

Factory setting (valid for standby operation)**:**

Digital input	Command HIGH	Command LOW	Control word bit	Parameter
1	ON	OFF1	0	P554.2 = 1001 (standby)
2	ON	OFF2 (electrical)	1	P555.2 = 1002 (standby)
3	Acknowledge 		7	P565.2 = 1003 (standby)
5	Standby setting	Basic setting	30	P590 = 1005

Table 7-9 Digital inputs

Digital outputs

Digital outputs 1 and 2 on the AFE inverter are pre-wired for the precharging and main contactors. For safety reasons, they cannot be wired up for other purposes.

Two further digital outputs are available for optional functions.

Factory setting:

Digital output	Connector	Pin	Signal HIGH	Signal LOW	Status word bit	Parameter
3	-X102	29		Fault	3	603.1 = 1003
4	-X102	32		Operation	2	602.1 = 1004

Table 7-10 Digital outputs

NOTE

Faults, alarms and starting lockout (HIGH active) are displayed as **LOW active** via the terminal strip (digital outputs). See Section "Status word".

Basic converter interface SCom1

The USS protocol (universal serial interface) is implemented on the basic converter interface SCom1.

The following documentation is available depending on the particular application of the SCom1 basic converter interface:

- Connection of a PC / PG with SIMOVIS software for start-up/servicing/operation:
  The documentation is provided on SIMOVIS floppy disks in files BEDANLTG.TXT (ASCII format) and BEDANLTG.WRI (WRITE format).
- Connection of higher-level PLCs with USS protocol:
  SIMOVERT MASTERDRIVES
  Application of serial interfaces with USS protocol
  Order No.: 6SE7087-6CX87-4KB0

Additional general comments regarding connection and parameterization:

Connection: See Section "Control terminals"

NOTE

A communication link can be made either via the terminal strip on the CU -X100 (RS485 Standard) **or** the interface connection on the PMU -X300 (9-pin SUB D connector / RS232 or RS485 (V24)).

Only one of the above possible connections may be used!

A four-wire connection can be implemented when the SCom2 is connected via the terminal strip (-X100) on the CUSA board. Switchover between two-wire and four-wire connection is automatic.

NOTE

The bus terminations (150 Ω in total) must be set for the last bus station (slave). For positioning of jumpers on S1, see Fig. 7-1.

SCom1: Close jumpers S1.1 and S1.2 of DIP-FIX S1 on the CUSA.

Dual-port Ram (DPR für SCB, TSY, CB, TB)

The dual-port RAM is the internal interface on the CUSA (-X107) for connection of option boards via the LBA (Local Bus Adapter, option) of the electronics box.

Available option boards:

- TSY (Tachometer and Synchronization Board)
- TB (Technology Board)
- SCB (Serial Communication Board)
- CB (Communication Board)

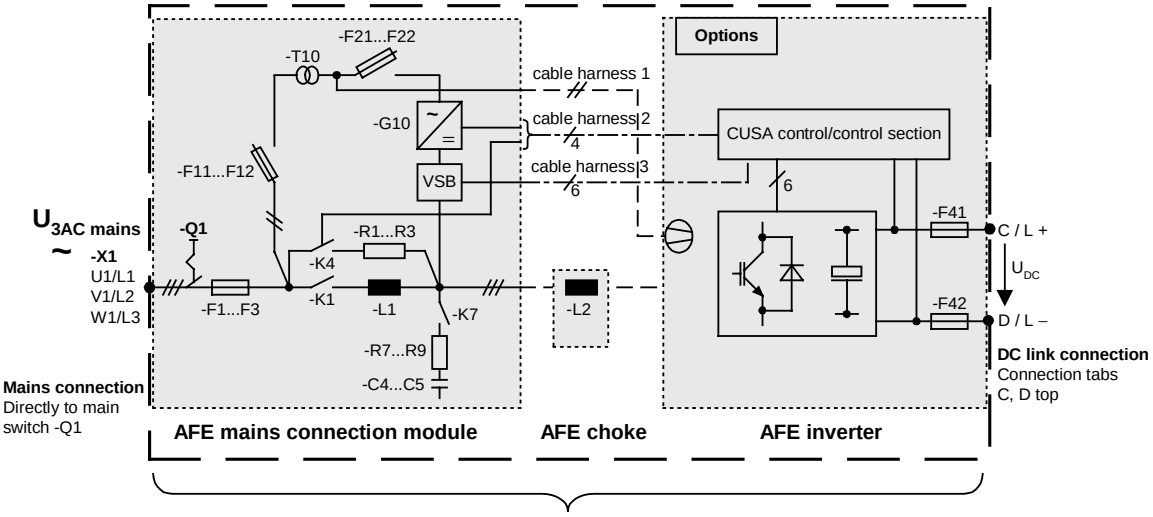
For further information about connecting option boards and parameterizing the interface, see also the operating instructions for the relevant boards.

For additional information, see Section "Control and status words".

8 Basic function check

WARNING

It imperative to observe the procedure described here for initial commissioning of the equipment.



AFE rectifier/regenerative feedback unit (chassis unit)

Please check:

Starting point:

1. Main switch-Q1 is open
2. Mains is connected to the main switch-Q1 (-X1 U1/L1 V1/L2 W1/L3), rotating clockwise (L1, L2, L3)
3. Internal wiring is completed;
   cable harnesses FKBL 1...3 are firmly seated
4. AFE choke power wiring (cf. section entitled "Connection schematic")
   Check phase assignments:
   Connection:
   Mains choke -L1 U2 with AFE inverter -X2 U2/T1
   V2 with AFE inverter -X2 V2/T2
   W2 with AFE inverter -X2 W2/T3
5. DC link connection not yet connected to motor inverter
6. No further control cables are connected, no communication

Preliminary check

- Main contactor -K1 and precharging contactor -K4 must be open
- Main switch must be open
- Mains voltage must be applied to the main switch
- Ensure clockwise rotating field
- Control panel (PMU) must still be dark
- Control transformer -T10 must be wired in accordance with the following table:

Mains voltage [V]	Lh1	Lh2
380	4	5
400	3	5
415	2	5
440	1	5
460	4	6
480	3	6
500	2	6
525	1	6
550	4	7
575	3	7
600	1	7
630	4	8
660	3	8
690	1	8

- Fuses -F11, -F12 and -F21, -F22 must be connected
- Internal wiring must be completed.

Activating main switch -Q1

- Control transformer -T10 supplies 230 V AC
  - to the fan of the AFE inverter
  - to the DC power supply -G10
  - to the switching contact for the precharging contactor
    X9: 4: 230 V,
    X9: 5 coil of contactor -K4
- 24 V power supply -G10 supplies to AFE inverter
  -X9: 1 (P24) 2:(M24)
- On the AFE inverter, the control panel (PMU) lights up, initialisation has been completed after several seconds and the status message: **0009 = READY FOR ON** appears on the PMU.

If the READY FOR ON message does not appear, check all contacts, fuses and voltages once again and replace CUSA if necessary.

Parameter reset

P052 = 1
Reset is run
P052 automatically returns to 0.

Disabling control of the AFE inverter

P561 = 0

NOTE

If this is not observed, the fuse may blow or the Clean Power filter may be subjected to increased stress.

Checking actual value acquisition and precharging

Issue the ON command via PMU (by default, ON command P554 already set on PMU)

- Reaction: Precharging begins with picking up of the contactor -K4, and the DC link voltage (see display parameter r006) rises within approximately 1 second to the final value, approximately 1.35 times the mains voltage. The main contactor -K1 is connected once the final value has been reached.
- Contacts: cf. section entitled "Control connections"
  Main contactor ON command from CUSA X100 terminal 6 (M24)-7 signal from normally-open CUSA binary output 2
  This command is forwarded to the mains angle acquisition circuit
  VSB: connector X3: terminal 5 signal
  X3: terminal 1 M24
  Output to potential-free contact VSB:
  X2 terminal 1: Transformer voltage -T10 230 V AC
  X2 terminal 3: to coil of main contactor -K1
- Reaction: Once the main contactor -K1 has picked up, the precharging contactor -K4 opens after approx. 500 ms.
- Status: 0011 "Ready to Run"
  The AFE inverter is now in the "Ready to Run " state and the following actual values must be correctly displayed:
  r032: Mains frequency tolerance ± 2 %
  r030: Mains voltage, currently applied
  RMS value tolerance ± 2 %

If the **fault F004** occurs, check the mains direction of rotation, check the main contactor's contacts and check the mains voltage.

Enabling control

⇒ After successful precharging and actual value check

P561 = 1

- Reaction: The AFE inverter pulse is audibly and evenly

  The DC link voltage (r006) goes to the value P071 x P125, and is stable with slight fluctuations ± approx. 1%.

  The current consumption of the AFE inverter (r004) should be no greater than 20% of the rated current of the unit (cf. P072).
- Fault: Replace CUSA or VSB in the event of clear deviations in the current consumption.

The basic function check of the AFE rectifier/regerative feedback unit has been completed and the unit is operable.

Commissioning can now take place depending on project planning.

9 Explanation of terminology and functionality of the AFE

Operating modes of the AFE rectifier/regenerative feedback unit

- Operating modes are set via P164 "Operating mode"
- See Section "Function diagrams"
- Applications:
  - Supplying the voltage-source DC link of SIMOVERT MASTERDRIVES series 6SE70 converters.
  - Reactive power compensation
  - Regenerative feedback from a DC voltage source to the supply system
- Operating modes:
  - Operating mode "cos(phi) control " (P164 = 1, factory setting):

    The sinusoidal line current is controlled with an adjustable cos(phi) (P120). For a cos(phi) of 1, only active power is taken from or regenerated to the line. A cos(phi) of + 0.8 results in a distribution of the line current into 80 % active current and 60 % reactive current (inductive, as cos(phi) is positive). The sign serves only to distinguish between inductive and capacitive reactive power. In this mode, therefore, a change in the active power automatically changes the reactive power. A higher-level closed-loop DC link voltage controller controls the DC link voltage to the setpoint (r447). The output of this closed-loop DC link voltage controller is the setpoint for the active current.
  - Operating mode "Reactive power compensation" (P164 = 0):

    The reactive power can be input as either capacitive or inductive (P122) (± 140 % of AFE rated apparent power) and is independent of the active power. A higher-level DC link voltage controller controls the DC link voltage to the setpoint (r447). The output of this DC link voltage controller is the setpoint for the active current. If the "sum“ (square-root of the sum of the squares of the absolute values) of the active and reactive power is greater than the maximum apparent power of the AFE, the reactive power is limited (= Line current management).
  - Operating mode "Current control" (P164 = 2):

    The active line current can be externally specified via a setpoint node (P486). The DC link voltage is not controlled and is given by an external voltage source (e.g. master Master AFE).
- Operating mode: "regenerative partial load" (P164 = 3):

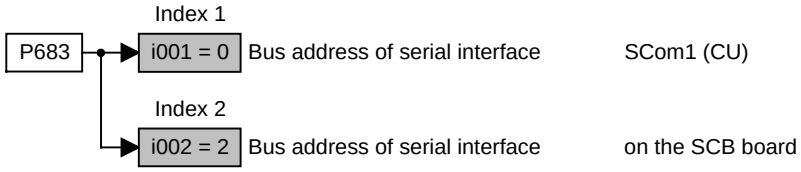
In this operating mode, active power is fed back into the mains as from $U_d > U_{dset}$.

Indexed parameters

These parameters are divided into various "indices" (i001, i002, etc.). A separate parameter value can be assigned to each index.

The meaning of the "indices" of the relevant parameter (parameter number) can be found in Section "Parameter List".

Example:



Data sets

"Indexed" parameters are divided according to data sets (indexed).

- GRD/RES (basic or reserve setting):
  These data sets make it possible, e.g. to switch from manual to automatic mode.
- RDS (reserve data set) 1 or 2:
  Two reserve data sets can be parameterized, e.g. for alternating operation of different converter types on one AFE.

The data sets are selected via the "control word" and read out in r012 and r152, see Section "Function diagrams".

10 Function diagrams

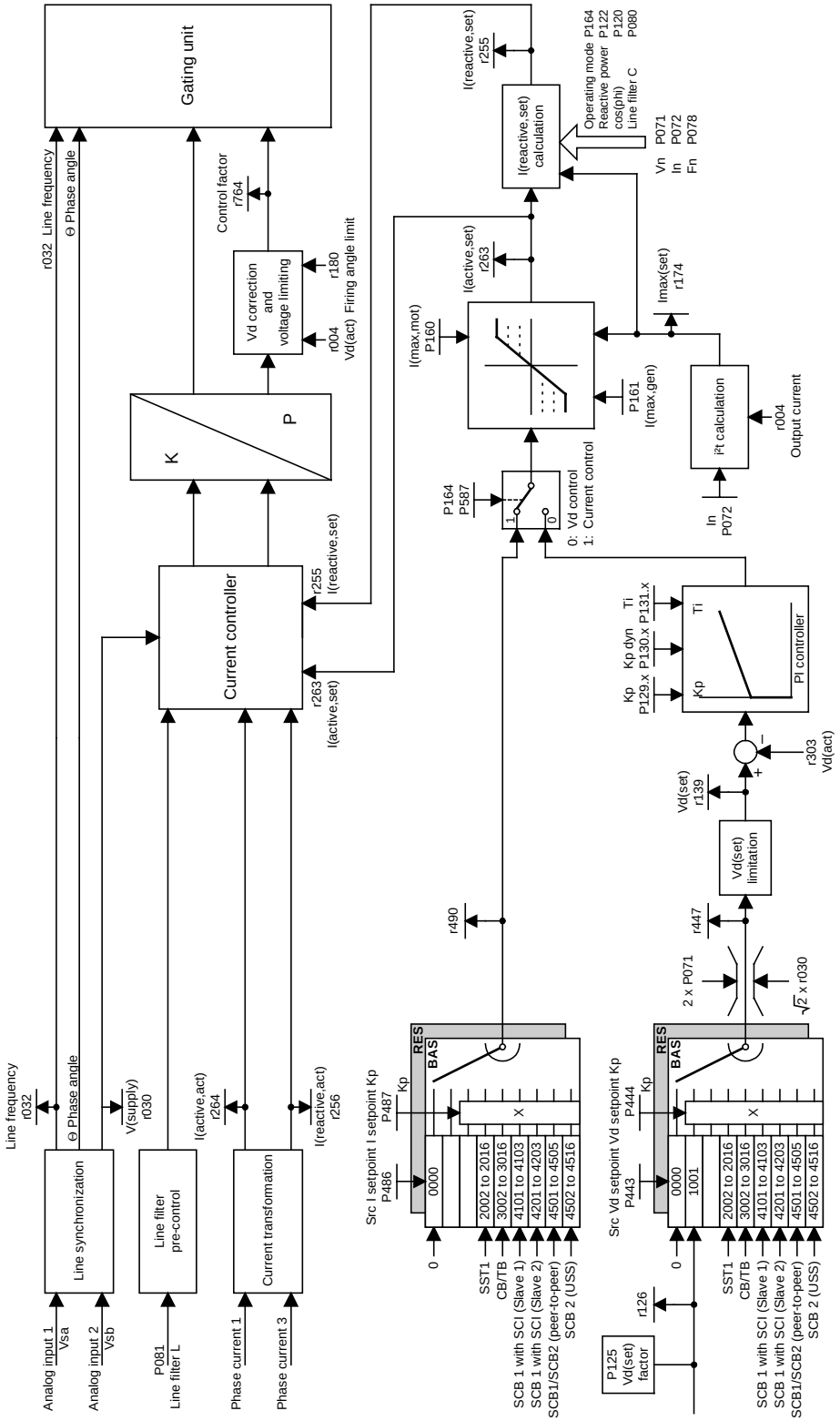


Fig. 10-1 Block diagram of the AFE control

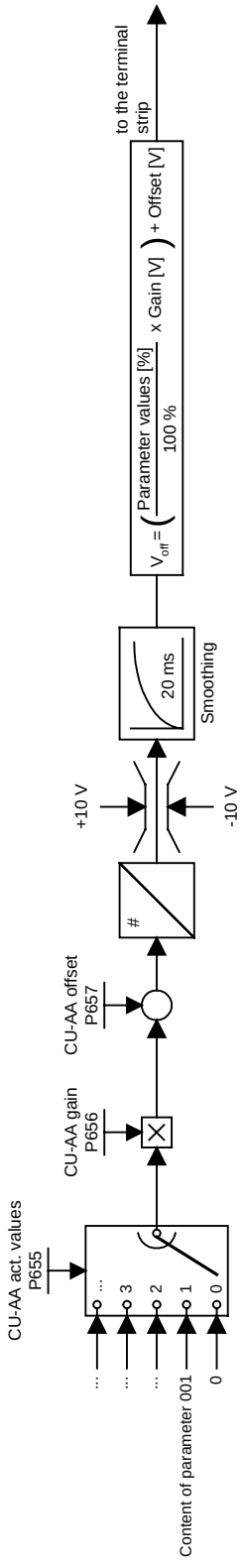
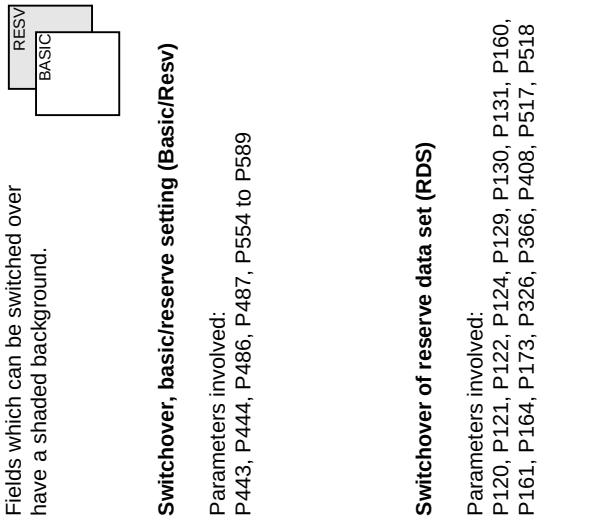


Fig. 10-2 Analog output



Switchover, basic/reserve setting (Basic/Resv)

Parameters involved:
P443, P444, P486, P487, P554 to P589

Switchover of reserve data set (RDS)

Parameters involved:
P120, P121, P122, P124, P129, P130, P131, P160, P161, P164, P173, P326, P366, P408, P517, P518

Fig. 10-3 Basic/reserve changeover

11 Parameterization

The functions stored in the converters are adjusted to suit specific applications by means of parameters. Every parameter is uniquely identified by its name and number. In addition to a parameter name and number, many parameters also have a parameter index. Using these indices, it is possible to store several values for a parameter under one parameter number.

Parameter numbers consist of a letter and a three-digit number. Upper case letters P, U, H and L are the codes for settable parameters and lower case letters r, n, d and c the codes for non-settable visualization parameters.

Examples

DC link voltage r006 = 541	Parameter name:	DC link voltage
	Parameter number:	r006
	Parameter index:	No index
	Parameter value:	541 V
Src ON/OFF1 P554.2 = 20	Parameter name:	Src ON/OFF1
	Parameter number:	P554
	Parameter index:	2
	Parameter value:	20

Parameters can be entered via

- the PMU parameterizing unit integrated in the converter front panel,
- the control terminal strip of the closed-loop control module CUSA (see Section "Control terminals"),
- easily via the optional OP1S operator panel,
- the serial interfaces RS485 and RS232 at -X300 on the PMU or
- on a PC with the SIMOVIS service program (Version 5.3 or higher).

The parameters stored in the converters can be altered only under particular conditions. The following conditions must be fulfilled before parameter settings can be changed:

- The relevant parameter must be a settable parameter (identifiable by upper case code letters in parameter number).
- Parameterization authorization must be set (P053 = 6 for parameterization via PMU or OP1S).
- Changes to parameter settings must be permitted by the current converter status (initial parameter settings must be set with the converter switched off).

11.1 Setting parameters via the PMU

The parameterization unit (PMU) is provided for direct parameterization, operation and visualization of the converter/inverter. It is an integral component of basic units and features a four-digit, seven-segment display and several keys.

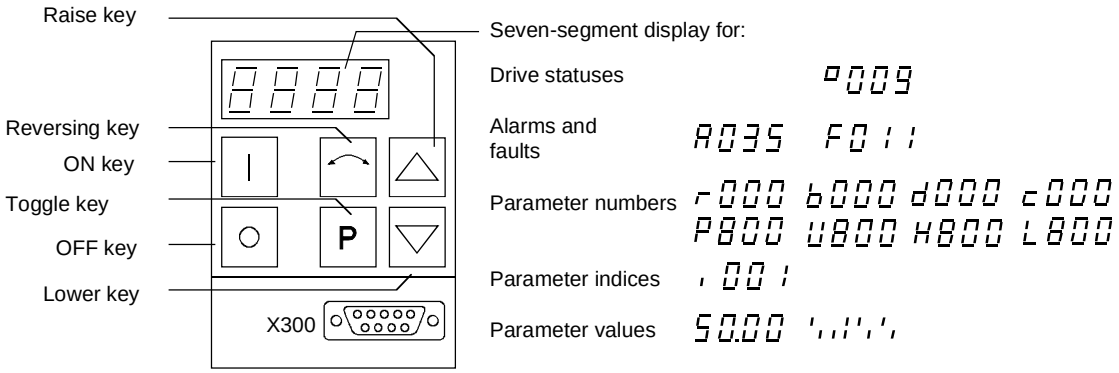


Fig. 11-1 PMU parameterization unit

Key	Meaning	Function
	ON key	• Switch on device (standard) • With active fault: Return to fault display • Command is executed when key is released
	OFF key	• Switch off device with OFF1 or OFF2 depending on parameterization (P554 to P557). Command is executed when key is released.
	Reversing key	• No function
P	Toggle key	• For switching between parameter number and parameter value in the sequence indicated (command becomes effective when the key is released). • If fault display is active: For acknowledging the fault
	Raise key	Increase the display value: • Press and release: Increase value by one increment • Hold down: Value is increased rapidly
	Lower key	Reduce the display value: • Press and release: Decrease value by one increment • Hold down: Value is decreased rapidly
P + P +	Hold toggle key and depress raise or lower key	• Press and hold P, then press second key. The command is executed when key is released (e.g. quick toggle).

Table 11-1 Control elements on the PMU

Toggle key (P key)

Since the seven-segment display on the PMU has only four digits, the 3 descriptive elements of a parameter, i.e.

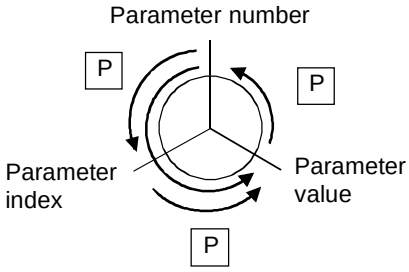
- ♦ parameter number,
- ♦ parameter index (for an indexed parameter) and
- ♦ parameter value

cannot be displayed simultaneously. It is therefore necessary to switch between the 3 elements. The toggle key is provided for this purpose. After the desired level has been selected, the parameter number can be adjusted with the Raise or Lower key.

Using the toggle key, you can switch

- from the parameter number to the parameter index
- from the parameter index to the parameter value
- from the parameter value to the parameter number

If the parameter is not indexed, the toggle key switches directly from the parameter number to the parameter value.



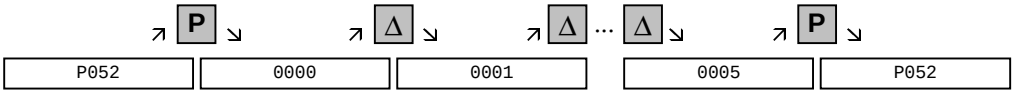
NOTE

If you change the value of a parameter, the new value normally becomes operative immediately. However, in the case of confirmation parameters (identified by an asterisk " * " in the Parameter List), the new value does not take effect until you switch from the parameter value to the parameter number.

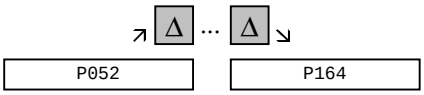
Changes to parameter settings made via the PMU are always stored in the non-volatile EEPROM after confirmation by the toggle key.

Example The following example shows the sequence of operator inputs via the PMU required to select operating mode "Reactive power compensation".

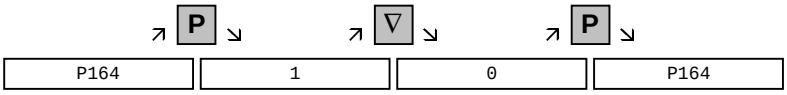
Set P052 to 5: Closed-loop control settings



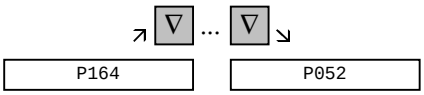
Increase number to P164: Select operating mode



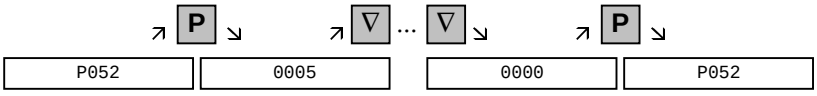
Set P164 to 0: Reactive power compensation



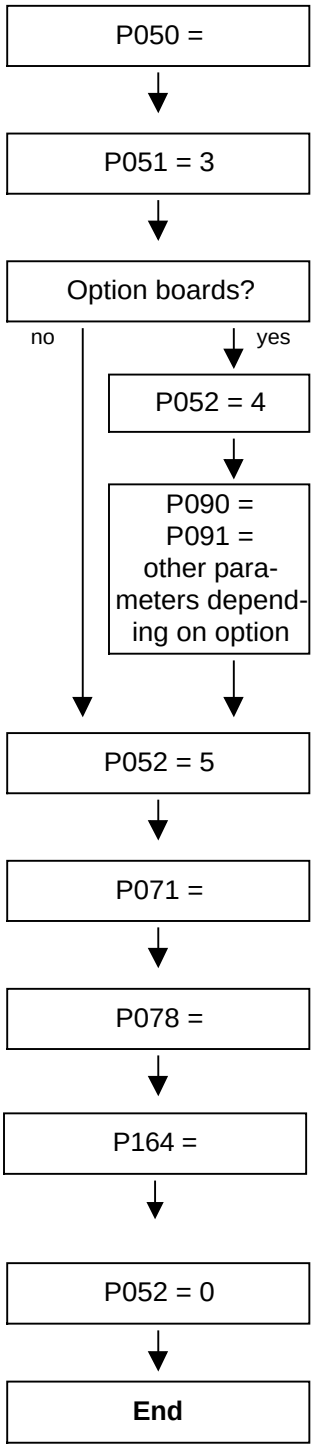
Return to P052: Function selection



Set P052 to 0: Return to previous operating state



11.2 "Start-up" parameterization



Select language:
0 = Deutsch, 1 = English, 2 = Espanol, 3 = Fracais, 4 = Italiano

Access level "Expert Mode"

Possible option boards: SCB, CB, TB, TSY

Select "Hardware Configuration"

Define and parameterize option boards:
Option boards: 0: None
1: CB
2: TB
3: SCB
4: TSY
(right-hand slot P090, centre slot P091)

Menu selection "Closed-loop control settings":
If fault "Fxxx" appears, see Section "Fault and alarm messages"

Input rated supply voltage in V

Input line frequency in Hz

Operating mode:
0: Reactive power compensation mode
1: cos(phi) mode
2: Current control
3: Regenerative partial load

Select function "Return"

11.2.1 Function selection (P052)

Start-up functions are selected via parameter **P052**. These provide start-up variants specially adapted to start-up mode.

Precondition Access stage 2 **(P051 = 2)** must be enabled and the AFE infeed must not be set to OPERATION (014).

The following functions are available:

- Return from function selection (P052 = 0)
- Factory setting (P052 = 1)
- Initialization (P052 = 2)
- Download (P052 = 3)
- Hardware configuration (P052 = 4)
- Closed-loop control setting (P052 = 5)
- Forming (P052 = 20)

The "Factory setting" and "Forming" functions are reset automatically on completion, i.e. P052 = 0 (return)!

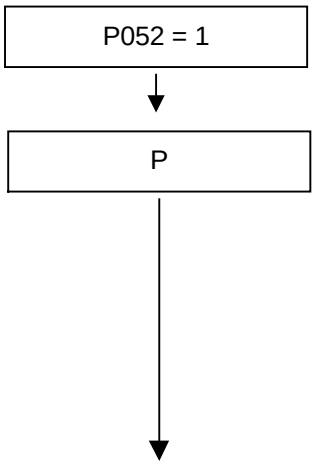
All other functions must be reset manually.

11.2.2 Factory setting (P052 = 1) (Parameter reset)

Function This function resets all parameters (see Section "Parameter List") to their factory values (supplied defaults). Please note the setting of P077!

Condition The "Factory setting" function can be selected in operating states CONTROL SETTINGS (005), FAULT (007), STARTING LOCKOUT (008) or READY FOR ON (009).

Result This function sets some converter data according to the device type (dependent on MLFB / P070).



Select factory setting (Parameter reset)

The numbers of the newly set parameters are displayed consecutively:

- **All** parameters set to factory values acc. to Parameter List (even board configuration P090/P091)
- Device data (derived from MLFB of converter (P070))
  P071 Rated supply voltage
  P072 AFE current (n)
  P078 Line frequency (n)
- Open-loop/closed-loop control parameters
  P173 Imax (maximum current)

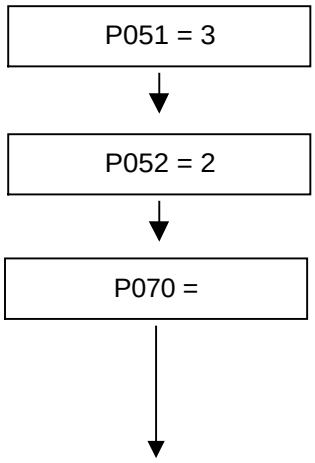
When the parameter have been set to their factory values, status display STARTING LOCKOUT (008) or READY FOR ON (009) appears.

11.2.3 Initialization (MLFB input) (P052 = 2)

Function This function is used to alter the order number (device type) of the converter.

Condition "Initialization" can be selected in operating states CONTROL SETTINGS (005), FAULT (007), STARTING LOCKOUT (008) or READY FOR ON (009).

Result When the order number is **changed,** only **some** parameters are reset to their factory values (shipped status of converter) as a function of the new order number. The process data connection remains unchanged.



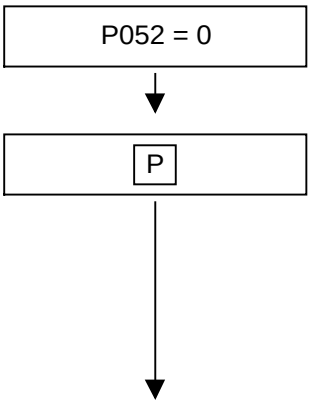
Access level "Expert Mode"
(to change P070)

Select Initialization

Specify MLFB
(= Order No. of the AFE inverter, see rating plate)
When the CU board is changed, the appropriate MLFB for the converter must be entered. When setting parameters via PMU, enter the corresponding code number (PWE) according to the table below.

Rated voltage 3 AC 380 V (-20 %) to 460 V (+5 %)			
Order number 6SE70..	**Type power** [kW]	**Rated current** [A]	**PWE**
31-0EE80	45	92	75
31-2EF80	55	124	83
31-5EF80	75	146	91
31-8EF80	90	186	99
32-1EG80	110	210	103
32-6EG80	132	260	109
33-2EG80	160	315	113
33-7EG80	200	370	117

Rated voltage 3 AC 500 V (-20 %) to 575 V (+5 %)			
Order number 6SE70..	**Type power** [kW]	**Rated current** [A]	**PWE**
26-1FE80	37	61	61
26-6FE80	45	66	63
28-0FF80	55	79	69
31-1FF80	75	108	79
31-3FG80	90	128	85
31-6FG80	110	156	95
32-0FG80	132	192	101
32-3FG80	160	225	105
Rated voltage 3 AC 660 V (-20 %) to 690 V (+5 %)			
Order number 6SE70..	**Type power** [kW]	**Rated current** [A]	**PWE**
26-0HF80	55	60	59
28-2HF80	75	82	73
31-0HG80	90	97	77
31-2HG80	110	118	81
31-5HG80	132	145	89
31-7HG80	160	171	97
32-1HG80	200	208	107



Select "Return"

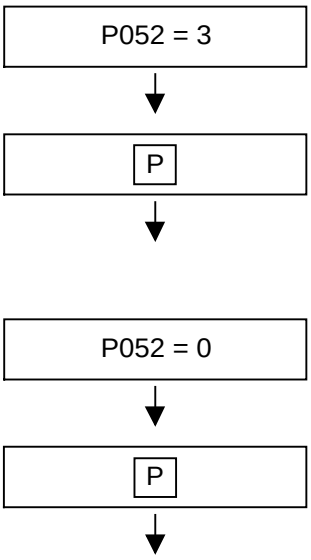
The **operating display** appears and, if the MLFB has been altered, the following parameters are set to new values:
Converter and motor data (as derived from converter MLFB (P070)) and open-loop and closed-loop control parameters ("Automatic parameterization" on all data sets analogous to selection of "Factory setting" function).
The process data connections (e.g. analog inputs/outputs) remain unchanged.

On completion of initialization, status display STARTING LOCKOUT (008) or READY FOR ON (009) appears.

11.2.4 Download (P052 = 3)

Function This function is used to read and alter parameters by means of a PC connected to the SCom1 basic converter interface.

Condition Parameters can be "downloaded" in the FAULT (007), STARTING LOCKOUT (008) or READY FOR ON (009) states.



Select "Download"

The **operating display** (021) appears.
Using a PC connected to basic converter interface SST1 and an appropriate application program (e.g. SIMOVIS), it is now possible to read and alter all parameters irrespective of the selected control mode, etc.

Select "Return"

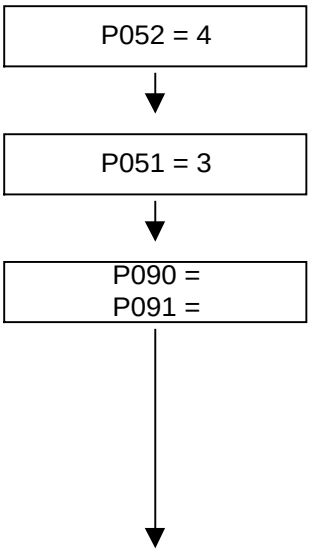
After Return, the STARTING LOCKOUT (008) or READY FOR ON (009) display appears.

11.2.5 Hardware configuration (P052 = 4)

Function The purpose of this function is to define option boards (SCB, TSY, CB, TB) installed in the electronics box of the converter.

Condition The "Hardware configuration" function can be selected in the FAULT (007), STARTING LOCKOUT (008) or READY FOR ON (009) states. The LBA bus link (Local Bus Adapter) is required additionally to install option boards in the electronics box. See Section "Interfaces".

Result All parameters which can be written in the "Hardware configuration" state ("H", see right-hand column in "Parameter List") can be altered.



Select "Hardware configuration"

Access level "Expert Mode"
(to be able to alter the following parameters)

Board in slot 2 (**RIGHT** in electronics box)
Board in slot 3 (**CENTRE** in electronics box!)

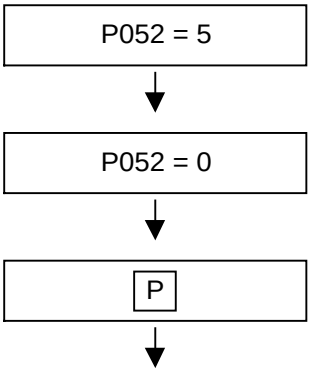
Parameter values for P090/P091:
0: No option board
1: CB Communication Board
2: TB Technology Board (P090 only)
3: SCB Serial Communication Board
4: TSY Digital Tacho and Synchronization Board

Slot in electronics box		Boards
Left	Slot 1 (CU)	CUSA
Centre	Slot 3 (options)	CB / SCB1 / SCB2 / (TSY, not with TB)
Right	Slot 2 (options)	CB / SCB1 / SCB2 / TSY / TB

NOTE

- Only one of each option board type may be inserted in the electronics box at one time.
- Technology boards (e.g. T300) must always be inserted in slot 2. The TSY board may not be inserted at the same time as a TB.
- If only one option board is in use, it must always be inserted in slot 2.

- Other parameters depending on option boards (see relevant Operating Instructions or Parameter List).
- Make selection between:



Select "Closed-loop control settings"
(see Section "Closed-loop control settings")

Select "Return"

The **operating display** (r000) appears. At the same time, parameters and internal quantities are set to new values depending on the function selection.

The hardware is initialized.
If one of the fault messages F050/F070/F080 appears, see Section "Fault and alarm messages".

On completion of the selected function, operating display STARTING LOCKOUT (008) or READY FOR ON (009) appears.

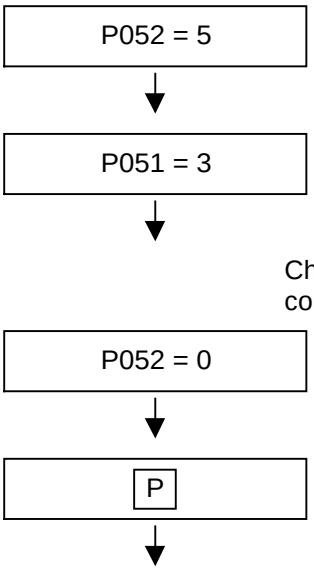
11.2.6 Closed-loop control settings (P052 = 5)

Function This function is used to alter the closed-loop control settings (AFE data).

Condition The "Closed-loop control settings" can be made in the FAULT (007), STARTING LOCKOUT (008) or READY FOR ON (009).

Result All parameters which can be written in the "Closed-loop control settings" state ("A", see right-hand column in Parameter List) can be altered by this function.

"Closed-loop control settings" is terminated by resetting the status (P052 = 0) with calculation of internal quantities.



Select "Closed-loop control settings"

Access level "Expert Mode"
(in case parameters which require Export Mode need to be altered)

Change selected parameters which can be altered in the "Closed-loop control settings" state.

Select "Return"

The **operating display** (r000) appears. At the same time, parameters and internal quantities are set to new values depending on the function selection.

On completion of the selected function, operating display STARTING LOCKOUT (008) or READY FOR ON (009) appears.

12 Parameter list

Key to parameter list

Example:

PNU ***:conf-P**	**Parameter Name in OP1** **Description**	**Range** **[Unit]** **Value Texts**	**# of Indices** **Factory Settings**	**read: _/_** **write: _/_**
P999 ***1)** 3E7Hex	**"Parameter Name in OP1"** "Description" RDS(2) parameter**6)** Type=I2; **2)** PKW: 1Hex=0.01 Hz; PZD Gr.: 0**3)**	–300.00 to 300.00 [Hz]	2 i001=50.00 i002=50.00 or: ←**7)**	2**5)**/ BR**4)** 2**5)**/ BR**4)**

1) Confirmation parameter: Does not become active until confirmation (press P key)

2) Parameter type
- O2 Unsigned 16-bit value
- I2 Signed 16-bit value
- L2 Nibble-coded quantity
- V2 Bit-coded quantity

3) Normalization group for PZD

PZD group	PZD normalization
	0 as PKW normalization
	61000Hex = P072 I(n,AFE)
	71000Hex = P071 V(n,supply)

Abbreviations: PZD Process Data; PKW Parameter Characteristic Value

4) Operating states:
- U MLFB Input (initialization)
- H Hardware Configuration
- A Control Settings
- B Ready (including Fault)
- R Run

5) Minimum access level which is needed to read or write a parameter.
- 1 Operation via PMU/OP
- 2 Standard Mode
- 3 Expert Mode

6) Abbreviations for indexed parameters
- RDS(2) Reserve data set parameter with 2 indices, switched over via control word 2, bit 18
- B/R Parameter with switchover option for basic and reserve setting in control word 2, bit 30

7) Parameter value is set to a default after initialization. Default settings are determined by the converter MLFB.

12.1 General visualization parameters

PNU *:conf-P	Parameter Name in OP1 Description	Range [Unit] Value Texts	# of Indices Factory Settings	read: _/_ write: _/_
r000	**Operation Display** Displays the operating status, fault and alarm messages See Section “Operator control" for a description		–	1 /UHABR
r001 1Hex	**Operating status** Visualization parameter indicating the current operating state of the AFE Description 0 = AFE MLFB input 1 = AFE initialization 2 = Hardware initialization 3 = Closed-loop control initialization 4 = Hardware settings (H) 5 = Closed-loop control settings (A) 7 = Fault 8 = Starting lockout 9 = Ready for ON 10 = DC-link precharging 11 = Ready to run 14 = Run 18 = Forming 21 = Downloading parameter settings .... Analog output: 100 % with code number (PWE) = 16384 Type = O2; PKW: 1HEX=1 PZD Gr.: 0	 MLFB Input Init. MLFB H/W Init System Init H/W Setting System Set. Fault ON locked Rdy ON Precharging Rdy Run Operation Capacitor forming Download	–	2 /UHABR
r004 4Hex	**Output Amps** AFE output current (fundamental r.m.s.) Note: The displayed value corresponds to the current at the inverter (CT). The line current at the AFE input deviates from this value by the current component which flows through the filter capacitor. Analog output: 100 % with code number (PWE) = 4 * P072 Type=O2; PKW: 1HEX=0.1 A PZD Gr.: 6	 [A]	–	2 / BR
r006 6Hex	**DC Bus Volts** Actual DC-link voltage value Display quantity for the PMU and OP. Analog output: 100 % with code number (PWE) = 4*P071 Type=I2; PKW: 1HEX=1 V PZD Gr.: 7	 [V]	–	2 / BR
r010 AHex	**AFE utilization** Thermal AFE utilization as a result of an I2t calculation of the output current. Loading the AFE with maximum current for • 30 seconds activates an alarm (P622) and for • 60 seconds to a reduction in the load current to 91 % of AFE rated current. Analog output: 100 % with code number (PWE) = 16384 % Type=O2; PKW: 1HEX=1 % PZD Group: 0	 [%]	–	2 / BR

PNU *:conf-P	Parameter Name in OP1 Description	Range [Unit] Value Texts	# of Indices Factory Settings	read: _/_ write: _/_
r012 CHex	**Base/Reserve** Basic/reserve settings of the process data connections for setpoints and control word bits Parameter values: 0: Basic setting 1: Reserve setting Analog output: 100 % with code number (PWE) = 16384 Type=O2; PKW: 1HEX=1 PZD Gr.: 0	 Basic Reserve	–	2 / BR
r013 DHex	**Operat. hours** Display of hours run with enabled inverter (in Run operating state). Indices: i001 = Days: Days (0...9999) i002 = Hrs.: Hours (0...24) i003 = Sec.: Seconds (0...3600) Type=O2; PKW: 1HEX=1 PZD Gr.: 0	 d h s	3	2 / BR
r030 1EHex	**Line volts** Actual line voltage (fundamental r.m.s.) Analog output: 100 % with code number (PWE) = 4 * P071 Type=O2; PKW: 1HEX=1 V PZD Gr.: 7	 [V]	–	2 / BR
r032 20Hex	**Line frequency** Actual frequency of line voltage Analog output: 100 % with code number (PWE) = 163.84 Hz Type=O2; PKW: 1HEX=0.01 Hz PZD Gr.: 0	 [Hz]	–	2 / BR

12.2 General parameters

PNU *:conf-P	Parameter Name in OP1 Description	Range [Unit] Value Texts	# of Indices Factory Settings	read: _/_ write: _/_
P050 * 32Hex	**Language** Plain text display language on the optional OP operator panel and in the SIMOVIS PC program Parameter values: 0: German 1: English 2: Spanish 3: French 4: Italian Type=O2; PKW: 1HEX=1 PZD Gr.: -	0 to 5 Deutsch English Espanol Francais Italiano	– 0	2 /UHABR 2 /UHABR
P051 * 33Hex	**Access Level** Access level setting; the higher the access level, the more parameters can be accessed for reading and writing. Parameter values: 1: Operation via PMU/ OP 2: Standard mode 3: Expert mode Type=O2; PKW: 1HEX=1 PZD Gr.: -	1 to 3 Operation Standard Expert	– 2	1 /UHABR 1 /UHABR
P052 * 34Hex	**Function Select** Selection of various commissioning steps and special functions. Parameter values: 0 = Return to the previously active drive status from one of the functions described below. 1 = Parameter Reset: All parameters are reset to their original settings (factory settings). According to the Profibus profile for variable speed drives this function is also accessible via parameter P970. On completion of this function, the parameter is automatically reset to 0. 2 = Enable MLFB setting mode (switch to MLFB Input operating status). The function can be deselected only by resetting the parameter to 0 (Return). 3 = Download/upread (switch to Download operating status). The function can be deselected only by resetting the parameter to 0 (Return). 4 = Hardware configuration (switch to Hardware Settings operating status). The function can be deselected only by resetting the parameter to 0 (Return). 5 = Closed-loop control settings (switch to Closed-Loop Control Settings operating status to parameterize plant data). The parameter must be reset to 0 (Return) to exit the function without modifying parameters internally. 20 = Forming Type=O2; PKW: 1HEX=1 PZD Gr.: -	0 to 20 Return Par. Reset Set MLFB Download H/W Setting Drive Setting Capacitor forming	– 0	2 /UHABR 2 /UHAB

PNU *:conf-P	Parameter Name in OP1 Description	Range [Unit] Value Texts	# of Indices Factory Settings	read: _/_ write: _/_
P053 * 35Hex	**Parameter access** Release of interfaces for parameterization. This parameter can always be written at any time from any interface. Parameter values: 0: None 1: COM BOARD (CB) 2: BASE KEYPAD (PMU) 4: BASE SERIAL (SST1) (SST1 and OP) 8: Serial I/O (SCB with USS) (SCB) 16: TECH BOARD (TB) Setting instructions: • Every interface is numerically coded. • Entering the number or the product of several different numbers assigned to different interfaces releases the relevant interface(s) for utilization as a parameterizing interface. Example: A factory setting of 6 indicates that interfaces BASE KEYPAD (PMU) and BASE SERIAL (SST1) are released as parameterizing interfaces. Type=O2; PKW: 1HEX=1.0 PZD Gr.: -	0 to 31	– 6	1 /UHABR 1 /UHABR
P054 36Hex	**OP Backlight** Backlighting for operator panel Parameter values: 0 = Panel is always backlit 1 = Panel is only backlit when in use Type=O2; PKW: 1HEX=1 PZD Gr.: -	0 to 1	– 0	3 / BR 3 / BR

12.3 Drive data

PNU *:conf-P	Parameter Name in OP1 Description	Range [Unit] Value Texts	# of Indices Factory Settings	read: _/_ write: _/_
P070 * 46Hex	**MLFB(6SE70..)** MLFB (order number) of basic unit For parameter values, see Section "Initialization" Type=O2; PKW: 1HEX=1 PZD Gr.: -	0 to 255	– 0	3 /U BR 3 /U
P071 47Hex	**Line volts** Line supply voltage for AFE (r.m.s. of line-to-line voltage) This parameter specifies the incoming AC supply voltage. It is used to calculate the setpoint DC link voltage (P125) and the thresholds for fault messages "Line supply overvoltage", "Line supply undervoltage" (P074) and "DC link undervoltage". Type=O2; PKW: 1HEX=1 V PZD Gr.: 0	90 to 1320 [V]	– ←	2 / ABR 2 / A
P072 48Hex	**AFE current(n)** AFE rated output current Type=O2; PKW: 1HEX=0.1 A PZD Gr.: 0	4.0 to 6540.0 [A]	– ←	2 /U ABR 4 /U
P074 4AHex	**Undervoltage threshold** Response threshold for shutdown on line undervoltage. The line supply voltage (P071) is the reference quantity. Note: P155: Maximum power failure time Type=O2; PKW: 1HEX=1 % PZD Gr.: –	6 to 100 [%]	– 65	2 / BR 2 / BR
P077 * 4DHex	**FactSettingType** Selective factory setting This parameter can be changed in the "MLFB Input" state (P052). If no MLFB has yet been entered, the selected factory setting type becomes effective immediately an MLFB number is entered and "MLFB Input" deselected (P052=0). It is possible to activate a specific factory setting by selecting "Par. Reset" (P052 = 1 or P970 = 0). This action does not, however, change the setting in P077. Parameter values: 0: Current factory setting remains valid. 1: AFE with OP: ⇒not currently implemented 2: AFE cabinet unit with terminal strip: This setting initializes the following parameters to values other than zero: P554, P566, P603 3: Current factory setting remains valid. 3: AFE cabinet unit with OP: ⇒not currently implemented Type:O2; PKW: 1HEX=1 PZD Gr.: -	0 to 4	– 0	3 /U BR 3 /U
P078 4EHex	**Line frequency** Frequency of incoming AC supply Type=O2; PKW: 1HEX=1 Hz PZD Gr.: –	50 to 60 [Hz]	– 50	2 / ABR 2 / A
P080 50Hex	**Line filter C/mF** Capacitance of the filter capacitors of one phase of the AFE line filter in mF for a "star circuit configuration". If the line filter capacitors are connected in a “delta configuration”, then 300% of the value must be parameterized. Type=O2; PKW: 1HEX=0.001 PZD Gr.: 0	0.000 to 10.000	– 0.000	3 / BR 3 / BR

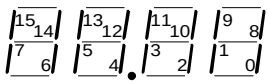
PNU *:conf-P	Parameter Name in OP1 Description	Range [Unit] Value Texts	# of Indices Factory Settings	read: _/_ write: _/_
P081 51Hex	**Line filter L/mH** Inductance L of AFE filter reactor in mH. Type=O2; PKW: 1HEX=0.001 PZD Gr.: 0	0.000 to 20.000	– ←	3 / BR 3 / BR
r082 52Hex	**Line filter L/%** Inductance L of AFE filter reactor in % (calculated from P081). Analog output: 100 % with code number (PWE) = 1638.4 % Type=O2; PKW: 1HEX=0.1 % PZD Gr.: 0	[%]	–	3 / BR
P083 53Hex	**R precharging** Precharging resistance in ohms. Type=O2; PKW: 1HEX=0.1 Ohm PZD Gr.: 0	0.0 to 1000.0 [ohms]	– 0.0	3 / BR 3 / B
r089 59Hex	**Board Position 1** Board in slot 1 (left) in electronics box Parameter values: 0 = None (formal setting only) 6 = CUSA board for AFE Analog output: 100 % with code number (PWE) = 16384 Type=O2; PKW: 1HEX=1 PZD Gr.: 0	 None AFE	–	3 / H BR

12.4 Hardware configuration

PNU *:conf-P	Parameter Name in OP1 Description	Range [Unit] Value Texts	# of Indices Factory Settings	read: _/_ write: _/_
P090 * 5AHex	**Board Position 2** PCB in slot #2 (right) of the electronics box Parameter values: 0 = No option board 1 = Communication Board (CB) 2 = Technology Board (TB) 3 = Serial Communication Board (SCB) 4 = Digital Tacho and Synchronization Board (TSY) Setting instruction: The following are the only permissible board/slot combinations: Slot 3 (P091) Slot 2 (P090) - CB - TB - SCB - TSY SCB CB CB TB SCB TB CB SCB CB TSY TSY CB SCB TSY TSY SCB Type=O2; PKW: 1HEX=1.0 PZD Gr.: -	0 to 4 None CB TB SCB TSY	– 0	3 / H BR 3 / H
P091 * 5BHex	**Board Position 3** Board in slot 3 (centre) in electronics box For description, see P090 (board position 2). Type=O2; PKW: 1HEX=1.0 PZD Gr.: -	0 to 4	– 0	3 / H BR 3 / H

12.5 Closed-loop control

PNU *:conf-P	Parameter Name in OP1 Description	Range [Unit] Value Texts	# of Indices Factory Settings	read: _/_ write: _/_
P120 78Hex	**CosPhi set** Power factor cos(PHI) setpoint. Parameter values: 0.800 ... 1.000 ⇒ inductive -0.800 ... -1.000 ⇒ capacitive RDS(2) parameter Type=I2; PKW: 1HEX=0.001 PZD Gr.: 4000HEX=4	–1.000 to 1.000	2 i001=1.000 i002=1.000	3 / BR 3 / BR
P122 7AHex	**React. pow.(set)** Reactive power setpoint for “reactive power compensation” mode (P164 = 0). Parameter values: Reactive power setpoint < 0 ⇒ inductive Reactive power setpoint > 0⇒ capacitive RDS(2) parameter Type=I2; PKW: 1HEX=0.1 % PZD Gr.: 4000HEX = 400%	–140.0 to 140.0 [%]	2 i001=0.0 i002=0.0	3 / BR 3 / BR
r123 7BHex	**Reactive power/kVAr** Reactive power setpoint in kVAr calculated from P122 (for the line supply voltage P071) for “reactive power compensation” mode (P164 = 0) Analog output: 100 % with code number (PWE) = 1638.4 kVA Type=I2; PKW: 1HEX=0.1 kVA PZD Gr.: 0	[kVAr]	–	3 / BR
P124 7CHex	**Sm.react.pow.** Smoothing time constant for reactive power setpoint specified in P122. RDS(2) parameter Type=O2; PKW: 1HEX=1 ms PZD Gr.: 0	0 to 900 [ms]	2 i001=50 i002=50	3 / BR 3 / BR
P125 7DHex	**Vd(set) factor** Factor for the fixed setpoint of the DC link voltage. The line supply voltage (P071) is the reference quantity. Visualization parameters: r126: Vd fixed setpoint r447: Vd setpoint of setpoint node (P443) r139: Vd setpoint Type=O2; PKW: 1HEX=0.01 PZD Gr.: –	1.42 to 1.90	– 1.58	3 / BR 3 / BR
r126 7EHex	**Vd (set, par)** Fixed setpoint for the DC link voltage setpoint V (calculated from P125) Note: Settable via P125 Vd(set) factor Analog output: 100 % with code number (PWE) = 4 x P071 Type=O2; PKW: 1HEX=1 V PZD Gr.: 7	[V]	–	3 / BR
P129 81Hex	**Vd reg. Kp** Gain of DC-link voltage (Vd) controller RDS(2) parameter Type=O2; PKW: 1HEX=0.1 PZD Gr.: 0	0.0 to 31.9	2 i001=2.0 i002=2.0	3 / BR 3 / BR
P130 82Hex	**Vd reg. Kp dyn** Dynamic gain of DC-link voltage (Vd) controller RDS(2) parameter Type=O2; PKW: 1HEX=0.1 PZD Gr.: 0	0.0 to 31.9	2 i001=10.0 i002=10.0	3 / BR 3 / BR

PNU *:conf-P	Parameter Name in OP1 Description	Range [Unit] Value Texts	# of Indices Factory Settings	read: _/_ write: _/_
P131 83Hex	**Vd regulator Ti** Integration time constant of the DC-link voltage (Vd) controller RDS(2) parameter Type=O2; PKW: 1HEX=0.1 ms PZD Gr.: 0	0.5 to 100.0 [ms]	2 i001=20.0 i002=20.0	3 / BR 3 / BR
r139 8BHex	**Ud (set)** Setpoint of DC-link voltage in V Note: The Vd setpoint (r139) can be higher than the set Vd setpoint (r447). For a high line supply voltage and/or a high capacitive reactive current, the DC link voltage is automatically increased so that a minimum modulation reserve is maintained. Analog output: 100 % with code number (PWE) = 4 x P071 Type=O2; PKW: 1HEX=1 V PZD Gr.: 7	[V]	–	3 / BR
r150 96Hex	**Control status** Status word of the closed-loop control Parameter values: Bit00 = 1: Initialization of closed-loop control complete Bit01 = 1: Ext. 24V power supply faulted Bit02 = Reserved Bit03 = 1: Precharging completed Bit04 = 1: Active current >= 0 (motoring, rectifier operation) Bit05 = 1: Reactive current >= 0 (capacitive) Bit06 = 1: Active current at limit Bit07 = 1: Reactive current at limit Bit08 = 1: Absolute current value at limit (r174) Bit09 = 1: Smoothed line supply voltage < 80 % of P071 Bit10 = 1: Smoothed line supply voltage > 105 or 110 % of P071 Bit11 = 1: Control factor at limit Bit12 = 1 Ud2t integrator increasing Bit13 = 1 DC link voltage < 90% of setpoint Bit14 = 1 DC link voltage > 110% of setpoint Bit15 = 1 Smoothed line supply voltage < P074 Coding of bits on the PMU:  Type=V2; PKW: 1HEX=1 PZD Gr.: 0		–	3 / BR
r152 98Hex	**Active RDS** Active reserve data set of the AFE Analog output: 100 % with code number (PWE) = 16384 Type=O2; PKW: 1HEX=1 PZD Gr.: 0		–	2 / ABR

PNU *:conf-P	Parameter Name in OP1 Description	Range [Unit] Value Texts	# of Indices Factory Settings	read: _/_ write: _/_
P155 9BHex	**max. t. pow.fail** Maximum time until the power failure fault (F009) or line supply undervoltage fault (F004) is output. If the unsmoothed line supply voltage falls below the threshold parameterized in P074, the inverter firing pulses are inhibited. The main contactor remains closed. If the line supply voltage does not increase above the minimum threshold (P074) within the maximum time for a power failure, the power failure fault F009 is output and the main contactor is opened (de-energized). If the smoothed line supply voltage falls below the threshold parameterized in P074, fault message F004 "line supply undervoltage" is output. Type=O2; PKW: 1HEX=1 s ZD-Gr.: 0	0 to 3000 [ms]	– 100	3 / BR 3 / BR
P160 A0Hex	**I start(mot,max)** Maximum current limit for motor operation. The line current is limited by this parameter. RDS(2) parameter Type=I2; PKW: 1HEX=0.1 % PZD: 4000HEX = 400 %	0.0 to 150.0 [%]	2 i001=150.0 i002=150.0	3 / ABR 3 / A
P161 A1Hex	**I start(gen,max)** Maximum regenerative current limit. The regenerative feedback current is limited to the value set here..0 RDS(2) parameter Type=I2; PKW: 1HEX=0.1 % PZD: 4000HEX = 400 %	–150.0 to 0.0 [%]	2 i001=-150.0 i002=-150.0	3 / ABR 3 / A
P164 A4Hex	**Operating mode** Selection of the operating mode Parameter values: 0: Operating mode “reactive power compensation” The setpoint for the reactive power can be set via P122. 1: Operating mode "cos(PHI)" The setpoint for the cos(PHI) can be set via P120. 2: Operating mode "closed-loop current control" The source of the current setpoint must be entered via P486. 3: Regenerative partial load RDS(2) parameter Type=O2; PKW: 1HEX=1 PZD Gr.: –	0 to 2	2 i001=1 i002=1	3 / ABR 3 / A

PNU *:conf-P	Parameter Name in OP1 Description	Range [Unit] Value Texts	# of Indices Factory Settings	read: _/_ write: _/_
P173 ADHex	**Imax** Maximum current (fundamental r.m.s.) Setpoint for current limitation (Imax controller) to protect the AFE. Maximum 1.36 x conv.current(n) (P072). Visualization parameters: r174: Actually applied maximum current setpoint (taking derating into account) Note: The maximum current set here must always be so high so that the AFE can handle the power demanded by the drive. If the drive demands more current than the maximum current set here, the AFE shuts down with the “overload” fault (F013). RDS(2) parameter Type=O2; PKW: 1HEX=1 A PZD Gr.: 6	1 to 30000 [A]	2 i001=← i002=←	3 / BR 3 / BR
r174 AEHex	**Imax(set)** Maximum current (setpoint applied) Setpoint applied for current limiting (Imax controller); takes into account the effect of the I²t calculation Note: P173 (parameterized maximum current setpoint) Analog output: 100 % with code number (PWE) = 40 x P072 Type=O2; PKW: 1HEX=1 A PZD Gr.: 6	[A]	–	3 / BR
r179 B3Hex	**Output Amps (rms)** Output current (fundamental rms) (fast actual value for automation purposes) Analog output: 100 % with code number (PWE) = 4*P072 Type=O2; PKW: 1HEX=0.1 A PZD Gr.: 6	[A]	–	3 / BR
r255 FFHex	**I (reactive,set)** Reactive current component setpoint. Limited by the maximum current (r174) and the active current setpoint (r263). Analog output: 100 % with code number (PWE) = 4 x P072 Type=I2; PKW: 1HEX=0.1 A PZD Gr.: 6	[A]	–	3 / BR
r256 100Hex	**I (reactive,act)** Actual value of reactive current component Analog output: 100 % with code number (PWE) = 4 x P072 Type=I2; PKW: 1HEX=0.1 A PZD Gr.: 6	[A]	–	3 / BR
r263 107Hex	**I (active,set)** Setpoint of active current component. Limited by the maximum current (r174). Analog output: 100 % with code number (PWE) = 4 x P072 Type=I2; PKW: 1HEX=0.1 A PZD Gr.: 6	[A]	–	3 / BR
r264 108Hex	**I (active,act)** Actual value of active current component Analog output: 100 % with code number (PWE) = 4 x P072 Type=I2; PKW: 1HEX=0.1 A PZD Gr.: 6	[A]	–	3 / BR

PNU *:conf-P	Parameter Name in OP1 Description	Range [Unit] Value Texts	# of Indices Factory Settings	read: _/_ write: _/_
r303 12FHex	**Vd(act)** Actual unsmoothed DC-link voltage value Analog output: 100 % with code number (PWE) = 4 x P071 Type=I2; PKW: 1HEX=1 V PZD Gr.: 7	[V]	–	3 / BR
P308 134Hex	**Sampling Time** Basic sampling time T0. Setting instructions: • When the sampling time is reduced, the available computing time should be checked via parameter r725 in the "Run" state. At least 5 % of the available computing time should always be left in reserve to avoid any delayed (slow) execution of operator inputs. • If fault F042 "Computing time" occurs, the sampling time setting must be increased again. Type=O2; PKW: 1HEX=0.1 ms PZD Gr.: –	0.8 to 4.0 [ms]	– 1.5	3 / ABR 3 / A
P325 145Hex	**MC switch-on del** Delay time for closing (energizing) the main contactor. By delaying energization of the main contactor, it is possible to charge the DC link up to the line voltage peak value via the precharging resistors. This measure will be necessary if the external DC-link capacitance connected to the AFE is significantly higher than that of the AFE. Type=O2; PKW: 1HEX=0.1 s PZD Gr.: –	0.0 to 30.0 [s]	– 0.0	3 / BR 3 / B
P326 146Hex	**Max.pre-chrg. t.** Maximum precharging time If the DC link is not successfully precharged within this period, fault message Precharging (F002) or, if the line voltage is too low, fault message Line Voltage (F004) is activated. RDS(2) parameter Type=O2; PKW: 1HEX=0.1 s PZD Gr.: 0	0.1 to 30.0 [s]	2 i001=3.0 i002=3.0	3 / BR 3 / B
P329 149Hex	**MCInvEnableDel** Delay between activation of the main contactor and enabling of the inverter. By increasing this time, it is possible to ensure that the DC link is charged up completely to the peak value of the mains voltage. This is necessary if the external DC link capacity connected to the AFE is considerably greater than that of the AFE. The set time should always be at least 100 ms greater than the time that the main contactor needs to close the contacts. Type=O2; PKW: 1HEX=0.o1 s PZD-Gr.: –	0.08 to 5.00 [s]	– 0.40	4 / BR 4 / BR

12.6 Functions

PNU *:conf-P	Parameter Name in OP1 Description	Range [Unit] Value Texts	# of Indices Factory Settings	read: _/_ write: _/_
P366 16EHex	**Auto Restart** Automatic restart (WEA) after power failure Parameter values: 0 = Inhibited 1 = Power failure acknowledgement only after power recovery 2 = AFE is restarted after power recovery CAUTION: External safety devices must be provided to ensure that the AFE does not start accidentally when P366 = 2! RDS(2) parameter Type=O2; PKW: 1HEX=1 PZD Gr.: -	0 to 2	2 i001=0 i002=0	3 / BR 3 / BR
P387 183Hex	**Vd minimum** Response threshold for shutdown DC-link undervoltage in closed-loop current control mode (P164 = 2). The line supply voltage is the reference quantity (P071). Type=O2; PKW: 1HEX=1 % PZD Gr.: –	5 to 140 [%]	– 100	3 / BR 3 / BR
P408 198Hex	**Forming time** DC link forming time This parameter defines the forming period for the DC link when P052=20. RDS parameter Type=O2; PKW: 1HEX=0.1 min PZD Gr.: 0	1.0 to 600.0 [min]	2 i001=10.0 i002=10.0	2 / ABR 2 / AB
P409 199Hex	**Line contac. del.** Delay time for commencement of precharging process. This parameter can be used to implement a time-graded sequence for starting up a number of drive units. Type=O2; PKW: 1HEX=0.1 s PZD Gr.: –	0.0 to 6.5 [s]	– 0.0	3 / BR 3 / B

12.7 Setpoint channel

PNU *:conf-P	Parameter Name in OP1 Description	Range [Unit] Value Texts	# of Indices Factory Settings	read: _/_ write: _/_
P443 * 1BBHex	**Src. Ud (set)** Source for the DC-link voltage setpoint. Parameter values: 1001: Fixed setpoint Other values: Acc. to process data connections of setpoint channel. B/R parameter Type=L2; PKW format(HEX)=param.value PZD Gr.: 0	0 to 4545	2 i001=1001 i002=1001	3 / BR 3 / BR
P444 1BCHex	**Vd (set) Kp** Gain for the DC-link voltage setpoint. B/R parameter Type=I2; PKW: 1HEX=0.1 % PZD: 4000HEX = 400 %	0.0 to 300.0 [%]	2 i001=100.0 i002=100.0	3 / BR 3 / BR
r447 1BFHex	**Vd (set,source)** Setpoint of DC-link voltage from setpoint nodes. The Vd setpoint is always limited to sensible values so as to prevent shutdown on faults as a result of impermissibly high setpoints. Minimum value: Peak value of line voltage = 1.42 x r030 Maximum value: 2x rated line voltage = 2 x P071 Analog output: 100 % with code number (PWE) = 4*P071 Type=O2; PKW: 1HEX=1 V PZD Gr.: 7	[V]	–	3 / BR
P486 * 1E6Hex	**Src.curr.setp.** Source for the setpoint of the active (line) current The parameterized active current setpoint is effective only in "Closed-loop current control" (P164 = 2) or "Slave AFE" modes (CW2, bit 27). Parameter values acc. to process data connections of setpoint channel. B/R parameter Type=L2; PKW format(HEX)=param. value PZD Gr.: 0	0 to 4545	2 i001=0 i002=0	3 / BR 3 / BR
P487 1E7Hex	**Curr.setp. Kp** Gain for the setpoint of the active (line) current in "Closed-loop current control" (P164 = 2) or "Slave AFE" modes (CW2, bit 27). B/R parameter Type=I2; PKW: 1HEX=0.1 % PZD: 4000HEX = 400 %	–300.0 to 300.0 [%]	2 i001=100.0 i002=100.0	3 / BR 3 / BR
r490 1EAHex	**Curr.setp.** Active (line) current setpoint in "Closed-loop current control" (P164 = 2) or "Slave AFE" modes (CW2, bit 27). Analog output: 100 % with code number (PWE) = 400 % Type=I2; PKW: 1HEX=0.1 % PZD: 4000HEX = 400 %	[A]	–	3 / BR

PNU *:conf-P	Parameter Name in OP1 Description	Range [Unit] Value Texts	# of Indices Factory Settings	read: _/_ write: _/_
P517 205Hex	**SetActValDev.Ud** Setpoint/actual value deviation in DC-link voltage Vd In the case of a large deviation between Vd setpoint and actual value, message "Setpoint actual value deviation" (status word 1, bits 8 (r552) is activated. Cf. P518 Minimum time of setpoint/actual value deviation Ref. quantity: Vd(set) (r126) RDS(2) parameter Type=O2; PKW: 1HEX=0.01 % PZD Gr.: 0	0.00 to 100.00 [%]	2 i001=2.00 i002=2.00	3 / BR 3 / B
P518 206Hex	**Deviation Time** Minimum time for setpoint/actual value deviation When there is a deviation between the setpoint/actual value (P517), the message "Setpoint/actual value deviation" (status word 1 bit 8 (r552)) is output when the time in P518 runs out. RDS(2) parameter Type=O2; PKW: 1HEX=0.01 s PZD Gr.: 0	0.0 to 10.00 [s]	2 i001=0.10 i002=0.10	3 / BR 3 / B

12.8 Control and status bit connections

PNU *:conf-P	Parameter Name in OP1 Description	Range [Unit] Value Texts	# of Indices Factory Settings	read: _/_ write: _/_
r550 226Hex	**Control Word 1** Display of control word 1, bits 0 to 15 (see Section "Control word"). Type=V2; PKW: 1HEX=1 PZD Gr.: 0		–	2 / BR
r551 227Hex	**Control Word 2** Display of control word 2, bits16 to 31 (see Section "Control word"). Type=V2; PKW: 1HEX=1 PZD Gr.: 0		–	2 / BR
r552 228Hex	**Status Word 1** Display of status word 1, bits 0 to 15 (see Section "Control word"). Type=V2; PKW: 1HEX=1 PZD Gr.: 0		–	2 / BR
r553 229Hex	**Status Word 2** Display of status word 2, bits 16 to 31 (see Section "Control word"). Type=V2; PKW: 1HEX=1 PZD Gr.: 0		–	2 / BR
P554 * 22AHex	**Src ON/OFF1** Source for ON/OFF1 command (control word 1, bit 0) See Section "Control word" for details Parameter values: 0: OFF1 1: Illegal setting 1001: Digital input 1 CUSA 1003: Digital input 3 CUSA 1010: ON/OFF keys PMU 2001: SST1, word 1,bit 0 Other values: See permissible settings in Section "Control word" (process data connections of control word) Note: A value of 4101 or 4201 is recommended in conjunction with the inputs of the serial IO system. B/R parameter Type=L2; PKW: PKW format(HEX)=param. value PZD Gr.: 0	0 to 5001	2 i001=1010 i002=1001	2 / BR 2 / BR
P555 * 22BHex	**Src1 OFF2(coast)** Source 1 of the OFF2 control command (control word 1, bit 1) See Section "Control word" for details Parameter values: 0: Illegal setting 1: Operating condition 1002: Digital input 2 CUSA Other values: See permissible settings in Section "Control word" (process data connections of control word) B/R parameter Type=L2; PKW: PKW format(HEX)=param. value PZD Gr.: 0	1 to 5001	2 i001=1 i002=1002	2 / BR 2 / BR
P556 * 22CHex	**Src2 OFF2 (coast)** Source 2 of the OFF2 control command (control word 1, bit 1) See P555 for description B/R parameter Type=L2; PKW: PKW format(HEX)=param. value PZD Gr.: 0	1 to 5001	2 i001=1 i002=1	2 / BR 2 / BR

PNU *:conf-P	Parameter Name in OP1 Description	Range [Unit] Value Texts	# of Indices Factory Settings	read: _/_ write: _/_
P557 * 22DHex	**Src3 OFF2 (coast)** Source 3 of the OFF2 control command (control word 1, bit 1) See P555 for description B/R parameter Type=L2; PKW: PKW format(HEX)=param.value PZD Gr.: 0	1 to 5001	2 i001=1 i002=1	2 / BR 2 / BR
P561 * 231Hex	**Src InvRelease** Source for the inverter enable command (control word 1, bit 3) See Section "Control word" for details Parameter values: 0: Disable inverter 1: Automatically when delay timers run down Other values: See permissible settings in Section "Control word" (process data connections of control word) B/R parameter Type=L2; PKW: PKW format(HEX)=param.value PZD Gr.: 0	0 to 5001	2 i001=1 i002=1	3 / BR 3 / BR
P565 * 235Hex	**Src1 Fault Reset** Source 1 of "Acknowledge" control command (control word 1, bit 7) See Section "Control word" for details Parameter values: 0: No source selected 1: Illegal setting 1003: Digital input 3 on CUSA Other values: See permissible settings in Section "Control word" (process data connections of control word) Note: The "Acknowledge" control command is edge-triggered. B/R parameter Type=L2; PKW: PKW format(HEX)=param.value PZD Gr.: 0	0 to 5001	2 i001=0 i002=1003	2 / BR 2 / BR
P566 * 236Hex	**Src2 Fault Reset** Source 2 of "Acknowledge" control command (control word 1, bit 7) See P565 for description B/R parameter Type=L2; PKW: PKW format(HEX)=param.value PZD Gr.: 0	0 to 5001	2 i001=0 i002=0	2 / BR 2 / BR
P567 * 237Hex	**Src3 Fault Reset** Source 3 of "Acknowledge" control command (control word 1, bit 7) See P565 for description B/R parameter Type=L2; PKW: PKW format(HEX)=param.value PZD Gr.: 0	0 to 5001	2 i001=2001 i002=2001	2 / BR 2 / BR
P568 * 238Hex	**Src Jog1 ON** Source for the Inching 1 setpoint (control word 1, bit 8) See Section "Control word" for details Parameter values: 0: No inching 1: Illegal setting 2001: SST1, word 1 bit 8 Other values: See permissible settings in Section "Control word" (process data connections of control word) B/R parameter Type=L2; PKW: PKW format(HEX)=param.value PZD Gr.: 0	0 to 5001	2 i001=0 i002=0	2 / BR 2 / BR

PNU *:conf-P	Parameter Name in OP1 Description	Range [Unit] Value Texts	# of Indices Factory Settings	read: _/_ write: _/_
P569 * 239Hex	**Src Jog2 ON** Source for the Inching 2 setpoint (control word 1, bit 8) See Section "Control word" for details Parameter values: 0: No inching 1: Illegal setting 2001: SST1, word 1, bit 8 Other values: See permissible settings in Section "Control word" (process data connections of control word) B/R parameter Type=L2; PKW format(HEX)=param.value PZD Gr.: 0	0 to 5001	2 i001=0 i002=0	2 / BR 2 / BR
P572 * 23CHex	**Src.regen.enable** Source for control command "Regenerative feedback enabled" (control word 1, bit 12) Parameter values: 0: Regenerative feedback disabled 1: Regenerative feedback enabled 2001: SST1, word 1, bit 8 Other values: See permissible settings in Section "Control word" (process data connections of control word) B/R parameter Type=L2; PKW format(HEX)=param.value PZD Gr.: 0	0 to 5001	2 i001=1 i002=1	2 / BR 2 / BR
P575 * 23FHex	**Src No Ext Fault1** Source for control command "External fault 1" (control word 1, bit 15) An L signal causes the drive to shut down on faults. Parameter values: 0: Illegal setting 1: No fault 1001: CUSA digital input 1 Other values: See permissible settings in Section "Control word" (process data connections of control word) B/R parameter Type=L2; PKW: PKW format(HEX)=param.value PZD Gr.: 0	1 to 5001	2 i001=1 i002=1	2 / BR 2 / BR
P576 * 240Hex	**Src. ext. 24V ok** Source for the bit for monitoring the external 24 V power supply. This bit is connected to digital input 4 on the CUSA at the factory. Parameter values: 0: Ext. 24V not o.k. 1: Ext. 24V o.k. 1001: CUSA digital input 1 Other values: See permissible settings in Section "Control word" (process data connections of control word) B/R parameter Type=L2;PKW format(HEX)=param.value PZD Gr.: 0	0 to 5001	2 i001=1004 i002=1004	3 / BR 3 / BR

PNU *:conf-P	Parameter Name in OP1 Description	Range [Unit] Value Texts	# of Indices Factory Settings	read: _/_ write: _/_
P578 * 242Hex	**Src. RDS bit 0** Source for bit 0 for selection of reserve data set (RDS) (control word 2, bit 18) Parameter values: 0: RDS bit 0 has a value of 0 1: RDS bit 0 has a value of 1 Other values: See permissible settings in Section "Control word" (process data connections of control word) Note: The reserve data set cannot be altered in Run mode. Any change to the bit setting will not take effect until the "Ready" state is reached. B/R parameter Type=L2; PKW: PKW format(HEX)=param. value PZD Gr.: 0	0 to 5001	2 i001=0 i002=0	3 / BR 3 / BR
P586 * 24AHex	**Src No ExtFault2** Source for control command "External fault 2" (control word 2, bit 26) An L signal causes the device to shut down on faults if: • the DC link has been precharged (operating state > 10) and • the 200 ms delay timer after precharging has run down Parameter values: 0: Illegal setting 1: No fault 1004: CUSA digital input 4 Other values: See permissible settings in Section "Control word" (process data connections of control word) B/R parameter Type=L2;PKW format(HEX)=param.value PZD Gr.: 0	1 to 5001	2 i001=1 i002=1	2 / BR 2 / BR
P587 * 24BHex	**Src.slave AFE** Source for "Master/slave AFE" switchover (control word 2, bit 27) Parameter values: 0: Master AFE (int. current setpoint) 1: Slave AFE (ext. current setpoint) 1002: CUSA digital input 2 Other values: See permissible settings in Section "Control word" (process data connections of control word) B/R parameter Type=L2; PKW: PKW format(HEX)=param.value PZD Gr.: 0	0 to 5001	2 i001=0 i002=0	3 / BR 3 / BR
P588 * 24CHex	**Src No Ext Warn1** Source for control command "External alarm 1" (control word 2, bit 28) Parameter values: 0: Illegal setting 1: No alarm 1002: CUSA digital input 2 Other values: See permissible settings in Section "Control word" (process data connections of control word) B/R parameter Type=L2; PKW: PKW format(HEX)=param.value PZD Gr.: 0	1 to 5001	2 i001=1 i002=1	3 / BR 3 / BR

PNU *:conf-P	Parameter Name in OP1 Description	Range [Unit] Value Texts	# of Indices Factory Settings	read: _/_ write: _/_
P589 * 24DHex	**Src No Ext Warn2** Source for control command "External alarm 2" (control word 2, bit 29) Parameter values: 0: Illegal setting 1: No alarm Other values: See permissible settings in Section "Control word" (process data connections of control word) B/R parameter Type=L2; PKW: PKW format(HEX)=param. value PZD Gr.: 0	1 to 5001	2 i001=1 i002=1	3 / BR 3 / BR
P590 * 24EHex	**Src Base/Reserve** Source for basic / reserve setting switchover command (control word 2, bit 30) Parameter values: 0: Basic setting 1: Reserve setting 1005: CUSA digital input 5 Other values: See permissible settings in Section "Control word" (process data connections of control word) Type=L2; PKW: PKW format(HEX)=param.value PZD Gr.: 0	0 to 5001	– 1005	3 / BR 3 / BR
P600 * 258Hex	**Dst Ready for ON** Destination of the status bit 'Ready for ON' (status word 1, bit 0) Power is ON, the drive can be switched on. Parameter values: Depending on the selected index, all settings specified in Section "Status word" (process data connections of status word) may be parameterized. Indices: i001: GG: Select a terminal on the basic unit i002: SCI: Select a terminal on SCI1/2 i003: TSY: Select a terminal on TSY Type=L2; PKW: PKW format(HEX)=param.value PZD Gr.: 0	0 to 5002	3 i001=0 i002=0 i003=0	3 / BR 3 / BR
P601 * 259Hex	**Dst Rdy for Oper** Destination of status bit "Ready to Run" (status word 1, bit 1) The DC link is charged, the pulses can be enabled. Parameter values, indices as for P600 Type=L2; PKW: PKW format(HEX)=param.value PZD Gr.: 0	0 to 5002	3 i001=0 i002=0 i003=0	3 / BR 3 / BR
P602 * 25AHex	**Dst Operation** Destination of status bit "Run" (status word 1, bit 2) The device is running. Parameter values, indices as for P600 Type=L2; PKW: PKW format(HEX)=param.value PZD Gr.: 0	0 to 5002	3 i001=0 i002=0 i003=0	2 / BR 2 / BR
P603 * 25BHex	**Dst Fault** Destination of status bit "Fault" (status word 1, bit 3) Note: The active status (bit has H level) is output via the terminal in inverted form (broken-wire proof). Parameter values, indices as for P600 Type=L2; PKW: PKW format(HEX)=param.value PZD Gr.: 0	0 to 5002	3 i001=0 i002=0 i003=0	2 / BR 2 / BR

PNU *:conf-P	Parameter Name in OP1 Description	Range [Unit] Value Texts	# of Indices Factory Settings	read: _/_ write: _/_
P604 * 25CHex	**Dst NO OFF2** Destination of the status bit 'No OFF2 command' (status word 1, bit 4) Parameter values, indices as for P600 Type=L2; PKW: PKW format(HEX)=param.value PZD Gr.: 0	0 to 5002	3 i001=0 i002=0 i003=0	3 / BR 3 / BR
P606 * 25EHex	**Dst ON blocked** Destination of the status bit "Starting lockout active" (status word 1, bit 6) Note: The active status (bit has H level) is output via the terminal in inverted form (broken-wire proof). Parameter values, indices as for P600 Type=L2; PKW: PKW format(HEX)=param.value PZD Gr.: 0	0 to 5002	3 i001=0 i002=0 i003=0	3 / BR 3 / BR
P607 * 25FHex	**Dst Warning** Destination of the status bit "Alarm" (status word 1, bit 7) Note: The active status (bit has H level) is output via the terminal in inverted form (broken-wire proof). Parameter values, indices as for P600 Type=L2; PKW: PKW format(HEX)=param.value PZD Gr.: 0	0 to 5002	3 i001=0 i002=0 i003=0	2 / BR 2 / BR
P608 * 260Hex	**Trg Bit Deviat.** Destination of the status bit "DC-link voltage setpoint = Actual DC-link voltage' (status word 1, bit 8) - cf. P517; see Section "Status word" for details Parameter values, indices as for P600 Type=L2; PKW: PKW format(HEX)=param.value PZD Gr.: 0	0 to 5002	3 i001=0 i002=0 i003=0	3 / BR 3 / BR
P611 * 263Hex	**Dst Low Voltage** Destination of the status bit "Low voltage' (status word 1, bit 11) Note: The active status (bit has H level) is output via the terminal in inverted form (broken-wire proof). Parameter values, indices as for P600 Type=L2; PKW: PKW format(HEX)=param.value PZD Gr.: 0	0 to 5002	3 i001=0 i002=0 i003=0	3 / BR 3 / BR
P612 * 264Hex	**Dst Contactor** Destination of the status bit "Energize main contactor' (status word 1, bit 12); H level: Energize contactor! CAUTION: For safety reasons, this status bit is always connected to digital output 2 on the CUSA board on the AFE. It is not possible or permissible to connect the bit in any other way as it protects the AFE against damage by preventing the main contactor from closing before the DC link has been charged. Type=L2; PKW: PKW format(HEX)=param.value PZD Gr.: 0	0 to 5002	3 i001=1002 i002=0 i003=0	3 / BR 3 / BR
P614 * 266Hex	**Dst.Gen.Mot.** Destination of the status bit "Generator/motor operation" (status word 1, bit 14) Meaning: L: Motor-mode operation (rectifier) H: Generator-mode operation (regen. feedback) Parameter values, indices as for P600 Type=L2; PKW: PKW format(HEX)=param.value PZD Gr.: 0	0 to 5002	3 i001=0 i002=0 i003=0	3 / BR 3 / BR

PNU *:conf-P	Parameter Name in OP1 Description	Range [Unit] Value Texts	# of Indices Factory Settings	read: _/_ write: _/_
P618 * 26AHex	**DstCurrLimAct.** Destination of the status bit "Current limit active' (status word 2, Bit 18) Note: The active status (bit has H level) is output via the terminal in inverted form (broken-wire proof). Parameter values, indices as for P600 Type=L2; PKW: PKW format(HEX)=param.value PZD Gr.: 0	0 to 5002	3 i001=0 i002=0 i003=0	3 / BR 3 / BR
P619 * 26BHex	**Dst Ext Fault 1** Destination of the status bit "External fault 1 active' (status word 2, bit 19) Note: The active status (bit has H level) is output via the terminal in inverted form (broken-wire proof). Parameter values, indices as for P600 Type=L2; PKW: PKW format(HEX)=param.value PZD Gr.: 0	0 to 5002	3 i001=0 i002=0 i003=0	3 / BR 3 / BR
P620 * 26CHex	**Dst Ext Fault 2** Destination of the status bit "External fault 2 active' (status word 2, bit 20) Notes: • The active status (bit has H level) is output via the terminal in inverted form (broken-wire proof). • The device accepts the fault after 200 ms provided that an ON command is active. Parameter values, indices as for P600 Type=L2; PKW: PKW format(HEX)=param.value PZD Gr.: 0	0 to 5002	3 i001=0 i002=0 i003=0	3 / BR 3 / BR
P621 * 26DHex	**Dst Ext Warning** Destination of the status bit "External alarm active' (status word 2, bit 21) Note: The active status (bit has H level) is output via the terminal in inverted form (broken-wire proof). Parameter values, indices as for P600 Type=L2; PKW: PKW format(HEX)=param.value PZD Gr.: 0	0 to 5002	3 i001=0 i002=0 i003=0	3 / BR 3 / BR
P622 * 26EHex	**Dst.warn.i2tAFE** Destination of the status bit "Inverter overload alarm" (status word 2, bit 22); cf. r010 (AFE utilization) Note: The active status (bit has H level) is output via the terminal in inverted form (broken-wire proof). Parameter values, indices as for P600 Type=L2; PKW: PKW format(HEX)=param.value PZD Gr.: -	0 to 5002	3 i001=0 i002=0 i003=0	3 / BR 3 / BR
P623 * 26FHex	**DstFltOvertmpAFE** Destination of the status bit "Inverter overtemperature fault" (status word 2, bit 23) Note: The active status (bit has H level) is output via the terminal in inverted form (broken-wire proof). Parameter values, indices as for P600 Type=L2; PKW: PKW format(HEX)=param.value PZD Gr.: 0	0 to 5002	3 i001=0 i002=0 i003=0	3 / BR 3 / BR

PNU *:conf-P	Parameter Name in OP1 Description	Range [Unit] Value Texts	# of Indices Factory Settings	read: _/_ write: _/_
P624 * 270Hex	**DstWarOvertmpAFE** Destination of the status bit "Inverter overtemperature alarm" (status word 2, bit 24) Note: The active status (bit has H level) is output via the terminal in inverted form (broken-wire proof). Parameter values, indices as for P600 Type=L2; PKW: PKW format(HEX)=param.value PZD Gr.: 0	0 to 5002	3 i001=0 i002=0 i003=0	3 / BR 3 / BR
P629 * 275Hex	**DstPrechrgContEn** Destination of the status bit “Precharging contactor energized” (status word 2, bit 29) Caution: For safety reasons, this status bit on the AFE is always connection to digital output 1 on the PEU. Type=L2; PKW: PKW format(HEX)=param.value PZD Gr.: 0	0 to 5002	3 i001=1001 i002=0 i003=0	3 / BR 3 / BR
P631 * 277Hex	**Dst Pre-Charging** Destination connection for the status bit "Precharging active" (status word 2, bit 31) Parameter values, indices as for P600 Type=L2; PKW: PKW format(HEX)=param.value PZD Gr.: 0	0 to 5002	3 i001=0 i002=0 i003=0	3 / BR 3 / BR

12.9 Analog inputs/outputs

PNU *:conf-P	Parameter Name in OP1 Description	Range [Unit] Value Texts	# of Indices Factory Settings	read: _/_ write: _/_
P655 * 28FHex	**CUA AnaOut ActVal** Actual value output via the analog output of the CUSA Setting instruction: Enter the number of the parameter whose value is to be displayed. Type=O2; PKW: 1HEX=1 PZD Gr.: 0	0 to 999	– 303	2 / BR 2 / BR
P656 290Hex	**CUSA AnalogOutGain** Gain factor of the analog output on the CUSA, see Section "Analog outputs" Parameter values: P656 = calculated output voltage when parameter value is set to 100 % The calculation formula for the output voltage is as follows: $V_{out} = \frac{PWE}{100\,\%} \cdot P656 + P657$ Note: The output voltage at the analog output can be maximum ± 10 V. Type=I2; PKW: 1HEX=0.01 V PZD Gr.: 0	–320.00 to 320.00 [V]	– 10.00	2 / BR 2 / BR
P657 291Hex	**CUSA AnalogOutOffs** Offset of the analog output on the CU, cf. P656 Type=I2; PKW: 1HEX=0.01 V PZD Gr.: 0	–100.00 to 100.00 [V]	– 0.00	2 / BR 2 / BR
P660 294Hex	**SCI AnalogInConf** Configuration of the analog inputs on the SCI1 boards, defining the type of input signals: Parameter values: 0: – 10 V ... + 10 V (Terminals X428/3, 6, 9) / –20 mA ... + 20 mA (Terminals X428/5, 8, 11); 1: 0 V ... + 10 V / 0 mA ... + 20 mA; 2: 4 mA ... + 20 mA Notes: • Only one signal can be processed per input. A choice of voltage or current signals can be evaluated. • Voltage and current signals must be connected to different terminals. • Settings 1 and 2 allow only unipolar signals to be used, i.e. the internal process quantities are also unipolar. • When setting 2 is selected, an input current of < 2 mA causes a shutdown on faults (open-wire monitoring). • Offset adjustment of the analog inputs is parameterized via parameter P662. Indices: i001: SI11 Slave 1, analog input 1; i002: SI12 Slave 1, analog input 2; i003: SI13 Slave 1, analog input 3; i004: SI21 Slave 2, analog input 1; i005: SI22 Slave 2, analog input 2; i006: SI23 Slave 2, analog input 3 Precondition: The associated SCB board must be logged on via P090 or P091. Type=O2; PKW: 1HEX=1.0 PZD Gr.: -	0 to 2 –10 V...+10 V 0 V...+10 V 4 mA...20 mA	6 i001=0 i002=0 i003=0 i004=0 i005=0 i006=0	3 / BR 3 / BR

PNU *:conf-P	Parameter Name in OP1 Description	Range [Unit] Value Texts	# of Indices Factory Settings	read: _/_ write: _/_
P661 295Hex	**SCI AnaInSmooth** Smoothing time constant of analog inputs on SCI boards Formula: T=2 ms x 2^{P661} Indices: See P660 Type=O2; PKW: 1HEX=1.0 PZD Gr.: -	0 to 15	6 i001=2 i002=2 i003=2 i004=2 i005=2 i006=2	3 / BR 3 / BR
P662 296Hex	**SCI AnalogInOffs** Zero offset of analog inputs on SCI boards See SCI Operator's Guide for setting instructions Indices: See P660 Type=I2; PKW: 1HEX=0.01 V PZD: 4000HEX=160 V	−20.00 to 20.00 [V]	6 i001=0.00 i002=0.00 i003=0.00 i004=0.00 i005=0.00 i006=0.00	3 / BR 3 / BR
P664 * 298Hex	**SCI AnaOutActVal** Output of actual values via analog outputs on SCI boards Setting instruction: Enter the number of the parameter whose value is to be output. See SCI Operator's Guide for details. Indices: i001: Sl11 Slave 1, analog output 1 i002: Sl12 Slave 1, analog output 2 i003: Sl13 Slave 1, analog output 3 i004: Sl21 Slave 2, analog output 1 i005: Sl22 Slave 2, analog output 2 i006: Sl23 Slave 2, analog output 3 Precondition: The associated SCB board must be logged on via P090 or P091. Type=O2; PKW: 1HEX=1.0 PZD Gr.: 0	0 to 1999	6 i001=0 i002=0 i003=0 i004=0 i005=0 i006=0	3 / BR 3 / BR
P665 299Hex	**SCI AnaOut Gain** Gain for analog outputs via the SCI slaves Setting instruction: See SCI Operator's Guide Indices: See P664 Type=I2; PKW: 1HEX=0.01 PZD: 4000HEX=160	−320.00 to 320.00	6 i001=10.00 i002=10.00 i003=10.00 i004=10.00 i005=10.00 i006=10.00	3 / BR 3 / BR
P666 29AHex	**SCI AnaOut Offs** Offset of analog outputs on SCI boards Setting instruction: See SCI Operator's Guide Indices: See P664 Type=I2; PKW: 1HEX=0.01 V PZD: 4000HEX=160 V	−100.00 to 100.00 [V]	6 i001=0.00 i002=0.00 i003=0.00 i004=0.00 i005=0.00 i006=0.00	3 / BR 3 / BR

12.10 Interface configuration

PNU *:conf-P	Parameter Name in OP1 Description	Range [Unit] Value Texts	# of Indices Factory Settings	read: _/_ write: _/_
P680 * 2A8Hex	**SCom1 Act Value** Output of actual values via serial interface SST1 Defines which parameter must be transferred at which telegram position. Notes: • Status word 1 (r968) should be assigned to word 1. • In the case of double word parameters (type I4), the associated parameter number must be entered in two consecutive words or else only the most significant word will be transferred. • The length (number of words) of the process data section in the telegram is set via P685, index i001. Indices: i001 = W01: Word 01 of (process data section) of the telegram i002 = W02: Word 02 of (process data section) of the telegram ... i016 = W16: Word 16 of (process data section) of the telegram Type=O2; PKW: 1HEX=1.0 PZD Gr.: 0	0 to 999	16 i001=968 i002=0 i003=0 i004=0 i005=0 i006=0 i007=0 i008=0 i009=0 i010=0 i011=0 i012=0 i013=0 i014=0 i015=0 i016=0	3 / BR 3 / BR
P682 2AAHex	**SCB Protocol** The SCB board can be operated as a • master for the SCI boards or as a • communications board (see SCB Operator's Guide). Parameter values: 0 = Master for SCI boards 1 = 4-wire USS 2 = 2-wire USS 3 = Peer to Peer 4 = Not assigned 5 = Not assigned Precondition: The associated SCB board must be logged on via P090 or P091 Type=O2; PKW: 1HEX=1.0 PZD Gr.: -	0 to 5 SCI module 4-wire USS 2-wire USS Peer-2-Peer Option 1 Option 2	– 0	3 / H BR 3 / H
P683 * 2ABHex	**SCom/SCB BusAddr** Bus address of serial interfaces (see Section "Serial interfaces") Indices: i001 = SST1: Bus address of serial interface 1 (CUSA) i002 = SCB: Bus address of SCB if P682 = 1, 2 Type=O2; PKW: 1HEX=1.0 PZD Gr.: -	0 to 31	2 i001=0 i002=0	3 / BR 3 / BR
P684 * 2ACHex	**SCom/SCB Baud** Baud rate of serial interfaces Parameter values: 1: 300 baud 8: 38400 baud 2: 600 baud 9: 57600 baud 3: 1200 baud 10: 76800 baud 4: 2400 baud 11: 93750 baud 5: 4800 baud 12: 115200 baud 6: 9600 baud 13: 187500 baud 7: 19200 baud Indices: i001 = SST1: Baud rate of ser. interface 1 (CUSA) i002 = SCB: Baud rate of SCB if P682 = 1, 2, 3 Type=O2; PKW: 1HEX=1.0 PZD Gr.: -	1 to 13	2 i001=6 i002=6	3 / BR 3 / BR

PNU *:conf-P	Parameter Name in OP1 Description	Range [Unit] Value Texts	# of Indices Factory Settings	read: _/_ write: _/_
P685 * 2ADHex	**SCom/SCB PCV** Number of words (16-bit) in PKW section in the net data block of the telegram (see Section "Serial interfaces") Parameter values: 0: No PKW section 3, 4: PKW section is 3 (ident., ind,value), 4 words long 127: Variable PKW length for transmission of parameter description and texts. Indices: i001 = SST1: Serial interface 1 (CUSA) i002 = SCB: SCB if P682 = 1, 2 Type=O2; PKW: 1HEX=1.0 PZD Gr.: -	0 to 127	2 i001=127 i002=127	3 / BR 3 / BR
P686 * 2AEHex	**SCom/SCB # PrDat** Number of words (16-bit) of process data section in the net data block of the telegram (see Section "Serial interfaces"). Indices: i001 = SST1: Serial interface 1 (CUSA) i002 = SCB: SCB if P682 = 1, 2, 3 Type=O2; PKW: 1HEX=1.0 PZD Gr.: -	0 to 16	2 i001=2 i002=2	3 / BR 3 / BR
P687 * 2AFHex	**SCom/SCB TlgOFF** Telegram failure time for CUSA and SCB Shutdown on faults occurs if no correct telegram is received within the specified time. Setting instructions: • Value 0: No monitoring and no fault shutdown; parameterize for sporadic (acyclic) telegrams (e.g. OP on SST1). • If a TB is installed in slot 2 and an SCB in slot 3, then the setting in i002 is irrelevant. Indices: i001 = SST1: Serial interface 1 (CUSA) i002 = SCB: SCB Type=O2; PKW: 1HEX=1.0 ms PZD: 4000HEX=1638.4 ms	0 to 6500 [ms]	2 i001=0 i002=0	3 / BR 3 / BR
P689 2B1Hex	**SCB Peer2PeerExt** Direct transfer of peer-to-peer receive data of the SCB. Identification of words in received peer-to-peer telegram which must be transferred on directly. Param. values: 0: No immediate transfer (to CUSA only) 1: Direct transfer (incl. transfer to CUSA) Indices: i001 = W01: Word 01 of (process data section of telegram) i002 = W02: Word 02 of (process data section of telegram) ... i005 = W05: Word 05 of (process data section of telegram) Precondition: P682 = 3 (peer-to-peer protocol) Type=O2; PKW: 1HEX=1.0 PZD Gr.: -	0 to 1	5 i001=0 i002=0 i003=0 i004=0 i005=0	3 / BR 3 / BR

PNU *:conf-P	Parameter Name in OP1 Description	Range [Unit] Value Texts	# of Indices Factory Settings	read: _/_ write: _/_
P690 * 2B2Hex	**SCB Act Values** Output of actual values via the serial interface of the SCB board Defines which parameter must be transferred at which telegram position. Notes: • Status word 1 (r968) should be assigned to word 1. • In the case of double word parameters (type I4), the associated parameter number must be entered in two consecutive words or else only the most significant word will be transferred. • The length (number of words) of the process data section in the telegram is set via P685, index i002. Indices: i001 = W01: Word 01 of (process data section) of the telegram i002 = W02: Word 02 of (process data section) of the telegram ... i016 = W16: Word 16 of (process data section) of the telegram CAUTION: When P682 = 3 (peer-to-peer protocol), a maximum of 5 words can be transferred (i001 to i005). Type=O2; PKW: 1HEX=1.0 PZD Gr.: 0	0 to 999	16 i001=0 i002=0 i003=0 i004=0 i005=0 i006=0 i007=0 i008=0 i009=0 i010=0 i011=0 i012=0 i013=0 i014=0 i015=0 i016=0	3 / BR 3 / BR
P694 * 2B6Hex	**CB/TB Act Values** Output of actual values via CB or TB Defines which parameter must be transferred at which telegram position. Notes: • Status word 1 (r968) should be assigned to word 1. • In the case of double word parameters (type I4), the associated parameter number must be entered in two consecutive words or else only the most significant word will be transferred. Indices: i001= W01: Word 01 of (process data section) of the telegram i002= W02: Word 02 of (process data section) of the telegram ... i016= W16: Word 16 of (process data section) of the telegram Type=O2; PKW: 1HEX=1.0 PZD Gr.: 0	0 to 999	16 i001=968 i002=0 i003=0 i004=0 i005=0 i006=0 i007=0 i008=0 i009=0 i010=0 i011=0 i012=0 i013=0 i014=0 i015=0 i016=0	3 / BR 3 / BR
P695 * 2B7Hex	**CB/TB TlgOFFTime** Telegram failure time for CB and TB Shutdown on faults occurs if no correct telegram is received within the specified time. Setting instructions: Value 0: No monitoring and no fault shutdown; parameterize for sporadic (acyclic) telegrams. Type=O2; PKW: 1HEX=1.0 ms PZD: 4000HEX=1638.4 ms	0 to 6500 [ms]	– 10	3 / BR 3 / BR

PNU *:conf-P	Parameter Name in OP1 Description	Range [Unit] Value Texts	# of Indices Factory Settings	read: _/_ write: _/_
P696 2B8Hex	**CB Parameter 1** Communication Board parameter 1 Refer to documentation of installed COM BOARD Setting instructions: • This parameter is relevant only if a Communication Board is configured and parameterized (P090 or P091 = 1) • The validity of the setting is monitored by the board. • If the value is not accepted by the COM BOARD, fault 80 with fault value 5 is displayed. Type=O2; PKW: 1HEX=1.0 PZD Gr.: 0	0 to 65535	– 0	3 / H BR 3 / H
P697 2B9Hex	**CB Parameter 2** Communication Board parameter 2 See P696 Type=O2; PKW: 1HEX=1.0 PZD Gr.: 0	0 to 65535	– 0	3 / H BR 3 / H
P698 2BAHex	**CB Parameter 3** Communication Board parameter 3 See P696 Type=O2; PKW: 1HEX=1.0 PZD Gr.: 0	0 to 65535	– 0	3 / H BR 3 / H
P699 2BBHex	**CB Parameter 4** Communication Board parameter 4 See P696 Type=O2; PKW: 1HEX=1.0 PZD Gr.: 0	0 to 65535	– 0	3 / H BR 3 / H
P700 2BCHex	**CB Parameter 5** Communication Board parameter 5 See P696 Type=O2; PKW: 1HEX=1.0 PZD Gr.: 0	0 to 65535	– 0	3 / H BR 3 / H
P701 2BDHex	**CB Parameter 6** Communication Board parameter 6 See P696 Type=O2; PKW: 1HEX=1.0 PZD Gr.: 0	0 to 65535	– 0	3 / H BR 3 / H
P702 2BEHex	**CB Parameter 7** Communication Board parameter 7 See P696 Type=O2; PKW: 1HEX=1.0 PZD Gr.: 0	0 to 65535	– 0	3 / H BR 3 / H
P703 2BFHex	**CB Parameter 8** Communication Board parameter 8 See P696 Type=O2; PKW: 1HEX=1.0 PZD Gr.: 0	0 to 65535	– 0	3 / H BR 3 / H
P704 2C0Hex	**CB Parameter 9** Communication Board parameter 9 See P696 Type=O2; PKW: 1HEX=1.0 PZD Gr.: 0	0 to 65535	– 0	3 / H BR 3 / H
P705 2C1Hex	**CB Parameter 10** Communication Board parameter 10 See P696 Type=O2; PKW: 1HEX=1.0 PZD Gr.: 0	0 to 65535	– 0	3 / H BR 3 / H
P706 2C3Hex	**CB Parameter 11** Communication Board parameter 11 Indices: i001 - i005 See P696 Type=O2; PKW: 1HEX=1.0 PZD Gr.: 0	0 to 65535	5 i001=0 i002=0 i003=0 i004=0 i005=0	3 / H BR 3 / H

12.11 Diagnostic functions

PNU *:conf-P	Parameter Name in OP1 Description	Range [Unit] Value Texts	# of Indices Factory Settings	read: _/_ write: _/_
r720 2D0Hex	**SW Version** Software version of the PCBs in positions 1 to 3 of the electronics box Indices: i001: SPI1: Software version of board in slot 1 i002: SPI2: Software version of board in slot 2 i003: SPI3: Software version of board in slot 3 Note: The TSY board has no software version. The equivalent identifier is always 0.0. Type=O2; PKW: 1HEX=0.1 PZD Gr.: 0		3	3 /U BR
r721 2D1Hex	**SW Generat.Date** Date of creation of the CUSA software Indices: i001: Year: Year i002: Mon.: Month i003: Day: Day Type=O2; PKW: 1HEX=1.0 PZD Gr.: 0		3	3 /U BR
r722 2D2Hex	**SW ID** Expanded software version code of the PCBs in positions 1 to 3 of the electronics box Indices: i001: SPI1: Software code of board in slot 1 i002: SPI2: Software code of board in slot 2 i003: SPI3: Software code of board in slot 3 Note: The TSY board has no software code. The equivalent code is always 0.0. Type=O2; PKW: 1HEX=0.1 PZD Gr.: 0		3	3 /U BR
r723 2D3Hex	**PCB Code** Identification code of boards in slots 1, 2 and 3 of the electronics box. Indices: i001: SPI1: PCB code of board in slot 1 i002: SPI2: PCB code of board in slot 2 i003: SPI3: PCB code of board in slot 3 PCB codes: CU: 100 - 109 CB: 140 - 149 TB: 130 - 139 SCB: 120 - 129 TSY: 110 - 119 Type=O2; PKW: 1HEX=1.0 PZD Gr.: 0		3	3 /U BR

PNU *:conf-P	Parameter Name in OP1 Description	Range [Unit] Value Texts	# of Indices Factory Settings	read: _/_ write: _/_
r725 2D5Hex	**CalcTimeHeadroom** Available CPU computation time reserve on CUSA as % of total computing power. Relevant parameters are sampling time (P308) and pulse frequency (P761). Analog output: 100 % with code number (PWE) = 16384 % Type=O2; PKW: 1HEX=1.0 % PZD Gr.: 0	[%]	–	3 / BR
r730 2DAHex	**SCB Diagnosis** SCB diagnostic information All values displayed in hexadecimal notation Displayed numbers overflow at FF Hex. The meaning of individual indices depends of the selected SCB protocol (P682). Indices: i001: flTC Number of error-free telegrams i002: Terr Number of errored telegrams i003: Voff USS: Number of byte frame errors SCI boards: Number of slave power outages i004: Toff USS: Number of overrun errors SCI boards: Number of fiber optic link interrupts i005: PnoS USS: Parity error SCI boards: Number of missing response telegrams i006: STxL USS: STX error SCI boards: Number of search telegrams for slave acceptance i007: ETX ETX-error i008: BcCC USS: Block check error SCI boards: Number of configuration telegrams i009: L/KL USS/Peer to Peer: Incorrect telegram length SCI boards: Highest terminal numbers required acc. to PZD connection (P554 to P631) i010: T/An USS: Timeout SCI boards: Analog inputs/outputs required acc. to PZD connection of setpoint channel and actual value output via SCI (P664). i011: Res1 Reserved i012: Res2 Reserved i013: Warn SCB-DPR alarm word i014: Sl1? Setting indicating whether slave 1 is needed and, if yes, of what type 0: No slave needed 1: SCI1 2: SCI2 i015: Sl2? Setting indicating whether slave 2 is needed and, if yes, of what type 0: No slave needed 1: SCI1 2: SCI2 i016: IniF SCI boards: Initialization error Type=L2; PKW: 1HEX=1.0 PZD Gr.: 0		24	3 / H BR

PNU *:conf-P	Parameter Name in OP1 Description	Range [Unit] Value Texts	# of Indices Factory Settings	read: _/_ write: _/_
r731 2DBHex	**CB/TB Diagnosis** For detailed information please refer to the operating manuals of the relevant Com board (CB) or Tech board (TB). Type=L2; PKW: 1HEX=1.0 PZD Gr.: 0		32	3 / H BR
r748 2ECHex	**Trip Time** Times of fault events (reading of hours run counter (r013) at the time a fault occurred) Indices: Day Hours Seconds Latest fault (1) i001=S1-d i002=S1-h i003=S1-s Last acknowledged fault (2) i004=S2-d i005=S2-h i006=S2-s 2nd last acknowledged fault (3) i007=S3-d i008=S3-h i009=S3-s ... ... Oldest stored fault (8) i022=S8-d i023=S8-h i024=S8-s Description of faults in: r947 Fault number r949 Fault value r951 Fault number list P952 Number of faults Type=O2; PKW: 1HEX=1.0 PZD Gr.: 0		24	2 / BR

12.12 Gating unit

PNU *:conf-P	Parameter Name in OP1 Description	Range [Unit] Value Texts	# of Indices Factory Settings	read: _/_ write: _/_
r764 2FCHex	**Modulation Depth** Control factor of closed-loop control for gating unit. Analog output: 100 % with code number (PWE) = 400 % Type=O2; PKW: 1HEX=0.1 % PZD: 4000HEX=400 %	 [%]	–	3 / BR

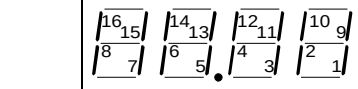
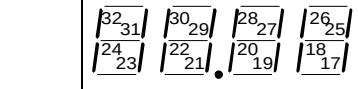
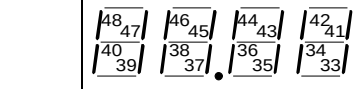
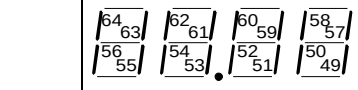
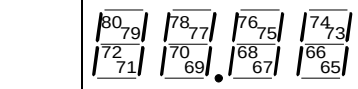
12.13 Factory parameters

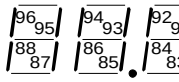
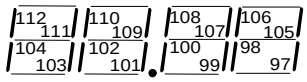
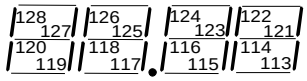
PNU *:conf-P	Parameter Name in OP1 Description	Range [Unit] Value Texts	# of Indices Factory Settings	read: _/_ write: _/_
P789 315Hex	**RAM Access Value** Content of a memory location on the CUSA board Type=L2; PKW format(HEX)=param.value PZD Gr.: 0	0 to 65535	– 0	3 / BR 4 / BR
P799 * 31FHex	**Special Access** Parameter for special access Type=O2; PKW: 1HEX=1.0 PZD Gr.: 0	0 to 65535	– 0	3 / BR 3 / BR

12.14 Profile parameters

PNU *:conf-P	Parameter Name in OP1 Description	Range [Unit] Value Texts	# of Indices Factory Settings	read: _/_ write: _/_
P918 396Hex	**CB Bus Address** Protocol-dependent bus address for communication boards: see board documentation Note: The validity of the bus address is monitored by the Com Board. If its value is not accepted by COM BOARD, fault F080 with fault value 5 is displayed Precondition: P090 = 1 or P091 = 1 (Communication board logged on) Type=O2; PKW: 1HEX=1.0 PZD Gr.: -	0 to 200	– 3	3 / H BR 3 / H
P927 * 39FHex	**Parameter Access** Enabling of interfaces for parameterization See P053 for description. Type=O2; PKW: 1HEX=1.0 PZD Gr.: -	0 to 31	– 6	3 / BR 3 / BR
P928 * 3A0Hex	**Src Base/Reserve** Source for basic/reserve setting switchover command (control word 2, bit 30); this parameter is identical to P590. See P590 for description. Type=L2; PKW: PKW format(HEX)=param.value PZD Gr.: 0	0 to 5001	– 1005	3 / BR 3 / BR

PNU *:conf-P	Parameter Name in OP1 Description	Range [Unit] Value Texts	# of Indices Factory Settings	read: _/_ write: _/_
r947 3B3Hex	**Fault Memory** Display of faults which caused the last 8 fault events (r748); up to 8 faults can be stored for each event. Each fault has its own fault number (see list of faults, Section 7). For plain text information associated with fault numbers: See r951. Indices: Fault 1 Fault 2 ... Fault 8 Latest fault (1) i001=S1-1 i002=S1-2 ... i008=S1-8 Last acknowledged fault (2) i009=S2-1 i010=S2-2 ... i016=S2-8 2nd last acknowledged fault (3) i017=S3-1 i018=S3-2 ... i024=S3-8 ... Oldest fault stored (8) i057=S8-1 i058=S8-2 ... i064=S8-8 Notes: A value of "0" means "No fault". In the event of a power failure, only the current and last acknowledged fault are stored. Indices 17 to 64 are then reset to 0. See P952 for the number of stored fault events. Example of a fault: Last acknowledged fault (2) Index r947 r949 Index r748 9: 35 / 0 — 4: 62 10: 37 / 2 — 5: 1 11: 0 / 0 — 6: 7 12 13 14 15 16 Fault time (r748): after 62 days, 1 hour, 7 sec operating hours Faults occurrences (r947): Fault value (r949): 35 No further details 37 2 Type=O2; PKW: 1HEX=1.0 PZD Gr.: 0		64	2 / BR
r949 3B5Hex	**Fault Value** Fault value of faults, facilitates troubleshooting for a variety of parameters. The fault values are stored in the same indices as the associated fault numbers (r947) - see example in r947. Type=O2; PKW: 1HEX=1.0 PZD Gr.: 0		64	3 / BR
r951 3B7Hex	**Fault Texts** List of fault texts; every fault text is stored under the same index as its fault number. Example (cf. r947): Fault 35 is stored in r947, i009. This is (r951, i035): 'Ext.fault1'. Type=O2; PKW: 1HEX=1.0 PZD Gr.: 0		116	2 / BR

PNU *:conf-P	Parameter Name in OP1 Description	Range [Unit] Value Texts	# of Indices Factory Settings	read: _/_ write: _/_
P952 * 3B8Hex	**# of Faults** Number of faults Contains the number of fault events stored in the fault memory (max. 8). If the parameter is set to "0", the entire contents of the diagnostic memory (r748 - fault time, r947 - fault number, r949 - fault value) are erased. Type=O2; PKW: 1HEX=1.0 PZD Gr.: -	0 to 8	– 0	2 / BR 2 / BR
r953 3B9Hex	**Warning Param1** Alarm parameter 1 If one of the alarms numbered from 1 to 16 occurs, the corresponding bar in the 7-segment display lights up.  Type=V2; PKW: 1HEX=1.0 PZD Gr.: 0		–	3 / BR
r954 3BAHex	**Warning Param2** Alarm parameter 2 If one of the alarms numbered from 17 to 32 occurs, the corresponding bar in the 7-segment display lights up.  Type=V2; PKW: 1HEX=1.0 PZD Gr.: 0		–	3 / BR
r955 3BBHex	**Warning Param3** Alarm parameter 3 If one of the alarms numbered from 33 to 48 occurs, the corresponding bar in the 7-segment display lights up.  Type=V2; PKW: 1HEX=1.0 PZD Gr.: 0		–	3 / BR
r956 3BCHex	**Warning Param4** Alarm parameter 4 If one of the alarms numbered from 49 to 64 occurs, the corresponding bar in the 7-segment display lights up.  Type=V2; PKW: 1HEX=1.0 PZD Gr.: 0		–	3 / BR
r957 3BDHex	**Warning Param5** Alarm parameter 5 If one of the alarms numbered from 65 to 80 occurs, the corresponding bar in the 7-segment display lights up.  Type=V2; PKW: 1HEX=1.0 PZD Gr.: 0		–	3 / BR

PNU *:conf-P	Parameter Name in OP1 Description	Range [Unit] Value Texts	# of Indices Factory Settings	read: _/_ write: _/_
r958 3BEHex	**Warning Param6** Alarm parameter 6 (CB alarms) If one of the alarms numbered from 81 to 96 occurs, the corresponding bar in the 7-segment display lights up.  Type=V2; PKW: 1HEX=1.0 PZD Gr.: 0		–	3 / BR
r959 3BFHex	**Warning Param7** Alarm parameter 6 (TB alarms 1) If one of the alarms numbered from 97 to 112 occurs, the corresponding bar in the 7-segment display lights up.  Type=V2; PKW: 1HEX=1.0 PZD Gr.: 0		–	3 / BR
r960 3C0Hex	**Warning Param8** Alarm parameter 6 (TB alarms 2) If one of the alarms numbered from 113 to 128 occurs, the corresponding bar in the 7-segment display lights up.  Type=V2; PKW: 1HEX=1.0 PZD Gr.: 0		–	3 / BR
r964 3C4Hex	**Drive ID** Drive identification Character string of the "Text" type. The first 2 characters contain the Ident number for drive identification on the Profibus. The remaining 24 characters contain the model name for displaying the drive model on visualization systems. Parameter values: 2 Byte: Ident number: 8022Hex 24 Byte: Model name (drive type): "MASTERDRIVES FC" Note: This parameter cannot be selected on the PMU; the value cannot be displayed on the OP. Type=VS; PKW: 1HEX=1.0 PZD Gr.: -		–	3 / BR
r965 3C5Hex	**Profile #** Profibus-specific parameter Note: This parameter cannot be selected on the PMU; the value cannot be displayed on the OP. Analog output: 100 % with code number (PWE) = 16384 Type=OS; PKW: 1HEX=1.0 PZD Gr.: 0		–	3 / BR
r967 3C7Hex	**Control Word 1** Visualization parameter for control word 1 (bits 0 - 15) Identical to r550 (control word 1) Type=V2; PKW: 1HEX=1.0 PZD Gr.: 0		–	2 / BR
r968 3C8Hex	**Status Word 1** Visualization parameter for status word 1 (bits 0 - 15) Identical to r552 (status word 1) Type=V2; PKW: 1HEX=1.0 PZD Gr.: 0		–	2 / BR

PNU *:conf-P	Parameter Name in OP1 Description	Range [Unit] Value Texts	# of Indices Factory Settings	read: _/_ write: _/_
P970 * 3CAHex	**Factory Settings** Parameter reset to factory settings Parameter values: 0: Parameter reset: All parameters are reset to their original values (factory settings). This parameter is then automatically reset to "1". 1: No parameter reset Note: The same function can be selected with P052 = 1. Type=O2; PKW: 1HEX=1.0 PZD Gr.: -	0 to 1	– 1	3 / B 3 / B
P971 * 3CBHex	**EEPROM Saving** Transfer to the EEPROM of parameter values stored in the RAM (to protect data when power is disconnected/fails) when the value of parameter changes from 0 to 1. The parameter must be set to 0 manually. Parameter values: 0: Change parameters 1: Save parameters Type=O2; PKW: 1HEX=1.0 PZD Gr.: -	0 to 1	– 0	3 / BR 3 / BR
r980 3D4Hex	**Par # List Pt1** List of available parameter numbers, part 1 The parameter numbers are listed in ascending sequence. The first 0 to appear in the list indicates that no further parameters are available. Indices: The value range of the index extends from 1 to 116. Index 116 has the special function of referring to the parameter number which contains the next part of the complete list. A value of 0 stored in index 116 indicates that there are no further parts of the complete list. Type=O2; PKW: 1HEX=1.0 PZD Gr.: 0		116	3 / BR
r981 3D5Hex	**Par # List Pt2** List of available parameter numbers, part 2 See r980. Type=O2; PKW: 1HEX=1.0 PZD Gr.: 0		116	3 / BR
r982 3D6Hex	**Par # List Pt3** List of available parameter numbers, part 3 See r980. Type=O2; PKW: 1HEX=1.0 PZD Gr.: 0		116	3 / BR
r983 3D7Hex	**Par # List Pt4** List of available parameter numbers, part 4 See r980. Type=O2; PKW: 1HEX=1.0 PZD Gr.: 0		116	3 / BR
r984 3D8Hex	**Par # List Pt5** List of available parameter numbers, part 5 See r980. Type=O2; PKW: 1HEX=1.0 PZD Gr.: 0		116	3 / BR
r985 3D9Hex	**Par # List Pt6** List of available parameter numbers, part 6 See r980. Type=O2; PKW: 1HEX=1.0 PZD Gr.: 0		116	3 / BR

PNU *:conf-P	Parameter Name in OP1 Description	Range [Unit] Value Texts	# of Indices Factory Settings	read: _/_ write: _/_
r986 3DAHex	**Par # List Pt7** List of available parameter numbers, part 7 See r980. Type=O2; PKW: 1HEX=1.0 PZD Gr.: 0		116	3 / BR
r987 3DBHex	**Par # List Pt8** List of available parameter numbers, part 8 See r980. Type=O2; PKW: 1HEX=1.0 PZD Gr.: 0		116	3 / BR
r988 3DCHex	**Par # List Pt9** List of available parameter numbers, part 9 See r980. Type=O2; PKW: 1HEX=1.0 PZD Gr.: 0		116	3 / BR
r989 3DDHex	**Par # List Pt10** List of available parameter numbers, part 10 See r980. Type=O2; PKW: 1HEX=1.0 PZD Gr.: 0		116	3 / BR
r990 3DEHex	**Par # List chg1** List of altered parameters, part 1 The parameter numbers are listed in ascending sequence. The first 0 to appear in the list indicates that no further parameters are available. Indices: The value range of the index extends from 1 to 116. Index 116 has the special function of referring to the parameter number which contains the next part of the complete list. A value of 0 stored in index 116 indicates that there are no further parts of the complete list. Type=O2; PKW: 1HEX=1.0 PZD Gr.: 0		116	3 / BR
r991 3DFHex	**Par # List chg2** List of altered parameters, part 2 See r990. Type=O2; PKW: 1HEX=1.0 PZD Gr.: 0		116	3 / BR
r992 3E0Hex	**Par # List chg3** List of altered parameters, part 3 See r990. Type=O2; PKW: 1HEX=1.0 PZD Gr.: 0		116	3 / BR

13 Process data

13.1 Control word

Operating states can be read in visualization parameter r001: e.g. READY FOR ON: r001 = 009

The functional sequences are described in the order in which they occur.

Introduction and example of application

An individual source can be parameterized for every control command (fixed values, digital inputs, PMU, PZD part of the telegram from the automation devices).

The selection parameters for the sources are, with the exception of P590 and P591, indexed 2x as follows:

Index i001: Basic setting (GRD)
Index i002: Reserve setting (RES)

One parameter is available to "connect up“ the source(s) for the control commands.

Example of source connection

The basic setting for the ON command (control word bit 0, control word 1) must be "connected up“ to digital input 1 of the CU (terminal -X101:16):

Control word 1 table shows that the factory setting of parameter P554.1 is 1010 for the basic setting of the ON command source.

Table A for the possible sources of the ON command specifies that 1010 is the "PMU operator control panel“ source.

Look for the parameter value for the required source in Tables X and A. The result for digital input 1 (BE1) on the CU can be found in Table X, it is 1001.

This parameter value must now be entered in parameter P554.1.

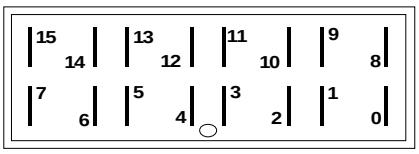
Command	Parameter	Possible sources	Parameter value	Required source connection
ON/OFF1 (GRD)	P554.1	Tab. X,A	1001	BE1 terminal -X101:16

A HIGH signal at terminal -X101:16 switches on the converter while a LOW signal switches it off.

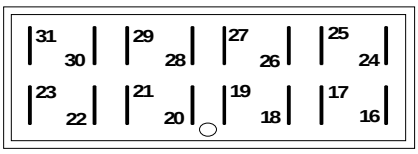
NOTES

- Multiple connections are permitted!
- The control word commands "OFF2“ (bit 1), "OFF3“ (bit 2) and "Acknowledge“ (bit 7) are always simultaneously effective from 3 sources (can be parameterized)!
- "Acknowledge“ (bit 7) is always additionally effective from the PMU!
- If the "ON“ command (bit 0) is connected to a serial interface (SCom, CB/TB, SCB-SCom), then an "OFF2" or "OFF3" command must also be parameterized on the terminal strip. Otherwise, the converter cannot be switched off via a defined command in the event of a communications failure!

13.1.1 Display of control word on PMU seven-segment display



Control word 1



Control word 2

13.1.2 Control word 1 (visualization parameter r550 or r967)

The factory setting applies only when P077 = 0.

Designation Bit No. (meaning)	High / Low values (1 = High, 0 = Low)		Parameter No. GRD (RES)	Fact. setting GRD (RES) (P077 = 0)	Possible sources see 8.1.4
ON / OFF1 (stop)	ON	OFF1			
0	1	0	P554.1 (2)	1010 (1001)	Tab. X,A
OFF2 (electrical)	ON	OFF2			
1	1	0	& P555.1 (2)	0001 (1002)	Tab. X,B
			& P556.1 (2)	0001 (0001)	Tab. X,B
			& P557.1 (2)	0001 (0001)	Tab. X,B
2	Reserved				
Inverter enable	Enabled	Inhibited			
3	1	0	P561.1 (2)	0001 (0001)	Tab. X,F
4	Reserved				
5	Reserved				
6	Reserved				
Acknowledge	ON				
7	0 → 1		P565.1 (2)	0000 (1003)	Tab. X,C
			P566.1 (2)	0000 (0000)	Tab. X,C
			P567.1 (2)	2001 (2001)	Tab. X,C
				1010 (fixed)	
Inching 1 1)	Inching 1 ON	Inching 1 OFF			
8	1	0	P568.1 (2)	0000 (0000)	Tab. X,C
Inching 2 1)	Inching 2 ON	Inching 2 OFF			
9	1	0	P569.1 (2)	0000 (0000)	Tab. X,C
PZD control by PLC	Control	No control			
10	1	0	≥1 SCom1/2		
			≥1 CB / TB		
			≥1 SCB 2		
11	Reserved				
12	Reserved				
13	Reserved				
14	Reserved				
External fault 1	No fault	External fault 1			
15	1	0	P575.1 (2)	0001 (0001)	Tab. X,D

1) There is no inching setpoint 1 or inching setpoint 2 on the AFE

13.1.3 Control word 2 (visualization parameter r551)

The factory setting applies only when P077 = 0.

Designation Bit No. (meaning)	High / Low values (1 = High, 0 = Low)		Parameter No. GRD (RES)	Fact. setting GRD (RES) (P077 = 0)	Possible sources see 8.1.4
Ext. 24 V	Ext. 24 V ok	Ext. 24 V not ok			
16 3)	1	0	P576.1 (2)	1004 (1004)	Tab. X,I
17	Reserved				
Reserve data set	RDS 2	RDS 1			
18 4)	1	0	P578.1 (2)	0000 (0000)	Tab. X,I
19	Reserved				
20	Reserved				
21	Reserved				
22	Reserved				
23	Reserved				
24	Reserved				
25	Reserved				
External fault 2	No fault	External fault 2			
26	1	0	P586.1 (2)	0001 (0001)	Tab. X,G
Slave AFE	Slave AFE	Master AFE			
27	1	0	P587.1 (2)	0000 (0000)	Tab. X,I
External alarm 1	No alarm	External alarm 1			
28	1	0	P588.1 (2)	0001 (0001)	Tab. X,G
External alarm 2	No alarm	External alarm 2			
29	1	0	P589.1 (2)	0001 (0001)	Tab. X,G
Basic / reserve	Reserve setting	Basic setting			
30	1	0	P590	1005	Tab. X,I
31 5)	Reserved				

3) On MASTERDRIVES CUVC, this bit corresponds to bit 0 for the data set of the setpoint channel

4) On MASTERDRIVES CUVC, this bit corresponds to bit 0 for the data set of the motor

5) The AFE always uses a main contactor without check-back

13.1.4 Sources for control words 1 and 2

Table X (external terminals)

1001	BE1 terminal -X101:16
1002	BE2 terminal -X101:17
1003	BE3 terminal -X101:18
1004	Assigned
1005	BE5 terminal -X101:20
4101	SCI, slave1, terminal 01
4102	SCI, slave1, terminal 02
4103	SCI, slave1, terminal 03
4104	SCI, slave1, terminal 04
4105	SCI, slave1, terminal 05
4106	SCI, slave1, terminal 06
4107	SCI, slave1, terminal 07
4108	SCI, slave1, terminal 08
4109	SCI, slave1, terminal 09
4110	SCI, slave1, terminal 10
4111	SCI, slave1, terminal 11
4112	SCI, slave1, terminal 12
4113	SCI, slave1, terminal 13
4114	SCI, slave1, terminal 14
4115	SCI, slave1, terminal 15
4116	SCI, slave1, terminal 16
4201	SCI, slave2, terminal 01
4202	SCI, slave2, terminal 02
4203	SCI, slave2, terminal 03
4204	SCI, slave2, terminal 04
4205	SCI, slave2, terminal 05
4206	SCI, slave2, terminal 06
4207	SCI, slave2, terminal 07
4208	SCI, slave2, terminal 08
4209	SCI, slave2, terminal 09
4210	SCI, slave2, terminal 10
4211	SCI, slave2, terminal 11
4212	SCI, slave2, terminal 12
4213	SCI, slave2, terminal 13
4214	SCI, slave2, terminal 14
4215	SCI, slave2, terminal 15
4216	SCI, slave2, terminal 16
5001	TSY, terminal 1

Table A

0000	Constant value 0
1010	PMU operator panel
2001	SCom1 word 1
3001	CB/TB word 1
4501	SCB1/2 peer-to-peer, SCB2 USS, word 1
4502	SCB1/2 peer-to-peer, word 2
4503	SCB1/2 peer-to-peer, word 3
4504	SCB1/2 peer-to-peer, word 4
4505	SCB1/2 peer-to-peer, word 5

Table B

0001	Constant value 1
1010	PMU operator panel
2001	SCom1 word 1
3001	CB/TB word 1
4501	SCB1/2 peer-to-peer, SCB2 USS, word 1
4502	SCB1/2 peer-to-peer, word 2
4503	SCB1/2 peer-to-peer, word 3
4504	SCB1/2 peer-to-peer, word 4
4505	SCB1/2 peer-to-peer, word 5

Table C

0000	Constant value 0
2001	SCom1 word 1
3001	CB/TB word 1
4501	SCB1/2 peer-to-peer, SCB2 USS, word 1
4502	SCB1/2 peer-to-peer, word 2
4503	SCB1/2 peer-to-peer, word 3
4504	SCB1/2 peer-to-peer, word 4
4505	SCB1/2 peer-to-peer, word 5

Table D

0001	Constant value 1
2001	SCom1 word 1
3001	CB/TB word 1
4501	SCB1/2 peer-to-peer, SCB2 USS, word 1
4502	SCB1/2 peer-to-peer, word 2
4503	SCB1/2 peer-to-peer, word 3
4504	SCB1/2 peer-to-peer, word 4
4505	SCB1/2 peer-to-peer, word 5

Table E

0000	Constant value 0
0001	Constant value 1
1010	PMU operator panel
2001	SCom1 word 1
3001	CB/TB word 1
4501	SCB1/2 peer-to-peer, SCB2 USS, word 1
4502	SCB1/2 peer-to-peer, word 2
4503	SCB1/2 peer-to-peer, word 3
4504	SCB1/2 peer-to-peer, word 4
4505	SCB1/2 peer-to-peer, word 5

Table F

0000	Constant value 0
0001	Constant value 1
2001	SCom1 word 1
3001	CB/TB word 1
4501	SCB1/2 peer-to-peer, SCB2 USS, word 1
4502	SCB1/2 peer-to-peer, word 2
4503	SCB1/2 peer-to-peer, word 3
4504	SCB1/2 peer-to-peer, word 4
4505	SCB1/2 peer-to-peer, word 5

Table G

0001	Constant value 1
2004	SCom1 word 4
3004	CB/TB word 4
4501	SCB1/2 peer-to-peer, word 1
4502	SCB1/2 peer-to-peer, word 2
4503	SCB1/2 peer-to-peer, word 3
4504	SCB1/2 peer-to-peer, SCB2 USS, word 4
4505	SCB1/2 peer-to-peer, word 5

Table H

0001	No MC checkback
4501	SCB1/2 peer-to-peer, word 1
4502	SCB1/2 peer-to-peer, word 2
4503	SCB1/2 peer-to-peer, word 3
4504	SCB1/2 peer-to-peer, word 4
4505	SCB1/2 peer-to-peer, word 5

Table I

0000	Constant value 0
0001	Constant value 1
2004	SCom1 word 4
3004	CB/TB word 4
4501	SCB1/2 peer-to-peer, word 1
4502	SCB1/2 peer-to-peer, word 2
4503	SCB1/2 peer-to-peer, word 3
4504	SCB1/2 peer-to-peer, SCB2 USS, word 4
4505	SCB1/2 peer-to-peer, word 5

13.1.5 Description of the control word bits

Bit 0: ON / OFF1 command (↑ "ON") / (L "OFF1")

Condition	Positive edge change from L to H (L → H) in READY FOR ON (009) state.
Result	♦ PRECHARGING (010) The precharging contactor is closed. The DC link is precharged, the main contactor then closed and the precharging contactor opened. ♦ READY TO RUN (011) ♦ RUN (014).

Bit 1: OFF2 command (L "OFF2") (electrical)

Condition	LOW signal
Result	♦ The inverter pulses are inhibited and the main contactor opened. ♦ STARTING LOCKOUT (008) until the command is withdrawn.

NOTE The **OFF2** command is simultaneously effective from three sources (P555, P556 and P557)!

Bit 2: Reserved

Bit 3: Inverter enable command (H "Inverter enable") / (L "Inverter inhibit")

Condition	HIGH signal and READY TO RUN (011)
Result	♦ RUN (014) The inverter pulses are enabled.
Condition	LOW signal
Result	♦ In RUN (014): Change to READY TO RUN (011) display, inverter pulses are inhibited.

Bit 4: Reserved

Bit 5: Reserved

Bit 6: Reserved

Bit 7: Acknowledge command (↑ "Acknowledge")

Condition	Positive edge change from L to H (L → H) in FAULT (007) state.
Result	♦ Reset all current faults after they have been transferred to the diagnostics memory. ♦ STARTING LOCKOUT (008) if no further faults are active. ♦ FAULT (007) if other faults are still active.
NOTE	The **acknowledge** command is simultaneously effective from three sources (P565, P566 and P567) and always from the PMU!

Bit 8: Inching 1 ON command (↑ "Inching 1 ON") / (L "Inching 1 OFF")

Condition	Positive edge change from L to H (L → H) in the READY FOR ON state (009).
Result	♦ An ON command is automatically issued (refer to control word bit 0).
Condition	LOW signal
Result	♦ An OFF1 command is automatically issued (refer to control word bit 0).

Bit 9: Inching 2 ON command (↑ "Inching 2 ON") / (L "Inching 2 OFF")

Condition	Positive edge change from L to H (L → H) in the READY FOR ON state (009).
Result	♦ An ON command is automatically issued (refer to control word bit 0).
Condition	LOW signal
Result	♦ An OFF1 command is automatically issued (refer to control word bit 0).

Bit 10: Control via PLC command (H "Control via PLC")

Condition	HIGH signal; The process data PZD (control word, setpoints) sent via the SCom1 interface of the CU, the CB/TB interface (option) and the SCom/SCB interface (option) are evaluated only in the case of an accepted command.
Result	♦ When several interfaces are in operation, only the process data of the interfaces sending an H signal are evaluated. ♦ With an L signal, the last values remain in the appropriate dual-port RAM of the interface.
NOTE	An H signal is displayed in visualization parameter r550 "Control word 1" if **one** of the interfaces sends an H signal!

Bit 11: Reserved

Bit 12: Regenerative feedback enable command (H "Regenerative feedback enable")

Condition	HIGH signal
Result	♦ Regenerative feedback operation is enabled.

Bit 13: Reserved

Bit 14: Reserved

Bit 15: External fault 1 command (L "External fault 1")

Condition	LOW signal
Result	♦ FAULT (007) and fault message (F035). The inverter pulses are inhibited and the main contactor opened. See Section "Fault and alarm messages"

Bit 16: Monitoring of external 24 V voltage supply (L "24V not o.k." / H "24V o.k.")

Condition	LOW signal
Result	♦ Alarm A039 in operating states STARTING LOCKOUT (008) and READY FOR ON (009). ♦ Fault F007 in operating states PRECHARGING (010), READY TO RUN (011) and RUN (014).

Bit 17: Reserved

Bit 18: Reserve data set RDS bit 0 command (L "RDS1" / H "RDS2")

Condition	READY FOR ON (009), PRECHARGING (010) or READY TO RUN (011) A HIGH signal activates RDS2, and a LOW signal RDS1.
Result	♦ The parameter settings of the appropriate reserve data set in the setpoint channel and closed-loop/open-loop control are activated. See Section "Function diagrams".

Bit 19: Reserved

Bit 20: Reserved

Bit 21: Reserved

Bit 22: Reserved

Bit 23: Reserved

Bit 24: Reserved

Bit 25: Reserved

Bit 26: External fault 2 command (L "External fault 2")

Condition LOW signal; Command is not activated until converter switches to READY TO RUN (011) and elapse of a 200 ms timer.

Result
- FAULT (007) and fault message (F036).
  The inverter pulses are inhibited and the main contactor (if installed) opened.

See Section "Fault and alarm messages".

Bit 27: Slave/master drive command (H "Slave AFE") / (L "Master drive")

Slave AFE
- The closed-loop control operates with an external line active current setpoint.
  The DC link voltage is specified by the master AFE.

Master AFE
- The closed-loop control operates with an internal line active current setpoint (= output of DC link voltage controller). The DC link voltage is maintained constantly at the set value.

Bit 28: External alarm 1 command (L "External alarm 1")

Condition LOW signal

Result
- The converter continues to operate in its current status. An alarm message (A015) is output.

See Section "Fault and alarm messages".

Bit 29: External alarm 2 command (L "External alarm 2")

Condition LOW signal

Result
- The converter continues to operate in its current status. An alarm message (A016) is output.

See Section "Fault and alarm messages".

Bit 30: Select reserve/basic setting (H "Reserve setting") / (L "Basic setting")

Condition	HIGH signal
Result	♦ The parameter values for the reserve setting for the control word itself, the setpoint channel and closed-loop control are activated.
Condition	LOW signal
Result	♦ The parameter values for the basic setting for the control word itself, the setpoint channel and closed-loop control are activated.

Bit 31: Reserved

13.2 Status word

Introduction and example of application

Status words are process data as defined by the explanation in Section "Process data".
A "destination" at which the bit status can be identified (digital outputs of CUSA, SCI 1/2 terminals, TSY terminals) can be parameterized for each bit in a status word.
One parameter is available for "wiring up" the destination for each status bit.
As shown below, the selection parameters have three indices:

Index i001 Selection of a terminal on the CUSA / PEU board (basic unit)

Index i002 Selection of a terminal on the SCI 1/2 board (option)

Index i003 Selection of a terminal on the TSY board (option)

Example of wiring to a destination

The message "motor operation" (status word 1, bit 14) must be "wired up" to digital output 3 (BA3) on the CUSA (terminal X102:29/33) as a high-active signal:

- "Wiring" of a status bit to a digital output on the CUSA is parameterized via index i001.
- The table for status word 1 indicates that the message "Motor operation" is assigned to parameter P614.
- Look for the parameter value for the desired destination in the same table. The result is 1003 for digital output 3 on the CU.

This parameter value must now be set in parameter P614.1.

Bit #	Meaning	Parameter	Parameter value	Desired destination connection
Bit 14	Motor operation	P614.1	1003	BA3 terminal -X102:29/33

When a High signal is applied to terminal -X102:29/33, the AFE operates in generator mode and, in the case of a Low signal, in motor mode.
If a value assigned to a terminal (digital output BA) is allocated to a destination once in a selection parameter, then it will not be available in the same index of any other selection parameter as a terminal is only suitable for the output of one status bit.

NOTE

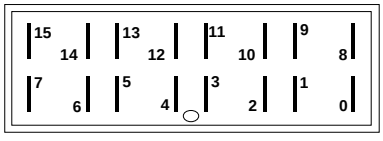
Faults, alarms and **starting lockout (HIGH active)** are displayed as **LOW active** via the terminal strip (digital outputs).
This also applies to any option boards!

See Section "Digital outputs".

13.2.1 Status word 1 (visualization parameter r552 or r968)

PMU display

"Status word 1"



Bit #	Value	1 = High 0 = Low	Select destin.
Bit 0	1	Ready for ON	P600.**x**
	0	Not ready for ON	
Bit 1	1	Ready to RUN	P601.**x**
	0	Not ready to RUN	
Bit 2	1	Run	P602.**x**
	0	Inv. pulses inhibited	
Bit 3	1	Fault	P603.**x**
	0	No fault	
Bit 4	1	No OFF2	P604.**x**
	0	OFF2	
Bit 5		Reserved	
Bit 6	1	Starting lockout	P606.**x**
	0	No starting lockout	
Bit 7	1	Alarm	P607.**x**
	0	No alarm	
Bit 8	1	No setp./act.v. deviation	P608.**x**
	0	Setp./act. val. deviation	
Bit 9	1	PZD control requested	always 1
	0	(not permitted)	
Bit 10		Reserved	
Bit 11	1	"Undervoltage" fault	P611.**x**
	0	No "Undervolts." fault	
Bit 12	1	MC energized	P612.**x**
	0	MC not energized	
Bit 13		Reserved	
Bit 14 [1)]	1	Generator operation	P614.**x**
	0	Motor operation	
Bit 15		Reserved	

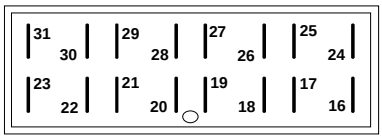
	Value	Destination
x = 1	0000	No destination
	1001	Assigned (precharging)
	1002	Assigned (main contactor)
	1003	BA3, -X102:29/33
	1004	BA4, -X102:32/33
x = 2	0000	No destination
	4101	SCI 1/2, slave 1, BA1
	4102	SCI 1/2, slave 1, BA2
	4103	SCI 1/2, slave 1, BA3
	4104	SCI 1/2, slave 1, BA4
	4105	SCI 1/2, slave 1, BA5
	4106	SCI 1/2, slave 1, BA6
	4107	SCI 1/2, slave 1, BA7
	4108	SCI 1/2, slave 1, BA8
	4109	SCI 2 only, slave 1, BA9
	4110	SCI 2 only, slave 1, BA10
	4111	SCI 2 only, slave 1, BA11
	4112	SCI 2 only, slave 1, BA12
	4201	SCI 1/2, slave 2, BA1
	4202	SCI 1/2, slave 2, BA2
	4203	SCI 1/2, slave 2, BA3
	4204	SCI 1/2, slave 2, BA4
	4205	SCI 1/2, slave 2, BA5
	4206	SCI 1/2, slave 2, BA6
	4207	SCI 1/2, slave 2, BA7
	4208	SCI 1/2, slave 2, BA8
	4209	SCI 2 only, slave 2, BA9
	4210	SCI 2 only, slave 2, BA10
	4211	SCI 2 only, slave 2, BA11
	4212	SCI 2 only, slave 2, BA12
x = 3	0000	No destination
	5001	TSY, BA1
	5002	TSY, BA2

1) This bit corresponds to bit "CW/CCW rotation" on the MASTERDRIVES CUVC

13.2.2 Status word 2 (visualization parameter r553)

PMU display

"Status word 2"



Bit #	Value	1 = High 0 = Low	Select destin.
Bit 16		Reserved	
Bit 17		Reserved	
Bit 18 2)	1	Current limit active	P618.x
	0	Current limit not active	
Bit 19	1	External fault 1	P619.x
	0	No external fault 1	
Bit 20	1	External fault 2	P620.x
	0	No external fault 2	
Bit 21	1	External alarm	P621.x
	0	No external alarm	
Bit 22	1	AFE i2t alarm	P622.x
	0	No AFE i2t alarm	
Bit 23	1	AFE overtemp. fault	P623.x
	0	No AFE overtemp. fault	
Bit 24	1	AFE overtemp. alarm	P624.x
	0	No AFE overtemp. alarm	
Bit 25		Reserved	
Bit 26		Reserved	
Bit 27		Reserved	
Bit 28		Reserved	
Bit 29 3)	1	PC contactor energized	P629.x
	0	PC cntact. not energized	
Bit 30		Reserved	
Bit 31	1	Precharging active	P631.x
	0	Precharging not active	

	Value	Destination
x = 1	0000	No destination
	1001	Assigned
	1002	Assigned
	1003	BA3, -X102:29/33
	1004	BA4, -X102:32/33
x = 2	0000	No destination
	4101	SCI 1/2, slave 1, BA1
	4102	SCI 1/2, slave 1, BA2
	4103	SCI 1/2, slave 1, BA3
	4104	SCI 1/2, slave 1, BA4
	4105	SCI 1/2, slave 1, BA5
	4106	SCI 1/2, slave 1, BA6
	4107	SCI 1/2, slave 1, BA7
	4108	SCI 1/2, slave 1, BA8
	4109	SCI 2 only, slave 1, BA9
	4110	SCI 2 only, slave 1, BA10
	4111	SCI 2 only, slave 1, BA11
	4112	SCI 2 only, slave 1, BA12
	4201	SCI 1/2, slave 2, BA1
	4202	SCI 1/2, slave 2, BA2
	4203	SCI 1/2, slave 2, BA3
	4204	SCI 1/2, slave 2, BA4
	4205	SCI 1/2, slave 2, BA5
	4206	SCI 1/2, slave 2, BA6
	4207	SCI 1/2, Slave 2, BA7
	4208	SCI 1/2, Slave 2, BA8
	4209	SCI 2 only, Slave 2, BA9
	4210	SCI 2 only, Slave 2, BA10
	4211	SCI 2 only, Slave 2, BA11
	4212	SCI 2 only, Slave 2, BA12
x = 3	0000	No destination
	5001	TSY, BA1
	5002	TSY, BA2

2) This bit corresponds to "Overspeed" bit on the MASTERDRIVES CUVC
3) This bit corresponds to "Bypassing contactor energized" bit on the MASTERDRIVES CUVC

13.2.3 Description of the status word bits

Bit 0: "Ready for ON" signal (H)

HIGH signal STARTING LOCKOUT (008) or READY FOR ON (009) state

Meaning
- The power supply, open-loop control and closed-loop control are all operative.
- The inverter pulses are inhibited.

Bit 1: "Ready to Run" signal (H)

HIGH signal PRECHARGING (010) or READY TO RUN (011) state

Meaning
- The power supply, open-loop control and closed-loop control are all operative.
- The converter is switched on.
- Precharging has been completed.
- The AFE inverter pulses are disabled and Ud control is disabled.

Bit 2: "Run" signal (H)

HIGH signal RUN state (014)

Meaning
- The converter is in operation.
- The AFE inverter pulses are enabled.
- Ud control is in operation.

Bit 3: "Fault" signal (H)

HIGH signal FAULT state (007)

Meaning
- A fault (fault type irrelevant) has occurred.

Output at terminal strip (CUSA, TSY, SCI1/2) with L signal.

Bit 4: "OFF2" signal (L)

LOW signal OFF2 command is active

Meaning
- An OFF2 command (control word bit 1) has been issued.

Bit 5: Reserved

Bit 6: "Starting lockout" signal (H)

HIGH signal STARTING LOCKOUT state (008)

Meaning
- The power supply, open-loop control and closed-loop control are all operative.
- The signal is continuously applied as long as an OFF2 command via control word bit 1 or an ON command via control word bit 0 is active (edge evaluation).

Output at terminal strip (CUSA, SCB1) with L signal.

Bit 7: "Alarm" signal" (H)

HIGH signal Alarm (Axxx)

Meaning
- An alarm (type irrelevant) has occurred.
- This signal remains active until the cause has been eliminated.

Output at terminal strip (CUSA, SCB1) with L signal.

Bit 8: "Setpoint/actual value deviation" signal (L)

LOW signal "Setpoint/actual value deviation" alarm (A034)

Meaning
- There is currently a deviation between the Vd setpoint and Vd actual value which is greater than the setting in P517 (set/act.val.dev. Vd) and active for longer than P518 (set/act.val.dev.time).
- The bit is reset to an H signal as soon as the deviation decreases to below the setting in parameter P517.

Bit 9: "PZD control requested" signal (H)

HIGH signal This signal is always active.

Bit 10: Reserved

Bit 11: "Undervoltage fault" signal (H)

HIGH signal "Undervoltage in DC link" fault (F008)

Meaning
- The DC link voltage has dropped below the permissible limit value.

See Section "Fault and alarm messages"

Output at terminal strip (CUSA, TSY, SCI1/2) with L signal.

Bit 12: "MC energized" signal (H)

HIGH signal The main contactor is energized.

WARNING

On the AFE, this status bit is always connected to digital output 2 on the CUSA. A different wiring is not possible and is also not allowed because the AFE inverter might be destroyed if the main contactor is activated before the DC link has been precharged.

Bit 13: Reserved

Bit 14: "Motor operation" signal (L)

LOW signal AFE operates in rectifier mode (active current >= 0)

Bit 15: Reserved

Bit 16: Reserved

Bit 17: Reserved

Bit 18: "Current limit active" signal (L)

LOW signal AFE operates at the present current limit setting

Meaning

- If the AFE output current is limited, the DC-link voltage can no longer be regulated to the selected setpoint.

Output at terminal strip (CUSA, SCB1) with L signal.

Bit 19: "External fault 1" signal (H)

HIGH signal " External fault 1"

Meaning

- An "External fault 1" is active in control word bit 1.

Output at terminal strip (CUSA, SCB1) with L signal.

Bit 20: "External fault 2" signal (H)

HIGH signal " External fault 2"

Meaning

- An "External fault 2" is active in control word bit 26.

Output at terminal strip (CUSA, SCB1) with L signal.

Bit 21: "External alarm" signal (H)

HIGH signal "External alarm"

Meaning

- An "External alarm 1" is active in control word bit 28 or an "External alarm 2" in control word bit 29.

Output at terminal strip (CUSA, SCB1) with L signal.

Bit 22: "AFE i^2t alarm" signal (H)

HIGH signal "AFE i^2t alarm" (A025)

Meaning

- If the converter continues to operate under the current load conditions, the AFE will be thermally overloaded.

Output at terminal strip (CUSA, SCB1) with L signal.

Bit 23: "AFE overtemperature fault" signal (H)

HIGH signal "Inverter temperature too high" fault (F023)

Meaning
- The inverter temperature limit value has been exceeded.

See Section "Fault and alarm messages".

Output at terminal strip (CUSA, SCB1) with L signal.

Bit 24: "AFE overtemperature alarm" signal (H)

HIGH signal "Inverter temperature too high" alarm (A022)

Meaning
- Alarm-tripping temperature threshold of inverter has been exceeded.

See Section "Fault and alarm messages".

Output at terminal strip (CUSA, SCB1) with L signal

Bit 25: Reserved

Bit 26: Reserved

Bit 27: Reserved

Bit 28: Reserved

Bit 29: "PC energized" signal (H)

HIGH signal The precharging contactor is energized.

WARNING

The status bit is always connected to terminal -X9 on the AFE. A different wiring is not possible and is also not allowed because the AFE inverter might be destroyed if the main contactor is activated before the DC link has been precharged.

Bit 30: Reserved

Bit 31: "Precharging active" signal (H)

HIGH signal PRECHARGING state (010)

Meaning
- The DC link is precharged as soon as an ON command is issued.

14 Faults and alarms

14.1 Faults

General information about faults

The available information for each fault event comprises the following parameters:

Parameter	r947	Fault number
	r949	Fault value
	r951	Fault texts
	P952	Number of faults
	r748	Fault time

If a fault message is not acknowledged before the electronics supply voltage is disconnected, then the same fault message will be active again when the supply is next turned on. The drive cannot be started until the message has been acknowledged (exception: Automatic restart function is selected, see P366).

Fault messages

No.	Description of fault	Remedial measures
F002	**Precharging** The DC-link voltage failed to reach the minimum limit (≈ P071 line supply voltage) during precharging. The maximum precharging time (P326) has been exceeded.	Check the line voltage, compare with **P071 Line voltage** Check the maximum precharging time (P326);
F003	**Line overvoltage** The voltage at the input terminals is higher than the response threshold (110 % or 120 % of P071 in inverter disabled or Run states). The voltage at the input terminals is higher than the maximum voltage limit + 5 % (E.g.: 460 V + 5 % = 483 V) and DC-link voltage is higher than the maximum continuous permissible value.	Check the line voltage, compare with **P071 Line voltage**
F004	**Line undervoltage** The voltage at the input terminals is less than the response threshold (50 % of P071 during precharging and P074 in operation). The line supply undervoltage fault is also activated if Vsupply < 80 % of P071 and if F013 occurs. If the fault occurs immediately after the drive is started up (for the first time), then the phase sequence may be incorrect. The line must always be connected in a CW phase sequence.	Check the line voltage Check P074 Compare with **P071 Line voltage** Check the line phase sequence

Line voltage range	Max. contin. perm. Vd at III >90% P072	Max. contin. perm. Vd at III ≤ 90% P072
380 V to 460 V	740 V	760 V
500 V to 575 V	922 V	947 V
660 V to 690 V	1100 V	1130 V

Fault messages		
No.	**Description of fault**	**Remedial measures**
F006	**DC-link overvoltage** The drive has been shut down due to an excessive DC-link voltage. Line voltage range I Shutdown threshold 380 V to 460 V I approx. 820 V 500 V to 575 V I approx. 1020 V 660 V to 690 V I approx. 1220 V	Regenerative feedback power of the connected converter is greater than that of the AFE. Check the following parameters: • **P572 Source regeneration enable** • **P161 Max. generator current limit of AFE** • **P173 Maximum current**
F007	**Electrical off** Failure of the electronic voltage supply -G10 in the mains connection module (external 24 V)	Check the external voltage supply Check the wiring (hardware and software) for the ext. 24 V monitoring function (software FS: 576 = 1004 = digital input 4).
F008	**DC-link undervoltage** The DC-link voltage has dropped below the minimum limit value (≈ line supply voltage)	Check • the main contactor control in cases where the fault occurs immediately after precharging • **P160 Maximum motor current limit** • **P173 Maximum current**
F009	**Supply failure** The line voltage has remained below the undervoltage threshold (P074) for longer than the maximum line failure period (P155). The line failure fault is also activated if the line voltage frequency drops below 40 Hz or exceeds 70 Hz.	Check • the line voltage and line frequency Compare with • the threshold in **Undervoltage threshold P074** • the maximum **Line failure time P155** • the **Line voltage P071**
F011	**Overcurrent** The drive has been shut down as a result of overcurrent. The trip threshold has been exceeded.	Check • the main contactor control in cases where the fault occurs immediately after precharging • the AFE output for short circuit or earth fault
F013	**Overload** The maximum current parameterized in P173 has been exceeded by more than 10% or the load in regenerative feedback mode was so high that the DC-link voltage has reached its maximum value.	Check • the maximum current **P173 $I_{Maximum\ current}$** • the AFE load
F023	**Inverter temp.** The inverter temperature has exceeded its maximum limit. **r949 = 1** Inverter temperature limit is exceeded **r949 = 2** Sensor 1: Break in sensor lead or sensor defective **r949 = 18** Sensor 2: Break in sensor lead or sensor defective **r949 = 34** Sensor 3: Break in sensor lead or sensor defective **r949 = 50** Sensor 4: Break in sensor lead or sensor defective	Measure inlet or ambient air temperature. Apply reduction curves when ϑ >40 ºC. ☞ Section "Technical Data" in Operator's Guide Check • whether fan -E1 is connected and/or rotating in the correct direction. • the air inlet and outlet openings for dirt/blockage. • the temperature sensor connected to -X30
F024	**Overload precharging resistor** Precharging resistor protection has responded during DC-link forming and automatic restart (WEA). Fault F024 occurs when III > 1 % P072 for longer than 1.5 × P326.	Check • for high-resistance short circuit or earth fault during forming or WEA • whether line voltage < 80 % during WEA

Fault messages		
No.	**Description of fault**	**Remedial measures**
F025	**UCE Ph. L1** A UCE shutdown has occurred in phase L1	Check • phase L1 for short circuit or earth fault (-X2:U2 - including motor). • the contacts on the **CU**.
F026	**UCE Ph. L2** A UCE shutdown has occurred in phase L2	Check • phase L2 for short circuit or earth fault (-X2:V2 - including motor). • the contacts on the **CU**.
F027	**UCE Ph. L3** A UCE shutdown has occurred in phase L3	Check • phase L3 for short circuit or earth fault (-X2:W2 - including motor). • the contacts on the **CU**.
F029	**Meas. val. sensing** A fault has occurred in the measured value sensing circuit. • **(r949 = 1)** Offset cannot be adjusted in phase L1. • **(r949 = 2)** Offset cannot be adjusted in phase L2. • **(r949 = 3)** Offset cannot be adjusted in phases L1 and L3.	Defect in the measured value sensing circuit Defect in the power section (valve is not blocking)
F030	**DC-link short circuit** A short circuit has been detected during DC-link precharging.	Check the DC link
F035	**Ext. fault 1** Parameterizable external fault input 1 has been activated	Check • whether an external fault has occurred • whether the lead to the appropriate digital input is interrupted • **P575 Src No Ext Fault1** ☞ Section "Digital inputs" in Operator's Guide
F036	**Ext. fault 2** Parameterizable external fault input 2 has been activated	Check • whether an external fault has occurred • whether the lead to the appropriate digital input is interrupted • **P586 Src No Ext Fault2** ☞ Section "Digital inputs" in Operator's Guide
F039	**DC link ground fault** An earth fault has been detected during DC-link precharging	Check: Maximum connected inverter power greater than 4 x AFE inverter power? If No: Check the DC link If Yes: Contact your local SIEMENS AG branch
F040	**AS internal** Incorrect operating status	Replace the CUSA (-A10) board
F041	**EEprom fault** A fault occurred as values were been saved to the EEPROM	Replace the CUSA (-A10) board
F042	**Comp. time** Computation time problems	Reduce the computation time load, increase **P308 Sampling time**, check **r725 Available computation time**.
F045	**Opt.brd.HW** A hardware fault occurred as an option board was being accessed	Replace the CUSA board Check the connection between the subrack and option boards

Fault messages		
No.	**Description of fault**	**Remedial measures**
F046	**Par.con.**	Switch the device off and on again. Replace the CUSA (-A10) board.
F047	**Int.comp.time**	Replace the CUSA (-A10) board.
F048	**Interf. pulse freq** Fault during power OFF or pulse inhibit	Switch the device off and the on again. Replace the CUSA (-A10) board if the fault occurs again.
F049	**SW release** The SW versions of the EPROMs on the CU are different. The fault occurs as a result of the comparison of the language EPROM and CU software.	• Replace the language EPROM
F050	**TSY init.** TSY board initialization error	Check whether • the TSY is correctly inserted • the parameter is set correctly for the installed board **P090 Board Position 2** – **P091 Board position 3** **r723 PCB Code** – **724 PCB Code**
F060	**MLFB missing** This fault is set if the MLFB = 0 (0.0 kW) when the device exits the INITIALIZATION state. MLFB = order number.	Enter the appropriate MLFB in parameter **P070 MLFB (6SE70..)** after acknowledgement in INITIALIZATION. (MLFB can be entered only if the appropriate access levels are set in the two access parameters.)
F062	**Multiparal.** Fault in connection with the multiparallel circuit has been detected	• Check ImPI and the communications card and if required, replace • Check configuration and connections of the multiparallel circuit • Check parameter settings (**P070 "MLFB(6SE70..)"**) • Replace the CUSA (-A10). • Replace the ImPI
F065	**INT1 telegram** No telegram has been received on interface 1 (SCom1/USS protocol) within the telegram failure period.	• Check the connection CU -X100:1 to 5 or check connection PMU -X300. • Check **P687.01"SCom/SCB TlgOFF"** • Replace the CUSA (-A10).
F070	**SCB init.** SCB board initialization error	**r949 = 1 or 2** • Check the contacts on the SCB and whether the board slot matches the appropriate parameter setting. • **r723 PCB Code ,** • **r724 PCB Code and** • **P090 Board Position 2,** • **P091 Board Position 3** **r949 = 5** Error in initialization data • Check parameters **P682 and P684** **r949 = 6** Timeout during initialization and **r949 = 10** Error in configuration channel • Check parameters **P090, P091, P682 and P684**
F072	**SCB heartb.** SCB is no longer processing the monitoring counter (heartbeat counter).	• Replace the SCB • Check the connection between the subrack and option board
F073	**Aninput1 SL1** Amps at analog input 1, slave1, have dropped below 4mA	Check connection from signal source to SCI1 (slave 1) -X428:4, 5.
F074	**Aninput2 SL1** Amps at analog input 2, slave1, have dropped below 4mA	Check connection from signal source to SCI1 (slave 2) -X428:7, 8.
F075	**Aninput3 SL1** Amps at analog input 3, slave1, have dropped below 4mA	Check connection from signal source to SCI1 (slave 3) -X428:10, 11.

Fault messages		
No.	**Description of fault**	**Remedial measures**
F076	**Aninput1 SL2** Amps at analog input 1, slave2, have dropped below 4mA	Check connection from signal source to SCI1 (slave1) -X428:4, 5.
F077	**Aninput2 SL2** Amps at analog input 2, slave2, have dropped below 4mA	Check connection from signal source to SCI1 (slave 2) -X428:7,8.
F078	**Aninput3 SL2** Amps at analog input 3, slave2, have dropped below 4mA	Check connection from signal source to SCI1 (slave 3) -X428:10, 11.
F079	**SCB telegram** A telegram has not been received from the SCB (USS, peer-to-peer, SCI) within the telegram failure time.	• Check the connections of the SCB1(2). • Check **P687.01"SCom/SCB TlgOFF".** • Replace the SCB1(2). • Replace the CU (-A10).
F080	**TB/CB init.** Board initialization error at the DPR interface	**r949 = 1** TB/CB not inserted or TB/CB board code incorrect **r949 = 2** TB is not compatible **r949 = 3** CB is not compatible **r949 = 5** Error in initialization data Check contacts on the T300 / CB board and whether the board slot matches the appropriate parameter setting; • **P090 Board Position 2,** • **P091 Board Position 3** • **r723 PCB Code,** • **r724 PCB Code** **r949 = 6** Timeout during initialization **r949 = 10** Error in configuration channel Check the CB initialization parameters; • **P918 CB Bus Address,** • **696 to P705 CB Parameters 1 to 10**
F081	**TB/CB heartb.** TB or CB is no longer processing the monitoring counter	• Replace the TB or CB • Check the connection between the subrack and option board
F082	**TB/CB Tlgr.** No new process data have been received from the TB or CB within the telegram failure time.	• Check the connections of the CB/TB. • Check **P695 "CB/TB TlgOFFTime".** • Replace the CB. • Replace the TB.
F091	**Form.interrupt** Forming of the DC link has been interrupted. r949 = 1 Abortion due to another fault r949 = 2 Abortion because Vd too low r949 = 3 Abortion by OFF command r949 = 4 Abortion because no ON command within 20 s of forming function selection	• Depending on the fault • Line voltage too low or incorrect line voltage (P071) parameterized • OFF command • No ON command
F255	Fault in NOVRAM	Switch the device off and then on again. Replace the CU if the fault occurs again.

Table 14-1 Fault numbers, causes and their counter-measures

14.2 Alarms

An alarm message is periodically displayed on the PMU by A=alarm and a 3-digit number. An alarm cannot be acknowledged. It is automatically deleted once the cause has been removed. Several alarms can be active simultaneously, in which case they are displayed one after another.

If the AFE inverter is operated with the OP1S control panel, the warning is displayed in the bottom line of the operation display. The red LED also flashes (refer to the OP1S Operating Instructions).

Alarm messages			
Alarm No.	**Param-No.** Bit No.	**Description**	**Remedial measures**
A001	**P953** 0	**Comp. time** CU board comp. time utilization too high	Check **r725 Available computation time**. Increase **P308 Sampling time**
A015	**P953** 14	**Ext. alarm 1** Parameterizable, external alarm input 1 has been activated	External alarm is active. Check whether the lead to the appropriate digital input is interrupted. Check parameter **P588 Src No Ext Warn1** ☞ Section "Digital inputs" in Operator's Guide
A016	**P953** 15	**Ext. alarm 2** Parameterizable, external alarm input 2 has been activated	External alarm is active. Check whether the lead to the appropriate digital input is interrupted. Check parameter **P589 Src No Ext Warn2**. ☞ Section "Digital inputs" in Operator's Guide
A020	**P954** 3	**Overcurrent** An overcurrent has been detected.	Check the driven load for an overload condition. • Are the dynamic requirements too high?
A021	**P954** 4	**Overvoltage** A DC-link overvoltage condition has been detected.	Check the line voltage. • Are the dynamic requirements too high?
A022	**P954** 5	**Inv.temp.** The alarm activation threshold has been exceeded.	Check **r011 AFE temperature**. Measure inlet or ambient air temperature. Apply reduction curves when ϑ >40 °C. ☞ Section "Technical Data" in Operator's Guide Check • whether fan -E1 is connected and/or rotating in the correct direction. • the air inlet and outlet openings for dirt/blockage. • the temperature sensor connected to -X30
A025	**P954** 8	**I2t- inv.** The inverter will be thermally overloaded if it continues to operate under the current load conditions.	Check whether the rated output current or peak current (operating class II) is (was) too high. Check **r010 AFE Utilization**

Alarm messages			
Alarm No.	**Param-No.** Bit No.	**Description**	**Remedial measures**
A039	**P955** 6	**Electrical off** The electronics voltage supply is not o.k.	Check • the ext. 24 V voltage supply -G1 • the digital input and signal lead for monitoring of the ext. 24 V voltage supply
A040	**P955** 7	**Supply voltage** The voltage at the input terminals is outside the rated range (< 80 % or > 110 % of P071) in operation	Check • the line voltage • **P071 Line voltage**
A047	**P955** 14	**Reactive current limited** The reactive current of the AFE is limited.	Check the • line voltage (r030) • maximum current (P173) • motor-mode current limit (P160) • generator-mode current limit **(P161)**
A048	**P955** 15	**Vd^2t integrator** The monitoring function of the maximum continuous DC link voltage (using the Vd2t-integrator) has reached 50 % of the final value. If the high DC link voltage is caused by a high capacitive reactive current, then this might be limited (A047). If the high DC link voltage is caused by a high line voltage (r030), the line overvoltage fault (F003) message will be activated eventually (depending on the amplitude of Vd).	Check the • line voltage (r030) • DC-link voltage **(r006)**
A049	**P956** **0**	**No slave** On the ser. I/O (SCB1 with SCI1/2), no slave is connected or fiber optic is interrupted or no supply to slaves.	**P660 SCI AnalogInConf** • Check slave. • Check fiber optic.
A050	**P956** **1**	**Slave incorrect** On the ser. I/O, the slaves connected do not correspond to the parameter setting (slave number or slave type).	Check **P660 SCI AnalogInConf**
A051	**P956** 2	**Peer bdrate** Baud rate for peer connection is too high or different.	Match baud rates of SCB boards involved in the link **P684 SCom/SCB Baud**
A052	**P956** 3	**Peer PZD-L** PZD length set too high for peer connection (>5).	Reduce the number of words **P686 SCom/SCB # PrDat.**.
A053	**P956** 4	**Peer Lng f.** The PZD lengths of the sender and receiver in the peer connection do not match.	Match word lengths of sender and receiver **P686 SCom/SCB # PrDat**
A057	**P956** 8	**TB-Param** Alarm occurs if a TB is logged on and connected, but it does not respond to parameter jobs from the PMU, SCom1 or SCom2 within 6 s.	Replace TB configuration (software).

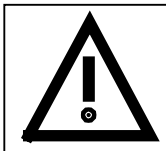
Alarm messages			
Alarm No.	**Param-No.** Bit No.	**Description**	**Remedial measures**
A065	**P957** 0	**WEA active** The WEA option **(P366)** restarts the drive. **No** time monitor is activated when the DC link is precharging. The automatic restart process can be aborted with an OFF command.	 **CAUTION** The WEA function can place operating personnel at risk. Check whether you really need to use WEA. Change **P366 WEA** if necessary.
A081.. A096	**r958** 0...15	**CB alarm** See Operator's Guide for CB board	
A097.. A112	**r959** 0...15	**TB alarm 1** See Operator's Guide for TB board	
A113.. A128	**r960** 0...15	**TB alarm 2** See Operator's Guide for TB board	

Table 14-2 Alarm numbers, causes and their counter-measures

14.3 Fatal errors (FF)

Fatal errors are serious hardware or software errors which no longer permit normal operation of the unit. They only appear on the PMU in the form "FF<No>". The software is re-booted by actuating any key on the PMU.

FFxx	Fault message	Switch device off and on again. Call service department if fatal fault is displayed again
FF01	**Time sector overflow** A non-removable time sector overflow has been identified in the higher priority time sectors.	Increase sampling time **(P308)** or reduce pulse frequency **(P761)** Replace the CUSA
FF03	**Access error option board** A fatal fault has occurred as external option boards (CB, TB, SCB, TSY ..) were being accessed	Replace the CUSA Replace the LBY Replace the option board
FF06	**Stack overflow** Stack overflow.	Increase sampling time **(P308)** or reduce pulse frequency **(P761)** Replace the CUSA
FFxx	**Any other fatal fault.**	Replace the CUSA

Table 14-3 Fatal errors

15 Maintenance

WARNING

SIMOVERT MASTERDRIVES units are operated at high voltages.
All work carried out on or with the equipment must conform to all the national electrical codes (VBG 4 in Germany).
Maintenance and service work may only be executed by qualified personnel.

Only spare parts authorized by the manufacturer may be used.
The prescribed maintenance intervals and also the instructions for repair and replacement must be complied with.
Hazardous voltages are still present in the drive units up to 5 minutes after the converter has been powered down due to the DC link capacitors. Thus, the unit or the DC link terminals must not be worked on until at least after this delay time.
The power terminals and control terminals can still be at hazardous voltage levels even when the motor is stationary.

If it is absolutely necessary that the drive converter be worked on when powered-up:

- Never touch any live parts.
- Only use the appropriate measuring and test equipment and protective clothing.
- Always stand on an ungrounded, isolated and ESD-compatible pad.

If these warnings are not observed, this can result in death, severe bodily injury or significant material damage.

15.1 Mains connection module

Refer to the chapter entitled "Connecting-up and wiring" for the positions and equipment designation of the electrical components in the mains connection module.

The mains connection module contains the following components:

Item	Equipment designation		Brief description
1	-A52	VSB module	Mains angle acquisition
2	-Q1	Switch-disconnector	Main switch
3	-Q1#	Control lever	Main switch accessory 1 N/O + 1 N/C
4	-F1...F3	Main fuses	Input fuses
5	-F21, F22	Fuse-type switch-disconnectors	for control transformer
6	-F21, F22 #	Fuse	AM104 4A 14x51
7	-F11, F12	Fuse-type switch-disconnector	for DC power supply
8	-F11, F12 #	Fuse	AM144 4A 14x51
9	-T10	230 V control transformer	Auxiliary supply for fan AFE, contactor relay, power supply
10	-K1	Main contactor	Main contactor 230 V, 50/60 Hz
11	-K1 -Z1	Varistor	Main contactor accessory
12	-K10	Contactor relay	for main contactor 6 N/O + 2 N/C 24 V
13	-K1 -V1	Suppression diode	Accessory -K10
14	-G10	Power supply	Controlled power supply 24 V DC, 6 A
15	-L1	Commutating reactor	Clean Power filter
16	-L2	Choke	Part of Clean Power filter
17	-K7	Contactor	Filter contactor 230 V, 50/60 Hz
18	-K4	Contactor	Precharging contactor 230 V, 50/60 Hz
19	-Z4	Varistor	for contactor 230 V, 50/60 Hz
20	-C4	Capacitor	Part of Clean Power filter
21	-R7...R9	Resistor	Filter resistors of Clean Power filter
22	-R1...R3	Resistor	Precharging resistors of Clean Power filter

Table 15-1 Components of the mains connection module

15.2 AFE inverter maintenance

15.2.1 Replacing the fan

The fan is designed for an operating time of $L_{10} \geq 35\,000$ hours at an ambient temperature of $T_u = 40$ °C. It should be replaced in good time to maintain the availability of the unit.

The fan assembly consists of:

- the fan housing
- a fan

The fan assembly is installed between the capacitor battery and the motor connection.

Replacement

- Withdraw connector X20.
- Remove the cable fastening.
- Undo the two M6x12 Torx screws.
- Pull out the fan assembly towards the front.
- Install the new fan assembly in reverse sequence.

Prior to start-up, check that the fan can run freely and check for correct direction of air flow.
The air must be blown upwards out of the unit.

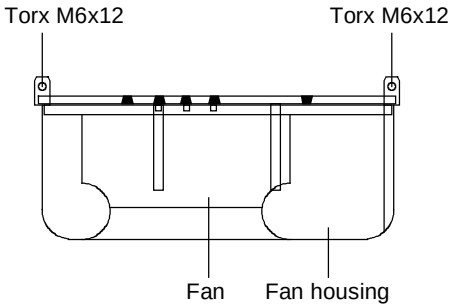


Fig. 15-1 Fan assembly

15.2.2 Replacing the starting capacitor

The starting capacitor is

- next to the fan connection (types E - G)
- Withdraw the plug connections on the starting capacitor.
- Unscrew the starting capacitor.
- Install the new starting capacitor in reverse sequence (4.5 Nm).

15.2.3 Replacing the capacitor battery

The unit is an assembly which consists of the DC link capacitors, the capacitor support and the DC link bus module.

Construction types E and F

- Disconnect the electrical connection to the inverter bus module.
- Undo the mechanical interlock.
- Swing the capacitor battery out towards the front and lift the unit out towards the top.

Construction type G

- Remove the connection for the balancing resistor (cable lug M6).
- Detach the mechanical fastening.
- Swing the capacitor battery out towards the front and lift the unit at an angle of 45 ° out of the converter.

15.2.4 Replacing the SML and the SMU

SML: Snubber Module Lower

SMU: Snubber Module Upper

- Remove the capacitor battery.
- Undo the fixing screws (4 x M8, 8 - 10 Nm or 4 x M6, 2.5 - 5 Nm, 1 x M4, max 1.8 Nm).
- Remove the modules.

Install the new modules in the reverse sequence.

15.2.5 Removing and installing the module busbars (from type G)

Removal

- Remove the capacitor battery.
- Undo the screws of the module busbars.
  M8 power connections
  M6 fastening on spacers
  M4 circuit.
- Take out the insulation of the SMU / SML.
- Lift out the module busbars.

Installation

NOTE

The spacing between the plus busbar and the minus busbar must be at least 4 mm. In order to install the module busbars, you must therefore use a template, e.g. a 4 mm thick piece of plastic.

- Place the module busbars and SMU/SML insulation on spacer bolts and fix in place (M6).
- Place the template instead of the DC link bus module in the module busbars.
- Locate the SMU and SML and tighten the modular connections (M8, 8 - 10 Nm, M6, 2.5 - 5 Nm).
- Screw the nuts tight on the spacer bolts (6 Nm).
- Connect the circuit resistors (M4, 1.8 Nm).
- Tighten the power connections (M8, 13 Nm).
- Remove the template from the module busbars.

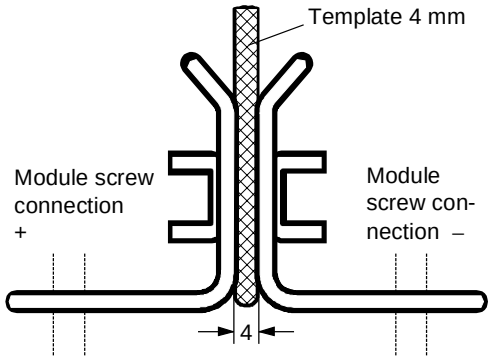


Fig. 15-2 Installing the module busbars

15.2.6 Replacing the balancing resistor

The balancing resistor is situated in the rear installation level on the heat sink between the inverter modules, i.e. behind the capacitor battery and the module busbars.

- Remove the capacitor battery.
- Undo the fixing screws and take out the balancing resistor.
- Install the new component in reverse sequence.
- The balancing resistor is tightened with 1.8 Nm.
  Coat the base plate evenly and thinly with a thermo-lubricant, paying attention to correct contact assignment!

15.2.7 Replacing the IVI

IVI: Inverter-Value Interface (interface board for the power section)

The IVI board is screwed on at the rear of the electronics box.

- Withdraw the connections X205, X206, X208, X31 and X33 from the IVI board.
- Remove the capacitor battery (types E and F).
- Disconnect the fiber-optic cables (type G with with rated input voltage 3 ph. AC 660 - 690 V).
- Remove the PSU together with its insulation (type G)
- Take all the units out of the electronics box and place them on a suitable surface which is not statically charged.
- Undo the two fixing screws of the electronics box.
- Push the electronics box out of its interlock and remove it towards the front.
- Pull out the ABO adaption board.
- Unscrew the IVI board and take it out.
- Install the new IVI in reverse sequence.

15.2.8 Replacing the VDU and the VDU resistor

VDU: Voltage-Dividing Unit

The VDU and the VDU resistor are only found on converters with higher supply voltages. The VDU bracket is an integral component of the electronics slide-in unit.

VDU

- Detach the plug-in connections.
- Undo the fixing screw.
- Take out the VDU.
- Install the new VDU in the reverse sequence.

VDU resistor

- Unscrew the cable fasteners.
- Detach the plug-in connections.
- Take out the VDU resistor.
- Install the new VDU resistor in the reverse sequence.

15.2.9 Replacing the PSU

PSU: Power Supply Unit

- Withdraw connectors X18, X258 and X70 ab.
- Remove the Torx screw with ground connection from the side panel.
- Push the PSU out of its locking pins and take it out sideways and frontwards under the input bus.
- Install the new PSU in the reverse sequence.

15.2.10 Replacing the IGD

IGD: IGBT Gate Drive

Construction types E and F

- The IGD board is mounted directly on the IGBT modules.
- Take out the capacitor battery.
- Remove the electronics box with IVI board for type E.
- Mark the output wiring U2/T1, V2/T2 and W2/T3 and disconnect it.
- Remove the inverter bus module after unscrewing the twelve M6 screws.
- Withdraw connector X295.
- Undo the fixing screws and remove the IGD board.

Construction type G

- The IGD board is mounted directly on the IGBT modules.
- Take out the capacitor battery.
- Remove the SML and SMU modules.
- Remove the inverter bus module.
- Remove the fiber-optic cables or the connector X295.
- Withdraw connectors X290 and X291.
- Undo the fixing screws and remove the IGD board.

Unscrew the fixing screws and remove the IGD board.

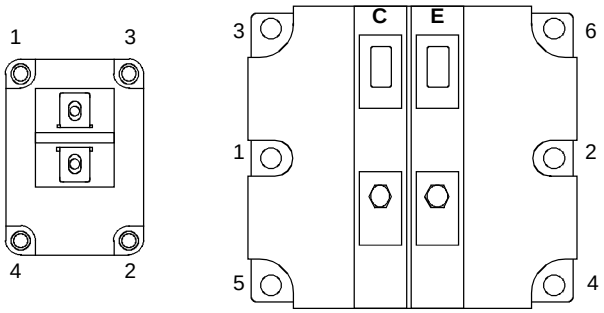
NOTE

The spacing between the plus busbar and the minus busbar must be at least 4 mm. In order to install the module busbars, you must therefore use a template, e.g. a 4 mm thick piece of plastic.

15.2.11 Replacing the IGBT module

Replacement is carried out as in the case of the IGD board, with the following additions:

- ♦ Remove the fixing screws of the faulty IGBT module and take it out.
- ♦ Install a new IGBT module, paying attention to the following:
  - Coat the contact surfaces thinly and evenly with a thermo-lubricant.
  - Tighten the fixing screws of the IGBT module with 5 Nm, observing the sequence of tightening.



Screw on IGBT module:
1. Hand-tighten (~ 0.5 Nm)
   Sequence 1 - 2 - 3 - 4 - 5 - 6
2. Tighten with 5 Nm
   (MLFB 6SE7031-8EF80: 2.5 - 3.5 Nm)
   Sequence 1 - 2 - 3 - 4 - 5 - 6

Fig. 15-3 Screwing on the IGBT module

15.2.12 Replacing the PMU

- Remove the ground cable on the side panel.
- Carefully press the snap catches on the adapter section together, remove the PMU with adapter section from the electronics box.
- Withdraw connector X108 on the CUx board.
- Carefully lift forward the PMU out of the adapter section using a screwdriver.
- Install the new PMU in the reverse sequence

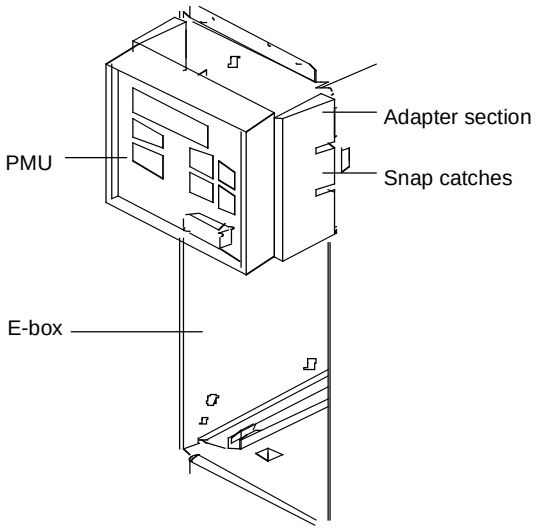


Fig. 15-4 PMU with adapter section on the electronics box

15.3 Fuses

15.3.1 DC fuses

Order No.	Fuse				
6SE70...	gR (SITOR)		North-America		
	[A]	Type	[A]	Type	[V]
Line voltage 3AC 380 V to 460 V					
31-0EE80	160	3NE3224	250	170M3716	660
31-2EF80	250	3NE3227	350	170M3718	660
31-5EF80	250	3NE3227	350	170M3718	660
31-8EF80	315	3NE3230-0B	450	170M3720	660
32-1EG80	450	3NE3233	550	170M6709	660
32-6EG80	450	3NE3233	550	170M6709	660
33-2EG80	500	3NE3334-0B	630	170M6710	660
33-7EG80	500	3NE3334-0B	630	170M6710	660
Line voltage 3AC 500 V to 575 V					
	[A]	Type	[A]	Type	[V]
26-1FE80	125	3NE3222	160	170M3714	660
26-6FE80	160	3NE3224	160	170M3714	660
28-0FF80	160	3NE3224	250	170M3716	660
31-1FF80	200	3NE3225	350	170M3718	660
31-3FG80	200	3NE3225	350	170M3718	660
31-6FG80	250	3NE3227	350	170M3718	660
32-0FG80	400	3NE3232-0B	450	170M6707	660
32-3FG80	400	3NE3232-0B	450	170M6707	660
Line voltage 3AC 660 V to 690 V					
26-0HF80	125	3NE3222			
28-2HF80	160	3NE3224			
31-0HG80	200	3NE3225			
31-2HG80	200	3NE3225			
31-5HG80	315	3NE3230-0B			
31-7HG80	315	3NE3230-0B			
32-1HG80	400	3NE3232-0B			

15.3.2 Fan fuses of the AFE inverters

Line voltage 3AC 380 V to 460 V	
Order No. 6SE70..	**Fan Fuse (F1 / F2)**
31-0EE80 31-0EE80-1AA0	FNQ-R-2
31-2EF80 31-2EF80-1AA0	FNQ-R-2
31-5EF80 31-5EF80-1AA0	FNQ-R-2
31-8EF80 31-8EF80-1AA0	FNQ-R-2
32-1EG80 32-1EG80-1AA0	FNQ-R-5
32-6EG80 32-6EG80-1AA0	FNQ-R-5
33-2EG80 33-2EG80-1AA0	FNQ-R-5
33-7EG80 33-7EG80-1AA0	FNQ-R-5
Manufacturer:	FNQ-R- Bussmann

Line voltage 3AC 500 V to 575 V	
Order No. 6SE70..	**Fan Fuse (F1 / F2)**
26-1FE80 26-1FE80-1AA0	FNQ-R-2
26-6FE80 26-6FE80-1AA0	FNQ-R-2
28-0FF80 28-0FF80-1AA0	FNQ-R-2
31-1FF80 31-1FF80-1AA0	FNQ-R-2
31-3FG80 31-3FG80-1AA0	FNQ-R-5
31-6FG80 31-6FG80-1AA0	FNQ-R-5
32-0FG80 32-0FG80-1AA0	FNQ-R-5
32-3FG80 32-3FG80-1AA0	FNQ-R-5
Manufacturer:	FNQ-R- Bussmann

Line voltage 3AC 660 V to 690 V	
Order No. 6SE70..	**Fan Fuse (F1 / F2)**
26-0HF80 26-0HF80-1AA0	FNQ-R-2
28-2HF80 28-2HF80-1AA0	FNQ-R-2
31-0HG80 31-0HG80-1AA0	FNQ-R-5
31-2HG80 31-2HG80-1AA0	FNQ-R-5
31-5HG80 31-5HG80-1AA0	FNQ-R-5
31-7HG80 31-7HG80-1AA0	FNQ-R-5
32-1HG80 32-1HG80-1AA0	FNQ-R-5
Manufacturer: FNQ-R- Bussmann	

15.3.3 Fuses of the auxiliary power supply of the mains connection module

Equipment designation	Fuse
-F11, F12	AM144 4A 14x51
-F21, F22	AM104 4A 10x38

15.3.4 Main fuses

Line voltage 3AC 380 V to 460 V		
Type power [kW]	**Main fuses (-F1...F3)**	
45	690 V / 100 A	3NE1021-0
55	690 V / 160 A	3NE1224-0
75	690 V / 160 A	3NE1224-0
90	690 V / 200 A	3NE1225-0
110	690 V / 250 A	3NE1227-0
132	690 V / 310 A	3NE1230-0
160	690 V / 350 A	3NE1331-0
200	690 V / 400 A	3NE1332-0

Line voltage 3AC 500 V to 575 V		
Type power [kW]	**Main fuses (-F1...F3)**	
37	690 V / 80 A	3NE1820-0
45	690 V / 80 A	3NE1820-0
55	690 V / 100 A	3NE1021-0
75	690 V / 125 A	3NE1022-0
90	690 V / 160 A	3NE1224-0
112	690 V / 200 A	3NE1225-0
132	690 V / 250 A	3NE1227-0
160	690 V / 250 A	3NE1227-0

Line voltage 3AC 660 V to 690 V		
Type power [kW]	**Main fuses (-F1...F3)**	
55	690 V / 80 A	3NE1820-0
75	690 V / 100 A	3NE1021-0
90	690 V / 125 A	3NE1022-0
110	690 V / 160 A	3NE1224-0
132	690 V / 160 A	3NE1224-0
160	690 V / 200 A	3NE1225-0
200	690 V / 250 A	3NE1227-0

16 Forming

For units in the 400 V and 690 V voltage classes (cf. 9th digit of the MLFB, letter E or H), the DC link capacitors must be formed again after an idle period of more than 2 years.

For units in the 500 V voltage class (cf. 9th digit of the MLFB, letter F), the DC link capacitors must be formed again after an idle period of more than 1 year.

If this is not carried out, the unit can be damaged when the line voltage is powered up.

If the unit was started-up within one year after having been manufactured, the DC link capacitors do not have to be re-formed. The date of manufacture of the unit can be read from the serial number.

How the serial number is made up

(Example: A-J60147512345)

Digit	Example	Meaning
1 and 2	A-	Place of manufacture
3	J	1997
	K	1998
	L	1999
	M	2000
4	1 to 9	January to September
	O	October
	N	November
	D	December
5 to 14		Not relevant for forming

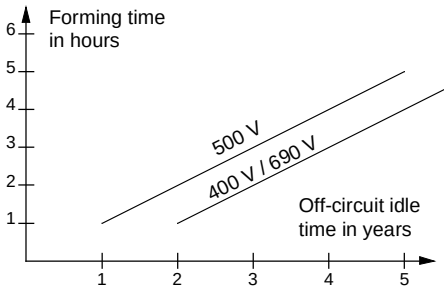
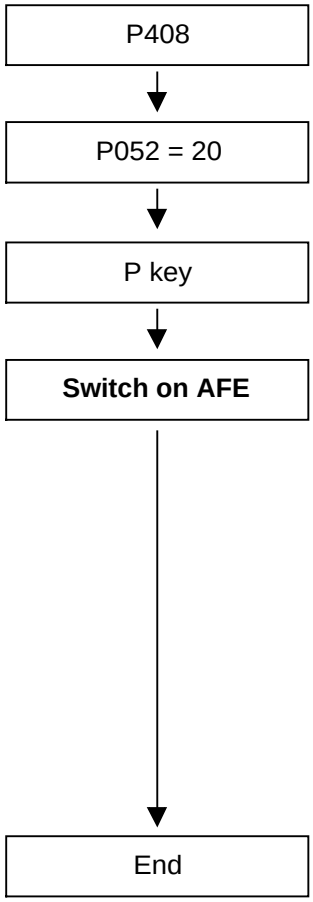


Fig. 16-1 Forming time depending on the idle time of the AFE inverter



Set forming time (60.0 to 600.0 minutes)

Select "Form DC link"

The operating display appears:
The AFE must be switched on within 20 s or else a shutdown on faults (F091) will occur (fault value 4).

NOTE:
While forming is in progress, the SIMOVERT MASTERDRIVES MC/VC must not be switched on!

- The DC link forming operation is carried out (forming period as set in P408).
- During the forming period set in P408, the pre-charging contactor is energized and de-energized in such a way that the DC link capacitor is charged up to the line voltage peak value.
- The current limit set in P160 is not effective with respect to the forming operation!

On completion of the function, operating display "Ready" (009) appears.

17 Technical Data

17.1 Mains connection module

EU low-voltage directive 73/23/EEC and RL93/68/EEC	EN 50178
EU machine directive 89/392/EEC	EN 60204-1
Type of cooling	Air cooling
Permissible ambient and cooling-medium temperature • during operation • during storage, transport	 0° C to +50° C (32° F to 114° F) -25° C to +70° C (-13° F to 158° F)
Installation height	See AFE inverter
Permissible humidity rating	Relative humidity ≤ 95 % during transport and storage ≤ 85 % during operation (moisture condensation not permissible)
Climatic class	Class 3K3 to DIN IEC 721-3-3 (during operation)
Pollution degree	Pollution degree 2 to IEC 664-1 (DIN VDE 0110. Part 1). Moisture condensation during operation is not permissible
Overvoltage category	Category III to IEC 664-1 (DIN VDE 0110, Part 2)
Degree of protection	to EN 60529 IP00
Radio interference suppression Standard Options	to EN 61800-3 No radio interference suppression Radio interference suppression filter for Class A1 to EN 55011

Table 17-1 Mains connection modules: general technical data

Designation		Value			
Order No.	6SE71...	31-0EE83-2NA0	31-2EF83-2NA0	31-5EF83-2NA0	31-8EF83-2NA0
Rated voltage	[V]	3 AC 380 (-20 %) to 460 (+5 %)			
Rated frequency	[Hz]	50 / 60			
Rated current	[A]	92	124	146	186
Rated output	[kVA]	58...70	78...95	90...110	115...135
Auxiliary current supply	[V]	DC 24 (20 - 30), approx. 1 A			
Auxiliary current supply fan	[V]	AC 230, approx. 0.5 A			
Power loss	[kW]	0.25	0.33	0.38	0.48
Type of construction		E	F	F	F
Dimensions • Width • Height • Depth	[mm]	 274 1310 408	 440 1310 440	 440 1310 440	 440 1310 440
Weight incl. AFE choke approx. [kg]		110	170	170	178

Table 17-2 Mains connection modules (380 V to 460 V, Part 1)

Designation		Value			
Order No.	6SE71...	32-1EG83-2NA0	32-6EG83-2NA0	33-2EG83-2NA0	33-7EG83-2NA0
Rated voltage	[V]	3 AC 380 (-20 %) to 460 (+5 %)			
Rated frequency	[Hz]	50 / 60			
Rated current	[A]	210	260	315	370
Rated output	[kVA]	130...160	160...195	195...235	230...280
Auxiliary current supply	[V]	DC 24 (20 - 30), approx. 1 A			
Auxiliary current supply fan	[V]	AC 230, approx. 0.5 A			
Power loss	[kW]	0.55	0.67	0.82	0.97
Type of construction		G	G	G	G
Dimensions • Width • Height • Depth	[mm]	 580 1339 459	 580 1339 459	 580 1339 459	 580 1339 459
Weight incl. AFE choke approx. [kg]		240	245	295	300

Table 17-3 Mains connection modules (380 V to 460 V, Part 2)

Designation		Value			
Order No.	6SE71...	26-1FE83-2NA0	26-6FE83-2NA0	28-0FF83-2NA0	31-1FF83-2NA0
Rated voltage	[V]	3 AC 500 (-20 %) to 575 (+5 %)			
Rated frequency	[Hz]	50 / 60			
Rated current	[A]	61	66	79	108
Rated output	[kVA]	50...58	55...63	65...75	90...103
Auxiliary current supply	[V]	DC 24 (20 - 30), approx. 1 A			
Auxiliary current supply fan	[V]	AC 230, approx. 0.5 A			
Power loss	[kW]	0.21	0.23	0.27	0.38
Type of construction		E	E	F	F
Dimensions • Width • Height • Depth	[mm]	 274 1310 408	 274 1310 408	 440 1310 440	 440 1310 440
Weight incl. AFE choke approx.	[kg]	101	105	155	170

Table 17-4 Mains connection modules (500 V to 575 V, Part 1)

Designation		Value			
Order No.	6SE71...	31-3FG83-2NA0	31-6FG83-2NA0	32-0FG83-2NA0	32-3FG83-2NA0
Rated voltage	[V]	3 AC 500 (-20 %) to 575 (+5 %)			
Rated frequency	[Hz]	50 / 60			
Rated current	[A]	128	156	192	225
Rated output	[kVA]	106...160	130...149	160...183	185...214
Auxiliary current supply	[V]	DC 24 (20 - 30), approx. 1 A			
Auxiliary current supply fan	[V]	AC 230, approx. 0.5 A			
Power loss	[kW]	0.45	0.55	0.81	0.95
Type of construction		G	G	G	G
Dimensions • Width • Height • Depth	[mm]	 580 1339 459	 580 1339 459	 580 1339 459	 580 1339 459
Weight incl. AFE choke approx.	[kg]	223	240	245	285

Table 17-5 Mains connection modules (500 V to 575 V, Part 2)

Designation		Value			
Order No.	6SE71...	26-0HF83-2NA0	28-2HF83-2NA0	31-0HG83-2NA0	31-2HG83-2NA0
Rated voltage	[V]	3 AC 660 (-20 %) to 690 (+5 %)			
Rated frequency	[Hz]	50 / 60			
Rated current	[A]	60	82	97	118
Rated output	[kVA]	65...68	88...93	105...110	127...134
Auxiliary current supply	[V]	DC 24 (20 - 30), approx. 1 A			
Auxiliary current supply fan	[V]	AC 230, approx. 0.5 A			
Power loss	[kW]	0.27	0.37	0.44	0.53
Type of construction		E	E	G	G
Dimensions • Width • Height • Depth	[mm]	 440 1310 440	 440 1310 440	 580 1339 459	 580 1339 459
Weight incl. AFE choke approx.	[kg]	155	170	219	240

Table 17-6 Mains connection modules (660 V to 690 V, Part 1)

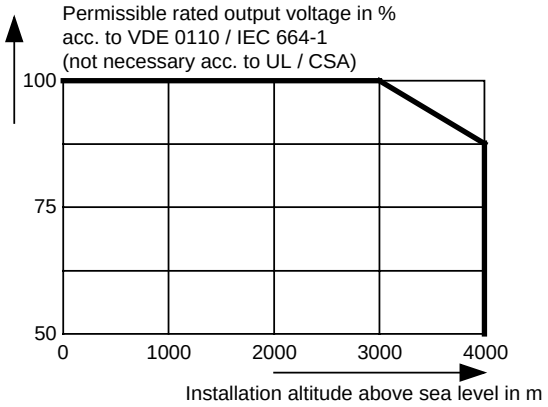
Designation		Value			
Order No.	6SE71...	31-5HG83-2NA0	31-7HG83-2NA0	32-1HG83-2NA0	
Rated voltage	[V]	3 AC 660 (-20 %) to 690 (+5 %)			
Rated frequency	[Hz]	50 / 60			
Rated current	[A]	145	171	208	
Rated output	[kVA]	157...165	185...195	225...235	
Auxiliary current supply	[V]	DC 24 (20 - 30), approx. 1 A			
Auxiliary current supply fan	[V]	AC 230, approx. 0.5 A			
Power loss	[kW]	0.66	0.78	0.95	
Type of construction		G	G	G	
Dimensions • Width • Height • Depth	[mm]	 580 1339 459	 580 1339 459	 580 1339 459	
Weight incl. AFE choke approx.	[kg]	245	295	295	

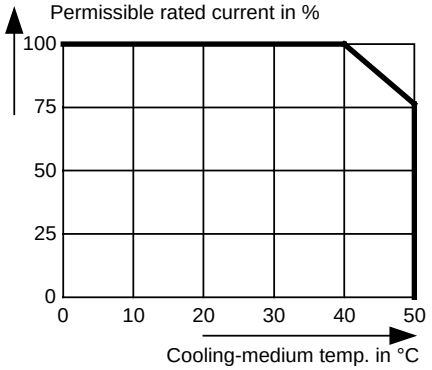
Table 17-7 Mains connection modules (660 V to 690 V, Part 2)

17.2 AFE inverter

EU low-voltage directive 73/23/EEC and RL93/68/EEC	EN 50178
EU directive EMC 89/336/EEC	EN 61800-3
EU machine directive 89/392/EEC	EN 60204-1
Approval	UL: E 145 153 CSA: LR 21 927
Type of cooling	Air cooling with built-in fan
Permissible ambient and cooling-medium temperature	
• during operation	0° C to +40° C (32° F to 104° F) (up to 50 °C, see Fig. „Derating curves“)
• during storage	-25° C to +70° C (-13° F to 158° F)
• during transport	-25° C to +70° C (-13° F to 158° F)
Installation height	≤ 1000 m above sea level (100 % load capability) > 1000 m to 3500 m above sea level (for load capability. see Fig. „Derating curves“)
Permissible humidity rating	Relative humidity ≤ 95 % during transport and storage ≤ 85 % during operation (moisture condensation not permissible)
Climatic class	Class 3K3 to DIN IEC 721-3-3 (during operation)
Pollution degree	Pollution degree 2 to IEC 664-1 (DIN VDE 0110. Part 1). Moisture condensation during operation is not permissible
Overvoltage category	Category III to IEC 664-1 (DIN VDE 0110, Part 2)
Degree of protection	EN 60529 IP00
Class of protection	Class 1 to IEC 536 (DIN VDE 0106, Part 1)
Shock protection	to EN 60204-1 and DIN VDE 0106 Part 100 (VBG4)
Radio interference suppression	to EN 61800-3
• Standard	No radio interference suppression
• Options	Radio interference suppression filter for Class A1 to EN 55011
Interference immunity	Industrial to EN 61800-3
Paint finish	For interior installation
Mechanical specifications	
• Vibrations	to DIN IEC 68-2-6
During stationary use:	
Constant amplitude	
- of deflection	0.075 mm in the frequency range 10 Hz to 58 Hz
- of acceleration	9.8 m/s² in the frequency range > 58 Hz to 500 Hz
During transport:	
- of deflection	3.5 mm in the frequency range 5 Hz to 9 Hz
- of acceleration	9.8 m/s² in the frequency range > 9 Hz to 500 Hz
• Shocks	to DIN IEC 68-2-27 / 08.89 30 g, 16 ms half-sine shock

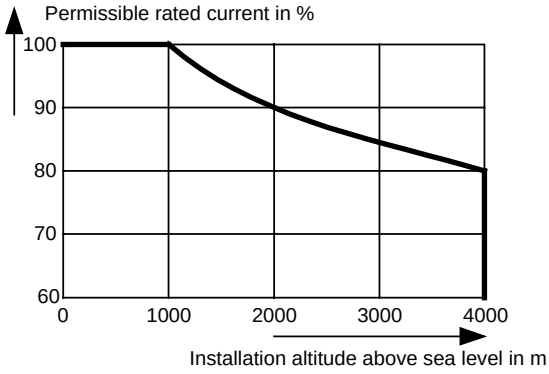
Table 17-8 AFE inverter, general data





Temp [°C]	Derating factor K_2
50	0.76
45	0.879
40	1.0
35	1.125 *
30	1.25 *
25	1.375 *

* See the following Note



Altitude [m]	Derating factor K_1
1000	1.0
2000	0.9
3000	0.845
4000	0.8

Fig. 17-1 Derating curves

The derating of the permissible rated current for installation altitudes of over 1000 m and at ambient temperatures below 40 °C is calculated as follows:

Total derating = $\text{Derating}_{\text{altitude}}$ x $\text{Derating}_{\text{ambient temperature}}$

$K = K_1 \times K_2$

NOTE

It must be borne in mind that total derating must **not be greater** than 1!

Example: Altitude: 3000 m $K_1 = 0.845$
Ambient temperature: 35 °C $K_2 = 1.125$
$\Rightarrow$ Total derating = 0.845 x 1.125 = 0.95

Designation	Value					
Order No. 6SE70...	31-0EE80	31-2EF80	31-5EF80	31-8EF80	32-1EG80	32-6EG80
Rated voltage [V] • Input • Output	3 AC 380 (-20 %) to 460 (+5 %) DC 600 to 740					
Rated frequency [Hz]	50 / 60					
Rated current [A] • Input 3 AC • Output DC	 92 105	 124 140	 146 165	 186 215	 210 240	 260 300
Rated output [kVA]	58...70	78...95	90...110	115...135	130...160	160...195
Auxiliary current supply [V]	DC 24 (20 - 30)					
• Max. aux. curr. requirement [A] Standard version at 20 V	1.7	2.1			2.3	
• Max. aux. curr. requirement [A] Maximum version at 20 V	2.7	3.2			3.5	
Auxiliary current supply fan [V]	1 AC or 2 AC 230					
• Aux. curr. requirem. at 50 Hz [A]	0.43	0.80			0.95	
• Aux. curr. requirem. at 60 Hz [A]	0.49	1.2			1.4	
Pulse frequency [kHz]	3	3	3	3	3	3
Load class II to EN 60 146-1-1						
Base load current [A]	0.91 x rated output current					
Base load duration [s]	240					
Overload current [A]	1.36 x rated output current					
Overload duration [s]	60					
Losses, cooling, power factor						
Power factor conv. cosφU	< 0.98					
Efficiency η (rated operation)	≥ 0.98					
Power loss [kW]	1.05	1.35	1.56	1.70	2.18	2.75
Cooling-air requirement [m³/s]	0.10	0.14	0.14	0.14	0.31	0.31
Sound pressure levels, types of construction, dimensions, weights						
Sound pressure level IP00 [dB(A)]	69	69	69	69	80	80
Type of construction	E	F	F	F	G	G
Dimensions [mm] • Width • Height • Depth	 270 1050 350	 360 1050 350	 360 1050 350	 360 1050 350	 508 1450 450	 508 1450 450
Weight approx. [kg]	55	65	65	65	155	155

Table 17-9 Air-cooled AFE inverters (Part 1)

Designation	Value					
Order No. 6SE70...	33-2EG80	33-7EG80				
Rated voltage [V] • Input • Output	3 AC 380 (-20 %) to 460 (+5 %) DC 600 to 740					
Rated frequency [Hz]	50 / 60					
Rated current [A] • Input 3 AC • Output DC	 315 360	 370 425				
Rated output [kVA]	195...235	230...280				
Auxiliary current supply [V]	DC 24 (20 - 30)					
• Max. aux. curr. requirement [A] Standard version at 20 V	2.3					
• Max. aux. curr. requirement [A] Maximum version at 20 V	3.5					
Auxiliary current supply fan [V]	1 AC or 2 AC 230					
• Aux. curr. requirem. at 50 Hz [A]	0.95					
• Aux. curr. requirem. at 60 Hz [A]	1.4					
Pulse frequency [kHz]	3	3				
Load class II to EN 60 146-1-1						
Base load current [A]	0.91 x rated output current					
Base load duration [s]	240					
Overload current [A]	1.36 x rated output current					
Overload duration [s]	60					
Losses, cooling, power factor						
Power factor conv. cosφU	< 0.98					
Efficiency η (rated operation)	≥ 0.98					
Power loss [kW]	3.47	4.05				
Cooling-air requirement [m³/s]	0.41	0.41				
Sound pressure levels, types of construction, dimensions, weights						
Sound pressure level IP00 [dB(A)]	82	82				
Type of construction	G	G				
Dimensions [mm] • Width • Height • Depth	 508 1450 450	 508 1450 450				
Weight approx. [kg]	155	155				

Table 17-10 Air-cooled AFE inverters (Part 2)

Designation		Value					
Order No.	6SE70...	26-1FE80	26-6FE80	28-0FF80	31-1FF80	31-3FG80	31-6FG80
Rated voltage	[V]						
• Input • Output		3 AC 500 (-20 %) to 575 (+5 %) DC 750 to 920					
Rated frequency	[Hz]	50 / 60					
Rated current	[A]						
• Input • Output	3 AC DC	61 66	66 75	79 90	108 120	128 145	156 175
Rated output	[kVA]	50...58	55...63	65...75	90...103	106...160	130...149
Auxiliary current supply	[V]	DC 24 (20 - 30)					
• Max. aux. curr. requirement Standard version at 20 V	[A]	1.7		2.1		2.3	
• Max. aux. curr. requirement Maximum version at 20 V	[A]	2.7		3.2		3.5	
Auxiliary current supply fan	[V]	1 AC or 2 AC 230					
• Aux. curr. requirem. at 50 Hz	[A]	0.43	0.80			0.95	
• Aux. curr. requirem. at 60 Hz	[A]	0.49	1.2			1.4	
Pulse frequency	[kHz]	3	3	3	3	3	3
Load class II to EN 60 146-1-1							
Base load current	[A]	0.91 x rated output current					
Base load duration	[s]	240					
Overload current	[A]	1.36 x rated output current					
Overload duration	[s]	60					
Losses, cooling, power factor							
Power factor conv. cosφU		< 0.98					
Efficiency η (rated operation)		≥ 0.98					
Power loss	[kW]	0.75	0.84	1.04	1.50	1.80	2.18
Cooling-air requirement	[m³/s]	0.10	0.10	0.14	0.14	0.31	0.31
Sound pressure levels, types of construction, dimensions, weights							
Sound pressure level IP00	[dB(A)]	69	69	69	69	80	80
Type of construction		E	E	F	F	G	G
Dimensions	[mm]						
• Width • Height • Depth		270 1050 350	270 1050 350	360 1050 350	360 1050 350	508 1450 450	508 1450 450
Weight approx.	[kg]	55	55	65	65	155	155

Table 17-11 Air-cooled AFE inverters (Part 3)

Designation	Value					
Order No. 6SE70...	32-0FG80	32-3FG80				
Rated voltage [V] • Input • Output	3 AC 500 (-20 %) to 575 (+5 %) DC 750 to 920					
Rated frequency [Hz]	50 / 60					
Rated current [A] • Input 3 AC • Output DC	 192 220	 225 250				
Rated output [kVA]	160...183	185...214				
Auxiliary current supply [V]	DC 24 (20 - 30)					
• Max. aux. curr. requirement [A] Standard version at 20 V	2.3					
• Max. aux. curr. requirement [A] Maximum version at 20 V	3.5					
Auxiliary current supply fan [V]	1 AC or 2 AC 230					
• Aux. curr. requirem. at 50 Hz [A]	0.95					
• Aux. curr. requirem. at 60 Hz [A]	1.4					
Pulse frequency [kHz]	3	3				
Load class II to EN 60 146-1-1						
Base load current [A]	0.91 x rated output current					
Base load duration [s]	240					
Overload current [A]	1.36 x rated output current					
Overload duration [s]	60					
Losses, cooling, power factor						
Power factor conv. cosφU	< 0.98					
Efficiency η (rated operation)	≥ 0.98	≥ 0.97				
Power loss [kW]	2.82	3.40				
Cooling-air requirement [m³/s]	0.41	0.41				
Sound pressure levels, types of construction, dimensions, weights						
Sound pressure level IP00 [dB(A)]	82	82				
Type of construction	G	G				
Dimensions [mm] • Width • Height • Depth	 508 1450 450	 508 1450 450				
Weight approx. [kg]	155	155				

Table 17-12 Air-cooled AFE inverters (Part 4)

Designation	Value					
Order No. 6SE70...	26-0HF80	28-2HF80	31-0HG80	31-2HG80	31-5HG80	31-7HG80
Rated voltage [V] • Input • Output	3 AC 660 (-20 %) to 690 (+5 %) DC 1035 to 1100					
Rated frequency [Hz]	50 / 60					
Rated current [A] • Input 3 AC • Output DC	 60 66	 82 90	 97 105	 118 130	 145 160	 171 190
Rated output [kVA]	65...68	88...93	105...110	127...134	157...165	185...195
Auxiliary current supply [V]	DC 24 (20 - 30)					
• Max. aux. curr. requirement [A] Standard version at 20 V	2.1		2.3			
• Max. aux. curr. requirement [A] Maximum version at 20 V	3.2		3.5			
Auxiliary current supply fan [V]	1 AC or 2 AC 230					
• Aux. curr. requirem. at 50 Hz [A]	0.80		0.95			
• Aux. curr. requirem. at 60 Hz [A]	1.2		1.4			
Pulse frequency [kHz]	3	3	3	3	3	3
Load class II to EN 60 146-1-1						
Base load current [A]	0.91 x rated output current					
Base load duration [s]	240					
Overload current [A]	1.36 x rated output current					
Overload duration [s]	60					
Losses, cooling, power factor						
Power factor conv. cosφU	< 0.98					
Efficiency η (rated operation)	≥ 0.98					
Power loss [kW]	0.90	1.24	1.68	2.03	2.43	3.05
Cooling-air requirement [m³/s]	0.14	0.14	0.31	0.31	0.41	0.41
Sound pressure levels, types of construction, dimensions, weights						
Sound pressure level IP00 [dB(A)]	69	69	80	80	82	82
Type of construction	F	F	G	G	G	G
Dimensions [mm] • Width • Height • Depth	 360 1050 350	 360 1050 350	 508 1450 450	 508 1450 450	 508 1450 450	 508 1450 450
Weight approx. [kg]	65	65	155	155	155	155

Table 17-13 Air-cooled AFE inverters (Part 5)

Designation	Value					
Order No. 6SE70...	32-1HG80					
Rated voltage [V] • Input • Output	3 AC 660 (-20 %) to 690 (+5 %) DC 1035 to 1100					
Rated frequency [Hz]	50 / 60					
Rated current [A] • Input 3 AC • Output DC	 208 230					
Rated output [kVA]	225...235					
Auxiliary current supply [V]	DC 24 (20 - 30)					
• Max. aux. curr. requirement [A] Standard version at 20 V	2.3					
• Max. aux. curr. requirement [A] Maximum version at 20 V	3.5					
Auxiliary current supply fan [V]	1 AC or 2 AC 230					
• Aux. curr. requirem. at 50 Hz [A]	1.1					
• Aux. curr. requirem. at 60 Hz [A]	1.4					
Pulse frequency [kHz]	3					
Load class II to EN 60 146-1-1						
Base load current [A]	0.91 x rated output current					
Base load duration [s]	240					
Overload current [A]	1.36 x rated output current					
Overload duration [s]	60					
Losses, cooling, power factor						
Power factor conv. cosφU	< 0.98					
Efficiency η (rated operation)	≥ 0.98					
Power loss [kW]	3.70					
Cooling-air requirement [m³/s]	0.41					
Sound pressure levels, types of construction, dimensions, weights						
Sound pressure level IP00[dB(A)]	82					
Type of construction	G					
Dimensions [mm] • Width • Height • Depth	 508 1450 450					
Weight approx. [kg]	250					

Table 17-14 Air-cooled AFE inverters (Part 6)

Water-cooled AFE inverters

Order No.	Power loss [kW]	Cooling water require-ment [L/min]	Maximum additional heat dissipation at Tair ≤ 30 °C [kW]
Rated input voltage 3 AC 380 to 460 V			
6SE7031-0EE80-1AA0	1.05	12	0.7
6SE7031-2EF80-1AA0	1.35	12	0.7
6SE7031-5EF80-1AA0	1.56	12	0.7
6SE7031-8EF80-1AA0	1.70	12	0.7
6SE7032-1EG80-1AA0	2.18	26	1.5
6SE7032-6EG80-1AA0	2.75	26	1.5
6SE7033-2EG80-1AA0	3.47	26	1.5
6SE7033-7EG80-1AA0	4.05	26	1.5
Rated input voltage 3 AC 500 to 575 V			
6SE7026-1FE80-1AA0	0.75	12	0.7
6SE7026-6FF80-1AA0	0.84	12	0.7
6SE7028-0FF80-1AA0	1.04	12	0.7
6SE7031-1FF80-1AA0	1.50	26	1.5
6SE7031-3FG80-1AA0	1.80	26	1.5
6SE7031-6FG80-1AA0	2.18	26	1.5
6SE7032-0FG80-1AA0	2.82	26	1.5
6SE7032-3FG80-1AA0	3.40	26	1.5
Rated input voltage 3 AC 660 to 690 V			
6SE7026-0HF80-1AA0	0.90	12	0.7
6SE7028-2HF80-1AA0	1.24	12	0.7
6SE7031-0HG80-1AA0	1.68	26	1.5
6SE7031-2HG80-1AA0	2.03	26	1.5
6SE7031-5HG80-1AA0	2.43	26	1.5
6SE7031-7HG80-1AA0	3.05	26	1.5
6SE7032-1HG80-1AA0	3.70	26	1.5

Table 17-15 Water-cooled AFE inverter

NOTE

The units are identical in design to the air-cooled AFE inverters. Instead of the heat sink for air, an air/water cooler has been installed.

All the technical data not listed in Table 17-15 for a particular unit are the same as those of the air-cooled AFE-inverter. The first 12 positions of the Order No. are identical.
The supplement "-1AA0” indicates water cooling.

17.3 Notes regarding water-cooled units

Other conditions affecting operation

The unit is to be connected to an existing external cooling-water circuit.

The construction of this cooling-water circuit under the aspects of

- open or closed circuit
- choice and juxtaposition of materials
- composition of cooling water
- cooling-water cooling (recooling, supply of fresh cooling water)
- and others

have an important effect on the safe functioning and service life of the whole installation.

WARNING

The warnings given under “Standard units" apply.

Installation and servicing work on the water cooling system must be performed with the power disconnected.

There must be no **condensation** on the units (also applies to standard units).

17.3.1 Notes regarding installation and components

A closed-circuit water-cooling system of stainless steel with water/water heat exchanger is recommended for the converters.

To prevent electrochemical corrosion and transfer of vibration, SIMOVERT MASTERDRIVES are to be connected to **water supply and return lines by flexible, electrically non-conducting hose. The hose length (in total) should be > 1.5 m.**

If plastic piping is used in the installation, this hose is not necessary.

The water hoses should be connected up before the converter is installed.

If hose clips are used, they should be checked for tightness at three-monthly intervals.

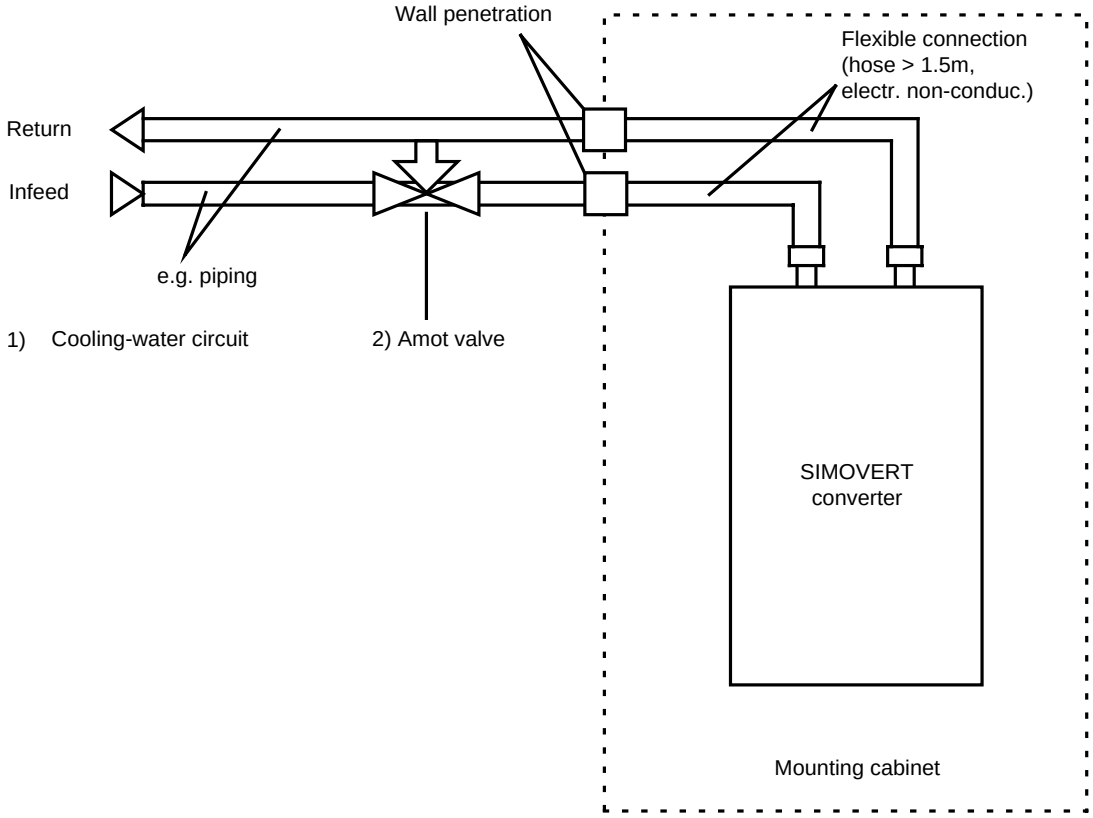


Fig. 17-2 Cooling-water circuit for SIMOVERT converters

The operating pressure is to be adjusted according to the flow conditions in the supply and return sides of the water cooling system.

The volume of cooling water per unit time is to be set to within the values given in Table 17-15.
This can be done, for example, by means of valves with flowmeter (e.g. as made by “OSTACO Armaturen AG”, CH-8902 Urdorf, Tel. ++4117355555).

The flowmeters made by GPI (5252 East 36th Street North Wichita, KS USA 67220-3205 Tel.: 316-686-7361, Fax.: 316-686-6746) have also proved very effective.

The user must take measures to ensure that the max. permissible operating pressure (≤ 1 bar) is not exceeded. Use must be made of a pressure regulating device.

Closed-circuit cooling systems are to be provided with pressure balancing devices with safety valve (≤ 3 bar) and air venting devices.

The air must be let out of the cooling system while filling is in progress.

To ensure that the necessary volume keeps flowing, flushback filters should be fitted instead of the normal pipe strainer. Flushback filters automatically take care of the return flow.

These are manufactured by, for example, Benckiser GmbH, Industriestrasse 7, D-6905 Schriesheim Tel.: +49-6203-730.

ASI 1 Information Bulletin E20125-C6038-J702-A1-7400 of February 1997 contains information about suggested plant configurations for various applications.

Water piping must be laid with extreme care. The pipes must be properly secured mechanically and checked for leakage.

Water pipes must under no circumstances make contact with live parts (insulation clearance: at least 13 mm).

17.3.2 Application

In application, the same general conditions apply as to standard units (with air cooling), with the exception of the cooling conditions described below.

Water is normally used as the cooling medium (see Section "Coolant"). Antifreeze is added only in exceptional cases.

Within a cooling water temperature range of from + 5 °C to + 38 °C, the unit can be operated at 100% rated current.

If higher cooling water temperatures are necessary, the unit operating current must be reduced as shown in Figures 2 and 3 (Curve 1).

This applies only where water is used as the cooling medim (see notes in Section "Anti-condensation, Antifreeze").

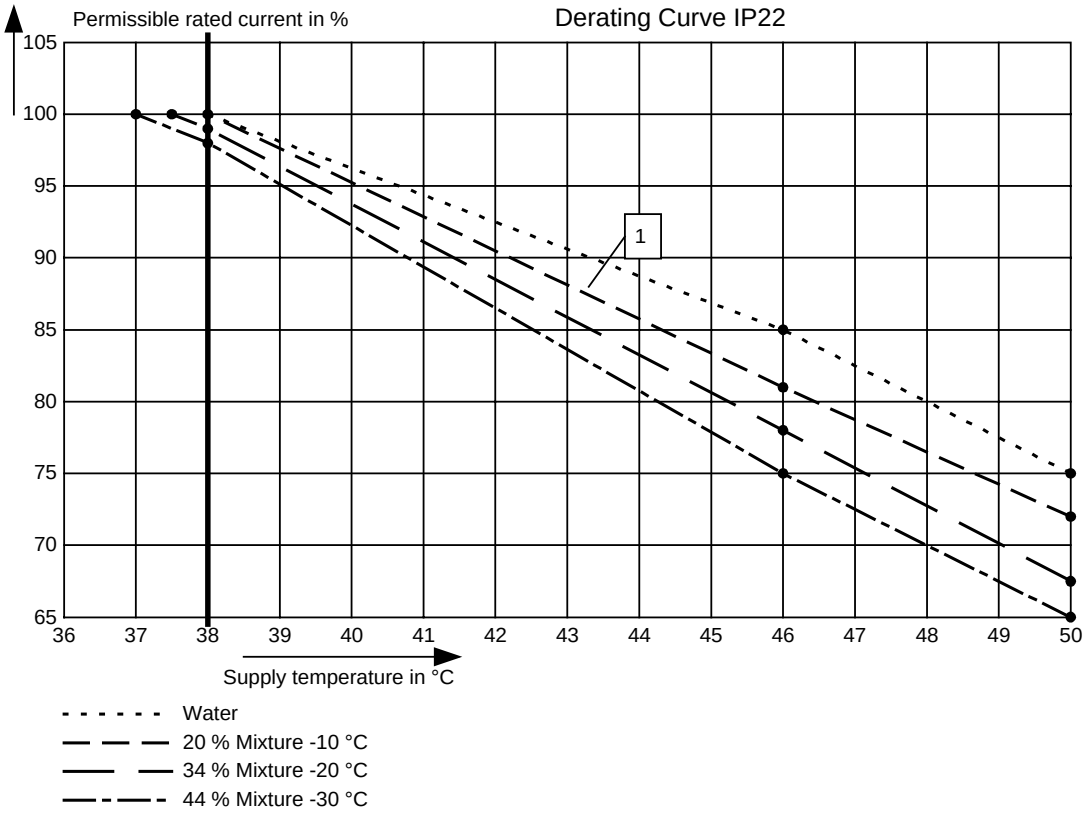


Fig. 17-3 Reduction curve applying to installation in IP22 cabinets

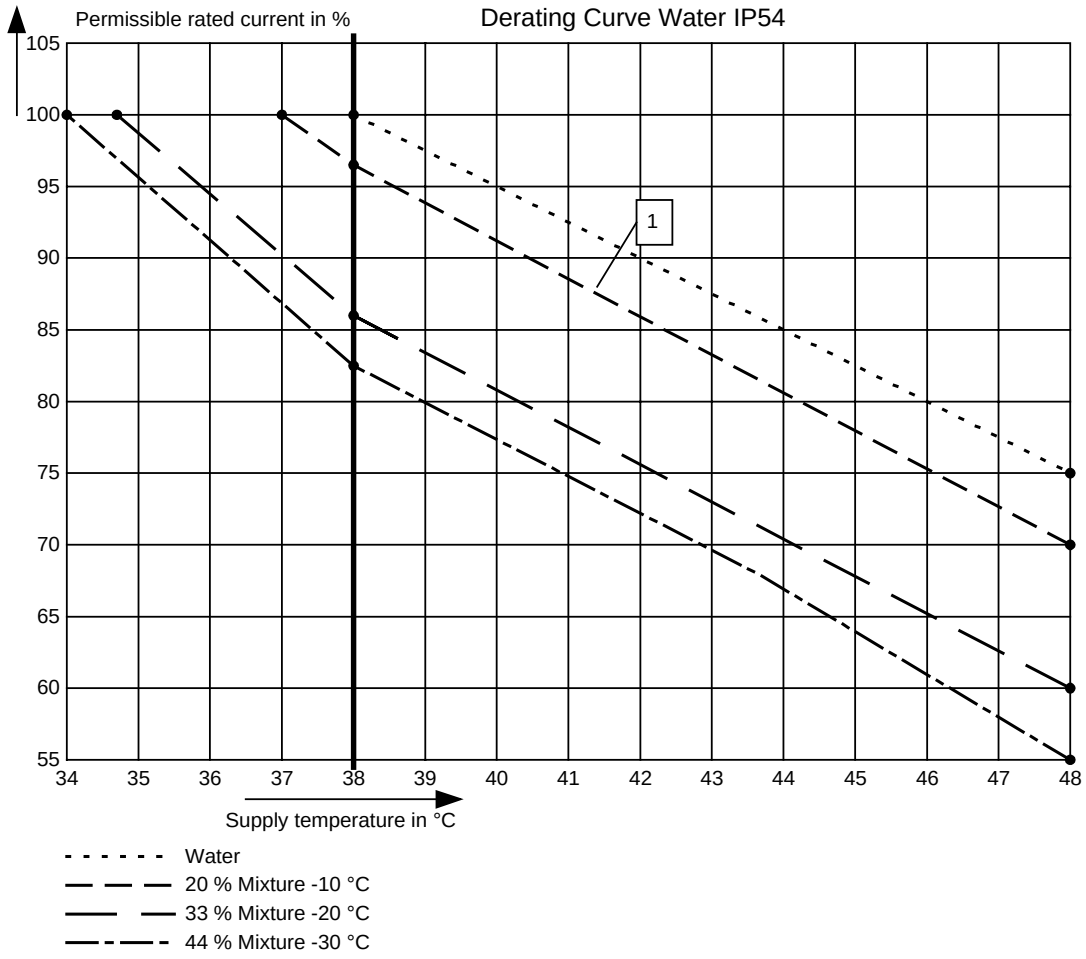


Fig. 17-4 Reduction curve 2 applying to installation in IP54 cabinets

NOTE

The maximum coolant temperature is 50 °C for IP22 cubicles and 46 °C for IP54 cubicles!

17.3.3 Coolant

Normal service water or a water-antifreeze mixture (see Section "Antifreeze additive") can be used as coolant.

17.3.3.1 Definition of cooling water

Chemically neutrally reacting, clean water free of solid substances (mains water).

Max. grain size of any entrained particles	≤ 0.1 mm
pH value	**6.0 to 8.0**
Chloride	< 40 ppm
Sulfate	< 50 ppm
Dissolved substances	< 340 ppm
Total hardness	< 170 ppm
Conductivity (water only, also see Section "Antifreeze additive")	< 500 µS/cm
Cooling water inlet temperature	+ 5 ... 38 °C
Cooling water temperature rise per unit (rated operation)	Δ T ≈ 5 °C
Operating pressure	≤ 1 bar

IMPORTANT

Operating pressures higher than 1 bar are not permissible!

If the system is operating at a higher pressure, the supply pressure must be reduced to 1 bar at each unit.

The heat sink material is not seawater-proof, i.e. **it must not be cooled directly with seawater!**

Filters (sieves) with a mesh size of < 100 µm are to be fitted in the unit water systems (see Section “Notes regarding installation and components”)!

If there is a risk of freezing, appropriate counter-measures should be taken for operation, storage and transport, e.g. draining and blowing out with air, extra heaters, etc.

WARNING

The warning notes for "standard units" apply.

Installation and servicing work on the water systems must always be performed with the electric power disconnected.

17.3.3.2 Antifreeze additive

By the use of antifreeze, the lower operating temperature limit can be reduced from + 5 °C to 0 °C, and when not operating the system is protected against freezing at temperatures down to – 30 °C.

Because of its physical properties (heat absorption, thermal conductivity, viscosity), antifreeze reduces cooling system efficiency. It should only be used when absolutely necessary.

Reduction curves for antifreeze are given in the Section "Application" (Fig. 17-3 and 17-4). Without derating, premature aging of unit components cannot be ruled out. Converter tripping by the overtemperature protection must also be expected.

WARNING

Operation at temperatures of < 0 °C is not permitted, not even with antifreeze!

Use of other media can shorten the service life.

If less that 20 % Antifrogen N is added to the cooling water, the risk of corrosion is increased, which can shorten the service life.

If more than 30 % Antifrogen N is added to the cooling water, this will have an adverse effect on heat dissipation and hence on the proper functioning of the unit. It must always be kept in mind that a higher pumping capacity is required when Antifrogen N is added to the cooling water.

When antifreeze is used, no potential differences must occur in the whole cooling system. If necessary, the components must be connected with an equipotential bonding strip.

NOTE

Where antifreeze is concerned, pay attention to the information given in the safety data sheet!

Antifrogen N (made by Hoechst) is preferred for use as antifreeze.

The safety data sheet is appended.

Background:
Antifrogen N was thoroughly analysed for this application. Special attention was given to compatibility with other materials and to environmental and health aspects. Furthermore, many years of experience have been gained with Antifrogen N, and the definition of cooling water is based on this antifreeze agent.

In order to obtain the benefit of the good anti-corrosive properties of Antifrogen N and water mixtures, the concentration of the mixture must be at least 20 %.

The use of antifreeze places higher demands on cooling system tightness because the surface tension of the Antifrogen and water mixture is about 100 times smaller than that of pure water.

Hotwater-proof asbestos-based seals are suitable. For seals with packing glands, graphite cord can be used. For pipe joints where hemp is used, coating the hemp with fermit or fermitol has proved effective.

WARNING

Antifrogen N can give rise to leakage at polytetrafluorethylene seals.

Proportion of Antifrogen N added [%]	Kinematic viscosity [mm²/s]	Relative pressure loss	Antifreeze protection to [°C]
0	1.8	1.09	
20	3.5	1.311	-10
34	4.72	1.537	-20
45	7.73	1.743	-30

Table 17-16 Antifrogen N material data at T = 0 °C coolant temperature

More than 45 % impedes heat dissipation and hence proper functioning of the unit.

It must always be kept in mind that the pumping capacity required for using Antifrogen N additive must be adjusted, and the backpressure arising in the unit must also be taken into account.

The necessary coolant flow volume must be attained under all circumstances.

The electrical conductivity of the coolant is increased when antifreeze is added to the cooling water. Antifrogen N contains inhibitors to counteract the attendant increased propensity for electrochemical corrosion.

To prevent weakening of the inhibitors and the corrosion that would then result, the following measures are necessary:

1. When the cooling system is drained, it must either be refilled with the same mixture within 14 days, or it must be flushed out with water several times and the heat sinks must then be blow through with compressed air.
2. The water and Antifrogen N mixture must be renewed every 3 to 5 years.

If other antifreeze agents are used, they must be **ethylene glycol based**. They must also have been approved by reputable companies in the automotive industry (GM, Ford, Chrysler).

Example: **DOWTHERM SR-1.**

Concerning the electrical conductivity of the antifreeze and water mixture, the antifreeze manufacturer’s guidelines apply.

The water that is mixed with the antifreeze must strictly comply with the defnition given in the Section "Definition of cooling water".

WARNING

Use of other agents can shorten the service life.

Mixing different antifreeze agents is not permitted under any circumstances.

17.3.4 Protection against condensation

Special measures are necessary to prevent condensation.

Condensation occurs when the cooling water inlet temperature is considerably lower than the room temperature (air temperature). The permissible temperature difference between cooling water and air varies according to the relative humidity ϕ of the room air. The temperature at which moist air will deposit droplets of water is called the dew point.

The following table lists the dew points (in °C) for an atmospheric pressure of
1 bar (≈ height 0 to 500 m above sea level). If the cooling water temperature is lower than the value given, condensation must be expected, i.e. the cooling water temperture must always be ≥ dew point.

Room temp. °C	**ϕ = 20 %**	**ϕ = 30 %**	**ϕ = 40 %**	**ϕ = 50 %**	**ϕ = 60 %**	**ϕ = 70 %**	**ϕ = 80 %**	**ϕ = 85 %**	**ϕ = 90 %**	**ϕ = 95 %**	**ϕ = 100 %**
10	< 0	< 0	< 0	0.2	2.7	4.8	6.7	7.6	8.4	9.2	10
20	< 0	2	6	9.3	12	14.3	16.4	17.4	18.3	19.1	20
25	0.6	6.3	10.5	13.8	16.7	19.1	21.2	22.2	23.2	24.1	24.9
30	4.7	10.5	14.9	18.4	21.3	23.8	26.1	27.1	28.1	29	29.9
35	8.7	14.8	19.3	22.9	26	28.6	30.9	32	33	34	34.9
38	11.1	17.4	22	25.7	28.8	31.5	33.8	34.9	36	36.9	37.9
40	12.8	19.1	23.7	27.5	30.6	33.4	35.8	36.9	37.9	38.9	39.9
45	16.8	23.3	28.2	32	35.3	38.1	40.6	41.8	42.9	43.9	44.9
50	20.8	27.5	32.6	36.6	40	42.9	45.5	46.6	47.8	48.9	49.9

Table 17-17 Dew point temperature as a function of relative humidity ϕ and room temperature at an altitude of 0 m above sea level

The dew point also depends on the absolute pressure, i.e. on altitude.

The dew points for low atmospheric pressures lie below the value for sea level, and it is therefore always sufficient to plan the cooling water supply temperature for an altitude of 0 m.

Various measures can be taken to afford protection against condensation:

1. The simplest precaution is to fit a temperature-controlled valve arrangement in the water supply, e.g. bypass method (see Fig. 17-2) with the designation “amot valve” (available from: Ing. Büro Neundörfer, Fichtenstr.5, D-91094 Langensendelbach, Tel.: +49-9133-3497). This method has the disadvantage that the water temperature is always adjusted to the temperature set on the bypass valve. This temperature is in the vicinity of the maximum attainable room temperature (at which condensation is most likely to occur), which means that the unit is always under maximum thermal stress.
2. Water temperature control places considerably less stess on the units. The water temperature is controlled as a function of room temperature. This method is certainly to be preferred where there are high room temperatures, low water temperatures and high humidities.
3. Physical dehumidifying. This is only effective in closed rooms. It comprises operating an air/water heat exchanger with cold water to constantly condense the moisture out of the room air.
4. A humidity alarm can be installed to give a warning when condensation is imminent. Such an alarm is available from ENDRICH (Tel.: +49-07452-6007-0); when the temperature falls to within 2 K of dew point, a signal contact closes.

17.3.5 Notes on materials

Cooling water installations with copper pipes and/or copper joints are to be avoided and are possible only if special measures are taken, e.g. closed cooling circuit, full filtering (i.e. copper ions are filtered out), water additives (such as the products of “Schilling Chemie GmbH”, PO Box 1136, D-71687 Freiberg, Tel. +49-7141-703-0).

The hose connection nozzles on the heat sink side must be of stainless steel or heavy gauge aluminium. **Under no circumstances may the connection nozzles be of brass or copper.**

PVC hoses are not suitable for use with antifreeze!

Hard PVC pipes are suitable for use with the antifreeze agents listed in Section "Antifreeze additive".

IMPORTANT

The water cooling system must not contain any zinc at all.

Where antifreeze is used, please note:
zinc reacts with all glycol-based inhibitors.

Never use galvanized pipes for this reason!

If the plant incorporates normal iron pipes or cast iron accessories (e.g. motor housings), a separate cooling system with water/water heat exchangers is to be installed for the converters.

If a heat exchanger made of CuNi 90/10 is used, be sure to pay attention to the water conductivity (hose) (see Section "Note regarding installation and components").

17.3.6 Cabinet design an connection system

- Components not mounted on the heat sink, e.g. the electronic devices and the DC link capacitors, are cooled by the heat exchangers at the heat sink fins.

  When a chassis unit is installed in a cubicle, make sure that the air discharged by the fan can enter the inside of the chassis. For this reason, there must be a clearance of at least **130 mm** between top of chassis and cubicle roof (or existing cover) for applications with degrees of protection > IP42.

  The **compartmentalizations** to be fitted to units with air-cooling are **counterproductive** here! They **must not be fitted**.
- The units require no external cooling air.

  It must nevertheless be kept in mind that additional heat losses of other components in the cubicle, such as reactors, cannot be extracted!
- The temperature of the cooling air circulating inside the chassis is monitored with a sensor.
- If an application with degree of protection IP54 is set up, it is necessary to close the gaps between the chassis side walls and the cubicle walls.
- In cubicle systems, partition walls up to the top cover plate are to be fitted between the units.
- If the units are operated with degree of protection IP54, the air temperature inside the units during rated operation is distinctly higher than the water supply temperature.
- One-inch internal threads are provided for the **water connection**. The connection nipples must be of stainless steel or heavy gauge aluminium. Ideally, flat seals should be used.
- If the connectors supplied with the units are used, they should be sealed with Loctite 542.
- The “Goldschlange” (gold snake) hose made by Paguag is recommended.
- For the joint, use is made of an NW25 screw-type sleeve for “Goldschlange” hose with inside piece of V2A and a double nipple of V2A.
- Cooling water supply (blue) and return (red) are to be connected in accordance with the colour coding, which is to be found next to the 1-inch water connection beneath the heat sink.

17.4 AFE chokes

Designation		Value			
Type (Rated output)	[kW]	45	55	75	90
Rated voltage	[V]	3 AC 380 (-20 %) to 460 (+5 %)			
Rated frequency	[Hz]	50 / 60			
Rated current	[A]	92	124	146	186
Power loss	[kW]	0.25	0.29	0.33	0.38
Dimensions	[mm]				
• Length		300	355	355	355
• Width		177	178	193	193
• Height		267	340	335	335
Weight approx.	[kg]	50	70	70	78

Table 17-18 AFE chokes (380 V to 460 V, Part 1)

Designation		Value			
Type (Rated output)	[kW]	110	132	160	200
Rated voltage	[V]	3 AC 380 (-20 %) to 460 (+5 %)			
Rated frequency	[Hz]	50 / 60			
Rated current	[A]	210	260	315	370
Power loss	[kW]	0.55	0.63	0.68	0.85
Dimensions	[mm]				
• Length		420	420	480	480
• Width		212	212	272	272
• Height		384	384	380	380
Weight approx.	[kg]	95	100	150	155

Table 17-19 AFE chokes (380 V to 460 V, Part 2)

Designation		Value			
Type (Rated output)	[kW]	37	45	55	75
Rated voltage	[V]	3 AC 500 (-20 %) to 575 (+5 %)			
Rated frequency	[Hz]	50 / 60			
Rated current	[A]	61	66	79	108
Power loss	[kW]	0.20	0.21	0.29	0.33
Dimensions	[mm]				
• Length		300	300	355	355
• Width		177	177	178	193
• Height		267	267	332	332
Weight approx.	[kg]	41	45	55	70

Table 17-20 AFE chokes (500 V to 575 V, Part 1)

Designation		Value			
Type (Rated output)	[kW]	90	110	132	160
Rated voltage	[V]	3 AC 500 (-20 %) to 575 (+5 %)			
Rated frequency	[Hz]	50 / 60			
Rated current	[A]	128	156	192	225
Power loss	[kW]	0.38	0.485	0.58	0.62
Dimensions	[mm]				
• Length		355	420	420	480
• Width		193	212	212	274
• Height		332	384	384	380
Weight approx.	[kg]	78	95	100	140

Table 17-21 AFE chokes (500 V to 575 V, Part 2)

Designation		Value			
Type (Rated output)	[kW]	55	75	90	110
Rated voltage	[V]	3 AC 660 (-20 %) to 690+5 %)			
Rated frequency	[Hz]	50 / 60			
Rated current	[A]	60	82	97	118
Power loss	[kW]	0.33	0.34	0.35	0.535
Dimensions	[mm]				
• Length		355	355	355	420
• Width		178	193	193	212
• Height		332	330	335	384
Weight approx.	[kg]	55	70	74	95

Table 17-22 AFE chokes (660 V to 690 V, Part 1)

Designation		Value			
Type (Rated output)	[kW]	132	160	200	
Rated voltage	[V]	3 AC 660 (-20 %) to 690 (+5 %)			
Rated frequency	[Hz]	50 / 60			
Rated current	[A]	145	171	208	
Power loss	[kW]	0.58	0.59	0.66	
Dimensions	[mm]				
• Length		420	480	480	
• Width		212	274	274	
• Height		384	380	380	
Weight approx.	[kg]	100	150	150	

Table 17-23 AFE chokes (660 V to 690 V, Part 2)

18 Environmental Friendliness

Environmental aspects during development

The number of components has been significantly reduced over earlier converter series by the use of highly integrated components and the modular design of the complete series. Thus, the energy requirement during production has been reduced.

Special significance was placed on the reduction of the volume, weight and variety of metal and plastic components.

Plastic components used

ABS:	PMU board LOGO	PC:	Covers
LDPE:	Capacitor ring	PP:	Insulating plates bus retrofit
PA6.6:	Fuse holder, mounting strip, capacitor holder, cable holder, terminal blocks, terminal strip, supports, PMU adapter, covers, cable holders	PS:	Fan housing
		UP:	Clamping section fastening bolts, tensioning washer

Halogen-containing flame retardants were, for all essential components, replaced by environmentally-friendly flame retardants.

Environmental compatibility was an important criterion when selecting the supplied components.

Environmental aspects during production

Purchased components are generally supplied in recyclable packaging.

Surface finishes and coatings were eliminated with the exception of the galvanized sheet steel side panels.

ASIC devices and SMD devices were used on the boards.

The production is emission-free.

Environmental aspects for disposal

The unit can be broken down into recyclable mechanical components as a result of easily releasable screw and snap connections.

The plastic components are to DIN 54840 and have a recycling symbol.

Units should be disposed of through certified disposal companies. Addresses are available from your local Siemens partner.

19 Certificates

SIEMENS Automation and Drives

Confirmation

Erlangen, 01.05.1998

This confirms that

Equipment	AC drive converter
• Type	SIMOVERT MASTERDRIVES
• Order No.	6SE70...

is manufactured in conformance with DIN VDE 0558, Part 2 and EN 60204, Part 6.2 (≙ DIN VDE 0113, Part 6.2).

This equipment fulfills the protection requirements against electric shock according to DIN VDE 0106 Part 100 when the following safety rules are observed:

- Service work in operation is only permissible at the electronics box
- The converter must be switched into a no-voltage condition and isolated from the supply when replacing any part/component
- All panels must be closed during operation.

Thus, this equipment conforms to the appropriate regulations in Germany according to VBG 4 §2 (2) (VBG is a German regulatory body for safety-related issues).

The local operating regulations (e.g. EN 50110-1, EN 50110-2) must be observed when operating the equipment.

A&D DS A P1

Mickal

Automation &Drives

SIEMENS Automation and Drives

Test certificate

Erlangen, 01.05.1998

Equipment AC drive converter

- Type: SIMOVERT MASTERDRIVES
- Order No.: 6SE70... [1)]

The routine testing according to these test instructions

475 100.9000.00 QP size A - D
476 100.9000.00 QP size E - G
476 200.9000.00 QP size J - L

Test contents:		
	I. Insulationstest	• refer to EN 50178, Part 9.4.5.2 and UL508/CSA 22.2-14.M 91, Part 6.8
	II. Functions test acc. to EN 50178	• Initialization and start-up • Customer terminals • Power section inspection • Inspection of protection and monitoring devices
	III. RUN-IN	• Continuous test > 5 hours ambient temperature 55 °C
	IV. Functions test acc. to EN 50178	• see II. Functions test

The equipment complied with the test requirements.
The test results are documented within the production data base

1) For complete type, serial number and technical data please see rating plate.

A&D DS A PE D P

Schlögel

Automation &Drives

SIEMENS

Factory certificate *

regarding electromagnetic compatability

4SE.476 000 0001.00 WB EMV

Manufacturer:	Siemens Aktiengesellschaft	
	Automation & Drives Group	
	Business Division	Variable-speed drives
	Sub-Division	AC-Drive systems
Address:	P.O. Box 3269	
	D-91050 Erlangen	
Product name:	SIMOVERT Type 6SE70 Chassis units AC-AC and DC-AC	

When correctly used, the designated product fulfills all the requirements of Directive 89/336/EEC regarding electromagnetic compatibility.

We confirm the conformance of the above designated product with the Standards:

EN 61800-3 10-1996

EN 61000-4-2 (old IEC 801-2)

EN 61000-4-4 (old IEC 801-4)

EN 61000-4-5 (old IEC 801-5)

IEC 1000-4-3 (old IEC 801-3)

EN 55011 (DIN VDE 0875 Part 11)

Note:

These instructions relating to EMC-correct installation, correct operation, connecting-up conditions and associated instructions in the product documentation supplied must be observed.

Erlangen, 01.05.1998

H. Mickal
A&D DS A P1

*) acc. to EN 10204 (DIN 50049)

This declaration does not guarantee any features.

20 Block diagrams

21 Dimension drawings

21.1 AFE power supply module

Type of construction 1 (E)	480 676.9210.00 MB
Type of construction 2 (F)	480 654.9210.00 MB
Type of construction 3 (G)	480 657.9210.00 MB

21.2 AFE inverter

Type of construction E	476 245.9000.00 MB
Type of construction F	476 254.9000.00 MB
Type of construction G	476 256.9000.00 MB

The following editions have been published so far:

Edition	Internal Item Number
AB	GWE-476 200 4000.76 J AB-76 A5E00388673

Version AB consists of the following chapters:

Chapter		Changes	Pages	Version date
1	Definitions and Warnings	first edition	4	10.99
2	Description	first edition	3	10.99
3	First Start-up	first edition	2	10.99
4	Transport, Storage, Unpacking	first edition	2	10.99
5	Installation	first edition	7	10.99
6	Installation in Conformance with EMC Regulations	first edition	1	10.99
7	Connecting-up and Wiring	first edition	19	10.99
8	Basic Function Check	first edition	4	10.99
9	Explanation of Terminology and Functionality of the AFE	first edition	2	10.99
10	Function Diagrams	first edition	2	10.99
11	Parameterization	first edition	11	10.99
12	Parameter List	first edition	40	10.99
13	Process Data	first edition	21	10.99
14	Faults and Warnings	first edition	8	10.99
15	Maintenance	first edition	14	10.99
16	Forming	first edition	2	10.99
17	Technical Data	first edition	26	10.99
18	Environmental Friendliness	first edition	1	10.99
19	Certificates	first edition	3	10.99
20	Block Diagrams	first edition	15	10.99
21	Dimension Drawings	first edition	7	10.99

Siemens AG
Automation and Drives
Motion Control Systems
P.O. Box 3180, D-91050 Erlangen

Siemens Aktiengesellschaft

Subject to change

Order No.: 6SE7087-6CX86-2AA0
Printed in the federal Republic of Germany
10.99