Operating Instructions Edition: AF

simovert masterdrives

Motion Control / Vector Control

Frequency Inverter (DC-AC) Chassis Type

SIEMENS

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

indicates an **imminently** hazardous situation which, if not avoided, will result in death, serious injury and considerable damage to property.

WARNING

indicates a **potentially** hazardous situation which, if not avoided, could result in death, serious injury and considerable damage to property.

CAUTION

used with the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

CAUTION

used without safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

NOTICE

NOTICE used without the safety alert symbol indicates a potential situation which, if not avoided, may result in an undesirable result or state.

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.

Proper use of Siemens products

WARNING

Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be adhered to. The information in the relevant documentation must be observed.

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.

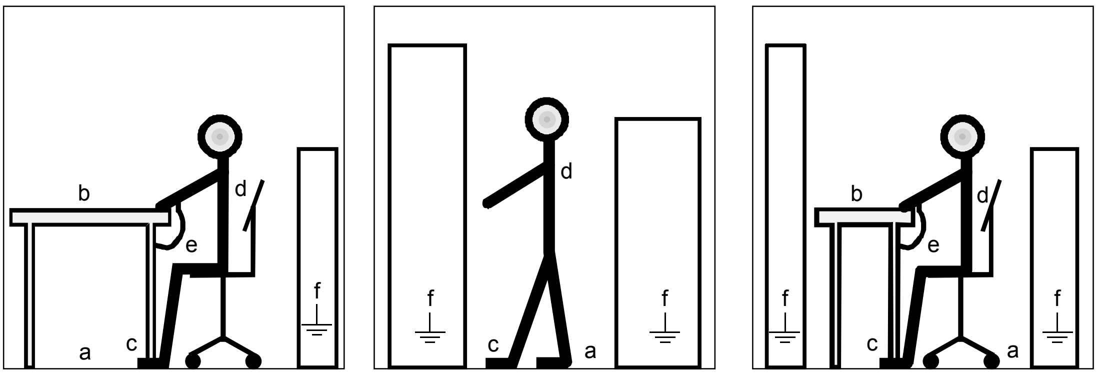
Boards must only be placed on conductive surfaces.

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



Sitting **Standing** **Standing / Sitting**

Fig. 1-1 ESD protective measures

Safety and Operating Instructions for Drive Converters

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

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 commissioninng as well as maintenance are to be carried out by **skilled technical personnel** (Observe IEC 60364 or CENELEC HD 384 or DIN VDE 0100 and IEC 60664 or DIN VDE0110 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 directive 98/37/EG (Machinery Safety Directive - MSD). Account is to be taken of EN 60204.

Commissioning (i.e. the starting of normal opertion) 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 EN 50178 / DIN VDE 0160 in conjunction with EN 60439-1 / DIN VDE 0660 part 500 and EN 60146 / 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 EN 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 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. Electric 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. BGV A3) 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, like screening, earthing, 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 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 control 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 admissible.

After disconnection of the drive converter from the voltage supply, live appliance parts and power terminals must not be touched immediately because of possibly energized capacitors. In this respect, 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 SAFETY INSTRUCTIONS IN A SAFE PLACE!

Residual risks of Power Drive Systems (PDS)

DANGER

The components for the controller and drive of a Power Drive System (PDS) are authorized for industrial and commercial use in industrial networks. Their use in public networks requires a different planning and/or additional measures.

It is only permissible to operate these components in enclosed housings or in superordinate control cabinets and when all protective devices and protective covers are used.

These components may only be handled by qualified and trained specialist persons who are familiar with and observe all the safety instructions on the components and in the relevant technical user documentation.

The machine manufacturer must take into account the following residual risks resulting from the components for the controller and drive of a Power Drive System (PDS) when evaluating the risk of his machine in accordance with the EC machinery guideline.

1. Undesired movements of driven machine components during commissioning, operation, maintenance and repair, e.g. as a result of
   - HW and/or SW errors in the sensors, controller, actuators and connection system
   - Reaction times of the controller and the drive
   - Operation and/or ambient conditions not compliant with the specification
   - Errors in parameterization, programming, wiring and installation
   - Use of radio units/mobile phones in the direct vicinity of the controller
   - External influences/damage.
2. Extraordinary temperatures and emissions of light, noises, particles and gases, e.g. as a result of
   - Component failure
   - Software errors
   - Operation and/or ambient conditions not compliant with the specification
   - External influences/damage.
3. Dangerous contact voltages, e.g. as a result of
   - Component failure
   - Influence upon electrostatic charging
   - Induction of voltages in the case of moving motors
   - Operation and/or ambient conditions not compliant with the specification
   - Condensation/conductive contamination
   - External influences/damage.
4. Operational electrical, magnetic and electromagnetic fields that may pose a risk to people with a pacemaker, implants or metallic items if they are too close.
5. Release of pollutants and emissions if components are not operated or disposed of properly.

For additional information on the residual risks emanating from the components of the PDS, please refer to the relevant chapters of the technical user documentation.

DANGER

Electrical, magnetic and electromagnetic fields (EMF) that occur during operation can pose a danger to persons who are present in the direct vicinity of the product – especially persons with pacemakers, implants, or similar devices.

The relevant directives and standards must be observed by the machine/plant operators and persons present in the vicinity of the product. These are, for example, EMF Directive 2004/40/EEC and standards EN 12198-1 to -3 pertinent to the European Economic Area (EEA), as well as accident prevention code BGV 11 and the associated rule BGR 11 "Electromagnetic fields" of the German employer's liability accident insurance association pertinent to Germany.

These state that a hazard analysis must be drawn up for every workplace, from which measures for reducing dangers and their impact on persons are derived and applied, and exposure and danger zones are defined and observed.

The safety information in the Storage, Transport, Installation, Commissioning, Operation, Maintenance, Disassembly and Disposal sections must also be taken into account.

2 Description

Range of application

From the DC voltage at terminals C/L+ and D/L-, inverters generate a three-phase system of variable output frequency with the method of pulse width modulation (PWM) for feeding three-phase motors at terminals U2/T1, V2/T2, W2/T3.

When the DC link is charged the control board is supplied with voltage by an integral power supply unit. If the DC link is discharged, the control board can be fed via an external 24 V supply at terminal X9.

The unit functions are controlled by the software on the control board.

The unit can be operated via the PMU operator control panel, the user-friendly OP1S operator control panel, the terminal strip or via a bus system. Option boards can be used to expand the unit's functions.

Pulse encoders and analog tachometers can be used as motor encoders.

The power section and the electronics of the inverter are cooled by a fan. The customer must connect up 230 V AC (50/60 Hz) to the terminals X18/1...5 to supply the fan.

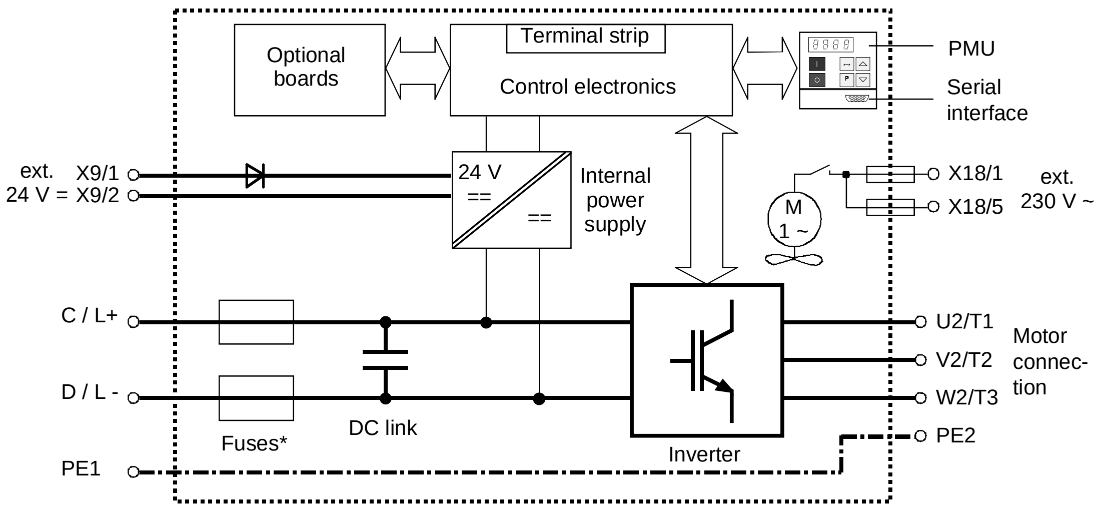


Fig. 2-1 Circuit principle of the inverter

***NOTE**

The fuses are an option in the case of types E to G!

3 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.

CAUTION

If the storage period of one year is exceeded, the unit must be newly formed. See Section ”Forming".

Unpacking

The packaging comprises a wooden base, board and corrugated paper. It can be disposed of corresponding to the appropriate local regulations. After the consignment has been unpacked and checked to ensure that everything is complete and not damaged, the units and components can be installed and commissioned. Depending on the degree of protection and type of construction, the units are mounted on a pallet either with or without transport rails.

Type of construction	Pallet
E, F, G, J, K, L	One unit per type of construction

4 First 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. Also check the unit to ensure it is complete and that the optional boards are correctly equipped on the basis of the package label (on the outside of the packaging). Make sure that the techonology option is enabled if this was included in the order.	See section "Transport, Storage, Unpacking"
Mount the unit and install optional boards which have not yet 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"
Form the DC link capacitors, if necessary	If the DC link of the unit was de-energized for more than one year, you have to newly form the DC link capacitors	See section "Forming"
Connect the protective conductor, the power cables or buses and, if present, the ext. 24 V supply	Starting with the protective conductor please connect the power cables or DC link buses and the 230 V AC for the fan. If configured, also connect the external 24 V supply. Pay attention to EMC instructions when laying the cables. Please do not at this stage connect any control, communication, encoder and motor cables (exception: cable for connecting up an OP1S, if parameterization is to be effected via the OP1S).	See section "Connecting-up" and "Installation in Conformance with EMC Regulations"
Connect the control cables, communication cables, encoder cables and motor cables	Please connect the remaining control, communication, encoder and motor cables. Pay attention to the EMC instructions when laying the cables. **WARNING** ⚠ The device must be **disconnected** from its voltage supplies (24 V DC electronics supply **and** DC link / mains voltage) before the control and encoder leads are connected or disconnected! Failure to observe this advice can result in encoder defects, which may in turn cause uncontrolled axis movements.	See section "Connecting-up" and "Installation in Conformance with EMC Regulations"
Power up the external 24 V supply or the line voltage	After checking that the cabling has been correctly connected and that it sits properly, power up the external 24 V supply or the line voltage. 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.	

If necessary, carry out parameter reset to factory setting

If the PMU does not show status °005 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"

↓

Parameterizing by download or with parameter modules

See section "Parameterization"

↓

De-energize 24 V supply or line voltage

↓

Function test

After checking the unit and the cabling once more, power up the line voltage or DC bus voltage and perform a function test according to your parameterization.

WARNING

It must be ensured that no danger for persons and equipment can occur by energizing the power and the unit. It is recommended not to couple the driven machine until the function test has been successfully completed.

↓

Further start-up and parameterization according to your specific requirements

5 Installation

5.1 Installing the unit

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.

NOTE

MASTERDRIVES components are designed in accordance with degree of protection IP20 or IBXXB in accordance with EN 60529 and as open-type devices to UL 50, thus providing protection against electrical shocks. In order to also ensure protection against mechanical and climatic stresses the components have to be operated in housings/cabinets/rooms that are designed according to the requirements of' EN 60529 and classified as enclosure type to UL 50.

Clearances

When positioning the units, it must be observed that the DC link connection is located at the top section of the unit and the motor connection at the lower section of the unit.

The units can be mounted flush with each other.

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

Please refer to the dimension drawings on the following pages regarding 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.
- Cooling air
The ambient climate of the units must not exceed the values of 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.

NOTE for types E to G

MASTERDRIVES chassis units are CE designated products with standard IP00 degree of protection.

When installed in a cabinet, an additional direct touch protection is necessary. IEC60204-1 6.2 must be observed meticulously.

For types E to G there is the option M20 for IP20 degree of protection.

5.1.1 Installing units of types E, F, G

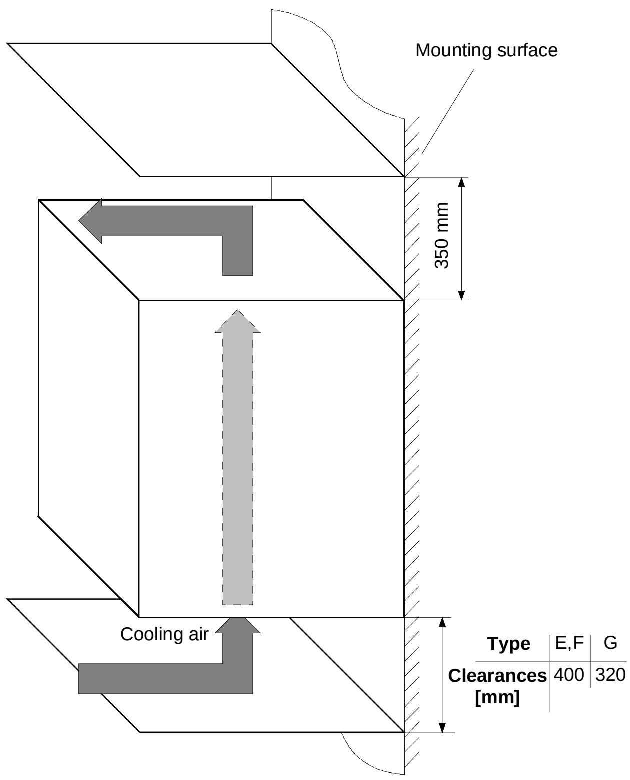


Fig. 5-1 Minimum clearances for cooling air requirement (types E, F, G)

The following are required for mounting:

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

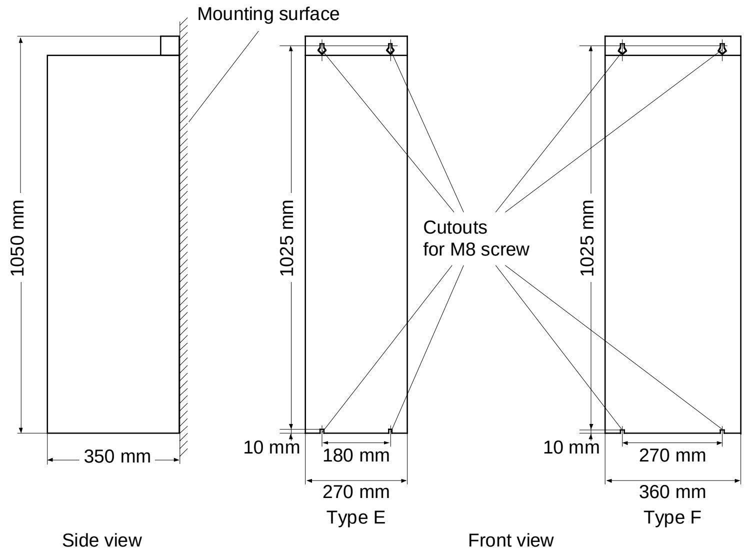


Fig. 5-2 Dimension drawing for types E, F

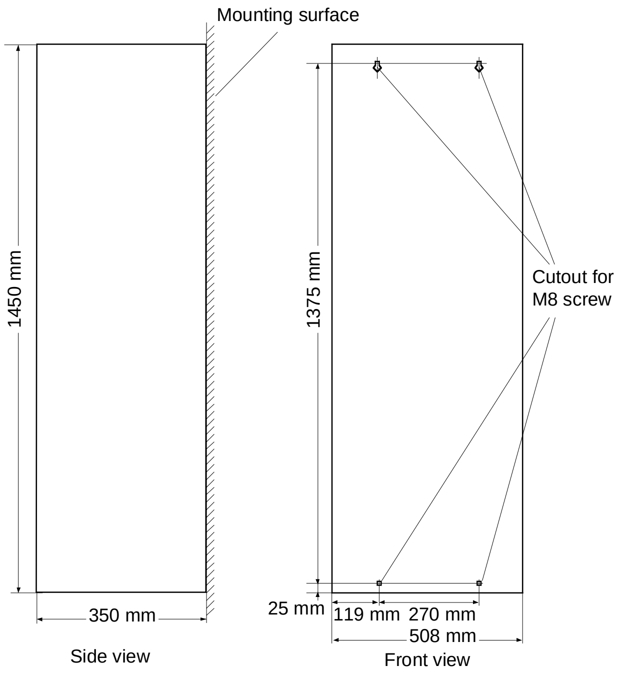


Fig. 5-3 Dimension drawing for type G

5.1.2 Installing units of type J

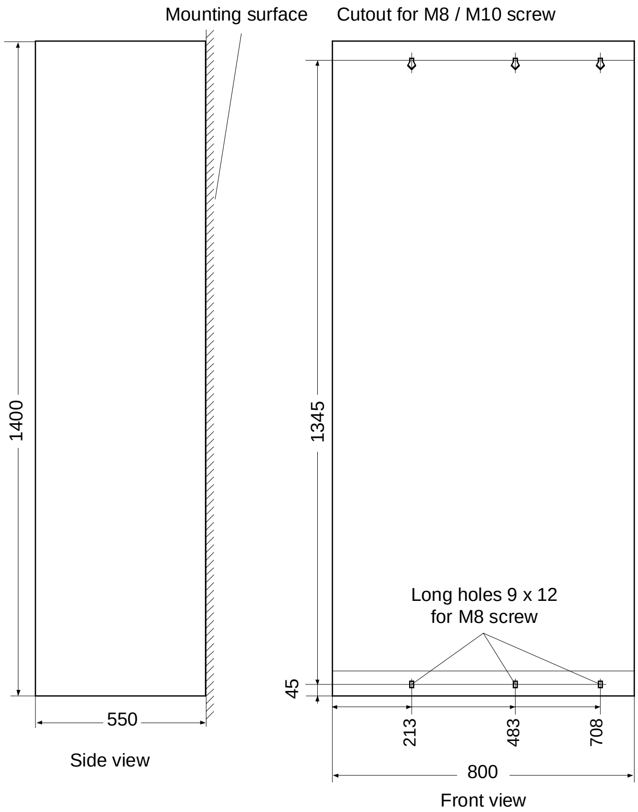


Fig. 5-4 Dimension drawing for type J

Air cooling

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.

The Fig. 5-6 shows the necessary **partition measures**. 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.

The necessary **opening cross-sections** are indicated in the table.

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
13509 Berlin 27
Telephone: (030) 4381-0
Fax: (030) 4381-222

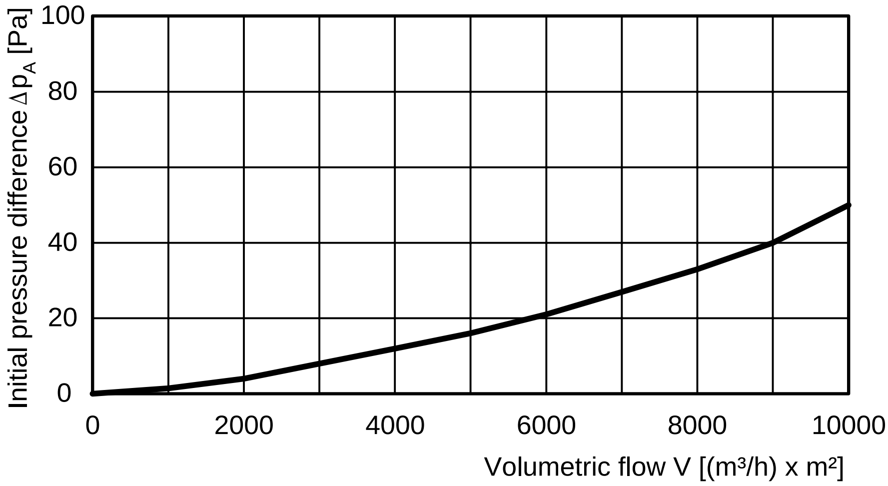


Fig. 5-5 Data sheet of the filter mat

Fans, volumetric flow, opening cross-sections

MLFB	6SE7035-xTJ50
Fan	2 x RH28M
Minimum volumetric flow [m^3/s]	0.46
Minimum opening cross-section in the cabinet doors [m^2] Degree of protection IP00 to IP42	0.26
Minimum opening cross-section in the top cover [m^2] Degree of protection < IP20	0.26
Minimum opening cross-section in the roof section [m^2] Degree of protection IP22 to IP42	0.26

Table 5-1 Fans, volumetric flow, opening cross-sections

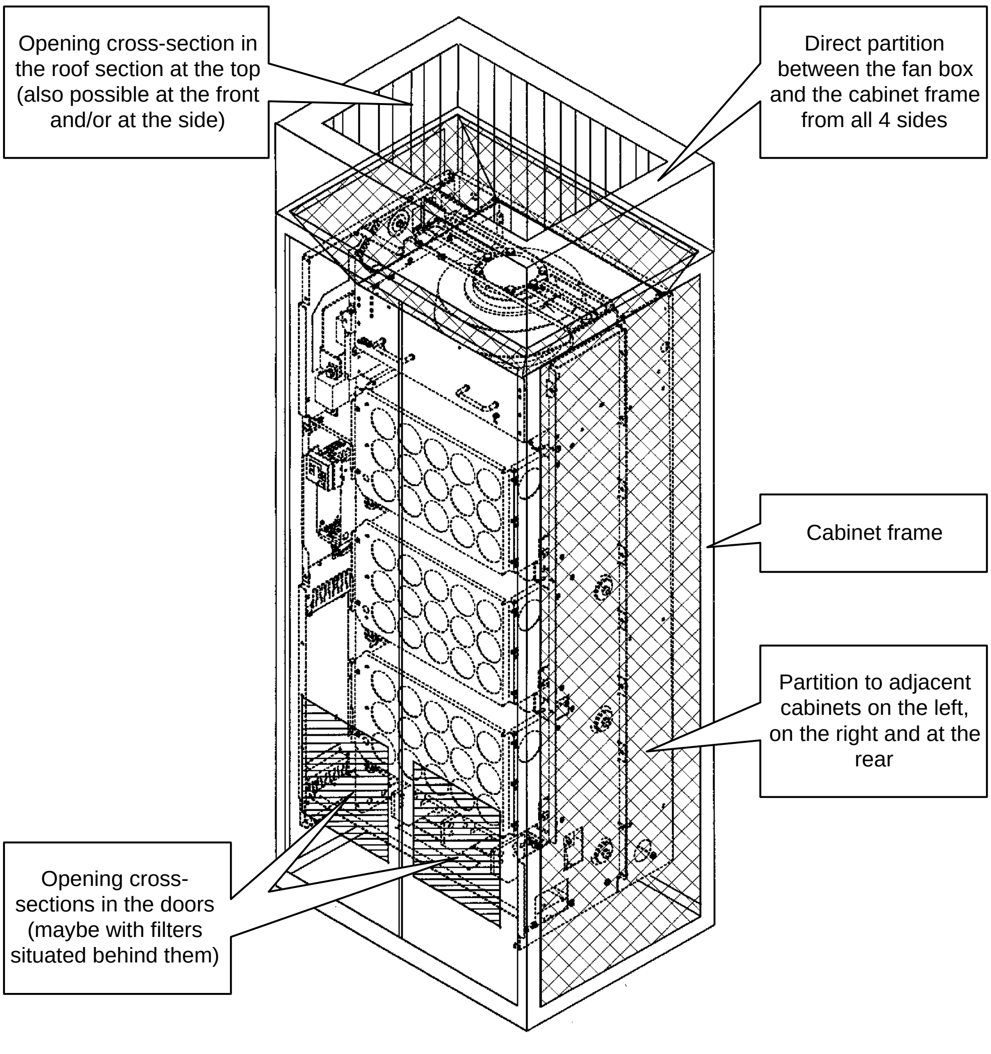


Fig. 5-6 Partition measures

Water cooling

The units with water cooling (MLFB Annex: -1AA0 / -1AA1) are suitable for installing in an enclosed cabinet (IP54). 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.

Implementation of the DC 24 V auxiliary supply

In order to ensure that the units can function satisfactorily (in view of electromagnetic influences), it may be necessary to provide each chassis unit with its own DC 24 V auxiliary supply with an isolating transformer.

5.2 Installing the optional boards

WARNING

The boards may only be replaced by qualified personnel.

It is not permitted to withdraw or insert the boards under voltage.

Slots

A maximum of six slots are available in the electronics box of the unit for installing optional boards. The slots are designated with the letters A to G. Slot B is not provided in the electronics box. It is used in units of the Compact PLUS type of construction.

If you wish to use slots D to G, you will additionally require the following:

- Bus expansion LBA (Local Bus Adapter), which is used for mounting the CU control board and up to two adaption boards, and
- An adaption board (ADB - Adaption Board) on which up to two optional boards can be mounted.

The slots are situated at the following positions:

♦ Slot A	CU control board	Position: top
♦ Slot C	CU control board	Position: bottom
♦ Slot D	Adaption board at mounting position 2	Position: top
♦ Slot E	Adaption board at mounting position 2	Position: bottom
♦ Slot F	Adaption board at mounting position 3	Position: top
♦ Slot G	Adaption board at mounting position 3	Position: bottom

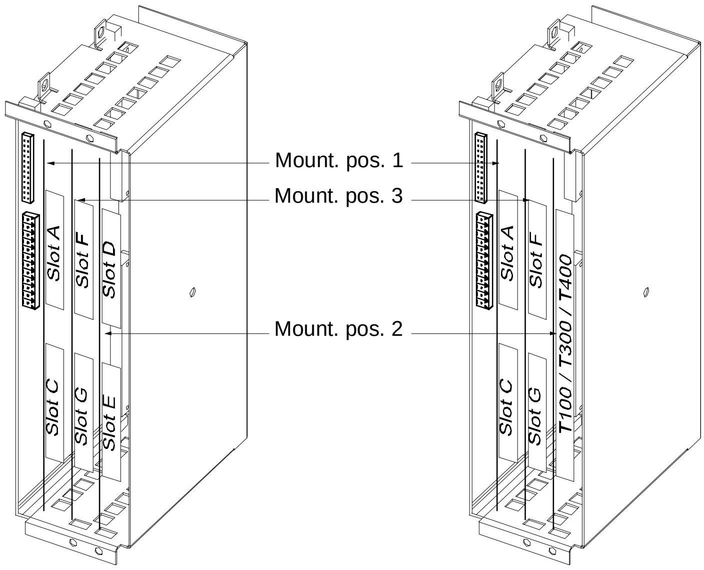


Fig. 5-7 Position of the slots in the electronics box

NOTE

Technology boards (T100, T300, T400, TSY) must always be installed in slot 2.

Mounting positions 2 and 3 can also be used for communication boards SCB1 and SCB2.

DANGER

The unit has hazardous voltage levels up to 5 minutes after it has been powered down due to the DC link capacitors. The unit or the DC link terminals must not be worked on until at least after this delay time.

CAUTION

The optional boards contain components which could be damaged by electrostatic discharge. These components can be very easily destroyed if not handled with caution. You must observe the ESD cautionary measures when handling these boards.

Disconnecting the unit from the supply

DANGER

Disconnect the unit from the incoming power supply (AC or DC supply) and de-energize the unit. Remove the 24 V voltage supply for the electronics. Remove all connecting cables.

Open the front panel.

Preparing installation

Remove the CU board or the adaption board from the electronics box as follows:

- ♦ Disconnect the connecting cables to the CU board or to the optional boards.
- ♦ Undo the fixing screws on the handles above and below the CU board or the adaption board.
- ♦ Pull the CU board or the adaption board out of the electronics box using the handles.
- ♦ Place the CU board or the adaption board on a grounded working surface.

Installing the optional board

Insert the optional board from the right onto the 64-pole system connector on the CU board or on the adaption board. The view shows the installed state.

Screw the optional board tight at the fixing points in the front section of the optional board using the two screws attached.

NOTE

The optional board must be pressed tightly onto the plug connector, it is not sufficient to simply tighten the screws!

Re-installing the unit

Re-install the CU board or the adaption board in the electronics box as follows:

- ♦ Insert the CU board into mounting position 1 and the adaption board into mounting position 2 or 3.

NOTE

The mounting position 3 can only be used when an adaption board or a technology board has been mounted in mounting position 2.
Boards should first be installed in mounting position 2, before mounting position 3 is used.

- ♦ Secure the CU board/adaption board at the handles with the fixing screws.

Re-connect the previously removed connections.

Check that all the connecting cables and the shield sit properly and are in the correct position.

6 Installation in Conformance with EMC Regulations

Basic EMC rules

Rules 1 to 13 are generally applicable. Rules 14 to 20 are particularly important for limiting noise emission.

Rule 1 All of the metal cabinet parts must be connected through the largest possible surface areas (not paint on paint). If required, use serrated washers. The cabinet door must be connected to the cabinet through grounding straps which must be kept as short as possible.

NOTE Grounding installations/machines is essentially a protective measure. However, in the case of drive systems, this also has an influence on the noise emission and noise immunity. A system can either be grounded in a star configuration or each component grounded separately. Preference should be given to the latter grounding system in the case of drive systems, i.e. all parts of the installation to be grounded are connected through their surface or in a mesh pattern.

Rule 2 Signal cables and power cables must be routed separately (to eliminate coupled-in noise). Minimum clearance: 20 cm. Provide partitions between power cables and signal cables. The partitions must be grounded at several points along their length.

Rule 3 Contactors, relays, solenoid valves, electromechanical operating hours counters, etc. in the cabinet must be provided with quenching elements, for example, RC elements, diodes, varistors. These quenching devices must be connected directly at the coil.

Rule 4 Non-shielded cables associated with the same circuit (outgoing and incoming conductor) must be twisted, or the surface between the outgoing and incoming conductors kept as small as possible in order to prevent unnecessary coupling effects.

Rule 5 Eliminate any unnecessary cable lengths to keep coupling capacitances and inductances low.

Rule 6 Connect the reserve cables/conductors to ground at both ends to achieve an additional shielding effect.

Rule 7 In general, it is possible to reduce the noise being coupled-in by routing cables close to grounded cabinet panels. Therefore, wiring should be routed as close as possible to the cabinet housing and the mounting panels and not freely through the cabinet. The same applies for reserve cables/conductors.

Rule 8 Tachometers, encoders or resolvers must be connected through a shielded cable. The shield must be connected to the tachometer, encoder or resolver and at the SIMOVERT MASTERDRIVES through a large surface area. The shield must not be interrupted, e.g. using intermediate terminals. Pre-assembled cables with multiple shields should be used for encoders and resolvers (see Catalog DA65).

Rule 9

The cable shields of digital signal cables must be connected to ground at both ends (transmitter and receiver) through the largest possible surface area. If the equipotential bonding is poor between the shield connections, an additional equipotential bonding conductor with at least 10 mm² must be connected in parallel to the shield, to reduce the shield current. Generally, the shields can be connected to ground (= cabinet housing) in several places. The shields can also be connected to ground at several locations, even outside the cabinet.

Foil-type shields are not to be favoured. They do not shield as well as braided shields; they are poorer by a factor of at least 5.

Rule 10

The cable shields of **analog** signal cables can be connected to ground at both ends if the equipotential bonding is good. Good equipotential bonding is achieved if Rule 1 is observed.

If low-frequency noise occurs on analog cables, for example: speed/measured value fluctuations as a result of equalizing currents (hum), the shields are only connected for analog signals at one end at the SIMOVERT MASTERDRIVES. The other end of the shield should be grounded through a capacitor (e.g. 10 nF/100 V type MKT). However, the shield is still connected at both ends to ground for high frequency as a result of the capacitor.

Rule 11

If possible, the signal cables should only enter the cabinet at one side.

Rule 12

If SIMOVERT MASTERDRIVES are operated from an external 24 V power supply, this power supply must not feed several consumers separately installed in various cabinets (hum can be coupled-in!). The optimum solution is for each SIMOVERT MASTERDRIVE to have its own power supply.

Rule 13

Prevent noise from being coupled-in through the supply.

SIMOVERT MASTERDRIVES and automation units/control electronics should be connected-up to different supply networks. If there is only one common network, the automation units/control electronics have to be de-coupled from the supply using an isolating transformer.

Rule 14

The use of a radio interference suppression filter is obligatory to maintain limit value class "First environment" or "Second environment", even if sinusoidal filters or dv/dt filters are installed between the motor and SIMOVERT MASTERDRIVES.

Whether an additional filter has to be installed for further consumers, depends on the control used and the wiring of the remaining cabinet.

Rule 15

A noise suppression filter should always be placed close to the fault source. The filter must be connected to the cabinet housing, mounting panel, etc. through a large surface area. A bare metal mounting panel (e.g. manufactured from stainless steel, galvanized steel) is best, as electrical contact is established through the entire mounting surface. If the mounting panel is painted, the paint has to be removed at the screw mounting points for the frequency converter and the noise suppression filter to ensure good electrical contact.

The incoming and outgoing cables of the radio interference suppression filter have to be spatially separated/isolated.

Rule 16

In order to limit the noise emitted, all variable-speed motors have to be connected-up using shielded cables, with the shields being connected to the respective housings at both ends in a low-inductive manner (through the largest possible surface area). The motor feeder cables also have to be shielded inside the cabinet or at least shielded using grounded partitions. Suitable motor feeder cable e.g. Siemens PROTOFLEX-EMV-CY (4 x 1.5 mm^2 ... 4 x 120 mm^2) with Cu shield. Cables with steel shields are unsuitable.

A suitable PG gland with shield connection can be used at the motor to connect the shield. It should also be ensured that there is a low-impedance connection between the motor terminal box and the motor housing. If required, connect-up using an additional grounding conductor. **Do not use plastic motor terminal boxes!**

Rule 17

A line reactor has to be installed between the radio interference suppression filter and the SIMOVERT MASTERDRIVES.

Rule 18

The line supply cable has to be spatially separated from the motor feeder cables, e.g. by grounded partitions.

Rule 19

The shield between the motor and SIMOVERT MASTERDRIVES must not be interrupted by the installation of components such as output reactors, sinusoidal filters, dv/dt filters, fuses, contactors. The components must be mounted on a mounting panel which simultaneously serves as the shield connection for the incoming and outgoing motor cables. Grounded partitions may be necessary to shield the components.

Rule 20

In order to limit the radio interference (especially for limit value class "First environment "), in addition to the line supply cable, all cables externally connected to the cabinet must be shielded.

Examples of these basic rules:

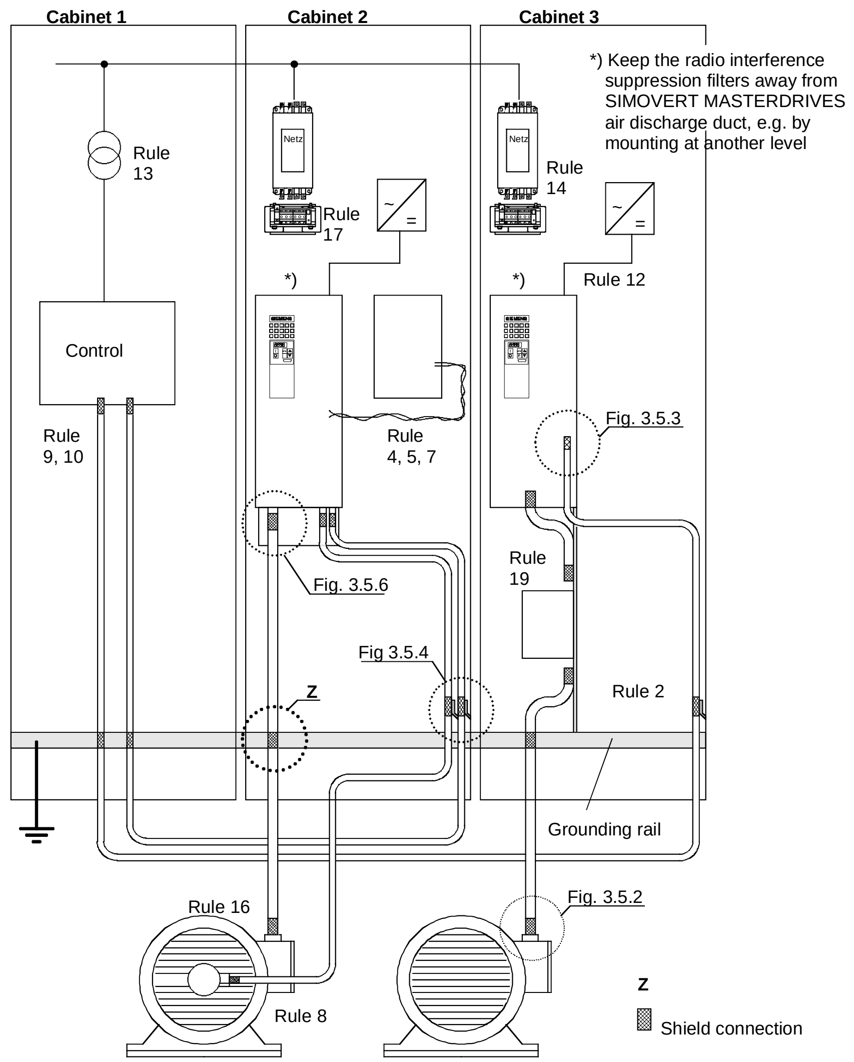


Fig. 6-1 Examples for applying the basic EMC rules

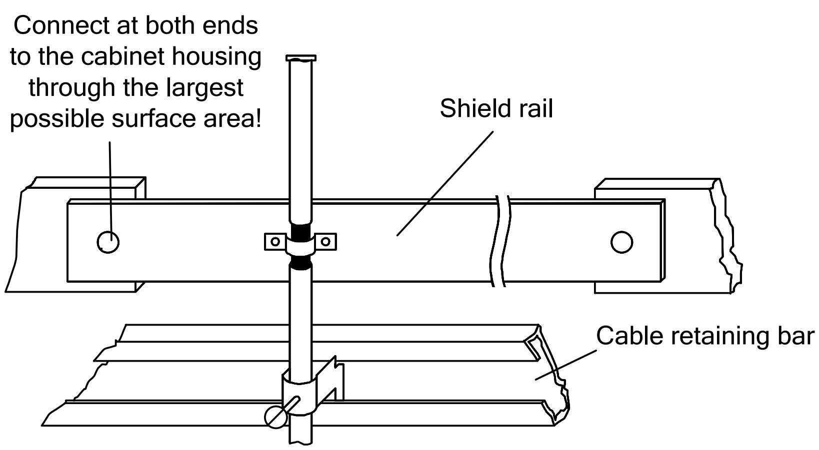


Fig. 6-2 Connecting the motor cable shield where the cable enters the cabinet

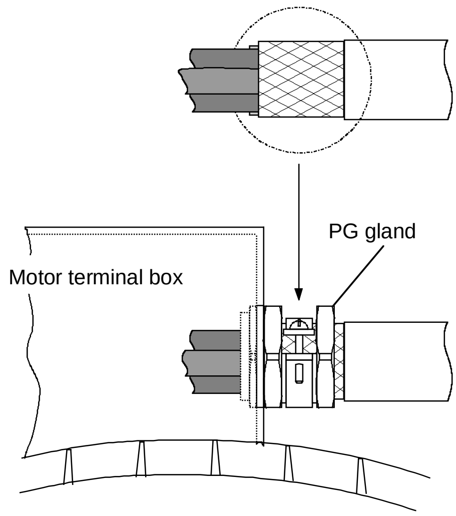


Fig. 6-3 Shield connection at the motor

The shield can be connected through a PG or metric gland (nickel-plated brass) with a strain relief bar. Thus, the degree of protection IP 20 can be achieved.

For higher degrees of protection (up to IP 68), there are special PG glands with shield connection, e.g.:

- SKINDICHT SHVE, Messrs. Lapp, Stuttgart
- UNI IRIS Dicht or UNI EMV Dicht, Messrs. Pflitsch, Hückeswagen

It is not permissible to use plastic motor terminal boxes!

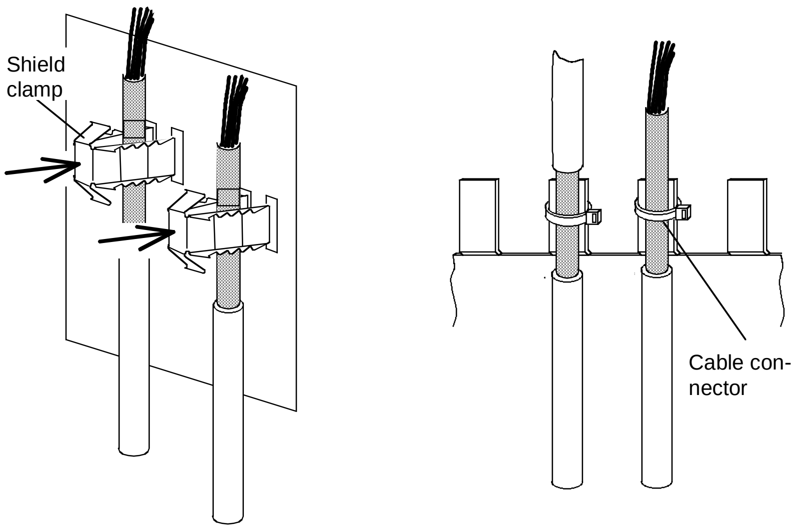


Fig. 6-4 Connecting the signal cable shields for SIMOVERT MASTERDRIVES

- Every SIMOVERT MASTERDRIVES has shield clamps to connect the signal cable shields.
- For chassis units (sizes ≥ E), the shields can be additionally connected using cable connectors at the shield connecting locations.

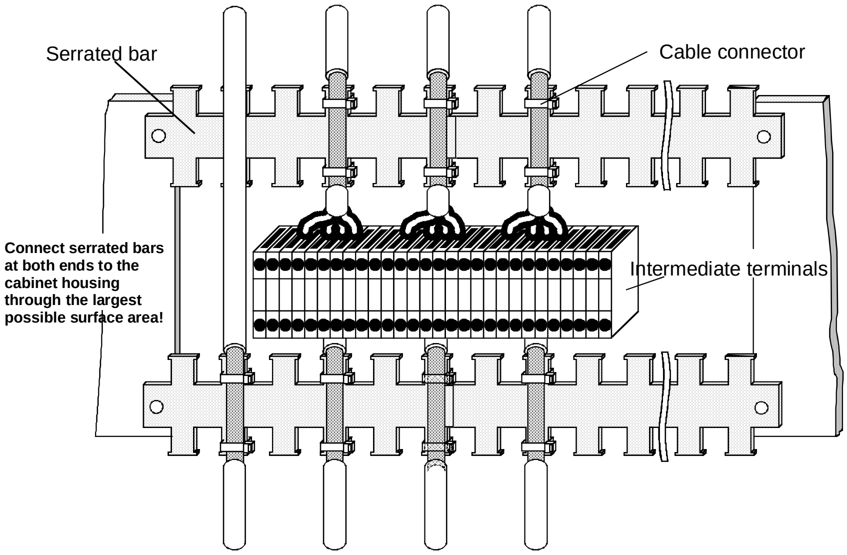


Fig. 6-5 Connecting signal cable shields in the cabinet

Wherever possible, intermediate terminals should not be used as they reduce the shielding effect!

7 Connecting-up

DANGER

SIMOVERT MASTERDRIVES units are operated at high voltages.
The equipment must be in a no-voltage condition (disconnected from the supply) before any work is carried out!
Only professionally trained, qualified personnel must work on or with the units.
Death, severe bodily injury or significant property damage could occur if these warning instructions are not observed.

Only create electrical connections if the unit is in a no-voltage condition!

Hazardous voltages are still present in the unit up to 5 minutes after it has been powered down due to the DC link capacitors. Thus, the appropriate delay time must be observed before working on the unit or on the DC link terminals.

The power terminals and control terminals can still be live even when the motor is stationary.

When working on an opened unit, it should be observed that live components (at hazardous voltage levels) can be touched (shock hazard).

The user is responsible that all the units are installed and connected-up according to recognized regulations in that particular country as well as other regionally valid regulations. Cable dimensioning, fusing, grounding, shutdown, isolation and overcurrent protection should be particularly observed.

NOTE

The inverters are suitable for connection to

- rectifier units,
- rectifier/regenerative feedback units and
- self-comm utating rectifier/regenerative feedback units (AFE), which are fed from systems with or without grounded neutral point (TN systems and TT systems or IT systems according to EN 60364-3).

The inverters are dimensioned for overvoltage category III according to IEC 60664-1.

In systems with grounded phase conductor and a line voltage > 600 V AC measures should be provided on the plant side to limit any overvoltages occurring to overvoltage category II according to IEC 60664-1.

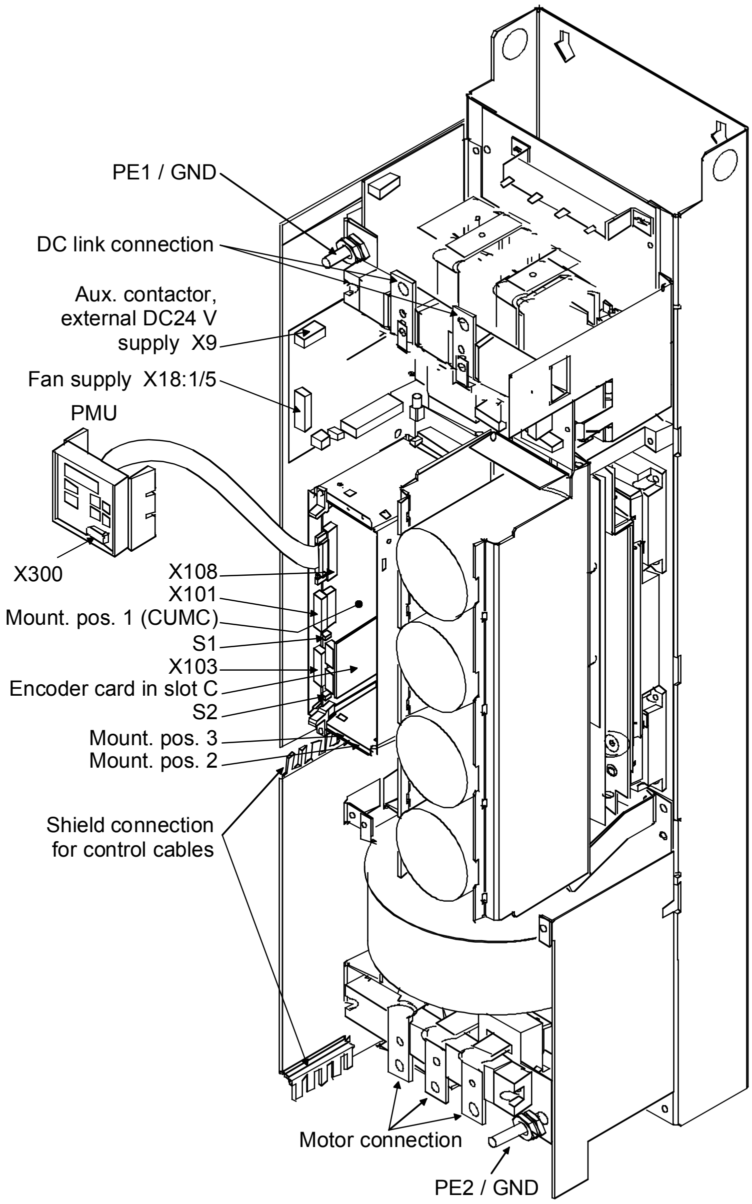


Fig. 7-1 Connection overview for type E and F

NOTE

The 230 V fan must be supplied with AC 230 V externally via terminal strip X18 1/5 on the PSU.

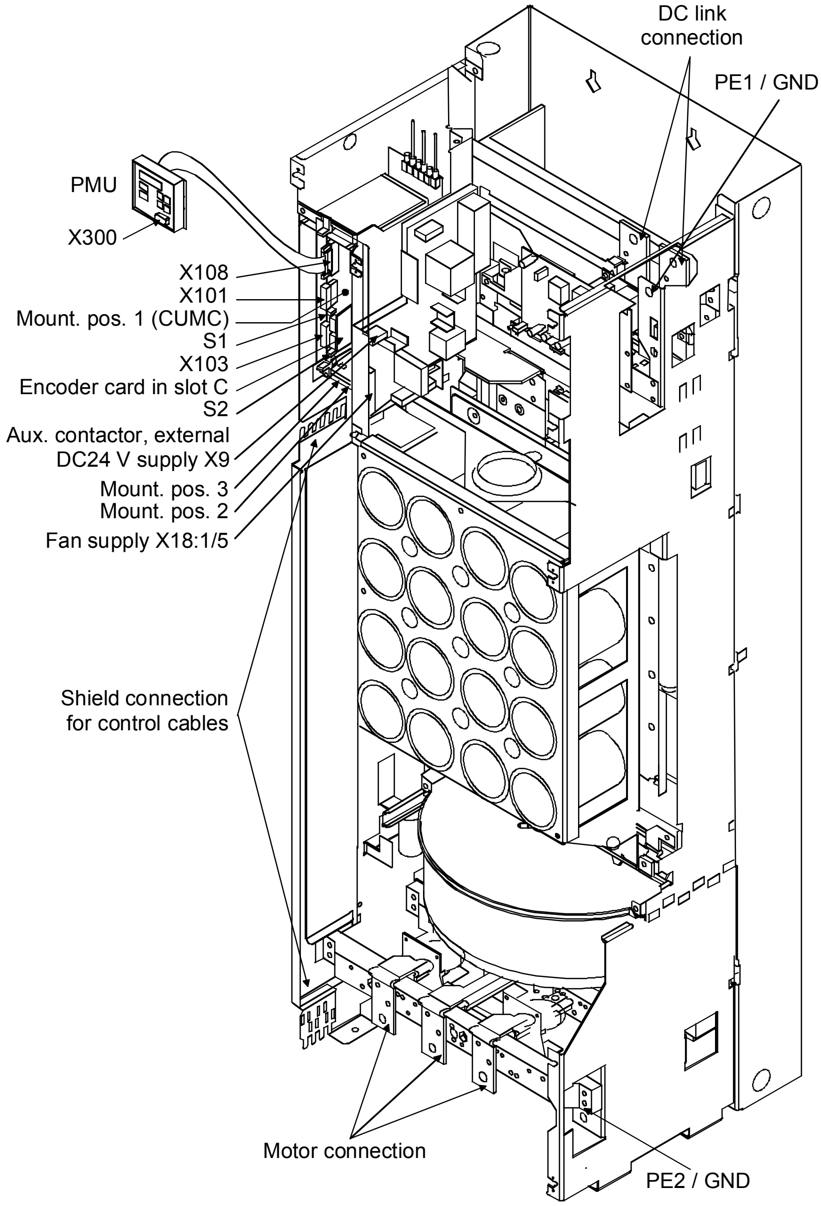


Fig. 7-2 Connection overview for type G

NOTE

The 230 V fan must be supplied with AC 230 V externally via terminal strip X18 1/5 on the PSU.

7.1 Power connections

WARNING

If the input and output terminals are mixed up, the unit will be destroyed!

If the input terminals are mixed up, the converter or the rectifier unit can be destroyed!

The supply terminals are marked as follows:

DC connection:	C/L+	D/L-	
Motor connection:	U2/T1	V2/T2	W2/T3
Protective conductor connection:	PE1	PE2	

NOTICE

When connected to DC busbars, the units have to be protected with fuses according to Fig. 7-3 and Table 7-1. If the connection between the busbar and the unit is short-circuit-proof, protection can also be provided via internal unit fuses (internal unit fuses are standard from type ≥ J onwards, and are available as option L30 for units of type "**E**" – "G").

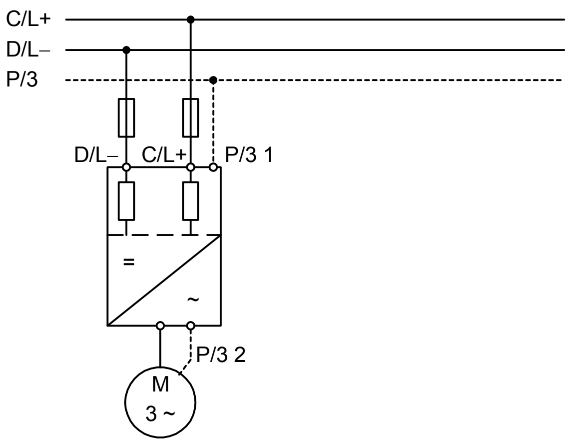


Fig. 7-3 DC busbars

Order number 6SE70...	Rated direct current [A]	Infeed side: Cross-section VDE [mm²]	Infeed side: Cross-section AWG	Infeed side: Recommended fuse [A]	Recommended fuse: Type 3NE	Recommended fuse: North America 170M	North America [V]	North America [A]	Motor side: Rated output voltage [V]	Motor side: Rated output current [A]	Motor side: Cross-section VDE [mm²]	Motor side: Cross-section AWG
31-0TE□0	110	1x70	1x000	160	3224	3718	600 3	50 0	to 480	92	1x35	1x0
31-2TF□0	148	2x35	2x0	250	3227	3718	660 3	50 0	to 480	124	2x25	2x2
31-8TF□0	184	2x35	2x0	250	3227	3718	660 3	50 0	to 480	155	2x35	2x0
32-1TG□0	208	2x50	2x00	315 3	230-0B 3	72 0	660	450	0 to 480	175	2x35	2x0
32-6TG□0	254	2x70	2x000	450	3233	6709	660 5	50 0	to 480	218	2x50	2x00
33-2TG□0	312	2x95	2x4/0	450	3233	6709	660 5	50 0	to 480	262	2x70	2x000
33-7TG□0	367	2x120	2x300	500 3	334-0B 6	71 0	660	630	0 to 480	308	2x95	2x4/0
35-1TJ□0 5	03	4x300	4x800	450	2x3233	2x6709	660 5	50 0	to 480	423	2x300	2x800
36-0TJ70 7	02	4x300	4x800 5	60	2x3335	-	- - 0		to 480	590	4x300	4x800
37-0TJ70 8	21	4x300	4x800 5	60	2x3335	-	- - 0		to 480	690	4x300	4x800
38-6TK70 1	02 3	4x300	4x800 7	10	2x3337-8	-	- - 0		to 480	860	4x300	4x800
41-1TK70 1	31 0	6x300	6x800 8	00	2x3337-8	-	- - 0		to 480	1100	4x300	4x800
41-3TL70 1	55 1	6x300	6x800 9	00	2x3340	-	- - 0		to 480	1300	4x300	4x800

AWG: American Wire Gauge

□ = 5 corresponds to MASTERDRIVES Motion Control
= 7 corresponds to MASTERDRIVES Motion Control Performance 2

Table 7-1 Cross-sections, fuses

NOTES

- The connection cross-sections are determined for copper cables at 40 °C (104 °F) ambient temperature and cables with a permissible operating temperature at the conductor of 70 °C (in accordance with DIN VDE 0298-4 / 08.03).
- If DC fuses are integrated, additional fuses are not necessary on the infeed side provided that the connecting cables to the DC bus are laid short-circuit-proof and that there is no risk of the cables being overloaded by other consumers.
  The fuses are integrated in units of type J.
  The fuses are an option (L30) on units of types E, F and G.
- The connecting lengths to the rectifier unit - also between inverters on systems - need to be kept as short as possible. Ideally, these are executed as low-inductance bus bars.

Possible connection cross-sections, screw connection, tightening torque

Type	Order number	Max. connection cross-sections		Screw connection	Tightening torque	
		mm^2 to VDE	AWG		Nm	lbf ft
E	6SE703_-__E_0	2 x 70	2 x 00	M10	25	18
F	6SE703_-__F_0	2 x 70	2 x 00	M10	25	18
G	6SE703_-__G_0	2 x 150	2 x 300	M12	50	37
J	6SE703_-__J_0	2 x 300	2 x 800	M12 / M16	50 / 115	37 / 85

Table 7-2 Maximum connectable cross-sections, tightening torque

Protective conductor connection

The protective conductor has to be connected on both the input and the motor side and must be dimensioned in accordance with the power connections.

NOTE - Types E - G

The 230 V fan must be supplied externally with AC 230 V via the terminal strip X18 1/5 on the PSU.

Connections on optional boards

Each optional board is provided with additional connections which are necessary for the function of the optional board - encoder connections, bus connections or additional terminals.

You will find detailed information on the connections of the optional boards in the corresponding documentation.

7.2 Auxiliary power supply, main contactor

**Types E, F, G:
X9 - external DC 24 V supply, main contactor control**

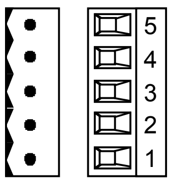
The 5-pole terminal strip is used for connecting up a 24 V voltage supply and a bypass contactor.

The 24V-voltage supply is required if the inverter is connected up via a bypass contactor.

The aux. current supply simultaneously ensures communication with the automation even if the supply voltage of the power section is de-energized.

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	Main contactor control	Main contactor control	AC 230 V
4	Main contactor control	Main contactor control	1 kVA
3 n.c		Not connected	
2	0 V	Reference potential	0 V
1	+24 V (in)	DC24 V ... DC30 V 24 V voltage supply	For current requirement see section "Technical Data"

Connectable cross-section: 2.5 mm^2 (AWG 12)

Terminal 1 is at the front when installed.

Table 7-3 Connection of external DC 24 V aux. voltage supply and bypass contactor control (types E, F, G)

NOTE

The excitation coil of the main contactor has to be damped with overvoltage limiters, e.g. RC element.

WARNING

The external 24 V voltage supply must meet the requirements for safety separation (PELV electrical circuit = Protective Extra Low Voltage).

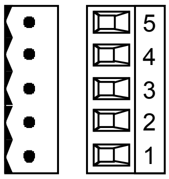
Type J - L: X9 - external DC 24 V supply, main contactor control

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

The connection base is located easily accessibly on the DIN rail below the slide-in unit of the electronics box.

The voltage supply is required if the inverter is connected up via a bypass contactor.

The connections for the contactor control are floating.



Terminal	Designation	Meaning	Range
5	Main contactor control	Main contactor control	AC 230 V
4	Main contactor control	Main contactor control	1 kVA
3 n.	c.	Not connected	
2	0 V	Reference potential	0 V
1	+24 V (in)	DC24 V ... DC30 V 24 V voltage supply	For current requirement see section “Technical Data“

Connectable cross-section: 2.5 mm² (AWG 12)

Table 7-4 Connection of external DC 24 V aux. voltage supply and main contactor control (type J-L)

NOTE

The excitation coil of the main contactor has to be damped with overvoltage limiters, e.g. RC element.

The 230 V fan has to be supplied with AC230 V externally. The connecting points are located on the fuse-disconnectors on the right next to the DIN rail of X9.

WARNING

The external 24 V voltage supply must meet the requirements for safety separation (PELV electrical circuit = Protective Extra Low Voltage).

7.3 Control connections

Standard connections

In the basic version, the unit has the following control connections on the CUMC:

- Serial interface (RS232 / RS485) for PC or OP1S (interface 1)
- One serial interface (USS bus, RS485) (interface 2)
- One control terminal strip with digital and analog inputs and outputs

WARNING

Before the control cables and encoder cables are connected or disconnected, the unit must be disconnected from the supply (24 V electronic power supply **and** DC link/line voltage)!

If this measure is not observed, this can result in defects on the encoder. A defective encoder can cause uncontrolled axis movements.

WARNING

The external 24 V infeed and all circuits connected to the control terminals must meet the requirements for safety separation as stipulated in EN 50178 (PELV circuit = Protective Extra Low Voltage).

NOTE

The ground of the control connections is connected inside the unit with the protective conductor (ground) – (PELV electrical circuit).

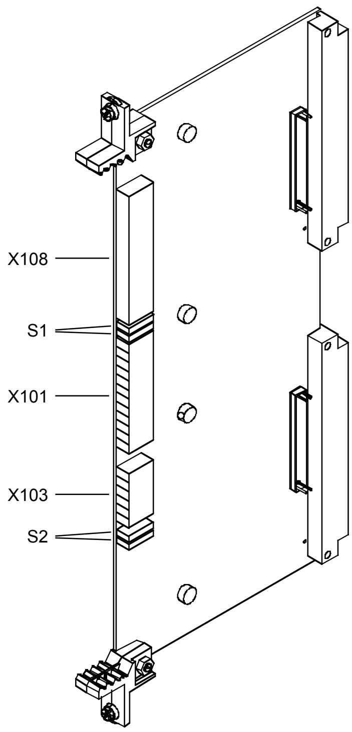


Fig. 7-4 View of the CUMC

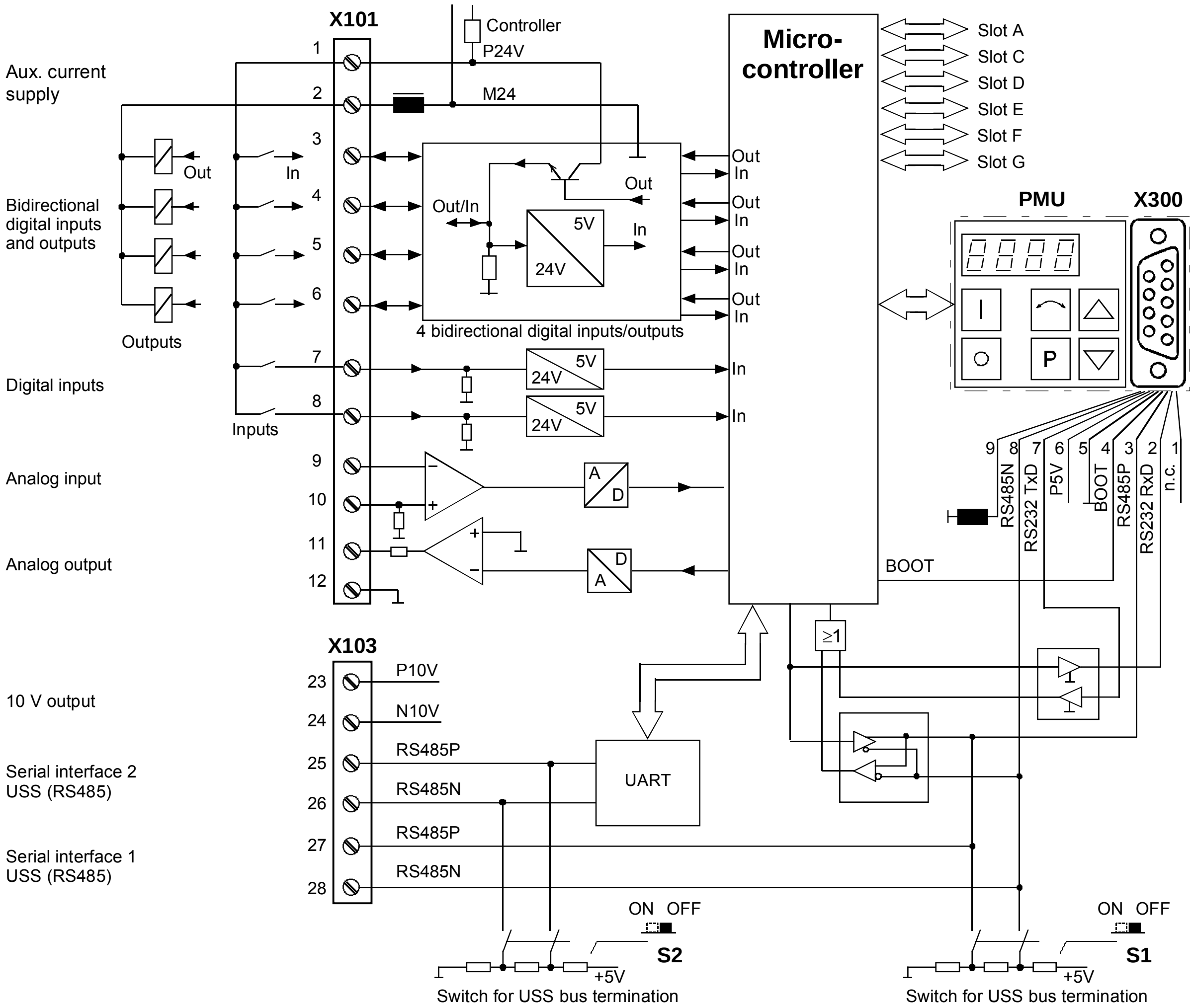


Fig. 7-5 Overview of the standard connections

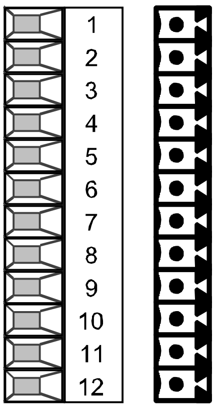
X101 – Control terminal strip

The following connections are provided on the control terminal strip:

- 4 optionally parameterizable digital inputs and outputs
- 2 digital inputs
- 1 analog input
- 1 analog output
- 24 V aux. voltage supply (max. 150 mA, output only!) for the inputs and outputs

WARNING

If the digital inputs are supplied from an external 24 V supply, this must be referenced to frame X101.2. Terminal X101.1 (P24 AUX) may **not** be connected with the 24V supply.



Terminal	Designation	Meaning	Range
1	P24 AUX	Aux. voltage supply	DC 24 V / 150 mA
2	M24 AUX	Reference potential	0 V
3	DIO1	Digital input/output 1	24 V, 10 mA / 20 mA
4	DIO2	Digital input/output 2	24 V, 10 mA / 20 mA
5	DIO3	Digital input/output 3	24 V, 10 mA / 20 mA
6	DIO4	Digital input/output 4	24 V, 10 mA / 20 mA
7	DI5	Digital input 5	24 V, 10 mA
8	DI6	Digital input 6	24 V, 10 mA
9 AI	+ Anal	og input +	11 bit + sign differential input:
10 AI	–	Analog input –	± 10 V / Ri = 40 kΩ
11 AO		Analog output	8 bit + sign ± 10 V, 5 mA
12	M AO	Ground analog output	

Connectable cross-section: 0.14 mm² to 1.5 mm² (AWG 16)

Terminal 1 is at the top when installed.

Table 7-5 Control terminal strip

In the case of digital inputs, levels below 3 V are interpreted as low and levels above 13 V as high.

NOTE

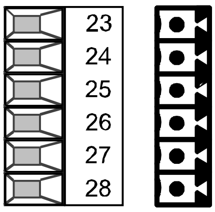
The outputs of the customer terminal can assume undefined states during power up/board initialization/execution time overflow, unless a specific response has been expressly defined (and implemented in the hardware) for these periods.

X103 - 10 V voltage output, SCom1, SCom2

The following connections are provided on the control terminal strip:

♦ 10 V aux. voltage (max. 5 mA) for the supply of external potentiometers

♦ 2 serial interfaces SCom1 and SCom2 (USS / RS485)



Terminal	Designation	Meaning	Range
23 P10	V	+10 V supply for ext. potentiometer	+10 V ±1.3 %, Imax = 5 mA
24 N10	V	-10 V supply for ext. potentiometer	-10 V ±1.3 %, Imax = 5 mA
25	RS485 P (SCom2)	USS bus connection SCom2	RS485
26	RS485 N (SCom2)	USS bus connection SCom2	RS485
27	RS485 P (SCom1)	USS bus connection SCom1	RS485
28	RS485 N (SCom1)	USS bus connection SCom1	RS485

Connectable cross-section: 0.14 mm^2 to 1.5 mm^2 (AWG 16)

The terminals 23 and 24 are short-circuit proof.

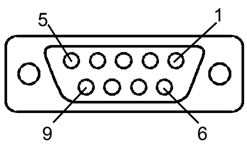
Terminal 23 is at the top when installed.

Table 7-6 Control terminal strip X103

X300 - Serial interface

Either an OP1S or a PC can be connected up via the 9-pole SUB D socket.

The 9-pole SUB D socket is internally coupled with the USS bus, with the result that it is possible to exchange data with further converters and inverters which are linked via the USS bus.



Pin	Name	Meaning	Range
1 n.	c.	Not connected	
2	RS232 RxD	Receive data via RS232	RS232
3	RS485 P	Data via RS485	RS485
4 Boot		Control signal for software update	Digital signal, low active
5	M5V	Reference potential to 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	M_RS232/485	Digital ground (choked)	

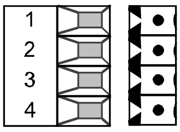
Table 7-7 Serial interface X300

Switch settings

Switch	Meaning
S1 • ope n • closed	**SCom1 (X300): Bus terminating resistor** • Resist or open • Resistor closed
S2 • ope n • closed	**SCom2 (X101/10,11): Bus terminating resistor** • Resist or open • Resistor closed

X533 - Safe stop option

The safe stop option comprises the safety relay and the connecting terminals for relay triggering and a checkback contact.



Terminal	Designation	Meaning	Range
1	Contact 1	Checkback "safe stop"	DC 20 V – 30 V
2	Contact 2	Checkback "safe stop"	1 A
3	Control input "safe stop"	Rated resistance of field coil $\geq$ 823 Ω ± 10 % at 20 °C	DC 20 V – 30 V max. operating frequency: 6/min
4	P24 DC	Supply voltage "safe stop"	DC 24 V / 30 mA

Connectable cross-section: 1.5 mm² (AWG 16)

Terminal 4 is at the front when installed.

Table 7-8 Terminal assignment for the "safe stop" option

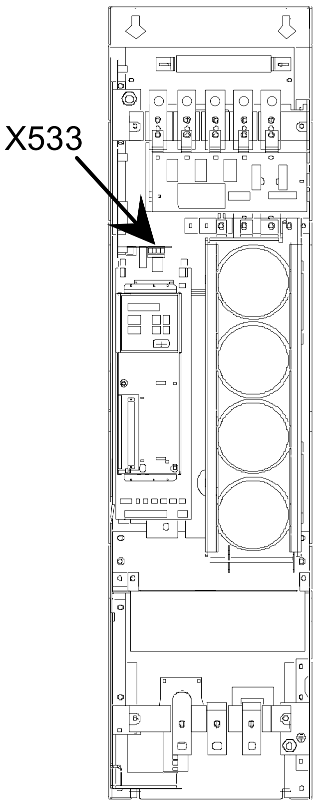


Fig. 7-6 Types E and F

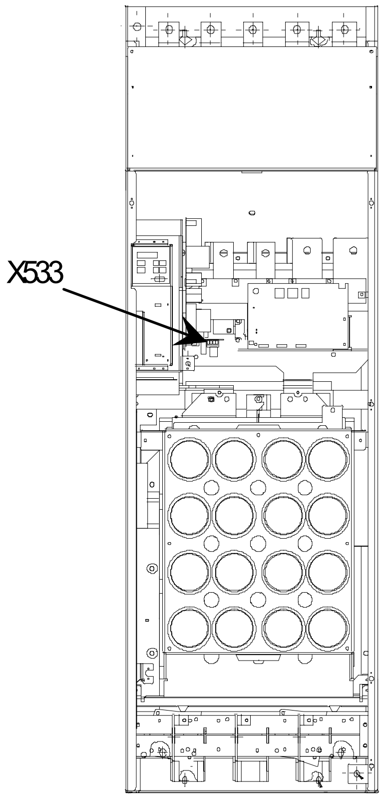


Fig. 7-7 Type G

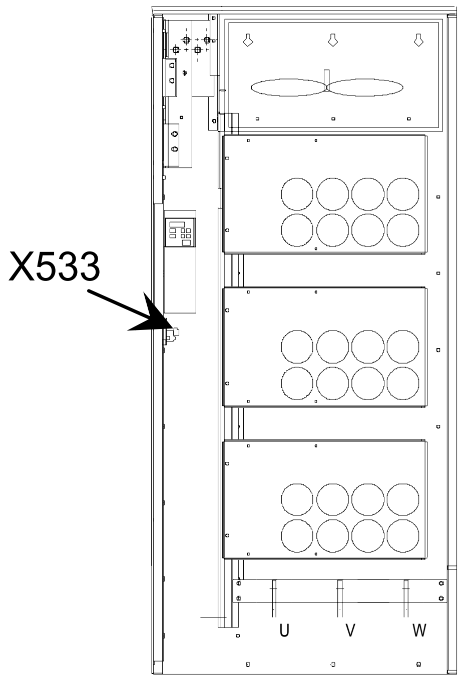
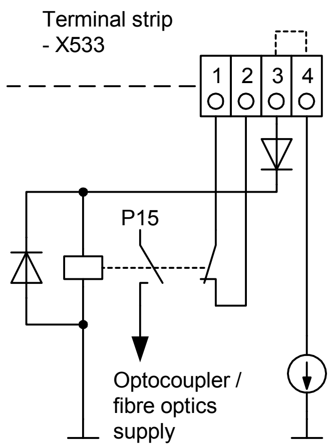


Fig. 7-8 Types ≥ J

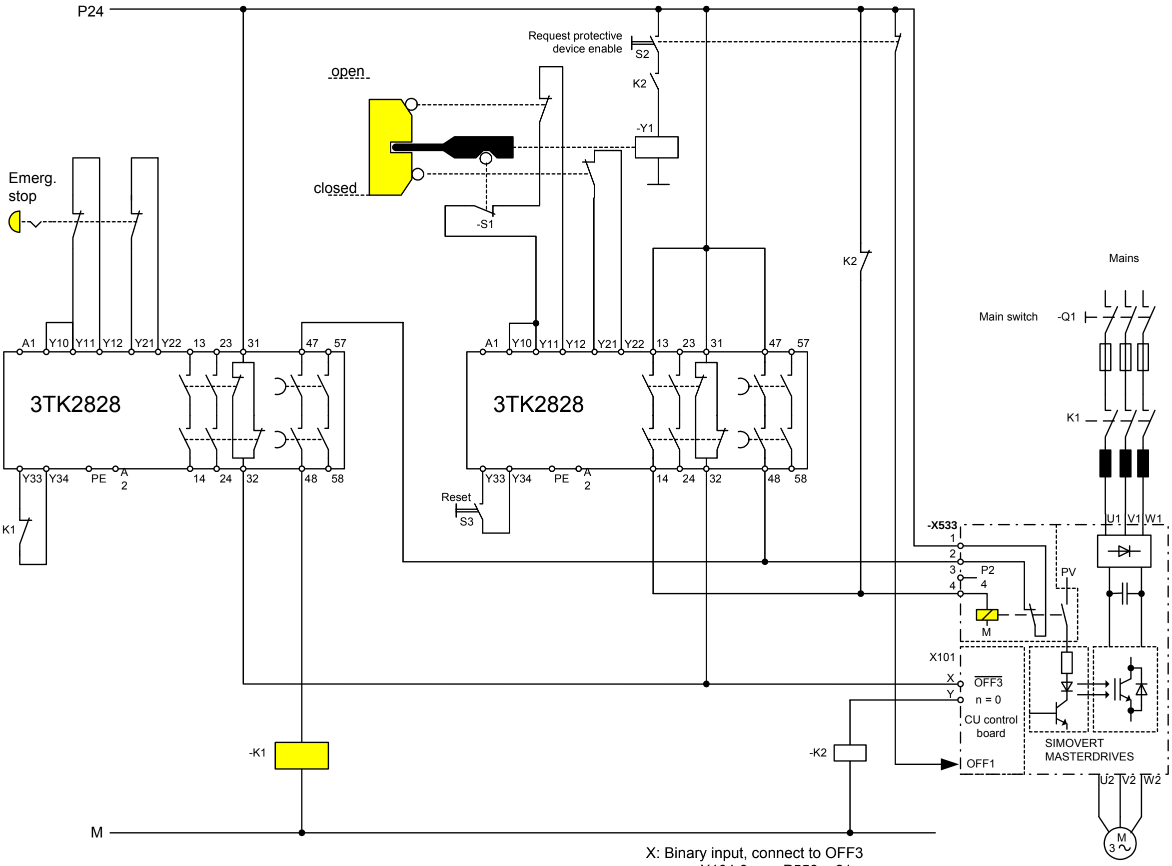
The field coil of the safety relay is connected at one end to the grounded electronics frame. When the field coil is supplied via an external 24 V supply, its negative pole must be connected to ground potential. The external 24 V supply must comply with the requirements for PELV circuits to EN 50178 (DIN VDE 0160).

In the shipped state, a jumper is inserted between terminals 3 and 4. The jumper must be removed before the "SAFE STOP" function can be used and an external control for selecting the function connected.

If the safety relay is supplied via the internal supply at X533:4, the external 24 V supply must deliver at least 22 V at terminal X9:1/2 to ensure that the relay picks up reliably (internal voltage drop).



The checkback contacts of the safety relay are capable of at least 100,000 switching cycles at the specified load (30 V DC / 1 A). The mechanical service life is about 10^6 switching cycles. The safety relay is an important component in ensuring reliability and availability of the machine. For this reason, the pcb with the safety relay must be replaced in the case of malfunction. In this case, the unit must be returned for repair or replaced. Function checks must be carried out at regular intervals, which must be defined in compliance with Employer's Liability Insurance Regulation BGV A3 §39, para. 3. Accordingly, function checks must be performed as required by the relevant service conditions, but at least once a year and additionally after initial commissioning and any modification and/or maintenance work.



X: Binary input, connect to OFF3
e. g. X101.8 --> P558 = 21
Y: Binary output, connect to "Comparison value reached"
e. g. X101.6 --> P654 = 120; P796 = 0 (comparison value)

Fig. 7-9 *Sample application of "safe stop" function with contactor safety combination for monitoring a moving protective device in Safety Category 3 to EN 954-1*

All external cables relevant to the safety function are protected, e.g. installed in cable ducts, to preclude the possibility of short circuits. Cables must be installed in compliance with the requirements of EN 60204-1, Section 14.

In the circuit shown in Fig. 7-9, the tumbler does not release the moving protective device until the drive has stopped. It may be possible to omit the tumbler if the risk assessment of the machine deems this to be safe. In this case, the NC contact of the protective device is connected directly to terminals Y11 and Y12 and electromagnet Y1 is omitted.

Binary input X is negated with signal "OFF3", i.e. at 24 V, the converter decelerates the motor to zero speed along the parameterized deceleration ramp. The converter signals zero speed via binary output Y, thus energizing relay K2.

Once the motor has stopped, the safety relay in the converter is opened and the coil of main contactor K1 remains at 24 V via the checkback contact. If contacts in the safety relay are sticking, the checkback contacts do not close and the safety combination on the right deenergizes main contactor K1 via delayed contacts 47/48 when the set delay period expires.

7.4 Fan supply

X18 – Fan supply

Terminal	Designation	Meaning	Range
1	N	Fan supply (neutral conductor)	
2	-		
3	Internally assigned	Fan N via fuse F1	
4	-		
5	L	Fan supply (phase)	230 V ± 15 % / 50/60 Hz
6	-		
7	Internally assigned	Fan L via fuse F2	
8	-		
9	-		
10	Internally assigned		
11	Internally assigned		
12	Internally assigned		
13	Internally assigned		

NOTE

The 1AC 230 V fan supply X18/1 must be grounded (neutral conductor N connected to protective conductor PE).

7.5 Fan fuses

Line voltage DC 510 V to 660 V		
Order number	**Fan fuse (F1 / F2)**	**Fan fuse (F101 / F102)**
6SE7031-0TE□0 F	NQ-R-2	
6SE7031-2TF□0 F	NQ-R-2	
6SE7031-8TF□0 F	NQ-R-2	
6SE7032-1TG□0 F	NQ-R-5	
6SE7032-6TG□0 F	NQ-R-5	
6SE7033-2TG□0 F	NQ-R-5	
6SE7033-7TG□0 F	NQ-R-5	
6SE7035-1TJ□0 6SE7035-1TJ□0-1AA0	FNQ-R-5	
6SE7036-0TJ70 6SE7036-0TJ70-1AA0	FNQ-R-5	
6SE7038-6TK70 6SE7038-6TK70-1AA0		FNM-10 FNQ-R-5
6SE7041-1TK70 6SE7041-1TK70-1AA0		TRM 30 FNQ-R-5
6SE7041-3TL70 6SE7041-3TL70-1AA0		TRM 30 FNQ-R5
Manufacturer: F NQ-R Bussmann		

□ = 5 corresponds to MASTERDRIVES Motion Control
= 7 corresponds to MASTERDRIVES Motion Control Performance 2

Table 7-9 Fan fuses

NOTE

The 230 V fan must be supplied with AC 230 V externally via terminal strip X18 1/5 on the PSU.

8 Parameterization

It is possible to parameterize the units of the SIMOVERT MASTERDRIVES series by various methods of parameter input. Every unit can be set via the dedicated parameterizing unit (PMU) without the need to use additional components.

Each unit is supplied with the user software DriveMonitor and comprehensive electronic documentation on a CD. In the case of installation on a standard PC the units can be parameterized via the serial interface of the PC. The software provides extensive parameter aids and a prompted start-up function.

The unit can be further parameterized by entering parameters with the OP1S manual operator panel and via a controller at the field bus level (e.g. Profibus).

NOTE

In firmware V.20 (for performance 2 units) BICO parameters can also be changed in the "Run" drive status (see also parameter list "Changeable in"). In contrast to firmware v1.x in which BICO parameters could only be changed in the "Ready" drive status, structural changes can also be made on performance 2 units with firmware V2.0 during running operation.

WARNING

Unintentional axis movements may occur as a result of undesired changes to BICO parameters in the "Run" drive status.

8.1 Parameter menus

Parameters with related functions are compiled in menus for structuring the parameter set stored in the units. A menu thus represents a selection out of the entire supply of parameters of the unit.

It is possible for one parameter to belong to several menus. The parameter list indicates which individual menus a parameter belongs to. Assignment is effected via the menu number allocated to each menu.

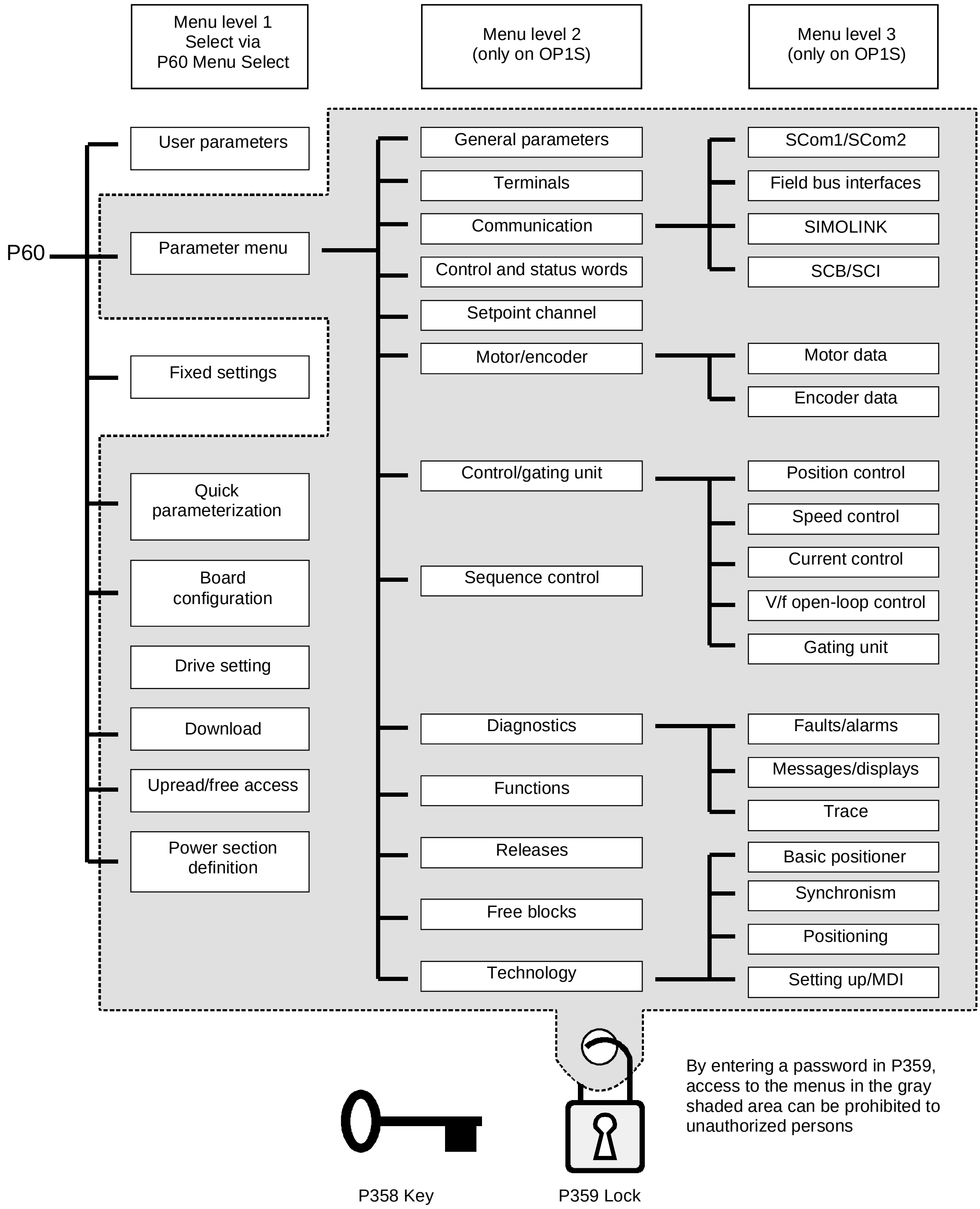


Fig. 8-1 Parameter menus

Menu levels

The parameter menus have several menu levels. The first level contains the main menus. These are effective for all sources of parameter inputs (PMU, OP1S, DriveMonitor, field bus interfaces).

The main menus are selected in parameter P60 Menu Selection.

Examples:
P060 = 0 "User parameters" menu selected
P060 = 1 "Parameter menu" selected
...
P060 = 8 "Power section definition" menu selected

Menu levels 2 and 3 enable the parameter set to be more extensively structured. They are used for parameterizing the units with the OP1S operator control panel.

Main menus

P060	Menu	Description
0	User parameters	• Freely configurable menu
1	Parameter menu	• Contains complete parameter set • More extensive structure of the functions achieved by using an OP1S operator control panel
2	Fixed settings	• Used to perform a parameter reset to a factory or user setting
3	Quick parameterization	• Used for quick parameterization with parameter modules • When selected, the unit switches to status 5 "Drive setting"
4	Board configuration	• Used for configuring the optional boards • When selected, the unit switches to status 4 "Board configuration"
5	Drive setting	• Used for detailed parameterization of important motor, encoder and control data • When selected, the unit switches to status 5 "Drive setting"
6	Download	• Used to download parameters from an OP1S, a PC or an automation unit • When selected, the unit switches to status 21 "Download"
7	Upread/free access	• Contains the complete parameter set and is used for free access to all parameters without being restricted by further menus • Enables all parameters to be upread/upload by an OP1S, PC or automation unit
8	Power section definition	• Used to define the power section (only necessary for units of the Compact and chassis type) • When selected, the unit switches to status 0 "Power section definition"

Table 8-1 Main menus

User parameters

In principle, parameters are firmly assigned to the menus. However, the "User parameters" menu has a special status. Parameters assigned to this menu are not fixed, but can be changed. You are thus able to put together the parameters required for your application in this menu and structure them according to your needs. The user parameters can be selected via P360 (Select UserParam).

Lock and key

In order to prevent undesired parameterization of the units and to protect your know-how stored in the parameterization, it is possible to restrict access to the parameters by defining your own passwords with the parameters:

- ♦ P358 key and
- ♦ P359 lock.

8.2 Changeability of parameters

The parameters stored in the units can only be changed under certain conditions. The following preconditions must be satisfied before parameters can be changed:

Preconditions	Remarks
• Either a function parameter or a BICO parameter must be involved (identified by upper-case letters in the parameter number).	Visualization parameters (identified by lower-case letters in the parameter number) cannot be changed.
• Parameter access must be granted for the source from which the parameters are to be changed.	Release is given in P053 Parameter access.
• A menu must be selected in which the parameter to be changed is contained.	The menu assignment is indicated in the parameter list for every parameter.
• The unit must be in a status which permits parameters to be changed.	The statuses in which it is possible to change parameters are specified in the parameter list.

Table 8-2 Preconditions for being able to change parameters

NOTE

The current status of the units can be interrogated in parameter r001.

Examples

Status (r001)	P053	Result
"Ready for ON" (09)	2	P222 Src n(act) can only be changed via the PMU
"Ready for ON" (09)	6	P222 Src n(act) can be changed via the PMU and SCom1 (e.g. OP1S)
"Operation" (14)	6	P222 Src n(act) cannot be changed on account of the drive status

Table 8-3 Influence of drive status (r001) and parameter access (P053) on the changeability of a parameter

8.3 Parameter input via the PMU

The PMU parameterizing unit enables parameterization, operator control and visualization of the converters and inverters directly on the unit itself. It is an integral part of the basic units. It has a four-digit seven-segment display and several keys.

The PMU is used with preference for parameterizing simple applications requiring a small number of set parameters, and for quick parameterization.

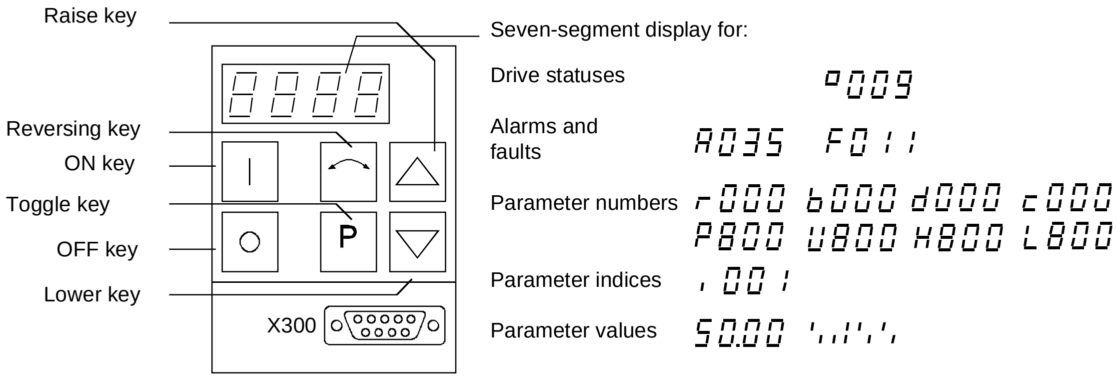


Fig. 8-2 PMU parameterizing unit

Key	Significance	Function
I	ON key	• For energizing the drive (enabling motor activation). • If there is a fault: For returning to fault display
O	OFF key	• For de-energizing the drive by means of OFF1, OFF2 or OFF3 (P554 to 560) depending on parameterization.
⌒	Reversing key	• For reversing the direction of rotation of the drive. The function must be enabled by P571 and P572
P	Toggle key	• For switching between parameter number, parameter index 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	For increasing the displayed value: • Short press = single-step increase • Long press = rapid increase
▽	Lower key	For lowering the displayed value: • Short press = single-step decrease • Long press = rapid decrease
P + △	Hold toggle key and depress raise key	• If parameter number level is active: For jumping back and forth between the last selected parameter number and the operating display (r000) • If fault display is active: For switching over to parameter number level • If parameter value level is active: For shifting the displayed value one digit to the right if parameter value cannot be displayed with 4 figures (left-hand figure flashes if there are any further invisible figures to the left)
P + ▽	Hold toggle key and depress lower key	• If parameter number level is active: For jumping directly to the operating display (r000) • If parameter value level is active: For shifting the displayed value one digit to the left if parameter value cannot be displayed with 4 figures (right-hand figure flashes if there are any further invisible figures to the right)

Table 8-4 Operator control elements on the PMU

Toggle key (P key)

As the PMU only has a four-digit seven-segment display, the 3 descriptive elements of a parameter

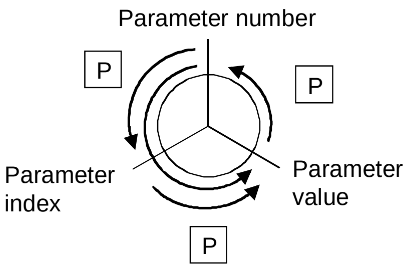
- ♦ Parameter number,
- ♦ Parameter index (if the parameter is indexed) and
- ♦ Parameter value

cannot be displayed at the same time. For this reason, you have to switch between the individual descriptive elements by depressing the toggle key. After the desired level has been selected, adjustment can be made using the raise key or the lower key.

With the toggle key, you can change over:

- 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, you can jump directly from the parameter number to the parameter value.



NOTE

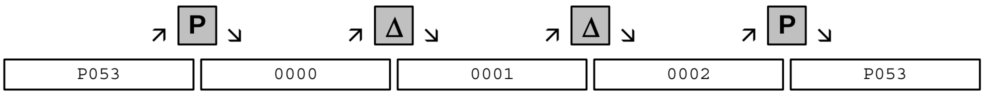
If you change the value of a parameter, this change generally becomes effective immediately. It is only in the case of acknowledgement parameters (marked in the parameter list by an asterisk ‘ * ’) that the change does not become effective until you change over from the parameter value to the parameter number.

Parameter changes made using the PMU are always safely stored in the EEPROM (protected in case of power failure) once the toggle key has been depressed.

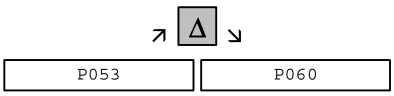
Example

The following example shows the individual operator control steps to be carried out on the PMU for a parameter reset to factory setting *).

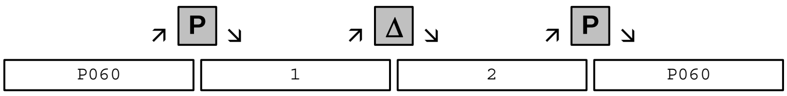
Set P053 to 0002 and grant parameter access via PMU



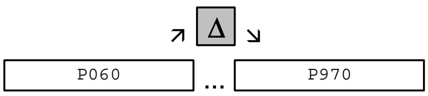
Select P060



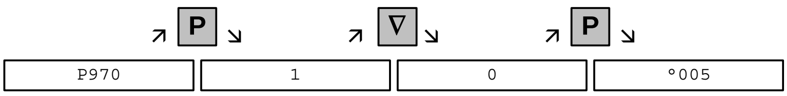
Set P060 to 0002 and select "Fixed settings" menu



Select P970



Set P970 to 0000 and start parameter reset



*) P70, Order number 6SE70… is retained

8.4 Parameter input via the OP1S

The operator control panel (OP1S) is an optional input/output device which can be used for parameterizing and starting up the units. Plain-text displays greatly facilitate parameterization.

The OP1S has a non-volatile memory and can permanently store complete sets of parameters. It can therefore be used for archiving sets of parameters. The parameter sets must be read out (upread) from the units first. Stored parameter sets can also be transferred (downloaded) to other units.

The OP1S and the unit to be operated communicate with each other via a serial interface (RS485) using the USS protocol. During communication, the OP1S assumes the function of the master whereas the connected units function as slaves.

The OP1S can be operated at baud rates of 9.6 kBd and 19.2 kBd, and is capable of communicating with up to 32 slaves (addresses 0 to 31). It can therefore be used both in a point-to-point link (e.g. during initial parameterization) and within a bus configuration.

The plain-text displays can be shown in one of five different languages (German, English, Spanish, French, Italian). The language is chosen by selecting the relevant parameter for the slave in question.

Order numbers

Components	**Order Number**
OP1S	6SE7090-0XX84-2FK0
Connecting cable 3 m	6SX7010-0AB03
Connecting cable 5 m	6SX7010-0AB05
Adapter for installation in cabinet door incl. 5 m cable	6SX7010-0AA00

NOTE

The parameter settings for the units connected to the OP1S are given in the corresponding documentation of the unit (Compendium).

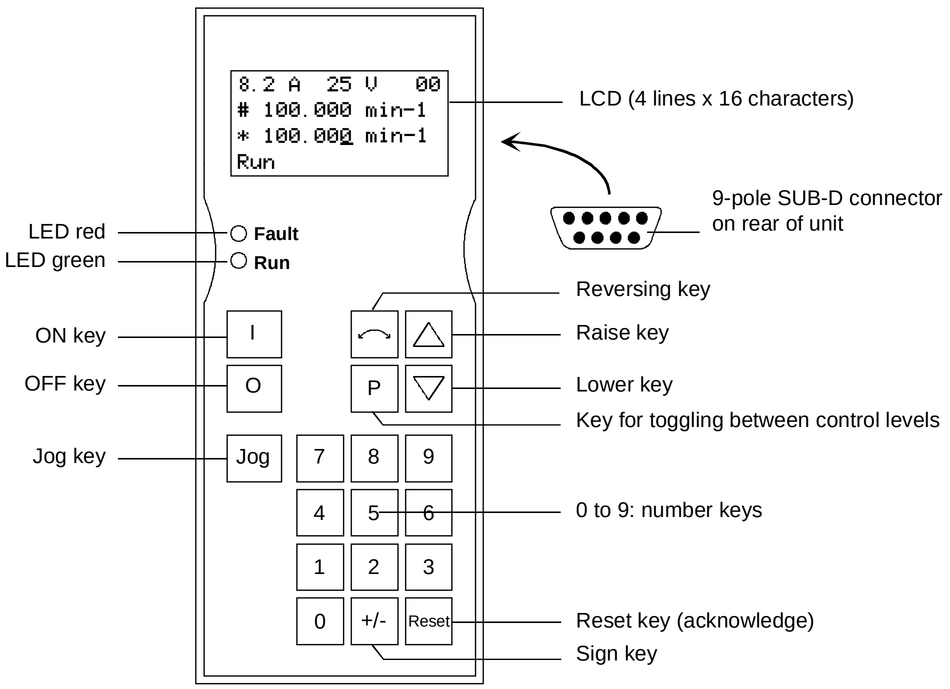


Fig. 8-3 View of the OP1S

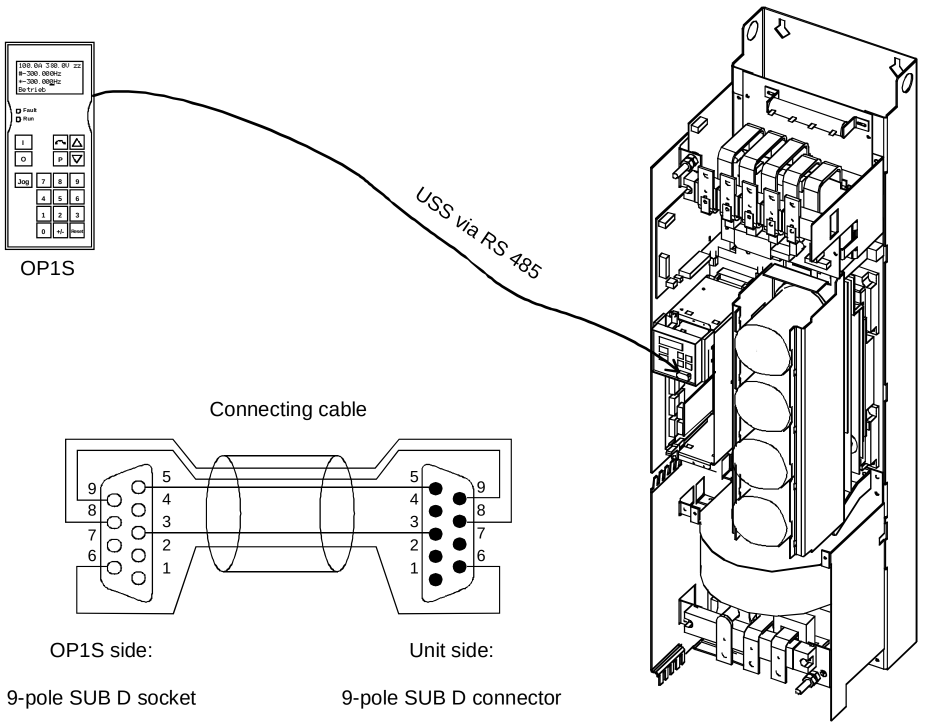


Fig. 8-4 The OP1S directly connected to the unit

NOTE

In the as-delivered state or after a reset of the parameters to the factory setting, a point-to-point link can be adopted with the OP1S without any further preparatory measures and parameterization can be commenced.

Key	Significance	Function
I	ON key	• For energizing the drive (enabling motor activation). The function must be enabled by means of parameterization.
O	OFF key	• For de-energizing the drive by means of OFF1, OFF2 or OFF3, depending on parameterization. This function must be enabled by means of parameterization.
Jog	Jog key	• For jogging with jogging setpoint 1 (only effective when the unit is in the "ready to start" state). This function must be enabled by means of parameterization.
⌒	Reversing key	• For reversing the direction of rotation of the drive. The function must be enabled by means of parameterization.
P	Toggle key	• For selecting menu levels and switching between parameter number, parameter index and parameter value in the sequence indicated. The current level is displayed by the position of the cursor on the LCD display (the command comes into effect when the key is released). • For conducting a numerical input
Reset	Reset key	• For leaving menu levels • If fault display is active, this is for acknowledging the fault. This function must be enabled by means of parameterization.
△	Raise key	For increasing the displayed value: • Short press = single-step increase • Long press = rapid increase • If motorized potentiometer is active, this is for raising the setpoint. This function must be enabled by means of parameterization
▽	Lower key	For lowering the displayed value: • Short press = single-step decrease • Long press = rapid decrease • If motorized potentiometer is active, this is for lowering the setpoint. This function must be enabled by means of parameterization.
+/-	Sign key	• For changing the sign so that negative values can be entered
0 to 9	Number keys	• Numerical input

Table 8-5 Operator control elements of the OP1S

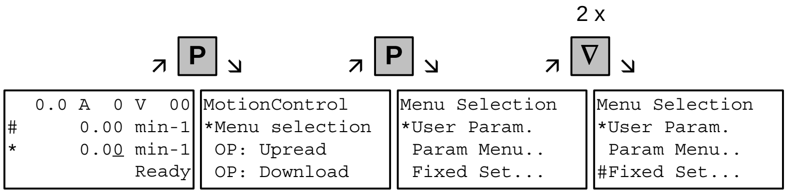
NOTE

If you change the value of a parameter, the change does not become effective until the toggle key (P) is pressed.

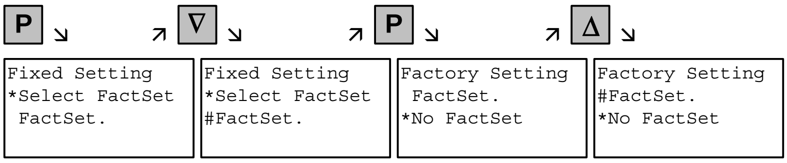
Parameter changes made using the OP1S are always stored safely in the EEPROM (protected in case of power failure) once the toggle key (P) has been pressed.

Some parameters may also be displayed without a parameter number, e.g. during quick parameterization or if "Fixed setting" is selected. In this case, parameterization is carried out via various sub-menus.

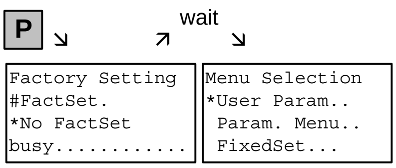
Example of how to proceed for a parameter reset.



Selection of fixed setting



Selection of factory setting



Start of factory setting

NOTE

It is not possible to start the parameter reset in the "Run" status.

8.5 Parameter input with DriveMonitor

NOTE

Please refer to the online help for detailed information on DriveMonitor ( **button or F1 key).**

8.5.1 Installation and connection

8.5.1.1 Installation

A CD is included with the devices of the MASTERDRIVES Series when they are delivered. The operating tool supplied on the CD (DriveMonitor) is automatically installed from this CD. If "automatic notification on change" is activated for the CD drive on the PC, user guidance starts when you insert the CD and takes you through installation of DriveMonitor. If this is not the case, start file "Autoplay.exe" in the root directory of the CD.

8.5.1.2 Connection

There are two ways of connecting a PC to a device of the SIMOVERT MASTERDRIVES Series via the USS interface. The devices of the SIMOVERT MASTERDRIVES Series have both an RS232 and an RS485 interface.

RS232 interface

The serial interface that PCs are equipped with by default functions as an RS232 interface. This interface is not suitable for bus operation and is therefore only intended for operation of a SIMOVERT MASTERDRIVES device.

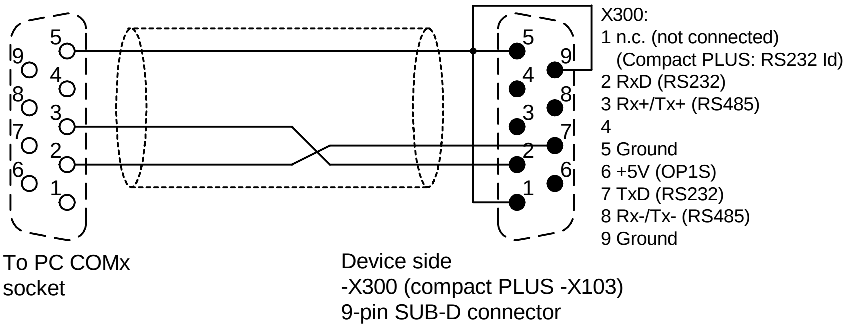


Fig. 8-5 Connecting cable for connecting PC COM(1-4) to SIMOVERT MASTERDRIVES X300

NOTICE

DriveMonitor must not be operated via the Sub-D socket X300 if the SST1 interface parallel to it is already being used for another purpose, e.g. bus operation with SIMATIC as the master.

RS485 interface

The RS485 interface is multi-point capable and therefore suitable for bus operation. You can use it to connect 31 SIMOVERT MASTERDRIVES with a PC. On the PC, either an integrated RS485 interface or an RS232 ↔ RS485 interface converter is necessary. On the device, an RS485 interface is integrated into the -X300 (compact PLUS -X103) connection. For the cable: see pin assignment -X300 and device documentation of the interface converter.

8.5.2 Establishing the connection between DriveMonitor and the device

8.5.2.1 Setting the USS interface

You can configure the interface with menu *Tools* → *ONLINE Settings*.

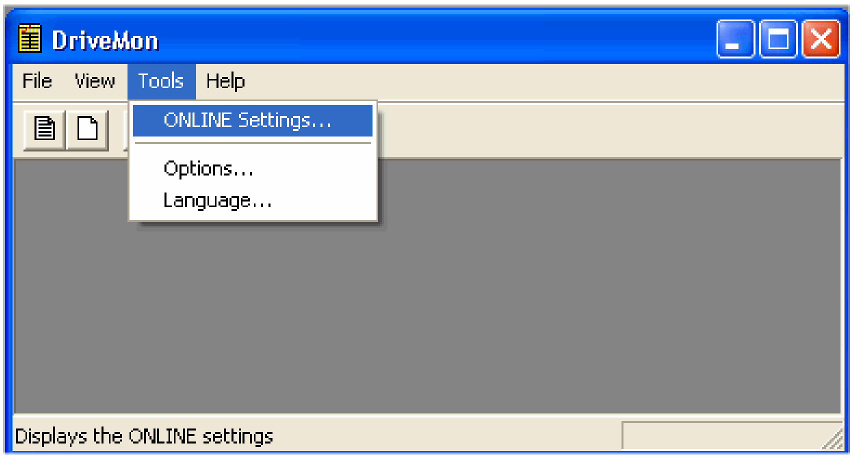


Fig. 8-6 Online settings

The following settings (Fig. 8-7) are possible:

- **Tab card "Bus Type",** options
  USS (operation via serial interface)
  Profibus DP (only if DriveMonitor is operated under Drive ES).
- **Tab card "Interface"**
  You can enter the required COM interface of the PC (COM1 to COM4) and the required baudrate here.

NOTE

Set the baudrate to the baudrate parameterized in SIMOVERT MASTERDRIVES (P701) (factory setting 9600 baud).

Further settings: operating mode of the bus in RS485 operation; setting according to the description of the interface converter RS232/RS485

- **Tab card "Extended"**
  Request retries and Response timeout; here you can increase the values already set if communication errors occur frequently.

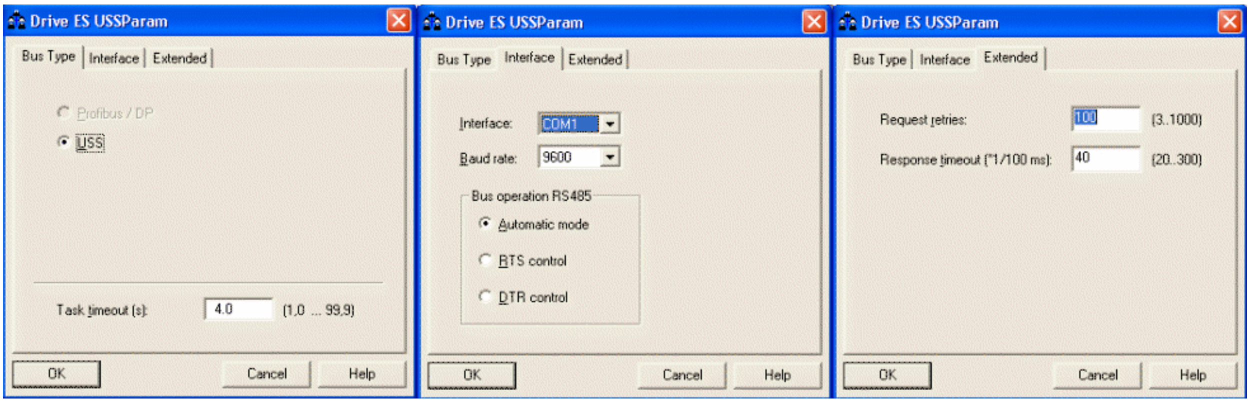


Fig. 8-7 Interface configuration

8.5.2.2 Starting the USS bus scan

DriveMonitor starts with an empty drive window. Via the menu "*Set up an ONLINE connection*..." the USS bus can be scanned for connected devices:

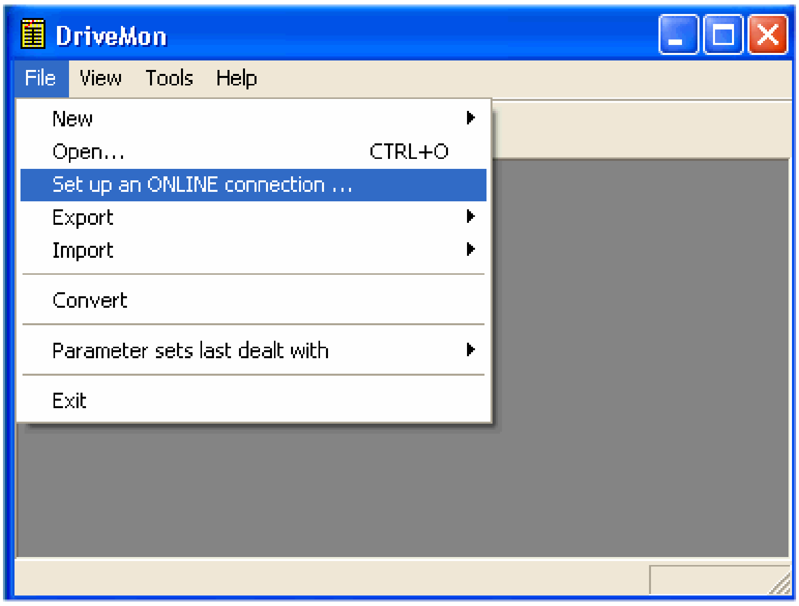


Fig. 8-8 Starting the USS bus scan

NOTE

The "Set up an online connection" menu is only valid from Version 5.2 onwards.

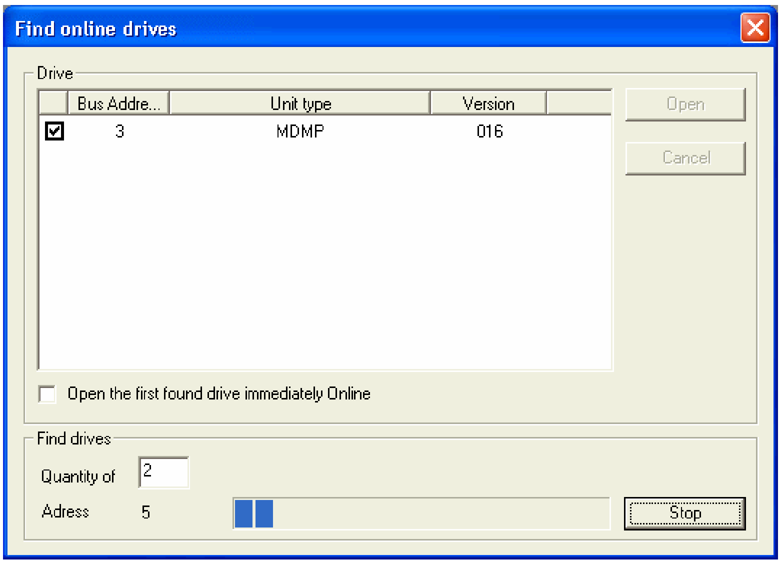


Fig. 8-9 Search for online drives

During the search the USS bus is scanned **with the set baudrate only**. The baud rate can be changed via "*Tools → ONLINE Settings*", see section 8.5.2.1.

8.5.2.3 Creating a parameter set

With menu *File→ New →...* you can create a new drive for parameterization (see Fig. 8-10). The system creates a download file (*.dnl), in which the drive characteristic data (type, device version) are stored. You can create the download file on the basis of an empty parameter set or the factory setting.

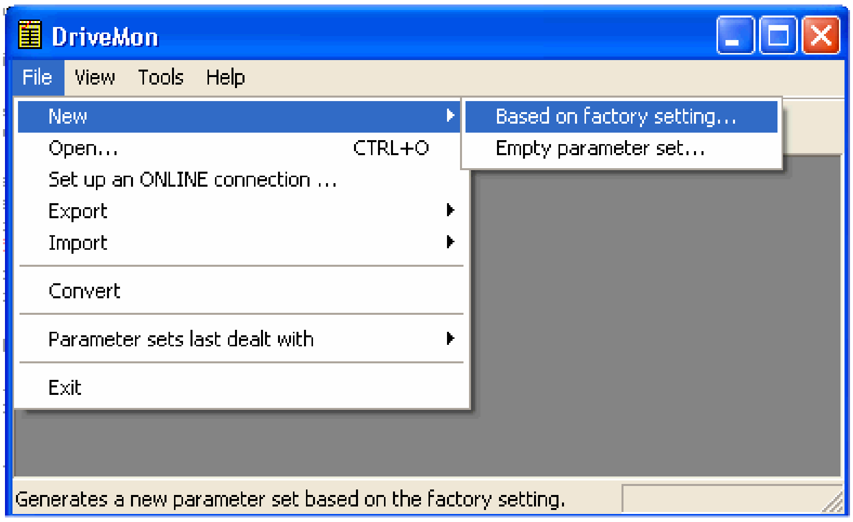


Fig. 8-10 Creating a new drive

Based on factory setting:

- The parameter list is preassigned with the factory setting values

Empty parameter set:

- For compilation of individually used parameters

If the parameters of a parameter set that has already been created have to be changed, this can be done by calling the corresponding download file via the "*File→ Open*" menu function. The last four drives can be opened via *"Parameter sets last dealt with"*.

When you create a new drive, the window "Drive Properties" (Fig. 8-11) opens. Here you must enter the following data:

- In dropdown list box "Device type", select the type of device (e.g. MASTERDRIVES MC). You can only select the devices stored.
- In dropdown list box "Device version", you can select the software version of the device. You can generate databases for (new) software versions that are not listed when you start online parameterization.
- You must only specify the bus address of the drive during online operation (switchover with button Online/Offline)

NOTE

The specified bus address must be the same as that of the parameterized SST bus address in SIMOVERT MASTERDRIVES (P700).

No bus address is assigned to the drive with the button "Disconnect network connection".

NOTE

Field "Number of PCD" has no special significance for the parameterization of MASTERDRIVES and should be left at "2".

If the value is changed, it must be/remain ensured that the setting value in the program matches the value in parameter P703 of the drive at all times.

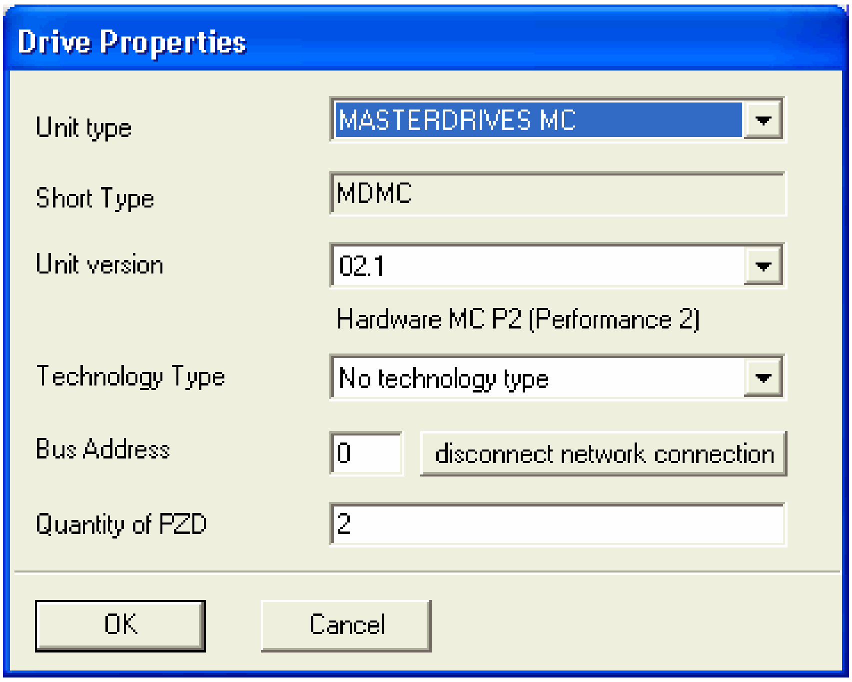


Fig. 8-11 Create file; Drive properties

After confirming the drive properties with *ok* you have to enter the name and storage location of the download file to be created.

8.5.3 Parameterization

8.5.3.1 Structure of the parameter lists, parameterization with DriveMonitor

Parameterization using the parameter list is basically the same as parameterization using PMU (See Compendium, Chapter "Parameterizating Steps"). The parameter list provides the following advantages:

- ♦ Simultaneous visibility of a larger number of parameters
- ♦ Text display for parameter names, index number, index text, parameter value, binectors, and connectors
- ♦ On a change of parameters: Display of parameter limits or possible parameter values

The parameter list has the following structure:

Field No.	Field Name	Function
1	P. Nr	Here the parameter number is displayed. You can only change the field in menu Free parameterization.
2	Name	Display of the parameter name, in accordance with the parameter list
3	Ind	Display of the parameter index for indexed parameters. To see more than index 1, click on the [+] sign. The display is then expanded and all indices of the parameter are displayed
4	Index text	Meaning of the index of the parameter
5	Parameter value	Display of the current parameter value. You can change this by double-clicking on it or selecting and pressing Enter.
6	Dim	Physical dimension of the parameter, if there is one

With buttons *Offline, Online (RAM), Online (EEPROM)* (Fig. 8-12 [1]) you can switch modes. When you switch to online mode, device identification is performed. If the configured device and the real device do not match (device type, software version), an alarm appears. If an unknown software version is recognized, the option of creating the database is offered. (This process takes several minutes.)

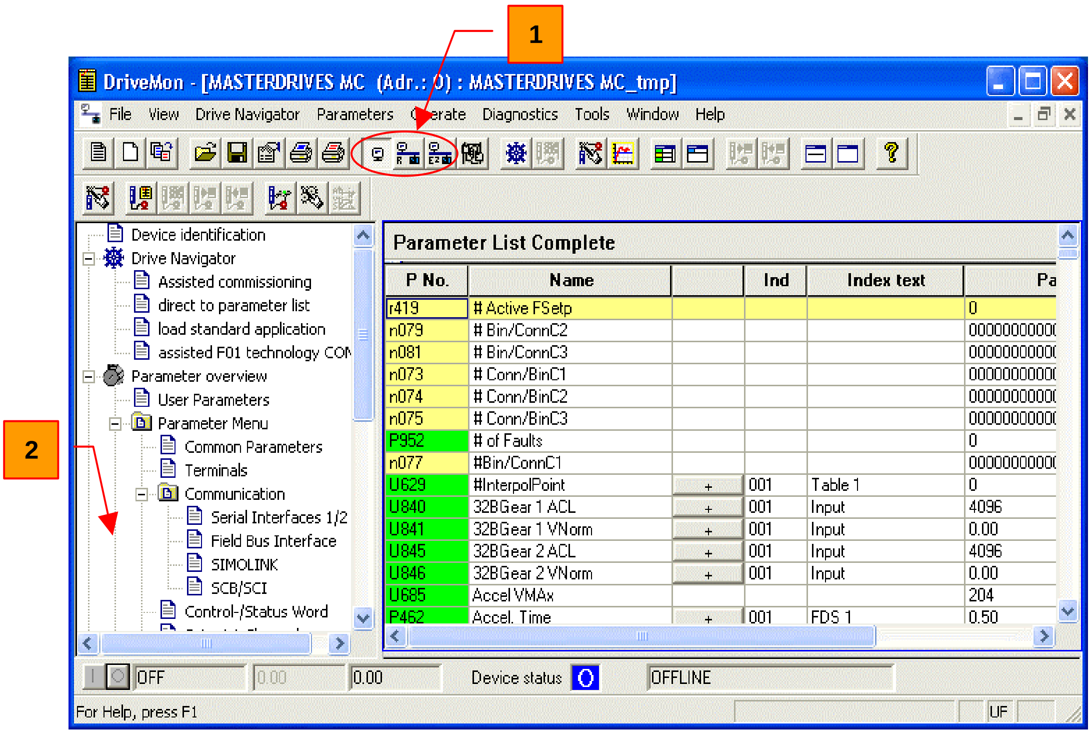


Fig. 8-12 *Drive window/parameter list*

The DriveMonitor drive window has a directory tree for navigation purposes (Fig. 8-12 [2]). You can deselect this additional operating tool in menu V*iew - Parameter selection*.

The drive window contains all elements required for the parameterization and operation of the connected device. In the lower bar, the status of the connection with the device is displayed:

Connection and device ok

Connection ok, device in fault state

Connection ok, device in alarm state

Device is parameterized offline

No connection with the device can be established (only offline parameterization possible).

NOTE

If no connection with the device can be established because the device does not physically exist or is not connected, you can perform offline parameterization. To do so, you have to change to offline mode. In that way, you can create an individually adapted download file, which you can load into the device later.

Drive Navigator This is used to quickly access important functions of the DriveMonitor. Settings for Drive Navigator under *Tools -> Options* (Fig. 8-14):

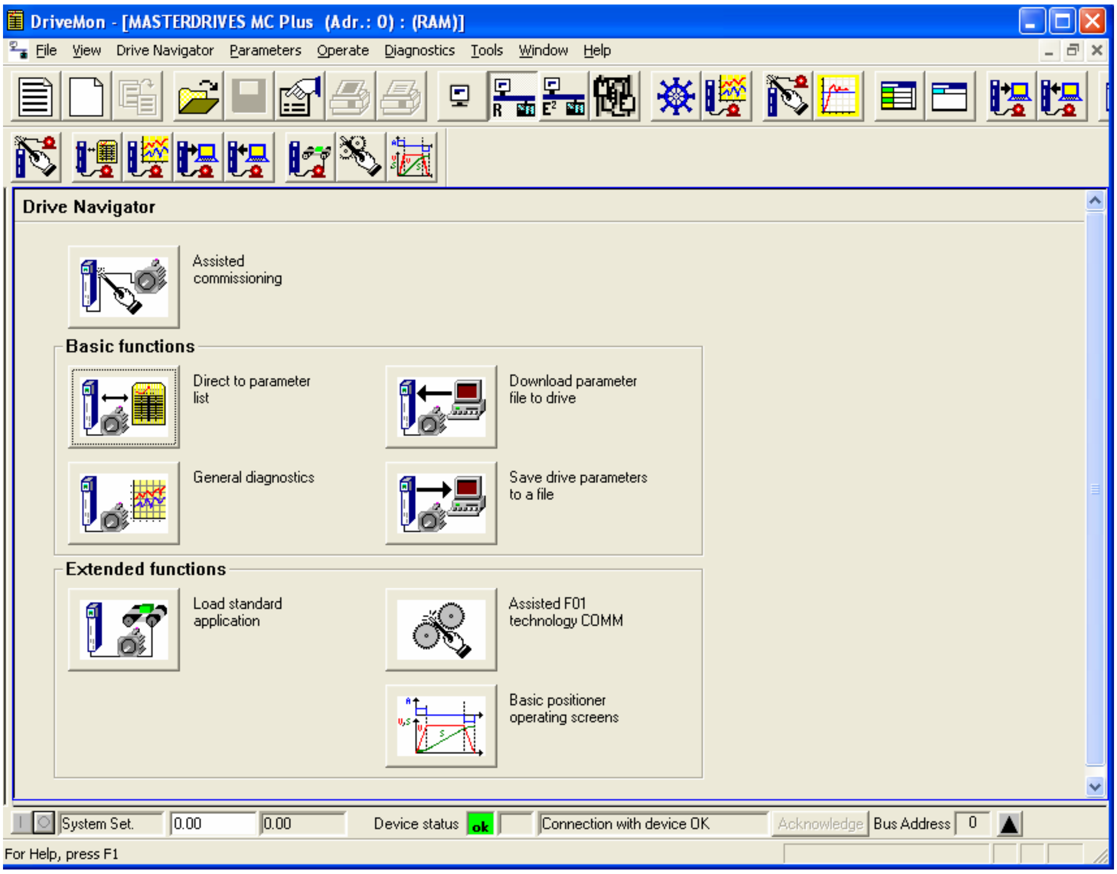


Fig. 8-13 Drive Navigator

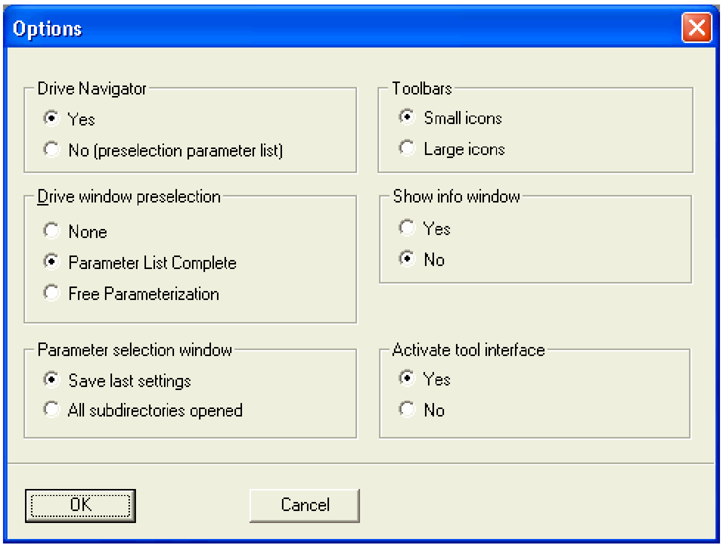
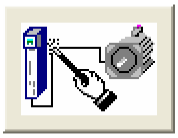
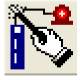
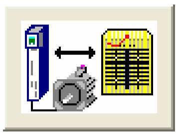
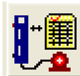
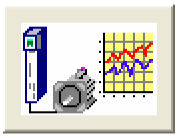
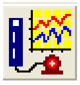


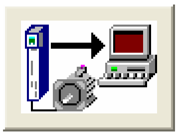
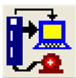
Fig. 8-14 Options menu display

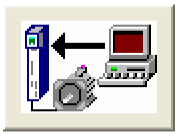
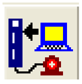
Toolbar of the Drive Navigator

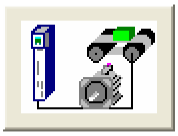
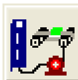
 =  Assisted commissioning

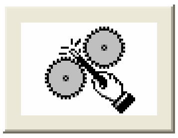
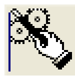
 =  Direct to parameter list

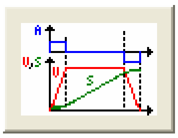
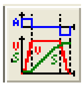
 =  General diagnostics

 =  Save drive parameters to a file

 =  Download parameter file to drive

 =  Load standard application

 =  Assisted F01 technology COMM

 =  Basic positioner operating screens

8.5.3.2 General diagnostics

Via the *Diagnostics → General diagnostics* menu the following window opens. This window gives a general overview of the active warnings and faults and their history. Both the warning and the fault number as well as plain text are displayed.

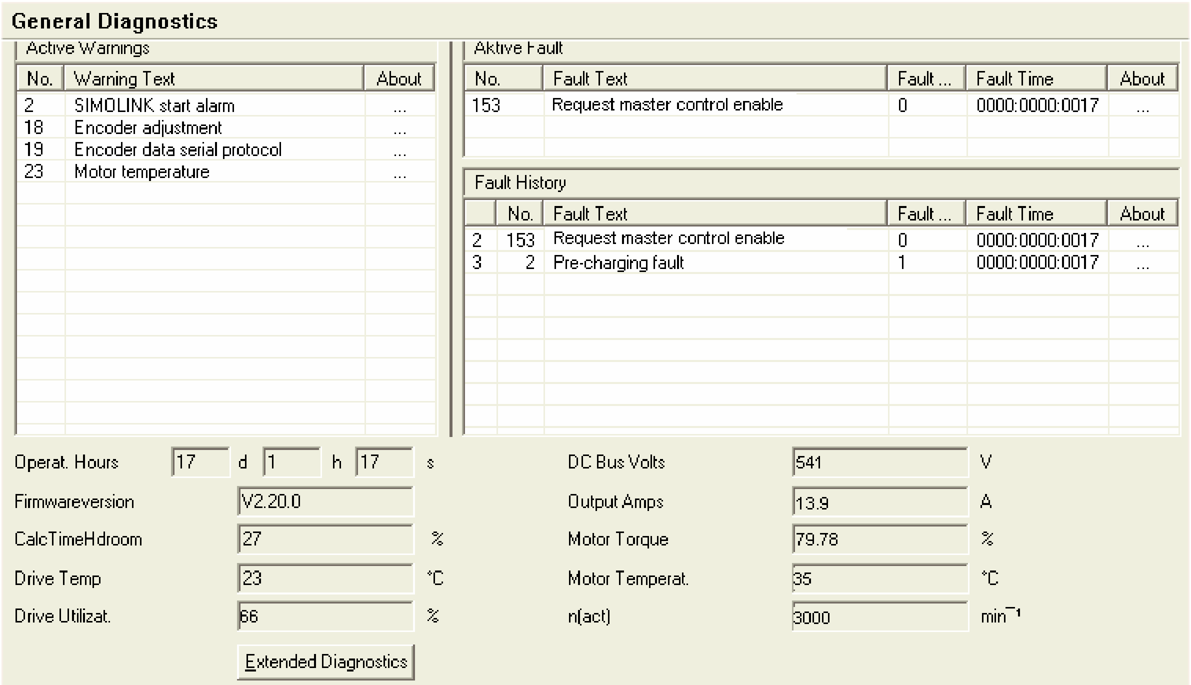


Fig. 8-15 General diagnostics

Via the *Extended Diagnostics* button you can reach the next diagnostics window.

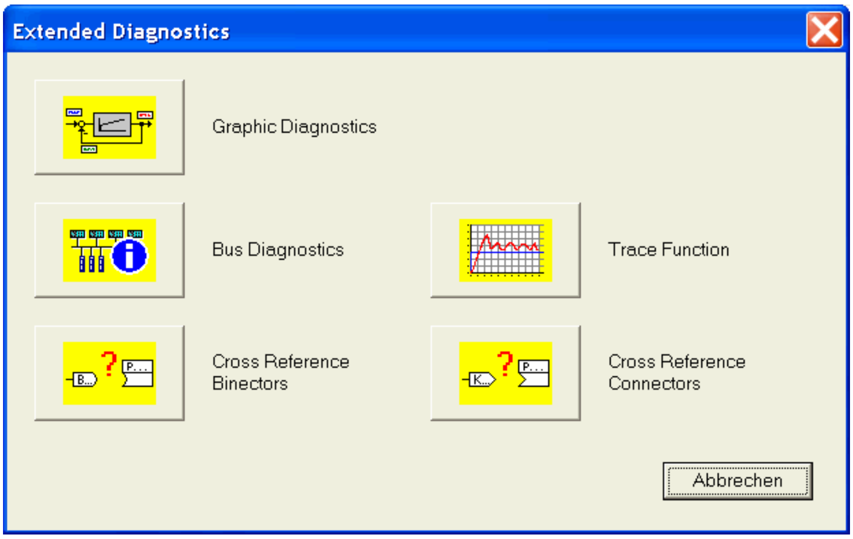


Fig. 8-16 Extended diagnostics

8.6 Parameter reset to factory setting

The factory setting is the defined initial state of all parameters of a unit. The units are delivered with this setting.

You can restore this initial state at any time by resetting the parameters to the factory setting, thus canceling all parameter changes made since the unit was delivered.

P053 = 6	**Grant parameter access** 6: Parameter changes permitted via PMU and serial interface SCom1 (OP1S and PC)
↓	
P060 = 2	**Select "Fixed settings" menu**
↓	
P366 = ?	**Select desired factory setting** 0: Standard Note: This parameter was correctly set prior to delivery of the unit and only needs to be changed in exceptional cases.
↓	
P970 = 0	**Start parameter reset** 0: Parameter reset 1: No parameter change

Unit carries out parameter reset and then leaves the "Fixed settings" menu.

Fig. 8-17 Sequence for parameter reset to factory setting

8.7 Parameterizing by download

Downloading with the OP1S

The OP1S operator control panel is capable of upreading parameter (Upread or Upload) sets from the units and storing them. These parameter sets can then be transferred to other units by download. Downloading with the OP1S is thus the preferred method of parameterizing replacement units in a service case.

During downloading with the OP1S, it is assumed that the units are in the as-delivered state. The parameters for the power section definition are thus not transferred. If a PIN has been entered to release optional technology functions, this is also not overwritten during downloading. (Refer to Compendium, section "Detailed parameterization, power section definition"). If a PIN has been entered to release optional technology functions, this is also not overwritten during downloading.

With the "OP: Download" function, a parameter set stored in the OP1S can be written into the connected slave. Starting from the basic menu, the "OP: Download" function is selected with "Lower" or "Raise" and activated with "P".

P

```
MotionControl        Download
*Menu selection      *1909199701
 OP: Upread          MASTERDRIVES MC
#OP: Download
```

Example: Selecting and activating the "Download" function

Now one of the parameter sets stored in the OP1S has to be selected using the "Lower" or "Raise" keys (displayed in the second line). The selected ID is confirmed with the "P" key. Now the slave ID can be displayed with "Lower" or "Raise". The slave ID contains various characteristic features of the unit such as rated output, order number, software version, etc.
The "Download" procedure is then started with the "P" key. During download, the OP1S displays the parameter currently being written.

P P

```
Download             Download             MotionControl 00
*1909199701          *1909199701           Download
MASTERDRIVES MC      MASTERDRIVES MC         Pxxx
```

Example: Confirming the ID and starting the "Download" procedure

With "Reset", the procedure can be stopped at any time. If downloading has been fully completed, the message "Download ok" appears and the display returns to the basic menu.

After the data set to be downloaded has been selected, if the identification of the stored data set does not agree with the identification of the connected unit, an error message appears for approximately 2 seconds. The operator is then asked if downloading is to be discontinued.

	↗ P ↘	↗ P ↘	↗ 2 s ↘
Download *1909199701 MASTERDRIVES MC	Download *1909199701 MASTERDRIVES MC	Error: Different IDs	MotionControl 00 Stop download? #yes no

Yes: Downloading is discontinued.

No: Downloading is carried out.

8.8 Parameterizing with parameter modules

Pre-defined, function-assigned parameter modules are stored in the units. These parameter modules can be combined with each other, thus making it possible to adjust your unit to the desired application by just a few parameter steps. Detailed knowledge of the complete parameter set of the unit is not required.

Parameter modules are available for the following function groups:

1. Motors
2. Motor encoders
3. Control types
4. Setpoint and command sources

Parameterization is effected by selecting a parameter module from each function group and then starting quick parameterization. A parameter reset to the factory setting is performed and then, according to your selection, the required device parameters are set to achieve the required control functionality. The parameters necessary for fine adjustment of the control structure (all the parameters of the respective function diagrams) are automatically adopted in the user menu (P060 = 0).

NOTE

If parameter changes have already been carried out on the unit, it is recommended that you carry out a parameter reset to the factory setting prior to performing "Quick parameterization".

P060 = 3

Select "Quick Parameterization" menu

P071 = ?

Input of unit line voltage in V
AC Units: RMS value of AC voltage
DC Units: DC link voltage

P095 = ?

Input of motor type
0: No motor connected
1: 1FT6/1FK6 synchronous servo-motor
2: 1PH7(=1PA6)/1PL6/1PH4 induction servo-motor
5: Torque motor 1FW3

P095 = 1 | 2 | 5

P096 = ?

Input the code number for the connected 1FK6/1FT6 motor (see section "Motor list")

P097 = ?

Input the code number for the connected 1PH7(=1PA6), 1PH4, 1PL6 motor (see section "Motor list")

P099 = ?

Input the code number for the connected 1FW3 motor (see section "Motor list")

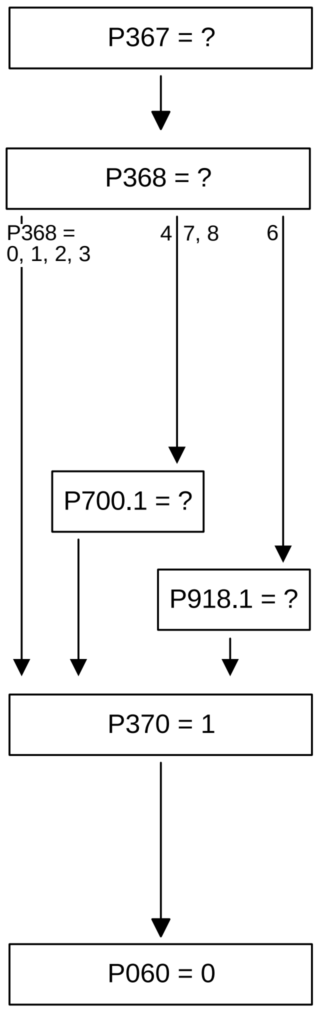
P130 = ?

Select motor encoder
0: automatic encoder detection
1: 2-pole resolver
2: Resolver with pole pair number of motor
3: Encoder 2048/rev.
4: Multiturn encoder 2048/rev.
5: Pulse encoder 1024/rev.
7: Encoders without C/D track 2048/rev (SW V1.30 and later)
The absolute initial position is not set on encoders without a C/D track. These can only be used on asynchronous machines. The position is corrected via a zero pulse (if connected).
1PA6, 1PL6, 1PH4 and 1PH7 asynchronous motors with encoder:
These motors are normally supplied with an ERN1381 encoder without C/D track.

0, 1, 2, 3, 5, 6, 7 | 4

P147.1 = ?

Selection of a multiturn enocder
1: EQN1325 (2048 lines)
2: ECN1313 (2048 lines)
6: EnDat
7: EQI1325 (32 lines)
8: EQN1125 (Heidenhain) EnDat
9: ECN1113 (Heidenhain) EnDat



Select type of control
0: V/f open-loop control
2: Torque control
3: Speed control

Select setpoint and command source
0: PMU (not for Compact PLUS)
1: Analog input and terminal strip
2: Fixed setpoints and terminal strip
3: MOP and terminal strip
4: USS
5: not used
6: PROFIBUS (CBP2)
7: OP1S and fixed setpoints via SCom1
8: OP1S and MOP via SCom1

Input the USS address

Input the PROFIBUS address

Start of quick parameterization
0: No parameter change
1: Parameter change according to chosen combination of parameter modules

Note:
After start-up an automatic factory setting of P366 = 0 takes place, followed by the associated parameterization.

Return to user menu

Fig. 8-18 Sequence for parameterizing with parameter modules

Function diagram modules

Function diagram modules (function diagrams) are shown after the flow chart for parameter modules stored in the unit software. On the first few pages are the:

- setpoint and command sources, on the following pages are the
- analog outputs and the display parameters and the
- open-loop and closed-loop control types.

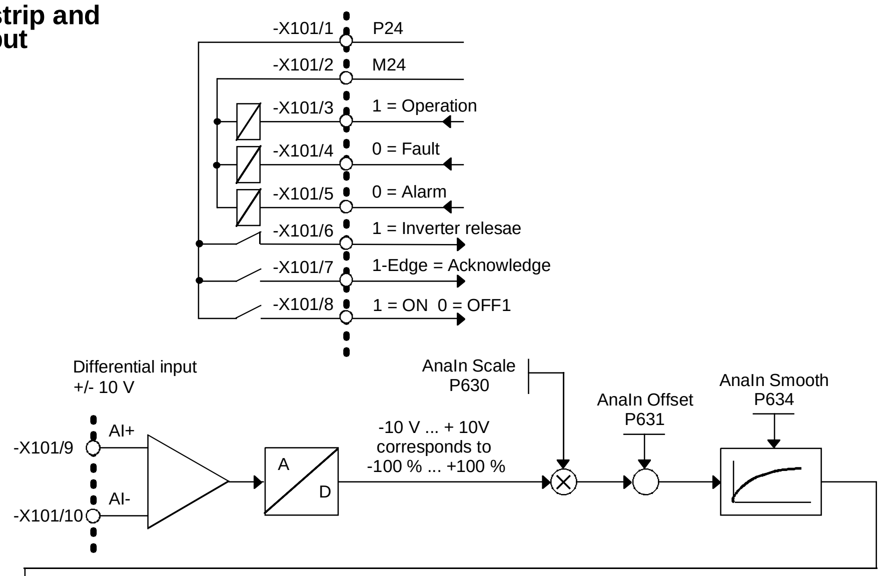
It is therefore possible to put together the function diagrams to exactly suit the selected combination of setpoint/command source and open/closed-loop control type. This will give you an overview of the functionality parameterized in the units and of the necessary assignment of the terminals.

The function parameters and visualization parameters specified in the function diagrams are automatically adopted in the user menu and can be visualized or changed there.

The parameter numbers of the user menu are entered in P360.

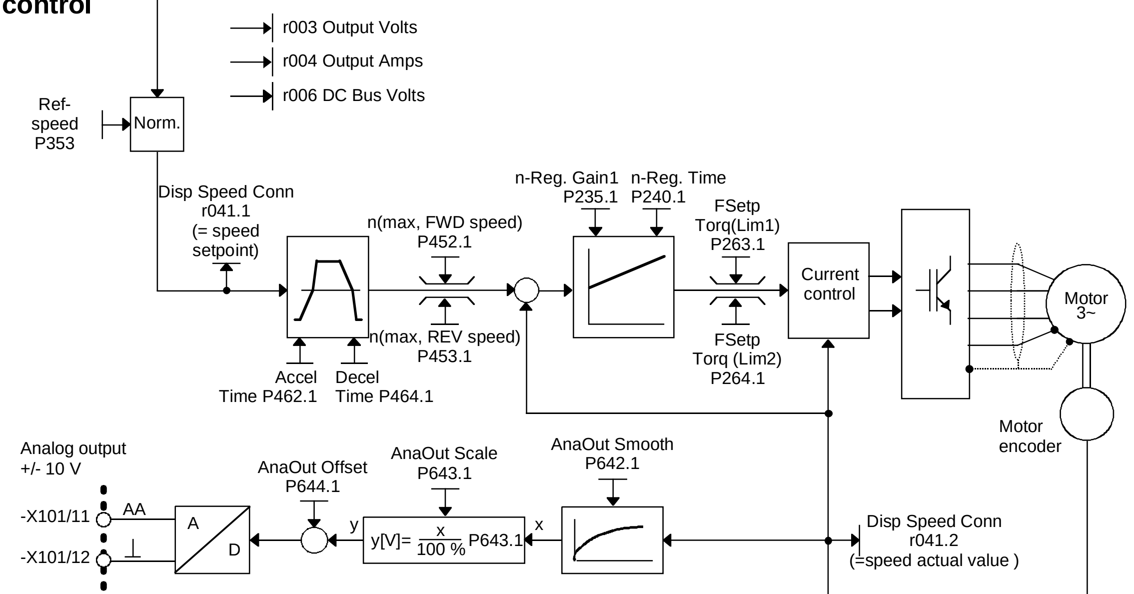
Setpoint and command source

Terminal strip and analog input



Control type:

Speed control

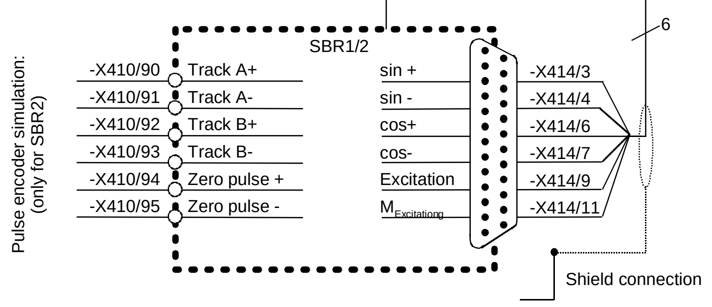


Type of encoder:

Resolver

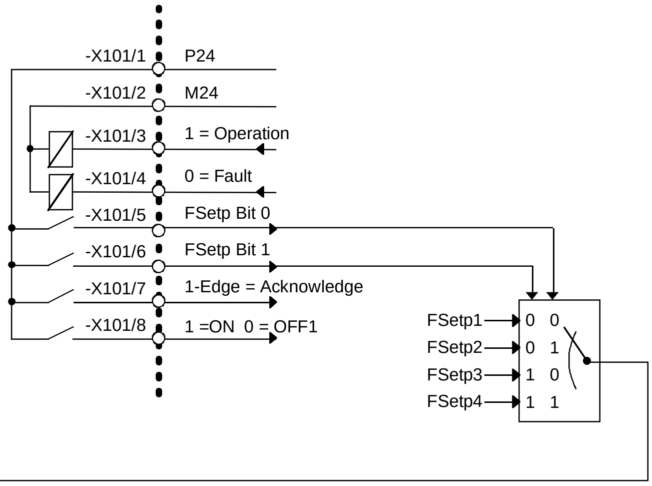
Data of resolver to be connected:
- 2-pole

Data of pulse encoder simulation:
- 1024 pulses/revolution



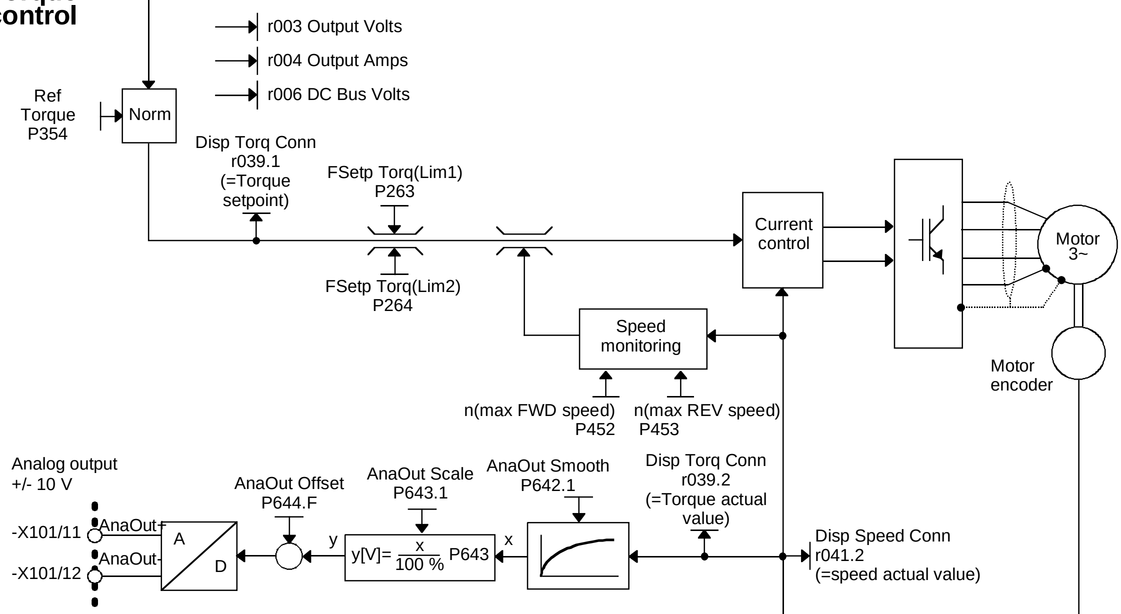
Setpoint and command source:

Terminal strip and fixed setpoints (FSetp)



Control type:

Torque control

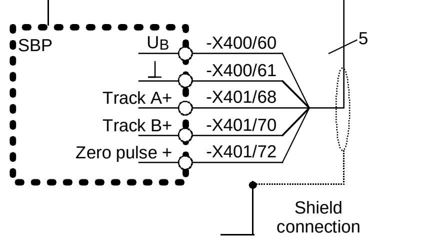


Type of encoder:

Pulse encoder

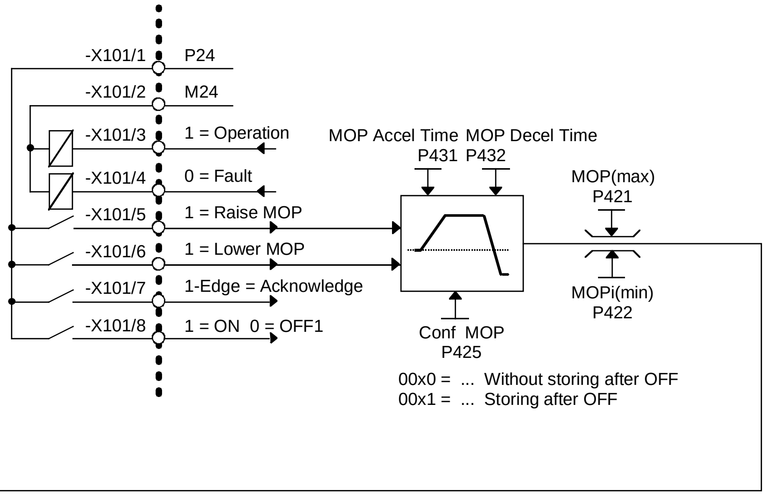
Full information on pulse encoder connection is given in the SBP operating instruction (Order No. 6SE7087-6NX84-2FA0).

Data of pulse encoder to be connected:
- HTL encoder (15 V)
- 1024 Inc.
- without control track



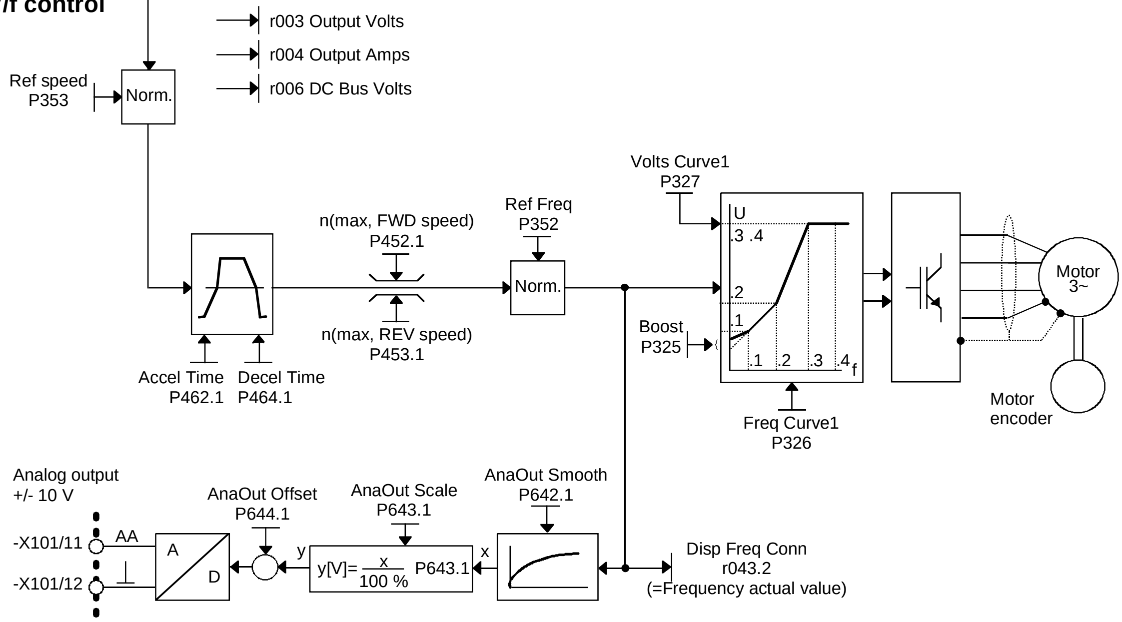
Setpoint and command source

Terminal strip and motorized potentiometer



Type of control

V/f control



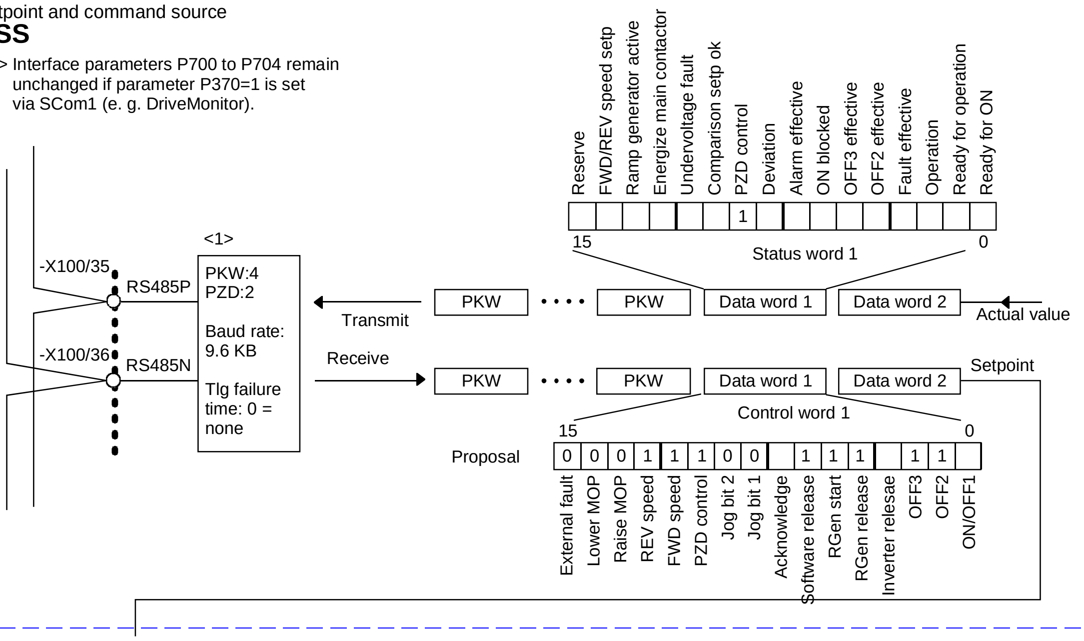
Type of encoder:

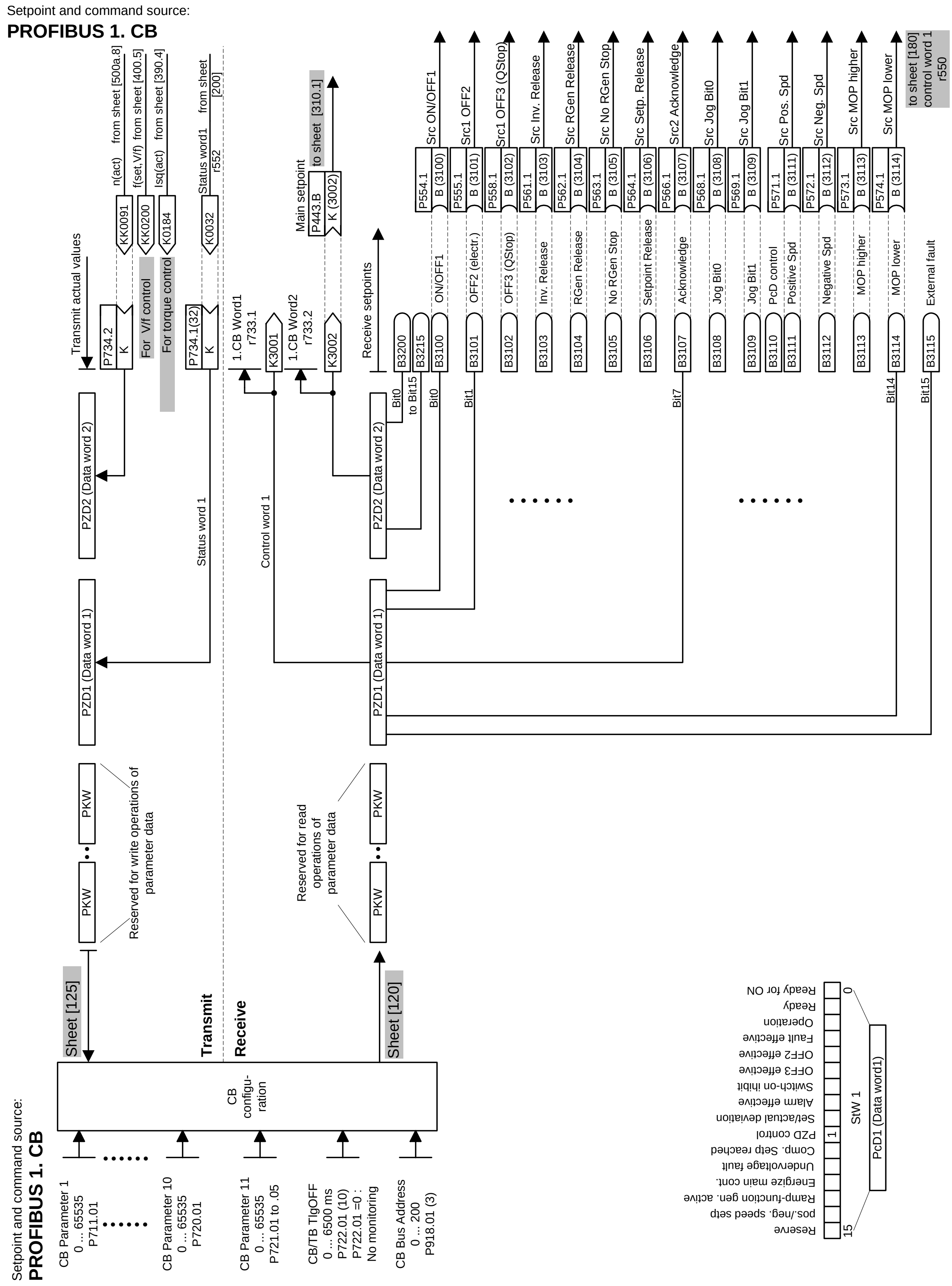
Without encoder

Setpoint and command source

USS

<1> Interface parameters P700 to P704 remain unchanged if parameter P370=1 is set via SCom1 (e. g. DriveMonitor).




Setpoint and command source:
PROFIBUS 1. CB
CB Parameter 1 0 ... 65535 P711.01
CB Parameter 10 0 ... 65535 P720.01
CB Parameter 11 0 ... 65535 P721.01 to .05
CB/TB TlgOFF 0 ... 6500 ms P722.01 (10) P722.01 =0 : No monitoring
CB Bus Address 0 ... 200 P918.01 (3)
CB configu-ration
Sheet [125]
Sheet [120]
Transmit
Receive
PKW
Reserved for write operations of parameter data
Reserved for read operations of parameter data
PZD1 (Data word 1)
PZD2 (Data word 2)
Transmit actual values
P734.2 K
For V/f control
For torque control
P734.1(32) K
KK0091 n(act) from sheet [500a.8]
KK0200 f(set,V/f) from sheet [400.5]
K0184 Isq(act) from sheet [390.4]
K0032 Status word1 r552 from sheet [200]
Status word 1
Control word 1
1.CB Word1 r733.1 K3001
1.CB Word2 r733.2 K3002
Main setpoint P443.B K (3002) to sheet [310.1]
Receive setpoints
Bit0 to Bit15 B3200 B3215
Bit0 B3100 ON/OFF1 P554.1 B (3100) Src ON/OFF1
Bit1 B3101 OFF2 (electr.) P555.1 B (3101) Src1 OFF2
B3102 OFF3 (QStop) P558.1 B (3102) Src1 OFF3 (QStop)
B3103 Inv. Release P561.1 B (3103) Src Inv. Release
B3104 RGen Release P562.1 B (3104) Src RGen Release
B3105 No RGen Stop P563.1 B (3105) Src No RGen Stop
B3106 Setpoint Release P564.1 B (3106) Src Setp. Release
Bit7 B3107 Acknowledge P566.1 B (3107) Src2 Acknowledge
B3108 Jog Bit0 P568.1 B (3108) Src Jog Bit0
B3109 Jog Bit1 P569.1 B (3109) Src Jog Bit1
B3110 PcD control
B3111 Positive Spd P571.1 B (3111) Src Pos. Spd
B3112 Negative Spd P572.1 B (3112) Src Neg. Spd
B3113 MOP higher P573.1 B (3113) Src MOP higher
Bit14 B3114 MOP lower P574.1 B (3114) Src MOP lower
Bit15 B3115 External fault
to sheet [180] control word 1 r550
StW 1
PcD1 (Data word1)
0 Ready for ON
Ready
Operation
Fault effective
OFF2 effective
OFF3 effective
Switch-on inhibit
Alarm effective
Set/actual deviation
1 PZD control
Comp. Setp reached
Undervoltage fault
Energize main cont.
Ramp-function gen. active
pos./neg. speed setp
15 Reserve

8.9 Motor lists

Synchronous motors 1FK6 / 1FK7 / 1FT6 / 1FS6

NOTE

1FK7xxx HD (High Dynamic, P096=82-92) are new AC servo motors based on the 1FK6 series. The data of 1FK7xxx HD (High Dynamic) and 1FK6xxx therefore tally.

Input in P096	Motor order number (MPRD)	Speed n_n [rpm]	Torque M_n [Nm]	Current I_n [A]	Number of pole pairs
1	1FK6032-6AK7	6000	0.8	1.5	3
2	1FK6040-6AK7	6000	0.8	1.75	3
3	1FK6042-6AF7	3000	2.6	2.4	3
4	1FK6060-6AF7	3000	4.0	3.1	3
5	1FK6063-6AF7	3000	6.0	4.7	3
6	1FK6080-6AF7	3000	6.8	5.2	3
7	1FK6083-6AF7	3000	10.5	7.7	3
8	1FK6100-8AF7	3000	12.0	8.4	4
9	1FK6101-8AF7	3000	15.5	10.8	4
10	1FK6103-8AF7	3000	16.5	11.8	4
11	1FT6031-4AK7_	6000	0.75	1.2	2
12	1FT6034-1AK7_-3A 1FT6034-4AK7_	6000	1.4	2.1	2
13	1FT6041-4AF7_	3000	2.15	1.7	2
14	1FT6041-4AK7_	6000	1.7	2.4	2
15	1FT6044-1AF7_-3A 1FT6044-4AF7_	3000	4.3	2.9	2
16	1FT6044-4AK7_	6000	3.0	4.1	2
17	1FT6061-6AC7_	2000	3.7	1.9	3
18	1FT6061-1AF7_-3A 1FT6061-6AF7_	3000	3.5	2.6	3
19	1FT6061-6AH7_	4500	2.9	3.4	3
20	1FT6061-6AK7_	6000	2.1	3.1	3
21	1FT6062-6AC7_	2000	5.2	2.6	3
22	1FT6062-1AF7_-3A 1FT6062-6AF7_	3000	4.7	3.4	3
23	1FT6062-1AH7_ 1FT6062-6AH7_	4500	3.6	3.9	3
24	1FT6062-6AK7_	6000	2.1	3.2	3
25	1FT6064-6AC7_	2000	8.0	3.8	3

Input in P096	Motor order number (MPRD)	Speed n_n [rpm]	Torque M_n [Nm]	Current I_n [A]	Number of pole pairs
26	1FT6064-1AF7_-3A 1FT6064-6AF7_	3000	7.0	4.9	3
27	1FT6064-6AH7_ 1FT6064-1AH71	4500	4.8	5.5	3
28	1FT6064-6AK7_	6000	2.1	3.5	3
29	1FT6081-8AC7_	2000	7.5	4.1	4
30	1FT6081-8AF7_	3000	6.9	5.6	4
31	1FT6081-8AH7_	4500	5.8	7.3	4
32	1FT6081-8AK7_	6000	4.6	7.7	4
33	1FT6082-8AC7_	2000	11.4	6.6	4
34	1FT6082-1AF7_-1A 1FT6082-8AF7_	3000	10.3	8.7	4
35	1FT6082-1AH7_ 1FT6082-8AH7_	4500	8.5	11.0	4
36	1FT6082-8AK7_	6000	5.5	9.1	4
37	1FT6084-8AC7_	2000	16.9	8.3	4
38	1FT6084-1AF7_-1A 1FT6084-8AF7_	3000	14.7	11.0	4
39	1FT6084-8AH7_ 1FT6084-1AH71	4500	10.5	12.5	4
40	1FT6084-8AK7_ 1FT6084-1AK71	6000	6.5	9.2	4
41	1FT6084-8SC7_	2000	23.5	12.5	4
42	1FT6084-8SF7_	3000	22.0	17.0	4
43	1FT6084-8SH7_	4500	20.0	24.5	4
44	1FT6084-8SK7_	6000	17.0	25.5	4
45	1FT6086-8AC7_	2000	22.5	10.9	4
46	1FT6086-1AF7_-1A 1FT6086-8AF7_	3000	18.5	13.0	4
47	1FT6086-8AH7_ 1FT6086-1AH71	4500	12.0	12.6	4
48	1FT6086-8SC7_	2000	33.0	17.5	4
49	1FT6086-8SF7_	3000	31.0	24.5	4
50	1FT6086-8SH7_	4500	27.0	31.5	4
51	1FT6086-8SK7_	6000	22.0	29.0	4
52	1FT6102-8AB7_	1500	24.5	8.4	4
53	1FT6102-1AC7_-1A 1FT6102-8AC7_	2000	23.0	11.0	4
54	1FT6102-8AF7_	3000	19.5	13.2	4
55	1FT6102-8AH7_	4500	12.0	12.0	4

Input in P096	Motor order number (MPRD)	Speed n_n [rpm]	Torque M_n [Nm]	Current I_n [A]	Number of pole pairs
56	1FT6105-8AB7_	1500	41.0	14.5	4
57	1FT6105-1AC7_-1A 1FT6105-8AC7_	2000	38.0	17.6	4
58	1FT6105-8AF7_	3000	31.0	22.5	4
59	1FT6105-8SB7_	1500	59.0	21.7	4
60	1FT6105-8SC7_	2000	56.0	28.0	4
61	1FT6105-8SF7_	3000	50.0	35.0	4
62	1FT6108-8AB7_	1500	61.0	20.5	4
63	1FT6108-8AC7_	2000	55.0	24.5	4
64	1FT6108-8SB7_	1500	83.0	31.0	4
65	1FT6108-8SC7_	2000	80.0	40.0	4
66	1FT6132-6AB7_	1500	62.0	19.0	3
67	1FT6132-6AC7_	2000	55.0	23.0	3
68	1FT6132-6AF7_	3000	36.0	23.0	3
69	1FT6132-6SB7_	1500	102.0	36.0	3
70	1FT6132-6SC7_	2000	98.0	46.0	3
71	1FT6132-6SF7_	3000	90.0	62.0	3
72	1FT6134-6AB7_	1500	75.0	24.0	3
73	1FT6134-6AC7_	2000	65.0	27.0	3
74	1FT6134-6SB7_	1500	130.0	45.0	3
75	1FT6134-6SC7_	2000	125.0	57.0	3
76	1FT6134-6SF7_	3000	110.0	72.0	3
77	1FT6136-6AB7_	1500	88.0	27.0	3
78	1FT6136-6AC7_	2000	74.0	30.0	3
79	1FT6136-6SB7_	1500	160.0	55.0	3
80	1FT6136-6SC7_	2000	150.0	72.0	3
81	1FT6108-8SF7_	3000	70.0	53.0	4
High Dynamic					
82	1FK6033-7AK71 1FK7033-7AK71	6000	0.9	1.5	3
83	1FK6043-7AK71 1FK7043-7AK71	6000	2.0	4.4	3
84	1FK6043-7AH71 1FK7043-7AH71	4500	2.6	4.0	3
85	1FK6044-7AF71 1FK7044-7AF71	3000	3.5	4.0	3
86	1FK6044-7AH71 1FK7044-7AH71	4500	3.0	4.9	3

Input in P096	Motor order number (MPRD)	Speed n_n [rpm]	Torque M_n [Nm]	Current I_n [A]	Number of pole pairs
87	1FK6061-7AF71 1FK7061-7AF71	3000	5.4	5.3	3
88	1FK6061-7AH71 1FK7061-7AH71	4500	4.3	5.9	3
89	1FK6064-7AF71 1FK7064-7AF71	3000	8.0	7.5	3
90	1FK6064-7AH71 1FK7064-7AH71	4500	5.0	7.0	3
91	1FK6082-7AF71 1FK7082-7AF71	3000	8.0	6.7	4
92	1FK6085-7AF71 1FK7085-7AF71	3000	6.5	7.0	4
Water cooling					
100	1FT6132-6WB7	1500	150.0	58.0	3
101	1FT6132-6WD7	2500	135.0	82.0	3
102	1FT6134-6WB7	1500	185.0	67.0	3
103	1FT6134-6WD7	2500	185.0	115.0	3
104	1FT6136-6WB7	1500	230.0	90.0	3
105	1FT6136-6WD7	2500	220.0	149.0	3
106	1FT6138-6WB7	1500	290.0	112.0	3
107	1FT6138-6WD7	2500	275.0	162.0	3
108	1FT6163-8WB7	1500	450.0	160.0	4
109	1FT6163-8WD7	2500	450.0	240.0	4
110	1FT6168-8WB7	1500	690.0	221.0	4
111	1FT6168-8WC7	2000	550.0	250.0	4
112 to 119	for future applications				
120	1FT6062-6WF7	3000	10.1	7.5	3
121	1FT6062-6WH7	4500	10.0	11.0	3
122	1FT6062-6WK7	6000	9.8	15.2	3
123	1FT6064-6WF7	3000	16.1	11.4	3
124	1FT6064-6WH7	4500	16.0	18.5	3
125	1FT6064-6WK7	6000	15.8	27.0	3
126	1FT6082-8WC7	2000	22.1	13.6	4
127	1FT6082-8WF7	3000	21.6	19.1	4
128	1FT6082-8WH7	4500	20.8	28.4	4
129	1FT6082-8WK7	6000	20.0	32.6	4
130	1FT6084-8WF7	3000	35.0	27.0	4
131	1FT6084-8WH7	4500	35.0	39.0	4
132	1FT6084-8WK7	6000	34.0	51.0	4

Input in P096	Motor order number (MPRD)	Speed n_n [rpm]	Torque M_n [Nm]	Current I_n [A]	Number of pole pairs
133	1FT6086-8WF7	3000	46.0	37.0	4
134	1FT6086-8WH7	4500	45.0	53.0	4
135	1FT6086-8WK7	6000	44.0	58.0	4
136	1FT6105-8WC7	2000	82.0	60.0	4
137	1FT6105-8WF7	3000	78.0	82.0	4
138	1FT6108-8WB7	1500	116.0	43.0	4
139	1FT6108-8WC7	2000	115.0	57.0	4
140	1FT6108-8WF7	3000	109.0	81.0	4
141 to 149	for future applications				
Other types					
150	1FT6108-8AF7	3000	37.0	25.0	4
151	1FT6105-8SH7	4500	40.0	41.0	4
152	1FT6136-6SF7	3000	145.0	104.0	3
153	1FT6021-6AK7	6000	0.3	1.1	3
154	1FT6024-6AK7	6000	0.5	0.9	3
155	1FT6163-8SB7	1500	385.0	136.0	4
156	1FT6163-8SD7	2500	340.0	185.0	4
157	1FT6168-8SB7	1500	540.0	174.0	4
158 to 159	for future applications				
Compact					
160	1FK7022-5AK71	6000	0.6	1.4	3
161	1FK7032-5AK71	6000	0.75	1.4	3
162	1FK7040-5AK71	6000	1.1	1.7	4
163	1FK7042-5AF71	3000	2.6	1.9	4
164	1FK7042-5AK71	6000	1.5	2.4	4
165	1FK7060-5AF71	3000	4.7	3.7	4
166	1FK7060-5AH71	4500	3.7	4.1	4
167	1FK7063-5AF71	3000	7.3	5.6	4
168	1FK7063-5AH71	4500	3.0	3.8	4
169	1FK7080-5AF71	3000	6.2	4.4	4
170	1FK7080-5AH71	4500	4.5	4.7	4
171	1FK7083-5AF71	3000	10.5	7.4	4
172	1FK7083-5AH71	4500	3.0	3.6	4
173	1FK7100-5AF71	3000	12.0	8.0	4
174	1FK7101-5AF71	3000	15.5	10.5	4
175	1FK7103-5AF71	3000	14.0	12.0	4
176	1FK7042-5AH71	4500	2.2	2.2	4

Input in P096	Motor order number (MPRD)	Speed n_n [rpm]	Torque M_n [Nm]	Current I_n [A]	Number of pole pairs
177	1FK7105-5AC7	2000	37.0	16.0	4
178	1FK7105-5AF7	3000	26.0	18.0	4
179 to 199	for future applications				
Explosion-proof					
200	1FS6074-6AC71	2000	7.2	3.4	3
201	1FS6074-6AF71	3000	6.3	4.4	3
202	1FS6074-6AH71	4500	4.5	5.0	3
203	1FS6074-6AK71	6000	1.9	3.2	3
204	1FS6096-8AC71	2000	20.0	9.8	4
205	1FS6096-6AF71	3000	17.0	12.0	4
206	1FS6096-8AH71	4500	11.0	11.5	4
207	1FS6115-8AB73	1500	37.0	13.0	4
208	1FS6115-8AC73	2000	34.0	16.0	4
209	1FS6115-8AF73	3000	28.0	20.0	4
210	1FS6134-6AB73	1500	68.0	22.0	3
211	1FS6134-6AC73	2000	59.0	24.0	3
212	1FS6134-6AF73	3000	34.0	22.0	3
213 to 253	for future applications				

Table 8-6 Motor list 1FK6 / 1FK7 / 1FT6 / 1FS6

Torque motors 1FW3

Input in P099	Motor order number (MPRD)	Speed n_n [rpm]	Torque M_n [Nm]	Current I_n [A]	Number of pole pairs
1	1FW3201-1.H	300	300	22	14
2	1FW3202-1.H	300	500	37	14
3	1FW3203-1.H	300	750	59	14
4	1FW3204-1.H	300	1000	74	14
5	1FW3206-1.H	300	1500	117	14
6	1FW3208-1.H	300	2000	152	14
7	1FW3AH150 gen.	General template for customer-specific 1FW3			7
8	1FW3AH200 gen.	General template for customer-specific 1FW3			14
9	1FW3AH280 gen.	General template for customer-specific 1FW3			17
10	1FW3281-1.G	250	2400	153	17
11	1FW3283-1.G	250	3400	222	17
12	1FW3285-1.G	250	4800	306	17
13	1FW3288-1.G	250	6700	435	17
14	1FW3281-1.E	150	2500	108	17
15	1FW3283-1.E	150	3500	150	17
16	1FW3285-1.E	150	5000	207	17
17	1FW3288-1.E	150	7000	292	17
18 to 30	for future applications				
31	1FW3150-1.H	300	100	7	7
32	1FW3150-1.L	500	100	11	7
33	1FW3150-1.P	800	100	17	7
34	1FW3152-1.H	300	200	14	7
35	1FW3152-1.L	500	200	22	7
36	1FW3152-1.P	800	200	32	7
37	1FW3154-1.H	300	300	20	7
38	1FW3154-1.L	500	300	32	7
39	1FW3154-1.P	800	300	47	7
40	1FW3155-1.H	300	400	28	7
41	1FW3155-1.L	500	400	43	7
42	1FW3155-1.P	800	400	64	7
43	1FW3156-1.H	300	500	34	7
44	1FW3156-1.L	500	500	53	7
45	1FW3156-1.P	800	500	76	7

Input in P099	Motor order number (MPRD)	Speed n_n [rpm]	Torque M_n [Nm]	Current I_n [A]	Number of pole pairs
46 to 60	for future applications				
61	1FW3201-1.E	150	300	12	14
62	1FW3201-1.L	500	300	37	14
63	1FW3202-1.E	150	500	21	14
64	1FW3202-1.L	500	500	59	14
65	1FW3203-1.E	150	750	30	14
66	1FW3203-1.L	500	750	92	14
67	1FW3204-1.E	150	1000	40	14
68	1FW3204-1.L	500	1000	118	14
69	1FW3206-1.E	150	1500	65	14
70	1FW3206-1.L	500	1400	169	14
71	1FW3208-1.E	150	2000	84	14
72	1FW3208-1.L	500	1850	226	14
73 to 253	for future applications				

Table 8-7 Motor list 1FW3

Asynchronous motors 1PH7 / 1PL6 / 1PH4

For 1PH7, 1PH4, and 1PL6 motors, the up-to-date calculation data have been stored in the unit. These might differ from the rating plate slightly. Always use the data stored. The magnetization current is determined by automatic parameterization.

NOTE

1PH7xxx is the new designation of what were formerly 1PA6xxx motors. The 1PH7xxx and 1PA6xxx data therefore tally.

Input in P097	Motor order number (MPRD)	Rated speed n_n [rpm]	Pole pair number Z_p	Current I_n [A]	Voltage U_n [V]	Torque M_n [Nm]	Frequency f_n [Hz]
1	1PH7101-2_F	1750	2	9.7	398	23.5	60.0
2	1PH7103-2_D	1150	2	9.7	391	35.7	40.6
3	1PH7103-2_F	1750	2	12.8	398	34.1	61.0
4	1PH7103-2_G	2300	2	16.3	388	31.1	78.8
5	1PH7105-2_F	1750	2	17.2	398	43.7	60.0
6	1PH7107-2_D	1150	2	17.1	360	59.8	40.3
7	1PH7107-2_F	1750	2	21.7	381	54.6	60.3
8	1PH7131-2_F	1750	2	23.7	398	70.9	59.7
9	1PH7133-2_D	1150	2	27.5	381	112.1	39.7
10	1PH7133-2_F	1750	2	33.1	398	95.5	59.7
11	1PH7133-2_G	2300	2	42.4	398	93.4	78.0
12	1PH7135-2_F	1750	2	40.1	398	117.3	59.5
13	1PH7137-2_D	1150	2	40.6	367	161.9	39.6
14	1PH7137-2_F	1750	2	53.1	357	136.4	59.5
15	1PH7137-2_G	2300	2	54.1	398	120.4	77.8
16	1PH7163-2_B	400	2	28.2	274	226.8	14.3
17	1PH7163-2_D	1150	2	52.2	364	207.6	39.2
18	1PH7163-2_F	1750	2	69.1	364	185.5	59.2
19	1PH7163-2_G	2300	2	77.9	374	157.8	77.4
20	1PH7167-2_B	400	2	35.6	294	310.4	14.3
21	1PH7167-2_D	1150	2	66.4	357	257.4	39.1
22	1PH7167-2_F	1750	2	75.3	398	223.7	59.2
23	1PH7184-2_B	400	2	51.0	271	390	14.2
24	1PH7184-2_D	1150	2	89.0	383	366	39.2
25	1PH7184-2_F	1750	2	120.0	388	327	59.0
26	1PH7184-2_L	2900	2	158.0	395	265	97.4
27	1PH7186-2_B	400	2	67.0	268	505	14.0
28	1PH7186-2_D	1150	2	116.0	390	482	39.1
29	1PH7186-2_F	1750	2	169.0	385	465	59.0

Input in P097	Motor order number (MPRD)	Rated speed n_n [rpm]	Pole pair number Z_p	Current I_n [A]	Voltage U_n [V]	Torque M_n [Nm]	Frequency f_n [Hz]
30	1PH7186-2_L	2900	2	206.0	385	333	97.3
31	1PH7224-2_B	400	2	88.0	268	725	14.0
32	1PH7224-2_D	1150	2	160.0	385	670	38.9
33	1PH7224-2_U	1750	2	203.0	395	600	58.9
34	1PH7224-2_L	2900	2	274.0	395	490	97.3
35	1PH7226-2_B	400	2	114.0	264	935	14.0
36	1PH7226-2_D	1150	2	197.0	390	870	38.9
37	1PH7226-2_F	1750	2	254.0	395	737	58.9
38	1PH7226-2_L	2900	2	348.0	390	610	97.2
39	1PH7228-2_B	400	2	136.0	272	1145	13.9
40	1PH7228-2_D	1150	2	238.0	390	1070	38.9
41	1PH7228-2_F	1750	2	342.0	395	975	58.8
42	1PH7228-2_L	2900	2	402.0	395	708	97.2
43	1PL6184-4_B	400	2	69.0	300	585	14.4
44	1PL6184-4_D	1150	2	121.0	400	540	39.4
45	1PL6184-4_F	1750	2	166.0	400	486	59.3
46	1PL6184-4_L	2900	2	209.0	400	372	97.6
47	1PL6186-4_B	400	2	90.0	290	752	14.3
48	1PL6186-4_D	1150	2	158.0	400	706	39.4
49	1PL6186-4_F	1750	2	231.0	400	682	59.3
50	1PL6186-4_L	2900	2	280.0	390	494	97.5
51	1PL6224-4_B	400	2	117.0	300	1074	14.2
52	1PL6224-4_D	1150	2	218.0	400	997	39.1
53	1PL6224-4_F	1750	2	292.0	400	900	59.2
54	1PL6224-4_L	2900	2	365.0	400	675	97.5
55	1PL6226-4_B	400	2	145.0	305	1361	14.0
56	1PL6226-4_D	1150	2	275.0	400	1287	39.2
57	1PL6226-4_F	1750	2	350.0	400	1091	59.1
58	1PL6226-4_L	2900	2	470.0	400	889	97.4
59	1PL6228-4_B	400	2	181.0	305	1719	14.0
60	1PL6228-4_D	1150	2	334.0	400	1578	39.2
61	1PL6228-4_F	1750	2	470.0	400	1446	59.0
62	1PL6228-4_L	2900	2	530.0	400	988	97.3
63	1PH4103-4_F	1500	2	20.2	350	48	52.9
64	1PH4105-4_F	1500	2	27.3	350	70	53.1
65	1PH4107-4_F	1500	2	34.9	350	89	52.8
66	1PH4133-4_F	1500	2	34.1	350	95	51.9

Input in P097	Motor order number (MPRD)	Rated speed n_n [rpm]	Pole pair number Z_p	Current I_n [A]	Voltage U_n [V]	Torque M_n [Nm]	Frequency f_n [Hz]
67	1PH4135-4_F	1500	2	51.2	350	140	51.6
68	1PH4137-4_F	1500	2	60.5	350	172	51.6
69	1PH4163-4_F	1500	2	86.3	350	236	50.9
70	1PH4167-4_F	1500	2	103.3	350	293	51.0
71	1PH4168-4_F	1500	2	113.0	350	331	51.0
72	1PH7107-2_G	2300	2	24.8	398	50	78.6
73	1PH7167-2_G	2000	2	88.8	350	196	67.4
74 to 99	for future applications						
100	1PL6284-..D.	1150	2	478.0	400	2325	38.9
101 to 253	for future applications						

Table 8-8 Motor list 1PH7 / 1PL6 / 1PH4

For information about motor ratings and availability please see Catalog DA65.3 "Synchronous and asynchronous servomotors for SIMOVERT MASTERDRIVES".

The data stored under the motor numbers describe the design point of the motor. In Chapter 3 "Induction servo motors" of Catalog DA65.3 two operating points are indicated for operation with MASTERDRIVES MC. The operating points are calculated for 400 V and 480 V AC line voltage on the converter input side.

The data for the 480 V line voltage are stored in the control system as the rated motor current is slightly lower for a few motors in this operating point.

P293 "Field weakening frequency" is always decisive for the actual field weakening operating point. The field weakening frequency P293 is automatically calculated for a line voltage of 400 V.

8.10 Motor identification

From Version V1.30 onwards, automatic motor identification is available. In the case of Siemens motors (P095 = 1 or 2) the motor type is first selected in P096 or P097. In the case of non-Siemens motors (P095 = 3 or 4), the rating plate data and number of pole pairs have to be entered, and then automatic paramterizing is called with P115 = 1.

After exit from the "drive initial start-up" status with P060 = 1, P115 = 2 is set and hence motor identification is selected. The converter must now be switched in within 30 s so that measuring can start. The alarm A078 is set during the 30 s.

CAUTION

The motor shaft can move slightly during the measurement operation. The motor cables are live. Voltages are present at the converter output terminals and hence also at the motor terminals; they are therefore hazardous to touch.

WARNING

It must be ensured that no danger for persons and equipment can occur by energizing the power and the unit.

If measurement is not started within 30 s or if it is interrupted by an OFF command, error F114 is set. The converter status during measurement is "Motid-Still" (r001 = 18). Measurement is ended automatically, and the converter reverts to the status "Ready for start-up" (r001 = 009).

In current-controlled mode (P290 = 0), automatic motor indentification should **always** be performed during initial start-up.

8.11 Complete parameterization

To make full use of the complete functionality of the inverter/converter, parameterization must be carried out in accordance with the "Compendium". You will find the relevant instructions, function diagrams and complete lists of parameters, binectors and connectors in the Compendium.

Language	Compendium order number
German	6SE7080-0QX70
English	6SE7087-6QX70
French	6SE7087-7QX70
Spanish	6SE7087-8QX70
Italian	6SE7087-2QX70

9 Maintenance

DANGER

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 (BGV A3 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.

9.1 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.

DANGER

To replace the fan the converter has to be disconnected from the supply and removed.

DANGER

Make sure that the leads to the fan are connected the right way round. Otherwise the fan will not operate!

Construction types E - G

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.

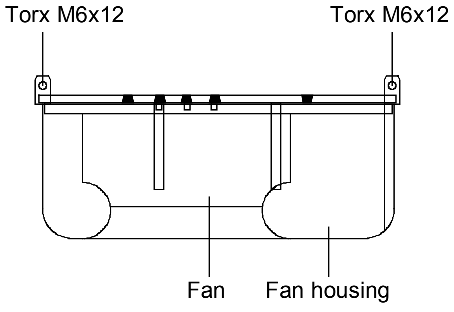


Fig. 9-1 Fan assembly

Construction type J – L

The fan assembly consists of:

- ♦ the fan housing
- ♦ one or two fans
- ♦ the starting capacitors

The fan assembly is installed at the top in the chassis.

- ♦ Withdraw connector X20.
- ♦ Unscrew the two M8 screws of the fan assembly.
- ♦ In the case of type K with only one fan, you must dismantle the support plate below the fan (2 x M8).
- ♦ Pull out the fan assembly towards the front (if necessary, tilt it slightly down at the front) and lay it down securely.

CAUTION

The fan assembly weighs up to 38 kg, depending on its design.

- ♦ Undo the cable fastenings and fan connections.
- ♦ Take the fan support plate out of the fan assembly and remove the fan from the support plate.
- ♦ Install the new fan assembly in the reverse sequence.

For type K and L: Renew contact washers for grounding.

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.

9.2 Replacing the fan fuse (construction type J)

The fuses are in a fuse holder which is mounted on a DIN rail in the bottom of the unit. The fuse holder has to be opened to replace the fuses.

9.3 Replacing the starting capacitor

The starting capacitor is

- next to the fan connection (types E - G)
- on or inside the fan assembly (type J – L).

- ♦ Withdraw the plug connections on the starting capacitor.
- ♦ Unscrew the starting capacitor.
- ♦ Install the new starting capacitor in reverse sequence (4.5 Nm).

9.4 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.

Construction type J

The capacitor battery consists of three modules. Each module contains a capacitor support and a DC link bus module.

- Detach the plug-in connections.
- Detach the mechanical fastening (three screws: two on the left, **one** on the right)

Tilt the capacitor battery sideways until its endstop, slightly raise the unit and lift it forwards out of the converter.

CAUTION

The capacitor battery weighs up to 30 kg, depending on the converter output!

9.5 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.

10 Forming

CAUTION

If a unit has been non-operational for more than one year, the DC link capacitors have to be newly formed. 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	N	2001
	P	2002
	R	2003
	S	2004
	T	2005
	U	2006
	V	2007
	W	2008
4	1 to 9	January to September
	O	October
	N	November
	D	December
5 to 14		Not relevant for forming

The following applies for the above example:
Manufacture took place in June 2001.

During forming, the DC link of the unit is connected up via a rectifier, a smoothing capacitor and a resistor.

During forming a defined voltage and a limited current are applied to the DC link capacitors and the internal conditions necessary for the function of the DC link capacitors are restored again.

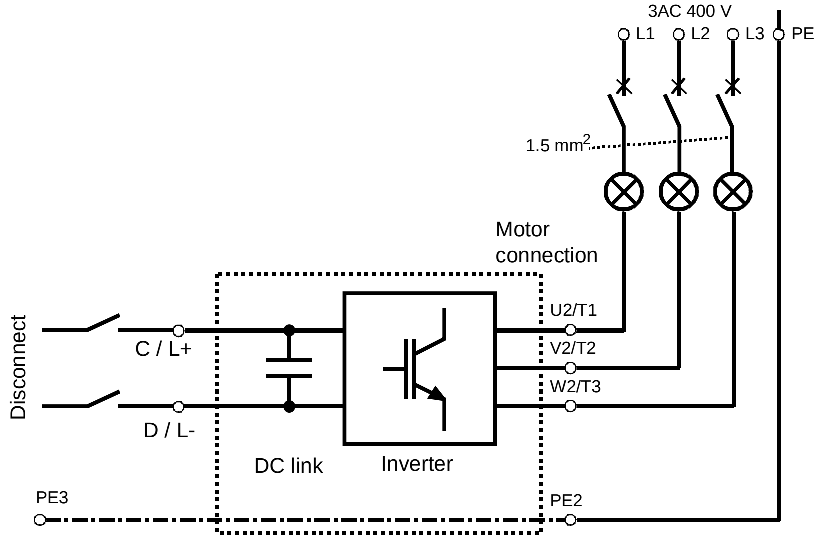


Fig. 10-1 Forming circuit

Components for the forming circuit (suggestion)

- 1 fuse-switch triple 400 V / 10 A
- 3 incandescent lamps 230 V / 100 W
- Various small parts e.g. lamp holders, 1.5 mm^2 cable, etc.

DANGER

The unit has hazardous voltage levels up to 5 minutes after it has been powered down due to the DC link capacitors. The unit or the DC link terminals must not be worked on until at least after this delay time.

Procedure

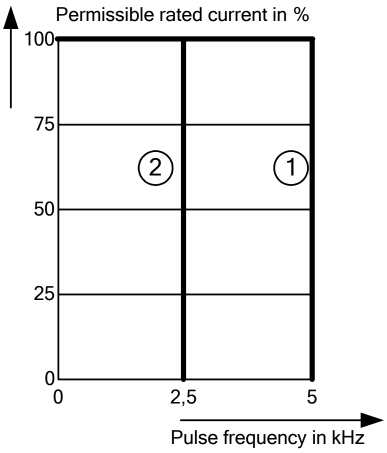
- Before you form the unit, all mains connections must be disconnected.
- The converter incoming supply must be switched off.
- The unit is not permitted to receive a switch-on command (e.g. via the keyboard of the PMU or the terminal strip).
- Connect the required components in accordance with the circuit example.
- Energize the forming circuit. The duration of forming is approx. 1 hour.

11 Technical Data

EC Low-voltage directive 73/23/EEC and RL93/68/EEC	EN 50178
EC EMC directive 89/336/EEC	EN 61800-3
EC Machinery safety directive 89/392/EEC	EN60204-1
Approvals	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 • during storage • during transport	 0° C to +40° C (32° F to 104° F) (up to 50° C see Fig. "Derating curves") -25° C to +70° C (-13° F to 158° F) -25° C to +70° C (-13° F to 158° F)
Installation altitude	≤ 1000 m above sea level (100 % load capability) > 1000 m to 4000 m above sea level (for load capability: see Fig. "Derating curves")
Permissible humidity rating	Relative air humidity ≤ 95 % during transport and storage ≤ 85 % during operation (moisture condensation not permissible)
Environmental conditions acc. to DIN IEC 721-3-3	climate: 3K3 chemical active substances: 3C1
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 • Standard • Option	EN 60529 IP00 IP20 (only E, F and G types of construction)
Protection class	Class 1 to IEC 536 (DIN VDE 0106. Part 1)
Shock protection	to EN 60204-1 and to DIN VDE 0106. Part 100 (BGV A3)
Radio interference suppression • Standard • Options	to EN 61800-3 No radio interference suppression Radio interference suppression filter for class A1 acc. to EN 55011
Interference immunity	Industrial to EN 61800-3
Paint finish	For interior installation
Mechanical specifications • Vibrations During stationary use: Constant amplitude - of deflection - of acceleration During transport - Deflection - Acceleration • Shocks (only E, F and G types of construction)	 to DIN IEC 68-2-6 0.075 mm in the frequency range 10 Hz to 58 Hz 9.8 m/s² in the frequency range > 58 Hz to 500 Hz 3.5 mm in frequency range 5 Hz to 9 Hz 9.8 m/s² in frequency range > 9 Hz to 500 Hz to DIN IEC 68-2-27 / 08.89 30 g. 16 ms half-sine shock
Miscellaneous	The devices are ground-fault protected, short-circuit-proof and idling-proof on the motor side

Table 11-1 General data

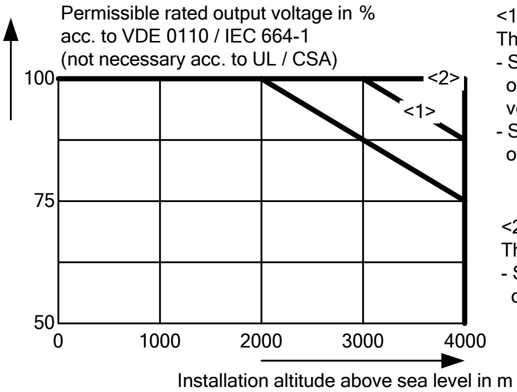
Derating curves



1 Derating curve 1

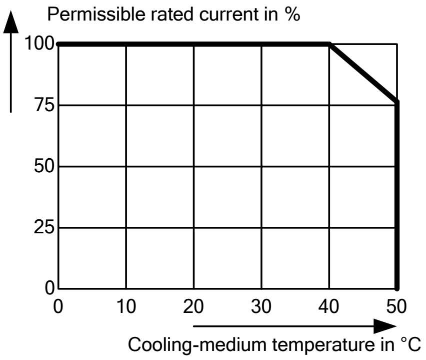
2 Derating curve 2

See Technical Data tables



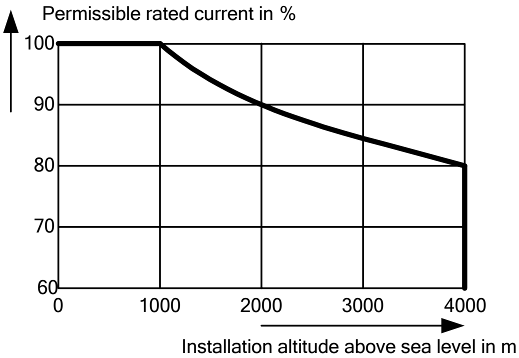
<1>
The derating curve only applies to the following units:
- Sizes E to G with a rated input voltage of 510 - 650 V **only** in the case of an actual input voltage of 510 - 540 V
- Sizes J to L with a rated input voltage of 675 - 810 V

<2>
The derating curve only applies to the following units:
- Sizes J to L with a rated input voltage of 510 - 650 V



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. 11-1 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

Rating plate

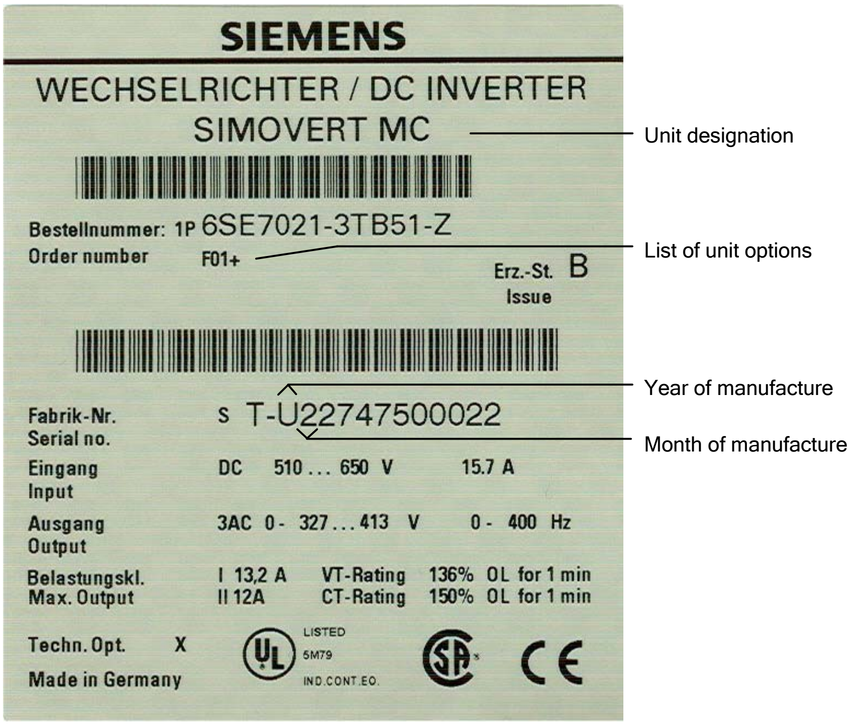


Fig. 11-2 Rating plate

Date of manufacture

The date of manufacture can be derived as follows:

Character	Year of manufacture:	Character	Month of manufacture
U	2006	1 to 9	January to September
V	2007	O	October
W	2008	N	November
X	2009	D	December

Table 11-2 Assignment of characters to the month and year of manufacture

Option codes

Option	Meaning	Option	Meaning
	SBP: Pulse encoder evaluation		**CBP2:** PROFIBUS (sync freq possible)
C11	Slot A	G91	Slot A
C13	Slot C	G92	Slot B
C14	Slot D	G93	Slot C
C15	Slot E	G95	Slot E
C16	Slot F	G97	Slot G
C17	Slot G		**CBC:** CAN bus
	SBR1: Resolver evaluation without pulse encoder simulation	G21 G23	Slot A Slot C
C23	Slot C	G24	Slot D
	SBR2: Resolver evaluation with pulse encoder evaluation	G25 G26	Slot E Slot F
C33	Slot C	G27	Slot G
	SBM2: Encoder and absolute-value encoder evaluation		**EB1:** Expansion Board 1
	Is supported by MC firmware version 1.30 and higher.	G61 G63 G64	Slot A Slot C Slot D
C41	Slot A	G65	Slot E
C42	Slot B	G66	Slot F
C43	Slot C	G67	Slot G
F01	Technology software		**EB2:** Expansion Board 2
F02	"Power Extension PIN" Activation of 2.5 kHz pulse frequency	G71 G73 G74	Slot A Slot C Slot D
	SLB: SIMOLINK	G75 G76	Slot E Slot F
G41	Slot A	G77	Slot G
G43	Slot C	K11	LBA backplane adapter installed in the electronics box
G44	Slot D		
G45	Slot E		Adapter board ADB
G46	Slot F	K01	Mounting position 2 (Slot D, E)
G47	Slot G	K02	Mounting position 3 (Slot F, G)
		K80	“Safe STOP” option

Table 11-3 Meaning of the option codes

Designation	Value				
Order number 6SE70...	31-0TE□0	31-2TF□0	31-8TF□0	32-1TG□0	32-6TG□0
Rated voltage [V] Input Output	DC 510 to 650 (-15 % / +10 %) 3 AC 0 ... rated input voltage x 0,64				
Rated frequency [Hz] Input Output	--- 0 ... 400				
Rated current [A] Input Output	110 92	148 124	184 155	208 175	254 218
DC link voltage [V]	= rated direct voltage				
Rated output [kVA]	61...76	82...103	102...128	115...145	143...181
Aux. power supply [V]	DC 24 (20 -30) (3.0 A without options; more with options)				
Aux. power supply [V]	AC 230 ±15 % (for the fan)				
Pulse frequency [kHz]	2.5 kHz *) / 5 kHz				
Derating curve	①	①	②	②	②
Load class II acc. to EN60146-1-1:					
Base load current Overload current Cycle time Overload duration	0.91 x rated output current 1.6 x rated output current 300 s 30 s				
Losses, cooling, power factor					
Power factor Converter cosφU	< 0.92 ind.	< 0.92 ind.	< 0.92 ind.	< 0.92 ind.	< 0.92 ind.
Efficiency η Pulse frequency 5 kHz	0.97	0.97	0.97	0.98	0.98
Dissipated losses [kW] Pulse frequency 5 kHz	1.25	1.51	2.04	2.30	3.00
Cooling air required [m³/s]	0.10	0.14	0.14	0.31	0.31
Sound pressure level, dimensions, weights					
Sound pressure level [dB(A)]	69	69	69	80	80
Type of construction	E	F	F	G	G
Dimensions [mm] Width Height Depth	270 1050 350	360 1050 350	360 1050 350	508 1450 350	508 1450 460
Weight [kg]	55	65	65	155	155

*) With Z = F02; 2.5 kHz pulse frequency

□ = 5 corresponds to MASTERDRIVES Motion Control
= 7 corresponds to MASTERDRIVES Motion Control Performance 2

Designation		Value			
Order number 6SE70...	33-2TG□0	33-7TG□0	35-1TJ□0		
Rated voltage [V] Input Output	DC 510 to 650 (-15 % / +10 %) 3 AC 0 ... rated input voltage x 0.64				
Rated frequency [Hz] Input Output	--- 0 ... 400				
Rated current [A] Input Output	312 262	367 308	503 423		
DC link voltage [V]	= rated direct voltage				
Rated output [kVA]	172...217	203...256	278...351		
Aux. power supply [V]	DC 24 (20 -30) (3.0 A without options; more with options)				
Aux. power supply [V]	AC 230 ±15 % (for the fan)				
Pulse frequency [kHz]	5.0 – 6.0	5.0 – 6.0	5.0 – 6.0		
Derating curve	➁	➁	➁		
Load class II acc. to EN60146-1-1:					
Base load current Overload current 1) Cycle time Overload duration	0.91 x rated output current 1.6 x rated output current 300 s 30 s				
Losses, cooling, power factor					
Power factor Converter cosφU	< 0.92 ind.	< 0.92 ind.	< 0.92 ind.		
Efficiency η Pulse frequency 5 kHz	0.98	0.98	0.98		
Dissipated losses [kW] Pulse frequency 5 kHz	3.60	4.50	5.20		
Cooling air required [m³/s]	0.41	0.41	0.46		
Sound pressure level, dimensions, weights					
Sound pressure level [dB(A)]	82	82	79		
Type of construction	G	G	J		
Dimensions [mm] Width Height Depth	508 1450 460	508 1450 460	800 1400 551		
Weight [kg]	155	155	250		

1) 6SE7035-1TJ50: Overload current only 1.36 x rated output current
Overload duration 60 s
Cycle time 300 s

□ = 5 corresponds to MASTERDRIVES Motion Control
= 7 corresponds to MASTERDRIVES Motion Control Performance 2

Designation	Value				
Order number 6SE70...	36-0TJ70	37-0TJ70	38-6TK70	41-1TK70	41-3TL70
Rated voltage [V] Input Output	DC 510 to 650 (-15 % / +10 %) 3 AC 0 ... rated input voltage x 0.64				
Rated frequency [Hz] Input Output	--- 0 ... 400				
Rated current [A] Input Output	702 590	821 960	1023 860	1310 1100	1551 1300
DC link voltage [V]	= rated direct voltage				
Rated output [kVA]	389...490	455...573	567...714	724...914	856...1080
Aux. power supply [V]	DC 24 (20 -30) (3.0 A without options; more with options)				
Aux. power supply [V]	AC 230 ±15 % (for the fan)				
Pulse frequency [kHz]	2.5	2.5	2.5	2.5	2.5
Derating curve	②	②	②	②	②
Load class II acc. to EN60146-1-1:					
Base load current Overload current Cycle time Overload duration	0.91 x rated output current 1.6 x rated output current 300 s 30 s				
Losses, cooling, power factor					
Power factor Converter cosφU	< 0.92 ind.	< 0.92 ind.	< 0.92 ind.	< 0.92 ind.	< 0.92 ind.
Efficiency η Pulse frequency 2.5 kHz	0.98	0.98	0.98	0.98	0.98
Dissipated losses [kW] Pulse frequency 2.5 kHz	8.2	8.8	11.9	13.4	14.5
Cooling air required [m³/s]	0.60	0.60	0.60	0.88	0.92
Sound pressure level, dimensions, weights					
Sound pressure level [dB(A)]	77	80	80	82	89
Type of construction	J	J	K	K	L
Dimensions [mm] Width Height Depth	800 1400 551	800 1400 551	800 1750 551	800 1750 551	1100 1750 551
Weight [kg]	250	275	520	540	850

Table 11-4 Technical data

Water-cooled inverter

Order No.	Power loss (at 2.5 kHz) [kW]	Cooling water requirement *) [l/min]	Maximum additional heat dissipation at Tair ≤ 30 °C [kW]	Typical pressure drop according to volumetric flow
Rated input voltage DC 510 to 650 V				
6SE7031-0TE□0-1AA1	1.05	7.25	0.7	0.2 bar at 7.3 l/min
6SE7031-2TF□0-1AA1	1.35	9.20	0.7	0.2 bar at 11 l/min
6SE7031-5TF□0-1AA1	1.56	10.20	0.7	0.2 bar at 11 l/min
6SE7031-8TF□0-1AA1	1.70	11.10	0.7	0.2 bar at 11 l/min
6SE7032-1TG□0-1AA1	2.18	16.10	1.5	0.2 bar at 25 l/min
6SE7032-6TG□0-1AA1	2.75	18.90	1.5	0.2 bar at 25 l/min
6SE7033-2TG□0-1AA1	3.47	22.40	1.5	0.2 bar at 25 l/min
6SE7033-7TG□0-1AA1	4.05	25.30	1.5	0.2 bar at 25 l/min

□ = 5 corresponds to MASTERDRIVES Motion Control
= 7 corresponds to MASTERDRIVES Motion Control Performance 2

Table 11-5 Water-cooled inverter

NOTE

These units and the air-cooled inverters are identically constructed. Instead of the heat sink for air, an air/water cooler has been installed.

All the technical data not listed in Table 11-5 for a particular unit are the same as those of the air-cooled inverter. The first 12 positions of the Order No. are identical.
The supplement "-1AA1” indicates water cooling

Refer to the tables in Section 11.1.7 for the data for water-cooled units of types J to L.

*) The cooling water requirement applies for the unit rating of the inverter and 100 % utilization of the additional heat dissipation obtained from a water temperature rise intake/return of ΔT = 5 K.

Cooling, power requirement of fan, sound pressure level

The following values apply to units:
6SE7035-1TJ□0, 6SE7036-0TJ□0

□ = 5 corresponds to MASTERDRIVES Motion Control
= 7 corresponds to MASTERDRIVES Motion Control Performance 2

Fan voltage / frequency	**[V / Hz]**	**230 / 50**	**230 / 60**
Fan current-requirement	[A]	2.45	3.6
Flow	[m^3/s]	0.46	0.464
Sound pressure level IP00	[dB(A)]	77	77.5
Sound pressure level chassis in IP20 - cabinet	[dB(A)]	70.5	71.5
Sound pressure level chassis in IP42 - cabinet with dust filter, 400 mm high cabinet cover	[dB(A)]	70.5	71

The following values apply to units:
6SE7037-0TJ70, 6SE7038-6TK70

Fan voltage / frequency	**[V / Hz]**	**230 / 50**	**230 / 60**
Fan current-requirement	[A]	5.0	7.4
Flow	[m^3/s]	0.6	0.6
Sound pressure level IP00	[dB(A)]	80	82
Sound pressure level chassis in IP20 - cabinet	[dB(A)]	76	77
Sound pressure level chassis in IP42 - cabinet with dust filter, 400 mm high cabinet cover	[dB(A)]	74	75

The following values apply to unit: 6SE7041-1TK70

Fan voltage / frequency	**[V / Hz]**	**230 / 50**	**230 / 60**
Fan current-requirement	[A]	12.8	22
Flow	[m^3/s]	0.88	0.88
Sound pressure level IP00	[dB(A)]	82	86
Sound pressure level chassis in IP20 - cabinet	[dB(A)]	82	85
Sound pressure level chassis in IP42 - cabinet with dust filter, 400 mm high cabinet cover	[dB(A)]	81	84

The following values apply to unit: 6SE7041-3TL70

Fan voltage / frequency	**[V / Hz]**	**230 / 50**	**230 / 60**
Fan current-requirement	[A]	12.8	22
Flow	[m^3/s]	0.95	1.06
Sound pressure level IP00	[dB(A)]	89.2	91.3
Sound pressure level chassis in IP20 - cabinet	[dB(A)]	84.5	88.5
Sound pressure level chassis in IP42 - cabinet with dust filter, 400 mm high cabinet cover	[dB(A)]	84.3	87.2

Condition for sound-pressure measurement:

- Room height: 6 m
- Distance to nearest reflecting wall: 4 m

11.1 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).

11.1.1 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.

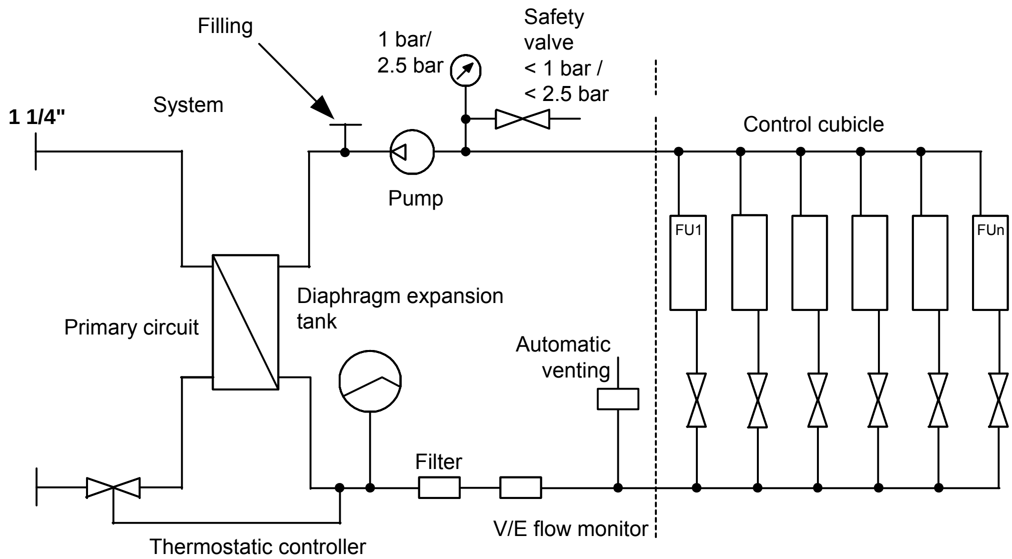


Fig. 11-3 Water-to-water heat exchanger

Water-water heat exchangers

If a water supply system is already available in the plant which does not exceed temperatures above 35 °C but does not fulfil the cooling water requirements, the two cooling systems can be connected using a water-water heat exchanger.

The coolers of the frequency converters are connected via a manifold so that the necessary flow rate is ensured but the pressure does not exceed the permitted value. Factors such as height differences and distances must be taken into account.

For devices without anti-freeze, we recommend using VARIDOSTOP available from Schilling Chemie. VARIDOSTOP is an organic corrosion inhibitor specially developed for semi-open and closed cooling systems. It protects metals against corrosion by forming a protective organic film on the surface of the metal.

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 value given in Table 11-8.
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 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 *) and air venting devices.

When the system is filled for the first time, the heat sinks have to be vented (see Section 11.1.7 "Start-up").

Units larger than or equal to type J have a vent valve for this purpose. On type E to G units there are no vent valves. Venting has to take place externally via the free tap (see Fig. 11-3).

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-69198 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).

*) ≤ 1.2 bar at a permissible operating pressure of 1.0 bar, or ≤ 3 bar at a permissible operating pressure of 2.5 bar

11.1.2 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 11-4 and 11-5 (Curve 1).

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

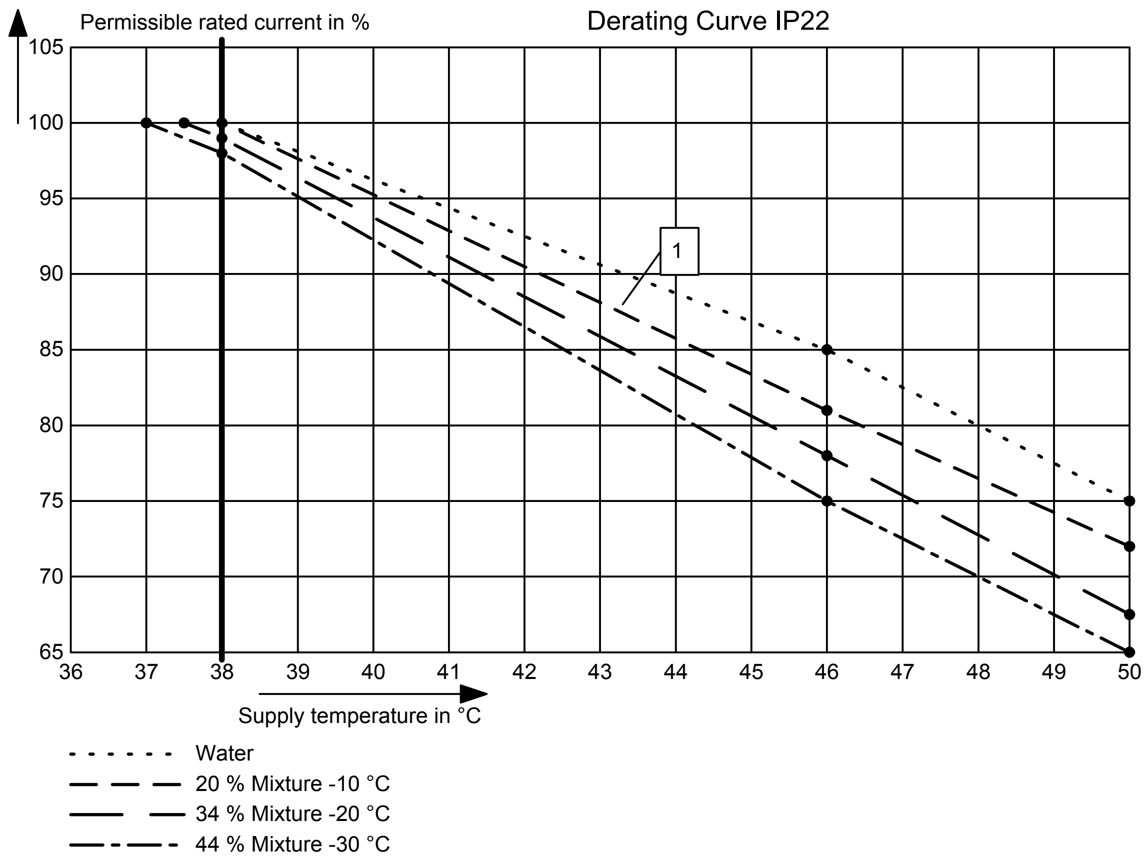


Fig. 11-4 Reduction curve applying to installation in IP22 cabinets

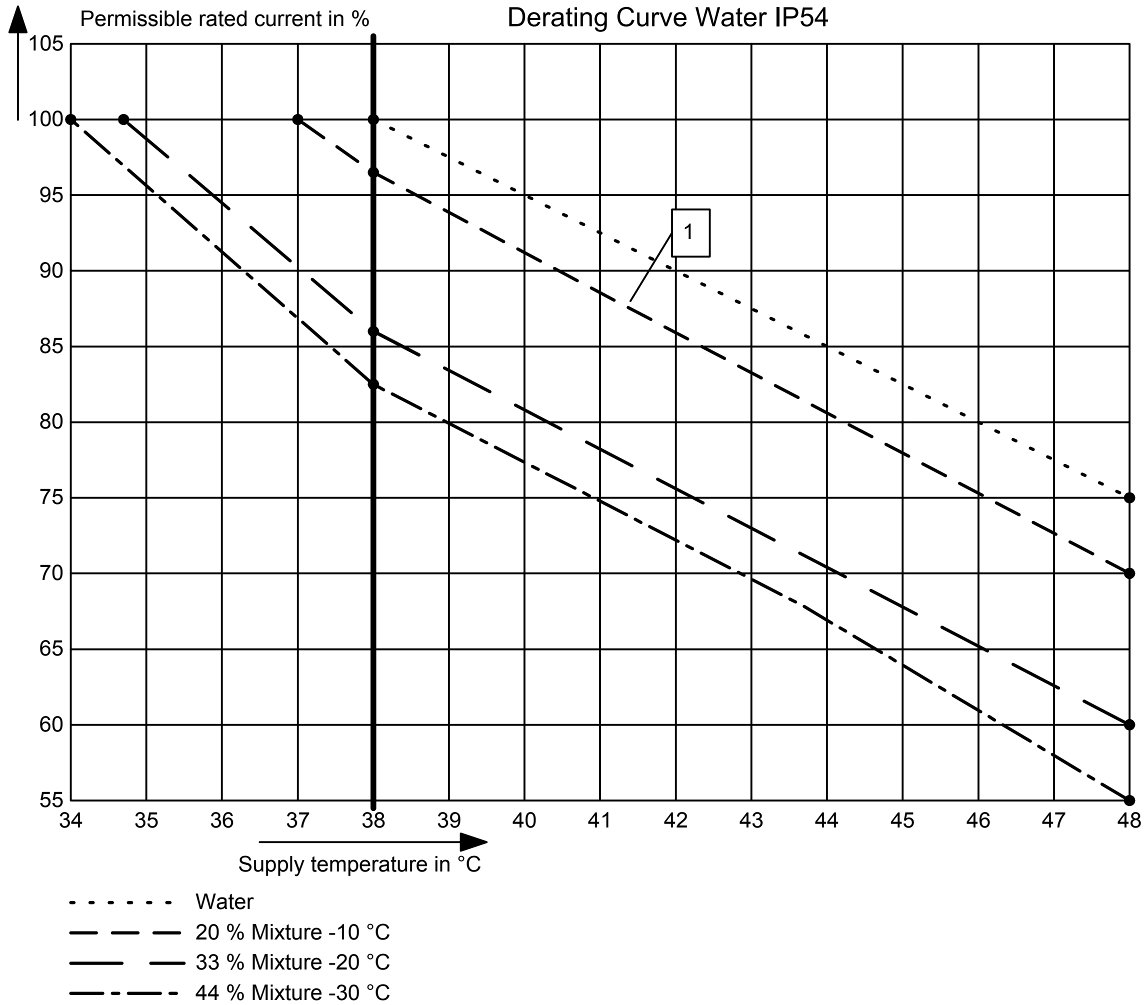


Fig. 11-5 Reduction curve 2 applying to installation in IP54 cabinets

NOTE

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

11.1.3 Coolant

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

11.1.3.1 Definition of cooling water

The cooling water must meet the following requirements in the long term:

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	
• Type of construction E to G	≤ 1.0 bar
• Type of construction K	≤ 2.5 bar

NOTICE

No operating pressures higher than 1.0 bar, or 2.5 bar (≥ type of construction J), are permitted!

If the equipment is operating at a higher pressure, the pressure at each unit is to be reduced to 1.0 bar, or 2.5 bar (in the case of type of construction K).

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.

11.1.3.2 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" (Figs. 11-4 and 11-5). 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 Clariant, www.clariant.com) 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 11-6 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.

11.1.3.3 Corrosion protection agent

We recommend the use of a corrosion protection inhibitor for the cooling circuit, e.g. NALCO 00GE056 corrosion protection from ONDEO Nalco (Nalco Deutschland GmbH, www.nalco.com, D-60486 Frankfurt, Tel. +49-697934-410). Concentration of the corrosion protection inhibitor in the cooling water 0.1 ... 0.14 %.

The cooling water should be checked 3 months after the first filling of the cooling circuit and then once a year.

If any clouding, discoloration or bacteria are detected in the cooling water, the cooling circuit has to be flushed out and refilled.

An inspection glass should be installed in the cooling circuit to be able to monitor the cooling water easily.

11.1.4 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 11-7 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. Temperature control is recommended for this purpose (see Fig. 11-3). 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.
2. 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.
3. A humidity alarm can be installed to give a warning when condensation is imminent. Such an alarm is available from ENDRICH (www.endrich.com); when the temperature falls to within 2 K of dew point, a signal contact closes.

11.1.5 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 Nalco Deutschland GmbH; www.nalco.com; D-60486 Frankfurt, Tel. +49-697934-410).

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".

NOTICE

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").

11.1.6 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.

11.1.7 Characteristic data of water-cooled units, types J, K and L

The tables listed below give the rated water flow volume in l/min and the pressure difference (in Pa) across the heat sink at rated flow volume.

The water-cooled units have a lower power loss (i.e. a higher efficiency) than the air-cooled units. The power loss is given in table 11-8.

Background

MASTERDRIVES with water-cooling have the same power rating as the air-cooled units. Since the thermal resistance of the heat sinks for the IGBT is distinctly better than that attainable with air-cooling, the modules are operated with a junction temperature that is 20 K lower. The result of this is that the module losses are about 5 % lower.

This effect also gives the modules a good life expectancy.

Many units are also equipped with small built-in fans. The lower power losses of these can also be taken into account.

NOTE

In the tables below, the data for new units or more exact data are printed in bold type.

MLFB	**Flow [l/min]**	**Differential pressure [Pa]**	**Sound level IP20 [dBA]***	**Sound level IP42 [dBA]***	**Sound level IP54 [dBA]***	**Water heating [k]**	**Power loss [kW]**
6SE7035-1TJ□0-1AA0	24	**16900**	76	75	72	4	5.58
6SE7036-0TJ□0-1AA0	26	**19840**	76	75	72	4	6.39
6SE7037-0TJ□0-1AA0	**30**	**27270**	**76**	**75**	**72**	**4.5**	**7.74**
6SE7037-0TK□0-1AA0	30	**9300**	76	76	73	5	9.05
6SE7038-6TK□0-1AA0	40	**16560**	76	76	73	5	10.4
6SE7041-1TK□0-1AA0	46	**21900**	76	76	73	5	10.7
6SE7041-3TL□0-1AA0	51	**12000**	75	74	71	5	12.3

□ = 5 corresponds to MASTERDRIVES Motion Control
= 7 corresponds to MASTERDRIVES Motion Control Performance 2

Table 11-8 Characteristic data of DC units, 510 V to 650 V

* The sound level was determined under the following boundary conditions:

Distance to the unit 1 m, height above floor level 1 m, distance to the next reflecting wall 4 m, room height 6m.

The chassis were installed in Siemens 8MC cabinets without any special soundproofing measures.

Fan voltage/frequency	V/Hz	230/50	230/60
Current requirement types J and K	A	2.45	3.6
Current requirement type L	A	4.9	7.2
Sound pressure level IP20	dB(A)	See table	See table +1.0
Sound pressure level IP42	dB(A)	See table	See table +0.5
Sound pressure level IP54	dB(A)	See table	See table

Table 11-9 Operating data of fan for types J and K

Type	Water contents (litres)
J	1.4
K	3.0
L	2.8

Table 11-10 Water contents of the heat sinks (± 10 %)

Start-up

The heat sinks have to be vented when the units are filled for the first time.

The equipment has to be disconnected from the supply when venting is performed.

- Dismantle the lock screw in front of the actual vent valve.
- Carry out venting.
  Units of type E to G:
  There is no vent valve on these units.
  Venting has to take place externally via the free tap (see Fig. 11-3).
- Close the vent cock.
- Tighten the lock screw again.
- Check for tightness.
- The necessary volumetric flow must be ensured. The filters or strainers have to be cleansed. Cleansing should be repeated at regular intervals.
- If anti-freezing agents are used, the designation of the agent, its manufacturer and its mixing ratio must be documented.

12 Faults and Alarms

12.1 Faults

General information regarding faults

For each fault, the following information is available:

Parameter	r947	Fault number
	r949	Fault value
	r951	Fault list
	P952	Number of faults
	r782	Fault time

If a fault message is not reset before the electronic supply voltage is switched off, then the fault message will be present again when the electronic supply is switched on again. The unit cannot be operated without resetting the fault message.

Number / Fault	Cause	Counter-measure
F001 Main contactor checkback	The monitoring time of the main contactor checkback (P600) has expired.	- Check main contactor checkback - Clear main contactor checkback (P591.B = 0) - Increase monitoring time (P600)
F002 Pre-charging fault	The monitoring time of pre-charging has expired, i.e. the DC link voltage has not reached the setpoint within 3 secs.	- Check voltage connection (AC or DC) - Unit-dependent: Check fuses - Compare value in P070 and unit MLFB
F006 DC link overvoltage	Due to excessive DC link voltage, shutdown has occurred. The rated value of the shutdown threshold is 819 V. Due to component tolerances shutdown can take place in the range from 803 V to 835 V. In the fault value the DC link voltage upon occurence of the fault is indicated (normalization 0x7FFF corresponds to 1000V)	Check the line voltage (AC-AC) or the input direct voltage (DC-AC). Compare value with P071 (Line Volts)
F008 DC link undervoltage	The lower limit value of 76% of the DC link voltage has been fallen short of. In the fault value the DC link voltage upon occurence of the fault is indicated (normalization 0x7FFF corresponds to 1000V)	- Check the line voltage (AC-AC) or the input direct voltage (DC-AC). Compare value with P071 (Line Volts) - Check input rectifier (AC-AC) - Check DC link
F011 Overcurrent not Compact PLUS	Overcurrent shutdown has occurred. The shutdown threshold has been exceeded. The phase in which an overcurrent has occurred is indicated in a bit-coded manner in the fault value (see P949). Phase U --> Bit 0 = 1--> fault value = 1 Phase V --> Bit 1 = 1--> fault value = 2 Phase W--> Bit 2 = 1--> fault value = 4 If an overcurrent occurs simultaneously in several phases, the total of the fault values of the phases concerned is the resulting fault value.	- Check the converter output for short-circuit or earth fault - Check the load for an overload condition - Check whether motor and converter are correctly matched - Check whether the dynamic requirements are too high

Number / Fault	Cause	Counter-measure
F015 Motor blocked	Motor is blocked/overloaded (current control), or has stalled (v/f characteristic): Static load is too high The fault is not generated until after the time entered in P805. Binector B0156 is set, in status word 2 r553 Bit 28. Whether the drive is blocked or not can be detected at P792 (Perm Deviation) and P794. P806 enables detection to be limited to "at standstill" (P806 = 1, only for current control) or to be completely de-activated (P806 = 2). In the case of current control, the precondition for this fault is that the torque limits (B0234) have been reached. In the case of slave drive, detection is de-activated. In the case of v/f control, the I(max) controller must be active.	- Reduce the load - Release the brake - Increase current limits - Increase P805 Blocking Time - Increase the response threshold for the permissible deviation P792 - Increase torque limits or torque setpoint - Check connection of motor phases including correct phase assignment/sequence v/f characteristic only: - Reduce rate of acceleration - Check characteristic setting.
F017 SAFE STOP Compact PLUS only	SAFE STOP operating or failure of the 24 V power supply during operation (only for Compact PLUS units)	Jumper applied for SAFE STOP? SAFE STOP checkback connected? On Compact PLUS units: check 24 V supply
F020 Excess temperature of motor	The motor temperature limit value has been exceeded. r949 = 1 Motor temperature limit value exceeded r949 = 2 Short-circuit in the motor temperature sensor cable or sensor defective r949 = 4 Wire break of motor temperature sensor cable or sensor defective	- Temperature threshold adjustable in P381! - P131 = 0 -> fault de-activated - Check the motor (load, ventilation etc.) - The current motor temperature can be read in r009 (Motor Temperat.) - Check the sensor for cable break, short-circuit
F021 Motor I2t	Parameterized limit value of the I2t monitoring for the motor (P384.002) has been exceeded	Check: Thermal time constant of motor P383 Mot ThermT-Const or motor I2t load limit P384.002. The I2t monitoring for the motor is automatically activated if P383 >=100s (=factory setting) and P381 > 220°C is set. Monitoring can be switched off by setting a value <100s in P383.
F023 Excess temperature of inverter	The limit value of the inverter temperature has been exceeded	- Measure the air intake and ambient temperature (Observe minimum and maximum ambient temperature from 0°C to 45°C!) - Observe the derating curves at theta > 45 °C (Compact PLUS) or 40 °C - Check whether the fan is running - Check that the air entry and discharge openings are not restricted - In the case of units >= 22 kW acknowledgement is only possible after 1 minute
F025 UCE upper switch/UCE Phase L1	For Compact PLUS units: UCE upper switch For chassis type units: UCE Phase L1	- Check the converter outputs for earth fault - Check the switch for "SAFE STOP" on Compact units

Number / Fault	Cause	Counter-measure
F026 UCE lower switch/UCE Phase L2	For Compact PLUS units: UCE lower switch For Compact and chassis type units: UCE Phase L2	- Check the converter outputs for earth fault - Check the switch for "SAFE STOP" on Compact units
F027 Pulse resistor fault / UCE Phase L3	For Compact PLUS AC/AC units: Pulse resistance fault For chassis type units: UCE Phase L3	- Check the converter outputs for earth fault - Check the switch for "SAFE STOP" on Compact DC/DC units and chassis units with the option "SAFE STOP"
F029 Meas. value sensing Compact PLUS only	A fault has occurred in the measured value sensing system: - (r949 = 1) Offset adjustment in phase L1 not possible - (r949 = 2) Offset adjustment in phase L3 not possible. - (r949 = 3) Offset adjustment in phases L1 and L3 not possible. - (r949=65) Autom. Adjustment of the analog inputs is not possible	Fault in measured value sensing Fault in power section (valve cannot block) Fault on CU
F035 External fault 1	Parameterizable external fault input 1 has been activated.	- Check whether there is an external fault - Check whether the cable to the corresponding digital output is interrupted - P575 (Src No ExtFault1)
F036 External fault 2	Parameterizable external fault input 2 has been activated.	- Check whether there is an external fault - Check whether the cable to the corresponding digital output is interrupted - P576 (Src No ExtFault2)
F038 Voltage OFF during parameter storage	A voltage failure has occurred during a parameter task.	Re-enter the parameter. The number of the parameter concerned is indicated in fault value r949.
F040 Internal fault of sequence control	Incorrect operating status	Replace the control board (CUMC) or the unit (Compact PUS).
F041 EEPROM fault	A fault has occurred during the storage of values in the EEPROM.	Replace the control board (CUMC) or the unit (Compact PLUS)
F042 Time slot overflow	The available calculating time of the time slot has been exceeded. At least 10 failures of time slots T2, T3, T4 or T5 (see also parameter r829.2 to r829.5)	- Reduce pulse frequency - Calculate individual blocks in a slower sampling time - The technology functions Synchronization (U953.33) and Positioning (U953.32) must not be enabled at the same time.

Number / Fault	Cause	Counter-measure
F043 DSP link	The link to the internal signal processor is interrupted	- Reduce pulse frequency (perhaps caused by calculating time overflow) - If fault re-occurs, replace the board/unit The pulse frequency P340 should not be adjusted to values larger than 7.5 kHz (for 60MHz - DSP) or 6 kHz (for 40MHz - DSP). If higher values are set, indices 12 to 19 have to be checked on visualization parameter r829. The indicated free calculating time of the DSP time slots always have to be greater than zero. If the calculating time is exceeded, this is also displayed by fault F043 (DSP coupling). Remedy: Reduce pulse frequency (P340)
F044 BICO manager fault	A fault has occurred in the softwiring of binectors and connectors	Fault value r949: >1000: Fault during connector softwiring >2000: Fault during binector softwiring - Voltage OFF and ON - Factory setting and new parameterization - Exchange the board 1028:Link memory is full. The link area between the two processors is full. No further connectors can be transferred. - Reduction of the linked connections between the two processors. Interface between the two processors is position control/setpoint conditioning i.e.softwires from and to the setpoint conditioning, position controller, speed controller, torque interface and current controller which are not necessary should be dissolved to reduce the link (value 0).
F045 HW fault on optional boards	A hardware fault has occurred during access to an optional board.	- Replace CU board (Compact, chassis units) - Replace the unit (Compact PLUS) - Check the connection betewen the subrack and the optional boards - Replace optional boards.
F046 Parameter coupling fault	A fault has occurred during the transfer of parameters to the DSP.	If fault re-occurs, replace the board/unit

Number / Fault	Cause	Counter-measure
F051 Encoder fault	- Signal amplitude of resolver or encoder is below the tolerance threshold - Power supply faults in the case of encoders and multiturn encoders - In the case of multiturn encoders (SSI/Endat), connection fault of the serial protocol	Fault value r949: 10th and 1st position: 9 = Resolver signal missing (sin/cos track) 20 = Position error: Alarm A18 was generated during the change to the "operation" state. (For remedial action see 29) 21 = A/B track undervoltage: Root(A^2+B^2)<0.01V (For remedial action see 29) 22 = A/B track overvoltage: Root(A^2+B^2)>1.45V (For remedial action see 29) 25 = Encoder initial position not recognized (C/D track missing) - Check encoder cable (faulty / interrupted)? - Correct encoder type parameterized? - Is the correct cable used for encoder or multiturn encoder? Encoders and multiturn encoders need different cables! - Encoder faulty? 26 = Encoder zero pulse outside the permitted range 27 = No encoder zero pulse has occurred 28 = Encoder/multiturn Voltage supply Encoder fault - Short-circuit in encoder connection? - Encoder faulty? - Encoder incorrectly connected up? !!!Power off/on or in drive settings and back to new initialization of the starting position!!! 29 = A/B track undervoltage: In the zero passage of one track the amount of the other track was less than 0.025 V - Check encoder cable (faulty/torn off)? - Is shield of encoder cable connected ? - Encoder faulty? - Replace SBR/SBM - Replace unit or basic board - Is the correct cable being used in each case for the encoder/multiturn encoder?`Encoders and multiturn encoders require different encoder cables! !!!Power off/on or in drive settings and back to new initialization of the starting position!!! Multiturn (SSI/EnDat): 30: Protocol fault CRC/Parity Check (EnDat) 31: Timeout Protocol (EnDat) 32: No-load level error, data line (SSI/EnDat) 33: Initialization of timeout - Check parameterization (P149) - Check encoder cable (faulty / torn off? - Encoder cable shield connected ? - Encoder faulty? - Replace SBR/SBM - Replace unit or basic board

Number / Fault	Cause	Counter-measure
		34: Address wrong (only EnDat) - Writing or reading of parameters not successful, check address and MRS code (P149) 35: The difference between the serial protocol and the pulse counter is greater than 0xFFFF (2^16). A possible fault may be a jump in the serial protocol. The fault can only be generated if an absolute encoder with incremental tracks (P149.01/.06 = X1XX) and multiturn portion is concerned. (EnDat) 40: Alarm, lighting, EnDat encoder 41: Alarm, signal amplitude, EnDat encoder 42: Alarm. position value, EnDat encoder 43: Alarm, overvoltage, EnDat encoder 44: Alarm, undervoltage, EnDat encoder 45: Alarm, overcurrent, EnDat encoder 46: Alarm, battery failure, EnDat encoder 49: Alarm, check sum error, EnDat encoder 60: SSI protocol faulty (see P143) 100th position: 0xx: Motor encoder faulty 1xx: External encoder faulty 1000th position: (from V1.50) 1xxx: Frequency exceeded, EnDat encoder 2xxx: Temperature, EnDat encoder 3xxx: Control reserve, light, EnDat encoder 4xxx: Battery charge, EnDat encoder 5xxx: Home point not reached
F054 Encoder board initialization fault	A fault has occurred during initialization of the encoder board.	Fault value r949: 1: Board code is incorrect 2: TSY not compatible 3: SBP not compatible 4: SBR not compatible 5: SBM not compatible (from V2.0 only the SBM2 board is supported; see also r826 function diagram 517) 6: SBM initialization timeout 7: Board double 20: TSY board double 21: SBR board double 23: SBM board three-fold 24: SBP board three-fold 30: SBR board slot incorrect 31: SBM board slot incorrect 32: SBP board slot incorrect 40: SBR board not present 41: SBM board not present 42: SBP board not present 50: Three encoder boards or two encoder boards, none of them on Slot C 60: internal fault
F056 SIMOLINK telegram failure	Communication on the SIMOLINK ring is disturbed.	- Check the fiber-optic cable ring - Check whether an SLB in the ring is without voltage - Check whether an SLB in the ring is faulty - Check P741 (SLB TlgOFF)

Number / Fault	Cause	Counter-measure
F058 Parameter fault Parameter task	A fault has occurred during the processing of a parameter task.	No remedy
F059 Parameter fault after factory setting/init.	A fault has occurred in the initialization phase during the calculation of a parameter.	The number of the inconsistent parameter is indicated in fault value r949. Correct this parameter (ALL indices) and switch voltage off and on again. Several parameters may be affected, i.e. repeat process.
F060 MLFB is missing during initial loading	Is set if parameter P070 is at zero when INITIAL LOADING is exited.	Enter correct MLFB after acknowledging the fault (power section, initial loading)
F061 Incorrect parameterization	A parameter which has been entered during drive setting is in the non-permissible range.	The number of the inconsistent parameter is indicated in fault value r949 (e.g. motor enocder = pulse encoder in the case of brushless DC motors) -> correct this parameter.
F063 PIN is missing	The synchronization or positioning technology functions have been activated without an authorization being present (PIN)	- Deactivate synchronization or positioning - Enter the PIN (U2977) If technology functions are inserted in the time slots without enabling the technology function through the PIN, the message F063 is generated. This fault can only be cleared by putting in the correct PIN at U977.01 and U977.02 and switching the power off and on again, or by disabling the technology functions (put U953.32 = 20 and U053.33 = 20).
F065 SCom telegram failure	No telegram has been received at an SCom interface (SCom/USS protocol) within the telegram failure time.	Fault value r949: 1 = Interface 1 (SCom1) 2 = Interface 2 (SCom2) Check the connection of PMU -X300 or X103 / 27,28 (Compact, chassis unit) Check the connection of X103 or X100 / 35,36 (Compact PLUS unit) Check "SCom/SCB TlgOff" P704.01 (SCom1) or P704.02 (SCom2)
F070 SCB initialization fault	A fault has occurred during initialization of the SCB board.	Fault value r949: 1: Board code incorrect 2: SCB board not compatible 5: Error in configuration data (Check parameterization) 6: Initialization timeout 7: SCB board double 10: Channel error
F072 EB initialization fault	A fault has occurred during initialization of the EB board.	Fault value r949: 2: 1st EB1 not compatible 3: 2nd EB1 not compatible 4: 1st EB2 not compatible 5: 2nd EB2 not compatible 21: Three EB1 boards 22: Three EB2 boards 110: Fault on 1st EB1 120: Fault on 2nd EB1 210: Fault on 1st EB2 220: Fault on 2nd EB2
F073 AnInp1SL1 not Compact PLUS	4 mA at analog input 1, slave 1 fallen short of	Check the connection of the signal source to the SCI1 (slave 1) -X428: 4, 5.

Number / Fault	Cause	Counter-measure
F074 AnInp2 SL1 not Compact PLUS	4 mA at analog input 2, slave 1 fallen short of	Check the connection of the signal source to the SCI1 (slave 1) -X428: 7, 8.
F075 AnInp3 SL1 not Compact PLUS	4 mA at analog input 3, slave 1 fallen short of	Check the connection of the signal source to the SCI1 (slave 1) -X428: 10, 11.
F076 AnInp1 SL2 not Compact PLUS	4 mA at analog input 1, slave 2 fallen short of	Check the connection of the signal source to the SCI1 (slave 2) -X428: 4, 5.
F077 AnInp2 SL2 not Compact PLUS	4 mA at analog input 2, slave 2 fallen short of	Check the connection of the signal source to the SCI1 (slave 2) -X428: 7, 8.
F078 AnInp3 SL2 not Compact PLUS	4 mA at analog input 3, slave 2 fallen short of	Check the connection of the signal source to the SCI1 (slave 2) -X428: 10, 11.
F079 SCB telegram failure not Compact PLUS	No telegram has been received by the SCB (USS, peer-to-peer, SCI) within the telegram failure time.	- Check the connections of the SCB1(2). - Check P704.03"SCom/SCB Tlg OFF" - Replce SCB1(2) - Replace CU (-A10)
F080 TB/CB initialization fault	Fault during initialization of the board at the DPR interface	Fault value r949: 1: Board code incorrect 2: TB/CB board not compatible 3: CB board not compatible 5: Error in configuration data 6: Initialization timeout 7: TB/CB board double 10: Channel error Check the T300/CB board for correct contacting, check the PSU power supply, check the CU / CB / T boards and check the CB initialization parameters: - P918.01 CB Bus Address, - P711.01 to P721.01 CB parameters 1 to 11
F081 OptBrdHeartbeat-Counter	Heartbeat-counter of the optional board is no longer being processed	Fault value r949: 0: TB/CB heatbeat-counter 1: SCB heartbeat-counter 2: Additional CB heartbeat-counter - Acknowledge the fault (whereby automatic reset is carried out) - If the fault re-occurs, replace the board concerned (see fault value) - Replace ADB - Check the connection between the subrack and the optional boards (LBA) and replace, if necessary
F082 TB/CB telegram failure	No new process data have been received by the TB or the CB within the telegram failure time.	Fault value r949: 1 = TB/CB 2 = additional CB - Check the connection to TB/CB - Check P722 (CB/TB TlgOFF) - Replace CB or TB

Number / Fault	Cause	Counter-measure
F085 Add. CB initialization fault	A fault has occurred during initialization of the CB board.	Fault value r949: 1: Board code incorrect 2: TB/CB board not compatible 3: CB board not compatible 5: Error in configuration data 6: Initialization timeout 7: TB/CB board double 10: Channel error Check the T300 / CB board for correct contacting and check the CB initialization parameters: - P918.02 CB Bus Address, - P711.02 to P721.02 CB Parameters 1 to 11
F087 SIMOLINK initialization fault	A fault has occurred during initialization of the SLB board.	- Replace CU (-A10), or replace the unit (Compact PLUS type) - Replace SLB
F099 Friction characteristic record	Recording of the friction characteristic was interrupted or not done at all.	Fault value r949 gives the cause (bit coded): Bit Meaning Value displayed 0 Pos. speed limit 1 1 Neg. speed limit 2 2 Releases missing: direction of rotation, inverter, controller 4 3 Speed controller connecting 8 4 Interrupt through cancellation of the record command 16 5 Illegal dataset changover 32 6 Time exceeded 64 7 Measuring error 128
F109 MId R(L)	The rotor resistance determined during measurement of the direct current deviates too greatly.	- Repeat measurement - Enter data manually
F111 MId DSP	A fault has occurred during the Mot Id. r949=1 The current does not build up when voltage pulses are applied r949=2 (only for P115=4) The difference between speed setpoint and actual value is too large during measurement r949=3 (only for P115=4) The magnetizing current determined is too high. r949=121 The stator resistance P121 is not determined correctly r949=124 The rotor time constant P124 is parameterized with the value 0 ms r949=347 The valve voltage drop P347 is not determined correctly	- Repeat measurement - When r949=1: Check motor cables - When r949=2: Avoid mechanical stressing of the motor during the measurement; if the fault occurs directly after the start of the motor identification check the encoder and motor cables. - When r949=3: Check the motor rating plate data stored (ratio Vrated / Irated does not correspond with the measured inductance
F112 Mid X(L)	A fault has occurred during measurement of the motor inductances or leakages.	- Repeat measurement
F114 MId OFF	The converter has automatically stopped the automatic measurement due to the time limit up to power-up having been exceeded or due to an OFF command during the measurement, and has reset the function selection in P115.	Re-start with P115 function selection = 2 "Motor identification at standstill".The ON command must be given within 20 sec. after the alarm message A078 = standstill measurement has appeared. Cancel the OFF command and re-start measurement.

Number / Fault	Cause	Counter-measure
F116 Technology board fault not Compact PLUS	See TB documentation	See TB documentation
F117 Technology board fault not Compact PLUS	See TB documentation	See TB documentation
F118 Technology board fault not Compact PLUS	See TB documentation	See TB documentation
F119 Technology board fault not Compact PLUS	See TB documentation	See TB documentation
F120 Technology board fault not Compact PLUS	See TB documentation	See TB documentation
F121 Technology board fault not Compact PLUS	See TB documentation	See TB documentation
F122 Technology board fault not Compact PLUS	See TB documentation	See TB documentation
F123 Technology board fault not Compact PLUS	See TB documentation	See TB documentation
F124 Technology board fault not Compact PLUS	See TB documentation	See TB documentation
F125 Technology board fault not Compact PLUS	See TB documentation	See TB documentation
F126 Technology board fault not Compact PLUS	See TB documentation	See TB documentation
F127 Technology board fault not Compact PLUS	See TB documentation	See TB documentation
F128 Technology board fault not Compact PLUS	See TB documentation	See TB documentation

Number / Fault	Cause	Counter-measure
F129 Technology board fault not Compact PLUS	See TB documentation	See TB documentation
F130 Technology board fault not Compact PLUS	See TB documentation	See TB documentation
F131 Technology board fault not Compact PLUS	See TB documentation	See TB documentation
F132 Technology board fault not Compact PLUS	See TB documentation	See TB documentation
F133 Technology board fault not Compact PLUS	See TB documentation	See TB documentation
F134 Technology board fault not Compact PLUS	See TB documentation	See TB documentation
F135 Technology board fault not Compact PLUS	See TB documentation	See TB documentation
F136 Technology board fault not Compact PLUS	See TB documentation	See TB documentation
F137 Technology board fault not Compact PLUS	See TB documentation	See TB documentation
F138 Technology board fault not Compact PLUS	See TB documentation	See TB documentation
F139 Technology board fault not Compact PLUS	See TB documentation	See TB documentation
F140 Technology board fault not Compact PLUS	See TB documentation	See TB documentation
F141 Technology board fault not Compact PLUS	See TB documentation	See TB documentation

Number / Fault	Cause	Counter-measure
F142 Technology board fault not Compact PLUS	See TB documentation	See TB documentation
F143 Technology board fault not Compact PLUS	See TB documentation	See TB documentation
F144 Technology board fault not Compact PLUS	See TB documentation	See TB documentation
F145 Technology board fault not Compact PLUS	See TB documentation	See TB documentation
F146 Technology board fault not Compact PLUS	See TB documentation	See TB documentation
F147 Technology board fault not Compact PLUS	See TB documentation	See TB documentation
F148 Fault 1 Function blocks	An active signal is present at binector U061 (1).	Examine cause of fault, see function diagram 710
F149 Fault 2 Function blocks	An active signal is present at binector U062 (1).	Examine cause of fault, see function diagram 710
F150 Fault 3 Function blocks	An active signal is present at binector U063 (1).	Examine cause of fault, see function diagram 710
F151 Fault 4 Function blocks	An active signal is present at binector U064 (1).	Examine cause of fault, see function diagram 710
F152 Signs of life repeatedly invalid.	After an appropriate number of invalid signs of life, the sign of life monitoring block has gone into fault status.	Check cause of fault, see function diagram 170
F153 No valid sign-of-life tool interface	Within the monitoring time of the tool interface no valid sign-of-life has been received from the tool interface.	Cyclically execute write tasks from the tool interface within the monitoring time whereby the sign-of-life has to be increased by 1 for every write task.
F255 Fault in EEPROM	A fault has occurred in the EEPROM.	Switch off the unit and switch it on again. If the fault re-occurs, replace CU (-A10), or replace the unit (Compact PLUS).

Table 12-1 Fault numbers, causes and their counter-measures

12.2 Alarms

The alarm message is periodically displayed on the PMU by A = alarm/ alarm message and a 3-digit number. An alarm cannot be acknowledged. It is automatically deleted once the cause has been eliminated. Several alarms can be present. The alarms are then displayed one after the other.

When the converter is operated with the OP1S operator control panel, the alarm is indicated in the lowest operating display line. The red LED additionally flashes (refer to the OP1S operating instructions).

Number / Alarm	Cause	Counter-measure
A001 Time slot overflow	The calculating time work load is too high. a) At least 3 failures of time slots T6 or T7 (see also parameter r829.6 or r829.7) b) At least 3 failures of time slots T2, T3, T4 or T5 (see also parameter r829.2 to r829.5)	- Reduce pulse frequency - Calculate individual function blocks in slower time slots (parameter U950 ff.)
A002 SIMOLINK start alarm	Start of the SIMOLINK ring is not functioning.	- Check the fiber-optic cable ring for interruptions - Check whether there is an SLB without voltage in the ring - Check whether there is a faulty SLB in the ring
A003 Drive not synchronous	Although synchronization has been activated, the drive is not synchronous. Possible causes are: - Poor communication connection (frequent telegram failures) - Slow bus cycle times (in the case of high bus cycle times or synchronization of slow time slots, synchronizing can last for 1-2 minutes in the worst case). - Incorrect wiring of the time counter (only if P754 > P746 /T0)	SIMOLINK (SLB): - Check r748 i002 and i003 = counters for CRC faults and timeout faults - Check the fiber-optic cable connection - Check P751 on the dispatcher (connector 260 must be softwired); Check P753 on the transceiver (corresponding SIMOLINK connector K70xx must be softwired).
A004 Alarm startup of 2nd SLB	Startup of the 2nd SIMOLINK ring does not function.	- Check the fiber optic cable ring for any disconnections - Check whether an SLB in the ring is without voltage - Check whether an SLB in the ring is faulty
A005 Couple full	The closed-loop electronic system of MASTERDRIVES MC consists of two microprocessors. Only a limited number of couple channels are provided for transferring data between the two processors. The alarm displays that all couple channels between the two processors are busy. An attempt has, however, been made to interconnect another connector requireing a couple channel.	None
A014 Simulation active alarm	The DC link voltage is not equal to 0 when the simulation mode is selected (P372 = 1).	- Set P372 to 0. - Reduce DC link voltage (disconnect the converter from the supply)
A015 External alarm 1	Parameterizable external alarm input 1 has been activated.	Check - whether the cable to the corresponding digital input has been interrupted. - parameter P588 Src No Ext Warn1

Number / Alarm	Cause	Counter-measure
A016 External alarm 2	Parameterizable external alarm input 2 has been activated.	Check - whether the cable to the corresponding digital input has been interrupted. - parameter P589 Src No Ext Warn2
A017 Safe Stop alarm active	Safe Stop is detected in the READY states.	See F017 for causes/counter-measures.
A018 Encoder adjustment	Signal amplitude Resolver/encoder in the critical range.	See F051 for causes/counter-measures. As a general rule, it is necessary to initialize the starting position again => power OFF/ON or switch to the drive settings and back again!!! If alarm A18 occurs in the"Ready" status (r001 = 009) while an encoder is in use, the amplitude of the CD track signal is too small, or the connection to CD_Track may be interrupted, or an encoder without CD-Track is in use. In the case of an encoder without CD track, the P130 must be correctly set.
A019 Encoder data serial protocol	Connection fault of the serial protocol on multiturn encoders (SSI/Endat)	Serial protocol is defective on multiturn encoders. See F051 for causes/counter-measures. As a general rule, it is necessary to initialize the starting position again => power OFF/ON or switch to the drive settings and back again!!!
A020 Encoder adjustment, external encoder	The amplitude of an external encoder lies in the critical range.	Cause/remedies see F051 As a general rule, it is necessary to initialize the starting position again => power OFF/ON or switch to the drive settings and back again!!!
A021 Encoder data of external multiturn encoder faulty	A fault has occurred during processing of the serial protocol to an external code rotary encoder (SSI- or Endat-Multiturn).	Faulty serial protocol in the case of an external multiturn encoder. Cause/remedies see F051 As a general rule, it is necessary to initialize the starting position again => power OFF/ON or switch to the drive settings and back again!!
A022 Inverter temperature	The threshold for tripping an alarm has been exceeded.	- Measure intake air and ambient temperature. - Observe derating curves at theta > 45°C (Compact PLUS) or 40°C derating curves - Check whether the fan is operating - Check whether the air entry and discharge openings are restricted.
A023 Motor temperature	The parameterizable threshold (P380) for tripping an alarm has been exceeded.	Check the motor (load, ventilation, etc.). Read off the current temperature in r009 Motor Temperat.
A025 I2t converter	If the current load state is maintained, a thermal overload of the converter occurs. The converter will lower the max. current limit (P129).	- Reduce converter load - Check r010 (Drive Utiliz)

Number / Alarm	Cause	Counter-measure
A028 Diagnostics counter	The position of an encoder (motor encoder or external encoder) was incorrect for one or more samplings. This can result from EMC faults or a loose contact. When faults start to occur at a certain rate, fault message F51 is triggered by the corresponding fault variable.	For test purposes, fault message F51 can be triggered with the setting P847=2 in order to obtain more information about fault variable r949. All indices can also be monitored in r849 in order to find out which diagnostics counter counts the fault. If alarm A28 is hidden for this fault, then the corresponding index in P848 can be set to 1.
A029 I2t motor	The parameterized limit value for the I2t monitoring of the motor has been exceeded.	Motor load cycle is exceeded! Check the parameters: P382 Motor Cooling P383 Mot Tmp T1 P384 Mot Load Limits
A032 PRBS Overflow	An overflow has occurred during recording with noise generator PRBS	Repeat recording with lower amplitude
A033 Overspeed	The positive or negative maximum speed has been exceeded.	- Increase relevant maximum speed - Reduce regenerative load (see FD 480)
A034 Setpoint/actual value deviation	Bit 8 in r552 status word 1 of the setpoint channel. The difference between freqeuncy setpoint/actual value is greater than the parameterized value and the control monitoring time has elapsed.	Check - whether an excessive torque requirement is present - whether the motor has been dimensioned too small. Increase values P792 Perm Deviation Frq/ set/actual DevSpeed and P794 Deviation Time
A036 Brake checkback "Brake still closed"	The brake checkback indicates the "Brake still closed" state.	Check brake checkback (see FD 470)
A037 Brake checkback "Brake still open"	The brake checkback indicates the "Brake still open" state.	Check brake checkback (see FD 470)
A042 Motor stall/block	Motor is stalled or blocked. The alarm cannot be influenced by P805 "PullOut/BlckTime", but by P794 "Deviation Time"	Check - whether the drive is blocked - Whether the drive has stalled
A049 No slave not Compact PLUS	At serial I/O (SCB1 with SCI1/2), no slave is connected or fiber-optic cable is interrupted or slaves are without voltage.	P690 SSCI AnaIn Conf - Check slave. - Check cable.
A050 Slave incorrect not Compact PLUS	At ser. I/O the slaves required according to a parameterized configuration are not present (slave number or slave type): Analog inputs or outputs or digital inputs or outputs have been parameterized which are not physically present.	Check parameter P693 (analog outputs), P698 (digital outputs). Check connectors K4101...K4103, K4201...K4203 (analog inputs) and binectors B4100...B4115, B4120...B4135, B4200...B4215, B4220...B4235 (digital inputs) for connecting.
A051 Peer baud rate not Compact PLUS	In a peer-to-peer connection a baud rate has been selected which is too high or too different.	Adjust the baud rate in conjunction with the SCB boards P701 SCom/SCB Baud Rate
A052 Peer PcD L not Compact PLUS	In a peer-to-peer connection, a PcD length has been set which is too high (>5).	Reduce number of words P703 SCom/SCB PcD #

Number / Alarm	Cause	Counter-measure
A053 Peer Lng f. not Compact PLUS	In a peer-to-peer connection, the pcD length of transmitter and receiver do not match.	Adjust the word length for transmitter and receiver P703 SCom/SCB PcD #
A057 TB Param not Compact PLUS	Occurs when a TB is logged on and present, but parameter tasks from the PMU, SCom1 or SCom2 have not been answered by the TB within 6 seconds.	Replace TB configuration (software)
A061 Alarm 1 Function blocks	An active signal is present at binector U065 (1).	Check cause of alarm (see FD 710)
A062 Alarm 2 Function blocks	An active signal is present at binector U066 (1).	Check cause of alarm (see FD 710)
A063 Alarm 3 Function blocks	An active signal is present at binector U067 (1).	Check cause of alarm (see FD 710)
A064 Alarm 4 Function blocks	An active signal is present at binector U068 (1).	Check cause of alarm (see FD 710)
A072 Frict Char Init	Automatic initiation of the friction characteristic has been selected, but the drive has not yet been switched on. Note: If the ON command is not given within 30 seconds, the automatic initiation of the friction characteristic is stopped with fault F099.	Energize drive. (Drive status "Operation" 014)
A073 Interr InitFric	Automatic initiation of the friction characteristic has been interrupted (OFF command or fault). Note: If the drive is not switched on again within 5 minutes, the automatic initiation of the friction characteristic is stopped (F099).	Rectifiy any causes of the fault. Re-energize the drive.
A074 Incompl FricChar	Incomplete initiation of friction characteristic. As there is a lack of enables or due to limitations, complete initiation of the friction characteristic is not possible in both directions.	Grant enable for both directions of rotation. Set the speed limitations for both directions such that all characteristic points can be approached.
A075 Ls,Rr Dev.	The measured values of the leakage measurement or of rotor resistance deviate significantly.	If individual measured values significantly deviate from the average values, they are automatically disregarded in the calculation (for RI) or the value of the automatic parameterization remains (for Ls). It is only necessary to check the results for their plausibility in the case of drives with high requirements on torque or speed accuracy.
A078 Stands. Meas	The standstill measurement is executed when the converter is powered up. The motor can align itself several times in a certain direction with this measurement.	If the standstill measurement can be executed without any danger: - Power up the converter.
A081 CB alarm	The following description refers to the 1st CBP. For other CBs or the TB see operating instructions for CB board. The ID byte combinations which are being sent from the DP master in the configuration telegram are not in conformance with the permissible ID byte combinations. (See also Compendium, Chapter 8, Table 8.2-12). Consequence: No connection is made with the PROFIBUS master.	New configuration necessary

Number / Alarm	Cause	Counter-measure
A082 CB alarm	The following description refers to the 1st CBP. For other CBs or the TB see the operating instructions for the CB board. No valid PPO type can be identified from the configuration telegram of the DP master. Consequence: No connection is made with the PROFIBUS master.	New configuration necessary.
A083 CB alarm	The following description refers to the 1st CBP. For other CBs or the TB see the operating instructions for the CB board. No net data or invalid net data (e.g. complete control word STW1=0) are being received from the DP master. Consequence: The process data are not passed on to the dual port RAM. If P722 (P695) is not equal to zero, this will cause the fault message F082 to be tripped.	See operating instructions of the CB board
A084 CB alarm	The following description refers to the 1st CBP. For other CBs or the TB see the operating instructions for the CB board. The telegram traffic between the DP master and the CBP has been interrupted (e.g. cable break, bus cable pulled out or DP master powered down). Consequence: If P722 (P695) is not equal to zero, this will cause the fault message F082 to be tripped.	See operating instructions of the CB board
A085 CB alarm	The following description refers to the 1st CBP. For other CBs or the TB see the operating instructions for the CB board. The CBP does not generate this alarm!	See operating instructions of the CB board
A086 CB alarm	The following description refers to the 1st CBP. For other CBs or the TB see the operating instructions for the CB board. Failure of the heartbeat counter on the basic unit. The heartbeat counter on the basic unit is no longer being incremented. The communication between the CBP and the basic board is disturbed.	See operating instructions of the CB board
A087 CB alarm	The following description refers to the 1st CBP. For other CBs or the TB see the operating instructions for the CB board. Fault in the DPS manager software of the CBP.	See operating instructions of the CB board
A088 CB alarm	See user manual for CB board	See user manual for CB board
A089 CB alarm	See user manual for CB board Alarm of the 2nd CB board corresponds to A81 of the 1st CB board	See user manual for CB board
A090 CB alarm	See user manual for CB board Alarm of the 2nd CB board corresponds to A82 of the 1st CB board	See user manual for CB board
A091 CB alarm	See user manual for CB board Alarm of the 2nd CB board corresponds to A83 of the 1st CB board	See user manual for CB board
A092 CB alarm	See user manual for CB board Alarm of the 2nd CB board corresponds to A84 of the 1st CB board	See user manual for CB board

Number / Alarm	Cause	Counter-measure
A093 CB alarm	See user manual for CB board Alarm of the 2nd CB board corresponds to A85 of the 1st CB board	See user manual for CB board
A094 CB alarm	See user manual for CB board Alarm of the 2nd CB board corresponds to A86 of the 1st CB board	See user manual for CB board
A095 CB alarm	Alarm of the 2nd CB board. Corresponds to A87 of the 1st CB board See operating instructions for CB board	See user manual for CB board
A096 CB alarm	See user manual for CB board Alarm of the 2nd CB board corresponds to A88 of the 1st CB board	See user manual for CB board
A097 TB alarm 1 not Compact PLUS	See user manual for TB board	See user manual for TB board
A098 TB alarm 1 not Compact PLUS	See user manual for TB board	See user manual for TB board
A099 TB alarm 1 not Compact PLUS	See user manual for TB board	See user manual for TB board
A100 TB alarm 1 not Compact PLUS	See user manual for TB board	See user manual for TB board
A101 TB alarm 1 not Compact PLUS	See user manual for TB board	See user manual for TB board
A102 TB alarm 1 not Compact PLUS	See user manual for TB board	See user manual for TB board
A103 TB alarm 1 not Compact PLUS	See user manual for TB board	See user manual for TB board
A104 TB alarm 1 not Compact PLUS	See user manual for TB board	See user manual for TB board
A105 TB alarm 1 not Compact PLUS	See user manual for TB board	See user manual for TB board
A106 TB alarm 1 not Compact PLUS	See user manual for TB board	See user manual for TB board
A107 TB alarm 1 not Compact PLUS	See user manual for TB board	See user manual for TB board

Number / Alarm	Cause	Counter-measure
A108 TB alarm 1 not Compact PLUS	See user manual for TB board	See user manual for TB board
A109 TB alarm 1 not Compact PLUS	See user manual for TB board	See user manual for TB board
A110 TB alarm 1 not Compact PLUS	See user manual for TB board	See user manual for TB board
A111 TB alarm 1 not Compact PLUS	See user manual for TB board	See user manual for TB board
A112 TB alarm 1 not Compact PLUS	See user manual for TB board	See user manual for TB board
A113 TB alarm 2 not Compact PLUS	See user manual for TB board	See user manual for TB board
A114 TB alarm 2 not Compact PLUS	See user manual for TB board	See user manual for TB board
A115 TB alarm 2 not Compact PLUS	See user manual for TB board	See user manual for TB board
A116 TB alarm 2 not Compact PLUS	See user manual for TB board	See user manual for TB board
A117 TB alarm 2 not Compact PLUS	See user manual for TB board	See user manual for TB board
A118 TB alarm 2 not Compact PLUS	See user manual for TB board	See user manual for TB board
A119 TB alarm 2 not Compact PLUS	See user manual for TB board	See user manual for TB board
A120 TB alarm 2 not Compact PLUS	See user manual for TB board	See user manual for TB board

Number / Alarm	Cause	Counter-measure
A121 TB alarm 2 not Compact PLUS	See user manual for TB board	See user manual for TB board
A122 TB alarm 2 not Compact PLUS	See user manual for TB board	See user manual for TB board
A123 TB alarm 2 not Compact PLUS	See user manual for TB board	See user manual for TB board
A124 TB alarm 2 not Compact PLUS	See user manual for TB board	See user manual for TB board
A125 TB alarm 2 not Compact PLUS	See user manual for TB board	See user manual for TB board
A126 TB alarm 2 not Compact PLUS	See user manual for TB board	See user manual for TB board
A127 TB alarm 2 not Compact PLUS	See user manual for TB board	See user manual for TB board
A128 TB alarm 2 not Compact PLUS	See user manual for TB board	See user manual for TB board
A129 Axis does not exist - machine data 1 = 0	Machine data 1 (position encoder type/axis type) is 0 (axis does not exist). Effect: Operation of the axis is inhibited and the position controller is deactivated.	You must assign a valid value to machine data 1 in order to operate the axis.
A130 Operating conditions do not exist	The "in operation [IOP]" checkback signal was missing when a traversing command was initiated. The following causes inhibit the "in operation" checkback signal (status bit No.2, refer to function diagram sheet 200) : -Control signals [OFF1], [OFF2], [OFF3] and/or "enable controller" [ENC] are not activated. -Checkback signals [OFF2] and/or [OFF3] are not activated. -A fault [FAULT] is active. Effect: The traversing command is inhibited.	Activate control signals [OFF1], [OFF2], [OFF3] and "enable controller" [ENC]. -If checkback signals [OFF2] and/or [OFF3] are missing, check the supply of control word 1 (MASTERDRIVES function diagram, sheet 180). -Analyze the queued fault number [FAULT_NO], remedy the fault, and then cancel the fault using the acknowledge fault [ACK_F] control signal. Note: To activate the "in operation" [IOP] status again, you must deactivate [OFF1] and then activate it again.

Number / Alarm	Cause	Counter-measure
A131 OFF1 missing	Control signal [OFF1] was deactivated while a traversing command was being executed. Effect: The drive is brought to a standstill via a ramp (P464 Deceleration Time). There is a subsequent pulse disable. This also valid if P443 =0 (function diagramm 310) and the ramp generator bypass (function diagramm 320) is used.	Check the activation of control signal [OFF1] from the user program.
A132 OFF2 missing	-Control signal [OFF2] was deactivated while a traversing command was being executed. -Checkback signal [OFF2] was deactivated while a traversing command was being executed. Effect: The pulse disable is initiated immediately. If the motor is not braked, it coasts down.	-Check the activation of control signal [OFF2] from the user program. -If checkback signal [OFF2] is missing, check the supply of control word 1 (MASTERDRIVES function diagram, sheet 180). Note: To activate the "in operation" [IOP] status again, you must deactivate [OFF1] and then activate it again.
A133 OFF3 missing	-Control signal [OFF3] was deactivated while a traversing command was being executed. -Checkback signal [OFF3] was deactivated while a traversing command was being executed. Effect: The motor decelerates at the current limit. There is a subsequent pulse disable.	-Check the activation of control signal [OFF3] from the user program. -If checkback signal [OFF3] is missing, check the supply of control word 1 (MASTERDRIVES function diagram, sheet 180). Note: To activate the "in operation" [IOP] status again, you must deactivate [OFF1] and then activate it again.
A134 Enable Controller ENC missing	The "enable controller" [ENC] control signal was deactivated while a traversing command was being executed (control bit No.3 "Inverter Enable", refer to function diagram, sheet 180) Effect: The pulse disable is initiated immediately. If the motor is not braked, it coasts down.	Check the activation of the "enable controller" [ENC] control signal from the user program.
A135 Actual position value not o.k	Actual position value not o.k. from position sensing (B0070 / B0071)	-Check interconnection of B0070 and B0071, -check position encoder and evaluation board, -check encoder cable.
A136 Machine data 1 changed - RESET necessary	Machine data 1 (position encoder type/axis type) was changed. Effect: The activation of traversing commands is inhibited.	If machine data 1 has been changed, the "reset technology" [RST] control signal must be activated. Alternatively switch the MASTERDRIVES electronic power supply off and on again
A137 Axis assignment incorrect	The same axis assignment (machine data 2) was entered for several axes (M7 only, not significant for the F01 technology option). Effect: The activation of traversing commands is inhibited.	A unique axis assignment must be entered for all axes on an M7-FM. For example, it is not allowed to define two X axes.

Number / Alarm	Cause	Counter-measure
A138 Axis assignment of roll feed incorrect	The NC block contains an axis number which is defined as a roll feed axis but the axis type is defined as an incremental or absolute position encoder (machine data 1 = 1 or 2). (M7 only, not significant for the F01 technology option) . The NC block for a roll feed axis type (machine data 1 = 3) contains: -No axis number (X, Y, Z...) -An incorrect axis number Effect: NC program execution is inhibited or aborted.	-Axis type 1 or 2:The block is not allowed to contain an axis number which is defined as a roll feed (M7 only). -Axis type 3:The axis number of the roll feed must be specified in every NC block.
A139 Incorrect parameterization PosTrack MotorEnc	Alarm is tripped only for rotary axis of motor encoder. The bit width of the product of the gear denominator (U810.2 * P116.2) must not be greater than the difference of the 32 bit data width of the flipflop and the multiturn resolution of the encoder. Example: Torque motor with EQN1325 MT: Multiturn resolution = 12 P116: 2/7 U810.2max = 2^(32 - MT)/P116.2 U810.2max = 149796	In accordance with the adjacent formula reduce the gear denominator of P116 and/or U810 respectively.
A140 Following error in standstill	The following error limit for standstill was exceeded at standstill: -Following error monitoring - at standstill (machine data 14) was entered incorrectly. -The value entered for "in position - exact stop window" (machine data 17) is greater than the value in "following error monitoring - at standstill" (machine data 14). -The axis was pushed out of position mechanically. Effect: The position control system is deactivated and the axis decelerates via "deceleration time during errors" (machine data 43).	-Check and correct the machine data. -Optimize the speed/current controller, -Rectify mechanical problem.
A141 Following error in motion	The following error limit for motion was exceeded during a traversing movement: -Following error monitoring - in motion (machine data 15) was entered incorrectly. -The mechanical system cannot follow the commands of the position controller. -Actual position value invalid -Incorrect optimization of the position controller or speed controller. -The mechanical system is sluggish or blocked. Effect: The position control system is deactivated and the drive decelerates via "deceleration time during faults" (machine data 43).	-Check and correct the machine data. -Check the actual position value (speed-controlled operation); check position encoder, evaluator module and encoder lead. -Optimize the position controller or the speed controller. -Check the mechanical system.

Number / Alarm	Cause	Counter-measure
A142 In position - timer monitoring	The "in position - exact stop window" was not reached within the time specified in "in position - timer monitoring": -In position - exact stop window (machine data 17) too small -In position - timer monitoring (machine data 16) too short -Position controller or speed controller not optimized -Mechanical causes Effect: The position control system is deactivated.	-Check and correct the machine data. -Optimize the position controller or speed controller. -Check the mechanical system.
A145 Actual-value disable not allowed - axis standstill	The "digital input" with the "disable actual value" function was actuated while the roll feed was running. Effect: The axis movement is stopped via the deceleration ramp, the "disable actual value" function is not executed.	The "digital input" for "disable actual value" can only be actuated when the axis is stationary.
A146 Direction of movement not allowed	A positioning movement was aborted. When attempting to resume the movement at the point of interruption, the roll feed would have had to travel in the opposite direction to reach the programmed target position. This is inhibited by the setting of machine data 37 "response after abort". There are various possible reasons for the axis crossing the target position when a positioning movement is aborted: -Motor coastdown -The axis was moved intentionally, e.g. in setup mode. Effect: The axis movement is inhibited.	Move the axis in front of the target position in setup mode before continuing.
A148 Deceleration = 0	The current deceleration value is 0, e.g. because of a RAM storage error or an error in the technology firmware. Effect: The position control system is deactivated and the drive is decelerated via the "deceleration time during errors" (machine data 43).	This fault should not normally occur. It is used as an emergency stop feature for the technology software. Replace the hardware (M7; MCT).
A149 Distance to go negative	Internal error in the technology software. Effect: The position control system is deactivated and the drive is decelerated via the "deceleration time during errors" (machine data 43).	This fault should not normally occur. It is used as an emergency stop feature for the technology software.

Number / Alarm	Cause	Counter-measure
A150 Slave axis already allocated to other master axis	The selected NC program contains a slave axis which is already being used by another master axis (M7 only, not significant for the F01 technology option). Example: NC program 1, started in axis X, contains NC blocks for axes X and Y. NC program 2 is started in axis Z and contains NC blocks for axes Z and Y. This program is denied with warning 150, because axis Y is already being used by program 1. Effect: NC program execution is inhibited or aborted.	The same slave axis cannot be used simultaneously by several NC programs.
A151 Slave axis operating mode not allowed	The slave axis required by the master axis is not in "slave" mode (M7 only, not significant for the F01 technology option). Effect: NC program execution is inhibited or aborted, the axis is brought to a standstill via the deceleration ramp.	The slave axis must be switched to "slave" mode.
A152 Slave axis operating mode changed	The "slave" mode was deselected in the slave axis during the traversing movement (M7 only, not significant for the F01 technology option). Effect: NC program execution is inhibited or aborted, the axis is brought to a standstill via the deceleration ramp.	The slave axis must remain switched to "slave" mode.
A153 Error in slave axis	A warning is active in the slave axis required by the master axis (M7 only, not significant for the F01 technology option). Effect: NC program execution is inhibited or aborted, the axis is brought to a standstill via the deceleration ramp.	The NC program will only run if all of the axes it needs are error-free. To clear this warning, you must first clear all the warnings in the slave axis.
A154 Follow-up mode in slave axis active	The "follow-up mode" [FUM] control signal is active in the slave axis required by the master axis. A slave axis which is switched to follow-up mode cannot be operated by the master axis (M7 only, not significant for the F01 technology option). Effect: NC program execution is inhibited or aborted, the axis is brought to a standstill via the deceleration ramp.	Deactivate follow-up mode in the slave axis.
A155 Reset in slave axis active	The "reset" [RST] control signal is active in the slave axis required by the master axis. A slave axis with an active reset cannot be used by the master axis (M7 only, not significant for the F01 technology option. Effect: NC program execution is inhibited or aborted, the axis is brought to a standstill via the deceleration ramp.	Cancel the "reset" [RST] control signal in the slave axis.

Number / Alarm	Cause	Counter-measure
A156 Axis type (MD1) of slave axis not allowed	An NC program was started in which a slave axis is defined as a roll feed axis type (M7 only, not significant for the F01 technology option). The warning is output in the master axis and indicates an illegal axis type in the slave axis. Effect: NC program execution is inhibited or aborted, the axis is brought to a standstill via the deceleration ramp.	Axes defined as roll feed axes can only be used in dedicated NC programs.
A160 Setup speed = 0	The value entered in level 1 or level 2 for the [F_S] velocity level in setup mode is zero. Effect: The axis movement is inhibited.	Define a permissible velocity level for level 1 and/or level 2. The permissible value range is between 0.01 [1000*LU/min] and "traversing velocity - maximum (machine data 23).
A161 Reference approach velocity = 0	The velocity value entered for "reference point - approach velocity" (machine data 7) is zero. Effect: The axis movement is inhibited.	Enter a permissible value for the approach velocity. The permissible value range is between 0.01 [1000*LU/min] and "traversing velocity - maximum (machine data 23).
A162 Reference point - reducing velocity = 0	The velocity value entered for "reference point - reducing velocity" (machine data 6) is zero. Effect: The axis movement is inhibited or stopped.	Enter a permissible value for the reference point -reducing velocity. The permissible value range is between 0.01 and 1000 [1000*LU/min].
A165 MDI block number not allowed	The MDI block number [MDI_NO] specified in the control signals is greater than 11. Effect: The axis movement is inhibited.	Define an MDI block number [MDI_NO] between 0 and 10.
A166 No position has been programmed in MDI mode	The "start" [STA] control signal was activated in MDI mode without initially transferring a positional value to the selected MDI block. Effect: The axis movement is inhibited.	Use the correct sequence: data transfer followed by axis start.
A167 No velocity has been programmed in MDI mode	The "start" [STA] control signal was activated in MDI mode without initially transferring a velocity value to the selected MDI block. Effect: The axis movement is inhibited.	Use the correct sequence: data transfer followed by axis start.
A168 G91 not allowed with MDI on the fly	G91 (incremental dimensions) was defined in the MDI block as the 1st G function for the MDI on-the-fly function. Effect: The axis movement is inhibited or stopped via the deceleration ramp.	The MDI on-the-fly function only allows G90 (absolute dimensions) as the 1st G function.
A169 Start conditions for flying MDI do not exist	-Control signal "reset technology" [RST] activated -Control signal "follow-up mode" [FUM] activated Effect: The "MDI on-the-fly" function is not executed.	Ensure that the control signals are activated correctly.
A170 Single block mode block does not exist	An NC block was started in single-block mode although a block has not yet been transferred. Effect: NC block execution is inhibited.	Transfer the block.

Number / Alarm	Cause	Counter-measure
A172 Program with this number does not exist	The program number specified in [PROG_NO] for automatic mode is not stored in the memory of the technology. Effect: NC program execution is inhibited.	-Transfer the program to the technology. -Select the correct program number.
A173 Program number not allowed	The program number specified in [PROG_NO] for automatic mode is not allowed. Effect: NC program execution is inhibited.	The permissible range for program numbers is between 1 and 200.
A174 Program number changed during traversing	The program number [PROG_NO] was changed while the program was running. Effect: NC program execution is aborted and the axis or axes are brought to a standstill via the deceleration ramp.	The program number must not be changed while the program is running.
A175 No block end programmed	The decoded NC block is not terminated with the following block identifier "0". You can use the "output actual values - decoder error location" task to read out the program number and block number where the block decoder detected an error. Effect: NC program execution is inhibited or aborted. Moving axes are stopped via the deceleration ramp.	Correct the block. The last block in the sequence must contain the following block identifier "0".
A177 Prog. number of block search forwd. does not exist	The program number for the main program (level 0), which was transferred with the block search function, does not exist. Effect: NC program execution is inhibited.	Specify an existing main program number.
A178 Program number of block search forward not allowed	-The program number for the main program (level 0), which was transferred with block search, is different from the selected program number. -No breakpoint is known for the "automatic block search" function (a program abort has not yet occurred). -A different program number is stored as the breakpoint for the "automatic block search" function. Effect: NC program execution is inhibited.	For the block search function, the selected program number [PROG_NO] must be specified as the program number for the main program.
A179 Prog.No.of block srch fwd level 1/2 does not exist	The subprogram number specified with block search for level 1 or level 2 does not exist. Effect: NC program execution is inhibited.	For the block search function, an existing program number must be specified as the subprogram number for level 1 or level 2.
A180 Prog.no. of block search forward level 1 <> cmd.	The subprogram number transferred with block search for level 1 is not the same as the subprogram number in the NC block. Effect: NC program execution is inhibited.	For the block search function, the subprogram number specified in the NC block must be specified as the subprogram number for level 1.
A181 Prog.no. of block search forward level 2 <> cmd.	The subprogram number transferred with block search for level 2 is not the same as the subprogram number in the NC block. Effect: NC program execution is inhibited.	For the block search function, the subprogram number specified in the NC block must be specified as the subprogram number for level 2.

Number / Alarm	Cause	Counter-measure
A183 Block no. of block search fwd l. 0 does not exist	The block number for the main program (level 0), which was transferred with block search, does not exist in the main program. Effect: NC program execution is inhibited.	For the block search function, an existing block number must be specified as the block number for the main program.
A184 Block no. of block search forward is no UP call	The block number for the main program (level 0), which was transferred with block search, does not contain a subprogram call for subprogram level 1. Effect: NC program execution is inhibited.	For the block search function, a block number with a subprogram call must be specified as the block number for the main program (level 0) if a block search is to be performed in subprogram level 1.
A185 Block no. of block search forward does not exist	The block number for subprogram level 1, which was transferred with block search, does not exist in the subprogram. Effect: NC program execution is inhibited.	For the block search function, a block number which exists in this subprogram must be specified as the block number for subprogram level 1.
A186 Block no of block search fwd lev 1 is no SP call	The block number for subprogram level 1, which was transferred with block search, does not contain a subprogram call for subprogram level 2. Effect: NC program execution is inhibited.	For the block search function, a block number with a subprogram call must be specified as the block number for subprogram level 1 if a block search is to be performed in subprogram level 2.
A187 Block no of block search fwd lev 2 does not exist	The block number for subprogram level 2, which was transferred with block search, does not exist in the subprogram. Effect: NC program execution is inhibited.	For the block search function, a block number which exists in this subprogram must be specified as the block number for subprogram level 2.
A188 Rem. loop count bl. search fwd lev1/2 not allowed	The remaining loop count transferred with block search for subprogram level 1 or 2 is greater than the programmed loop count. Effect: NC program execution is inhibited.	For the block search function, it is only allowed to specify a remaining loop count between 0 and the programmed loop count-1.
A190 Digital input not programmed	The NC block which was read in contains the "inprocess measurement" or "set actual value on-the-fly" function, although a digital input has not been programmed for this function (machine data 45). Effect: NC program execution is inhibited or aborted, the axis is brought to a standstill via the deceleration ramp.	Program the digital input for the desired function.
A191 Digital input not actuated	Although the "external block change" function was programmed, the digital input was not actuated in order to trigger the external block change. Effect: The NC program is interrupted, the axis is brought to a standstill via the deceleration ramp.	-Correct the program. -Check the actuation of the digital input.

Number / Alarm	Cause	Counter-measure
A195 Negative overtravel reached	-Negative software limit switch position approached -"Software limit switches - negative" (machine data 12) entered incorrectly -The programmed position is less than the negative software limit switch. -"Reference point - coordinate" (machine data 3) is less than the negative software limit switch. -Incorrect encoder actual value Effect: The axis movement is stopped via the deceleration ramp.	-Check the machine data and the NC program. -Check the encoder actual value.
A196 Positive overtravel reached	-Positive software limit switch position approached -"Software limit switches - positive" (machine data 13) entered incorrectly¨ -The programmed position is greater than the positive software limit switch -"Reference point - coordinate" (machine data 3) is greater than the positive software limit switch -Incorrect encoder actual value Effect: The axis movement is stopped via the deceleration ramp.	-Check the machine data and the NC programs. -Check the encoder actual value.
A200 No position has been programmed in Automatic mode	No position has been programmed in the NC block for the roll feed version, although the axis number of the roll feed is specified. Effect: NC program execution is inhibited or aborted, the axis is brought to a standstill via the deceleration ramp.	The axis number and the positional value must be specified in every NC block for the roll feed version.
A201 No velocity has been programmed in Automatic mode	The decoded NC block needs a path or axis velocity. Effect: NC program execution is inhibited or aborted, the axis is brought to a standstill via the deceleration ramp.	When using linear interpolation with path velocity (G01), a path velocity must be defined with F. When using chaining with axis velocity (G77), the axis velocities must be defined with FX, FY, etc. When using roll feed with axis velocity (G01), the velocity must be defined with F.

Number / Alarm	Cause	Counter-measure
A202 Axis unknown	An axis which does not exist was detected in the decoded NC block. A logical name (X, Y, Z, A, B, C) must be assigned to each axis with machine data 2 (axis assignment). Only these logical axis names can be used in the NC block. These errors cannot normally occur, since the logical axis names are verified when the NC blocks are entered. Exception: Machine data 2 (axis assignment) is changed afterwards. The NC program number and NC block number in which the NC block decoder detected the error can be read out with the "output actual values – decoder error location" task. Effect: NC program execution is inhibited or aborted, the axis is brought to a standstill via the deceleration ramp.	Correct the NC block.
A203 1st G-function not allowed	The NC block which was read in contains an illegal 1st G function. The NC program number and NC block number in which the NC block decoder detected the error can be read out with the "output actual values - decoder error location" task. Effect: The axis movement is inhibited or stopped via the deceleration ramp.	-MDI mode:Only G90 (absolute dimensions) or G91 (incremental dimensions) can be entered as the 1st G function. Only G91 is allowed for the roll feed version. -Automatic/single-block mode:Define a legal 1st G function according to the table (see the Programming Guide).
A204 2nd G-function not allowed	The NC block which was read in contains an illegal 2nd G function. The NC program number and NC block number in which the NC block decoder detected the error can be read out with the "output actual values - decoder error location" task. Effect: The axis movement is inhibited or stopped via the deceleration ramp.	-MDI mode:Only G30 to G39 (acceleration override) can be entered as the 2nd G function. -Automatic/single-block mode:Define a legal 2nd G function according to the table (see the Programming Guide).
A205 3rd G-function not allowed	The NC block which was read in contains an illegal 3rd G function. The NC program number and NC block number in which the NC block decoder detected the error can be read out with the "output actual values - decoder error location" task. Effect: The axis movement is inhibited or stopped via the deceleration ramp.	-MDI mode:No 3rd G function is allowed. -Automatic/single-block mode:Define a legal 3rd G function according to the table (see the Programming Guide).

Number / Alarm	Cause	Counter-measure
A206 4th G-function not allowed	The NC block which was read in contains an illegal 4th G function. The NC program number and NC block number in which the NC block decoder detected the error can be read out with the "output actual values - decoder error location" task. Effect: The axis movement is inhibited or stopped via the deceleration ramp.	-MDI mode:No 4th G function is allowed. -Automatic/single-block mode:Define a legal 4th G function according to the table (see the Programming Guide).
A208 D-number is not allowed	A D number greater than 20 was found in the decoded NC block. The NC program number and NC block number in which the NC block decoder detected the error can be read out with the "output actual values - decoder error location" task. Effect: The axis movement is inhibited or stopped via the deceleration ramp.	Correct the NC block.
A210 Interpolation of 3 axes not allowed	The decoded NC block contains an interpolation of 3 or more axes. The NC program number and NC block number in which the NC block decoder detected the error can be read out with the "output actual values - decoder error location" task. Effect: NC program execution is inhibited or aborted, the axis is brought to a standstill via the deceleration ramp.	Correct the NC block. Only 2D interpolation is allowed.
A211 Shortest distance G68 and G91 not allowed	G function G68 (shortest path for rotary axis) was detected in the decoded NC block, although G91 (incremental dimensions) is active. Example: N10 G91 G68 X20.000 The NC program number and NC block number in which the NC block decoder detected the error can be read out with the "output actual values - decoder error location" task. Effect: NC program execution is inhibited or aborted, the axis is brought to a standstill via the deceleration ramp.	Correct the NC block.Function G68 can only be programmed in association with G90 (absolute dimensions).

Number / Alarm	Cause	Counter-measure
A212 Special function and axis combination not allowed	A different axis was programmed in the NC block following a special function (M7 only). Example: N10 G50 X100 F1000 N15 G90 Y200 incorrect N15 G90 X200 correct The NC program number and NC block number in which the NC block decoder detected the error can be read out with the "output actual values - decoder error location" task. Effect: NC program execution is inhibited or aborted, the axis is brought to a standstill via the deceleration ramp.	Correct the NC program.The axis used in the NC block with the special function must also be programmed in the next NC block.
A213 Multiple D-number not allowed	The decoded NC block contains several D numbers. Example: N1 G41 D3 D5. The NC program number and NC block number in which the NC block decoder detected the error can be read out with the "output actual values - decoder error location" task. Effect: NC program execution is inhibited or aborted, the axis is brought to a standstill via the deceleration ramp.	Correct the NC block.
A214 Multiple acceleration behaviour not allowed	The decoded NC block contains several mutually exclusive G functions from the acceleration override group (G30 to G39). Example: N1 G34 G35 The NC program number and NC block number in which the NC block decoder detected the error can be read out with the "output actual values - decoder error location" task. Effect: NC program execution is inhibited or aborted, the axis is brought to a standstill via the deceleration ramp.	Correct the NC block.
A215 Multiple special functions not allowed	The decoded NC block contains several mutually exclusive G functions from the special function group (G87, G88, G89, G50, G51). Example: N1 G88 G50 The NC program number and NC block number in which the NC block decoder detected the error can be read out with the "output actual values - decoder error location" task. Effect: NC program execution is inhibited or aborted, the axis is brought to a standstill via the deceleration ramp.	Correct the NC block.

Number / Alarm	Cause	Counter-measure
A216 Multiple block transition not allowed	The decoded NC block contains several mutually exclusive G functions from the block transition group (G60, G64, G66, G67). Example: N1 G64 G66 X1.000 FX100.00 The NC program number and NC block number in which the NC block decoder detected the error can be read out with the "output actual values - decoder error location" task. Effect: NC program execution is inhibited or aborted, the axis is brought to a standstill via the deceleration ramp.	Correct the NC block.
A217 Multiple axis programming not allowed	The decoded NC block contains the same axis more than once. Example: N1 G90 G01 X100.000 X200.000 F100.00 The NC program number and NC block number in which the NC block decoder detected the error can be read out with the "output actual values - decoder error location" task. Effect: NC program execution is inhibited or aborted, the axis is brought to a standstill via the deceleration ramp.	Correct the NC block.
A218 Multiple path condition not allowed	The decoded NC block contains several mutually exclusive G functions from the preparatory function group (G00/G01/G76/G77). Example: N1 G01 (linear interpolation) G77 (chaining) X10 F100. The NC program number and NC block number in which the NC block decoder detected the error can be read out with the "output actual values - decoder error location" task. Effect: NC program execution is inhibited or aborted, the axis is brought to a standstill via the deceleration ramp.	Correct the NC block.
A219 Multiple dimensions specification not allowed	The decoded NC block contains several mutually exclusive G functions from the dimensional notation group (G90/G91). Example: N1 G90 G91. The NC program number and NC block number in which the NC block decoder detected the error can be read out with the "output actual values - decoder error location" task. Effect: NC program execution is inhibited or aborted, the axis is brought to a standstill via the deceleration ramp.	Correct the NC block.

Number / Alarm	Cause	Counter-measure
A220 Multiple zero offset selection not allowed	The decoded NC block contains several mutually exclusive G functions from the zero offset group (G53 to G59). Example: N1 G54 G58 The NC program number and NC block number in which the NC block decoder detected the error can be read out with the "output actual values - decoder error location" task. Effect: NC program execution is inhibited or aborted, the axis is brought to a standstill via the deceleration ramp.	Correct the NC block.
A221 Multiple tool offset selection not allowed	The decoded NC block contains several mutually exclusive G functions from the tool offset selection group (G43/G44). Example: N1 G43 G44 D2 The NC program number and NC block number in which the NC block decoder detected the error can be read out with the "output actual values - decoder error location" task. Effect: NC program execution is inhibited or aborted, the axis is brought to a standstill via the deceleration ramp.	Correct the NC block.
A223 Subprogram number does not exist	The decoded NC block contains a subprogram call, however the NC program which was called does not exist in the memory of the technology. Effect: NC program execution is inhibited or aborted, the axis is brought to a standstill via the deceleration ramp.	Correct the NC block.
A224 Subprogram nesting depth not allowed	The permissible nesting depth of subprograms was exceeded. Recursive calling of subprograms. The NC program number and NC block number in which the NC block decoder detected the error can be read out with the "output actual values - decoder error location" task. Effect: NC program execution is inhibited or aborted, the axis is brought to a standstill via the deceleration ramp.	Correct the NC program. The permissible nesting depth for subprograms is 2 subprogram levels.

Number / Alarm	Cause	Counter-measure
A225 Status of collision monitoring select. not allowed	The decoded NC block contains simultaneous selection and deselection of collision monitoring (G96/G97). Example: N1 G96 G97 X100 The NC program number and NC block number in which the NC block decoder detected the error can be read out with the "output actual values - decoder error location" task. Effect: NC program execution is inhibited or aborted, the axis is brought to a standstill via the deceleration ramp.	Correct the NC block.
A227 Negative overtravel violated	The look-ahead function of the decoder has detected that the negative software limit switch will be crossed. See also error message "A195: Negative overtravel reached". The NC program number and NC block number in which the NC block decoder detected the error can be read out with the "output actual values - decoder error location" task. Effect: NC program execution is inhibited or aborted, the axis is brought to a standstill via the deceleration ramp.	Correct the NC program. Check the machine data.
A228 Positive overtravel violated	The look-ahead function of the decoder has detected that the positive software limit switch will be crossed. See also error message "A196: Positive overtravel reached". The NC program number and NC block number in which the NC block decoder detected the error can be read out with the "output actual values - decoder error location" task. Effect: NC program execution is inhibited or aborted, the axis is brought to a standstill via the deceleration ramp.	Correct the NC program. Check the machine data.
A241 Table assignment changed	The table assignment has been changed. Effect: NC tables cannot be processed.	Load the table again. Note: A table can only be loaded again if it is not selected. The warning is cleared automatically when the table has been successfully loaded.
A242 Table 1 invalid	Table 1 was not loaded correctly or has been reset. Effect: Table 1 cannot be processed.	Load table 1 again. Note: Table 1 can only be loaded again if it is not selected. The warning is cleared automatically when table 1 has been successfully loaded.
A243 Table 2 invalid	Table 2 was not loaded correctly or has been reset. Effect: Table 2 cannot be processed.	Load table 2 again. Note: Table 2 can only be loaded again if it is not selected. The warning is cleared automatically when table 2 has been successfully loaded.

Number / Alarm	Cause	Counter-measure
A244 Travel table 3 not valid	Travel table 3 has not been correctly adopted or has been reset. Consequence: Travel table 3 cannot be processed.	Adopt travel table 3 again. Note: Travel table 3 can only be newly adopted if it is not selected. When travel table 3 has been successfully adopted, the alarm message is automatically canceled.
A245 Travel table 4 not valid	Travel table 4 has not been correctly adopted or has been reset. Consequence: Travel table 4 cannot be processed.	Adopt travel table 4 again. Note: Travel table 4 can only be newly adopted if it is not selected. When travel table 4 has been successfully adopted, the alarm message is automatically canceled.
A246 Travel table 5 not valid	Travel table 5 has not been correctly adopted or has been reset. Consequence: Travel table 5 cannot be processed.	Adopt travel table 5 again. Note: Travel table 5 can only be newly adopted if it is not selected. When travel table 5 has been successfully adopted, the alarm message is automatically canceled.
A247 Travel table 6 not valid	Travel table 6 has not been correctly adopted or has been reset. Consequence: Travel table 6 cannot be processed.	Adopt travel table 6 again. Note: Travel table 6 can only be newly adopted if it is not selected. When travel table 6 has been successfully adopted, the alarm message is automatically canceled.
A248 Travel table 7 not valid	Travel table 7 has not been correctly adopted or has been reset. Consequence: Travel table 7 cannot be processed.	Adopt travel table 7 again. Note: Travel table 7 can only be newly adopted if it is not selected. When travel table 7 has been successfully adopted, the alarm message is automatically canceled.
A249 Travel table 8 not valid	Travel table 8 has not been correctly adopted or has been reset. Consequence: Travel table 8 cannot be processed.	Adopt travel table 8 again. Note: Travel table 8 can only be newly adopted if it is not selected. When travel table 8 has been successfully adopted, the alarm message is automatically canceled.

Table 12-2 Alarm numbers, causes and their counter-measures

12.3 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.

Number / Fault	Cause	Counter-measure
FF01 Time slot overflow	A time slot overflow which cannot be remedied has been detected in the high-priority time slots. At least 40 failures of time slots T2, T3, T4 or T5 (see also parameter r829.2 to r829.5)	- Reduce pulse frequency (P340) - Replace CU
FF03 Access fault Optional board	Serious faults have occurred while accessing external option boards (CB, TB, SCB, TSY ..).	- Replace CU, or replace the unit (Compact PLUS type) - Replace the LBA - Replace the option board
FF04 RAM	A fault has occurred during the test of the RAM.	- Replace CU, or replace the unit (Compact PLUS type)
FF05 EPROM fault	A fault has occurred during the test of the EPROM.	- Replace CU, or replace the unit (Compact PLUS type)
FF06 Stack overflow	Stack has overflowed	For VC: Increase sampling time (P357) For MC: Reduce pulse frequency (P340) - Replace CU, or replace the unit (Compact PLUS type)
FF07 Stack Underflow	Stack underflow	- Replace CU, or replace the unit (Compact PLUS type) - Replace firmware
FF08 Undefined Opcode	Invalid processor command should be processed	- Replace CU, or replace the unit (Compact PLUS type) - Replace firmware
FF09 Protection Fault	Invalid format in a protected processor command	- Replace CU, or replace the unit (Compact PLUS type) - Replace firmware
FF10 Illegal Word Operand Address	Word access to uneven address	- Replace CU, or replace the unit (Compact PLUS type) - Replace firmware
FF11 Illegal Instruction Access	Jump command to uneven address	- Replace CU, or replace the unit (Compact PLUS type) - Replace firmware
FF13 Wrong firmware version	A version conflict between the firmware and the hardware has occurred.	- Replace firmware - Replace CU, or replace the unit (Compact PLUS type)
FF14 FF processing	Unexpected fatal error (During processing of the fatal errors, a fault number has occurred which is unknown to date).	Replace the board
FF15 CSTACK_OVERFLOW	Stack overflow (C-Compiler Stack)	Replace the board
FF16 NMI error not Compact PLUS	NMI	- Replace firmware - Replace CU, or replace the unit (Compact PLUS type)

Table 12-3 Fatal errors

13 Environmental Friendliness

Environmental aspects during the 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 support panel LOGO
LDPE:	Capacitor ring
PA6.6:	Fuse holders, mounting rail, capacitor holder, cable retainer, connecting strips, terminal strip, supports, PMU adapter, covers, cable holder
PC:	Covers
PP:	Insulating boards bus retrofit
PS:	Fan housing
UP:	Tensioning profile retaining bolts, tensioning disk

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

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

Environmental aspects during production

Purchased components are generally supplied in recyclable packaging materials (board).

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.

After the service life has expired, the product must be disposed of in accordance with the applicable national regulations.

Bisher sind folgende Ausgaben erschienen:
The following versions have been published so far:

Ausgabe Version	interne Sachnummer Internal item number
AA	476 957 4170 76 J AA-74
AB	476 957 4170 76 J AB-74
AC	476 957 4170 76 J AC-74
AD	A5E00394433
AE	A5E00394433
AF	A5E00394433

Ausgabe AF besteht aus folgenden Kapiteln:

Kapitel		Änderungen	Seiten-zahl	Ausgabe-datum
1	Definitionen und Warnungen	überarbeitete Ausgabe	6	08.2008
2	Beschre ibung	überarbeitete Ausgabe	1	06.2006
3	Erstinbetri ebsetzung	überarbeitete Ausgabe	1	06.2006
4	Transportieren, Lagern, Auspacken über	arbeitete Ausgabe	2	06.2006
5	Montag e	überarbeitete Ausgabe	11	06.2006
6	EMV-gerec hter Aufbau	überarbeitete Ausgabe	6	06.2006
7	Anschl ießen	überarbeitete Ausgabe	17	08.2008
8	Parametri erung	überarbeitete Ausgabe	52	06.2006
9	W artung	überarbeitete Ausgabe	4	08.2008
10	F ormieren	überarbeitete Ausgabe	2	06.2006
11	T echnische Daten	überarbeitete Ausgabe	23	08.2008
12	Störungen und Warnungen	überarbeitete Ausgabe	38	06.2006
13	Um weltverträglichkeit	überarbeitete Ausgabe	1	06.2006

Version AF consists of the following chapters:

Chapter		Changes	Pages	Version date
1	Definitions and Warnings	reviewed edition	6	08.2008
2	Descripti on	reviewed edition	1	06.2006
3	Transport, Storage, Unpacking	reviewed edition	2	06.2006
4	First Start-up	reviewed edition	1	06.2006
5	Installati on	reviewed edition	11	06.2006
6	Installation in Conformance with EMC Regulations	reviewed edition	6	06.2006
7	Con necting-up	reviewed edition	17	08.2008
8	Parameter ization	reviewed edition	52	06.2006
9	Mainte nance	reviewed edition	4	08.2008
10	F orming	reviewed edition	2	06.2006
11	Technical Data	reviewed edition	23	08.2008
12	Faults and Warnings	reviewed edition	36	06.2006
13	Environmental Friendliness	reviewed edition	1	06.2006

Änderungen von Funktionen, technischen Daten, Normen, Zeichnungen und Parametern vorbehalten.

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

Wir haben den Inhalt der Druckschrift auf Übereinstimmung mit der beschriebenen Hard- und Software überprüft. Dennoch können Abweichungen nicht ausgeschlossen werden, so dass wir für die vollständige Übereinstimmung keine Garantie übernehmen. Die Angaben in dieser Druckschrift werden jedoch regelmäßig überprüft und notwendige Korrekturen sind in den nachfolgenden Auflagen enthalten. Für Verbesserungsvorschläge sind wir dankbar.

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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.

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SIEMENS

Vector Control

Wechselrichter (DC-AC) Bauform Einbaugerät

Inverter (DC-AC) Chassis Type

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

indicates an **imminently** hazardous situation which, if not avoided, will result in death, serious injury and considerable damage to property.

WARNING

indicates a **potentially** hazardous situation which, if not avoided, could result in death, serious injury and considerable damage to property.

CAUTION

used with the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

CAUTION

used without safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

NOTICE

NOTICE used without the safety alert symbol indicates a potential situation which, if not avoided, may result in an undesirable result or state.

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.

Proper use of Siemens products

WARNING

Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be adhered to. The information in the relevant documentation must be observed.

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.

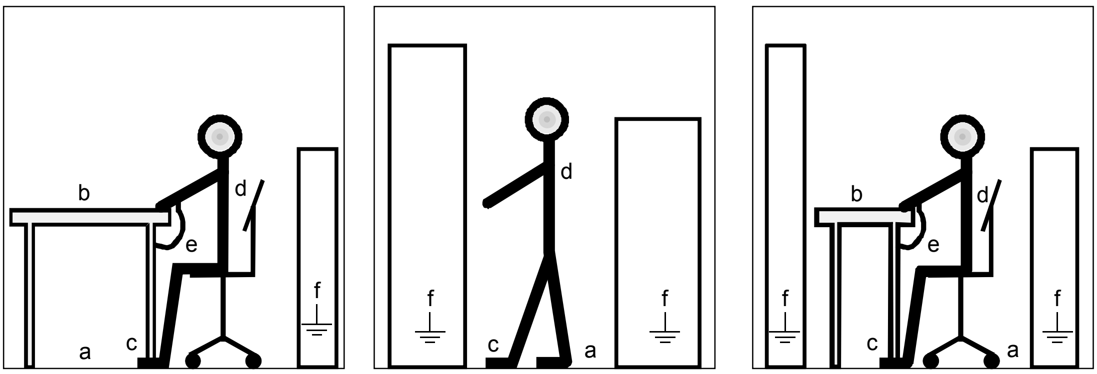
Boards must only be placed on conductive surfaces.

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



Sitting **Standing** **Standing / Sitting**

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 commissioninng as well as maintenance are to be carried out by **skilled technical personnel** (Observe IEC 60364 or CENELEC HD 384 or DIN VDE 0100 and IEC 60664 or DIN VDE0110 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 directive 98/37/EG (Machinery Safety Directive - MSD). Account is to be taken of EN 60204.

Commissioning (i.e. the starting of normal opertion) 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 EN 50178 / DIN VDE 0160 in conjunction with EN 60439-1 / DIN VDE 0660 part 500 and EN 60146 / 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 EN 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 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. Electric 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. BGV A3) 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, like screening, earthing, 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 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 control 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 admissible.

After disconnection of the drive converter from the voltage supply, live appliance parts and power terminals must not be touched immediately because of possibly energized capacitors. In this respect, 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!

Residual risks of Power Drive Systems (PDS)

DANGER

The components for the controller and drive of a Power Drive System (PDS) are authorized for industrial and commercial use in industrial networks. Their use in public networks requires a different planning and/or additional measures.

It is only permissible to operate these components in enclosed housings or in superordinate control cabinets and when all protective devices and protective covers are used.

These components may only be handled by qualified and trained specialist persons who are familiar with and observe all the safety instructions on the components and in the relevant technical user documentation.

The machine manufacturer must take into account the following residual risks resulting from the components for the controller and drive of a Power Drive System (PDS) when evaluating the risk of his machine in accordance with the EC machinery guideline.

1. Undesired movements of driven machine components during commissioning, operation, maintenance and repair, e.g. as a result of
   - HW and/or SW errors in the sensors, controller, actuators and connection system
   - Reaction times of the controller and the drive
   - Operation and/or ambient conditions not compliant with the specification
   - Errors in parameterization, programming, wiring and installation
   - Use of radio units/mobile phones in the direct vicinity of the controller
   - External influences/damage.
2. Extraordinary temperatures and emissions of light, noises, particles and gases, e.g. as a result of
   - Component failure
   - Software errors
   - Operation and/or ambient conditions not compliant with the specification
   - External influences/damage.
3. Dangerous contact voltages, e.g. as a result of
   - Component failure
   - Influence upon electrostatic charging
   - Induction of voltages in the case of moving motors
   - Operation and/or ambient conditions not compliant with the specification
   - Condensation/conductive contamination
   - External influences/damage.
4. Operational electrical, magnetic and electromagnetic fields that may pose a risk to people with a pacemaker, implants or metallic items if they are too close.
5. Release of pollutants and emissions if components are not operated or disposed of properly.

For additional information on the residual risks emanating from the components of the PDS, please refer to the relevant chapters of the technical user documentation.

DANGER

Electrical, magnetic and electromagnetic fields (EMF) that occur during operation can pose a danger to persons who are present in the direct vicinity of the product – especially persons with pacemakers, implants, or similar devices.

The relevant directives and standards must be observed by the machine/plant operators and persons present in the vicinity of the product. These are, for example, EMF Directive 2004/40/EEC and standards EN 12198-1 to -3 pertinent to the European Economic Area (EEA), as well as accident prevention code BGV 11 and the associated rule BGR 11 "Electromagnetic fields" of the German employer's liability accident insurance association pertinent to Germany.

These state that a hazard analysis must be drawn up for every workplace, from which measures for reducing dangers and their impact on persons are derived and applied, and exposure and danger zones are defined and observed.

The safety information in the Storage, Transport, Installation, Commissioning, Operation, Maintenance, Disassembly and Disposal sections must also be taken into account.

2 Description

From the DC voltage at terminals C/L+ and D/L-, inverters generate a three-phase system of variable output frequency with the method of pulse width modulation (PWM) for feeding three-phase motors at terminals U2/T1, V2/T2, W2/T3.

When the DC link is charged the control board is supplied with voltage by an integral power supply unit. If the DC link is discharged, the control board can be fed via an external 24 V supply at terminal X9.

The unit functions are controlled by the software on the control board.

The unit can be operated via the PMU operator control panel, the user-friendly OP1S operator control panel, the terminal strip or via a bus system. Option boards can be used to expand the unit's functions.

Pulse encoders and analog tachometers can be used as motor encoders.

The power section and the electronics of the inverter are cooled by a fan. The customer must connect up 230 V AC (50/60 Hz) to the terminals X18/1...5 to supply the fan.

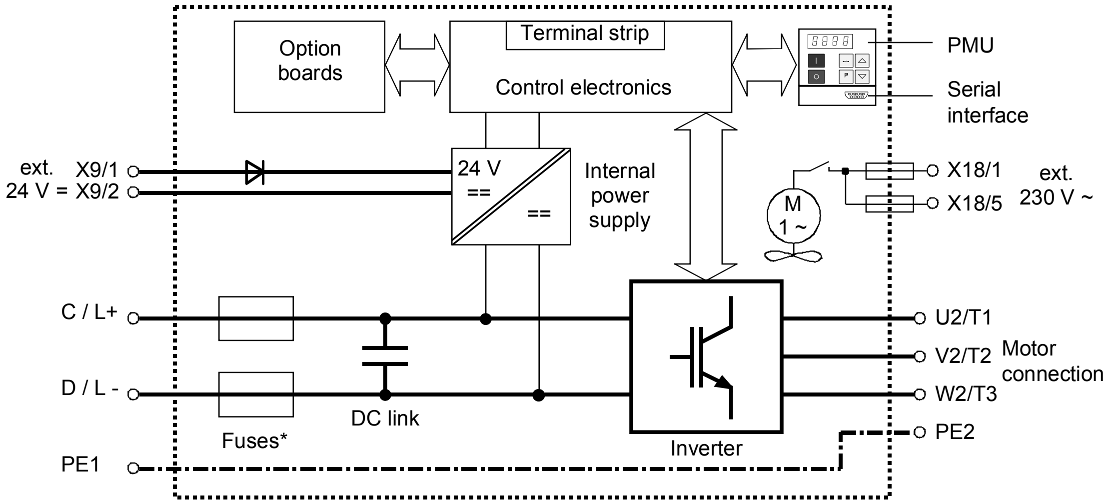


Fig. 2-1 Circuit principle of the inverter

***NOTE**	The fuses are an option in the case of types E to G!

3 First 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 the label (on the outside of the packaging) to ensure that the unit is complete and that the correct option boards have been fitted.	See section "Transport, Storage, Unpacking"
Mount the unit and install option boards which have not yet been fitted ↓	Retrofit any option 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"
Form the DC link capacitors, if necessary ↓	If the DC link of the unit was de-energized for more than one year, you have to newly form the DC link capacitors	See section "Forming"
Connect the protective conductor, the power cables or buses and, if present, the ext. 24 V supply ↓	Starting with the protective conductor please connect the power cables or DC link buses and the 230 V AC for the fan. If configured, also connect the external 24 V supply. Pay attention to the EMC instructions when laying the cables. Please do not at this stage connect any control, communication, encoder and motor cables (exception: cable for connecting up an OP1S, if parameterization is to be effected via the OP1S).	See section "Connecting-up" and "Installation in Conformance with EMC Regulations"
Connect the control cables, communication cables, encoder cables and motor cables ↓	Please connect the remaining control, communication, encoder and motor cables. Pay attention to the EMC instructions when laying the cables. **WARNING** ⚠ The device must be **disconnected** from its voltage supplies (24 V DC electronics supply **and** DC link / mains voltage) before the control and encoder leads are connected or disconnected! Failure to observe this advice can result in encoder defects, which may in turn cause uncontrolled axis movements.	See section "Connecting-up" and "Installation in Conformance with EMC Regulations"
Power up the external 24 V supply or the line voltage ↓	After checking that the cabling has been correctly connected and that it sits properly, power up the external 24 V supply or the line voltage. 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.	

Step	Description	Reference
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"
↓		
Parameterizing by download or with parameter modules		See section "Parameterization"
↓		
De-energize 24 V supply or line voltage		
↓		
Function test	After checking the unit and the cabling once more, power up the line voltage or DC bus voltage and perform a function test according to your parameterization.	
↓		

WARNING

It must be ensured that no danger for persons and equipment can occur by energizing the power and the unit. It is recommended not to couple the driven machine until the function test has been successfully completed.

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.

CAUTION

If the storage period of one year is exceeded, the unit must be newly formed. See Section “Forming".

Unpacking

The packaging comprises a wooden base, board and corrugated paper. It can be disposed of corresponding to the appropriate local regulations. After the consignment has been unpacked and checked to ensure that everything is complete and not damaged, the units and components can be installed and commissioned. Depending on the degree of protection and type of construction, the units are mounted on a pallet either with or without transport rails.

Type of construction	Pallet
E, F, G, J, K, L	One unit per type of construction
M • Master • Reactor • Slave	Three units Converter type K Converter type K without electronics box
N • Master • Slave	Two units Converter type L Converter type L without electronics box
Q • Master • Slave	Two units Converter type K Converter type K without electronics box

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.

NOTE

MASTERDRIVES components are designed in accordance with degree of protection IP20 or IPXXB in accordance with EN 60529 and as open-type devices to UL 50, thus providing protection against electrical shocks. In order to also ensure protection against mechanical and climatic stresses the components have to be operated in housings/cabinets/rooms that are designed according to the requirements of' EN 60529 and classified as enclosure type to UL 50.

Clearances

When positioning the units, it must be observed that the DC link connection is located at the top section of the unit and the motor connection at the lower section of the unit.

The units can be mounted flush with each other.

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

Please refer to the dimension drawings on the following pages regarding 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

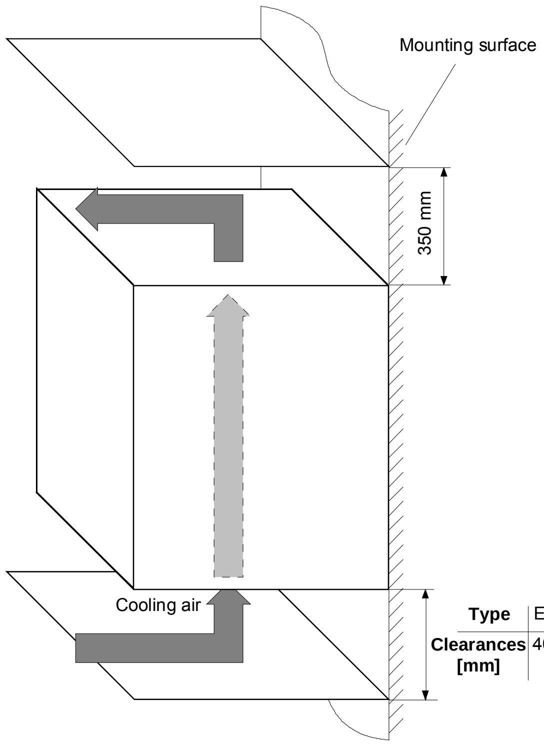
- Forei gn particles
  The units must be protected against the ingress of foreign particles as otherwise their function and operational safety cannot be ensured.
- Dust, gases, vapors
  Equipment rooms must be dry and dust-free. Ambient and cooling air must not contain any electrically conductive gases, vapors and dusts which could diminish the functionality. If necessary, filters should be used or other corrective measures taken.
- Cooli ng air
  The ambient climate of the units must not exceed the values of 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.

NOTE for types E to G

MASTERDRIVES chassis units are CE designated products with standard IP00 degree of protection.
When installed in a cabinet, an additional direct touch protection is necessary. IEC60204-1 6.2 must be observed meticulously.

For types E to G there is the option M20 for IP20 degree of protection.

5.1.1 Installing units of types E, F, G



Type	E,F	G
Clearances [mm]	400	320

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

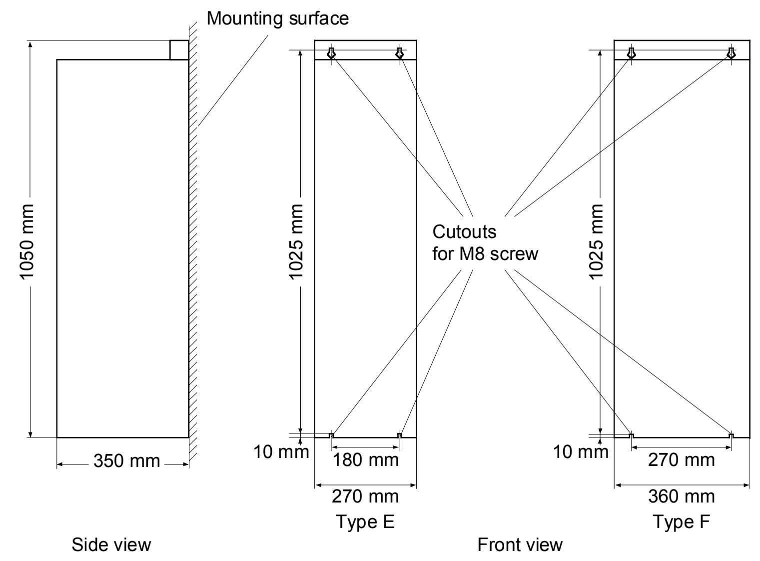


Fig. 5-2 Dimension drawing for types E, F

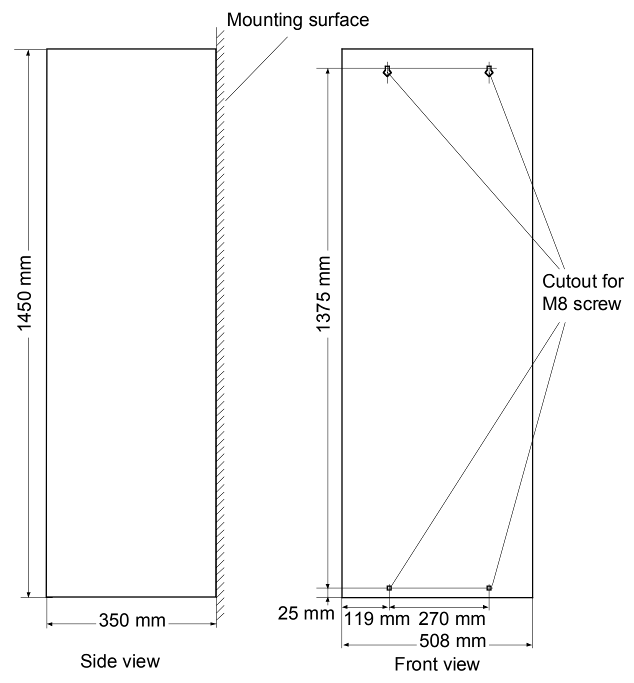
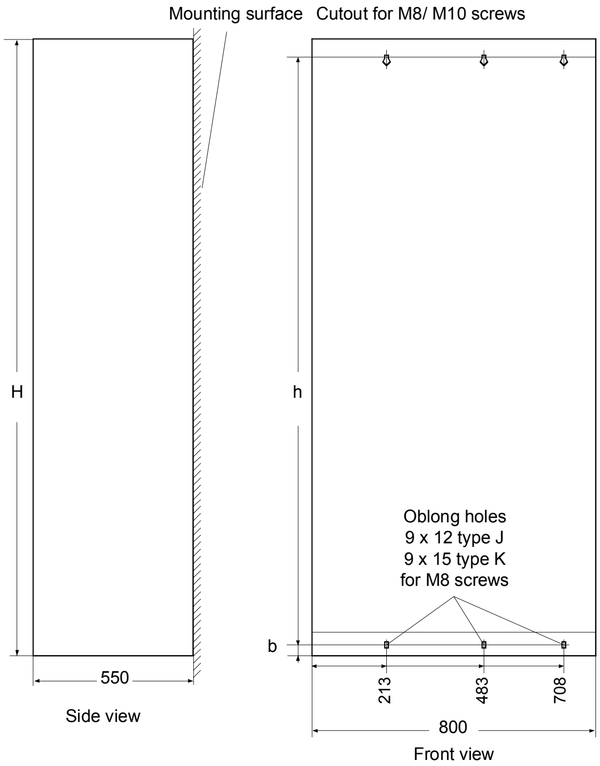


Fig. 5-3 Dimension drawing for type G

5.1.2 Installing units of type J upwards



Dimensions [mm]	Type J	Type K
H	1400	1730
h	1345	1675
b	45	25

Fig. 5-4 Dimension drawing for types J, K

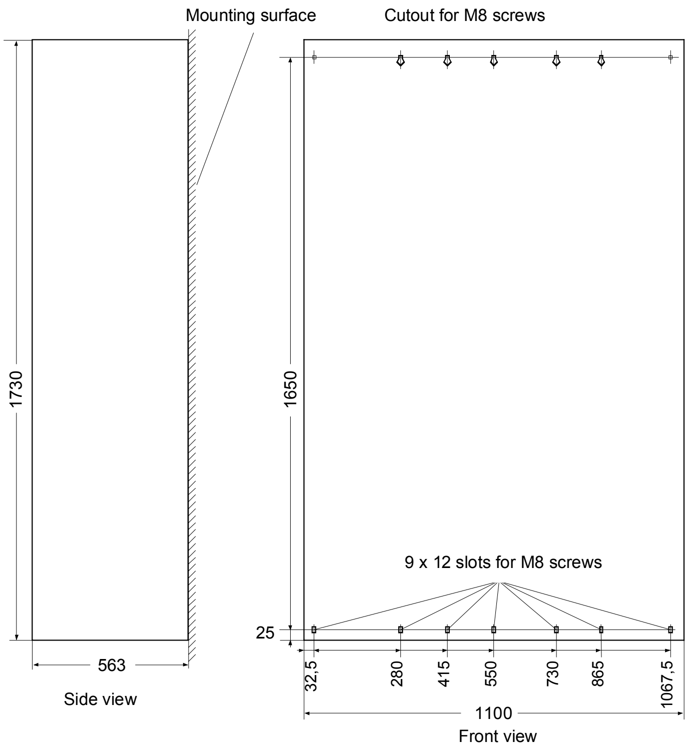


Fig. 5-5 Dimension drawing for type L

5.1.3 Mounting units of types M, N and Q

The three units of type M as well as the two units of type N or Q with degree of protection IP00 must be assembled as described in the project planning guide or the accompanying instructions (type M: parts list and exploded view).

The dimension drawings of the individual chassis give the spacings and postions of the mounting cutouts / slots.

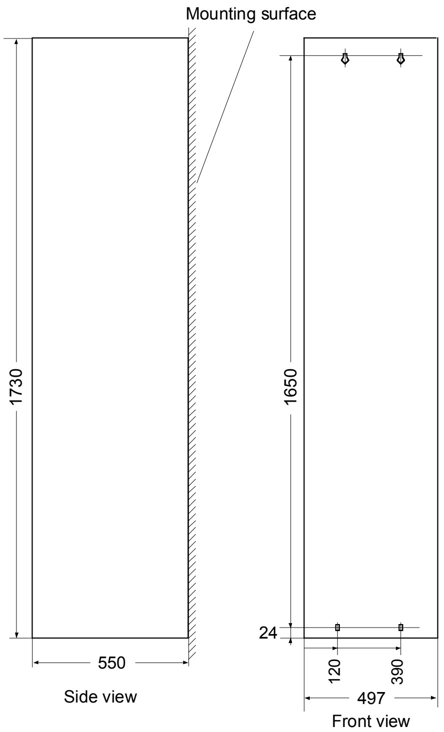


Fig. 5-6 Dimension drawing of reactor chassis

The control connections must then be made between master and slave:

- ♦ Carefully lay the control lines together (through the cable duct in the reactor chassis in the case of type M) into the master cabinet.
  - Plug connector insert -X238 / -X234 / -X32 / -X42
  - Fiber optic cable insert U41 / U51 / U61 / U42 / U43 / U52 / U53 / U62 / U63 in the master on the IPI

NOTE

Plugging in the fiber optic cables:
Push in the fiber optic cables as far as they will go (approx. 16 mm), and tighten union nut finger tight.

CAUTION

Fiber optic cables must not be kinked.

Bending radius for fiber optic cables ≥ 30 mm.

Air cooling

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.

The figure shows the necessary **partition measures**. 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.

The necessary **opening cross-sections** are indicated in the table.

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
13509 Berlin 27
Telephone: (030) 4381-0
Fax: (030) 4381-222

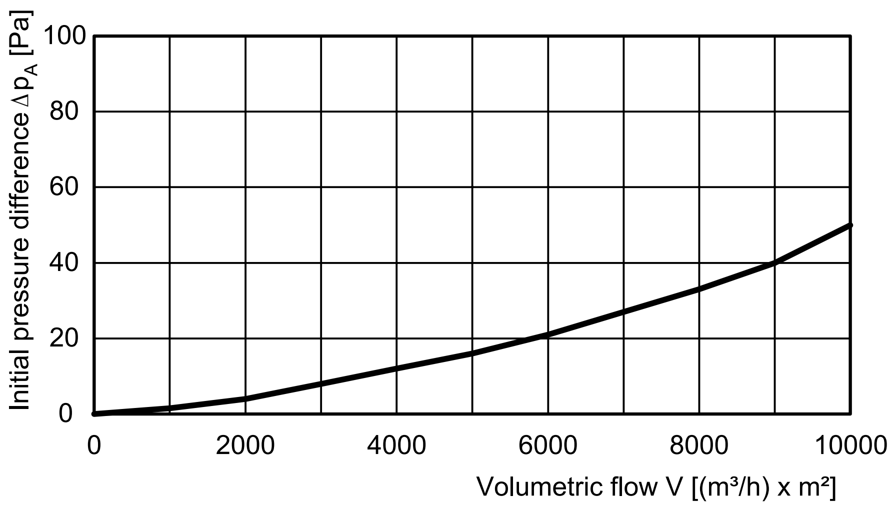


Fig. 5-7 Data sheet of the filter mat

Notes regarding type L:

An "active" roof section should be used for types of protection higher than IP20.

This roof section contains fans which blow the air out to the front.

For this purpose, fans which accomplish a volumetric flow of 1m³/s at a pressure of 80 Pa are required (e.g. 3 Nos. EBM W2E250HL06-01 in parallel). Except for the air outlets of these fans, the roof section is closed.

In order to enable adequate convection to be obtained in the range of the output bars, a directed (low) arcing short-circuit has to be accepted. For this, 5 holes each having a 100 mm^2 cross-sectional area must be made in the partition plate above the termination panel on the right-hand side of the unit. (See following diagram).

Fans, volumetric flow, opening cross-sections per inverter unit

	Number of inverters				
MLFB	1 x	6SE70xx-xTJ60 6SE70xx-xUJ60 6SE70xx-xWJ60	6SE703x-xTK60 6SE703x-xUK60 6SE703x-xWK60	6SE7041-1TK60 6SE7038-6UK60 6SE7038-6WK60	6SE7041-xTL60 6SE7041-xUL60 6SE7041-xWL60
	2 x	6SE7041-6	TM60	6SE7041-xUM60 6SE7041-xWM60 6SE7042-1TM60	6SE7042-5TN60 6SE7042-xUN60 6SE7042-xWN60
Fan		1 x RH28M	2 x RH28M	RH35B	RH35B
Minimum volumetric flow [m^3/s] 0.46			0.6	0.88	0.95
Min. opening cross-section in the cabinet doors [m^2] Type of protection IP00 to IP42		0.26	0.26	0.28	0.38
Min. opening cross-section in the top cover [m^2] Type of protection < IP20		0.26	0.26	0.28	0.38
Min. opening cross-section in the roof section [m^2] Type of protection IP22 to IP42		0.26	0.26	0.28	0.2 + fan (see construction type L)

Table 5-1 Fans, volumetric flow, opening cross-sections

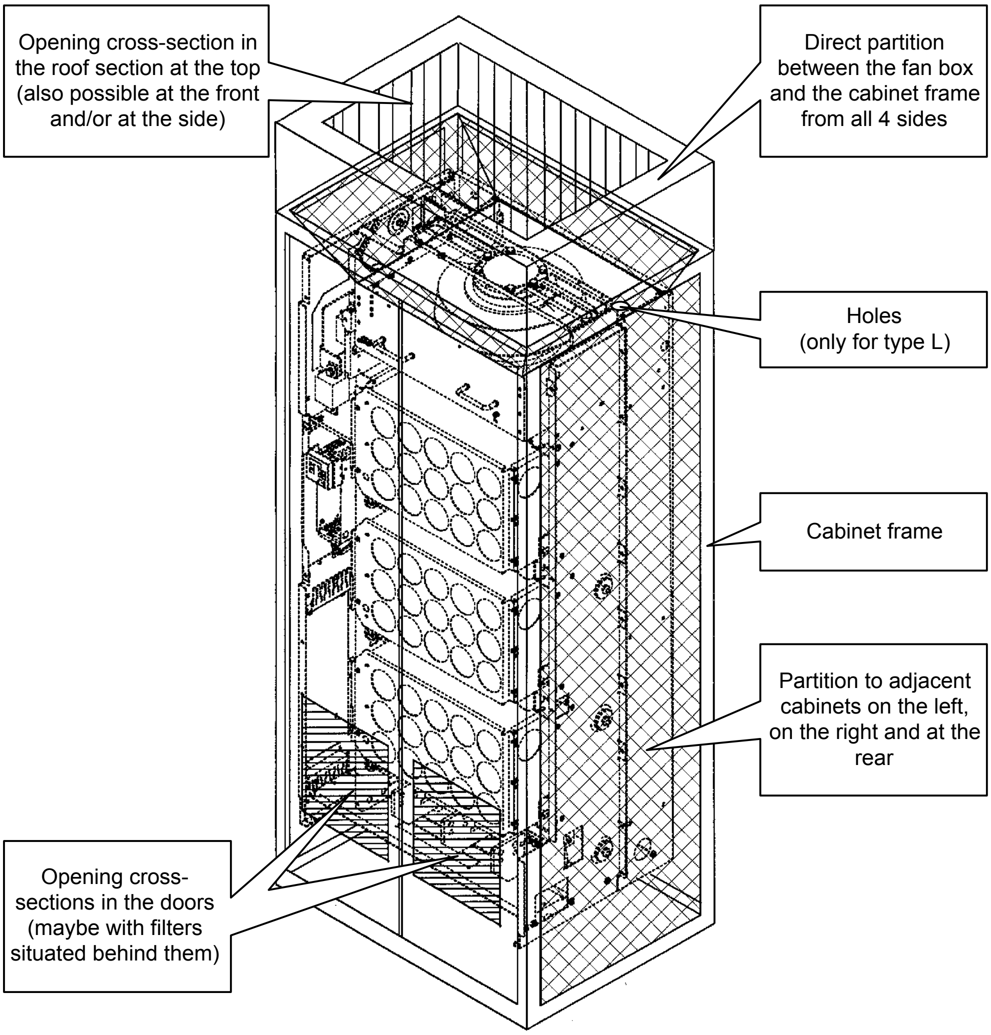


Fig. 5-8 Partition measures

Water cooling

The units with water cooling (MLFB Annex: -1AA0 / -1AA1) are suitable for installing in an enclosed cabinet (IP54). 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.

Implementation of the DC 24 V auxiliary supply

In order to ensure that the units can function satisfactorily (in view of electromagnetic influences), it may be necessary to provide each chassis unit with its own DC 24 V auxiliary supply with an isolating transformer.

In the case of type M, N, Q the DC 24 V supply for master and slave can be arranged as a joint infeed if the 24 V cable to the slave is in the envisaged shield duct.

5.2 Installing the option boards

CAUTION

The boards may only be replaced by qualified personnel.

It is not permitted to withdraw or insert the boards under voltage.

Slots

A maximum of six slots are available in the electronics box of the unit for installing option boards. The slots are designated with the letters A to G. Slot B is not provided in the electronics box. It is used in units of the Compact PLUS type of construction.

If you wish to use slots D to G, you will additionally require the following:

- ♦ Bus expansion LBA (Local Bus Adapter), which is used for mounting the CU board and up to two adaption boards, and
- ♦ An adaption board (ADB - Adaption Board) on which up to two option boards can be mounted.

The slots are situated at the following positions:

♦ Slot A	CU board	Position: top
♦ Slot C	CU board	Position: bottom
♦ Slot D	Adaption board at mounting position 2	Position: top
♦ Slot E	Adaption board at mounting position 2	Position: bottom
♦ Slot F	Adaption board at mounting position 3	Position: top
♦ Slot G	Adaption board at mounting position 3	Position: bottom

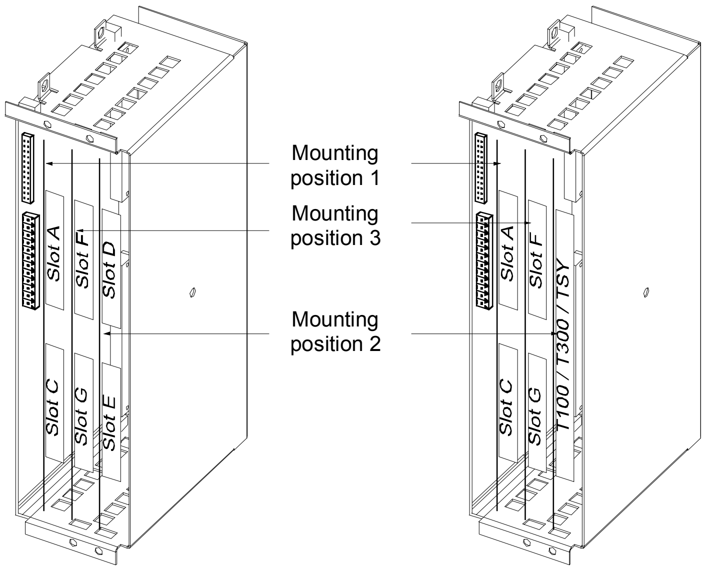


Fig. 5-9 Position of the slots for Compact and chassis type units

NOTE

Mounting position 2 can be used for technology boards (T100, T300, TSY).

Mounting positions 2 and 3 can also be used for communication boards SCB1 and SCB2.

DANGER

The unit has hazardous voltage levels up to 5 minutes after it has been powered down due to the DC link capacitors. The unit or the DC link terminals must not be worked on until at least after this delay time.

CAUTION

The option boards contain components which could be damaged by electrostatic discharge. These components can be very easily destroyed if not handled with caution. You must observe the ESD cautionary measures when handling these boards.

Disconnecting the unit from the supply

DANGER

Disconnect the unit from the incoming power supply (AC or DC supply) and de-energize the unit. Remove the 24 V voltage supply for the electronics. Take off all connecting leads.

Open the front panel.

Preparing installation

Remove the CU board or the adaption board from the electronics box as follows:

- Disconnect the connecting cables to the CU board or to the option boards.
- Undo the fixing screws on the handles above and below the CU board or the adaption board.
- Pull the CU board or the adaption board out of the electronics box using the handles.
- Place the CU board or the adaption board on a grounded working surface.

Installing the option board

Insert the option board from the right onto the 64-pole system connector on the CU board or on the adaption board. The view shows the installed state.

Screw the option board tight at the fixing points in the front section of the option board using the two screws attached.

NOTE

The option board must be pressed tightly onto the plug connector, it is not sufficient to simply tighten the screws!

Re-installing the unit

Re-install the CU board or the adaption board in the electronics box as follows:

- ♦ Insert the CU board into mounting position 1 and the adaption board into mounting position 2 or 3.

NOTE

The mounting position 3 can only be used when an adaption board or a technology board has been mounted in mounting position 2. Boards should first be installed in mounting position 2, before mounting position 3 is used.

- ♦ Secure the CU board/adaption board at the handles with the fixing screws.

Re-connect the previously removed connections.

Check that all the connecting cables and the shield sit properly and are in the correct position.

6 Design of drives in conformance with EMC regulations

Basic EMC rules

Rules 1 to 13 are generally applicable. Rules 14 to 20 are particularly important for limiting noise emission.

Rule 1 All of the metal cabinet parts must be connected through the largest possible surface areas (not paint on paint). If required, use serrated washers. The cabinet door must be connected to the cabinet through grounding straps which must be kept as short as possible.

NOTE Grounding installations/machines is essentially a protective measure. However, in the case of drive systems, this also has an influence on the noise emission and noise immunity. A system can either be grounded in a star configuration or each component grounded separately. Preference should be given to the latter grounding system in the case of drive systems, i.e. all parts of the installation to be grounded are connected through their surface or in a mesh pattern.

Rule 2 Signal cables and power cables must be routed separately (to eliminate coupled-in noise). Minimum clearance: 20 cm. Provide partitions between power cables and signal cables. The partitions must be grounded at several points along their length.

Rule 3 Contactors, relays, solenoid valves, electromechanical operating hours counters, etc. in the cabinet must be provided with quenching elements, for example, RC elements, diodes, varistors. These quenching devices must be connected directly at the coil.

Rule 4 Non-shielded cables associated with the same circuit (outgoing and incoming conductor) must be twisted, or the surface between the outgoing and incoming conductors kept as small as possible in order to prevent unnecessary coupling effects.

Rule 5 Eliminate any unnecessary cable lengths to keep coupling capacitances and inductances low.

Rule 6 Connect the reserve cables/conductors to ground at both ends to achieve an additional shielding effect.

Rule 7 In general, it is possible to reduce the noise being coupled-in by routing cables close to grounded cabinet panels. Therefore, wiring should be routed as close as possible to the cabinet housing and the mounting panels and not freely through the cabinet. The same applies for reserve cables/conductors.

Rule 8 Tachometers, encoders or resolvers must be connected through a shielded cable. The shield must be connected to the tachometer, encoder or resolver and at the SIMOVERT MASTERDRIVES through a large surface area. The shield must not be interrupted, e.g. using intermediate terminals. Pre-assembled cables with multiple shields should be used for encoders and resolvers (see Catalog DA65).

Rule 9

The cable shields of digital signal cables must be connected to ground at both ends (transmitter and receiver) through the largest possible surface area. If the equipotential bonding is poor between the shield connections, an additional equipotential bonding conductor with at least 10 mm² must be connected in parallel to the shield, to reduce the shield current. Generally, the shields can be connected to ground (= cabinet housing) in several places. The shields can also be connected to ground at several locations, even outside the cabinet.

Foil-type shields are not to be favoured. They do not shield as well as braided shields; they are poorer by a factor of at least 5.

Rule 10

The cable shields of **analog** signal cables can be connected to ground at both ends if the equipotential bonding is good. Good equipotential bonding is achieved if Rule 1 is observed.

If low-frequency noise occurs on analog cables, for example: speed/measured value fluctuations as a result of equalizing currents (hum), the shields are only connected for analog signals at one end at the SIMOVERT MASTERDRIVES. The other end of the shield should be grounded through a capacitor (e.g. 10 nF/100 V type MKT). However, the shield is still connected at both ends to ground for high frequency as a result of the capacitor.

Rule 11

If possible, the signal cables should only enter the cabinet at one side.

Rule 12

If SIMOVERT MASTERDRIVES are operated from an external 24 V power supply, this power supply must not feed several consumers separately installed in various cabinets (hum can be coupled-in!). The optimum solution is for each SIMOVERT MASTERDRIVE to have its own power supply.

Rule 13

Prevent noise from being coupled-in through the supply.

SIMOVERT MASTERDRIVES and automation units/control electronics should be connected-up to different supply networks. If there is only one common network, the automation units/control electronics have to be de-coupled from the supply using an isolating transformer.

Rule 14

The use of a radio interference suppression filter is obligatory to maintain limit value class "First environment" or "Second environment", even if sinusoidal filters or dv/dt filters are installed between the motor and SIMOVERT MASTERDRIVES.

Whether an additional filter has to be installed for further consumers, depends on the control used and the wiring of the remaining cabinet.

Rule 15

A noise suppression filter should always be placed close to the fault source. The filter must be connected to the cabinet housing, mounting panel, etc. through a large surface area. A bare metal mounting panel (e.g. manufactured from stainless steel, galvanized steel) is best, as electrical contact is established through the entire mounting surface. If the mounting panel is painted, the paint has to be removed at the screw mounting points for the frequency converter and the noise suppression filter to ensure good electrical contact.

The incoming and outgoing cables of the radio interference suppression filter have to be spatially separated/isolated.

Rule 16

In order to limit the noise emitted, all variable-speed motors have to be connected-up using shielded cables, with the shields being connected to the respective housings at both ends in a low-inductive manner (through the largest possible surface area). The motor feeder cables also have to be shielded inside the cabinet or at least shielded using grounded partitions. Suitable motor feeder cable e.g. Siemens PROTOFLEX-EMV-CY (4 x 1.5 mm^2 ... 4 x 120 mm^2) with Cu shield. Cables with steel shields are unsuitable.

A suitable PG gland with shield connection can be used at the motor to connect the shield. It should also be ensured that there is a low-impedance connection between the motor terminal box and the motor housing. If required, connect-up using an additional grounding conductor. **Do not use plastic motor terminal boxes!**

Rule 17

A line reactor has to be installed between the radio interference suppression filter and the SIMOVERT MASTERDRIVES.

Rule 18

The line supply cable has to be spatially separated from the motor feeder cables, e.g. by grounded partitions.

Rule 19

The shield between the motor and SIMOVERT MASTERDRIVES must not be interrupted by the installation of components such as output reactors, sinusoidal filters, dv/dt filters, fuses, contactors. The components must be mounted on a mounting panel which simultaneously serves as the shield connection for the incoming and outgoing motor cables. Grounded partitions may be necessary to shield the components.

Rule 20

In order to limit the radio interference (especially for limit value class "First environment "), in addition to the line supply cable, all cables externally connected to the cabinet must be shielded.

Examples of these basic rules:

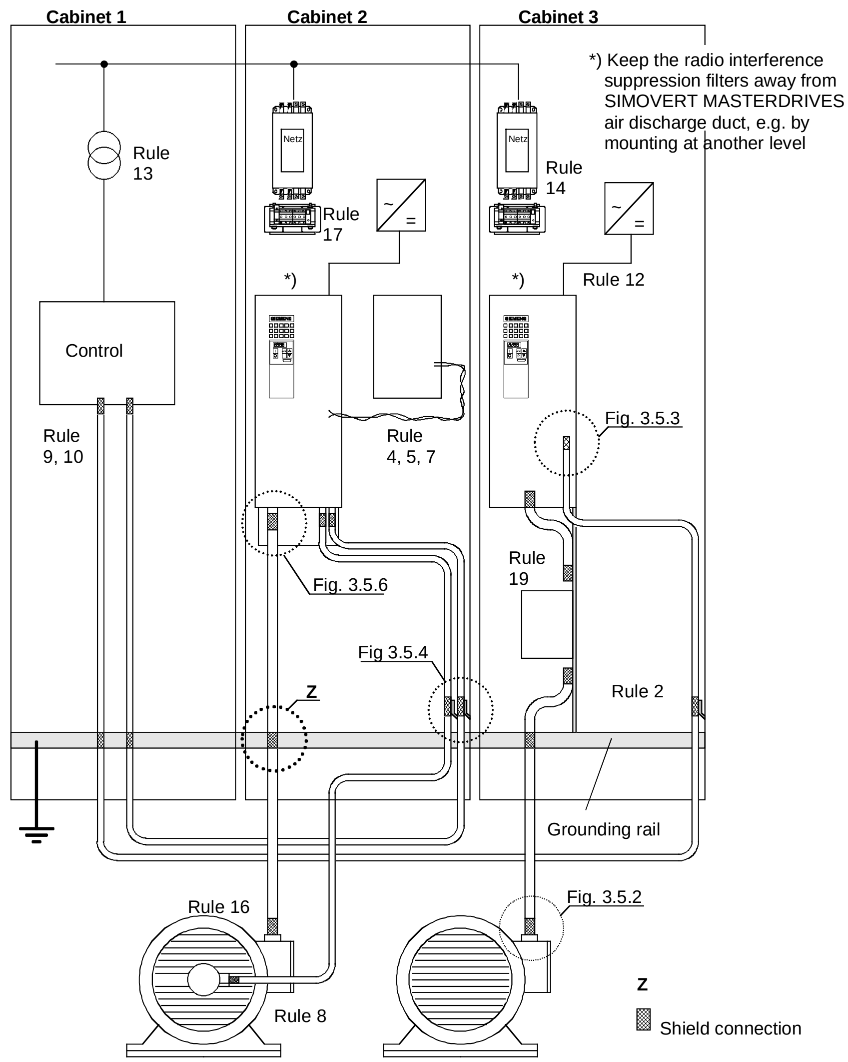


Fig. 6-1 Examples for applying the basic EMC rules

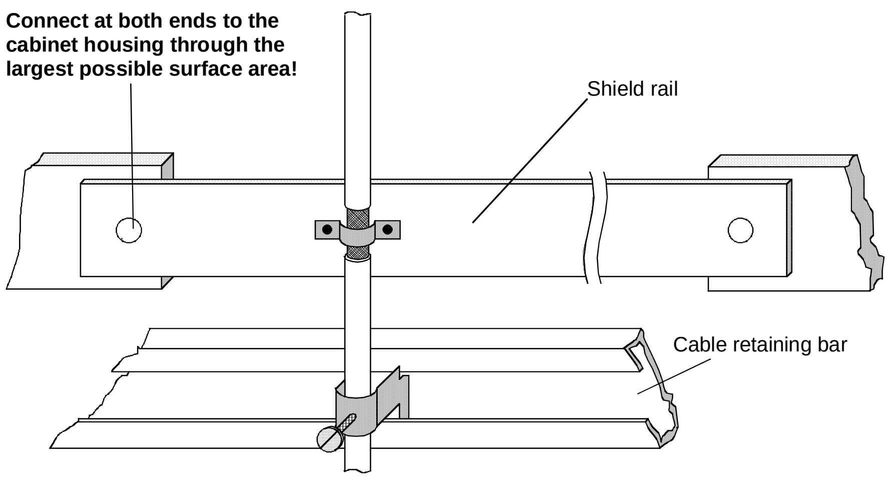


Fig. 6-2 Connecting the motor cable shield where the cable enters the cabinet

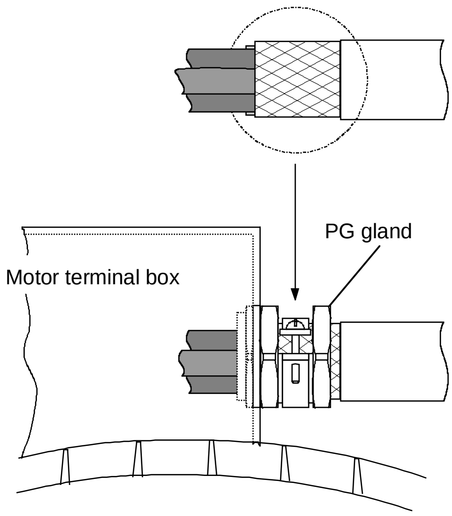


Fig. 6-3 Shield connection at the motor

The shield can be connected through a PG or metric gland (nickel-plated brass) with a strain relief bar. Thus, the degree of protection IP 20 can be achieved.

For higher degrees of protection (up to IP 68), there are special PG glands with shield connection, e.g.:

- ♦ SKINDICHT SHVE, Messrs. Lapp, Stuttgart
- ♦ UNI IRIS Dicht or UNI EMV Dicht, Messrs. Pflitsch, Hückeswagen

It is not permissible to use plastic motor terminal boxes!

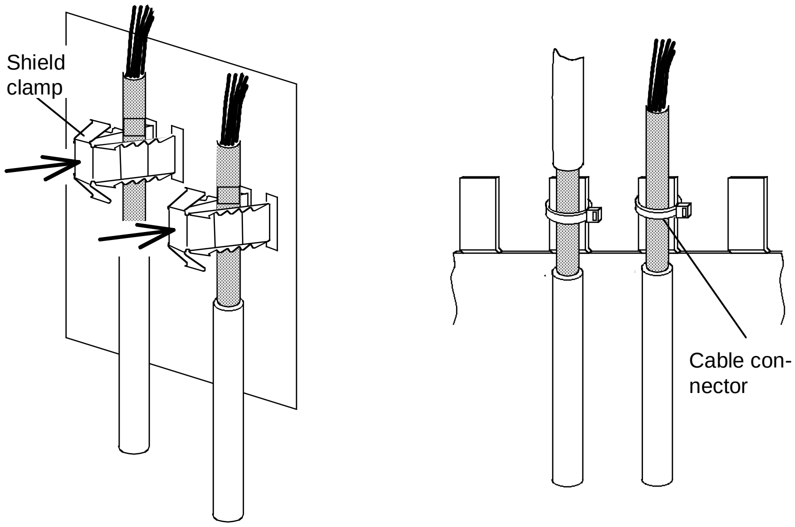


Fig. 6-4 Connecting the signal cable shields for SIMOVERT MASTERDRIVES

- Every SIMOVERT MASTERDRIVES has shield clamps to connect the signal cable shields.
- For chassis units (sizes ≥ E), the shields can be additionally connected using cable connectors at the shield connecting locations.

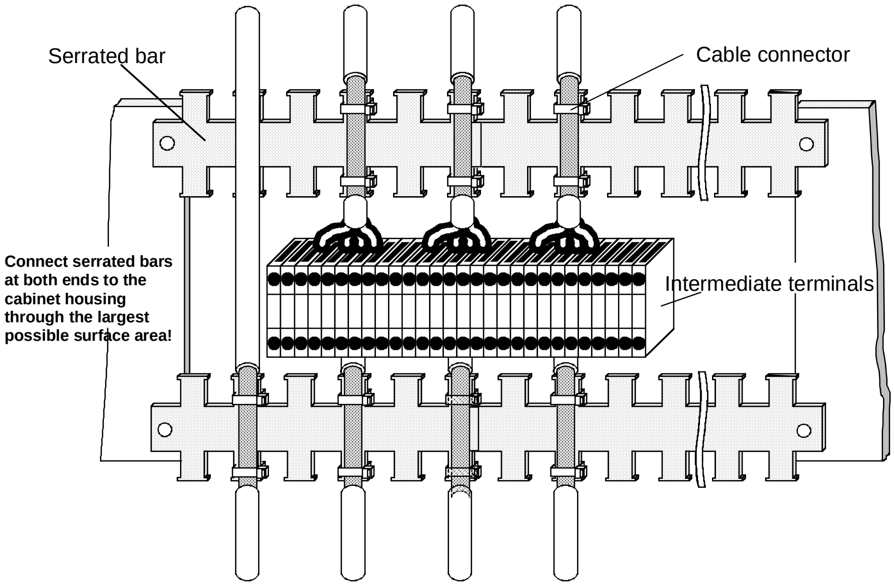


Fig. 6-5 Connecting signal cable shields in the cabinet

Wherever possible, intermediate terminals should not be used as they reduce the shielding effect!

7 Connecting-up

DANGER

SIMOVERT MASTERDRIVES units are operated at high voltages.
The equipment must be in a no-voltage condition (disconnected from the supply) before any work is carried out!
Only professionally trained, qualified personnel must work on or with the units.
Death, severe bodily injury or significant property damage could occur if these warning instructions are not observed.

Only create electrical connections if the unit is in a no-voltage condition!

Hazardous voltages are still present in the unit up to 5 minutes after it has been powered down due to the DC link capacitors. Thus, the appropriate delay time must be observed before working on the unit or on the DC link terminals.

The power terminals and control terminals can still be live even when the motor is stationary.

When working on an opened unit, it should be observed that live components (at hazardous voltage levels) can be touched (shock hazard).

The user is responsible that all the units are installed and connected-up according to recognized regulations in that particular country as well as other regionally valid regulations. Cable dimensioning, fusing, grounding, shutdown, isolation and overcurrent protection should be particularly observed.

NOTE

The inverters are suitable for connection to

- rectifier units,
- rectifier/regenerative feedback units and
- self-commutating rectifier/regenerative feedback units (AFE), which are fed from systems with or without grounded neutral point (TN systems and TT systems or IT systems according to EN 60364-3).

The inverters are dimensioned for overvoltage category III according to IEC 60664-1.

In systems with grounded phase conductor and a line voltage > 600 V AC measures should be provided on the plant side to limit any overvoltages occurring to overvoltage category II according to IEC 60664-1.

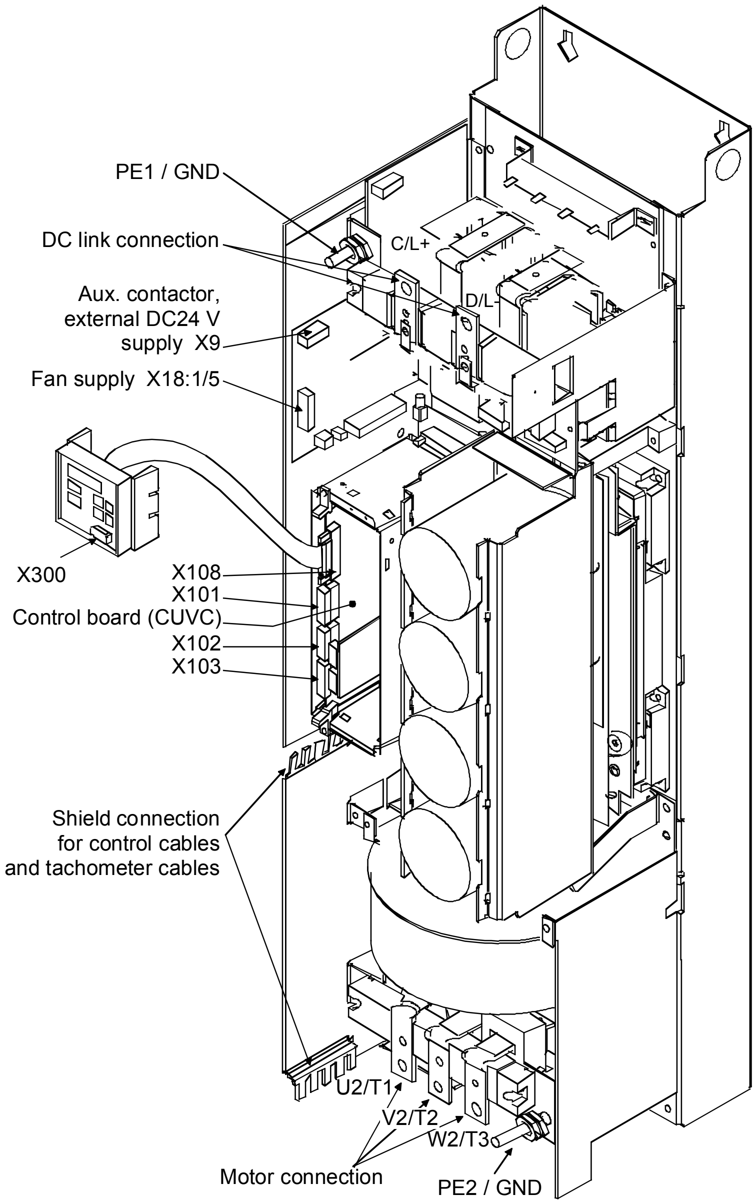


Fig. 7-1 Connection overview for type E and F

NOTE

The 230 V fan must be supplied with AC 230 V externally via terminal strip X18 1/5 on the PSU.

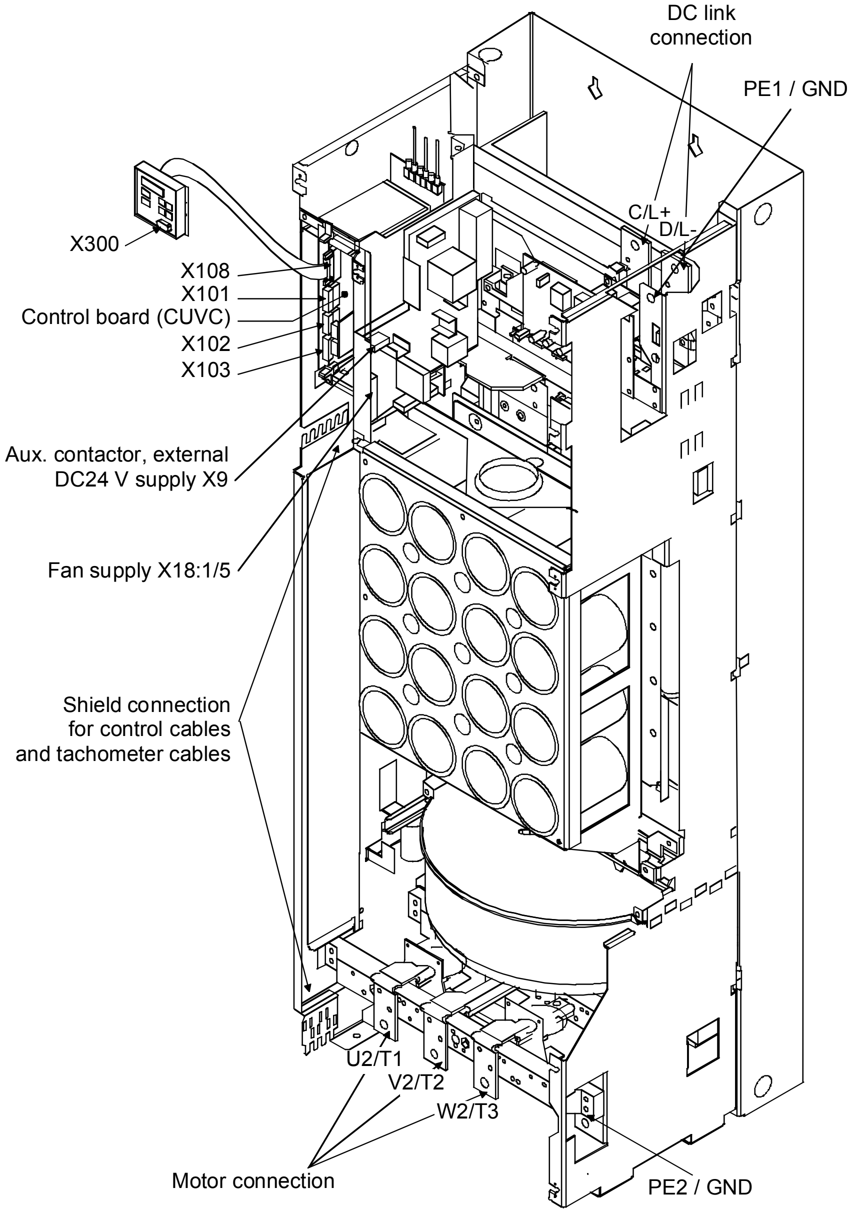


Fig. 7-2 Connection overview for type G

NOTE

The 230 V fan must be supplied with AC 230 V externally via terminal strip X18 1/5 on the PSU.

7.1 Power connections

WARNING

If the input and output terminals are mixed up, the unit will be destroyed!

If the input terminals are mixed up, the converter or the rectifier unit can be destroyed!

The supply terminals are marked as follows:

DC connection:	C/L+	D/L-	
Motor connection:	U2/T1	V2/T2	W2/T3
Protective conductor connection:	PE1	PE2	

NOTICE

When connected to DC busbars, the units have to be protected with fuses according to Fig. 7-3 and Table 7-1. If the connection between the busbar and the unit is short-circuit-proof, protection can also be provided via internal unit fuses (internal unit fuses are standard from type ≥ J onwards, and are available as option L30 for units of type "**E**" – "G").

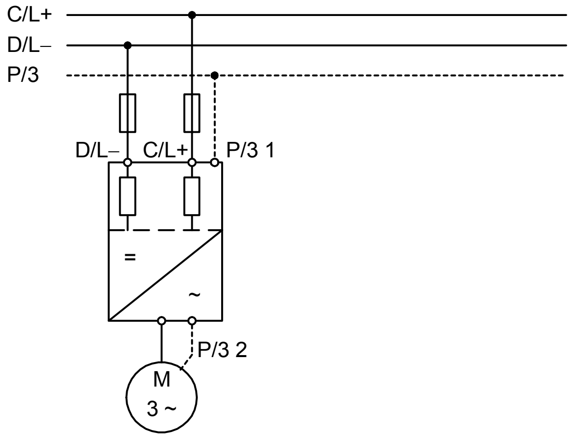


Fig. 7-3 DC busbars

Input voltage DC 510 V to 650 V								
Order No.	**Infeed-side**					**Motor side**		
	Rated input current	**cross-section**		**Recommended fuse**		**cross-section**		**Rated output current**
6SE70...	[A]	**VDE** [mm²]	**AWG MCM**	**aR (SITOR)** [A]	Typ	**VDE** [mm²]	**AWG MCM**	[A]
31-0TE60	110	1x70	1x000	160	3NE3224	1x35	1x0	92
31-2TF60	148	2x35	2x0	250	3NE3227	2x25	2x2	124
31-5TF60	174	2x35	2x0	250	3NE3227	2x25	2x2	146
31-8TF60	221	2x50	2x00	315	3NE3230-0B	2x35	2x0	186
32-1TG60	250	2x70	2x000	450	3NE3233	2x50	2x00	210
32-6TG60	309	2x95	2x4/0	450	3NE3233	2x70	2x000	260
33-2TG60	375	2x120	2x300	500	3NE3334-0B	2x95	2x4/0	315
33-7TG60	440	2x120	2x300	630	3NE3336	2x120	2x300	370
35-1TJ60	607	4x300	4x800	450	2x3NE3233	2x300	2x800	510
36-0TJ60	702	4x300	4x800	560	2x3NE3335	4x300	4x800	590
37-0TJ60	821	4x300	4x800	560	2x3NE3335	4x300	4x800	690
38-6TK60	1023	4x300	4x800	710	2x3NE3337-8	4x300	4x800	860
41-1TK60	1310	6x300	6x800	800	2x3NE3338-8	4x300	4x800	1100
41-3TL60	1551	6x300	6x800	900	2x3NE3340-8	4x300	4x800	1300
41-6TQ60	1940	6x300	6x800	710	2x2x3NE3337-8	4x300	4x800	1630
41-6TM60	1940	6x300	6x800	710	2x2x3NE3337-8	4x300	4x800	1630
42-1TQ60	2490	2x6x300	2x6x800	800	2x2x3NE3338-8	2x4x300	2x4x800	2090
42-5TN60	2940	2x6x300	2x6x800	900	2x2x3NE3340-8	6x300	6x800	2470

Input voltage DC 675 V to 810 V								
Order No.	**Infeed-side**					**Motor side**		
	Rated input current	**cross-section**		**Recommended fuse**		**cross-section**		**Rated output current**
6SE70...	[A]	**VDE** [mm²]	**AWG MCM**	**aR (SITOR)** [A]	Typ	**VDE** [mm²]	**AWG MCM**	[A]
26-1UE60	73	1x50	1x00	125	3NE3222	1x25	1x2	61
26-6UE60	79	1x50	1x00	125	3NE3222	1x25	1x2	66
28-0UF60	94	1x50	1x00	160	3NE3224	1x35	1x0	79
31-1UF60	129	2x35	2x0	200	3NE3225	2x16	2x4	108
31-3UG60	152	2x35	2x0	200	3NE3225	2x25	1x000	128
31-6UG60	186	2x50	2x00	250	3NE3227	2x35	1x4/0	156
32-0UG60	228	2x50	2x00	400	3NE3232-0B	2x35	2x0	192
32-3UG60	268	2x70	2x000	400	3NE3232-0B	2x50	2x00	225
33-0UJ60	353	2x300	2x800	500	3NE3334-0B	2x300	2x800	297
33-5UJ60	421	2x300	2x800	630	3NE3336	2x300	2x800	354
34-5UJ60	538	2x300	2x800	710	3NE3337-8	2x300	2x800	452
35-7UK60	678	4x300	4x800	450	2x3NE3333	2x300	2x800	570
36-5UK60	774	4x300	4x800	500	2x3NE3334-0B	4x300	4x800	650
38-6UK60	1023	4x300	4x800	630	2x3NE3336	4x300	4x800	860
41-1UL60	1285	6x300	6x800	800	2x3NE3338-8	4x300	4x800	1080
41-2UL60	1464	6x300	6x800	900	2x3NE3340-8	6x300	6x800	1230
41-4UQ60	1666	6x300	6x800	630	2x2x3NE3336	6x300	6x800	1400
41-6UQ60	1880	8x300	8x800	630	2x2x3NE3336	6x300	6x800	1580
41-4UM60	1666	6x300	6x800	630	2x2x3NE3336	6x300	6x800	1400
41-6UM60	1880	8x300	8x800	630	2x2x3NE3336	6x300	6x800	1580
42-1UN60	2440	2x6x300	2x6x800	800	2x2x3NE3338-8	2x4x300	2x4x800	2050
42-3UN60	2785	2x6x300	2x6x800	900	2x2x3NE3340-8	2x6x300	2x6x800	2340

Input voltage DC 890 V to 930 V								
Order No.	**Infeed-side**					**Motor side**		
	Rated input current	**cross-section**		**Recommended fuse**		**cross-section**		**Rated output current**
6SE70...		**VDE**	**AWG**	**aR (SITOR)**		**VDE**	**AWG**	
	[A]	[mm²]	**MCM** [A]		Typ	**MCM** [mm²]		[A]
26-0WF60	71	1x25	1x2	125	3NE3222	1x25	1x2	60
28-2WF60	98	1x50	1x00	160	3NE3224	1x35	1x0	82
31-0WG60	115	1x70	1x000	200	3NE3225	1x50	1x00	97
31-2WG60	140	2x35	1x0	200	3NE3225	2x25	1x2	118
31-5WG60	173	2x50	1x00	315	3NE3230-0B	2x25	2x2	145
31-7WG60	204	2x50	1x00	315	3NE3230-0B	2x25	2x2	171
32-1WG60	248	2x70	2x000	400	3NE3232-0B	2x50	2x00	208
33-0WJ60	353	2x300	2x800	500	3NE3334-0B	2x300	2x800	297
33-5WJ60	421	2x300	2x800	630	3NE3336	2x300	2x800	354
34-5WJ60	538	2x300	2x800	710	3NE3337-8	2x300	2x800	452
35-7WK60	678	4x300	4x800	450	2x3NE3333	2x300	2x800	570
36-5WK60	774	4x300	4x800	500	2x3NE3334-0B	4x300	4x800	650
38-6WK60	1023	4x300	4x800	630	2x3NE3336	4x300	4x800	860
41-1WL60	1285	6x300	6x800	800	2x3NE3338-8	4x300	4x800	1080
41-2WL60	1464	6x300	6x800	900	2x3NE3340-8	6x300	6x800	1230
41-4WQ60	1666	6x300	6x800	630	2x2x3NE3336	6x300	6x800	1400
41-6WQ60	1880	8x300	8x800	630	2x2x3NE3336	6x300	6x800	1580
41-4WM60	1666	6x300	6x800	630	2x2x3NE3336	6x300	6x800	1490
41-6WM60	1880	8x300	8x800	630	2x2x3NE3336	6x300	6x800	1580
42-1WN60	2440	2x6x300	2x6x800	800	2x2x3NE3338-8	2050		
42-3WN60	2785	2x6x300	2x6x800	900	2x2x3NE3340-8	2340		

AWG: American Wire Gauge (for cross-sections up to 120 mm²)

MCM: Mille Circular Mil (for cross-sections from 120 mm²)

Table 7-1 Conductor cross-sections, fuses

NOTE

The connection cross-sections are determined for copper cables at 40 °C (104 °F) ambient temperature and cables with a permissible operating temperature at the conductor of 70 °C (installation type C (taking the bundling factor of 0.75 into account) in accordance with DIN VDE 0298-4/08.03).

If DC fuses are integrated on units with rated DC voltages of 510 V to 930 V, additional fuses are then not necessary on the infeed side, provided that the supply cables to the DC bus are laid in a short-circuit proof manner and that overloading by other consumers can be excluded.
In the case of units of types J, K, L, M, N and Q, the fuses are an integral part of the unit.
In the case of units of types E, F and G, they are optional (L30).

The connection lengths to the rectifier unit, on systems also between the inverters, should be kept as short as possible. Ideally, they are designed as low-inductance busbars.

Possible connection cross-sections, screw connection, tightening torque

Type	Order number	Max. connection cross-sections		Screw connection	Tightening torque	
		mm^2 to VDE	AWG		Nm	lbf ft
E	6SE703_-__E_0	2 x 70	2 x 00	M10	25	18
F	6SE703_-__F_0	2 x 70	2 x 00	M10	25	18
G	6SE703_-__G_0	2 x 150	2 x 300	M12	50	37
J	6SE703_-__J_0	2 x 300	2 x 800	M12 / M16	50 / 115	37 / 85
K	6SE703_-__K_0	4 x 300	4 x 800	M12 / M16	50 / 115	37 / 85
L	6SE704_-__L_0	4 x 300	4 x 800	M12	50	37

Table 7-2 Maximum connectable cross-sections, tightening torque

Protective conductor connection

The protective conductor has to be connected on both the input and the motor side and must be dimensioned in accordance with the power connections.

NOTE type G

The 230 V fan must be supplied with AC 230 V externally via terminal strip X18 1/5 on the PSU.

7.2 Auxiliary power supply, main contactor

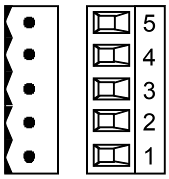
Types E, F, G: X9 - external DC 24 V supply, main contactor control

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

The voltage supply is required if the inverter is connected via a main contactor or bypass 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	Main contactor control	Main contactor control	AC 230 V
4	Main contactor control	Main 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 ... DC30 V For current requirement see section “Technical Data“

Connectable cross-section: 2.5 mm² (AWG 12)

Table 7-3 Connection of external DC 24 V aux. voltage supply and main contactor control (types E, F, G)

NOTE

The excitation coil of the main contactor has to be damped with overvoltage limiters, e.g. RC element.

WARNING

The external 24 V voltage supply must meet the requirements for safety separation (PELV electrical circuit = Protective Extra Low Voltage).

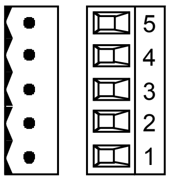
Type J – N: X9 - external DC 24 V supply, main contactor control

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

The connection base is located easily accessibly on the DIN rail below the slide-in unit of the electronics box.

The voltage supply is required if the inverter is connected up via a main or bypass contactor.

The connections for the contactor control are floating.



Terminal	Designation	Description	Range
5	Main contactor control	Main contactor control	AC 230 V
4	Main contactor control	Main 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 ... DC30 V For current requirement see section “Technical Data”

Connectable cross-section: 2.5 mm² (AWG 12)

Table 7-4 Connection of external DC 24 V aux. voltage supply and main contactor control (type J - N)

NOTE

The excitation coil of the main contactor has to be damped with overvoltage limiters, e.g. RC element.

The 230 V fan has to be supplied with AC230 V externally. The connecting points are located on the fuse-disconnectors on the right next to the DIN rail of X9.

WARNING

The external 24 V voltage supply must meet the requirements for safety separation (PELV electrical circuit = Protective Extra Low Voltage).

7.3 Control connections

Standard connections

In the basic version the unit has the following control connections on the CUVC control board:

- Serial interface (RS232 / RS485) for PC or OP1S
- A serial interface (USS bus, RS485)
- A control terminal strip for connecting up a HTL unipolar pulse encoder and a motor temperature sensor (PTC / KTY84)
- Two control terminal strips with digital and analog inputs and outputs.

WARNING

Before the control cables and encoder cables are connected or disconnected, the unit must be disconnected from the supply (24 V electronic power supply **and** DC link/line voltage)!

If this measure is not observed, this can result in defects on the encoder. A defective encoder can cause uncontrolled axis movements.

WARNING

The external 24 V infeed and all circuits connected to the control terminals must meet the requirements for safety separation as stipulated in EN 50178 (PELV circuit = Protective Extra Low Voltage).

NOTE

The ground of the control connections is connected inside the unit with the protective conductor (ground) – (PELV electrical circuit).

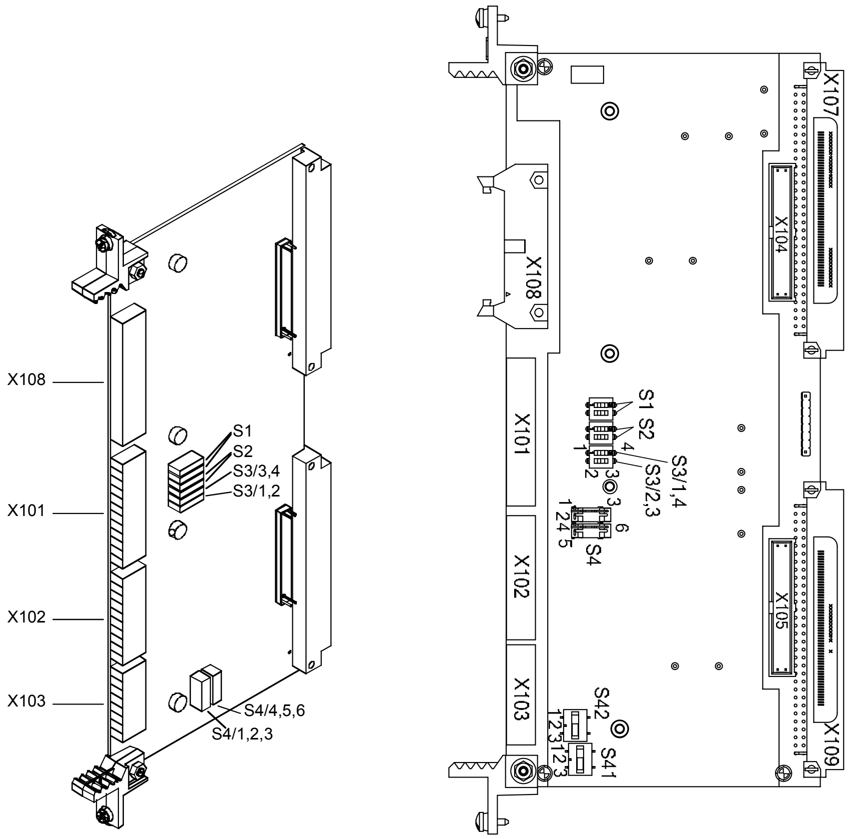


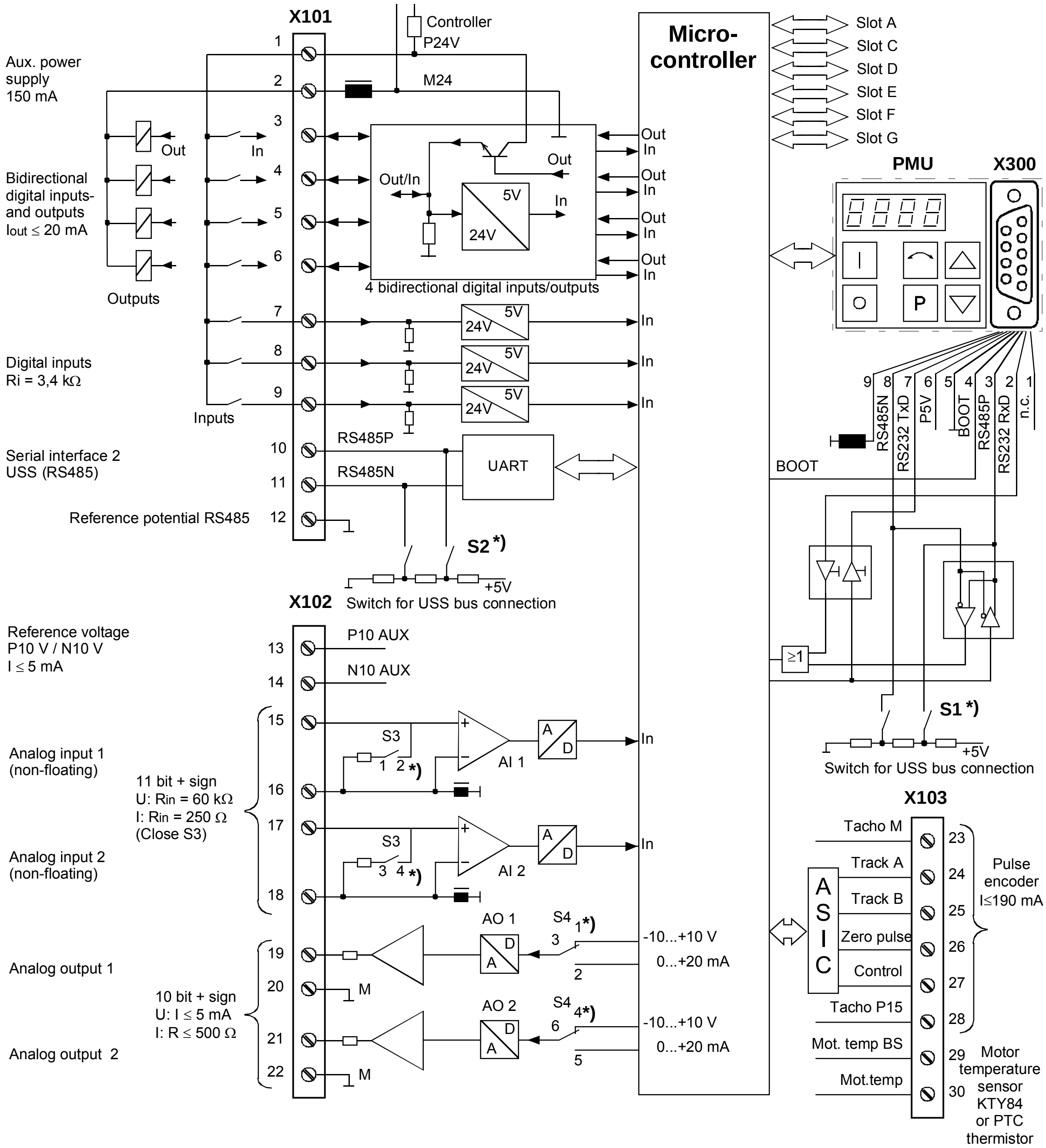
Fig. 7-4 View of the CUVC

NOTE

Switches have been changed on CUVCs from 11/2005:

♦ S1, S2, S3: Slide switch design
For contact assignment refer to section "Switch settings for slide switch design"

♦ Switc hes S4 **or** S41 and S42 are fitted. The contact assignment differs depending on the switch design (see section "Switch settings").



***)** Contact assignment according to switch design, see section "Switch settings"

Fig. 7-5 Overview of the standard connections

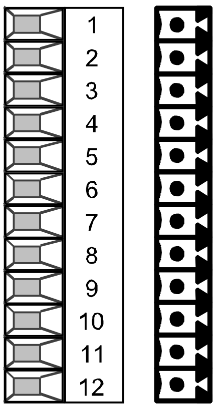
X101 – Control terminal strip

The following connections are provided on the control terminal strip:

- 4 optionally parameterizable digital inputs and outputs
- 3 digital inputs
- 24 V aux. voltage supply (max. 150 mA) for the inputs and outputs
- 1 serial interface SCom2 (USS / RS485)

WARNING

If the digital inputs are supplied by an external 24 V voltage supply, it must be referred to ground terminal X101.2. Terminal X101.1 (P24 AUX) **must not** be connected to the external 24 V supply.



Terminal	Designation	Meaning	Range
1	P24 AUX	Aux. voltage supply	DC 24 V / 150 mA
2	M24 AUX	Reference potential	0 V
3	DIO1	Digital input/output 1	24 V, 10 mA / 20 mA; L ≤ 3 V, H ≥ 13 V
4	DIO2	Digital input/output 2	
5	DIO3	Digital input/output 3	
6	DIO4	Digital input/output 4	
7	DI5	Digital input 5	24 V, 10 mA; L ≤ 3 V, H ≥ 13 V
8	DI6	Digital input 6	
9	DI7	Digital input 7	
10	RS485 P	USS bus connection SCom2	RS485
11	RS485 N	USS bus connection SCom2	RS485
12	M RS485	Reference potential RS485	

Connectable cross-section: 0.14 mm² to 1.5 mm² (AWG 16)

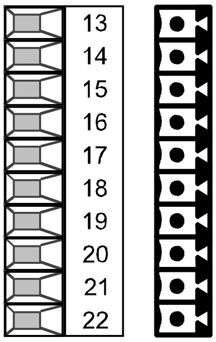
Terminal 1 is at the top when installed.

Table 7-5 Control terminal strip X101

X102 – Control terminal strip

The following connections are provided on the control terminal strip:

- ♦ 10 V aux. voltage (max. 5 mA) for the supply of an external potentiometer
- ♦ 2 analog inputs, can be used as current or voltage input
- ♦ 2 analog outputs, can be used as current or voltage output



Terminal	Designation	Meaning	Range
13 P10	V	+10 V supply for ext. potentiometer	+10 V ±1.3 %, Imax = 5 mA
14 N10	V	-10 V supply for ext. potentiometer	-10 V ±1.3 %, Imax = 5 mA
15	AI1+	Analog input 1 +	11 bit + sign
16	M AI1	Ground, analog input 1	<u>Voltage:</u>
17	AI2+	Analog input 2 +	± 10 V / Ri = 60 kΩ
18	M AI2	Ground, analog input 2	<u>Current:</u> Rin = 250 Ω
19	AO1	Analog output 1	10 bit + sign
20	M AO1	Ground, analog output 1	<u>Voltage:</u>
21	AO2	Analog output 2	± 10 V / Imax = 5 mA
22	M AO2	Ground, analog output 2	<u>Current:</u> 0...20 mA R ≥ 500 Ω

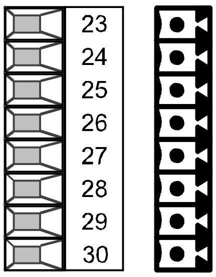
Connectable cross-section: 0.14 mm² to 1.5 mm² (AWG 16)

Terminal 13 is at the top when installed.

Table 7-6 Control terminal strip X102

X103 – Connection of HTL incremental encoder

The connection for an incremental encoder (HTL unipolar) is provided on the control terminal strip.



Terminal	Designation	Meaning	Range
23 -	V_{SS}	Ground for power supply	
24	Track A	Connection for track A	HTL unipolar; L ≤ 3 V, H ≥ 8 V
25	Track B	Connection for track B	
26	Zero pulse	Connection for zero pulse	
27	CTRL	Connection for control track	
28 +	V_{SS}	Power supply pulse encoder	15 V Imax = 190 mA
29 +	Temp	Plus (+) connection KTY84/PTC	KTY84: 0...200 °C
30 -	Temp	Minus (-) connection KTY84/PTC	PTC: R_{cold} ≤ 1.5 kΩ

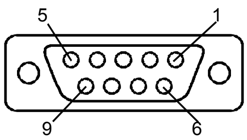
Connectable cross-section: 0.14 mm² to 1.5 mm² (AWG 16)

Terminal 23 is at the top when installed.

Table 7-7 Control terminal strip X103

X300 - Serial interface

Either an OP1S or a PC can be connected up via the 9-pole Sub D socket.



Pin	Name	Meaning	Range
1	n. c.	Not connected	
2	RS232 RxD	Receive data via RS232	RS232
3	RS485 P	Data via RS485	RS485
4	Boot	Control signal for software update	Digital signal, low active
5	M5V	Reference potential to 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	M_RS232/485	Digital ground (choked)	

Table 7-8 Serial interface X300

Switch settings for DipFix switch design

Switch	Meaning
S1 • ope n • closed	**SCom1 (X300): Bus terminating resistor** • Resist or open • Resistor closed
S2 • ope n • closed	**SCom2 (X101/10,11): Bus terminating resistor** • Resist or open • Resistor closed
S3 (1,2) • ope n • closed	**AI1: Changeover current/voltage input** • Volt age input • Current input
S3 (3,4) • ope n • closed	**AI2: Changeover current/voltage input** • Volt age input • Current input
S4 (1,2,3) • Jumper 1, 3 • Jumper 2, 3	**AO1: Changeover current/voltage output** • Volt age output • Current output
S4 (4,5,6) • Jumper 4, 6 • Jumper 5, 6	**AO2: Changeover current/voltage output** • Volt age output • Current output

Switch settings for slide switch design

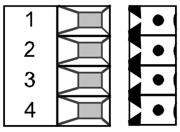
Switch	Contact	Status	Meaning
S1	1-4	open	Bus terminating resistor open
S1	1-4	closed	Bus terminating resistor closed
S2	2-3	open	Bus terminating resistor open
S2	2-3	closed	Bus terminating resistor closed
S3	1-4	open	AI1: Voltage input
S3	1-4	closed	AI1: Current input
S3	2-3	open	AI2: Voltage input
S3	2-3	closed	AI2: Current input
S41	1-2	closed	AO1: Current output
S41	2-3	closed	AO1: Voltage output
S42	1-2	closed	AO2: Current output
S42 2-3		closed	AO2:Voltage output

NOTE

Contacts S41 (4, 5, 6) and contacts S42 (4, 5, 6) are not used.

X533 - Safe stop option

The safe stop option comprises the safety relay and the connecting terminals for relay triggering and a checkback contact.



Terminal	Designation	Meaning	Range
1	Contact 1	Checkback "safe stop"	DC 20 V – 30 V
2	Contact 2	Checkback "safe stop"	1 A
3	Control input "safe stop"	Rated resistance of field coil ≥ 823 Ω ± 10 % at 20 °C	DC 20 V – 30 V max. operating frequency: 6/min
4	P24 DC	Supply voltage "safe stop"	DC 24 V / 30 mA

Connectable cross-section: 1.5 mm² (AWG 16)

Terminal 4 is at the front when installed.

Table 7-9 Terminal assignment for the "safe stop" option

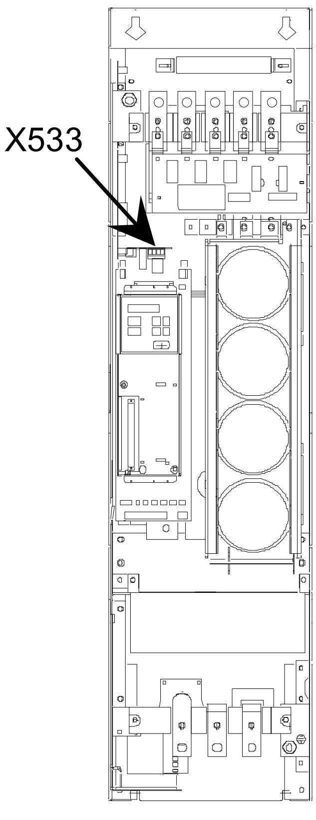


Fig. 7-6 Types E and F

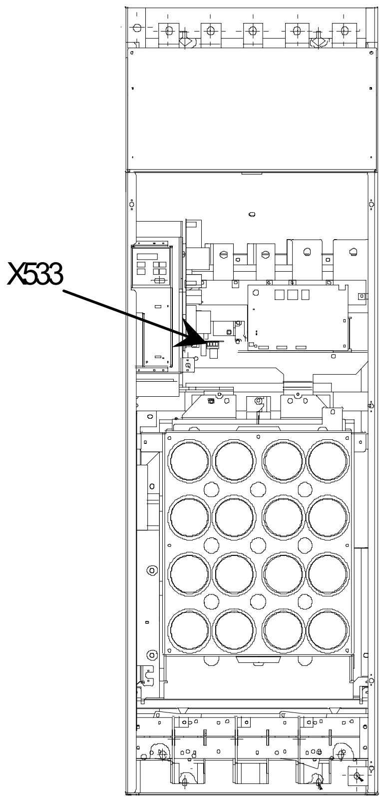


Fig. 7-7 Type G

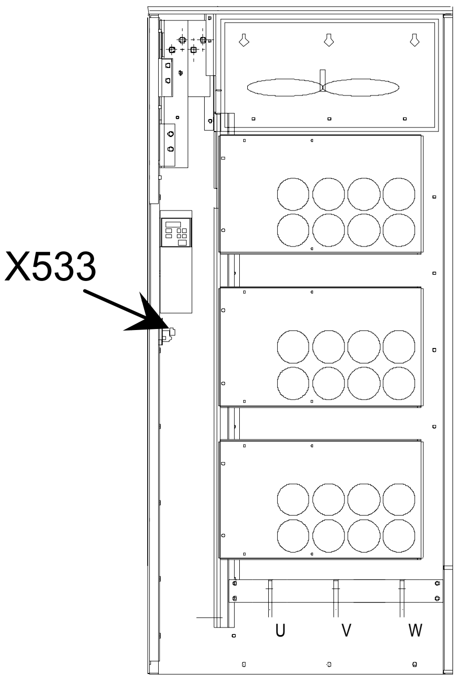
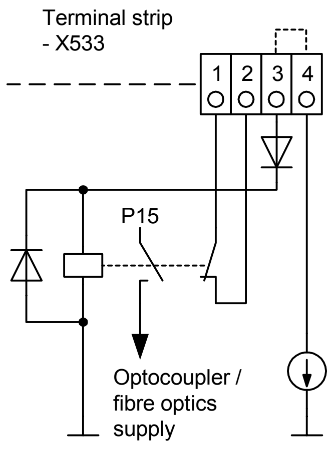


Fig. 7-8 Types ≥ J

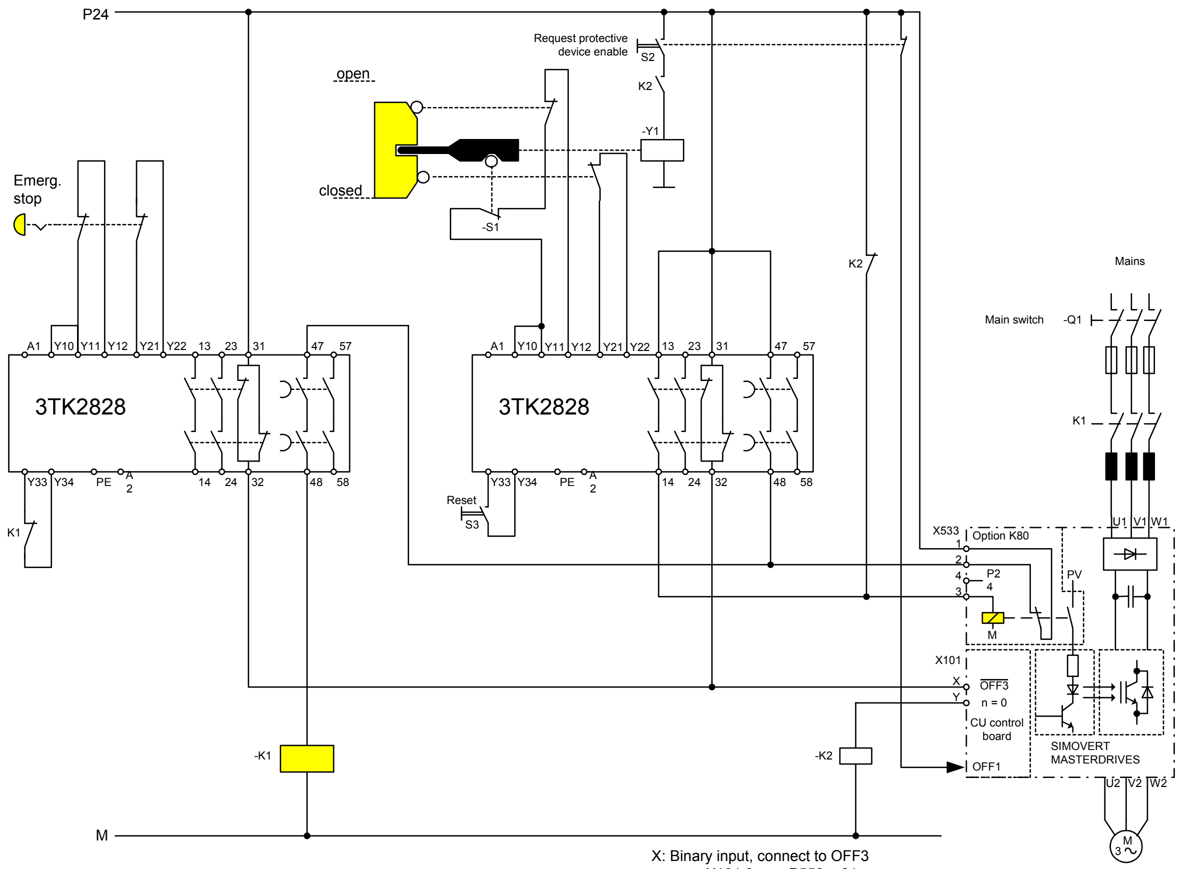
The field coil of the safety relay is connected at one end to the grounded electronics frame. When the field coil is supplied via an external 24 V supply, its negative pole must be connected to ground potential. The external 24 V supply must comply with the requirements for PELV circuits to EN 50178 (DIN VDE 0160).

In the shipped state, a jumper is inserted between terminals 3 and 4. The jumper must be removed before the "SAFE STOP" function can be used and an external control for selecting the function connected.

If the safety relay is supplied via the internal supply at X533:4, the external 24 V supply must deliver at least 22 V at terminal X9:1/2 to ensure that the relay picks up reliably (internal voltage drop).



The checkback contacts of the safety relay are capable of at least 100,000 switching cycles at the specified load (30 V DC / 1 A). The mechanical service life is about 10^6 switching cycles. The safety relay is an important component in ensuring reliability and availability of the machine. For this reason, the pcb with the safety relay must be replaced in the case of malfunction. In this case, the unit must be returned for repair or replaced. Function checks must be carried out at regular intervals, which must be defined in compliance with Employer's Liability Insurance Regulation BGV A3 §39, para. 3. Accordingly, function checks must be performed as required by the relevant service conditions, but at least once a year and additionally after initial commissioning and any modification and/or maintenance work.



X: Binary input, connect to OFF3
e. g. X101.8 --> P558 = 21
Y: Binary output, connect to "Comparison value reached"
e. g. X101.6 --> P654 = 120; P796 = 0 (comparison value)

Fig. 7-9 *Sample application of "safe stop" function with contactor safety combination for monitoring a moving protective device in Safety Category 3 to EN 954-1*

All external cables relevant to the safety function are protected, e.g. installed in cable ducts, to preclude the possibility of short circuits. Cables must be installed in compliance with the requirements of EN 60204-1, Section 14.

In the circuit shown in Fig. 7-9, the tumbler does not release the moving protective device until the drive has stopped. It may be possible to omit the tumbler if the risk assessment of the machine deems this to be safe. In this case, the NC contact of the protective device is connected directly to terminals Y11 and Y12 and electromagnet Y1 is omitted.

Binary input X is negated with signal "OFF3", i.e. at 24 V, the converter decelerates the motor to zero speed along the parameterized deceleration ramp. The converter signals zero speed via binary output Y, thus energizing relay K2.

Once the motor has stopped, the safety relay in the converter is opened and the coil of main contactor K1 remains at 24 V via the checkback contact. If contacts in the safety relay are sticking, the checkback contacts do not close and the safety combination on the right deenergizes main contactor K1 via delayed contacts 47/48 when the set delay period expires.

7.4 Fan supply

X18 – Fan supply

Terminal	Designation	Meaning	Range
1	N	Fan supply (neutral conductor)	
2	-		
3	Internally assigned	Fan N via fuse F1	
4	-		
5	L	Fan supply (phase)	230 V $\pm$ 15 % / 50/60 Hz
6	-		
7	Internally assigned	Fan L via fuse F2	
8	-		
9	-		
10	Internally assigned		
11	Internally assigned		
12	Internally assigned		
13	Internally assigned		

NOTE

The 1AC 230 V fan supply X18/1 must be grounded (neutral conductor N connected to protective conductor PE).

7.5 Fan fuses

Line voltage DC 270 V to 310 V	
Order No. 6SE70..	**Fan Fuse (F1 / F2)**
31-0RE60 F	NQ-R-2
31-3RE60 F	NQ-R-2
31-6RE60 F	NQ-R-2
32-0RE60 F	NQ-R-2
Manufacturer: F NQ-R Bussmann	

Line voltage DC 510 V to 660 V		
Order No. 6SE70..	**Fan Fuse (F1 / F2)**	**Fan Fuse (F101 / F102)**
31-0TE60 31-0TE60-1AA1	FNQ-R-2	
31-2TF60 31-2TF60-1AA1	FNQ-R-2	
31-5TF60 31-5TF60-1AA1	FNQ-R-2	
31-8TF60 31-8TF60-1AA1	FNQ-R-2	
32-1TG60 32-1TG60-1AA1	FNQ-R-5	
32-6TG60 32-6TG60-1AA1	FNQ-R-5	
33-2TG60 33-2TG60-1AA1	FNQ-R-5	
33-7TG60 33-7TG60-1AA1	FNQ-R-5	
35-1TJ60 35-1TJ60-1AA0	FNQ-R-5	
36-0TJ60 36-0TJ60-1AA0	FNQ-R-5	
37-0TJ/K60 37-0TJ/K60-1AA0		FNM-10 FNQ-R-5
38-6TK60 38-6TK60-1AA0		FNM-10 FNQ-R-5
41-1TK60 41-1TK60-1AA0		TRM 30 FNQ-R-5
41-3TL60 41-3TL60-1AA0		TRM 30 FNQ-R5

Line voltage DC 510 V to 660 V		
Order No. 6SE70..	**Fan Fuse (F1 / F2)**	**Fan Fuse (F101 / F102)**
41-6TQ/M60 41-6TQ/M60-1AA0		FNM-10 FNQ-R-5
42-1TQ60 42-1TQ60-1AA0		TRM 30 FNQ-R-5
42-5TN60 42-5TN60-1AA0		TRM 30 FNQ-R-5
Manufacturer: F NQ-R-, FNM- Bussmann TRM Gould Shawmut		

Line voltage DC 675 V to 810 V		
Order No. 6SE70..	**Fan Fuse (F1 / F2)**	**Fan Fuse (F101 / F102)**
26-1UE60 26-1UE60-1AA1	FNQ-R-2	
26-6UE60 26-6UE60-1AA1	FNQ-R-2	
28-0UF60 28-0UF60-1AA1	FNQ-R-2	
31-1UF60 31-1UF60-1AA1	FNQ-R-2	
31-3UG60 31-3UG60-1AA1	FNQ-R-5	
31-6UG60 31-6UG60-1AA1	FNQ-R-5	
32-0UG60 32-0UG60-1AA1	FNQ-R-5	
32-3UG60 32-3UG60-1AA1	FNQ-R-5	
33-0UJ60 33-0UJ60-1AA0	FNQ-R-5	
33-5UJ60 33-5UJ60-1AA0	FNQ-R-5	
34-5UJ60 34-5UJ60-1AA0	FNQ-R-5	
35-7UK60 35-7UK60-1AA0		FNM-10 FNQ-R-5
36-5UK60 36-5UK60-1AA0		FNM-10 FNQ-R-5
38-6UK60 38-6UK60-1AA0		TRM 30 FNQ-R5
41-1UL60 41-1UL60-1AA0		TRM 30 FNQ-R-5

Line voltage DC 675 V to 810 V		
Order No. 6SE70..	**Fan Fuse (F1 / F2)**	**Fan Fuse (F101 / F102)**
41-2UL60 41-2UL60-1AA0		TRM 30 FNQ-R-5
41-4UQ/M60 41-4UQ/M60-1AA0		TRM 30 FNQ-R-5
41-6UQ/M60 41-6UQ/M60-1AA0		TRM 30 FNQ-R-5
42-1UN60 42-1UN60-1AA0		TRM 30 FNQ-R-5
42-3UN60 42-3UN60-1AA0		TRM 30 FNQ-R-5
Manufacturer: F NQ-R-, FNM- Bussmann TRM Gould Shawmut		

Line voltage DC 660 V to 930 V		
Order No. 6SE70..	**Fan Fuse (F1 / F2)**	**Fan Fuse (F101 / F102)**
26-0WF60 26-0WF60-1AA1	FNQ-R-2	
28-2WF60 28-2WF60-1AA1	FNQ-R-2	
31-0WG60 31-0WG60-1AA1	FNQ-R-5	
31-2WG60 31-2WG60-1AA1	FNQ-R-5	
31-5WG60 31-5WG60-1AA1	FNQ-R-5	
31-7WG60 31-7WG60-1AA1	FNQ-R-5	
32-1WG60 32-1WG60-1AA1	FNQ-R-5	
33-0WJ60 33-0WJ60-1AA0	FNQ-R-5	
33-5WJ60 33-5WJ60-1AA0	FNQ-R-5	
34-5WJ60 34-5WJ60-1AA0	FNQ-R-5	
35-7WK60 35-7WK60-1AA0		FNM-10 FNQ-R-5
36-5WK60 36-5WK60-1AA0		FNM-10 FNQ-R-5
38-6WK60 38-6WK60-1AA0		TRM 30 FNQ-R-5

Line voltage DC 660 V to 930 V		
Order No. 6SE70..	**Fan Fuse (F1 / F2)**	**Fan Fuse (F101 / F102)**
41-1WL60 41-1WL60-1AA0		TRM 30 FNQ-R-5
41-2WL60 41-2WL60-1AA0		TRM 30 FNQ-R-5
41-4WQ/M60 41-4WQ/M60-1AA0		TRM 30 FNQ-R-5
41-6WQ/M60 41-6WQ/M60-1AA0		TRM 30 FNQ-R-5
42-1WN60 42-1WN60-1AA0		TRM 30 FNQ-R-5
42-3WN60 42-3WN60-1AA0		TRM 30 FNQ-R-5
Manufacturer: F NQ-R-, FNM- Bussmann TRM Gould Shawmut		

NOTE

The 230 V fan must be supplied with AC 230 V externally via terminal strip X18 1/5 on the PSU.

7.6 MASTER-SLAVE connection for parallel inverters

The units of types M, N and Q with degree of protection IP00 must be assembled as indicated in the planning guide.

The control connections between master and slave must then be made.

Procedure:

- ♦ Carefully lay the control cables to the master cabinet through the cable channel.
- ♦ Insert connectors -X238 / -X234 / -X32 / -X42.
- ♦ Insert fiber-optic cables U41 / U51 / U61 / U42 / U43 / U52 / U53 / U62 / U63 on the IPI in the master.

NOTE

Inserting the fiber-optic cables:

Insert the fiber-optic cables as far as they will go (approx. 16 mm, white mark) and screw the cap nut tight.

CAUTION

You must not make kinks in fiber-optic cables!

Bending radius for fiber-optic cables ≥ 30 mm.

8 Parameterization

It is possible to parameterize the units of the SIMOVERT MASTERDRIVES series by various methods of parameter input. Every unit can be set via the dedicated parameterizing unit (PMU) without the need to use additional components.

Each unit is supplied with the user software DriveMonitor and comprehensive electronic documentation on a CD. In the case of installation on a standard PC the units can be parameterized via the serial interface of the PC. The software provides extensive parameter aids and a prompted start-up function.

The unit can be further parameterized by entering parameters with the OP1S manual operator panel and via a controller at the field bus level (e.g. Profibus).

8.1 Parameter menus

Parameters with related functions are compiled in menus for structuring the parameter set stored in the units. A menu thus represents a selection out of the entire supply of parameters of the unit.

It is possible for one parameter to belong to several menus. The parameter list indicates which individual menus a parameter belongs to. Assignment is effected via the menu number allocated to each menu.

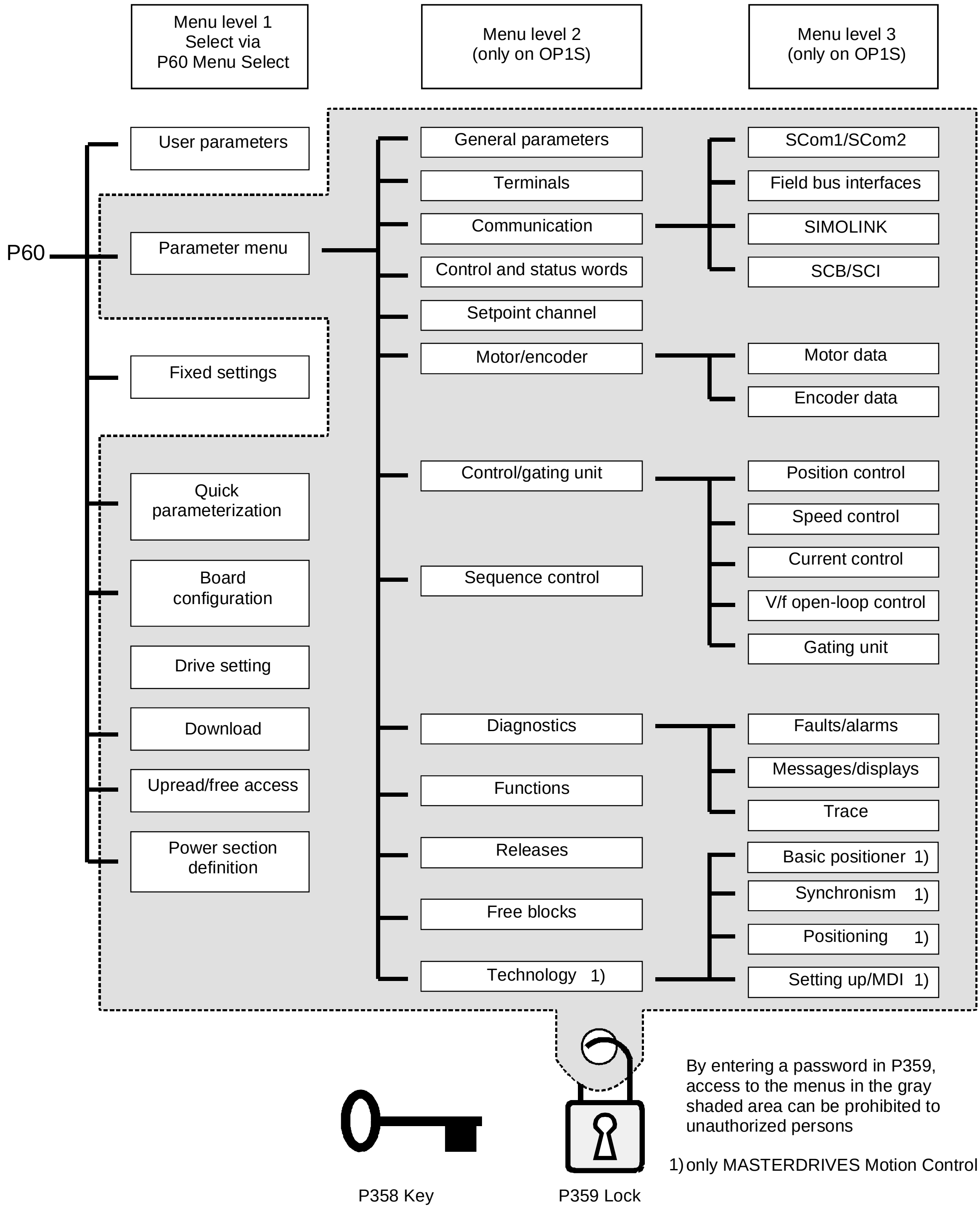


Fig. 8-1 Parameter menus

Menu levels

The parameter menus have several menu levels. The first level contains the main menus. These are effective for all sources of parameter inputs (PMU, OP1S, DriveMonitor, field bus interfaces).

The main menus are selected in parameter P60 Menu Selection.

Examples:
P060 = 0 "User parameters" menu selected
P060 = 1 "Parameter menu" selected
...
P060 = 8 "Power section definition" menu selected

Menu levels 2 and 3 enable the parameter set to be more extensively structured. They are used for parameterizing the units with the OP1S operator control panel.

Main menus

P060	Menu	Description
0	User parameters	• Freely configurable menu
1	Parameter menu	• Contains complete parameter set • More extensive structure of the functions achieved by using an OP1S operator control panel
2	Fixed settings	• Used to perform a parameter reset to a factory or user setting
3	Quick parameterization	• Used for quick parameterization with parameter modules • When selected, the unit switches to status 5 "Drive setting"
4	Board configuration	• Used for configuring the optional boards • When selected, the unit switches to status 4 "Board configuration"
5	Drive setting	• Used for detailed parameterization of important motor, encoder and control data • When selected, the unit switches to status 5 "Drive setting"
6	Download	• Used to download parameters from an OP1S, a PC or an automation unit • When selected, the unit switches to status 21 "Download"
7	Upread/free access	• Contains the complete parameter set and is used for free access to all parameters without being restricted by further menus • Enables all parameters to be upread/upload by an OP1S, PC or automation unit
8	Power section definition	• Used to define the power section (only necessary for units of the Compact and chassis type) • When selected, the unit switches to status 0 "Power section definition"

Table 8-1 Main menus

User parameters

In principle, parameters are firmly assigned to the menus. However, the "User parameters" menu has a special status. Parameters assigned to this menu are not fixed, but can be changed. You are thus able to put together the parameters required for your application in this menu and structure them according to your needs. The user parameters can be selected via P360 (Select UserParam).

Lock and key

In order to prevent undesired parameterization of the units and to protect your know-how stored in the parameterization, it is possible to restrict access to the parameters by defining your own passwords with the parameters:

- ♦ P358 key and
- ♦ P359 lock.

8.2 Changeability of parameters

The parameters stored in the units can only be changed under certain conditions. The following preconditions must be satisfied before parameters can be changed:

Preconditions	Remarks
• Either a function parameter or a BICO parameter must be involved (identified by upper-case letters in the parameter number).	Visualization parameters (identified by lower-case letters in the parameter number) cannot be changed.
• Parameter access must be granted for the source from which the parameters are to be changed.	Release is given in P053 Parameter access.
• A menu must be selected in which the parameter to be changed is contained.	The menu assignment is indicated in the parameter list for every parameter.
• The unit must be in a status which permits parameters to be changed.	The statuses in which it is possible to change parameters are specified in the parameter list.

Table 8-2 Preconditions for being able to change parameters

NOTE

The current status of the units can be interrogated in parameter r001.

Examples

Status (r001)	P053	Result
"Ready for ON" (09)	2	P222 Src n(act) can only be changed via the PMU
"Ready for ON" (09)	6	P222 Src n(act) can be changed via the PMU and SCom1 (e.g. OP1S)
"Operation" (14)	6	P222 Src n(act) cannot be changed on account of the drive status

Table 8-3 Influence of drive status (r001) and parameter access (P053) on the changeability of a parameter

8.3 Parameter input with DriveMonitor

NOTE **Please refer to the online help for detailed information on DriveMonitor (**  **button or F1 key).**

8.3.1 Installation and connection

8.3.1.1 Installation

A CD is included with the devices of the MASTERDRIVES Series when they are delivered. The operating tool supplied on the CD (DriveMonitor) is automatically installed from this CD. If "automatic notification on change" is activated for the CD drive on the PC, user guidance starts when you insert the CD and takes you through installation of DriveMonitor. If this is not the case, start file "Autoplay.exe" in the root directory of the CD.

8.3.1.2 Connection

There are two ways of connecting a PC to a device of the SIMOVERT MASTERDRIVES Series via the USS interface. The devices of the SIMOVERT MASTERDRIVES Series have both an RS232 and an RS485 interface.

RS232 interface The serial interface that PCs are equipped with by default functions as an RS232 interface. This interface is not suitable for bus operation and is therefore only intended for operation of a SIMOVERT MASTERDRIVES device.

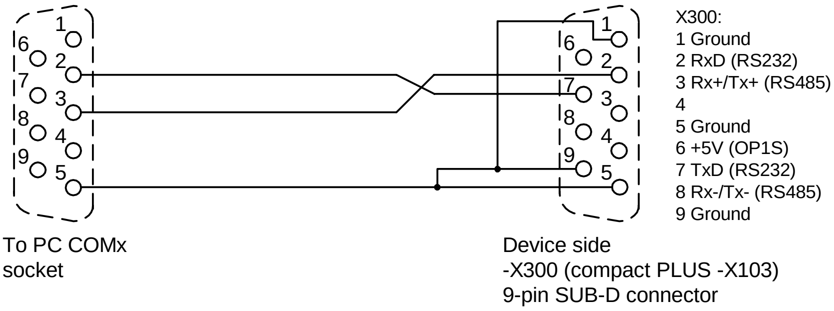


Fig. 8-2 Connecting cable for connecting PC COM(1-4) to SIMOVERT MASTERDRIVES X300

NOTICE DriveMonitor must not be operated via the Sub-D socket X300 if the SST1 interface parallel to it is already being used for another purpose, e.g. bus operation with SIMATIC as the master.

RS485 interface

The RS485 interface is multi-point capable and therefore suitable for bus operation. You can use it to connect 31 SIMOVERT MASTERDRIVES with a PC. On the PC, either an integrated RS485 interface or an RS232 ↔ RS485 interface converter is necessary. On the device, an RS485 interface is integrated into the -X300 (compact PLUS -X103) connection. For the cable: see pin assignment -X300 and device documentation of the interface converter.

8.3.2 Establishing the connection between DriveMonitor and the device

8.3.2.1 Setting the USS interface

You can configure the interface with menu *Tools → ONLINE Settings*.

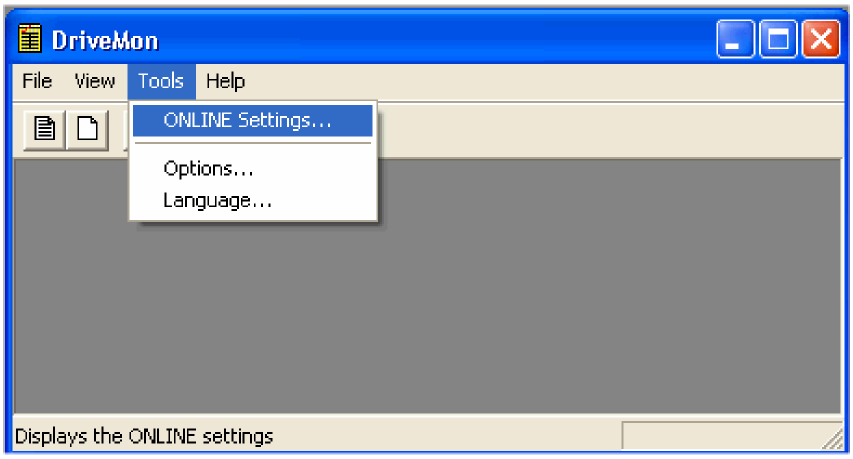


Fig. 8-3 Online settings

The following settings (Fig. 8-4) are possible:

- **Tab card "Bus Type",** options
  USS (operation via serial interface)
  Profibus DP (only if DriveMonitor is operated under Drive ES).
- **Tab card "Interface"**
  You can enter the required COM interface of the PC (COM1 to COM4) and the required baudrate here.

NOTE

Set the baudrate to the baudrate parameterized in SIMOVERT MASTERDRIVES (P701) (factory setting 9600 baud).

Further settings: operating mode of the bus in RS485 operation; setting according to the description of the interface converter RS232/RS485

- **Tab card "Extended"**
  Request retries and Response timeout; here you can increase the values already set if communication errors occur frequently.

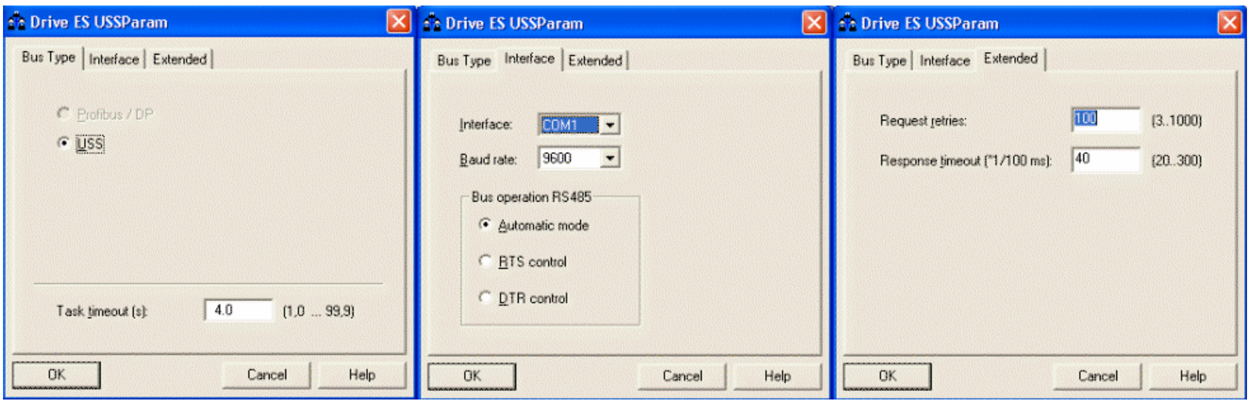


Fig. 8-4 Interface configuration

8.3.2.2 Starting the USS bus scan

DriveMonitor starts with an empty drive window. Via the menu "*Set up an ONLINE connection*..." the USS bus can be scanned for connected devices:

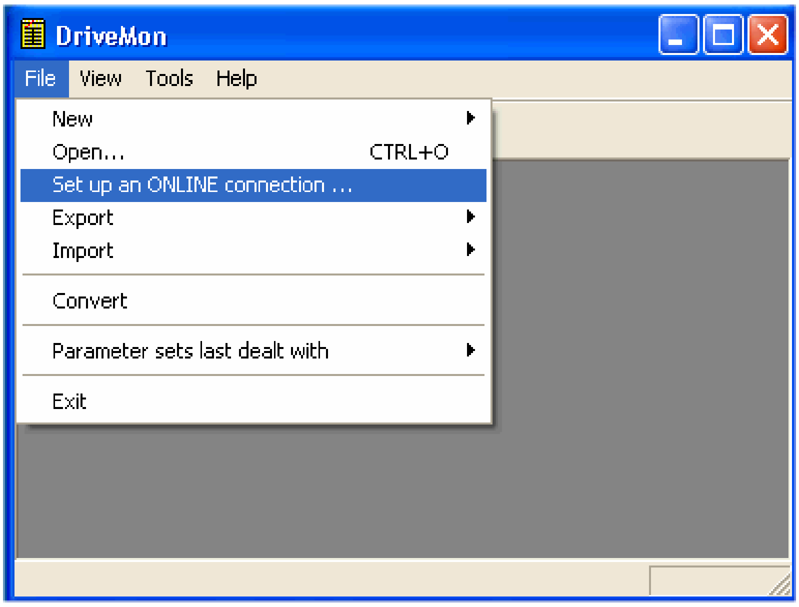


Fig. 8-5 Starting the USS bus scan

NOTE

The "Set up an online connection" menu is only valid from Version 5.2 onwards.

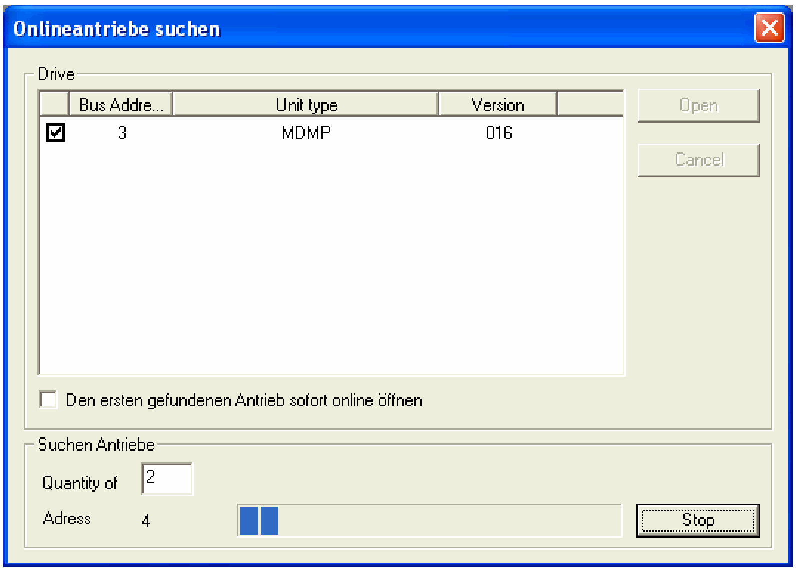


Fig. 8-6 Search for online drives

During the search the USS bus is scanned **with the set baudrate only**. The baud rate can be changed via "*Tools → ONLINE Settings*", see section 8.3.2.1.

8.3.2.3 Creating a parameter set

With menu *File*→ *New* →... you can create a new drive for parameterization (see Fig. 8-7). The system creates a download file (*.dnl), in which the drive characteristic data (type, device version) are stored. You can create the download file on the basis of an empty parameter set or the factory setting.

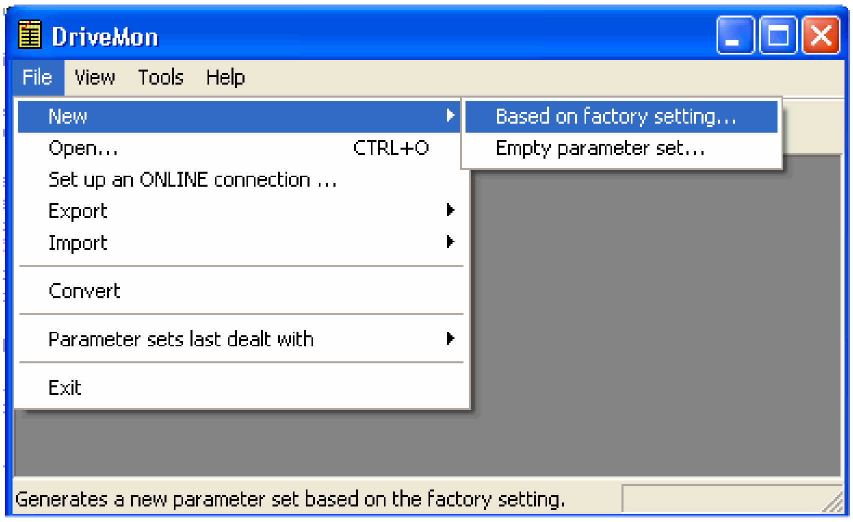


Fig. 8-7 Creating a new drive

Based on factory setting:

- ♦ The parameter list is preassigned with the factory setting values

Empty parameter set:

- ♦ For compilation of individually used parameters

If the parameters of a parameter set that has already been created have to be changed, this can be done by calling the corresponding download file via the "*File*→ *Open"* menu function. The last four drives can be opened via *"Parameter sets last dealt with"*.

When you create a new drive, the window "Drive Properties" (Fig. 8-8) opens. Here you must enter the following data:

- ♦ In dropdown list box "Device type", select the type of device (e.g. MASTERDRIVES MC). You can only select the devices stored.
- ♦ In dropdown list box "Device version", you can select the software version of the device. You can generate databases for (new) software versions that are not listed when you start online parameterization.
- ♦ You must only specify the bus address of the drive during online operation (switchover with button Online/Offline)

NOTE

The specified bus address must be the same as that of the parameterized SST bus address in SIMOVERT MASTERDRIVES (P700).

No bus address is assigned to the drive with the button "Disconnect network connection".

NOTE

Field "Number of PCD" has no special significance for the parameterization of MASTERDRIVES and should be left at "2".

If the value is changed, it must be/remain ensured that the setting value in the program matches the value in parameter P703 of the drive at all times.

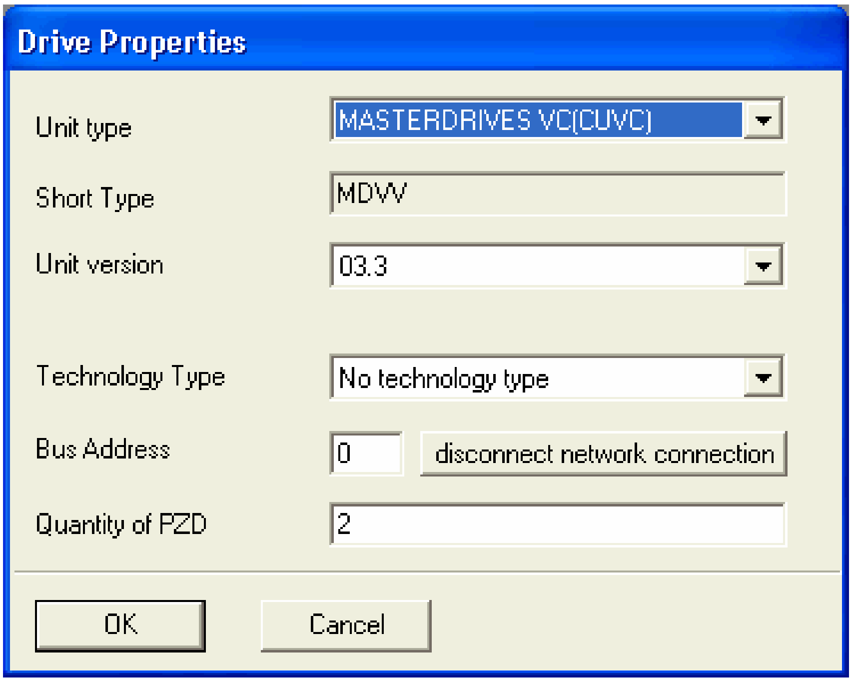


Fig. 8-8 Create file; Drive properties

After confirming the drive properties with *ok* you have to enter the name and storage location of the download file to be created.

8.3.3 Parameterization

8.3.3.1 Structure of the parameter lists, parameterization with DriveMonitor

Parameterization using the parameter list is basically the same as parameterization using PMU (See Chapter 6 "Parameterizating Steps"). The parameter list provides the following advantages:

- Simultaneous visibility of a larger number of parameters
- Text display for parameter names, index number, index text, parameter value, binectors, and connectors
- On a change of parameters: Display of parameter limits or possible parameter values

The parameter list has the following structure:

Field No.	Field Name	Function
1	P. Nr	Here the parameter number is displayed. You can only change the field in menu *Free parameterization*.
2	Name	Display of the parameter name, in accordance with the parameter list
3	Ind	Display of the parameter index for indexed parameters. To see more than index 1, click on the [+] sign. The display is then expanded and all indices of the parameter are displayed
4	Index text	Meaning of the index of the parameter
5	Parameter value	Display of the current parameter value. You can change this by double-clicking on it or selecting and pressing *Enter*.
6	Dim	Physical dimension of the parameter, if there is one

With buttons *Offline, Online (RAM), Online (EEPROM)* (Fig. 8-9 [1]) you can switch modes. When you switch to online mode, device identification is performed. If the configured device and the real device do not match (device type, software version), an alarm appears. If an unknown software version is recognized, the option of creating the database is offered. (This process takes several minutes.)

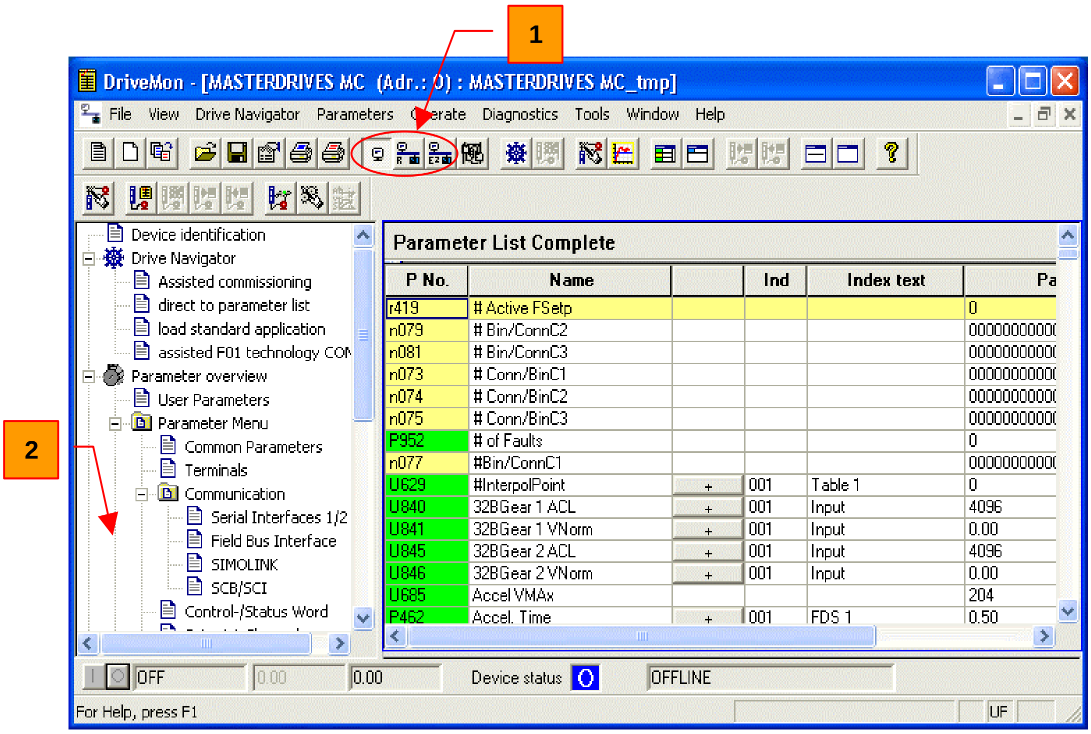


Fig. 8-9 Drive window/parameter list

The DriveMonitor drive window has a directory tree for navigation purposes (Fig. 8-9 [2]). You can deselect this additional operating tool in menu V*iew - Parameter selection*.

The drive window contains all elements required for the parameterization and operation of the connected device. In the lower bar, the status of the connection with the device is displayed:

Connection and device ok

Connection ok, device in fault state

Connection ok, device in alarm state

Device is parameterized offline

No connection with the device can be established (only offline parameterization possible).

NOTE

If no connection with the device can be established because the device does not physically exist or is not connected, you can perform offline parameterization. To do so, you have to change to offline mode. In that way, you can create an individually adapted download file, which you can load into the device later.

Drive Navigator

This is used to quickly access important functions of the DriveMonitor. Settings for Drive Navigator under *Tools -> Options* (Fig. 8-11):

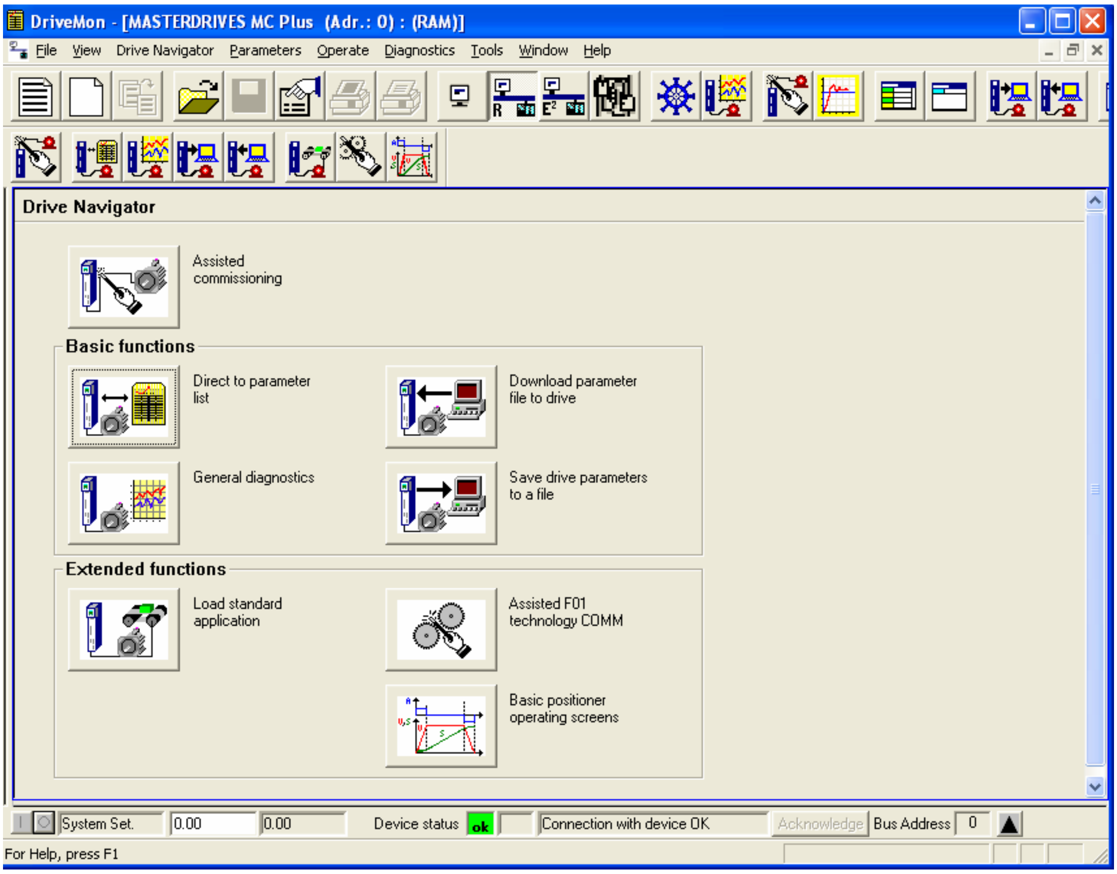


Fig. 8-10 Drive Navigator

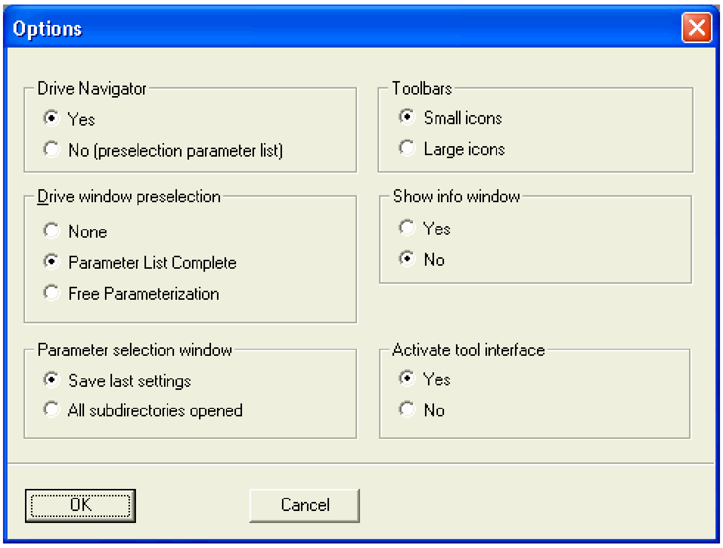
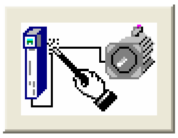
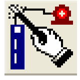
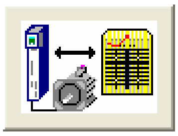
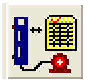
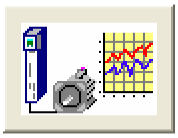
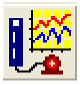


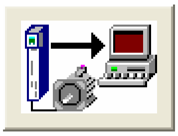
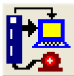
Fig. 8-11 Options menu display

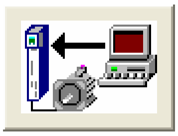
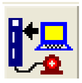
Toolbar of the Drive Navigator

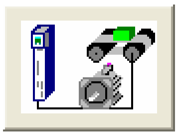
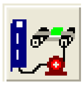
 =  Assisted commissioning

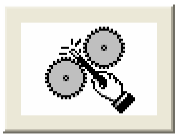
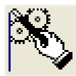
 =  Direct to parameter list

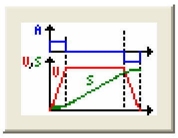
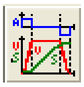
 =  General diagnostics

 =  Save drive parameters to a file

 =  Download parameter file to drive

 =  Load standard application

 =  Assisted F01 technology COMM

 =  Basic positioner operating screens

8.3.3.2 General diagnostics

Via the *Diagnostics → General diagnostics* menu the following window opens. This window gives a general overview of the active warnings and faults and their history. Both the warning and the fault number as well as plain text are displayed.

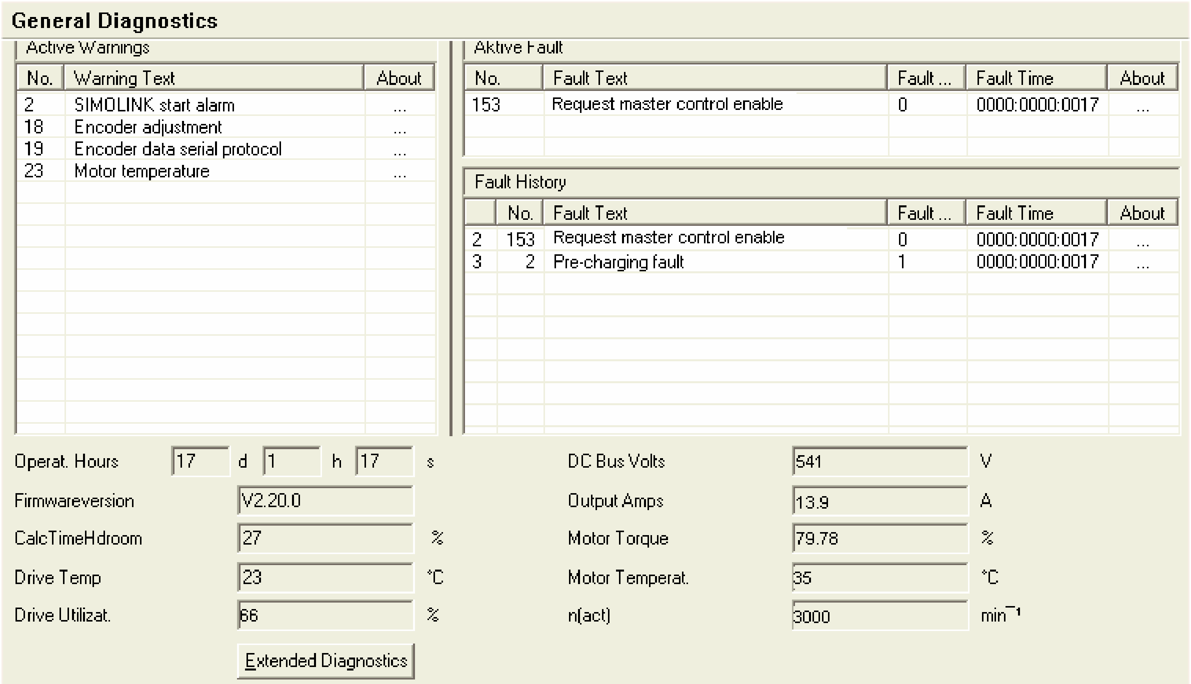


Fig. 8-12 General diagnostics

Via the *Extended Diagnostics* button you can reach the next diagnostics window.

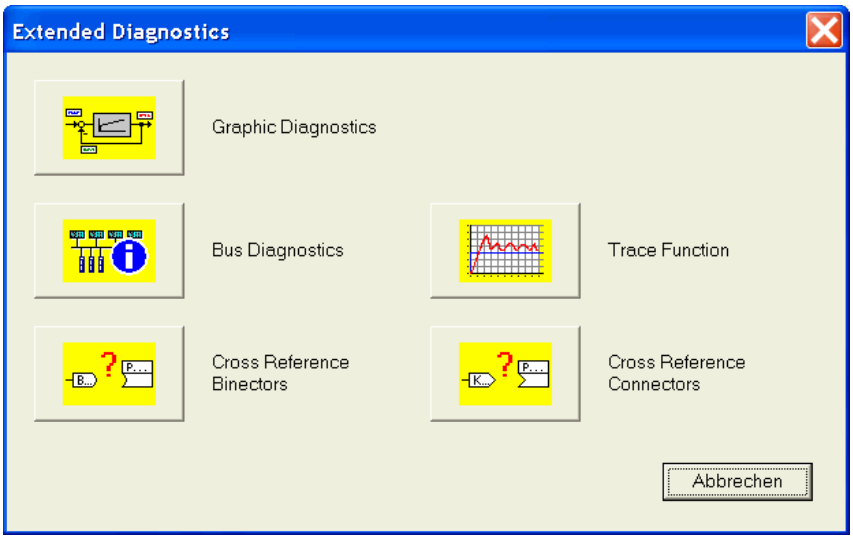


Fig. 8-13 Extended diagnostics

8.4 Parameter input via the PMU

The PMU parameterizing unit enables parameterization, operator control and visualization of the converters and inverters directly on the unit itself. It is an integral part of the basic units. It has a four-digit seven-segment display and several keys.

The PMU is used with preference for parameterizing simple applications requiring a small number of set parameters, and for quick parameterization.

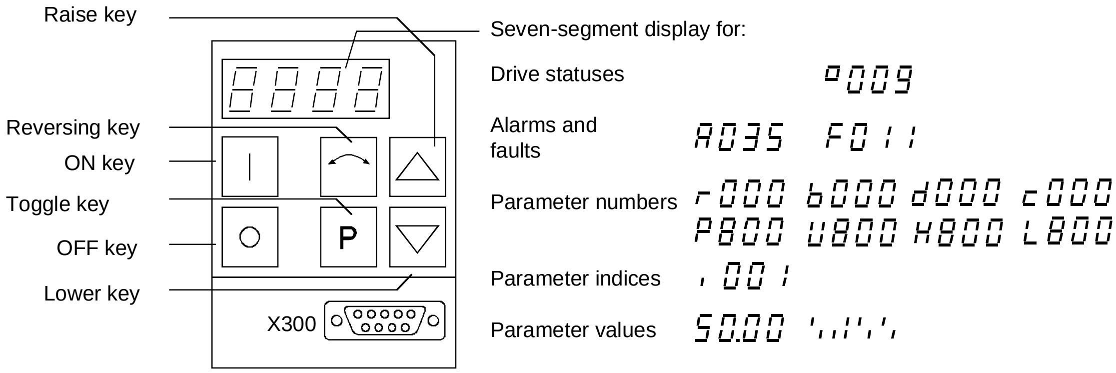


Fig. 8-14 PMU parameterizing unit

Key	Meaning	Function
I	ON key	• For energizing the drive (enabling motor activation). • If there is a fault: For returning to fault display
O	OFF key	• For de-energizing the drive by means of OFF1, OFF2 or OFF3 (P554 to 560) depending on parameterization.
⌒	Reversing key	• For reversing the direction of rotation of the drive. The function must be enabled by P571 and P572
P	Toggle key	• For switching between parameter number, parameter index 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	For increasing the displayed value: • Short press = single-step increase • Long press = rapid increase
▽	Lower key	For lowering the displayed value: • Short press = single-step decrease • Long press = rapid decrease
P + △	Hold toggle key and depress raise key	• If parameter number level is active: For jumping back and forth between the last selected parameter number and the operating display (r000) • If fault display is active: For switching over to parameter number level • If parameter value level is active: For shifting the displayed value one digit to the right if parameter value cannot be displayed with 4 figures (left-hand figure flashes if there are any further invisible figures to the left)
P + ▽	Hold toggle key and depress lower key	• If parameter number level is active: For jumping directly to the operating display (r000) • If parameter value level is active: For shifting the displayed value one digit to the left if parameter value cannot be displayed with 4 figures (right-hand figure flashes if there are any further invisible figures to the right)

Table 8-4 Operator control elements on the PMU

Toggle key (P key)

As the PMU only has a four-digit seven-segment display, the 3 descriptive elements of a parameter

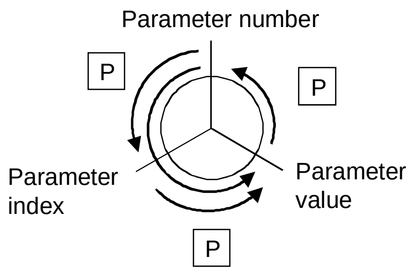
- ♦ Parameter number,
- ♦ Parameter index (if parameter is indexed) and
- ♦ Parameter value

cannot be displayed at the same time. For this reason, you have to switch between the individual descriptive elements by depressing the toggle key. After the desired level has been selected, adjustment can be made using the raise key or the lower key.

With the toggle key, you can change over:

- 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, you can jump directly to the parameter value.



NOTE

If you change the value of a parameter, this change generally becomes effective immediately. It is only in the case of acknowledgement parameters (marked in the parameter list by an asterisk ‘ * ’) that the change does not become effective until you change over from the parameter value to the parameter number.

Parameter changes made using the PMU are always safely stored in the EEPROM (protected in case of power failure) once the toggle key has been depressed.

Example

The following example shows the individual operator control steps to be carried out on the PMU for a parameter reset to factory setting.

Set P053 to 0002 and grant parameter access for PMU

P053	↗ P ↘	0000	↗ Δ ↘	0001	↗ Δ ↘	0002	↗ P ↘	P053

Select P060

P053	↗ Δ ↘	P060

Set P060 to 0002 and select "Fixed settings" menu

P060	↗ P ↘	1	↗ Δ ↘	2	↗ P ↘	P060

Select P970

P060	↗ Δ ↘	P366	↗ Δ ↘	P970

Set P970 to 0000 and start parameter reset

P970	↗ P ↘	1	↗ ∇ ↘	0	↗ P ↘	°009

8.5 Parameter input via the OP1S

The operator control panel (OP1S) is an optional input/output device which can be used for parameterizing and starting up the units. Plain-text displays greatly facilitate parameterization.

The OP1S has a non-volatile memory and can permanently store complete sets of parameters. It can therefore be used for archiving sets of parameters, but first the parameter sets must be read out (upread) from the units. Stored parameter sets can also be transferred (downloaded) to other units.

The OP1S and the unit to be operated communicate with each other via a serial interface (RS485) using the USS protocol. During communication, the OP1S assumes the function of the master whereas the connected units function as slaves.

The OP1S can be operated at baud rates of 9.6 kBd and 19.2 kBd, and is capable of communicating with up to 32 slaves (addresses 0 to 31). It can therefore be used in a point-to-point link (e.g. during initial parameterization) or within a bus configuration.

The plain-text displays can be shown in one of five different languages (German, English, Spanish, French, Italian). The language is chosen by selecting the relevant parameter for the slave in question.

Order numbers

Components	Order Number
OP1S	6SE7090-0XX84-2FK0
Connecting cable 3 m	6SX7010-0AB03
Connecting cable 5 m	6SX7010-0AB05
Adapter for installation in cabinet door incl. 5 m cable	6SX7010-0AA00

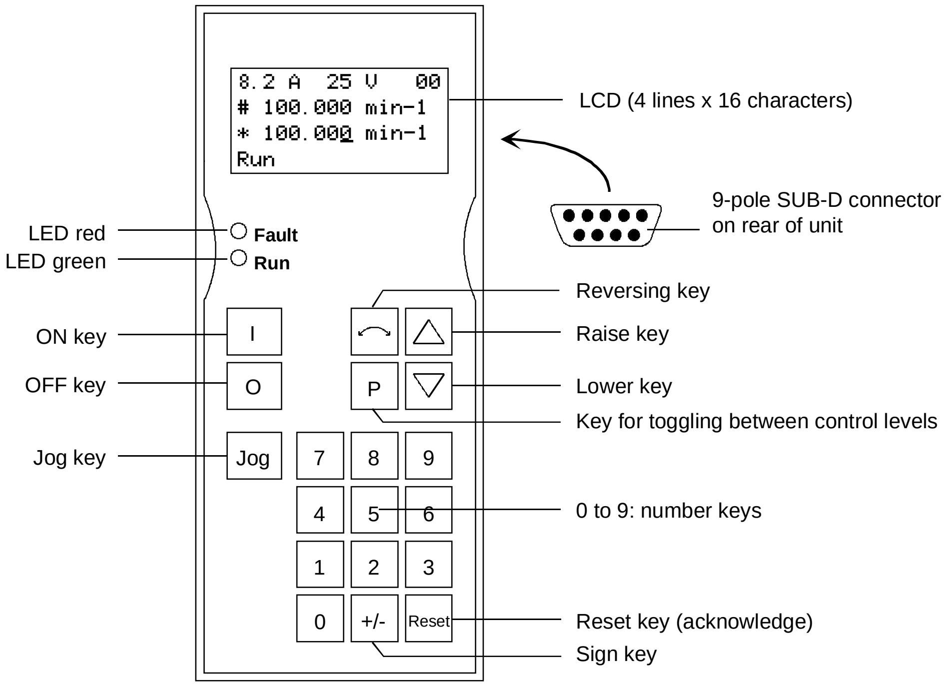


Fig. 8-15 View of the OP1S

8.5.1 Connecting, run-up

8.5.1.1 Connecting

The OP1S can be connected to the units in the following ways:

- ♦ Connection via 3 m or 5 m cable (e.g. as a hand-held input device for start-up)
- ♦ Connection via cable and adapter for installation in a cabinet door
- ♦ Plugging into MASTERDRIVES Compact units (for point-to-point linking or bus configuration)
- ♦ Plugging into MASTERDRIVES Compact PLUS units (for bus configuration)

Connection via cable

The cable is plugged into the Sub D socket X103 on units of the Compact PLUS type and into Sub D socket X300 on units of the Compact and chassis type.

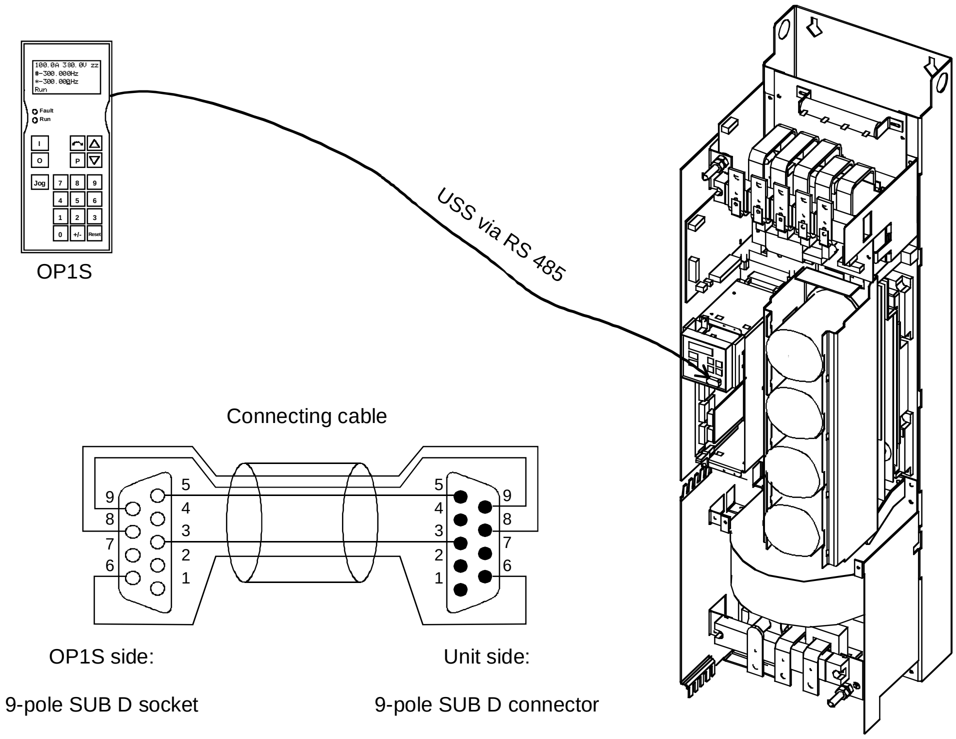


Fig. 8-16 The OP1S directly connected to the unit

8.5.1.2 Run-up

After the power supply for the unit connected to the OP1S has been turned on or after the OP1S has been plugged into a unit which is operating, there is a run-up phase.

NOTICE

The OP1S must not be plugged into the Sub D socket if the SCom1 interface parallel to the socket is already being used elsewhere, e.g. bus operation with SIMATIC as the master.

NOTE

In the as-delivered state or after a reset of the parameters to the factory setting with the unit's own control panel, a point-to-point link can be adopted with the OP1S without any further preparatory measures.

When a bus system is started up with the OP1S, the slaves must first be configured individually. The plugs of the bus cable must be removed for this purpose.

With the "OP: Download" function, a parameter set stored in the OP1S can be written into the connected slave. Starting from the basic menu, the "OP: Download" function is selected with "Lower" or "Raise" and activated with "P".

	P	
VectorControl *Menu Selection OP: Upread #OP: Download		Download *1909199701 MASTERDRIVES VC

Example: Selecting and activating the "Download" function

One of the parameter sets stored in the OP1S must now be selected with "Lower" or "Raise" (displayed in the second line). The selected ID is confirmed with "P". The slave ID can now be displayed with "Lower" or "Raise" (see section "Slave ID"). The "Download" procedure is then started with "P". During download, the OP1S displays the currently written parameter.

	P		P	
Download *1909199701 MASTERDRIVES VC		Download *1909199701 MASTERDRIVES VC		VectorControl 00 Download Pxxx

Example: Confirming the ID and starting the "Download" procedure

With "Reset", the procedure can be stopped at any time. If downloading has been fully completed, the message "Download ok" appears and the display returns to the basic menu.

After the data set to be downloaded has been selected, if the identification of the stored data set does not agree with the identification of the connected unit, an error message appears for approximately 2 seconds. The operator is then asked if downloading is to be discontinued.

	P		P		2 s	
Download *1909199701 MASTERDRIVES VC		Download *1909199701 MASTERDRIVES VC		Error: Different IDs		VectorControl 00 Stop download? #yes no

Yes: Downloading is discontinued.

No: Downloading is carried out.

9 Parameterizing steps

The chapter entitled "Parameterizing Steps" describes the parameter assignments to be made for starting up SIMOVERT MASTERDRIVES:

In addition to this chapter, you should also refer to Chapter 3 (First Start-Up) and Chapter 8 (Parameterization) in the operating instructions.

The parameterizing steps are divided into different categories:

- ♦ Parameter reset to factory setting (9.1)
- ♦ Quick parameterization procedures (9.2)
- ♦ Detailed parameterization (9.4)

Parameter reset to factory setting

The factory setting is the defined initial state of all the parameters of a unit. The units are delivered with this setting.

A detailed description is given in section 9.1.

Quick parameterization procedures

The quick parameterization procedures can always be used when the exact application conditions of the units are known and no tests with the associated extensive parameter corrections are required.

The following quick parameterization procedures are described in section 9.2:

1. Quick parameterization, P060 = 3
   (Parameterizing with parameter modules)
2. Parameterizing with user settings
   (Fixed settings or factory settings, P060 = 2)
3. Parameterizing with existing parameter files
   (Download, P060 = 6)

Depending on the specific conditions prevailing in each case, parameters can either be assigned in detail (see section 9.4) or with one of the specified quick procedures.

By activating a fixed setting (P060 = 2) the parameters of the unit can also be reset to the original values.

Detailed parameterization

Detailed parameterization should always be used in cases where the exact application conditions of the units are not known beforehand and detailed parameter adjustments need to be made locally, e.g. on initial start-up.

The description of detailed parameterization in section 9.4 is divided into the following main steps:

1. Power section definition (P060 = 8)
2. Board definition (P060 = 4)
3. Drive definition (P060 = 5)
4. Function adjustment.

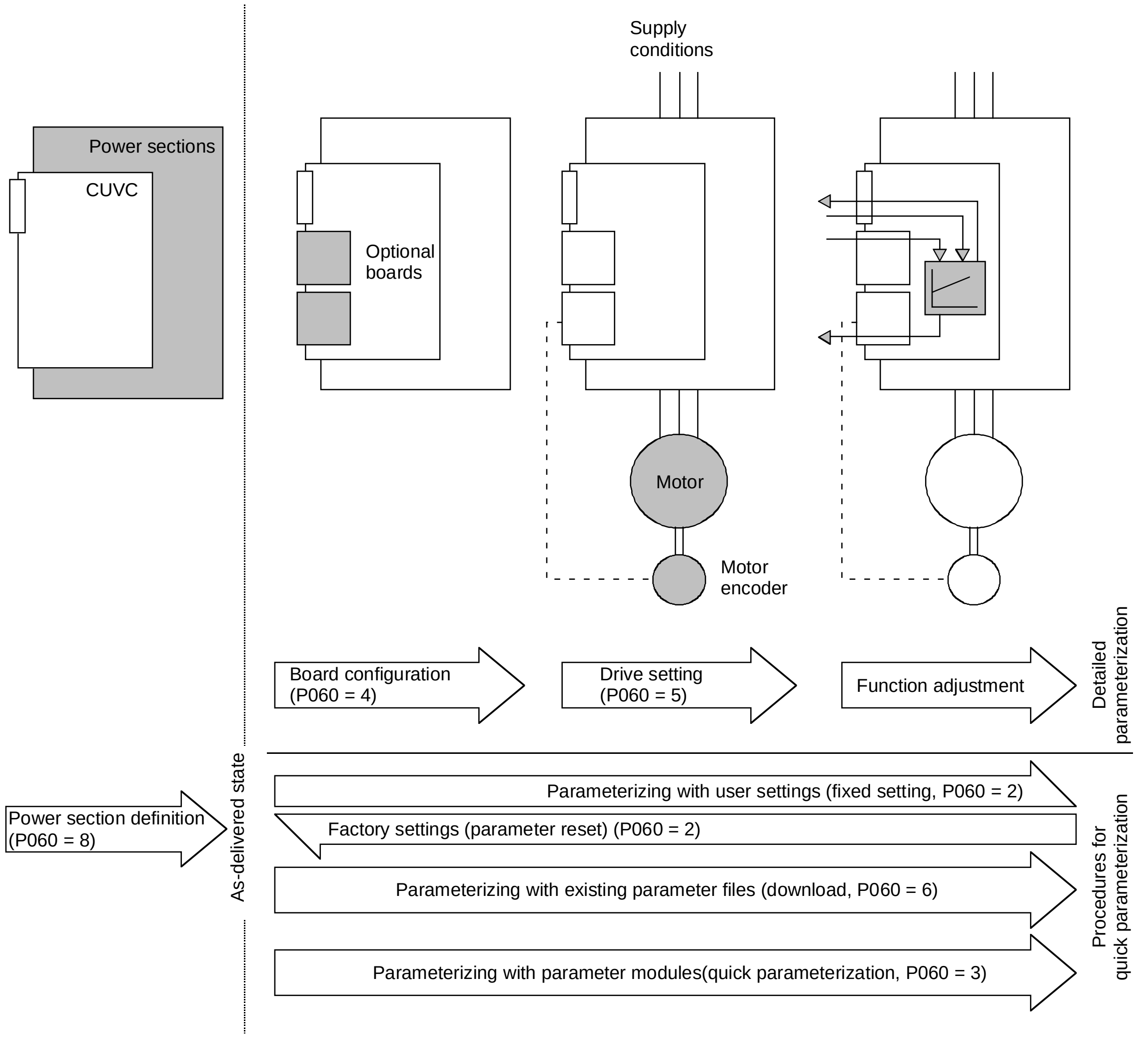


Fig. 9-1 Detailed and quick parameterization

9.1 Parameter reset to factory setting

The factory setting is the defined initial state of all parameters of a unit. The units are delivered with this setting.

You can restore this initial state at any time by resetting the parameters to the factory setting, thus canceling all parameter changes made since the unit was delivered.

The parameters for defining the power section and for releasing the technology options and the operating hours counter and fault memory are not changed by a parameter reset to factory setting.

Parameter number	Parameter name
P050	Language
P070	Order No. 6SE70..
P072	Rtd Drive Amps
P073	Rtd Drive Power
P366	Select FactSet
P947	Fault memory
P949	Fault value

Table 9-1 Parameters which are not changed by the factory setting

If the parameters are reset to the factory setting via one of the parameters (SST1, SST2, SCB, 1.CB/TB, 2.CB/TB), the interface parameters of that interface are not changed either. Communication via that interface therefore continues even after a parameter reset to the factory setting.

Parameter number	Parameter name
P053	Parameterization enable
P700	SST bus address
P701	SST baud rate
P702	SST PKW number
P703	SST PZD number
P704	SST frame failure

Table 9-2 The factory setting is made either via interface SST1 or SST2: Parameters that are not changed by the factory setting either. ***None*** *of the indices of the parameters is changed.*

Parameter number	Parameter name
P053	Parameterization enable
P696	SCB protocol
P700	SST bus address
P701	SST baud rate
P702	SST PKW number
P703	SST PZD number
P704	SST frame failure

Table 9-3 The factory setting is made via interface SCB2: Parameters that are not changed by the factory setting either. ***None*** *of the indices of the parameters is changed.*

Parameter number	Parameter name
P053	Parameterization enable
P711 to P721	CB parameters 1 to 11
P722	CB/TB frame failure
P918	CB bus address

Table 9-4 The factory setting is made either via interface 1.CB/TB or 2.CB/TB: Parameters that are not changed by the factory setting either. ***None*** *of the indices of the parameters is changed.*

NOTE

Parameter factory settings which are dependent on converter or motor parameters are marked with '(~)' in the block diagrams.

P053 = 6

Grant parameter access
6: Parameter changes permitted via PMU and serial interface SCom1 (OP1S and PC)

↓

P060 = 2

Select "Fixed settings" menu

↓

P366 = ?

Select desired factory setting
0: Standard with PMU, setpoint via MOP (BICO1)
1: Standard with OP1S, setpoints via fixed setpoints (BICO1)
2: Cabinet unit with OP1S, setpoint via fixed setpoints (BICO1)
3: Cabinet unit with PMU, setpoint via MOP (BICO1)
4: Cabinet unit with OP1S and NAMUR terminal strip (SCI), setpoint via MOP (BICO1)

Note: This parameter was correctly set prior to delivery of the unit and only needs to be changed in exceptional cases.

re 0 to 3: In BICO data set 2 activation/deactivation is carried out via the terminal strip and the setpoint is specified via fixed setpoint (P405).

↓

P970 = 0

Start parameter reset
0: Parameter reset
1: No parameter change

Unit carries out parameter reset and then leaves the "Fixed settings" menu

Fig. 9-2 Sequence for parameter reset to factory setting

Factory settings dependent on P366

Para-meters depen-dent on P366	Designation of the parameter on the OP1S (Src = Source)	Factory setting with PMU		Factory setting with OP1S		Cabinet unit with OP1S or terminal strip		Cabinet unit with PMU or terminal strip		Cabinet unit with NAMUR terminal strip (SCI)	
		P366 = 0		P366 = 1		P366 = 2		P366 = 3		P366 = 4	
		BICO1 (i001)	**BICO2 (i002)**	**BICO1 (i001)**	**BICO2 (i002)**	**BICO1 (i001)**	**BICO2 (i002)**	**BICO1 (i001)**	**BICO2 (i002)**	**BICO1 (i001)**	**BICO2 (i002)**
P443	Src MainSetpoint	KK058	KK040	KK040	KK040	KK040	KK040	KK058	KK040	KK058	K4102
P554	Src ON/OFF1	B0005	B0022	B2100	B0022	B2100	B0022	B0005	B0022	B2100	B4100
P555	Src1 OFF2	B0001	B0020	B0001	B0020	B0001	B0001	B0001	B0001	B0001	B0001
P556	Src2 OFF2	B0001	B0001	B0001	B0001	B0001	B0001	B0001	B0001	B0001	B4108
P565	Src1 Fault Reset	B2107	B2107	B2107	B2107	B2107	B2107	B2107	B2107	B2107	B2107
P566	Src2 Fault Reset	B0000	B0000	B0000	B0000	B0000	B0000	B0000	B0000	B4107	B4107
P567	Src3 Fault Reset	B0000	B0018	B0000	B0018	B0000	B0010	B0000	B0010	B0000	B0000
P568	Src Jog Bit0	B0000	B0000	B2108	B0000	B2108	B0000	B0000	B0000	B0000	B0000
P571	Src FWD Speed	B0001	B0001	B2111	B0001	B2111	B0001	B0001	B0001	B2111	B4129
P572	Src REV Speed	B0001	B0001	B2112	B0001	B2112	B0001	B0001	B0001	B2112	B4109
P573	Src MOP UP	B0008	B0000	B0000	B0000	B0000	B0000	B0008	B0000	B2113	B4105
P574	Src MOP Down	B0009	B0000	B0000	B0000	B0000	B0000	B0009	B0000	B2114	B4106
P575	Src No ExtFault1	B0001	B0001	B0001	B0001	B0018	B0018	B0018	B0018	B0018	B0018
P588	Src No Ext Warn1	B0001	B0001	B0001	B0001	B0020	B0020	B0020	B0020	B0020	B0020
P590	Src BICO DSet	B0014	B0014	B0014	B0014	B0012	B0012	B0012	B0012	B4102	B4102
P651	Src DigOut1	B0107	B0107	B0107	B0107	B0000	B0000	B0000	B0000	B0107	B0107
P652	Src DigOut2	B0104	B0104	B0104	B0104	B0000	B0000	B0000	B0000	B0104	B0104
P653	Src DigOut3	B0000	B0000	B0000	B0000	B0107	B0107	B0107	B0107	B0000	B0000
P693.1	SCI AnaOutActV 1	K0000	K0000	K0000	K0000	K0000	K0000	K0000	K0000	KK020	KK020
P693.2	SCI AnaOutActV 2	K0000	K0000	K0000	K0000	K0000	K0000	K0000	K0000	K0022	K0022
P693.3	SCI AnaOutActV 3	K0000	K0000	K0000	K0000	K0000	K0000	K0000	K0000	K0024	K0024
P698.1	Src SCI DigOut 1	B0000	B0000	B0000	B0000	B0000	B0000	B0000	B0000	B0100	B0100
P698.2	Src SCI DigOut 2	B0000	B0000	B0000	B0000	B0000	B0000	B0000	B0000	B0120	B0120
P698.3	Src SCI DigOut 3	B0000	B0000	B0000	B0000	B0000	B0000	B0000	B0000	B0108	B0108
P698.4	Src SCI DigOut 4	B0000	B0000	B0000	B0000	B0000	B0000	B0000	B0000	B0107	B0107
P704.3	SCom TlgOFF SCB	0 ms	0 ms	0 ms	0 ms	0 ms	0 ms	0 ms	0 ms	100 ms	100 ms
P796	Compare Value	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	2.0	2.0
P797	Compare Hyst	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	1.0	1.0
P049.4	OP OperDisp	r229	r229	P405	P405	P405	P405	r229	r229	r229	r229

Table 9-5 Factory setting dependent on P366

All other factory setting values are not dependent on P366 and can be taken from the parameter list or from the block diagrams (in the Compendium).

The factory settings for Index 1 (i001) of the respective parameter are displayed in the parameter list.

Significance of the binectors and connectors for factory setting:

Entry	Description	See function diagram (in Compendium)
B0000	Fixed binector 0	-15.4-
B0001	Fixed binector 1	-15.4-
B0005	PMU ON/OFF	-50.7-
B0008	PMU MOP UP	-50.7-
B0009	PMU MOP DOWN	-50.7-
B0010	DigIn1	-90.4-
B0012	DigIn2	-90.4-
B0014	DigIn3	-90.4-
B0016	DigIn4	-90.4-
B0018	DigIn5	-90.4-
B0020	DigIn6	-90.4-
B0022	DigIn7	-90.4-
B0100	Rdy for ON	-200.5-
B0104	Operation	-200.5-
B0107	No fault	-200.6-
B0108	No OFF2	-200.5-
B0120	CompV OK	-200.5-
B2100	SCom1 Word1 Bit0	-100.8-
...		
B2115	SCom1 Word1 Bit15	-100.8-
B4100	SCI1 Sl1 DigIn	-Z10.7- / -Z30.4-
...		
B4115	SCI1 Sl1 DigIn	-Z30.8-
r229	n/f(set,smooth)	-360.4- / -361.4- / -362.4- / -363.4- / -364.4-
P405	Fixed setpoint 5	-290.3-
KK0020	Speed (smoothed)	-350.8- / -351.8- / -352.8-
K0022	Output Amps (smoothed)	-285.8- / -286.8-
K0024	Torque (smoothed)	-285.8-
KK0040	Current FixSetp	-290.6-
KK0058	MOP (Output)	-300.8-

Bxxxx =	Binector =	freely assignable digital signal (values 0 and 1)
Kxxxx =	Connector =	freely assignable 16-bit signal (4000h = 100 %)
KKxxxx =	Double connector =	freely assignable 32-bit signal (4000 0000h = 100 %)

Use of binectors for **digital inputs** in factory settings:

When B0010 to B0017 (DigIn1 to 4) are used, the corresponding digital outputs cannot be used!

P366	**0**	**0**	**1**	**1**	**2**	**2**	**3**	**3**	**4**	**4**
BICO data set	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**
B0010						P567		P567		
B0012					P590	P590	P590	P590		
B0014	P590	P590	P590	P590						
B0016		P580		P580		P580		P580		P580
B0018		P567		P567	P575	P575	P575	P575	P575	P575
B0020		P555		P555	P588	P588	P588	P588	P588	P588
B0022		P554		P554		P554		P554		

Meaning of the parameters in the factory setting:

Entry	Description	See function diagram (in Compendium)
P554	Src ON/OFF1	-180-
P555	Src1 OFF2(electr)	-180-
P567	Src3 Fault Reset	-180-
P575	Src No ExtFault1	-180-
P580	Src FixSetp Bit0	-190-
P588	Src No Ext Warn 1	-190-
P590	Src BICO DSet	-190-

9.2 Quick parameterization procedures

The following quick procedures are always used in cases where the application conditions of the units are exactly known and no tests and related extensive parameter corrections are required. Typical examples of applications for quick parameterization are when units are installed in standard machines or when a unit needs replacing.

9.2.1 Quick parameterization, P060 = 3 (Parameterizing with parameter modules)

Pre-defined, function-assigned parameter modules are stored in the units. These parameter modules can be combined with each other, thus making it possible to adjust your unit to the desired application by just a few parameter steps. Detailed knowledge of the complete parameter set of the unit is not required.

Parameter modules are available for the following function groups:

1. Motors (input of the rating plate data with automatic parameterization of open-loop and closed-loop control)
2. Open-loop and closed-loop control types
3. Setpoint and command sources

Parameterization is effected by selecting a parameter module from each function group and then starting quick parameterization. In accordance with your selection, the necessary unit parameters are set to produce the desired control functionality. The motor parameters and the relevant controller settings are calculated using automatic parameterization (P115 = 1).

NOTE

Parameterizing with parameter modules is carried out only in BICO data set 1 and in function and motor data set 1.

Quick parameterization is effected in the "Download" converter status. Since quick parameterization includes the factory settings for all parameters, all previous parameter settings are lost.

Quick parameterization incorporates an abridged drive setting, (e.g. pulse encoder always with pulse number/revolution 1024). The complete procedure is given in the "Drive setting" section.

Function diagram modules

Function diagram modules (function diagrams) are shown after the flow chart for parameter modules stored in the unit software. On the first few pages are the :

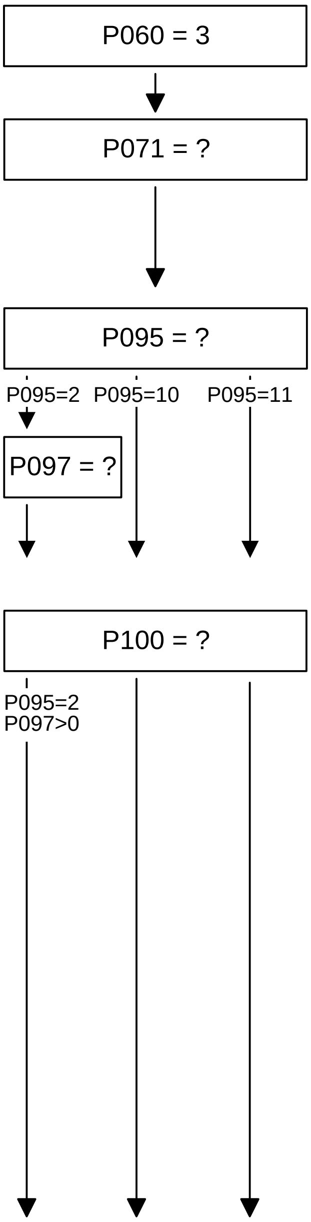
- setpoint and command sources (sheets s0 to s81), on the following pages are the
- analog outputs and the display parameters (sheet a0) and the
- open-loop and closed-loop control types (sheets r0 to r5).

It is therefore possible to put together the function diagrams to exactly suit the selected combination of setpoint/command source and open/closed-loop control type. This will give you an overview of the functionality parameterized in the units and of the necessary assignment of the terminals.

The function parameters and visualization parameters specified in the function diagrams are automatically adopted in the user menu (P060 = 0) and can be visualized or changed there.

The parameter numbers of the user menu are entered in P360.

Reference is made in the function diagrams to the respective function diagram numbers (Sheet [xxx]) of the detail diagrams (in the Compendium).



Menu selection "Quick parameterization"

Input unit line voltage in V
AC units: r.m.s. alternating voltage
DC units: DC link voltage
The input is important, e.g. for voltage limitation control (Vdmax control, P515 = 1)

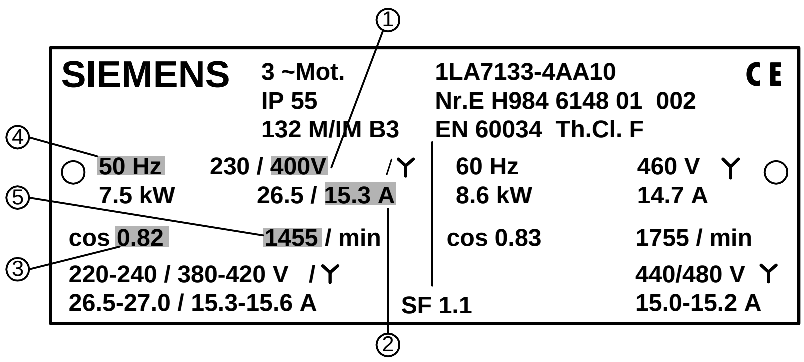
Enter the motor type
2: Compact asynchronous motor 1PH7 (=1PA6)/1PL6/1PH4
10: Async./Sync. IEC (international Norm)
11: Async./Sync. NEMA (US-Norm)

Enter the code number for the connected motor of the Range 1PH7(=1PA6)/1PL6/1PH4
(see "Motor List" section)
(Automatic parameter assignment is implemented as soon as the settings P095 = 2 and P097 > 0 have been made)

Enter the open/closed-loop control type (sheet r0 to r5)
0: v/f open-loop control + n-controller with pulse encoder (P130 = 11)
1: v/f open-loop control
2: v/f open-loop control, textile
3: Vector control without tachometer (f-control)
4: Vector control with tachometer (n-speed) with pulse encoder (P130 = 11)
5: Torque control (M control) with pulse controller (P130 = 11)

For v/f control (0..2) a linear curve is set in P330 (P330 = 1: parabolic).
The pulse encoder has a pulse number of P151 = 1024 per revolution.
The following inputs of motor data are necessary if the motor deviates from the converter data, if one of the vector control types (P100 = 3, 4, 5) has been selected or if speed feedback is used (P100 = 0). In the case of motor outputs higher than approx. 200 kW one of the vector control types should be used.

P101 = ?	**Enter the rated motor voltage in V** as per rating plate	①
P102 = ?	**Enter the rated motor current in A** as per rating plate (group drives: total of all motor currents)	②
P104=? / P105=?	**IEC motor: Cos (phi)** as per rating plate **NEMA motor: nominal rating [Hp]** (group drives: total of all ratings)	③
P106=?	**NEMA motor: Enter the motor efficiency in %** as per rating plate	
P107 = ?	**Enter the rated motor frequency in Hz** as per rating plate	④
P108 = ?	**Enter the rated motor speed in rpm** as per rating plate	⑤
P109 = ?	**Enter the motor pole pair number** (is automatically calculated)	



P114 = ?

P100=1,2

<u>**WARNING!**</u>

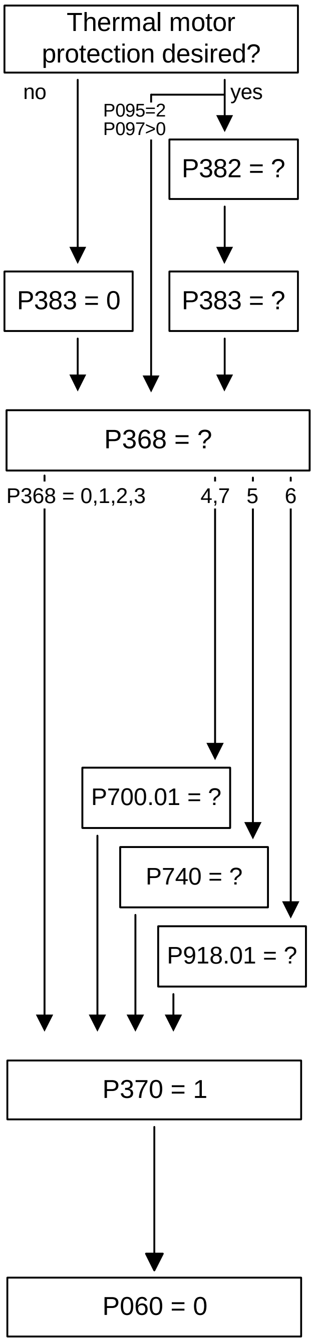
<u>**INCORRECT SETTINGS CAN BE DANGEROUS!**</u>

For vector control only:

Process-related boundary conditions for control

0: Standard drives (default)
1: Torsion, gear play
2: Acceleration drives
3: Load surge
4: Smooth running characteristics
5: Efficiency optimization
6: Heavy-duty starting
7: Dynamic torque response in field-weakening range

See "Drive setting" section for description



System with motor protection according to UL regulation?
The motor temperature is calculated via the motor current.
(In the pre-setting, motor overload protection in accordance with UL regulation is activated!)

Specify motor cooling
- 0: self-ventilated
- 1: forced-ventilated
  (automatically pre-set for P095 = 2, P097 > 0)

Enter the thermal time constant of the motor in s
The values can be taken from the table on the next page (automatically pre-set for P095 = 2, P097 > 0).
The motor load limit (P384.2) is pre-assigned to 100 %.

Select setpoint and command source (sheet s0...s4, s6, s7)
- 0: PMU + MOP (Operation via the operator panel, see next page for description)
- 1: Analog and digital inputs on the terminal strip
- 2: Fixed setpoints and digital inputs on the terminal strip
- 3: MOP and digital inputs on the terminal strip
- 4: USS1 (e.g. with SIMATIC)
- 5: not used
- 6: PROFIBUS (CBP)
- 7: OP1S and fixed setpoints via SCom1 (X300: PMU)
- 8: OP1S and MOP via SCom1 (X300: PMU)

Enter the USS bus address

Enter the SIMOLINK module address

Enter the PROFIBUS address

Start of quick parameterization
- 0: No parameter change
- 1: Parameter change in acordance with selected combination of parameter modules
  (automatic factory setting according to P366)
  (followed by automatic parameterization as for P115 = 1)

Return to the user menu
End of quick parameterization

P368 setpoint source

Settings PMU and motor-operated potentiometer (P368 = 0)

This setting allows the drive to be operated via the PMU:

ON / OFF	=	I / O	
faster / slower	=	Arrow up / down	△ ▽
Anticlockwise / clockwise	=	Arrow left / right	

When the I key is pressed, the motor starts and runs up to the minimum speed set in P457.

Afterwards, the speed can be increased by pressing the △ key.

The speed is decreased by pressing the ▽ key.

The selection of setpoint sources (P368) may be restricted by the type of factory setting (P366).

Factory setting P366	Setpoint source P368
0 = PMU	0 ... 8 = All sources possible
1 = OP1S	7 = OP1S
2 = Cabinet unit OP1S	7 = OP1S
3 = Cabinet unit PMU	0 = PMU
4 = OP1S and SCI	8 = OP1S

P383 Mot Tmp T1

Thermal time constant of the motor

Setting notes

Activation of the i^2t calculation is made by setting a parameter value >= 100 seconds.

Example: for a 1LA5063 motor, 2-pole design, the value 480 seconds has to be set.

The thermal time constants for Siemens standard motors are given in the following table in seconds:

1LA-/1LL motors

Type	2-pole	4-pole	6-pole	8-pole	10-pole	12-pole
1LA5063	480	780	-	-	-	-
1LA5070	480	600	720	-	-	-
1LA5073	480	600	720	-	-	-
1LA5080	480	600	720	-	-	-
1LA5083	600	600	720	-	-	-
1LA5090	300	540	720	720	-	-
1LA5096	360	660	720	840	-	-
1LA5106	480	720	720	960	-	-
1LA5107	-	720	-	960	-	-
1LA5113	840	660	780	720	-	-
1LA5130	660	600	780	600	-	-
1LA5131	660	600	-	-	-	-
1LA5133	-	600	840	600	-	-
1LA5134	-	-	960	-	-	-
1LA5163	900	1140	1200	720	-	-
1LA5164	900	-	-	-	-	-
1LA5166	900	1140	1200	840	-	-
1LA5183	1500	1800	-	-	-	-
1LA5186	-	1800	2400	2700	-	-
1LA5206	1800	-	2700	-	-	-
1LA5207	1800	2100	2700	3000	-	-
1LA6220	-	2400	-	3300	-	-
1LA6223	2100	2400	3000	3300	-	-
1LA6253	2400	2700	3000	3600	-	-
1LA6280	2400	3000	3300	3900	-	-
1LA6283	2400	3000	3300	3900	-	-
1LA6310	2700	3300	3600	4500	-	-
1LA6313	2700	3300	3600	4500	-	-
1LA6316	2880	3480	3780	4680	-	-
1LA6317	2880	3480	3780	4680	-	-
1LA6318	-	-	3780	4680	-	-
1LA831.	2100	2400	2700	2700	3000	3000
1LA835.	2400	2700	3000	3000	3300	3300
1LA840.	2700	3000	3300	3300	3600	3600
1LA845.	3300	3300	3600	3600	4200	4200
1LL831.	1500	1500	1800	1800	2100	2100
1LL835.	1800	1800	2100	2100	2400	2400
1LL840.	2100	2100	2100	2100	2400	2400
1LL845.	2400	2100	2400	2400	2700	2700

Type	2-pole	4-pole	6-pole	8-pole	10-pole	12-pole
1LA135.	1800	2100	2400	-	-	-
1LA140.	2100	2400	2700	2700	-	-
1LA145.	2400	2700	3000	3000	3300	3300
1LA150.	3000	3000	3300	3300	3900	3900
1LA156.	3600	3300	3600	3600	4200	4200
1LL135.	1200	1200	1500	-	-	-
1LL140.	1500	1500	1800	1800	-	-
1LL145.	1800	1800	1800	1800	2100	2100
1LL150.	2100	1800	2100	2100	2400	2400
1LL156.	2400	2100	2100	2100	2400	2400

1LA7 motors

The data for 1LA5 motors are also applicable for 1LA7 motors with the same designation.

1LG4 motors

Type	2-pole	4-pole	6-pole	8-pole
183	1200	1500	-	-
186	-	1500	1800	2100
188	1200	2100	2100	2400
206	1500	-	2100	-
207	1500	2100	2400	2400
208	1800	2700	2700	3000
220	-	2700	-	2700
223	2100	2400	2700	2700
228	2100	2700	3000	3300
253	2700	2700	3000	3000
258	2400	3000	3600	3000
280	2400	2700	3000	3300
283	2400	3000	2700	3300
288	2400	3300	3000	3300
310	2400	2700	3000	2700
313	2400	2400	3300	4200
316	2100	3600	3600	3600
317	3000	3600	4200	4500
318	3300	4200	4500	4800

1LG6 motors

Type	2-pole	4-pole	6-pole	8-pole
183	1800	1800	-	-
186	-	1800	2700	2100
206	1800	-	2700	-
207	1800	2700	2700	2700
220	-	2400	-	2700
223	2400	2700	3300	2400
253	2700	3000	2700	3000
280	2400	3300	3000	3600
283	2400	3000	3600	3900
310	2700	3300	3600	3900
313	2700	3900	3600	4200
316	2700	3900	4200	4200
317	2700	3900	4500	3900
318	3600	3900	4500	5700

1PH6 motors

Type	1PH610	1PH613	1PH616	1PH618	1PH620	1PH622
T1 in s	1500	1800	2100	2400	2400	2400

Exceptions: 1PH610 at n = 1150 rpm: T1 = 1200 n

1PA6 motors (= 1PH7 motors)

Shaft height	100	132	160	180	225
T1 in s	1500	1800	2100	2400	2400

Type	1PH7284	1PH7286	1PH7288
T1 in s	4500	5000	5400

1PL6 motors

Shaft height	180	225
T1 in s	1800	1800

Type	1PL6284	1PH6286	1PH6288
T1 in s	3200	3900	4300

1PH4 motors

Shaft height	100	132	160
T1 in s	1500	1800	2100

NOTE

If 1PH7, 1PL6, or 1PH4 motors are parameterized in the list selection (P097), both the motor cooling (P382) and the thermal motor time constant (P383) are assigned the correct default values.

Reference quantities

Display of function parameters, monitoring parameters, and connectors are limited to double the reference value.

After fast parameterization, the reference and rated motor values are identical. This enables signal representation (e.g. via connectors) up to twice the rated motor values. If this is not sufficient, you can switch to the menu "Drive setting" (P060 = 5) to adapt the reference values. The following parameters are available for that purpose:

P350	Reference current	in A
P351	Reference voltage	in V
P352	Reference frequency	in Hz
P353	Reference speed	in rpm
P354	Reference torque	in Nm

Dependent reference values

Speed reference frequency and reference speed are always coupled via the number of pole pairs.

$$P353 = P352 \times \frac{60}{P109}$$

If one of the two parameters is altered, the second is converted using this equation.
The reference power (in W) is calculated from the reference torque and reference speed:

$$R_{W,ref} = \frac{P354 \times P353 \times 2 \times \pi}{60}$$

Power values of the closed-loop control are also stated as a percentage and refer to the reference power stated. Conversion to rated motor power is possible using the ratio $P_{W,ref}$ / $P_{mot,rated}$.

$$P_{mot,rated} = \frac{P113 \times 2 \times \pi \times P108}{60}$$

Automatic motor identification

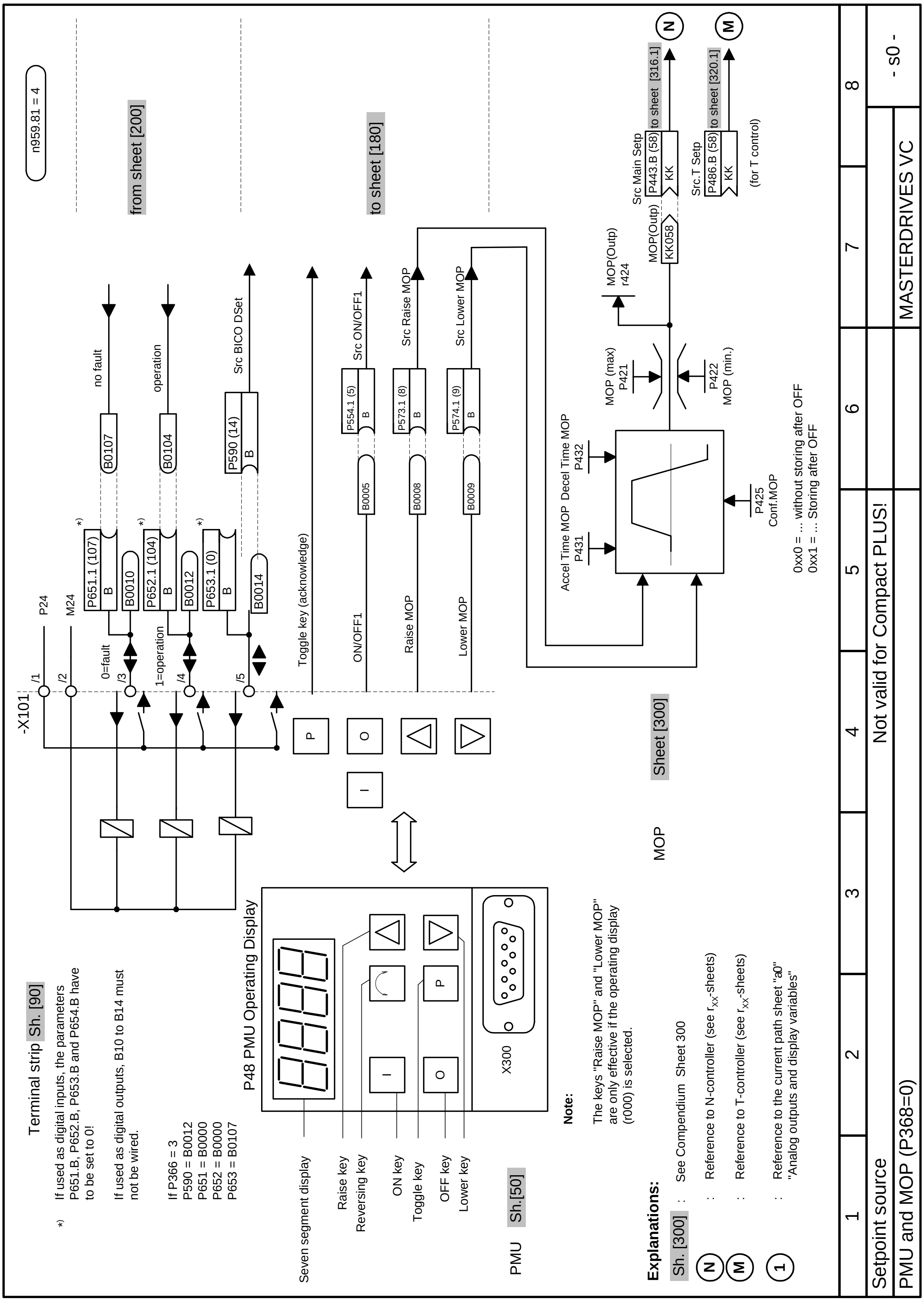
For exact determination of the motor parameters, it is possible to carry out automatic motor identification and speed controller optimization.

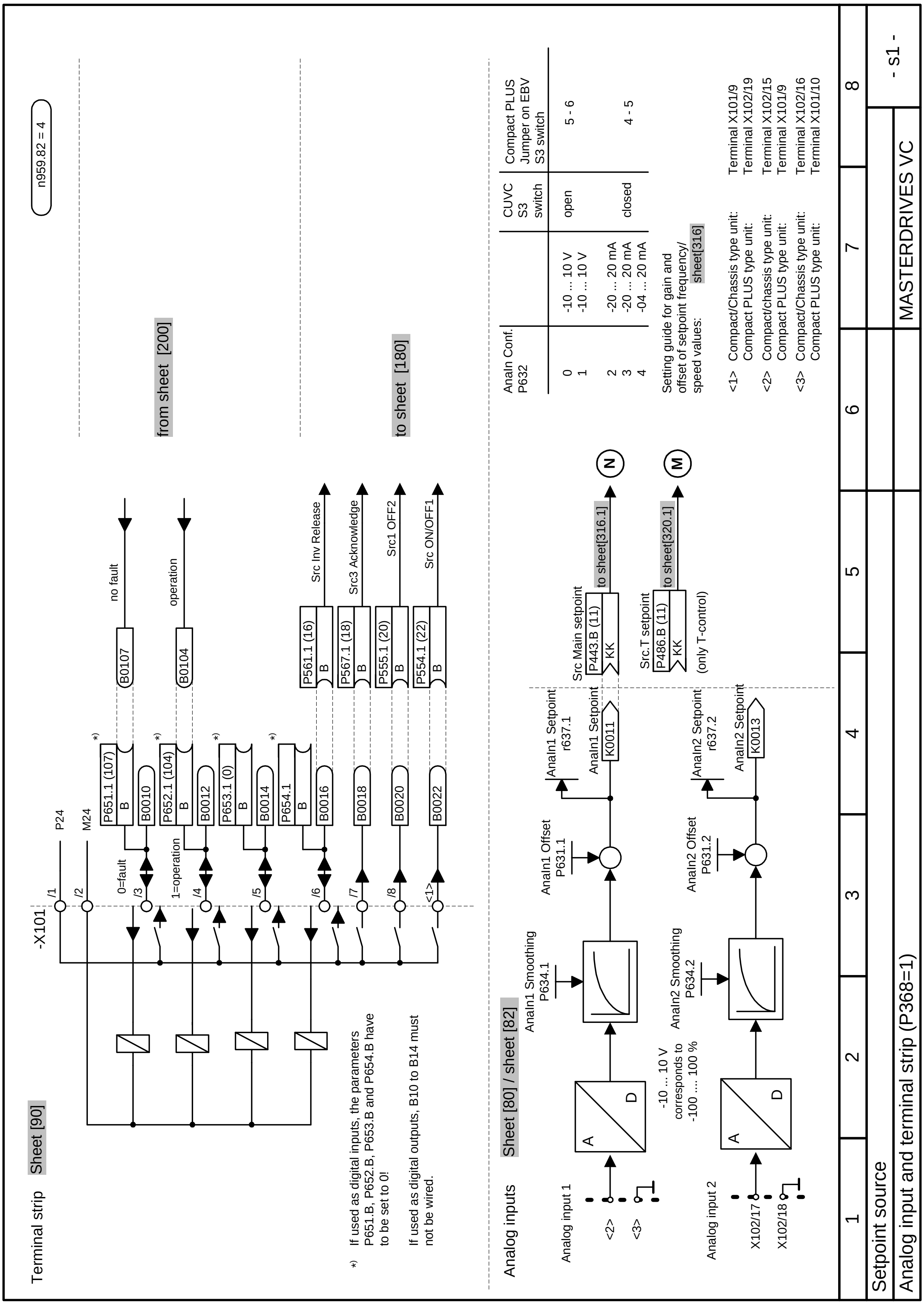
For this purpose, the procedures of the "Drive setting" have to be observed. If one of the vector control types (P100 = 3, 4, 5) of a converter without a sinusoidal output filter and of an induction motor without an encoder or with a pulse encoder (correct number of pulses in P151) is used, the motor identification procedure can be shortened. In this case, "Complete motor identification" has to be selected (P115 = 3) and the converter has to be powered up accordingly if the alarms A078 and A080 appear.

WARNING

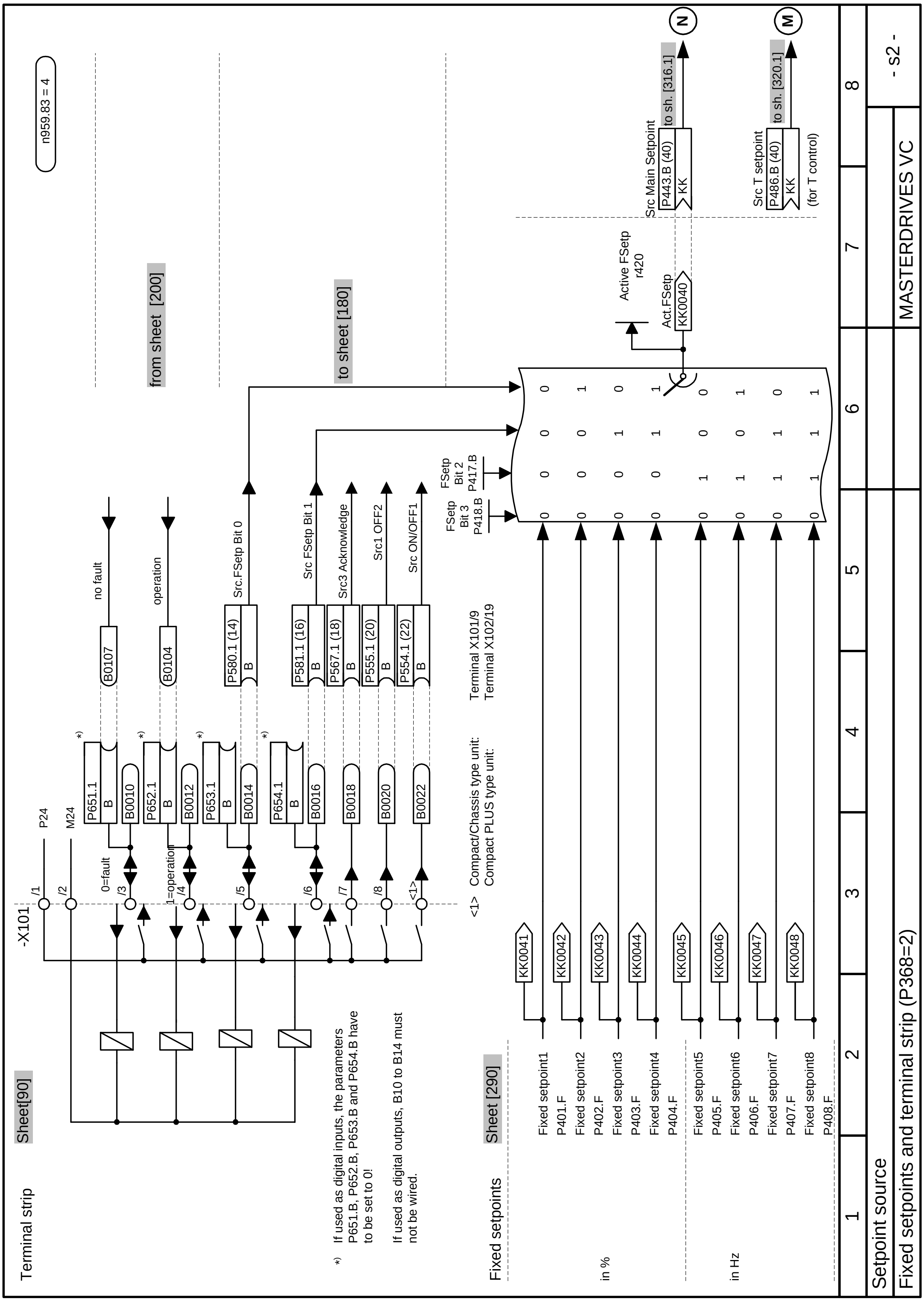
During motor identification inverter pulses are released and the drive rotates!

For reasons of safety, identification should first be carried out without coupling of the load.

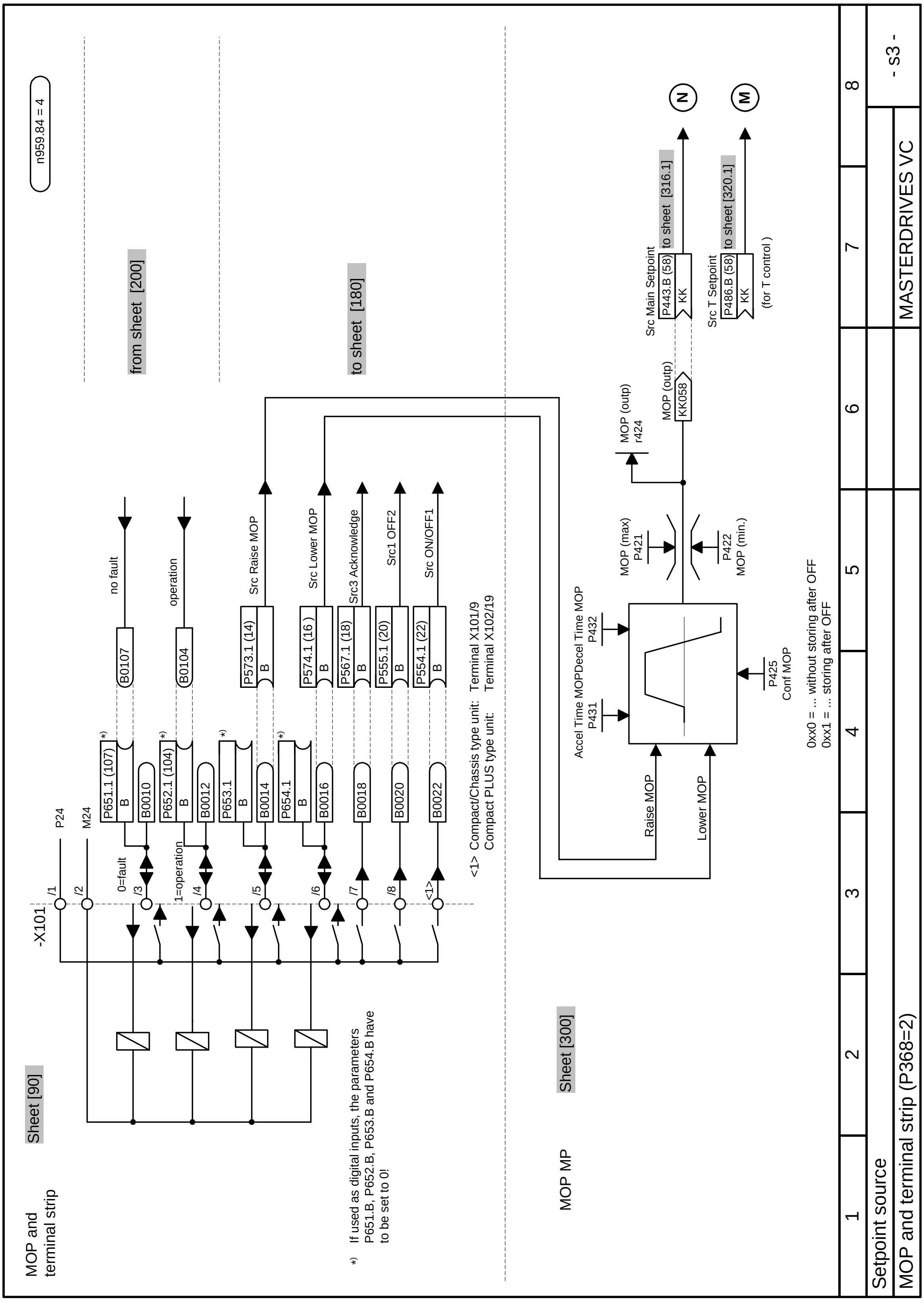

Terminal strip Sh. [90]
*) If used as digital inputs, the parameters P651.B, P652.B, P653.B and P654.B have to be set to 0!
If used as digital outputs, B10 to B14 must not be wired.
If P366 = 3
P590 = B0012
P651 = B0000
P652 = B0000
P653 = B0107
-X101
/1
P24
/2
M24
0=fault
/3
1=operation
/4
/5
P651.1 (107)
B
B0010
P652.1 (104)
B
B0012
P653.1 (0)
B
B0014
*)
B0107
no fault
B0104
operation
P590 (14)
B
Src BICO DSet
from sheet [200]
n959.81 = 4
P48 PMU Operating Display
Seven segment display
Raise key
Reversing key
ON key
Toggle key
OFF key
Lower key
X300
PMU Sh.[50]
P
O
I
Toggle key (acknowledge)
ON/OFF1
B0005
P554.1 (5)
B
Src ON/OFF1
to sheet [180]
Raise MOP
B0008
P573.1 (8)
B
Src Raise MOP
Lower MOP
B0009
P574.1 (9)
B
Src Lower MOP
Note:
The keys "Raise MOP" and "Lower MOP" are only effective if the operating display (r000) is selected.
MOP
Sheet [300]
Accel Time MOP
P431
Decel Time MOP
P432
MOP (max)
P421
MOP(Outp)
r424
P422
MOP (min.)
P425
Conf.MOP
0xx0 = ... without storing after OFF
0xx1 = ... Storing after OFF
Src Main Setp
MOP(Outp)
KK058
P443.B (58)
KK
to sheet [316.1]
N
Src.T Setp
P486.B (58)
KK
to sheet [320.1]
M
(for T control)
Explanations:
Sh. [300] : See Compendium Sheet 300
N : Reference to N-controller (see rxx-sheets)
M : Reference to T-controller (see rxx-sheets)
1 : Reference to the current path sheet "a0" "Analog outputs and display variables"
1
2
3
4
5
6
7
8
Setpoint source
Not valid for Compact PLUS!
PMU and MOP (P368=0)
MASTERDRIVES VC
- s0 -



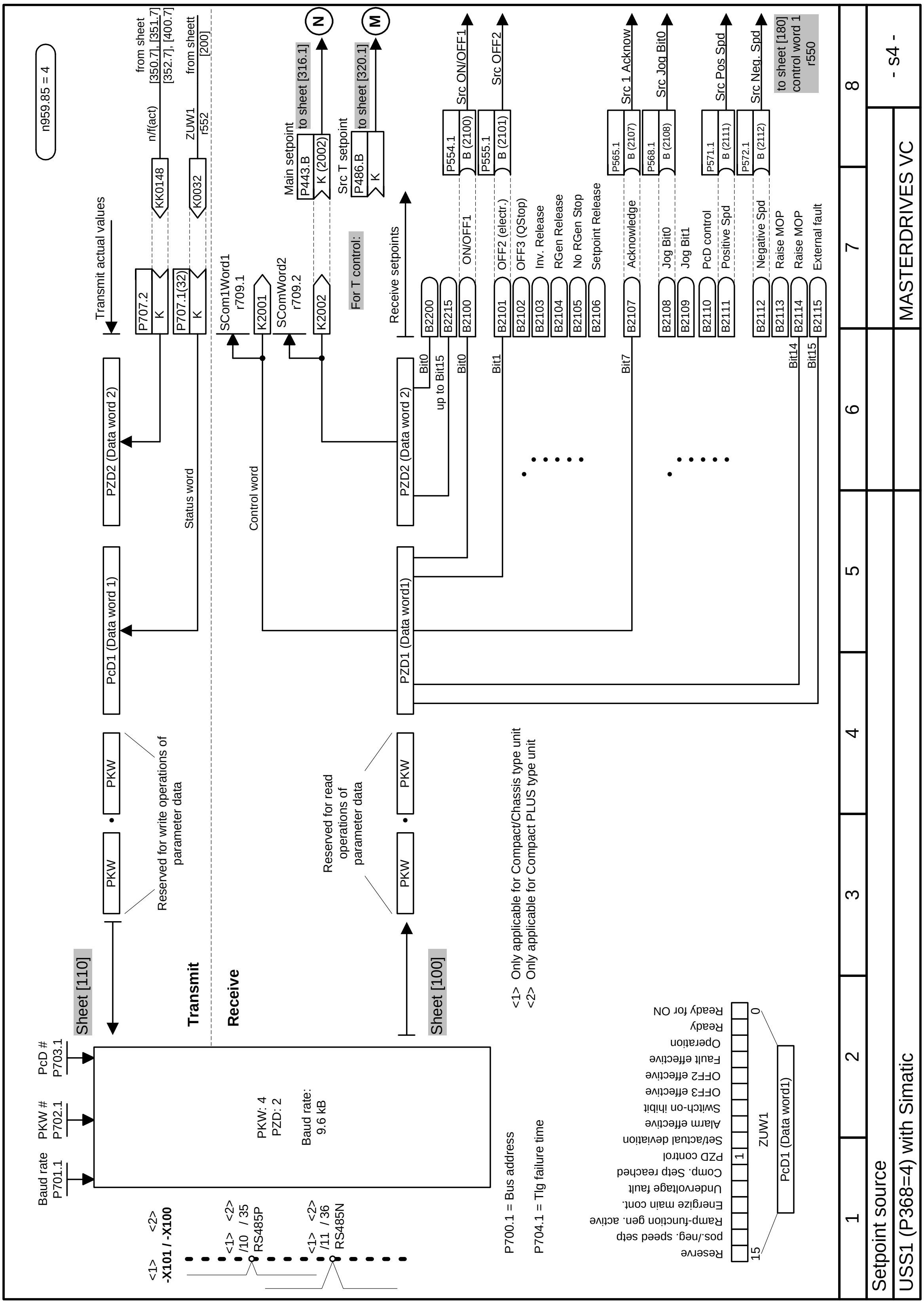
Terminal strip
Sheet [90]
-X101
P24
M24
/1
/2
/3
/4
/5
/6
/7
/8
<1>
0=fault
1=operation
P651.1 (107)
B
B0010
P652.1 (104)
B
B0012
P653.1 (0)
B
B0014
P654.1
B
B0016
B0018
B0020
B0022
*)
B0107
no fault
B0104
operation
P561.1 (16)
B
Src Inv Release
P567.1 (18)
B
Src3 Acknowledge
P555.1 (20)
B
Src1 OFF2
P554.1 (22)
B
Src ON/OFF1
from sheet [200]
to sheet [180]
n959.82 = 4
*) If used as digital inputs, the parameters P651.B, P652.B, P653.B and P654.B have to be set to 0!
If used as digital outputs, B10 to B14 must not be wired.
Analog inputs
Sheet [80] / sheet [82]
Analog input 1
<2>
<3>
A
D
-10 ... 10 V corresponds to -100 .... 100 %
AnaIn1 Smoothing
P634.1
AnaIn1 Offset
P631.1
AnaIn1 Setpoint
r637.1
AnaIn1 Setpoint
K0011
Src Main setpoint
P443.B (11)
KK
to sheet[316.1]
N
Analog input 2
X102/17
X102/18
A
D
AnaIn2 Smoothing
P634.2
AnaIn2 Offset
P631.2
AnaIn2 Setpoint
r637.2
AnaIn2 Setpoint
K0013
Src.T setpoint
P486.B (11)
KK
(only T-control)
to sheet[320.1]
M
AnaIn Conf. P632
0 -10 ... 10 V
1 -10 ... 10 V
2 -20 ... 20 mA
3 -20 ... 20 mA
4 -04 ... 20 mA
CUVC S3 switch
open
closed
Compact PLUS Jumper on EBV S3 switch
5 - 6
4 - 5
Setting guide for gain and offset of setpoint frequency/ speed values: sheet[316]
<1> Compact/Chassis type unit: Terminal X101/9
Compact PLUS type unit: Terminal X102/19
<2> Compact/chassis type unit: Terminal X102/15
Compact PLUS type unit: Terminal X101/9
<3> Compact/Chassis type unit: Terminal X102/16
Compact PLUS type unit: Terminal X101/10
1
2
3
4
5
6
7
8
Setpoint source
Analog input and terminal strip (P368=1)
MASTERDRIVES VC
- s1 -

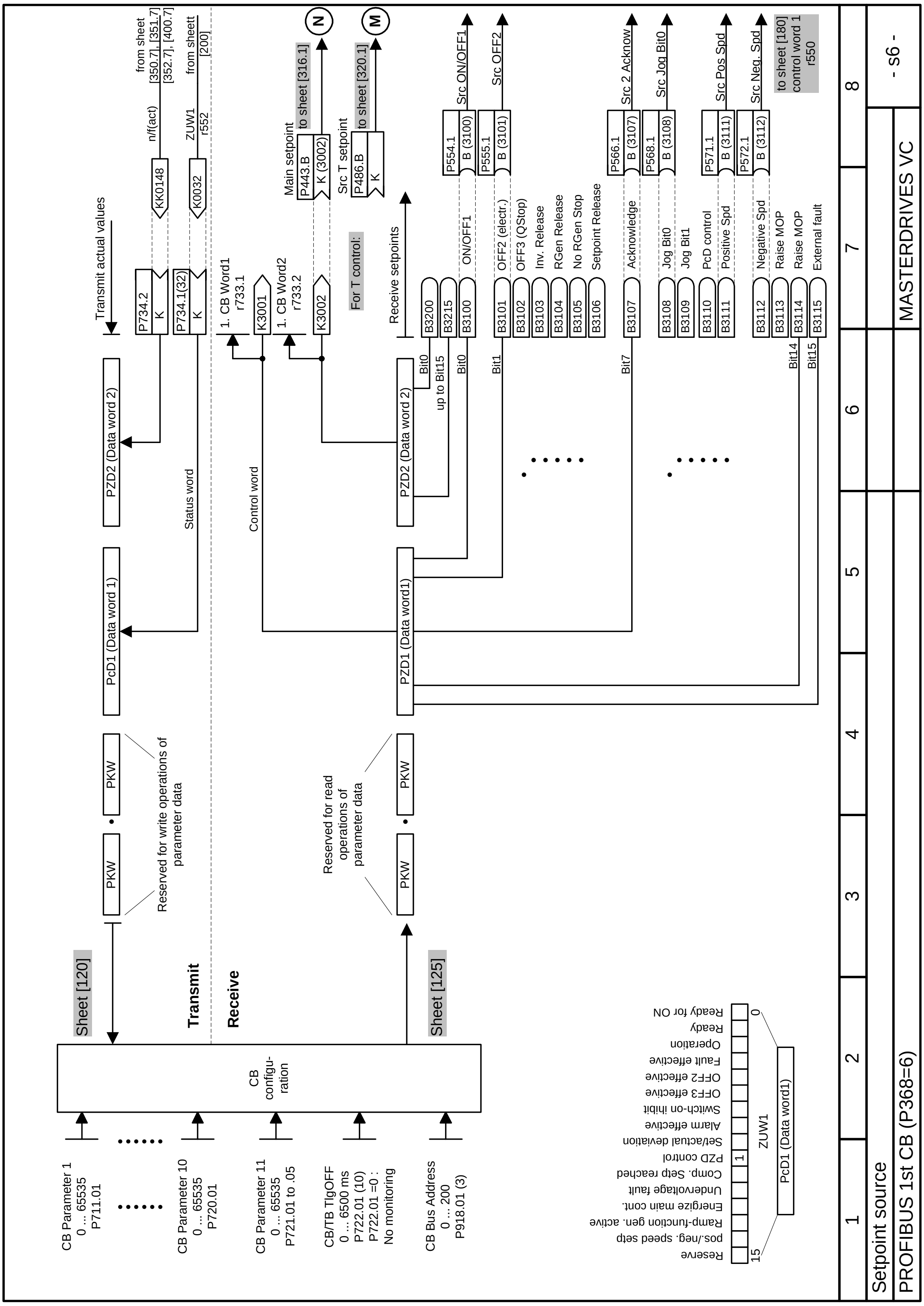


Terminal strip
Sheet[90]
-X101
/1
/2
P24
M24
0=fault
1=operation
/3
/4
/5
/6
/7
/8
<1>
P651.1
P652.1
P653.1
P654.1
B
B0010
B0012
B0014
B0016
B0018
B0020
B0022
*)
B0107
B0104
no fault
operation
P580.1 (14)
P581.1 (16)
P567.1 (18)
P555.1 (20)
P554.1 (22)
Src.FSetp Bit 0
Src FSetp Bit 1
Src3 Acknowledge
Src1 OFF2
Src ON/OFF1
from sheet [200]
to sheet [180]
n959.83 = 4
*) If used as digital inputs, the parameters P651.B, P652.B, P653.B and P654.B have to be set to 0!
If used as digital outputs, B10 to B14 must not be wired.
<1> Compact/Chassis type unit: Terminal X101/9
Compact PLUS type unit: Terminal X102/19
Fixed setpoints
Sheet [290]
in %
in Hz
Fixed setpoint1 P401.F
Fixed setpoint2 P402.F
Fixed setpoint3 P403.F
Fixed setpoint4 P404.F
Fixed setpoint5 P405.F
Fixed setpoint6 P406.F
Fixed setpoint7 P407.F
Fixed setpoint8 P408.F
KK0041
KK0042
KK0043
KK0044
KK0045
KK0046
KK0047
KK0048
FSetp Bit 3 P418.B
FSetp Bit 2 P417.B
Active FSetp r420
Act.FSetp KK0040
Src Main Setpoint P443.B (40) KK
to sh. [316.1]
Src T setpoint P486.B (40) KK
to sh. [320.1]
(for T control)
N
M
1 2 3 4 5 6 7 8
Setpoint source
Fixed setpoints and terminal strip (P368=2)
MASTERDRIVES VC
- s2 -

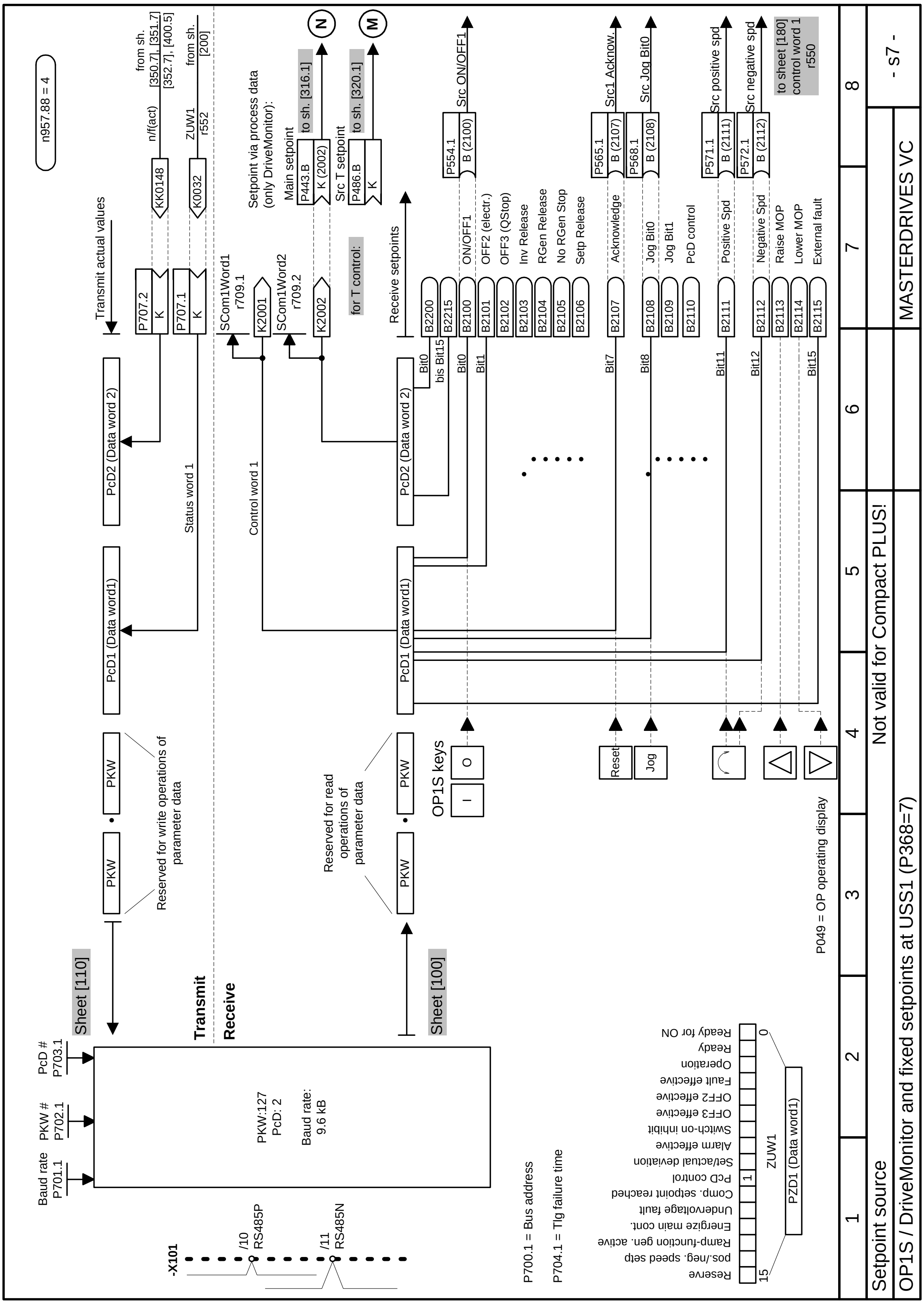


MOP and terminal strip
Sheet [90]
n959.84 = 4
from sheet [200]
to sheet [180]
Sheet [300]
MOP MP
-X101
P24
M24
0=fault
1=operation
P651.1 (107)
P652.1 (104)
P653.1
P654.1
B0010
B0012
B0014
B0016
B0018
B0020
B0022
B0107
B0104
no fault
operation
P573.1 (14)
P574.1 (16)
P567.1 (18)
P555.1 (20)
P554.1 (22)
Src Raise MOP
Src Lower MOP
Src3 Acknowledge
Src1 OFF2
Src ON/OFF1
<1> Compact/Chassis type unit: Terminal X101/9
Compact PLUS type unit: Terminal X102/19
*) If used as digital inputs, the parameters P651.B, P652.B, P653.B and P654.B have to be set to 0!
Raise MOP
Lower MOP
Accel Time MOP P431
Decel Time MOP P432
P425 Conf MOP
0xx0 = ... without storing after OFF
0xx1 = ... storing after OFF
MOP (max) P421
P422 MOP (min.)
MOP (outp) r424
MOP (outp) KK058
Src Main Setpoint P443.B (58)
to sheet [316.1]
Src T Setpoint P486.B (58)
to sheet [320.1]
(for T control)
Setpoint source
MOP and terminal strip (P368=2)
MASTERDRIVES VC
- s3 -

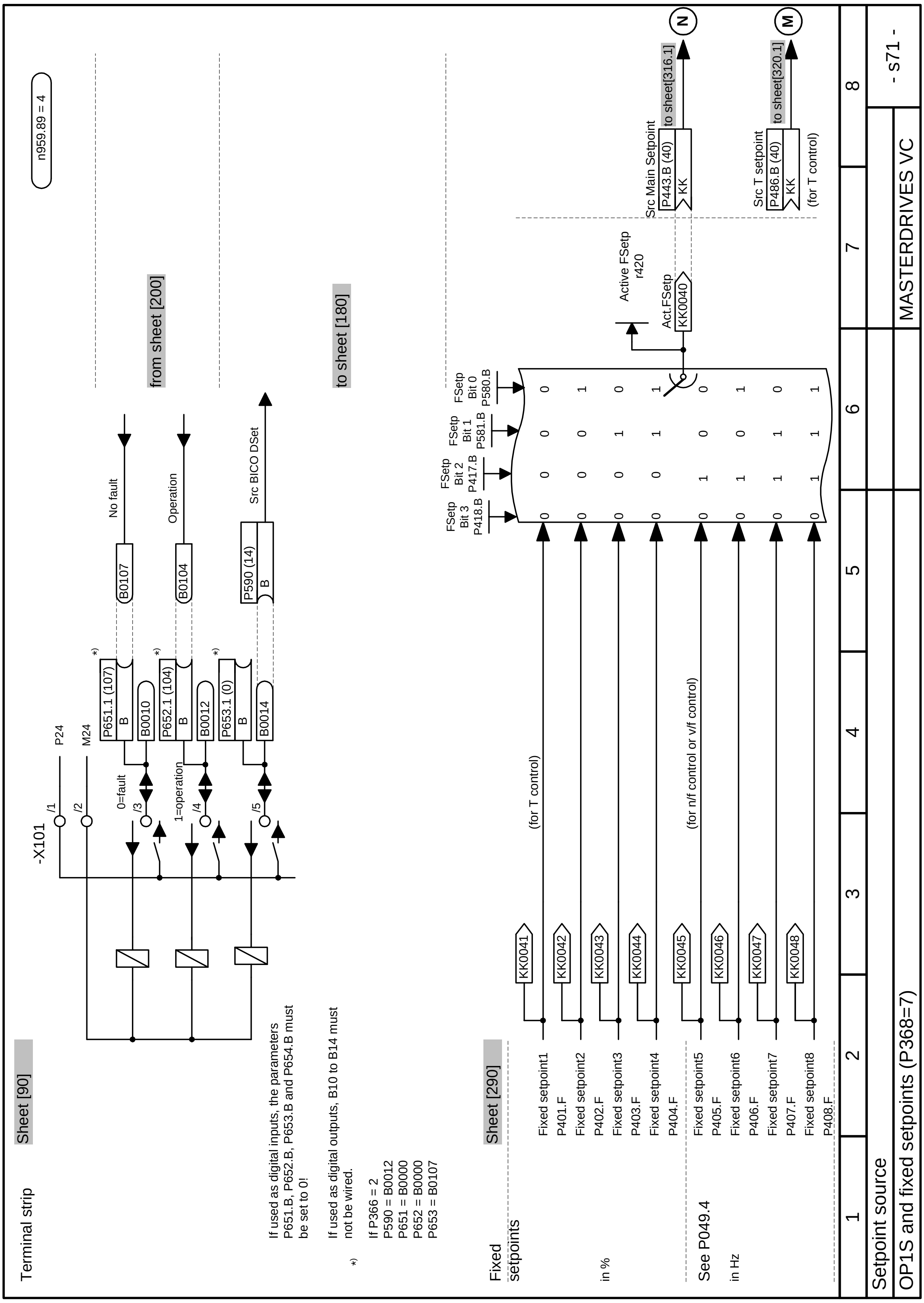

n959.85 = 4
Transmit actual values
Transmit
Receive
Sheet [110]
Sheet [100]
Baud rate P701.1
PKW # P702.1
PcD # P703.1
PKW: 4
PZD: 2
Baud rate: 9.6 kB
<1> <2> -X101 / -X100
<1> <2> /10 / 35 RS485P
<1> <2> /11 / 36 RS485N
PKW
PKW
PcD1 (Data word 1)
PZD2 (Data word 2)
Reserved for write operations of parameter data
Reserved for read operations of parameter data
PZD1 (Data word1)
PZD2 (Data word 2)
Status word
Control word
P707.2 K
P707.1(32) K
KK0148 n/f(act)
K0032 ZUW1 r552
from sheet [350.7], [351.7] [352.7], [400.7]
from sheett [200]
SCom1Word1 r709.1
K2001
SComWord2 r709.2
K2002
Main setpoint P443.B K (2002) to sheet [316.1]
Src T setpoint P486.B K to sheet [320.1]
For T control:
Receive setpoints
Bit0
up to Bit15
Bit0
Bit1
Bit7
Bit14
Bit15
B2200
B2215
B2100 ON/OFF1
B2101 OFF2 (electr.)
B2102 OFF3 (QStop)
B2103 Inv. Release
B2104 RGen Release
B2105 No RGen Stop
B2106 Setpoint Release
B2107 Acknowledge
B2108 Jog Bit0
B2109 Jog Bit1
B2110 PcD control
B2111 Positive Spd
B2112 Negative Spd
B2113 Raise MOP
B2114 Raise MOP
B2115 External fault
P554.1 B (2100) Src ON/OFF1
P555.1 B (2101) Src OFF2
P565.1 B (2107) Src 1 Acknow
P568.1 B (2108) Src Jog Bit0
P571.1 B (2111) Src Pos Spd
P572.1 B (2112) Src Neg. Spd
to sheet [180] control word 1 r550
<1> Only applicable for Compact/Chassis type unit
<2> Only applicable for Compact PLUS type unit
P700.1 = Bus address
P704.1 = Tlg failure time
ZUW1
PcD1 (Data word1)
Ready for ON
Ready
Operation
Fault effective
OFF2 effective
OFF3 effective
Switch-on inhibit
Alarm effective
Set/actual deviation
PZD control
Comp. Setp reached
Undervoltage fault
Energize main cont.
Ramp-function gen. active
pos./neg. speed setp
Reserve
1 2 3 4 5 6 7 8
Setpoint source
USS1 (P368=4) with Simatic
MASTERDRIVES VC
- s4 -

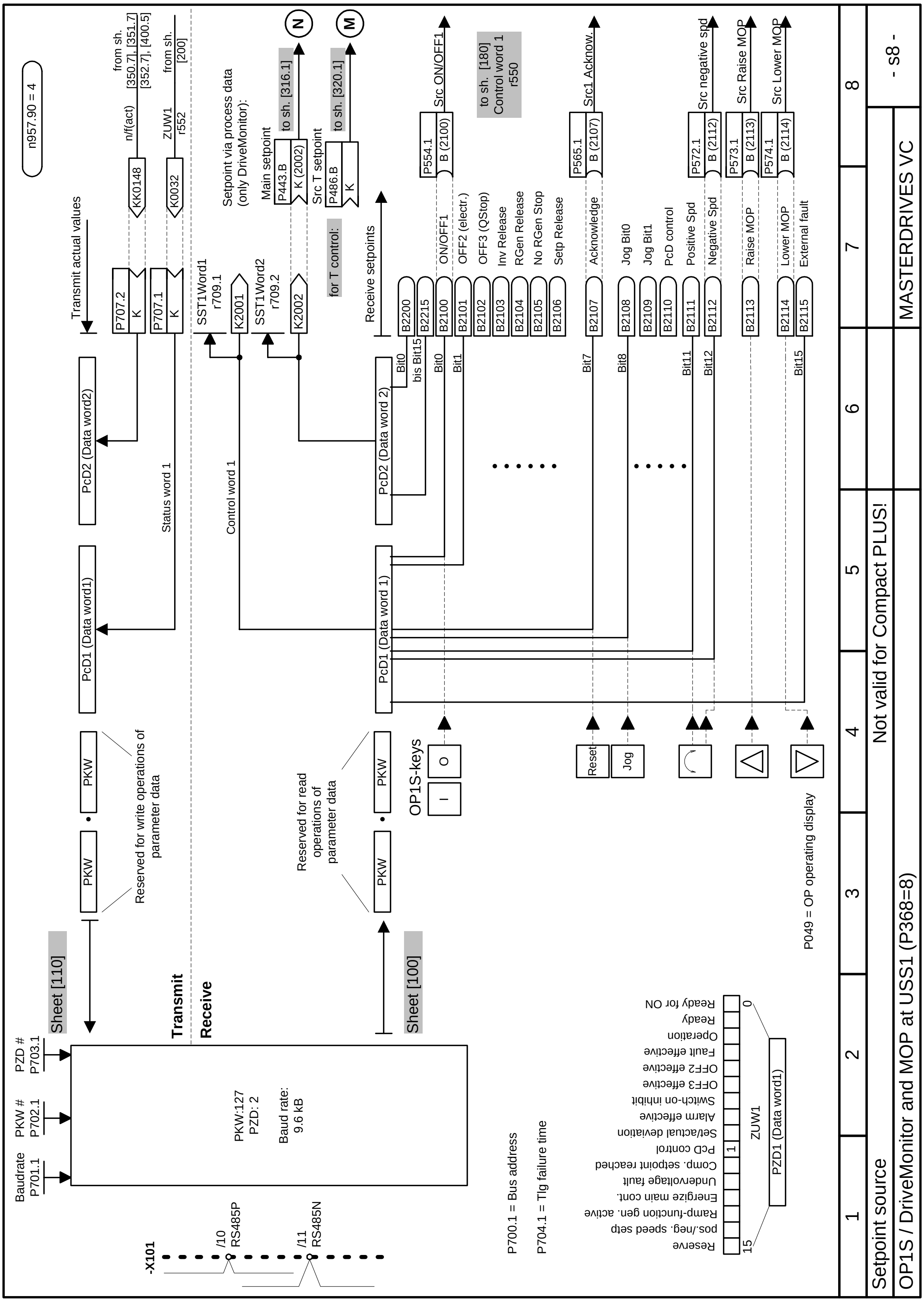


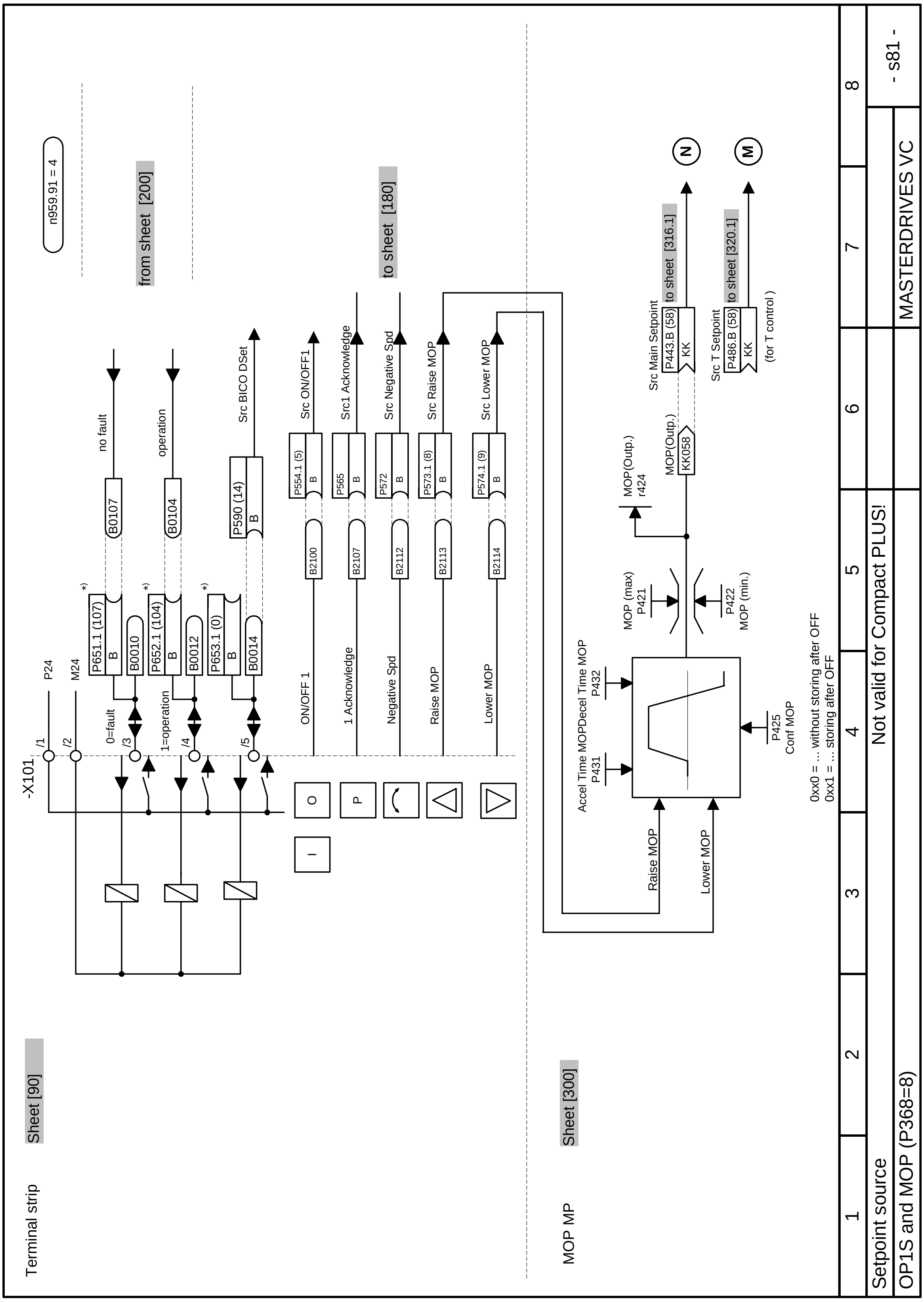
Transmit actual values
n/f(act)
from sheet [350.7], [351.7] [352.7], [400.7]
ZUW1 r552
from sheett [200]
KK0148
K0032
P734.2
P734.1(32)
Transmit
Receive
Sheet [120]
Sheet [125]
PKW
PcD1 (Data word 1)
PZD2 (Data word 2)
Reserved for write operations of parameter data
Status word
Control word
Reserved for read operations of parameter data
PZD1 (Data word1)
1. CB Word1 r733.1
1. CB Word2 r733.2
K3001
K3002
Main setpoint P443.B K (3002)
to sheet [316.1]
Src T setpoint P486.B K
to sheet [320.1]
For T control:
Receive setpoints
Bit0
up to Bit15
Bit1
Bit7
Bit14
Bit15
B3200
B3215
B3100 ON/OFF1
B3101 OFF2 (electr.)
B3102 OFF3 (QStop)
B3103 Inv. Release
B3104 RGen Release
B3105 No RGen Stop
B3106 Setpoint Release
B3107 Acknowledge
B3108 Jog Bit0
B3109 Jog Bit1
B3110 PcD control
B3111 Positive Spd
B3112 Negative Spd
B3113 Raise MOP
B3114 Raise MOP
B3115 External fault
P554.1 B (3100) Src ON/OFF1
P555.1 B (3101) Src OFF2
P566.1 B (3107) Src 2 Acknow
P568.1 B (3108) Src Jog Bit0
P571.1 B (3111) Src Pos Spd
P572.1 B (3112) Src Neg. Spd
to sheet [180] control word 1 r550
CB Parameter 1 0 ... 65535 P711.01
CB Parameter 10 0 ... 65535 P720.01
CB Parameter 11 0 ... 65535 P721.01 to .05
CB/TB TlgOFF 0 ... 6500 ms P722.01 (10) P722.01 =0 : No monitoring
CB Bus Address 0 ... 200 P918.01 (3)
CB configu-ration
ZUW1
PcD1 (Data word1)
Ready for ON
Ready
Operation
Fault effective
OFF2 effective
OFF3 effective
Switch-on inhibit
Alarm effective
Set/actual deviation
PZD control
Comp. Setp reached
Undervoltage fault
Energize main cont.
Ramp-function gen. active
pos./neg. speed setp
Reserve
1 2 3 4 5 6 7 8
Setpoint source
PROFIBUS 1st CB (P368=6)
MASTERDRIVES VC
- s6 -



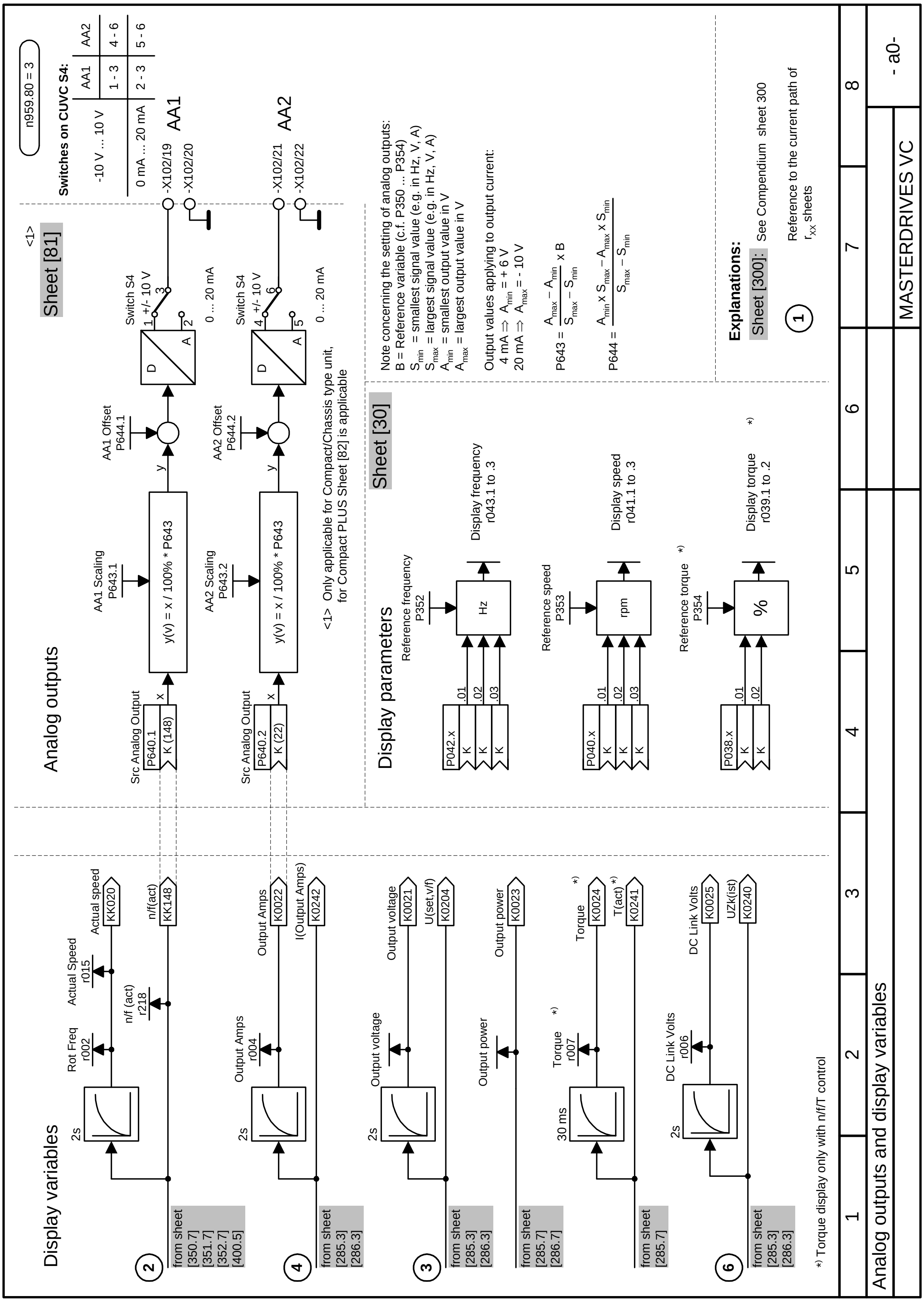
Setpoint source
OP1S / DriveMonitor and fixed setpoints at USS1 (P368=7)
Not valid for Compact PLUS!
MASTERDRIVES VC
- s7 -
n957.88 = 4
Baud rate P701.1
PKW # P702.1
PcD # P703.1
PKW:127
PcD: 2
Baud rate: 9.6 kB
-X101
/10 RS485P
/11 RS485N
Sheet [110]
Sheet [100]
Transmit
Receive
PKW
PcD1 (Data word1)
PcD2 (Data word 2)
Reserved for write operations of parameter data
Reserved for read operations of parameter data
Transmit actual values
Receive setpoints
Status word 1
Control word 1
P707.2 K
P707.1 K
KK0148 n/f(act)
K0032 ZUW1 r552
from sh. [350.7], [351.7] [352.7], [400.5]
from sh. [200]
SCom1Word1 r709.1 K2001
SCom1Word2 r709.2 K2002
Setpoint via process data (only DriveMonitor):
Main setpoint P443.B K (2002) to sh. [316.1]
Src T setpoint P486.B K to sh. [320.1]
for T control:
N
M
Bit0 bis Bit15 B2200 B2215
Bit0 B2100 ON/OFF1
Bit1 B2101 OFF2 (electr.)
B2102 OFF3 (QStop)
B2103 Inv Release
B2104 RGen Release
B2105 No RGen Stop
B2106 Setp Release
Bit7 B2107 Acknowledge
Bit8 B2108 Jog Bit0
B2109 Jog Bit1
B2110 PcD control
Bit11 B2111 Positive Spd
Bit12 B2112 Negative Spd
B2113 Raise MOP
B2114 Lower MOP
Bit15 B2115 External fault
P554.1 B (2100) Src ON/OFF1
P565.1 B (2107) Src1 Acknow.
P568.1 B (2108) Src Jog Bit0
P571.1 B (2111) Src positive spd
P572.1 B (2112) Src negative spd
to sheet [180] control word 1 r550
OP1S keys
I
O
Reset
Jog
P049 = OP operating display
P700.1 = Bus address
P704.1 = Tlg failure time
ZUW1
PZD1 (Data word1)
15
1
0
Reserve
pos./neg. speed setp
Ramp-function gen. active
Energize main cont.
Undervoltage fault
Comp. setpoint reached
PcD control
Set/actual deviation
Alarm effective
Switch-on inhibit
OFF3 effective
OFF2 effective
Fault effective
Operation
Ready
Ready for ON
1
2
3
4
5
6
7
8


Terminal strip
Sheet [90]
-X101
/1
/2
P24
M24
/3
/4
/5
0=fault
1=operation
P651.1 (107)
B
B0010
P652.1 (104)
B
B0012
P653.1 (0)
B
B0014
*)
B0107
No fault
B0104
Operation
P590 (14)
B
Src BICO DSet
from sheet [200]
to sheet [180]
n959.89 = 4
If used as digital inputs, the parameters P651.B, P652.B, P653.B and P654.B must be set to 0!
If used as digital outputs, B10 to B14 must not be wired.
*) If P366 = 2
P590 = B0012
P651 = B0000
P652 = B0000
P653 = B0107
Fixed setpoints
Sheet [290]
in %
Fixed setpoint1
P401.F
Fixed setpoint2
P402.F
Fixed setpoint3
P403.F
Fixed setpoint4
P404.F
See P049.4
in Hz
Fixed setpoint5
P405.F
Fixed setpoint6
P406.F
Fixed setpoint7
P407.F
Fixed setpoint8
P408.F
KK0041
KK0042
KK0043
KK0044
KK0045
KK0046
KK0047
KK0048
(for T control)
(for n/f control or v/f control)
FSetp Bit 3 P418.B
FSetp Bit 2 P417.B
FSetp Bit 1 P581.B
FSetp Bit 0 P580.B
0 0 0 0
0 0 0 1
0 0 1 0
0 0 1 1
0 1 0 0
0 1 0 1
0 1 1 0
0 1 1 1
Active FSetp r420
Act.FSetp KK0040
Src Main Setpoint
P443.B (40)
KK
to sheet[316.1]
N
Src T setpoint
P486.B (40)
KK
to sheet[320.1]
M
(for T control)
1 2 3 4 5 6 7 8
Setpoint source
OP1S and fixed setpoints (P368=7)
MASTERDRIVES VC
- s71 -

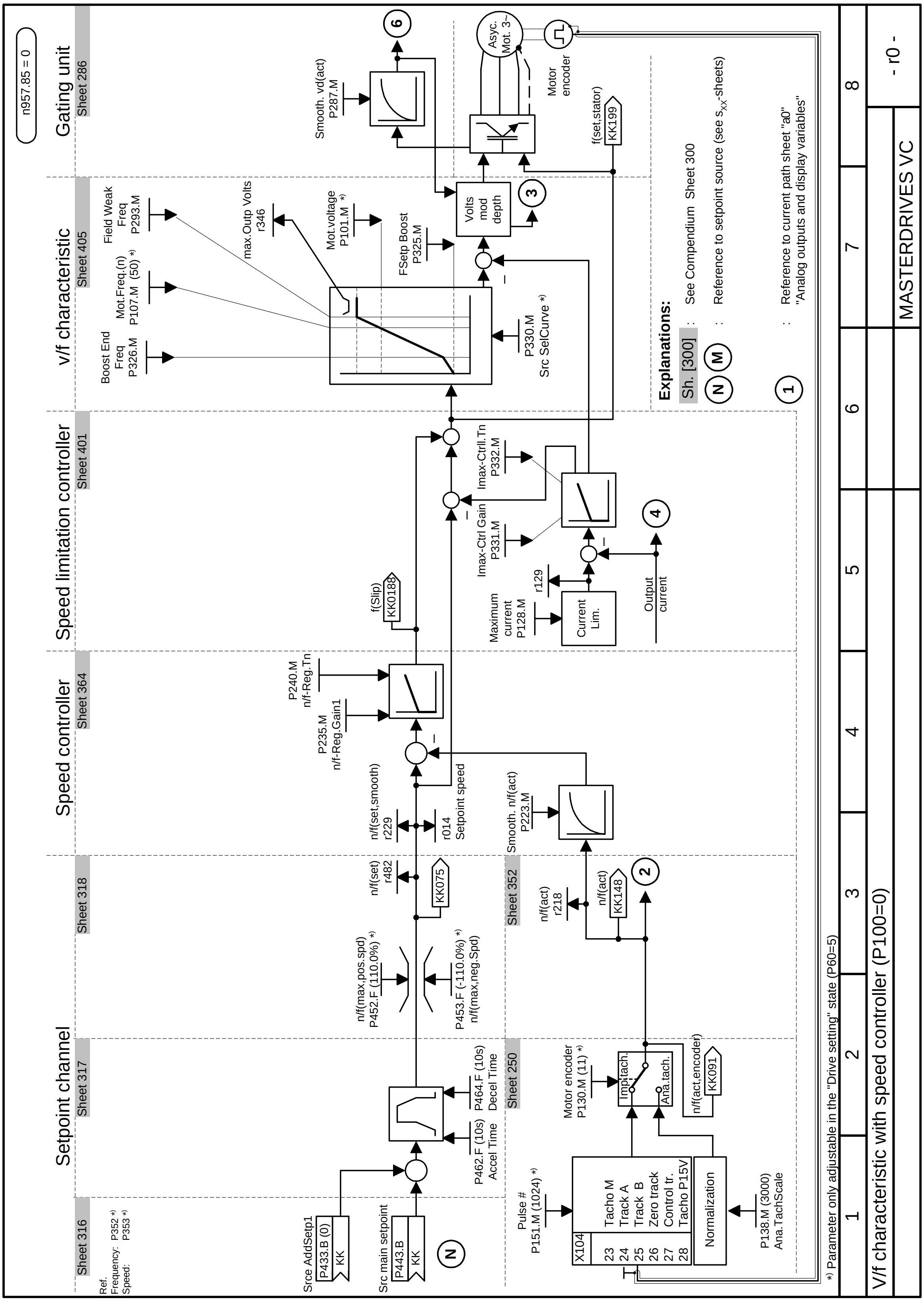

Setpoint source
OP1S / DriveMonitor and MOP at USS1 (P368=8)
Not valid for Compact PLUS!
MASTERDRIVES VC
- s8 -
n957.90 = 4
Baudrate P701.1
PKW # P702.1
PZD # P703.1
PKW:127
PZD: 2
Baud rate: 9.6 kB
-X101
/10 RS485P
/11 RS485N
Sheet [110]
Sheet [100]
Transmit
Receive
PKW
Reserved for write operations of parameter data
Reserved for read operations of parameter data
PcD1 (Data word1)
PcD2 (Data word2)
PcD1 (Data word 1)
PcD2 (Data word 2)
Status word 1
Control word 1
Transmit actual values
Receive setpoints
P707.2
P707.1
KK0148
K0032
n/f(act)
ZUW1
r552
from sh. [350.7], [351.7] [352.7], [400.5]
from sh. [200]
SST1Word1 r709.1
SST1Word2 r709.2
K2001
K2002
Setpoint via process data (only DriveMonitor):
Main setpoint
P443.B
K (2002)
to sh. [316.1]
Src T setpoint
P486.B
for T control:
to sh. [320.1]
OP1S-keys
Reset
Jog
P049 = OP operating display
P700.1 = Bus address
P704.1 = Tlg failure time
ON/OFF1
OFF2 (electr.)
OFF3 (QStop)
Inv Release
RGen Release
No RGen Stop
Setp Release
Acknowledge
Jog Bit0
Jog Bit1
PcD control
Positive Spd
Negative Spd
Raise MOP
Lower MOP
External fault
P554.1 B (2100) Src ON/OFF1
to sh. [180] Control word 1 r550
P565.1 B (2107) Src1 Acknow.
P572.1 B (2112) Src negative spd
P573.1 B (2113) Src Raise MOP
P574.1 B (2114) Src Lower MOP
ZUW1
PZD1 (Data word1)
Reserve
pos./neg. speed setp
Ramp-function gen. active
Energize main cont.
Undervoltage fault
Comp. setpoint reached
PcD control
Set/actual deviation
Alarm effective
Switch-on inhibit
OFF3 effective
OFF2 effective
Fault effective
Operation
Ready
Ready for ON

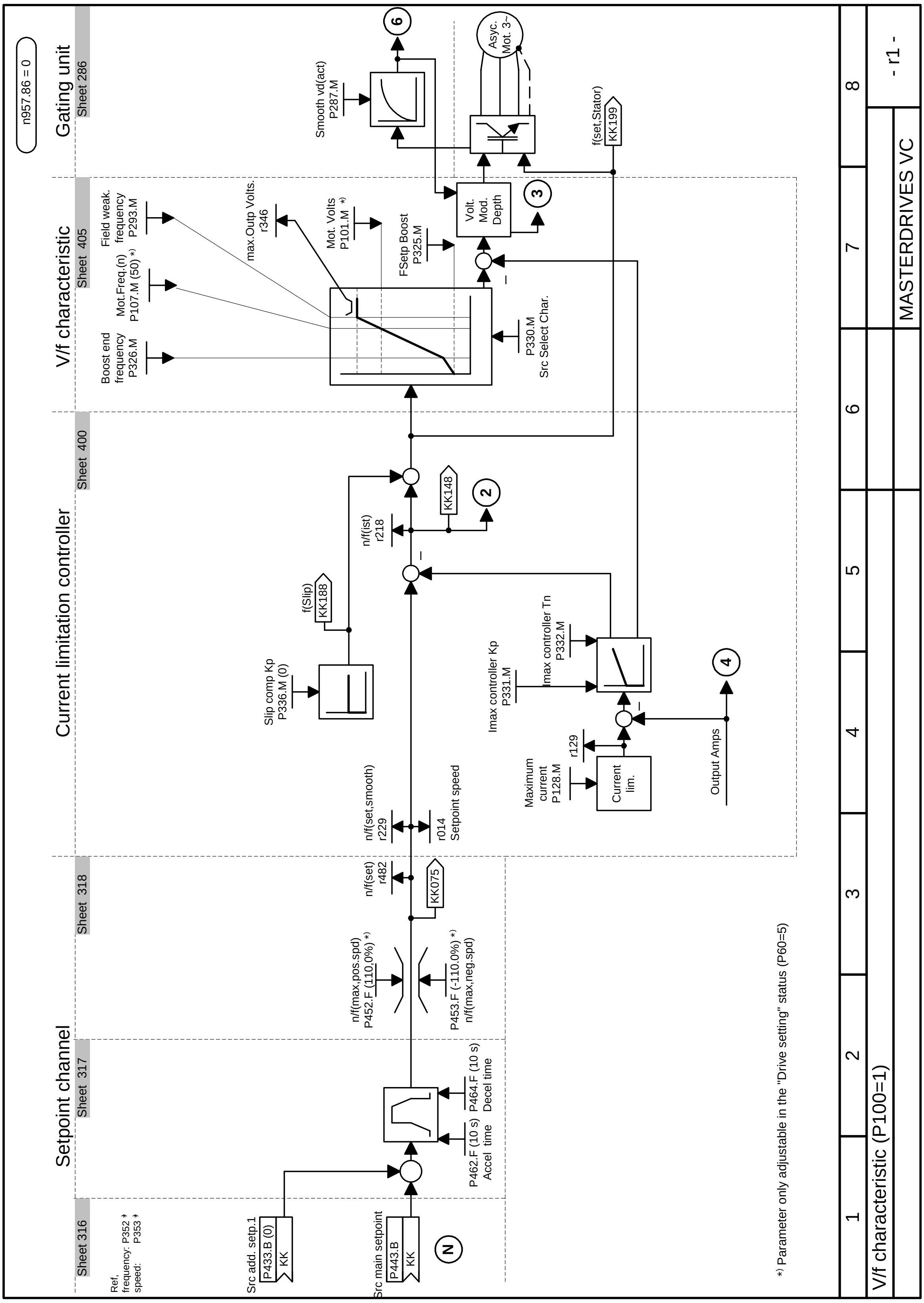


Terminal strip
Sheet [90]
-X101
P24
M24
0=fault
1=operation
P651.1 (107)
P652.1 (104)
P653.1 (0)
B0010
B0012
B0014
B0107
B0104
no fault
operation
from sheet [200]
n959.91 = 4
P590 (14)
Src BICO DSet
ON/OFF 1
1 Acknowledge
Negative Spd
Raise MOP
Lower MOP
B2100
B2107
B2112
B2113
B2114
P554.1 (5)
P565
P572
P573.1 (8)
P574.1 (9)
Src ON/OFF1
Src1 Acknowledge
Src Negative Spd
Src Raise MOP
Src Lower MOP
to sheet [180]
MOP MP
Sheet [300]
Accel Time MOP
P431
Decel Time MOP
P432
P425
Conf MOP
0xx0 = ... without storing after OFF
0xx1 = ... storing after OFF
MOP (max)
P421
P422
MOP (min.)
MOP(Outp.)
r424
KK058
Src Main Setpoint
P443.B (58)
to sheet [316.1]
Src T Setpoint
P486.B (58)
to sheet [320.1]
(for T control)
Not valid for Compact PLUS!
Setpoint source
OP1S and MOP (P368=8)
MASTERDRIVES VC
- s81 -

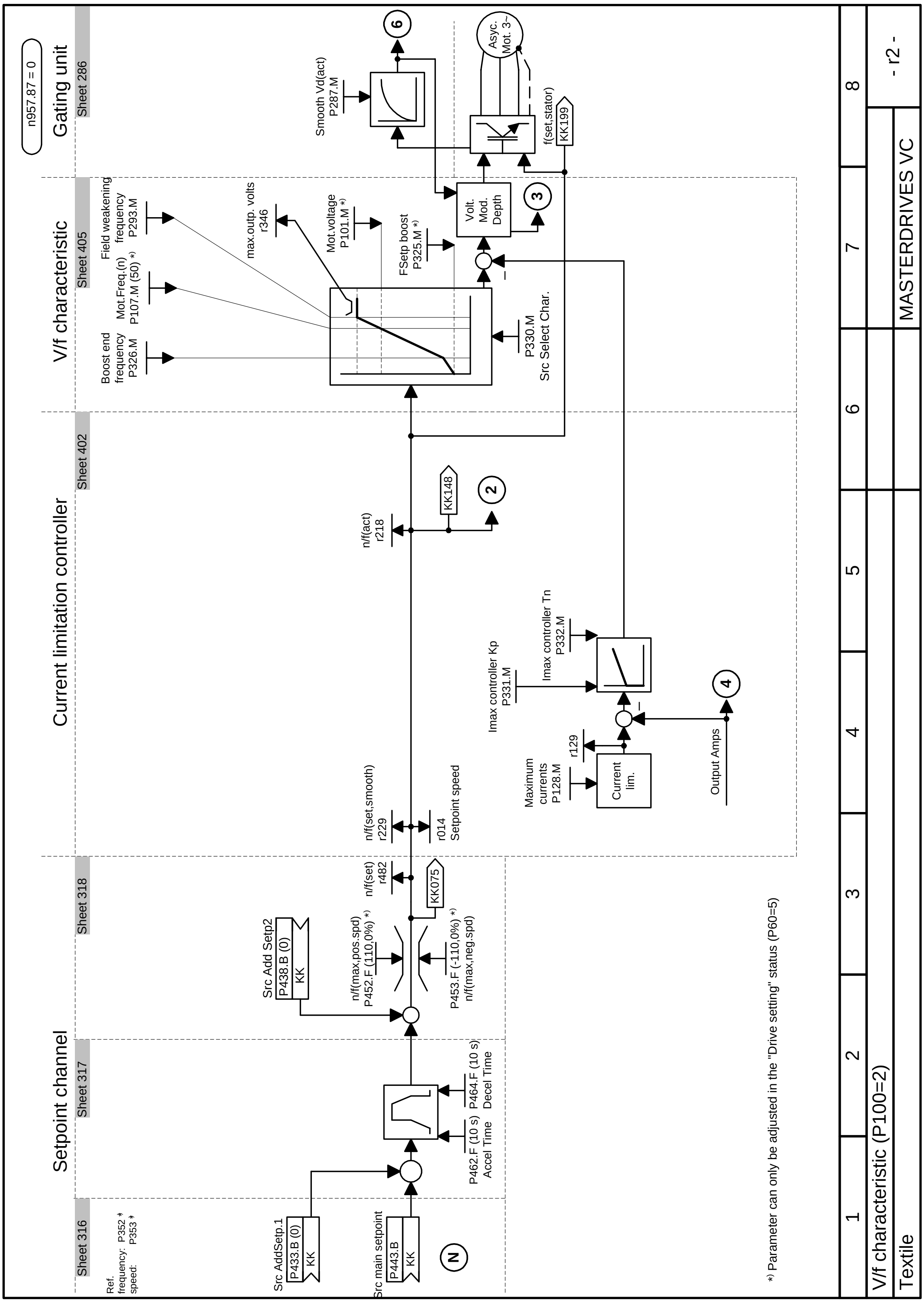


Display variables
2s
Rot Freq r002
Actual Speed r015
Actual speed KK020
n/f (act) r218
n/f(act) KK148
from sheet [350.7] [351.7] [352.7] [400.5]
2s
Output Amps r004
Output Amps K0022
I(Output Amps) K0242
from sheet [285.3] [286.3]
2s
Output voltage
Output voltage K0021
U(set,v/f) K0204
from sheet [285.3] [286.3]
Output power
Output power K0023
from sheet [285.7] [286.7]
30 ms
Torque r007 *)
Torque *) K0024
T(act) *) K0241
from sheet [285.7]
2s
DC Link Volts r006
DC Link Volts K0025
UZk(ist) K0240
from sheet [285.3] [286.3]
*) Torque display only with n/f/T control
Analog outputs
Src Analog Output P640.1 K (148)
x
AA1 Scaling P643.1
y(v) = x / 100% * P643
y
AA1 Offset P644.1
D A
Switch S4 1 +/- 10 V 3 2 0 ... 20 mA
-X102/19
-X102/20
AA1
Src Analog Output P640.2 K (22)
AA2 Scaling P643.2
AA2 Offset P644.2
Switch S4 4 +/- 10 V 6 5 0 ... 20 mA
-X102/21
-X102/22
AA2
Sheet [81]
<1>
n959.80 = 3
Switches on CUVC S4:
-10 V ... 10 V | AA1 1 - 3 | AA2 4 - 6
0 mA ... 20 mA | AA1 2 - 3 | AA2 5 - 6
<1> Only applicable for Compact/Chassis type unit, for Compact PLUS Sheet [82] is applicable
Display parameters
Sheet [30]
P042.x K K K .01 .02 .03
Reference frequency P352
Hz
Display frequency r043.1 to .3
P040.x K K K .01 .02 .03
Reference speed P353
rpm
Display speed r041.1 to .3
P038.x K K .01 .02
Reference torque P354 *)
%
Display torque r039.1 to .2 *)
Note concerning the setting of analog outputs:
B = Reference variable (c.f. P350 ... P354)
Smin = smallest signal value (e.g. in Hz, V, A)
Smax = largest signal value (e.g. in Hz, V, A)
Amin = smallest output value in V
Amax = largest output value in V
Output values applying to output current:
4 mA ⇒ Amin = + 6 V
20 mA ⇒ Amax = - 10 V
P643 = (Amax – Amin) / (Smax – Smin) x B
P644 = (Amin x Smax – Amax x Smin) / (Smax – Smin)
Explanations:
Sheet [300]: See Compendium sheet 300
1 Reference to the current path of rxx sheets
1 2 3 4 5 6 7 8
Analog outputs and display variables
MASTERDRIVES VC
- a0-

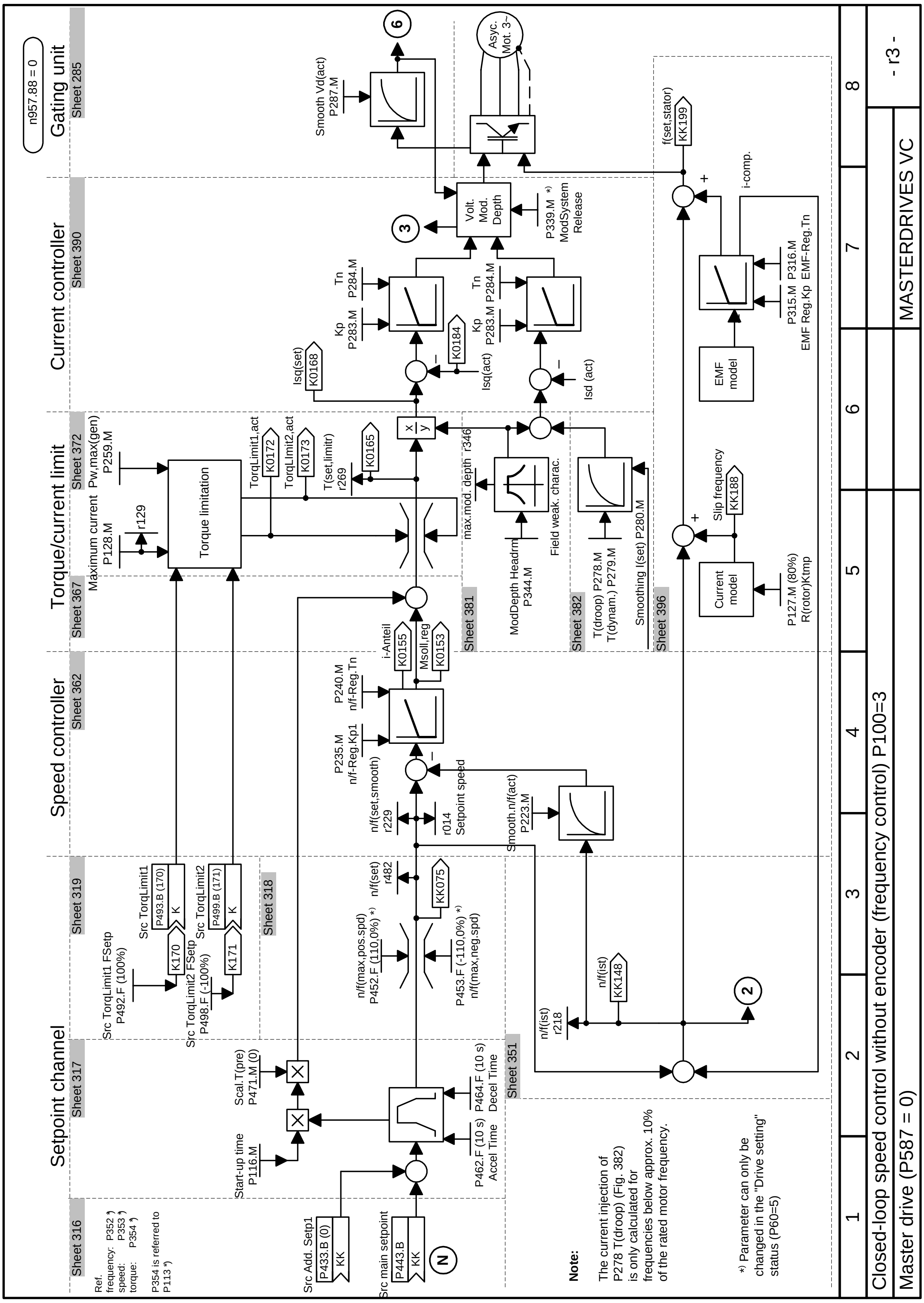

n957.85 = 0
Setpoint channel
Sheet 316
Sheet 317
Sheet 318
Speed controller
Sheet 364
Speed limitation controller
Sheet 401
v/f characteristic
Sheet 405
Gating unit
Sheet 286
Ref.
Frequency: P352 *)
Speed: P353 *)
Srce AddSetp1
P433.B (0)
KK
Src main setpoint
P443.B
KK
N
P462.F (10s)
Accel Time
P464.F (10s)
Decel Time
n/f(max,pos.spd)
P452.F (110.0%) *)
P453.F (-110.0%) *)
n/f(max,neg.Spd)
n/f(set)
r482
KK075
n/f(set,smooth)
r229
r014
Setpoint speed
P235.M
n/f-Reg.Gain1
P240.M
n/f-Reg.Tn
f(Slip)
KK0188
Maximum
current
P128.M
Current
Lim.
r129
Output
current
Imax-Ctrl Gain
P331.M
Imax-Ctrll.Tn
P332.M
4
Boost End
Freq
P326.M
Mot.Freq.(n)
P107.M (50) *)
Field Weak
Freq
P293.M
max.Outp Volts
r346
Mot.voltage
P101.M *)
FSetp Boost
P325.M
P330.M
Src SelCurve *)
Volts
mod
depth
3
Smooth. vd(act)
P287.M
6
Asyc.
Mot. 3~
Motor
encoder
f(set,stator)
KK199
Sheet 250
Sheet 352
Pulse #
P151.M (1024) *)
X104
23 Tacho M
24 Track A
25 Track B
26 Zero track
27 Control tr.
28 Tacho P15V
Normalization
P138.M (3000)
Ana.TachScale
Motor encoder
P130.M (11) *)
Imp.tach.
Ana.tach.
n/f(act,encoder)
KK091
n/f(act)
r218
n/f(act)
KK148
2
Smooth. n/f(act)
P223.M
Explanations:
Sh. [300] : See Compendium Sheet 300
N M : Reference to setpoint source (see s_{xx}-sheets)
1 : Reference to current path sheet "a0"
"Analog outputs and display variables"
*) Parameter only adjustable in the "Drive setting" state (P60=5)
1 2 3 4 5 6 7 8
V/f characteristic with speed controller (P100=0)
MASTERDRIVES VC
- r0 -

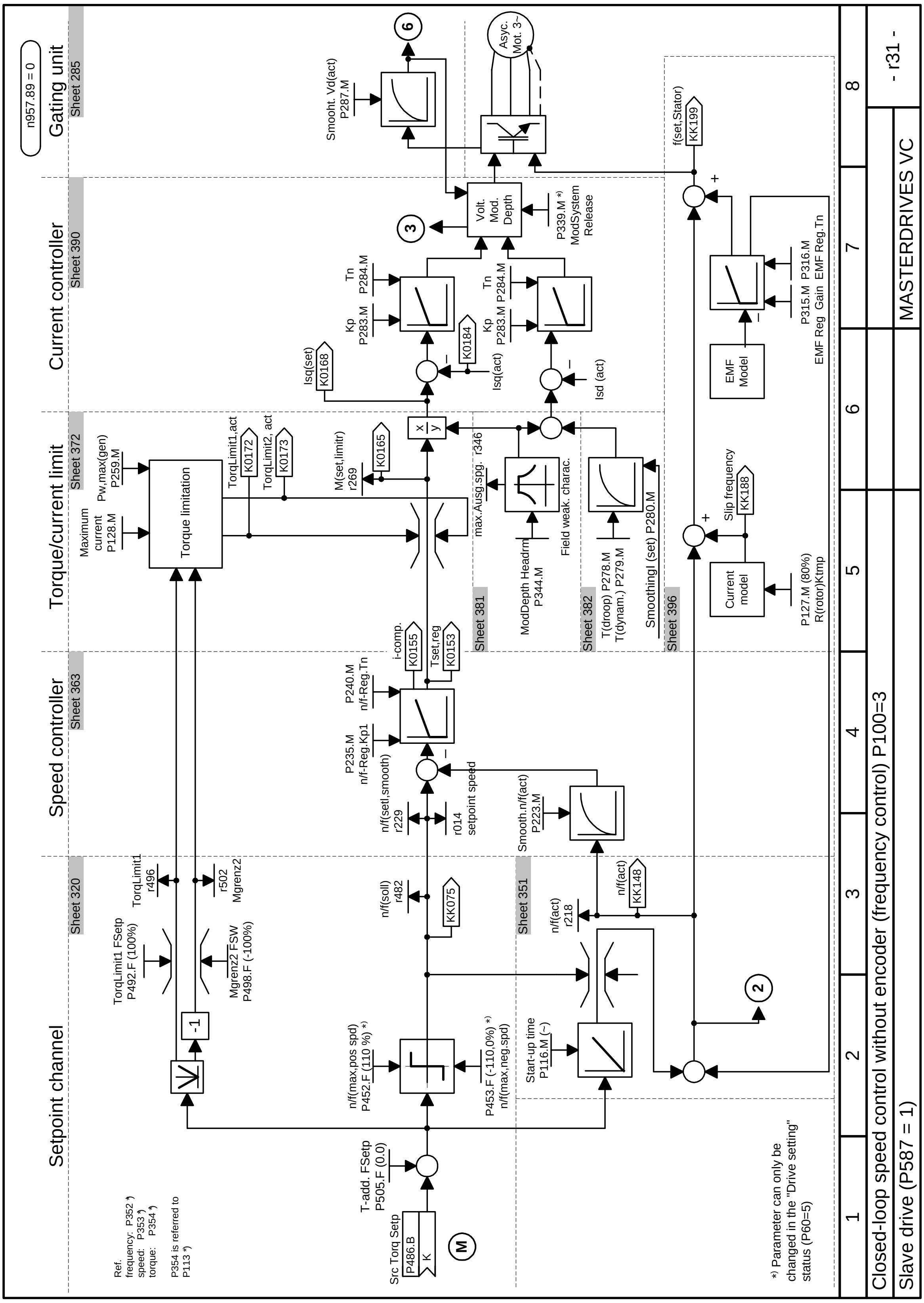


Setpoint channel
Sheet 316
Sheet 317
Sheet 318
Current limitation controller
Sheet 400
V/f characteristic
Sheet 405
Gating unit
Sheet 286
n957.86 = 0
Ref. frequency: P352 *)
speed: P353 *)
Src add. setp.1
P433.B (0)
KK
Src main setpoint
P443.B
KK
N
P462.F (10 s) Accel time
P464.F (10 s) Decel time
n/f(max,pos.spd) P452.F (110.0%) *)
P453.F (-110.0%) *) n/f(max,neg.spd)
n/f(set) r482
KK075
n/f(set,smooth) r229
r014 Setpoint speed
Slip comp Kp P336.M (0)
f(Slip) KK188
n/f(ist) r218
KK148
2
Maximum current P128.M
Current lim.
r129
Imax controller Kp P331.M
Imax controller Tn P332.M
4
Output Amps
Boost end frequency P326.M
Mot.Freq.(n) P107.M (50) *)
Field weak. frequency P293.M
max.Outp Volts. r346
Mot. Volts P101.M *)
FSetp Boost P325.M
P330.M Src Select Char.
Volt. Mod. Depth
3
Smooth vd(act) P287.M
6
f(set,Stator) KK199
Asyc. Mot. 3~
*) Parameter only adjustable in the "Drive setting" status (P60=5)
1 2 3 4 5 6 7 8
V/f characteristic (P100=1)
MASTERDRIVES VC
- r1 -

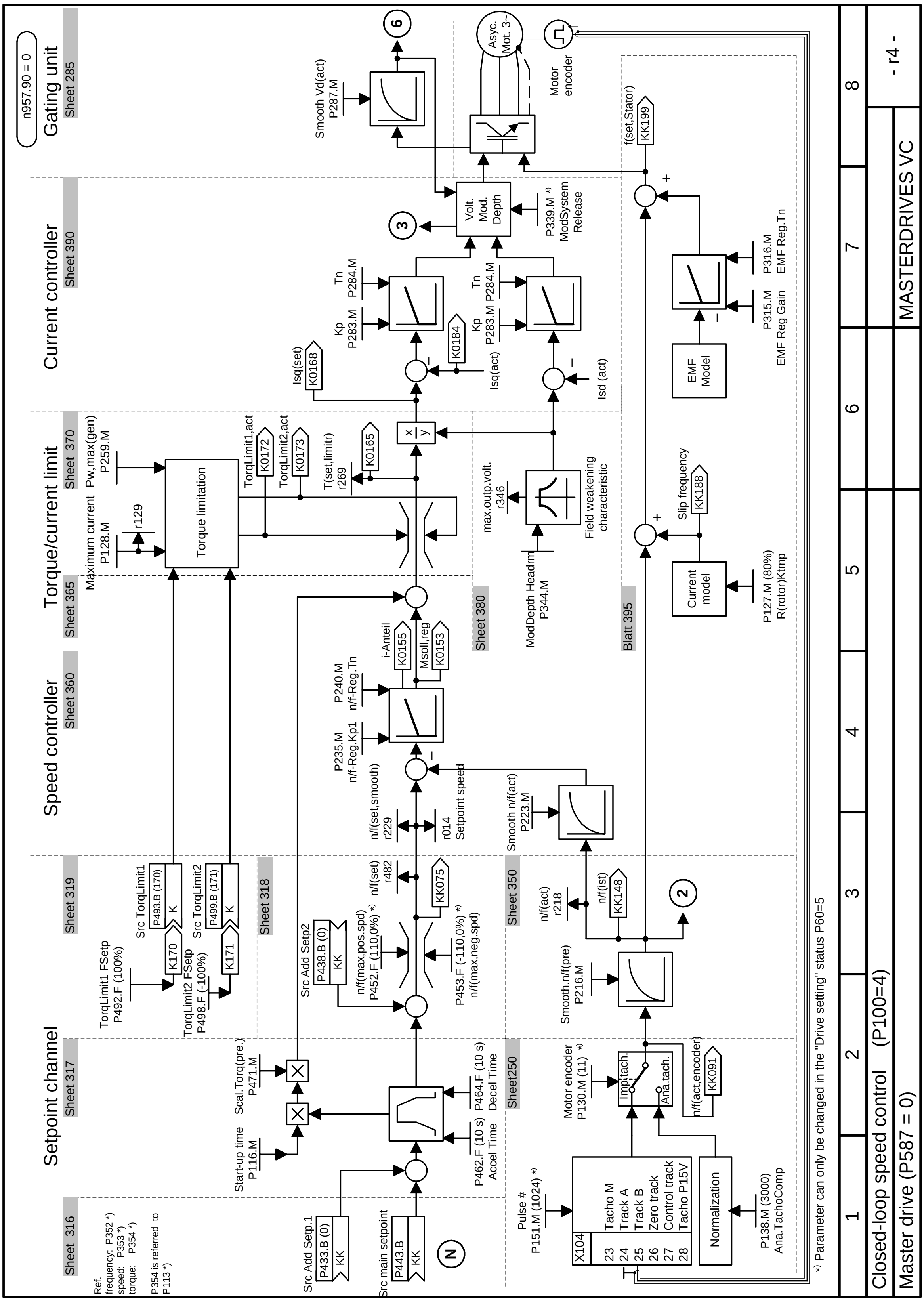


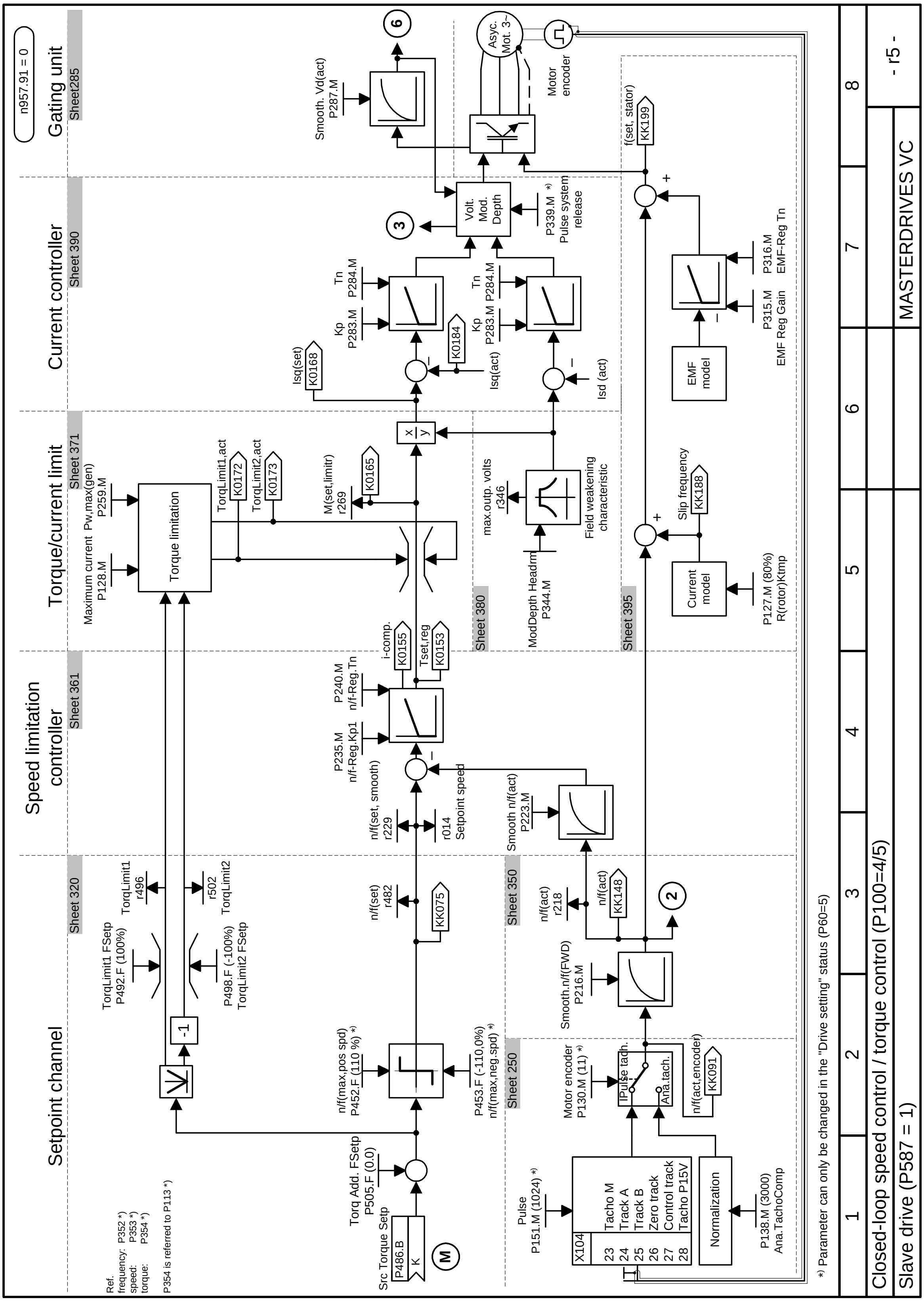
n957.87 = 0
Setpoint channel
Current limitation controller
V/f characteristic
Gating unit
Sheet 316
Sheet 317
Sheet 318
Sheet 402
Sheet 405
Sheet 286
Ref. frequency: P352 *)
speed: P353 *)
Src AddSetp.1
P433.B (0)
KK
Src main setpoint
P443.B
KK
N
P462.F (10 s)
Accel Time
P464.F (10 s)
Decel Time
Src Add Setp2
P438.B (0)
KK
n/f(max,pos.spd)
P452.F (110.0%) *)
P453.F (-110.0%) *)
n/f(max,neg.spd)
n/f(set)
r482
KK075
n/f(set,smooth)
r229
r014
Setpoint speed
Maximum currents
P128.M
Current lim.
r129
Imax controller Kp
P331.M
Imax controller Tn
P332.M
Output Amps
4
n/f(act)
r218
KK148
2
Boost end frequency
P326.M
Mot.Freq.(n)
P107.M (50) *)
Field weakening frequency
P293.M
max.outp. volts
r346
Mot.voltage
P101.M *)
FSetp boost
P325.M *)
P330.M
Src Select Char.
Volt. Mod. Depth
3
Smooth Vd(act)
P287.M
6
f(set,stator)
KK199
Asyc. Mot. 3~
*) Parameter can only be adjusted in the "Drive setting" status (P60=5)
1
2
3
4
5
6
7
8
V/f characteristic (P100=2)
Textile
MASTERDRIVES VC
- r2 -


n957.88 = 0
Setpoint channel
Sheet 316
Sheet 317
Speed controller
Sheet 362
Torque/current limit
Sheet 367
Sheet 372
Current controller
Sheet 390
Gating unit
Sheet 285
Ref.
frequency: P352 *)
speed: P353 *)
torque: P354 *)
P354 is referred to P113 *)
Src Add. Setp1
P433.B (0)
KK
Src main setpoint
P443.B
KK
N
Start-up time
P116.M
Scal.T(pre)
P471.M (0)
P462.F (10 s)
Accel Time
P464.F (10 s)
Decel Time
Sheet 351
Sheet 319
Src TorqLimit1 FSetp
P492.F (100%)
K170
Src TorqLimit1
P493.B (170)
K
Src TorqLimit2 FSetp
P498.F (-100%)
K171
Src TorqLimit2
P499.B (171)
K
Sheet 318
n/f(max,pos.spd)
P452.F (110,0%) *)
P453.F (-110,0%) *)
n/f(max,neg.spd)
n/f(set)
r482
KK075
n/f(ist)
r218
n/f(ist)
KK148
2
n/f(set,smooth)
r229
r014
Setpoint speed
Smooth.n/f(act)
P223.M
P235.M
n/f-Reg.Kp1
P240.M
n/f-Reg.Tn
i-Anteil
K0155
Msoll,reg
K0153
Sheet 381
Maximum current
P128.M
r129
Pw,max(gen)
P259.M
Torque limitation
TorqLimit1,act
K0172
TorqLimit2,act
K0173
T(set,limitr)
r269
K0165
max.mod. depth r346
ModDepth Headrm
P344.M
Field weak. charac.
Sheet 382
T(droop) P278.M
T(dynam.) P279.M
Smoothing I(set) P280.M
Sheet 396
Isq(set)
K0168
Kp
P283.M
Tn
P284.M
K0184
Isq(act)
Isd (act)
Volt.
Mod.
Depth
3
P339.M *)
ModSystem
Release
Smooth Vd(act)
P287.M
6
Asyc.
Mot. 3~
f(set,stator)
KK199
i-comp.
Slip frequency
KK188
Current
model
P127.M (80%)
R(rotor)Ktmp
EMF
model
P315.M P316.M
EMF Reg.Kp EMF-Reg.Tn
Note:
The current injection of P278 T(droop) (Fig. 382) is only calculated for frequencies below approx. 10% of the rated motor frequency.
*) Parameter can only be changed in the "Drive setting" status (P60=5)
1
2
3
4
5
6
7
8
Closed-loop speed control without encoder (frequency control) P100=3
Master drive (P587 = 0)
MASTERDRIVES VC
- r3 -



Setpoint channel
Sheet 320
Speed controller
Sheet 363
Torque/current limit
Sheet 372
Current controller
Sheet 390
Gating unit
Sheet 285
n957.89 = 0
Ref. frequency: P352 *) speed: P353 *) torque: P354 *)
P354 is referred to P113 *)
Src Torq Setp
P486.B
K
M
T-add. FSetp
P505.F (0.0)
n/f(max,pos spd)
P452.F (110 %) *)
P453.F (-110,0%) *)
n/f(max,neg.spd)
Start-up time
P116.M (~)
TorqLimit1 FSetp
P492.F (100%)
Mgrenz2 FSW
P498.F (-100%)
-1
TorqLimit1
r496
r502
Mgrenz2
n/f(soll)
r482
KK075
Sheet 351
n/f(act)
r218
n/f(act)
KK148
Smooth.n/f(act)
P223.M
n/f(setl,smooth)
r229
r014
setpoint speed
P235.M
n/f-Reg.Kp1
P240.M
n/f-Reg.Tn
i-comp.
K0155
Tset,reg
K0153
Maximum current
P128.M
Pw,max(gen)
P259.M
Torque limitation
TorqLimit1,act
K0172
TorqLimit2, act
K0173
M(set,limitr)
r269
K0165
Sheet 381
max.Ausg.spg. r346
ModDepth Headrm
P344.M
Field weak. charac.
Sheet 382
T(droop) P278.M
T(dynam.) P279.M
SmoothingI (set) P280.M
Sheet 396
Isq(set)
K0168
K0184
Isq(act)
Isd (act)
Kp
P283.M
Tn
P284.M
Volt. Mod. Depth
P339.M *)
ModSystem Release
Smooht. Vd(act)
P287.M
Asyc. Mot. 3~
Current model
P127.M (80%)
R(rotor)Ktmp
Slip frequency
KK188
EMF Model
P315.M P316.M
EMF Reg Gain EMF Reg.Tn
f(set,Stator)
KK199
*) Parameter can only be changed in the "Drive setting" status (P60=5)
1 2 3 4 5 6 7 8
Closed-loop speed control without encoder (frequency control) P100=3
Slave drive (P587 = 1)
MASTERDRIVES VC
- r31 -


Setpoint channel
Speed controller
Torque/current limit
Current controller
Gating unit
n957.90 = 0
Sheet 316
Sheet 317
Sheet 319
Sheet 318
Sheet 360
Sheet 365
Sheet 370
Sheet 380
Sheet 390
Sheet 285
Sheet250
Sheet 350
Blatt 395
Ref.
frequency: P352 *)
speed: P353 *)
torque: P354 *)
P354 is referred to P113 *)
Src Add Setp.1
P433.B (0)
KK
Src main setpoint
P443.B
KK
N
Start-up time
P116.M
Scal.Torq(pre.)
P471.M
P462.F (10 s)
Accel Time
P464.F (10 s)
Decel Time
TorqLimit1 FSetp
P492.F (100%)
TorqLimit2 FSetp
P498.F (-100%)
K170
K171
Src TorqLimit1
P493.B (170)
K
Src TorqLimit2
P499.B (171)
K
Src Add Setp2
P438.B (0)
KK
n/f(max,pos.spd)
P452.F (110,0%) *)
P453.F (-110,0%) *)
n/f(max,neg.spd)
n/f(set)
r482
KK075
n/f(set,smooth)
r229
r014
Setpoint speed
P235.M
n/f-Reg.Kp1
P240.M
n/f-Reg.Tn
i-Anteil
K0155
Msoll,reg
K0153
Maximum current
P128.M
r129
Torque limitation
Pw,max(gen)
P259.M
TorqLimit1,act
K0172
TorqLimit2,act
K0173
T(set,limitr)
r269
K0165
x
y
max.outp.volt.
r346
Field weakening characteristic
ModDepth Headrm
P344.M
Isq(set)
K0168
Kp
P283.M
Tn
P284.M
K0184
Isq(act)
Isd (act)
3
Volt. Mod. Depth
P339.M *)
ModSystem Release
Smooth Vd(act)
P287.M
6
Asyc. Mot. 3~
Motor encoder
f(set,Stator)
KK199
EMF Model
P315.M
EMF Reg Gain
P316.M
EMF Reg.Tn
Slip frequency
KK188
Current model
P127.M (80%)
R(rotor)Ktmp
Smooth n/f(act)
P223.M
n/f(act)
r218
n/f(ist)
KK148
2
Smooth.n/f(pre)
P216.M
Motor encoder
P130.M (11) *)
Imp.tach.
Ana.tach.
n/f(act,encoder)
KK091
Pulse #
P151.M (1024) *)
X104
23 Tacho M
24 Track A
25 Track B
26 Zero track
27 Control track
28 Tacho P15V
Normalization
P138.M (3000)
Ana.TachoComp
*) Parameter can only be changed in the "Drive setting" status P60=5
1
2
3
4
5
6
7
8
Closed-loop speed control (P100=4)
Master drive (P587 = 0)
MASTERDRIVES VC
- r4 -


Setpoint channel
Sheet 320
Speed limitation controller
Sheet 361
Torque/current limit
Sheet 371
Current controller
Sheet 390
Gating unit
Sheet285
n957.91 = 0
Ref. frequency: P352 *)
speed: P353 *)
torque: P354 *)
P354 is referred to P113 *)
Src Torque Setp
P486.B
K
Torq Add. FSetp
P505.F (0.0)
n/f(max,pos spd)
P452.F (110 %) *)
P453.F (-110.0%)
n/f(max,neg.spd) *)
Sheet 250
TorqLimit1 FSetp
P492.F (100%)
P498.F (-100%)
TorqLimit2 FSetp
TorqLimit1
r496
r502
TorqLimit2
-1
n/f(set)
r482
KK075
n/f(set, smooth)
r229
r014
Setpoint speed
P235.M
n/f-Reg.Kp1
P240.M
n/f-Reg.Tn
i-comp.
K0155
Tset,reg
K0153
Smooth n/f(act)
P223.M
Maximum current
P128.M
Pw,max(gen)
P259.M
Torque limitation
TorqLimit1,act
K0172
TorqLimit2,act
K0173
M(set,limitr)
r269
K0165
Sheet 380
ModDepth Headrm
P344.M
max.outp. volts
r346
Field weakening characteristic
Isq(set)
K0168
Kp
P283.M
Tn
P284.M
K0184
Isq(act)
Isd (act)
Volt. Mod. Depth
P339.M *)
Pulse system release
Smooth. Vd(act)
P287.M
Asyc. Mot. 3~
Motor encoder
f(set, stator)
KK199
Pulse
P151.M (1024) *)
X104
23 Tacho M
24 Track A
25 Track B
26 Zero track
27 Control track
28 Tacho P15V
Normalization
P138.M (3000)
Ana.TachoComp
Motor encoder
P130.M (11) *)
Pulse tach.
Ana.tach.
n/f(act,encoder)
KK091
Smooth.n/f(FWD)
P216.M
Sheet 350
n/f(act)
r218
n/f(act)
KK148
Sheet 395
Current model
P127.M (80%)
R(rotor)Ktmp
Slip frequency
KK188
EMF model
P315.M
EMF Reg Gain
P316.M
EMF-Reg Tn
*) Parameter can only be changed in the "Drive setting" status (P60=5)
1 2 3 4 5 6 7 8
Closed-loop speed control / torque control (P100=4/5)
Slave drive (P587 = 1)
MASTERDRIVES VC
- r5 -

Parameter assignments depending on setpoint source (P368) and control type (P100):

Parameter description		P368 = Setpoint source							
		P368 = 0 PMU + MOP	P368 = 1 Analog inp. + terminals	P368 = 2 FSetp + terminals	P368 = 3 MOP + terminals	P368 = 4 USS	P368 = 6 PROFI-BUS	P368 = 7 OP1S + FSetp	P368 = 8 OP1S + MOP
P554.1	Src ON/OFF1	B0005	B0022	B0022	B0022	B2100	B3100	B2100	B2100
P555.1	Src OFF2	1	B0020	B0020	B0020	B2101	B3101	1	1
P561.1	Src InvRelease	1	B0016	1	1	1	1	1	1
P565.1	Src1 Fault Reset	B2107	B2107	B2107	B2107	B2107	B2107	B2107	B2107
P567.1	Src3 Fault Reset	0	B0018	B0018	B0018	0	0	0	0
P568.1	Src Jog Bit0	0	0	0	0	B2108	B3108	B2108	0
P571.1	Src FWD Speed	1	1	1	1	B2111	B3111	B2111	1
P572.1	Src REV Speed	1	1	1	1	B2112	B3112	B2112	B2112
P573.1	Src MOP Up	B0008	0	0	B0014	0	0	0	B2113
P574.1	Src MOP Down	B0009	0	0	B0016	0	0	0	B2114
P580.1	Src FixSetp Bit0	0	0	B0014	0	0	0	0	0
P581.1	Src FixSetp Bit1	0	0	B0016	0	0	0	0	0
P590	Src BICO DSet	B0014 *	0	0	0	0	B0014	B0014 *	B0014 **
P651.1	Src DigOut1	B0107 *	B0107	B0107	B0107	B0107	B0107	B0107 *	B0107 *
P652.1	Src DigOut2	B0104 *	B0104	B0104	B0104	B0104	B0104	B0104 *	B0104 *
P653.1	Src DigOut3	0 *	B0115	0	0	0	0	0 *	0 *
P654.1	Src DigOut4	0	0	0	0	0	0	0	0
Setpoint conn. parameter		KK0058	K0011	KK0040	KK0058	K2002	K3002	KK0040	KK0058

*** For factory setting P366 = 2, 3**

- P590 = B0012
- P651 = B0000
- P652 = B0000
- P653 = B0107

**** For factory setting P366 = 4:**

- P590 = B4102

Bxxxx =	Binector (Digital signal; values 0 and 1)
Kxxxx =	Connector (16-bit signal; 4000h = 100 %)
KKxxxx =	Double connector (32-bit signal; 4000 0000h = 100 %)

v/f characteristic + n/f-control:	Setpoint connector parameter (Setp-KP) = P443
T-control + n/f control:	Setpoint connector parameter (Setp-KP) = P486

Parameter description		P100 = control type					
		P100 = 0 V/f + n	**P100 = 1 V/f**	**P100 = 2 Textile**	**f-Reg. (P587 = 0)**	**n-Reg. (P587 = 0)**	**P100 = 5 T-Reg.**
P038.1	DispTorqConn.r39.1	-	-	-	-	-	Sw-KP
P038.1	DispTorqConn.r39.2	-	-	-	-	-	K0165
P040.1	DispSpdConn.r41.1	Setp CP	Setp CP	Setp CP	Setp CP	Setp CP	KK0150
P040.2	DispSpdConn.r41.2	KK0148	KK0148	KK0148	KK0148	KK0148	KK0148
P040.3	Disp Freq Conn.r41.3	-	-	-	KK0091	KK0091	KK0091
P042.1	Disp Freq Conn.r43.1	Setp CP	Setp CP	Setp CP	Setp CP	Setp CP	KK0150
P042.2	Disp Freq Conn.r43.2	KK0148	KK0148	KK0148	KK0148	KK0148	KK0148
P042.3	Disp Freq Conn.r43.3	KK0199	KK0199	KK0199	KK0091	KK0091	KK0091

9.2.2 Parameterizing with user settings

During parameterization by selecting user-specific fixed settings, the parameters of the unit are described with values which are permanently stored in the software. In this manner, it is possible to carry out the complete parameterization of the units in one step just by setting a few parameters.

The user-specific fixed settings are not contained in the standard firmware; they have to be compiled specifically for the customer.

NOTE If you are interested in the provision and implementation of fixed settings tailored to your own requirements, please get in contact with your nearest SIEMENS branch office.

P060 = 2 — **Select "Fixed settings" menu**

↓

P366 = ? — **Select desired factory setting**

0...4: Factory settings
5: User setting 1 (currently as P366 = 0)
6: User setting 2 (currently as P366 = 0)
:
10: Lift and lifting equipment

↓

P970 = 0 — **Start parameter reset**

0: Parameter reset
1: No parameter change

Unit carries out parameter reset and then leaves the "Fixed settings" menu

Fig. 9-3 Sequence for parameterizing with user settings

9.2.3 Parameterizing by loading parameter files (download P060 = 6)

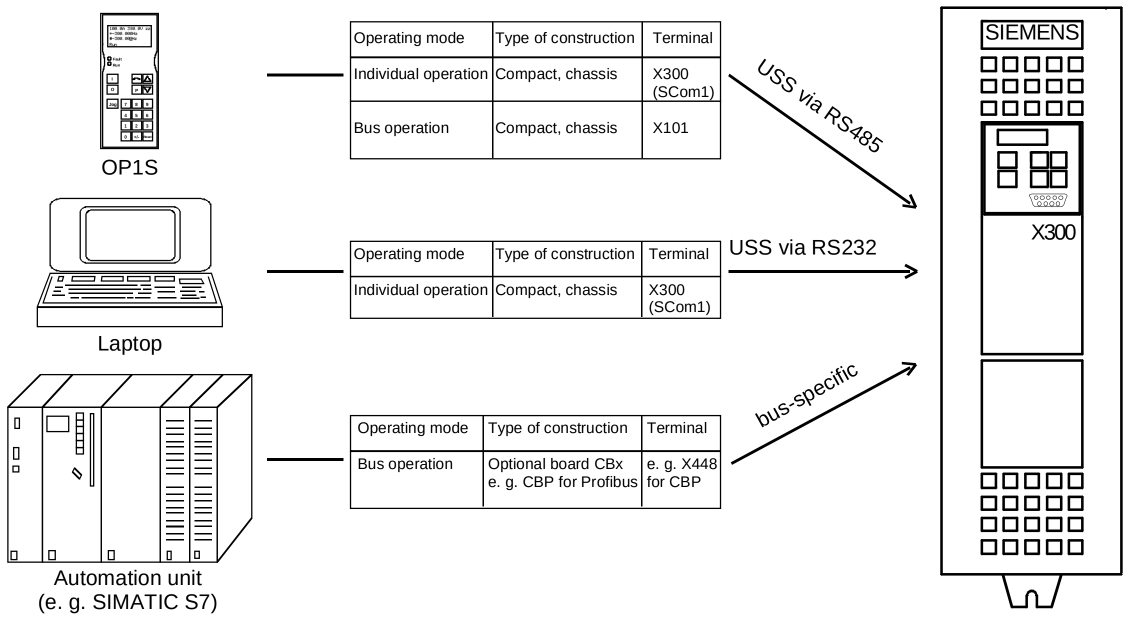
Download

When parameterizing with download, the parameter values stored in a master unit are transferred to the unit to be parameterized via a serial interface. The following can serve as master units:

1. OP1S operator control panel
2. PCs with DriveMonitor service program
3. Automation units (e.g. SIMATIC)

The interface SCom1 or SCom2 with USS protocol of the basic unit and field bus interfaces used for parameter transfer (e.g. CBP for PROFIBUS DP) can serve as serial interfaces.

Using download, all changeable parameters can be set to new values.



Operating mode	Type of construction	Terminal
Individual operation	Compact, chassis	X300 (SCom1)
Bus operation	Compact, chassis	X101

Operating mode	Type of construction	Terminal
Individual operation	Compact, chassis	X300 (SCom1)

Operating mode	Type of construction	Terminal
Bus operation	Optional board CBx e. g. CBP for Profibus	e. g. X448 for CBP

Fig. 9-4 Parameter transfer from various sources by download

Downloading with the OP1S

The OP1S operator control panel is capable of upreading parameter sets from the units and storing them. These parameter sets can then be transferred to other units by download. Downloading with the OP1S is thus the preferred method of parameterizing replacement units in a service case.

During downloading with the OP1S, it is assumed that the units are in the as-delivered state. The parameters for power section definition are thus not transferred. (Refer to Section "Detailed parameterization, power section definition")

Parameter number	Parameter name
P060	Menu selection
P070	Order No. 6SE70..
P072	Rtd Drive Amps(n)
P073	Rtd Drive Power(n)

Table 9-6 Parameters you cannot overwrite during download

The OP1S operator control panel also stores and transfers parameters for configuring the USS interface (P700 to P704). Depending on the parameterization of the unit from which the parameter set was originally upread, communication between the OP1S and the unit can be interrupted on account of changed interface parameters after downloading has been completed. To enable communication to re-commence, briefly interrupt the connection between the OP1S and the unit (disconnect OP1S or the cable). The OP1S is then newly initialized and adjusts itself after a short time to the changed parameterization via the stored search algorithm.

Download with DriveMonitor

With the aid of the DriveMonitor PC program, parameter sets can be upload from the units, saved to the hard disk or to floppy disks, and edited offline. These parameter sets, stored in parameter files, can then be downloaded to the units again.

The offline parameter editing facility can be used to produce special parameter files to suit a particular application. In such cases, the files need not contain the full set of parameters but can be limited to the parameters relevant to the application in question. For further information, see under "Upload / Download" in the "Parameterization" section.

NOTICE

Successful parameterization of the units by download is only ensured if the unit is in the "Download" status when the data is being transferred. Transition into this status is achieved by selecting the "Download" menu in P060.

P060 is automatically set to 6 after the download function has been activated in the OP1S or in the DriveMonitor service program.

If the CU of a converter is replaced, the power section definition has to be carried out before parameter files are downloaded.

If only parts of the entire parameter list are transferred by download, the parameters of the following table must always be transferred too, as these automatically result during the drive setting from the input of other parameters. During download, however, this automatic adjustment is **not** carried out.

Parameter number	Parameter name
P109	Pole pair number
P352	Reference frequency = P353 x P109 / 60
P353	Reference frequency = P352 x 60 / P109

Table 9-7 Parameters which always have to be loaded during download

If parameter P115 = 1 is set during download, the automatic parameterization is then carried out (according to the setting of parameter P114). In automatic parameterization, the controller settings are calculated from the motor rating plate data and the reference values P350 to P354 are set to the motor rated values of the first motor data set.

If the following parameters are changed during download, they are **not** then re-calculated by the automatic parameterization:

P116, P128, P215, P216, P217, P223, P235, P236, P237, P240, P258, P259, P278, P279, P287, P291, P295, P303, P313, P337, P339, P344, P350, P351, P352, P353, P354, P388, P396, P471, P525, P536, P602, P603.

9.2.4 Parameterization by running script files

Description

Script files are used to parameterize devices of the MASTERDRIVES series as an alternative to downloading a parameter set. A script file is a pure text file that must have the filename extension ***.ssc**. The script file executes individual commands using a simple command syntax for the purpose of device parameterization. (You can write the script files using a simple text editor, such as WordPad.)

NOTE

Please refer to the online help for the scriptfiles.

9.3 Motor list

Asynchronous motors 1PH7(=PA6) / 1PL6 / 1PH4

Input in P097	Motor order number (MPRD)	Rated speed n_n [rpm]	Frequency f_n [Hz]	Current I_n [A]	Voltage U_n [V]	Torque M_n [Nm]	cos φ	i_u [%]
1	1PH7101-2_F_	1750	60.0	9.7	398	23.5	0.748	58.3
2	1PH7103-2_D_	1150	40.6	9.7	391	35.7	0.809	51.8
3	1PH7103-2_F_	1750	60.95	12.8	398	34	0.835	41.3
4	1PH7103-2_G_	2300	78.8	16.3	388	31	0.791	50.4
5	1PH7105-2_F_	1750	60.0	17.2	398	43.7	0.773	54.1
6	1PH7107-2_D_	1150	40.3	17.1	360	59.8	0.807	51.4
7	1PH7107-2_F	1750	60.3	21.7	381	54.6	0.802	48.8
8	1PH7131-2_F_	1750	59.65	23.7	398	71	0.883	34.2
9	1PH7133-2_D_	1150	39.7	27.5	381	112	0.853	46.2
10	1PH7133-2_F_	1750	59.65	33.1	398	95.5	0.854	41.1
11	1PH7133-2_G_	2300	78.0	42.4	398	93	0.858	40.4
12	1PH7135-2_F_	1750	59.45	40.1	398	117	0.862	40.3
13	1PH7137-2_D_	1150	39.6	40.6	367	162	0.855	45.8
14	1PH7137-2_F_	1750	59.5	53.1	357	136	0.848	43.0
15	1PH7137-2_G_	2300	77.8	54.1	398	120	0.866	39.3
16	1PH7163-2_B_	400	14.3	28.2	274	227	0.877	40.4
17	1PH7163-2_D_	1150	39.15	52.2	364	208	0.841	48.7
18	1PH7163-2_F_	1750	59.2	69.0	364	185	0.855	41.2
19	1PH7163-2_G_	2300	77.3	78.5	398	158	0.781	55.3
20	1PH7167-2_B_	400	14.3	35.6	294	310	0.881	39.0
21	1PH7167-2_D_	1150	39.1	66.4	357	257	0.831	50.9
22	1PH7167-2_F_	1750	59.15	75.2	398	224	0.860	40.3
23	1PH7184-2_B_	400	14.2	49.5	271	390	0.840	52.5
24	1PH7184-2_D_	1150	39.1	87.5	383	366	0.820	48.0
25	1PH7184-2_F_	1750	59.0	120.0	388	327	0.780	52.9
26	1PH7184-2_L_	2900	97.4	158.0	395	267	0.800	48.7
27	1PH7186-2_B_	400	14.0	67.0	268	505	0.810	58.3
28	1PH7186-2_D_	1150	39.0	116.0	390	482	0.800	50.4
29	1PH7186-2_F_	1750	59.0	169.0	385	465	0.800	50.0
30	1PH7186-2_L_	2900	97.3	206.0	385	333	0.780	52.0
31	1PH7224-2_B_	400	14.0	88.0	268	725	0.870	41.5
32	1PH7224-2_D_	1150	38.9	160.0	385	670	0.810	49.4
33	1PH7224-2_U_	1750	58.9	203.0	395	600	0.840	43.4

Input in P097	Motor order number (MPRD)	Rated speed n_n [rpm]	Frequency f_n [Hz]	Current I_n [A]	Voltage U_n [V]	Torque M_n [Nm]	cos φ	i_μ [%]
34	1PH7224-2_L_	2900	97.3	274.0	395	490	0.840	42.0
35	1PH7226-2_B_	400	14.0	114.0	264	935	0.860	43.4
36	1PH7226-2_D_	1150	38.9	197.0	390	870	0.840	44.4
37	1PH7226-2_F_	1750	58.9	254.0	395	737	0.820	47.4
38	1PH7226-2_L_	2900	97.2	348.0	390	610	0.830	44.4
39	1PH7228-2_B_	400	13.9	136.0	272	1145	0.850	45.2
40	1PH7228-2_D_	1150	38.9	238.0	390	1070	0.850	41.4
41	1PH7228-2_F_	1750	58.8	342.0	395	975	0.810	49.6
42	1PH7228-2_L_	2900	97.2	402.0	395	708	0.820	46.4
43	1PL6184-4_B_	400	14.4	69.0	300	585	0.860	47.8
44	1PL6184-4_D_	1150	39.4	121.0	400	540	0.860	46.3
45	1PL6184-4_F_	1750	59.3	166.0	400	486	0.840	41.0
46	1PL6184-4_L_	2900	97.6	209.0	400	372	0.850	37.8
47	1PL6186-4_B_	400	14.3	90.0	290	752	0.850	52.2
48	1PL6186-4_D_	1150	39.4	158.0	400	706	0.860	39.3
49	1PL6186-4_F_	1750	59.3	231.0	400	682	0.840	39.8
50	1PL6186-4_L_	2900	97.5	280.0	390	494	0.840	38.7
51	1PL6224-4_B_	400	14.2	117.0	300	1074	0.870	38.5
52	1PL6224-4_D_	1150	39.1	218.0	400	997	0.850	39.5
53	1PL6224-4_F_	1750	59.2	292.0	400	900	0.870	30.8
54	1PL6224-4_L_	2900	97.5	365.0	400	675	0.870	32.3
55	1PL6226-4_B_	400	14.0	145.0	305	1361	0.850	46.2
56	1PL6226-4_D_	1150	39.2	275.0	400	1287	0.870	33.5
57	1PL6226-4_F_	1750	59.1	355.0	400	1091	0.870	34.4
58	1PL6226-4_L_	2900	97.4	470.0	395	889	0.870	32.4
59	1PL6228-4_B_	400	14.0	181.0	305	1719	0.860	42.5
60	1PL6228-4_D_	1150	39.2	334.0	400	1578	0.880	30.5
61	1PL6228-4_F_	1750	59.0	470.0	400	1448	0.860	36.8
62	1PL6228-4_L_	2900	97.3	530.0	400	988	0.870	35.0
63	1PH4103-4_F_	1750	61.2	20.5	400	48	0.75	56.1
64	1PH4105-4_F_	1750	61.3	28.0	400	70	0.78	48.2
65	1PH4107-4_F_	1750	61.0	36.0	400	89	0.78	50.0
66	1PH4133-4_F_	1750	60.2	36.0	400	96	0.82	33.3
67	1PH4135-4_F_	1750	59.8	52.0	400	139	0.79	42.3
68	1PH4137-4_F_	1750	59.9	63.0	400	172	0.81	36.5
69	1PH4163-4_F_	1750	59.3	88.0	400	235	0.78	47.7
70	1PH4167-4_F_	1750	59.4	107.0	400	295	0.80	41.1

Input in P097	Motor order number (MPRD)	Rated speed n_n [rpm]	Frequency f_n [Hz]	Current I_n [A]	Voltage U_n [V]	Torque M_n [Nm]	cos φ	i_μ [%]
71	1PH4168-4_F_	1750	59.4	117.0	400	333	0.82	36.8
72	1PH7107-2_G_	2300	78.6	24.8	398	50	0.80	48.8
73	1PH7167-2_G_	2300	77.4	85.0	398	183	0.84	47.1
74	1PH7284-_ _B_	500	17.0	144.0	400	1529	0.87	41.7
75	1PH7284-_ _D_	1150	38.6	314.0	400	1414	0.82	50.3
76	1PH7284-_ _F_	1750	58.7	393.0	400	1228	0.86	41.5
77	1PH7286-_ _B_	500	17.0	180.0	400	1909	0.86	43.3
78	1PH7286-_ _D_	1150	38.6	414.0	380	1745	0.81	52.7
79	1PH7286-_ _F_	1750	58.7	466.0	400	1474	0.87	39.5
80	1PH7288-_ _B_	500	17.0	233.0	400	2481	0.87	42.6
81	1PH7288-_ _D_	1150	38.6	497.0	385	2160	0.82	50.7
82	1PH7288-_ _F_	1750	58.7	586.0	400	1856	0.87	39.9
83 to 99	for future applications							
100	1PL6284-_ _D_	1150	38.9	478.0	400	2325	0.89	32.6
101	1PL6284-_ _F_	1750	59.0	616.0	400	2019	0.90	26.3
102	1PL6286-_ _D_	1150	38.9	637.0	380	2944	0.89	33.6
103	1PL6286-_ _F_	1750	59.0	736.0	400	2429	0.91	24.7
104	1PL6288-_ _D_	1150	38.9	765.0	385	3607	0.89	32.4
105	1PL6288-_ _F_	1750	59.0	924.0	400	3055	0.91	25.1
106 to 127	for future applications							

Table 8 Motor list 1PH7 (=1PA6) / 1PL6 / 1PH4

9.4 Detailed parameterization

Detailed parameterization should always be used in cases where the application conditions of the units are not exactly known beforehand and detailed parameter adjustments need to be carried out locally. An example of a typical application is initial start-up.

9.4.1 Power section definition

The power section definition has already been completed in the as-delivered state. It therefore only needs to be carried out if the CUVC needs replacing, and is not required under normal circumstances.

During the power section definition, the control electronics is informed which power section it is working with. This step is necessary for all Compact, chassis and cabinet type units.

WARNING

If CUVC boards are changed over between different units without the power section being re-defined, the unit can be destroyed when it is connected up to the voltage supply and energized.

The unit has to be switched to the "Power section definition" state for carrying out the power section definition. This is done by selecting the "Power section definition" menu. The power section is then defined in this menu by inputting a code number.

P060 = 8	**Select "Power section definition" menu**
P070 = ?	**Input the code number for the unit concerned** The code number is allocated to the order numbers (MLFB). The order number can be read off the unit's rating plate. The list of units is on the following pages.
P060 = 1	**Return to parameter menu**

Fig. 9-5 Sequence for performing the power section definition

NOTICE

To check the input data, the values for the converter supply voltage in P071 and the converter current in P072 should be checked after returning to the parameter menu. They must tally with the data given on the unit rating plate.

PWE: Parameter value P070

In [A]: Rated output current in Ampere (P072)

DC 270 V to 310 V

Order number	In [A]	PWE
6SE7031-0RE60	100.0	20
6SE7031-3RE60	131.0	34
6SE7031-6RE60	162.0	86
6SE7032-0RE60	202.0	92

DC 510 V to 650 V

Order number	In [A]	PWE Air-cooled	PWE Water-cooled
6SE7031-0TE60	92.0	75	-
6SE7031-2TF60	124.0	83	-
6SE7031-5TF60	146.0	91	-
6SE7031-8TF60	186.0	99	-
6SE7032-1TG60	210.0	103	-
6SE7032-6TG60	260.0	109	-
6SE7033-2TG60	315.0	113	-
6SE7033-7TG60	370.0	117	-
6SE7035-1TJ60	510.0	120	206
6SE7036-0TJ60	590.0	123	209
6SE7037-0TK60	690.0	126	212
6SE7038-6TK60	860.0	127	213
6SE7041-1TM60	1100.0	134	-
6SE7041-1TK60	1100.0	135	221
6SE7041-3TM60	1300.0	140	226
6SE7041-6TM60	1630.0	150	236
6SE7042-1TQ60	2090.0	153	239
6SE7041-3TL60	1300.0	154	199
6SE7037-0TJ60	690.0	163	167
6SE7038-6TS60	6450.0	181	247
6SE7041-1TS60	6270.0	185	250
6SE7042-5TN60	2470.0	194	244

DC 675 V to 810 V

Order number	In [A]	PWE Air-cooled	PWE Water-cooled
6SE7026-1UE60	61.0	61	-
6SE7026-6UE60	66.0	63	-
6SE7028-0UF60	79.0	69	-
6SE7031-1UF60	108.0	79	-
6SE7031-3UG60	128.0	85	-
6SE7031-6UG60	156.0	95	-
6SE7032-0UG60	192.0	101	-
6SE7032-3UG60	225.0	105	-
6SE7033-0UJ60	297.0	110	200
6SE7033-5UJ60	354.0	114	202
6SE7034-5UJ60	452.0	118	204
6SE7035-7UK60	570.0	121	207
6SE7036-5UK60	650.0	124	210
6SE7038-6UK60	860.0	128	214
6SE7041-0UM60	990.0	130	216
6SE7041-1UM60	1080.0	132	218
6SE7041-2UM60	1230.0	138	224
6SE7041-4UM60 6SE7041-4UQ60	1400.0	144	230
6SE7041-6UM60 6SE7041-6UQ60	1580.0	148	234
6SE7041-1UL60	1080.0	155	195
6SE7042-4UR60	2450.0	157	
6SE7041-2UL60	1230.0	159	197
6SE7043-3UR60	3270.0	161	-
6SE7044-1UR60	4090.0	165	-
6SE7044-8UR60	4900.0	169	-
6SE7045-7UR60	5720.0	173	-
6SE7046-5UR60	6540.0	177	-
6SE7036-5US60	4940.0	179	245
6SE7038-6US60	6540.0	182	248
6SE7041-1US60	6160.0	186	251
6SE7041-2US60	5840.0	188	253
6SE7042-1UN60	2050.0	190	240
6SE7042-3UN60	2340.0	192	242

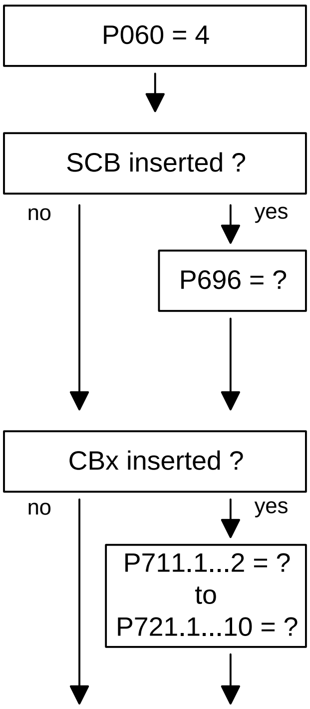
DC 890 V to 930 V

Order number	In [A]	PWE Air-cooled	PWE Water-cooled
6SE7026-0WF60	60.0	59	-
6SE7028-2WF60	82.0	73	-
6SE7031-0WG60	97.0	77	-
6SE7031-2WG60	118.0	81	-
6SE7031-5WG60	145.0	89	-
6SE7031-7WG60	171.0	97	-
6SE7032-1WG60	208.0	107	-
6SE7033-0WJ60	297.0	111	201
6SE7033-5WJ60	354.0	115	203
6SE7034-5WJ60	452.0	119	205
6SE7035-7WK60	570.0	122	208
6SE7036-5WK60	650.0	125	211
6SE7038-6WK60	860.0	129	215
6SE7041-0WM60	990.0	131	217
6SE7041-1WM60	1080.0	133	219
6SE7041-2WM60	1230.0	139	225
6SE7041-4WM60 6SE7041-4WQ60	1400.0	145	231
6SE7041-6WM60 6SE7041-6WQ60	1580.0	149	235
6SE7034-5WK60	452.0	152	238
6SE7041-1WL60	1080.0	156	196
6SE7042-4WR60	2450.0	158	-
6SE7041-2WL60	1230.0	160	198
6SE7043-3WR60	3270.0	162	-
6SE7044-1WR60	4090.0	166	-
6SE7044-8WR60	4900.0	170	-
6SE7045-7WR60	5720.0	174	-
6SE7046-5WR60	6540.0	178	-
6SE7036-5WS60	4940.0	180	246
6SE7038-6WS60	6540.0	183	249
6SE7041-1WS60	6160.0	187	252
6SE7041-2WS60	5840.0	189	254
6SE7042-1WN60	2050.0	191	241
6SE7042-3WN60	2340.0	193	243

9.4.2 Board configuration

During board configuration, the control electronics is informed in what way the installed optional boards have to be configured. This step is always necessary when CBx oder SLB optional boards are used.

The unit must be switched to the "Board configuration" status for this purpose. This is done by selecting the "Board configuration" menu. In this menu, parameters are set which are required for adapting the optional boards to the specific application (e.g. bus addresses, baud rates, etc.). After leaving the menu, the set parameters are transferred and the optional boards are initialized.



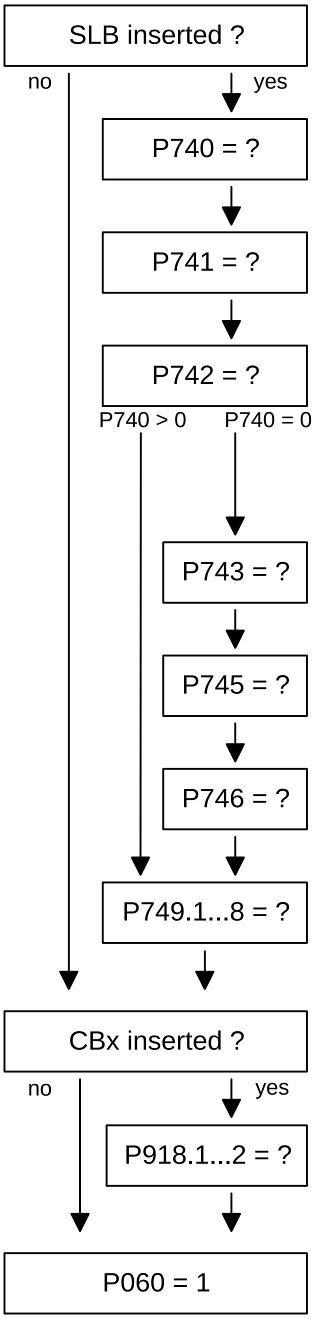
Select "Board configuration" menu

Serial communications board

SCB protocol
- 0: SCI
- 1: USS 4-wire
- 2: USS 2-wire
- 3: Peer-to-Peer

Communications board (e.g. Profibus-DP)

Enter the CB parameters 1 to 11 necessary for the inserted communications boards CBx
The necessary CB parameters and their significance can be derived from the function diagrams of the individual communications boards.



SIMOLINK bus interface

Enter the SLB module address

0:	Unit operates as a dispatcher
greater than 0:	Unit operates as a transceiver

Enter the SLB telegram failure time in ms

0:	No monitoring
greater than 0:	Monitoring time in ms

Enter the SLB transmit power (for plastic fiber-optic cables)

1: weak	up to 15 m fiber-optic cable length
2: medium	up to 25 m fiber-optic cable length
3: strong	up to 40 m fiber-optic cable length
NOTE:	If glass fiber-optic cables are used, the possible lengths are increased by the factor 7.5.

Enter the number of modules (incl. dispatcher) in the SIMOLINK ring

Enter the number of channels per module

Enter the SIMOLINK cycle time in ms

Enter the SLB read addresses

Communications board (e.g. Profibus-DP)

Enter the CB bus addresses

Return to the parameter menu

Board codes

The visualization parameter r826.x is used for displaying the board codes. These codes enable the type of installed electronic boards to be determined.

Parameter	Index	Position
r826	1	Basic board
r826	2	Slot A
r826	3	Slot B
r826	4	Slot C
r826	5	Slot D
r826	6	Slot E
r826	7	Slot F
r826	8	Slot G

If a T100, T300 or TSY technology board (mounting position 2) or an SCB1 or SCB2 (mounting position 2 or 3) is used, the board code can be found in the following indices:

Parameter	Index	Position
r826	5	Mounting position 2
r826	7	Mounting position 3

General board codes

Parameter value	Meaning
90 to 109	Mainboards or Control Unit
110 to 119	Sensor Board (SBx)
120 to 129	Serial Communication Board (Scx)
130 to 139	Technology Board
140 to 149	Communication Board (Cbx)
150 to 169	Special boards (Ebx, SLB)

Special board codes

Board	Meaning	Parameter value
CUVC	Control Unit Vector Control	92
CUMC	Control Unit Motion Control	93
CUMC+	Control Unit Motion Control Compact PLUS	94
CUVC+	Control Unit Vector Control Compact PLUS	95
CUPM	Control Unit Motion Control Performance 2	96
CUMP	Control Unit Motion Control Compact PLUS Performance 2	97
CUSA	Control Unit Sinus AFE	108
TSY	Tacho and synchronization board	110
SBP	Sensor Board Puls	111
SCB1	Serial Communication Board 1 (fiber-optic cable)	121
SCB2	Serial Communication Board 2	122
T100	Technology board	131
T300	Technology board	131
T400	Technology board	134
CBX	Communication Board	14x
CBP	Communication Board PROFIBUS	143
CBD	Communication Board DeviceNet	145
CBC	Communication Board CAN Bus	146
CBL	Communication Board CC-Link	147
CBP2	Communication Board PROFIBUS 2	148
EB1	Expansion Board 1	151
EB2	Expansion Board 2	152
SLB	SIMOLINK bus interface	161

9.4.3 Drive setting

The drive setting function extends the start-up facilities of quick parameterization.

During the drive setting, the control electronics is informed about the incoming voltage supply with which the drive converter is operating, about the connected motor and about the motor encoder. In addition, the motor control (V/f open-loop control or vector control) and the pulse frequency are selected. If required, the parameters necessary for the motor model can be calculated automatically. Furthermore, the normalization values for current, voltage, frequency, speed and torque signals are determined during the drive setting.

For start-up of the induction motor, first enter the manufacturer's parameters completely (see below):

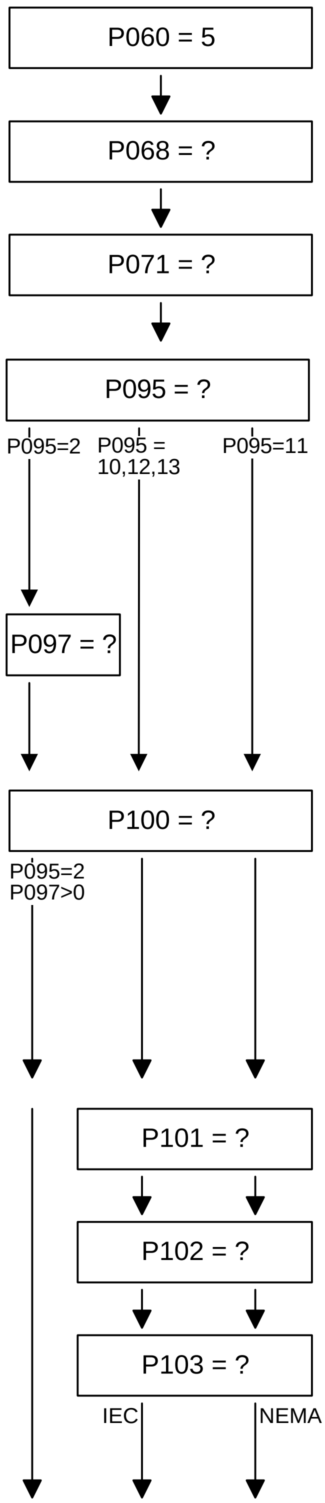
- In doing so, you must observe whether the induction motor has a star or a delta connection.
- You must always use the S1 data from the rating plate.
- You must enter the r.m.s. base frequency of the rated voltage and not the total r.m.s. value (including harmonic content) for converter operation.
- You must always enter the correct rated motor current **P102** (rating plate). If there are two different rated currents on the rating plate for special fan motors, you must use the value for M ~ n for constant torque (not $M \sim n^2$). A higher torque can be set with the torque and active-current limits.
- The accuracy of the rated motor current has a direct effect on the torque accuracy, as the rated torque is normalized to the rated current. If a rated current is increased by 4 %, this will also approximately result in a 4 % increase in the torque (referred to the rated motor torque).
- For group drives, you have to enter the total rated current **P102** = $x^*I_{mot,rated}$
- If the rated magnetizing current is known, you should enter it during the drive setting in **P103** (in % $I_{mot,rated}$). If this is done, the results of the "Automatic parameterization" (**P115** = 1) will be more precise.

- As the rated magnetizing current **P103** (not to be confused with the no-load current during operation with rated frequency **P107** and rated voltage **P101**) is usually not known, you can first enter 0.0 %. With the aid of the power factor (cosPHI) **P104,** an approximate value is calculated and displayed in **r119**.
  Experience shows that the approximation supplies values which are rather on the large side in the case of motors with a high rating (over 800 kW), whereas it supplies values which are slightly too low in the case of motors with low rating (below 22 kW).
  The magnetizing current is defined as a field-generating current component during operation at the rated point of the machine (U = **P101**, f = **P107**, n = **P108**, i = **P102**).
- The rated frequency **P107** and the rated speed **P108** automatically result in the calculation of the pole pair number **P109**. If the connected motor is designed as a generator and the generator data are on the rating plate (oversynchronous rated speed), you have to correct the pole pair number manually (increase by 1 if the motor is at least 4-pole), so that the rated slip (**r110**) can be correctly calculated.
- In the case of asynchronous motors, instead of the synchronous no-load speed, enter the real motor rated speed in **P108**, i.e. the slip frequency at nominal load has to be derived from parameters **P107...P109**.
- The rated motor slip (1 - **P108**/60 x **P109**/**P107**) should usually be greater than 0.35 % x **P107**.
  These low values are, however, only achieved in the case of motors with a very high rating (above approx. 1000 kW).
  Motors with average rating (45..800 kW) have slip values around 2.0...0.6 %.
  Motors with low rating (below 22 kW) can also have slip values up to 10 %.
- It is possible to achieve a more accurate evaluation of the rated slip after standstill measurement (**P115** = 2) by taking into account the temperature evaluation for the rotor resistance **P127**.
  On cold motors (approx. 20 °C), the value is usually around 70 % (± 10 %) and on warm motors (operating temperature) around 100 % (± 10 %). If there are any large differences, you can proceed on the assumption that the rated frequency **P107** or the rated speed **P108** do not correspond to the real values.
- If the rated motor frequency (engineered!) is below 8 Hz, you have to set **P107** = 8.0Hz in the drive setting. The rated motor voltage **P101** has to be calculated in the ratio 8 Hz / $f_{Mot,N}$ and the rated motor speed **P108** should result in the same slip:
  P108 = ((8 Hz - **P107**$_{old}$) x 60 / **P109**) + **P108**$_{old}$.

WARNING

During motor identification (P115 = 2...7) inverter pulses are released and the drive rotates!

For reasons of safety, identification should first be carried out without coupling of the load.



Select "Drive setting" menu

Output filter 0 = without output filter
1 = with sinusoidal output filter
2 = with dv/dt output filter

Input unit line voltage in V
AC units: r.m.s. alternating voltage
DC units: DC link voltage

Enter type of motor
2: Compact asynchronous motor 1PH7(=1PA6)/1PL6/1PH4
10: Async./Sync. IEC (international standard)
11: Async./Sync. NEMA (US standard)
12: Sync. motor, separately excited (special applications, not v/f characteristic)
13: Sync. motor, permanently excited (special applications, not v/f characteristic)

Enter the code number for the connected motor of the Range 1PH7(=1PA6)/1PL6/1PH4 (see "Motor list" section)
(Automatic parameter assignment is implemented as soon as the settings P095 = 2 and P097 > 0 have been made)

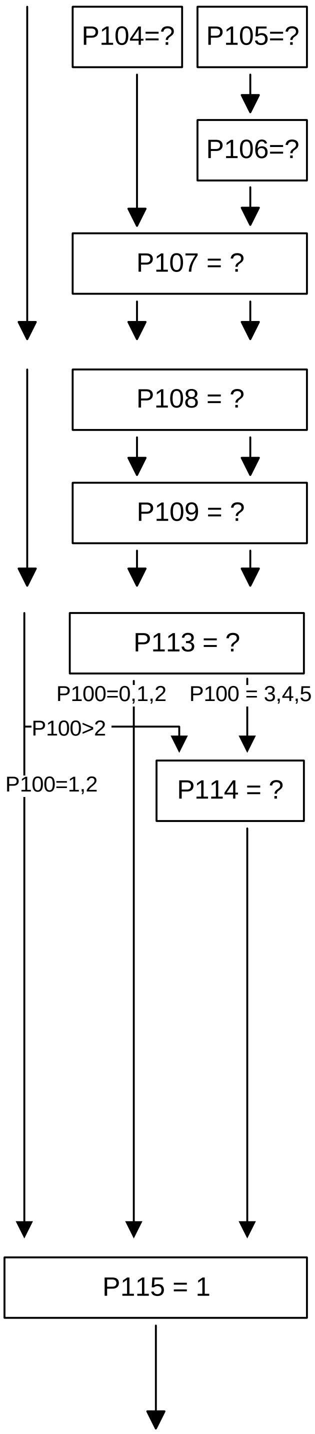
Enter the type of open/closed-loop control
0: v/f control + n control
1: v/f control
2: v/f control, textile
3: Speed control without tachometer (f control)
4: Speed control with tachometer (n control)
5: Torque control (T control)

Note: For motor ratings over approx. 200 kW one of the vector control types should be used (P100 > 2).

Enter the rated motor voltage in V
as per rating plate

Enter the rated motor current in A
as per rating plate
(Group drives: total of all motor currents)

Enter the motor magnetizing current as a % of the rated motor current
If value is not known, set P103 = 0, the value is then automatically calculated when you exit Drive setting (see r119).



IEC motor: Cos (phi) as per rating plate
NEMA motor: rated output [Hp]
(Group drives: total of all output ratings)

NEMA motor: Enter the motor efficiency in %
as per rating plate

Enter the rated motor frequency in Hz
as per rating plate

Enter the rated motor speed in rpm
as per rating plate

Enter the motor pole pair number
(This is calculated automatically)

Enter the rated motor torque in Nm
as per rating plate or motor catalog (this is only used for normalizing the process data and visualization parameters)

WARNING!
INCORRECT SETTINGS CAN BE DANGEROUS!
Process-related conditions for closed-loop control
0: Drive for standard applications (e.g. pumps)
1: Drive with strong torsion, gear play, large moments of inertia (e.g. paper machine)
2: Drive for very dynamic accelerations (without load inertia) (e.g. shears)
3: Drive for strong schock stressing (e.g. roll drive)
4: Drive with high smooth running characteristics at low speeds.
5: Drives with modest response requirements, which can be optimized in their efficiency with frequent part-load operation.
6: Drive with high starting torque.
7: Dynamic torque response in field-weakening range
See next section for description

Calculate motor model for "Automatic parameterization"
Reference values P350 to P354 are set to the rated motor values.
The motor parameters and controller settings are calculated.

P130 = ?

Select the motor encoder
 5: External SBP board
10: Without motor encoder
11: Pulse encoder (default if P095=2, P097>0)
12: Pulse encoder with control track
13: Analog input 1
14: Analog input 2
15: Pulse encoder with zero track
16: Pulse encoder with zero and control track

P130 = 10,13,14
P130 = 5
P130 = 11,12,15,16

WARNING
⚠ Please check that the encoder has been connected correctly!
Pulse encoder: Do not mix up tracks A and B!
Analog tachometer: Check voltage polarity (direction of rotation) and amplitude!
In the event of faults the drive may involuntarily race to maximum speed! For testing the encoder see parameter P115=7 and P115=3 and 4.

P151 = ? **Enter the pulse number/revolution of the pulse encoder**

P131 = ? **Select TmpSensor**
0: KTY84 (evaluation via P380/P381)
3: PT100 (evaluation only possible for SBP)

P139 = ? **Configuration of setpoint encoder**

P140 = ? **Setpoint encoder pulse number**

P141 = ? **Reference frequency of setpoint encoder**

P100 = 0,1,2

P330 = ? **Characteristic** 0: Linear characteristic (constant torque drives)
1: Parabolic characteristic (fans/pumps)

P339 = ? **Release the edge modulation systems (FLM)**
0: All systems
1: Edge modulation systems from 60 Hz
2: Edge modulation systems from 100 Hz
3: No edge modulation systems
4: Overmodulated space vector modulation

P340 = ?

Enter the pulse frequency in kHz
Pulse frequency for asynchronous space vector modulation
Notes:
- The adjustable range depends on the converter/inverter
- An increase in the pulse frequency results in a reduction of the maximum output current (see "Technical Data", derating curves)

↓

P350 = ?

Enter the reference value for all current quantities in A
(Normalization quantity for current limitations as well as current setpoints and actual values) (see example in section 9.2.1)

↓

P351 = ?

Enter the reference value for all voltage quantities in V
(Normalization quantity for voltage limitations as well as voltage setpoints and actual values)

↓

P352 = ?

Enter the reference value for all frequency quantities in Hz
(Normalization quantities for frequency limitations, frequency setpoints and actual values) (see example in section 9.2.1)
Note: The parameter P353 is automatically adjusted.

↓

P353 = ?

Enter the reference value for all speed quantities in rpm
(Normalization quantity for speed limitations, speed setpoints and actual values) (see example in section 9.2.1)
Note: The parameter P352 is automatically adjusted.

↓

P354 = ?

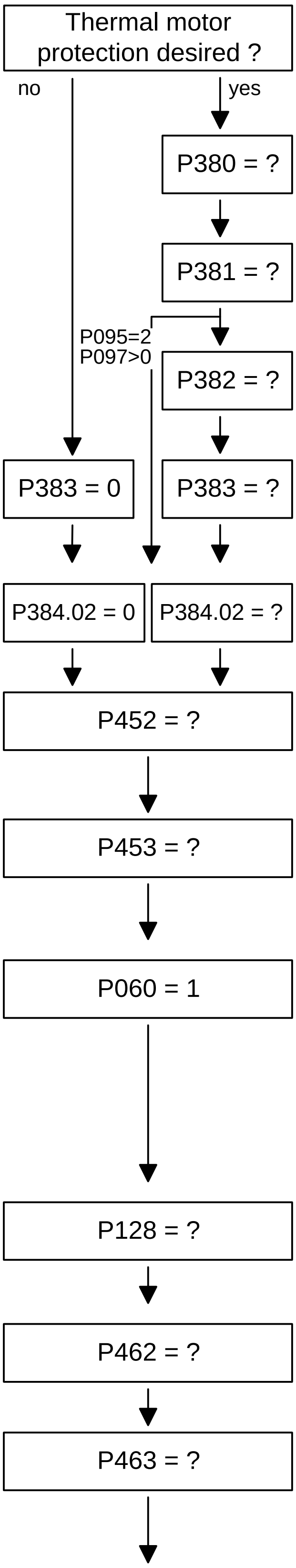
Enter the reference value for all torque quantities in Nm
(Normalization quantity for torque limitations, torque setpoints and actual values) (see example in section 9.2.1)

↓

P357 = ?

Enter the sampling time T0 in ms
The sampling time T0 is for determining the calculating frequency of all functions.
The sampling times T1...T19 are multiples of sampling time T0
Note: A very short sampling time T0 can lead to a calculation time overload if several function blocks are activated at the same time!

↓



System with motor protection according to UL regulation?
The motor temperature is calculated via the motor current.
(Motor overload protection in accordance with UL regulation activated as default setting!)

Enter the motor temperature for output of the alarm A023 "Motor overtemperature" (evaluation with KTY84)
(PTC evaluation: P380 = 1 °C)

Enter the motor temperature for output of the fault F020 "Motor overtemperature" (evaluation with KTY84)
(PTC evaluation: P381 = 1 °C)

Specify motor cooling
0: self-ventilated
1: force-ventilated (default if P095 = 2, P097 > 0)

Enter the thermal time constant of the motor in s
(< 100 s: monitoring deactivated)
(default if P095 = 2, P097 > 0)

Enter the motor load limit 1...300 %

Enter the maximum frequency or speed in positive direction of rotation in %
The value is referred to P352 (reference frequency) and P353 (reference speed)

Enter the maximum frequency or speed in negative direction of rotation in %
The value is referred to P352 (reference frequency) and P353 (reference speed)

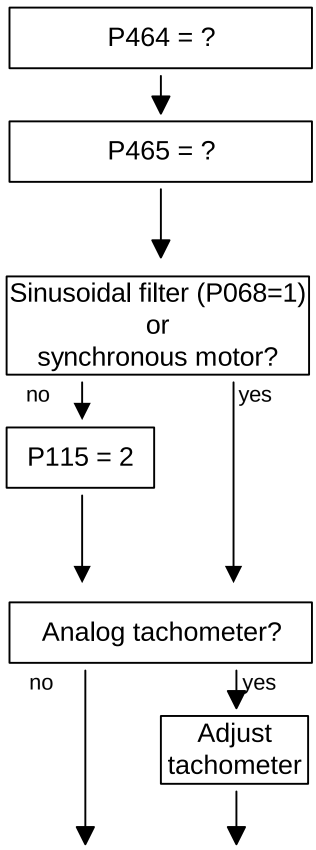
Return to the parameter menu

Note
When the "Drive settings" menu is exited, the entered parameter values are checked for their plausibility. Non-plausible parameter settings result in a fault. The erroneously set parameters are entered in parameter r949 (fault value).

Enter the maximum output current in A

Enter the acceleration time from standstill up to reference frequency (P352)

Enter the unit for acceleration time P462
0 = Seconds
1 = Minutes
2 = Hours



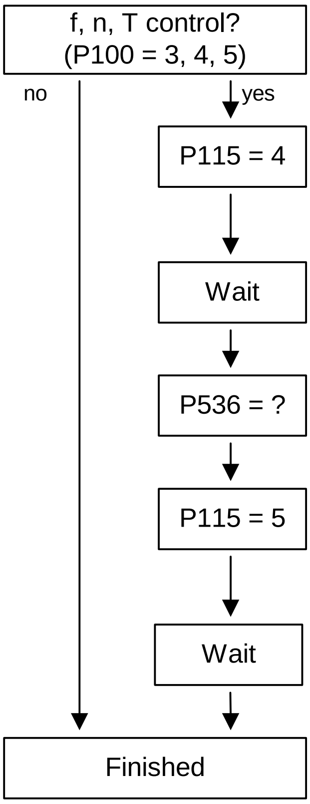
Enter the deceleration time from reference frequency (P352) up to standstill

Enter the unit for deceleration time P464
0 = Seconds
1 = Minutes
2 = Hours

Calculate motor model "Motor identification at standstill"
NOTICE:
Current flows through the motor and the rotor rotates!
After pressing the "P" key, the alarm message "A087" appears.
The converter must be turned on within 20 secs!

Analog tachometer present?

Adjust tachometer
Tachometer to ATI: See operating instructions for ATI
Tachometer to terminal strip: See function diagrams for analog inputs



Calculate motor model "No-load measurement"
NOTICE: Current flows through the motor and the rotor rotates!
After "P" key is pressed, the alarm message "A080" appears.
The converter must be switched on within 20 seconds!

Wait until the converter is "Ready for ON" again (°009)
For fault "Fxxx", refer to chapter "Faults and alarms"

Enter the dynamic performance of the speed control circuit in %
Important for subsequent controller optimization.

Calculate motor model "Controller optimization"
NOTICE: Current flows through the motor, the rotor rotates!
After "P" is pressed, the alarm message "A080" appears.
The converter must be switched on within 20 seconds!

Wait until the converter is powered-down
(Operating status "Ready for ON" (°009))
For fault "Fxxx", see chapter "Faults and alarms"

9.5 Notes regarding parameterization

The parameter im Kompendium list covers the setting parameters and visualization parameters of all available motor types (induction motors and synchronous motors), as well as all possible open-loop and closed-loop control modes (e.g. V/f characteristic, speed control).

The constellation under which this parameter is influenced or whether it is displayed at all is indicated under "Preconditions" in the parameter description.

Unless otherwise specified, all percentage values refer to the reference quantities in P350 to P354.

If reference quantities are changed, this will also change the significance of the parameters with percentage normalization (e.g. P352 = Maximum frequency).

Reference quantities

Reference variables are intended as an aid to presenting setpoint and actual value signals in a uniform manner. This also applies to fixed settings entered as a "percentage". A value of 100 % corresponds to a process data value of 4000h, or 4000 0000 h in the case of double values.

All setpoint and actual value signals (e.g. set speed and actual speed) refer to the physically applicable reference variables. In this respect, the following parameters are available:

P350	Reference current	in A
P351	Reference voltage	in V
P352	Reference frequency	in Hz
P353	Reference speed	in rpm
P354	Reference torque	in Nm

In quick parameterization mode and in automatic parameter assignment mode (P115 = 1(2,3)), these reference variables are set to the motor ratings. In case of automatic parameter assignment, this occurs only if the "Drive setting" converter status is activated.

Speed and frequency reference values

The reference speed and reference frequency are always connected by the pole pair number.

$$P353 = P352 \times \frac{60}{P109}$$

If one of the two parameters is changed, the other is calculated using this equation.

Since this calculation is not made on download (see section 9.2.3), these two quantities must always be loaded in the correct relationship.

If the setpoint and actual control signals are related to a desired reference speed in rpm, P353 must be set accordingly (P352 is calculated automatically). If a rotational frequency in Hz is to be used as the reference (calculated using the pole pair number P109), P352 must be set.

Torque reference value

Since the torque signals and parameters in the control system are always specified and displayed as a percentage, the ratio of the reference torque (P354) to the rated motor torque (P113) is always important for accuracy. If both values are the same, a display value of 100 % corresponds exactly to the rated motor torque, irrespective of the values actually entered in P354 and P113.

For purposes of clarity, however, it is advisable to enter the true rated torque of the drive in P113 (e.g. from catalog data).

$$P113 = \frac{P_{W\,(mot,\,rated)}}{\frac{2 \cdot \pi \cdot n(mot,rated)}{60}}$$

Reference power value

The reference power (in W) is calculated from the reference torque and reference speed:

$$R_{W,ref} = \frac{P354 \cdot P353 \cdot 2 \cdot \pi}{60}$$

Power values for the control system are also always specified as a percentage referred to the specified reference power. The ratio of $P_{W,ref}$ / $P_{mot,rated}$ can be used for conversion to the rated motor power.

$$P_{mot,rated} = \frac{P113 \cdot 2 \cdot \pi \cdot P108}{60}$$

Reference current value

If the reference torque P354 is increased, for example, the reference current P350 must be increased by the same factor, because the current increases at higher torque.

NOTE

Setting and visualization parameters in engineering units (e.g. Imax in A) must also be no more than twice the reference value.

If the reference quantities are changed, the physical value of all parameters specified as a percentage also changes; that is all the parameters of the setpoint channel, as well as the maximum power for the control system (P258, P259) and the static current for frequency control (P278, P279).

If the reference values and the rated motor values are identical (e.g. following quick parameterization), signal representation (e.g. via connectors) up to twice the rated motor values is possible. If this is not sufficient, you must change to the "Drive setting" menu (P060 = 5) to change the reference quantities.

Example

P107 = 52.00 Hz	Rated motor frequency
P108 = 1500.0 rpm	Rated motor speed
P109 = 2	Motor pole pair number

Pre-assignment:

P352 = 52.00 Hz	Reference frequency
P353 = 1560 rpm	Reference speed

For a maximum speed of four times the rated motor speed you must set the reference speed to at least 3000 rpm. The reference frequency is adjusted automatically (P352 = P353 / 60 x P109).

P352 = 100.00 Hz

P353 = 3000 rpm

A setpoint speed of 1500 rpm corresponds to a setpoint frequency of 50.00 Hz or an automation value of 50.0 %.

The representation range ends at 6000 rpm (2 x 3000 rpm).

This does not affect the internal representation range of the control system. Since the internal control signals refer to the rated motor quantities, there is always sufficient reserve control capacity.

The reference speed should normally be set to the desired maximum speed.

Reference frequencies of P352 = P107, P352 = 2 x P107,
P352 = 4 x P107 are favorable for the calculating time.

For a maximum torque of three times the rated motor torque (P113) it is advisable to set the reference torque to between twice and four times the value of parameter P113 (for four to eight times the representation range).

Separately excited synchronous motors

Function diagrams and start-up instructions for separately excited synchronous motors (with damping cage and excitation via sliprings) are available as separate instructions.

The following parameters are only effective for these synchronous motors:

P75 to P88; P155 to r168, P187, P258, P274, P297, P298, P301, r302, P306 to P312.

Automatic parameterization and motor identification

The following parameters are calculated or set to fixed values during automatic parameterization (P115 = 1):

P116	P236	P295	P337
P117	P240	P303	P339
P120	P258	P306	P344
P121	P259	P313	P347
P122	P273	P315	P348
P127	P274	P316	P388
P128	P278	P319	P392
P161	P279	P322	P396
P215	P283	P325	P471
P216	P284	P326	P525
P217	P287	P334	P536
P223	P291	P335	P602
P235	P293	P336	P603

- ♦ P350 to P354 are only set to the rated motor quantities in the converter status "Drive setting" (P060 = 5) or "Quick parameterization (P060 = 3).
- ♦ In converter status "Drive setting" (but not in "Ready" status), parameters are assigned automatically on selection of standstill measurement P115 = 2, 3.
- ♦ During the standstill measurement P115 = 2, 3, the following parameters are measured or calculated:
  - P103, P120, P121, P122, P127, P347, P349.
    The controller settings resulting from these values are in: P283, P284, P315, P316.
- ♦ During the rotating measurement P115 = 3, 4, P103 and P120 are adjusted.
- ♦ During the n/f controller optimization P115 = 5, the parameters P116, P223, P235, P236, P240 and P471 are determined.

In principle, automatic parameterization (P115 = 1) or motor identification (P115 = 2, 3) should be carried out as soon as one of the following parameters are adjusted in the converter status "Drive setting" (P060 = 5):

P068 = Output filter

P095 = Motor type

P097 = Motor number

P100 = Control type

P101...P109 = Motor rating plate data

P339 = Release of modulation system

P340 = Pulse frequency

P357 = Sampling time

In exceptional cases this is not necessary:

- If P068 is only adjusted between 0 and 2 (dv/dt filter).
- If P340 is adjusted in integer increments, e.g. from 2.5 kHz to 5.0 kHz...7.5 kHz... etc.
- If P339 is not set to over-modulated space vector modulation; if P339 = 4, 5 (over-modulated space vector modulation), the overrange limit P342 must also be reduced to limit torque ripple and motor heating.
- If changeover is made between speed and torque control (P100 = 4, 5).
- If changeover is made between speed and frequency control and the following parameters are adapted:

	f-control (P100 = 3)	**n-control (P100 = 4)**
P315 = EMF Reg.Kp	2 x Kp	Kp
P223 = Smooth.n/f(act)	≥ 0 ms	≥ 4 ms
P216 = Smooth. n/f(pre)	≥ 4.8 ms	≥ 0.0 ms
P222 = Src n/f(act)	KK0000	KK0000 (KK0091)

The speed controller dynamic response may have to be reduced in the case of encoder-less speed control (frequency control) (Reduce gain (P235); increase Tn (P240)).

Temperature monitoring of the motor

Activation of the measured value or PTC thermistor monitoring for the motor causes different fault and alarm signals depending on the setting of parameters P380 and P381. These are listed in the following table:

P380 / °C	**P381 / °C**	**Sensor**	**r009**	**Alarm A23 in ready**	**Alarm A23 in operation**	**Fault F20 in ready**	**Fault F20 in operation**
= 0	= 0	KTY84 for RL adapt.	if P386 = 2	-	-	-	-
= 0	= 1	PTC	no	-	-	-	yes 1)
= 1	= 0	PTC	no	yes 1)	yes 1)	-	-
= 1	= 1	PTC	no	yes 1)	-	-	yes 1)
= 0	> 1	KTY84	yes	-	-	-	yes 3)
> 1	= 0	KTY84	yes	yes 3)	yes 3)	yes 4)	yes 2)
> 1	> 1	KTY84	yes	yes 3)	yes 3)	yes 4)	yes 3)
= 1	> 1	KTY84	no	yes 1)	-	-	yes 3) 2)
> 1	= 1	KTY84	no	yes 3)	yes 3)	yes 4)	yes 2)

1) Alarm or fault are triggered on violation of the PTC thermistor temperature or on a cable break (not a cable short circuit).

2) Fault is only triggered on cable break or cable short-circuit.

3) Fault or alarm on violation of the temperature limit..

4) Fault is only triggered on cable short-circuit.

9.5.1 Drive setting according to process-related boundary conditions

In order to support start-up, process-related characteristics can be entered in **P114.** In a subsequent automatic parameterization **(P115** = 1) or motor identification **(P115** = 2, 3) and controller optimization **(P115** = 3, 5), parameter adjustments are made in the closed-loop control which are advantageous for the selected case, as experience has shown.

The parameter adjustments can be taken from the following table. The table clearly shows which parameters have a decisive influence on the closed-loop control. The values themselves are understood to be qualitative values and can be further adjusted according to the process-related requirements.

If the type of process-related boundary conditions is not evident in the current case (e.g. high smooth running characteristics at low speeds with simultaneously fast acceleration processes), the parameter settings can also be combined (manually). In any case, it is always sensible to perform start-up with the **standard setting** in order to then set the indicated parameters one after the other.

The settings of P114 = 2...4 are only possible if no gearless conditions are present.

P114 =
- 0: Standard drive (e.g. pumps, fans)
- 1: Torsion, gear play and large moments of inertia (e.g. paper machines)
- 2: Acceleration drives with constant inertia (e.g. shears)
- 3: High load surge requirements (in the case of f-control only possible from approx. 20%fmot,n)
- 4: High smooth running characteristics at low speeds (in the case of n-control; with a high encoder pulse numberl)
- 5: Efficiency optimization at partial load by flux reduction (low dynamic loading drives)
- 6: High start-up torque (heavy-duty start-up)
- 7: Dynamic torque response in the field-weakening range (e.g. motor test beds)

Only deviations from the standard setting (P114 = 0) are indicated:

	P114 = 0	P114 = 1	P114 = 2	P114 = 3	P114 = 4	P114 = 5	P114 = 6	P114 = 7
P216=Smooth n/f(FWD)	0ms (n-ctrl.) 4ms (f-ctrl.)	4.8ms (n-ctrl.)						
P217=Slip Fail Corr'n.	0=off		2=on (n-ctrl)					2=on
P223=Smooth n/f(act)	4ms (n-ctrl.) 0ms (f-ctrl.)	100ms						
P235=n/f-Reg Gain1	3.0 or 5.0				12.0 (n-ctrl.)			
P236=n/f-Reg Gain2	3.0 or 5.0				12.0 (n-ctrl.)			
P273=Smooth Isq(set)	6*P357 (T0)							3*P357
P240=n/f-Reg Tn	400ms				40ms (n-ctrl.)			
P279=Torque (dynamic)	20.0%						80% (f-ctrl.)	
P287=Smooth Vd(act)	9		0	0				
P291=FSetp Flux(set)	100%					110%		
P295=Efficiency Optim.	100%=off	99.9%				50%		
P303=Smooth Flux(set)	10-20ms	60ms				100 (n-ctrl.) 500 (f-ctrl.)		
P315=EMF Reg Gain	Gain(n)		1.5*Gain(n) (f-ctrl.)	1.5*Gain(n) (f-ctrl.)				
P339=ModSystRelease	0=All syst	3=only RZM	3=only RZM	3=only RZM	3=only RZM			3=only RZM
P344=ModDepthHeadrm	0.0%	3.0%	3.0%					30.0%
P536=n/f RegDyn(set)	50%	20%	100 (n-ctrl.) 50% (f-ctrl.)	200 (n-ctrl.) 100 (f-ctrl.)	200 (n-ctrl.) 50% (f-ctrl.)	25%	100 (n-ctrl.) 50% (f-ctrl.)	100% (n-ctrl.)

RZM = Space vector modulation

The gain Kp of the speed controller (P235, P236) depends on the inertia of the drive and has to be adapted if necessary.

Symmetrical optimum: P235 = 2 x P116 / P240

$Kp = 2 \times T_{start\text{-}up} / Tn$

The start-up time is the time taken by the drive to accelerate to rated speed when the rated torque is specified. This is determined during automatic speed controller optimization.

9.5.2 Changes to the function selection parameter (P052) VC(former)

The function selection parameter P052 of the firmware versions for the previous MASTERDRIVES VC units was used to select the various special functions and start-up steps. In order to make this important parameter more comprehensible for the user, the function groups "Special functions" and "Start-up steps" in the CUVC firmware have now been stored in two different parameters as follows:

P052 Function selection → **P060** Menu selection (Special functions)

P052 Function selection → **P115** Calculation of motor parameters

Fig. 9-6 Division of parameter P052(former) into P060 and P115

In addition to this, the new special function "User parameter" has been introduced, and the special function "Drive setting" (P052 = 5) has been subdivided into the functions "Quick parameterization" and "Drive setting". The new special function "Quick parameterization" involves parameterization for standard applications, and the new special function "Drive setting" involves parameterization for expert applications.

The special function "Download/Upread" (P052 = 3) has been subdivided into the functions "Download" and "Upread".

P060	Menu selection	P052 (former)	Function selection
0=	User parameter	--	See parameter list P060
1=	Parameter menu	0=	Return
2=	Fixed settings [1)]	1=	Param. Reset
3=	Quick parameterization	5=	Drive Setting
4=	Board configuration	4=	HW Config.
5=	Drive setting	5=	Drive Setting
6=	Download	3=	Download
7=	Upread	3=	Download
8=	Power section definition	2=	MLFB input

1) Selection in the factory setting menu (P366 Factory setting type, activation with P970)

P115	Calculation of motor model	P052 (former)	Function selection
1=	Automatic parameterization	6=	Auto Param.
2=	Motor identification at standstill	7=	Mot ID Stop
3=	Complete motor identification	8=	Mot ID All
4=	No-load measurement	9=	No Load Meas
5=	n/f controller optimization	10=	Reg Optim.
6=	Self-test	11=	Auto Test
7=	Tachometer test	12=	Tach Test

The new special function P060 = 0 (User parameter) enables the user to put together an important list of parameters especially for his own application.

When P060 = 0 (User parameter) is selected, apart from parameters P053, P060 and P358, only those parameters whose numbers have been entered in indices 4 to 100 of parameter P360 are visible.

10 Control word and status word

10.1 Description of the control word bits

The operating statuses can be read in visualization parameter r001: e.g. READY TO POWER-UP: r001 = 009

The function sequences are described in the sequence in which they are actually realized.

Function diagrams 180 and 190 refer to further function diagrams in the Compendium.

Bit 0: ON/OFF 1 command (↑ "ON") / (L "OFF1")

Condition

Positive edge change from L to H (L → H) in the READY TO POWER-UP condition (009).

Result

- ♦ PRECHARGING (010)
  Main contactor (option)/bypass contactor, if available, are switched-in (closed).
  The DC link is pre-charged.
- ♦ READY (011)
  If the drive was last powered-down with "OFF2", the next condition is only selected after the de-energization time (P603) has expired since the last shutdown
- ♦ GROUND FAULT TEST (012), only when the ground fault test has been selected (P375).
- ♦ RESTART ON THE FLY (013), if restart on the fly (control word bit 23 via P583) has been enabled**.**
- ♦ RUN (014).

Condition

LOW signal and P100 = 3, 4 (closed-loop frequency/speed control)

Result

- ♦ OFF1 (015), if the drive is in a status where the inverter is enabled.
  - For P100 = 3, 4 and slave drive, the system waits until the higher-level open-loop/closed-loop control shuts down the drive.
  - For P100 = 3, 4 and master drive, the setpoint at the ramp-function generator input is inhibited (setpoint = 0), so that the drive decelerates along the parameterized down ramp (P464) to the OFF shutdown frequency (P800).

  After the OFF delay time (P801) has expired, the inverter pulses are inhibited, and the main contactor (option/bypass contactor), if available, are opened.
  If the OFF1 command is withdrawn again when the drive is ramping-down, (e.g. as the result of an ON command), ramp-down is interrupted, and the drive goes back into the RUN (014) condition.

- For PRECHARGING (010), READY (011), RESTART-ON-THE-FLY (013) or MOT-ID-STANDSTILL (018), the inverter pulses are inhibited, and the main contactor (option)/bypass contactor, if available, is opened.
- SWITCH-ON INHIBIT (008); compare status word 1, bit 6
- READY-TO-POWER-UP (009), if "OFF2" or "OFF3" are not present.

Condition Low signal and P100 = 5 (closed-loop torque control)

Result
- An OFF2 command (electrical) is executed.

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

Condition LOW signal

Result
- The inverter pulses are inhibited, and the main contactor (option)/bypass contactor, if available, are opened.
- POWER-ON INHIBIT (008), until the command is removed.

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

Bit 2: OFF3 command (L "OFF3") (fast stop)

Condition LOW signal

Result
- This command has two possible effects:
  - DC braking is enabled (P395 = 1):
    DC BRAKING (017)
    The drive decelerates along the parameterized downramp for OFF3 (P466) until the frequency for the start of DC braking is reached (P398).
    The inverter pulses are then inhibited for the duration of the de-energization time (P603).
    After this, the drive DC brakes with an adjustable braking current (P396) for a braking time which can be parameterized (P397).
    The inverter pulses are then inhibited and the main contactor (option)/bypass contactor, if available, is opened.
  - DC braking is not enabled (P395 = 0):
    The setpoint is inhibited at the ramp-function generator input (setpoint = 0), so that the drive decelerates along the parameterized downramp for OFF3 (P466) to the OFF shutdown frequency (P800).
    The inverter pulses are inhibited after the OFF delay time (P801) has expired, and the main/bypass contactor, if used, is opened. If the OFF3 command is withdrawn while the drive is decelerating, the drive still continues to accelerate.

- For PRE-CHARGING (010), READY (011), RESTART-ON-THE-FLY (013) or MOT-ID STANDSTILL (018), the inverter pulses are inhibited, and the main/bypass contactor, if used, is opened.
- If the drive operates as slave drive, when an OFF3 command is issued, it automatically switches-over to the master drive.
- POWER-ON inhibit (008), until the command is withdrawn.

NOTE

The **OFF3** command is simultaneously effective from three sources (P558, P559 and P560)!

Priority of the **OFF** commands: **OFF2** > **OFF3** > **OFF1**

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

Condition
HIGH signal, READY (011) and the de-energization time (P603) has expired since the last time that the drive was shutdown.

Result
- RUN (014)
  The inverter pulses are enabled and the setpoint is approached via the ramp-function generator.

Condition
LOW signal

Result
- For RESTART-ON-THE-FLY (013), RUN (014), KINETIC BUFFERING with pulse enable, OPTIMIZATION OF THE SPEED CONTROLLER CIRCUIT (019) or SYNCHRONIZATION (020):
- The drive changes over into the READY (011), condition, and the inverter pulses are inhibited.
- If OFF1 is active (015), the inverter pulses are inhibited, the main/bypass contactor, if used, is opened, and the drive goes into the POWER-ON INHIBIT (008) condition.
- If OFF3 is active (016 / fast stop), the inverter inhibit command is ignored, fast stop is continued and, after shutdown (P800, P801), the inverter pulses are inhibited.

Bit 4: Ramp-function generator inhibit command (L "RFG inhibit")

Condition
LOW signal in the RUN (014) condition.

Result
- The ramp-function generator output is set to setpoint = 0.

Bit 5: Ramp-function generator hold command (L "RFG hold")

Condition
LOW signal in the RUN (014) condition.

Result
- The actual setpoint is "frozen at the ramp-function generator output".

Bit 6: Setpoint enable command (H "setpoint enable")

Condition HIGH signal and the de-energization time have expired (P602).

Result
- The setpoint at the ramp-function generator input is enabled.

Bit 7: Acknowledge command (↑ "Acknowledge")

Condition Rising (positive) edge change from L to H (L → H) in the FAULT condition (007).

Result
- All of the current faults are deleted after they have been previously transferred into the diagnostics memory.
- POWER-ON INHIBIT (008), if no actual faults are present.
- FAULT (007), if there are no faults.

NOTE The **Acknowledge** command is simultaneously effective from the 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 (rising) edge change from L to H (L → H) in the READY TO POWER-UP (009) condition.

Result
- An ON command is automatically executed (refer to control word bit 0), and inching frequency 1 (P448) is enabled in the setpoint channel.
  The ON/OFF1 command (bit 0) is ignored for active inching operation!
  The system must wait until the de-energization time (P603) has expired

Condition LOW signal

Result
- An OFF1 command is automatically executed (refer to control word bit 0).

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

Condition Rising (positive) edge change from L to H (L → H) in the READY TO POWER-UP (009) condition.

Result
- An ON command is automatically executed (refer to control board bit 0), and inching frequency 2 (P449) is enabled in the setpoint channel.
  The ON/OFF1 command (bit 0) is ignored if inching is active.
  The system must wait until the de-energization time (P603) has expired.

Condition LOW signal

Result
- An OFF1 command is automatically executed (refer to control word bit 0).

Bit 10: Control from the PLC command (H "control from the PLC")

Condition HIGH signal; the process data PZD (control word, setpoints) are only evaluated if the command has been accepted; this data is sent via the SST1 interface of the CU, the CB/TB interface (option) and the SST/SCB interface (option).

Result
- ♦ If several interfaces are used, only the process data of the interfaces are evaluated, which send an H signal.
- ♦ For an L signal, the last values are received in the appropriate dual port RAM of the interface.

NOTE An H signal appears in the visualization parameter r550 "control word 1", if **one** of the interfaces sends an H signal!

Bit 11: Clockwise rotating field command (H "clockwise rotating field")

Condition HIGH signal

Result
- ♦ The setpoint is influenced in conjunction with bit 12 "counter-clockwise rotating field“.

Bit 12: Counter-clockwise rotating field command (H "counter-clockwise rotating field")

Condition HIGH signal

Result
- ♦ The setpoint is influenced in conjunction with bit 11 "clockwise-rotating field".

NOTE The **counter-clockwise rotating field** and the **clockwise rotating field** command have no influence on supplementary setpoint 2, which is added after the ramp-function generator (RFG)!

Bit 13: Command to raise the motorized potentiometer (H "raise motorized potentiometer")

Condition HIGH signal

Result
- ♦ The motorized potentiometer in the setpoint channel is driven in conjunction with bit 14 "motorized potentiometer, lower".

Bit 14: Command to lower the motorized potentiometer (H "lower motorized potentiometer")

Condition HIGH signal

Result
- ♦ The motorized potentiometer in the setpoint channel is driven in conjunction with bit 13 "raise motorized potentiometer".

Bit 15: Command external fault 1 (L "External fault 1")

Condition LOW signal

Result
- ♦ FAULT (007) and fault message (F035).
  The inverter pulses are inhibited, the main contactor/bypass contactor, if used, is opened**.**

Bit 16: Function data set FDS bit 0 command

Result
- In conjunction with bit 17 "FDS BIT 1" one of the four possible function data sets is energized.

Bit 17: Function data set FDS bit 1 command

Result
- In conjunction with bit 16 "FDS BIT 0" one of the four possible function data sets is energized.

Bit 18: Motor data set, MDS bit 0 command

Condition
READY TO POWER-UP (009), PRE-CHARGING (010) or READY (011)

Result
- One of the four possible motor data sets is energized in conjunction with bit 19 "MDS BIT 1".

Bit 19: Motor data set, MDS bit 1 command

Condition
READY TO POWER-UP (009), PRE-CHARGING (010) or READY (011)

Result
- One of the four possible motor data sets is energized in conjunction with bit 18 "MDS BIT 0".

Bit 20: Fixed setpoint FSW bit 0 (LSB) command

Result
- In conjunction with bit 21 "FSW BIT 1", one of the four possible fixed setpoints is energized to input as percentage fixed setpoints, referred to the reference frequency P352 or reference speed P353.

Bit 21: Fixed setpoint FSW bit 1 (MSB) command

Result
- In conjunction with bit 20 "FSW BIT 0" one of the four possible fixed setpoints is energized for input as percentage fixed setpoints, referred to the reference frequency P352 or the reference speed P353.

Bit 22: Synchronizing enable command (H "synchronizing enable")

Condition
- For converter sychronization (P534 = 1):
  HIGH signal, TSY (option) available and P100 = 2 (V/f characteristic for textile applications).
- For line synchronization (P534 = 2):
  HIGH signal, TSY (option) P100 = 1, 2 or 3

Result
- The command enables the synchronizing function.

Bit 23: Restart-on-the-fly enable command (H "restart-on-the-fly enable")

Condition HIGH signal

Result
- ♦ The command enables the restart-on-the-fly function.

Bit 24: Droop/technology controller enable command (H "droop/technology controller enable")

Condition HIGH signal

Result
- ♦ The command enables the droop function, if P100 (open-loop/closed-loop control type) is assigned 3 (closed-loop frequency control) or 4 (closed-loop speed control), parameter P246 <> 0 and the inverted pulses of the drive converter are enabled.
  The speed/frequency controller output, fed back as negative signal to the speed/frequency setpoint, can be set via parameter P245 (source steady-state) and P246 (scaling steady-state)

Bit 25: Controller enable command (H "controller enable")

Condition HIGH signal and the drive converter inverter pulses are enabled.

Result
- ♦ The speed controller output is enabled for the appropriate control type (P100 = 0,4,5).

Bit 26: Command, external fault 2 (L "External fault 2")

Condition LOW signal; it is only activated from the READY (011) condition onwards and after an additional time delay of 200 ms.

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

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

Condition HIGH signal, P100 (open-loop/closed-loop control type) = 3, 4 (closed-loop frequency/speed control), and the drive inverter pulses are enabled.

Result
- ♦ Slave drive: The closed-loop control acts as closed-loop torque control (M closed-loop control). With f closed-loop control, precise torque control is not possible until from about 10 % of motor rated speed onwards.

Condition LOW signal, P100 (open-loop/closed-loop control type) = 3, 4 (closed-loop frequency/speed control), and the drive converter inverter pulses are enabled.

Result
- ♦ Master drive: The closed-loop control operates as closed-loop speed or frequency control (closed-loop frequency/speed control).

Bit 28: Command, external alarm 1 (L "External alarm 1")

Condition LOW signal

Result
- The operating status is maintained. An alarm message is issued (A015).

Bit 29: Command, external alarm 2 (L "External alarm 2")

Condition LOW signal

Result
- The operating status is maintained. An alarm message is issued (A016).

Bit 30: Select, BICO data sets (H "data set 2") / (L "data set 1")

Condition HIGH signal

Result
- The parameter settings of data set 2 for all binector and connector commands and signals, are activated.

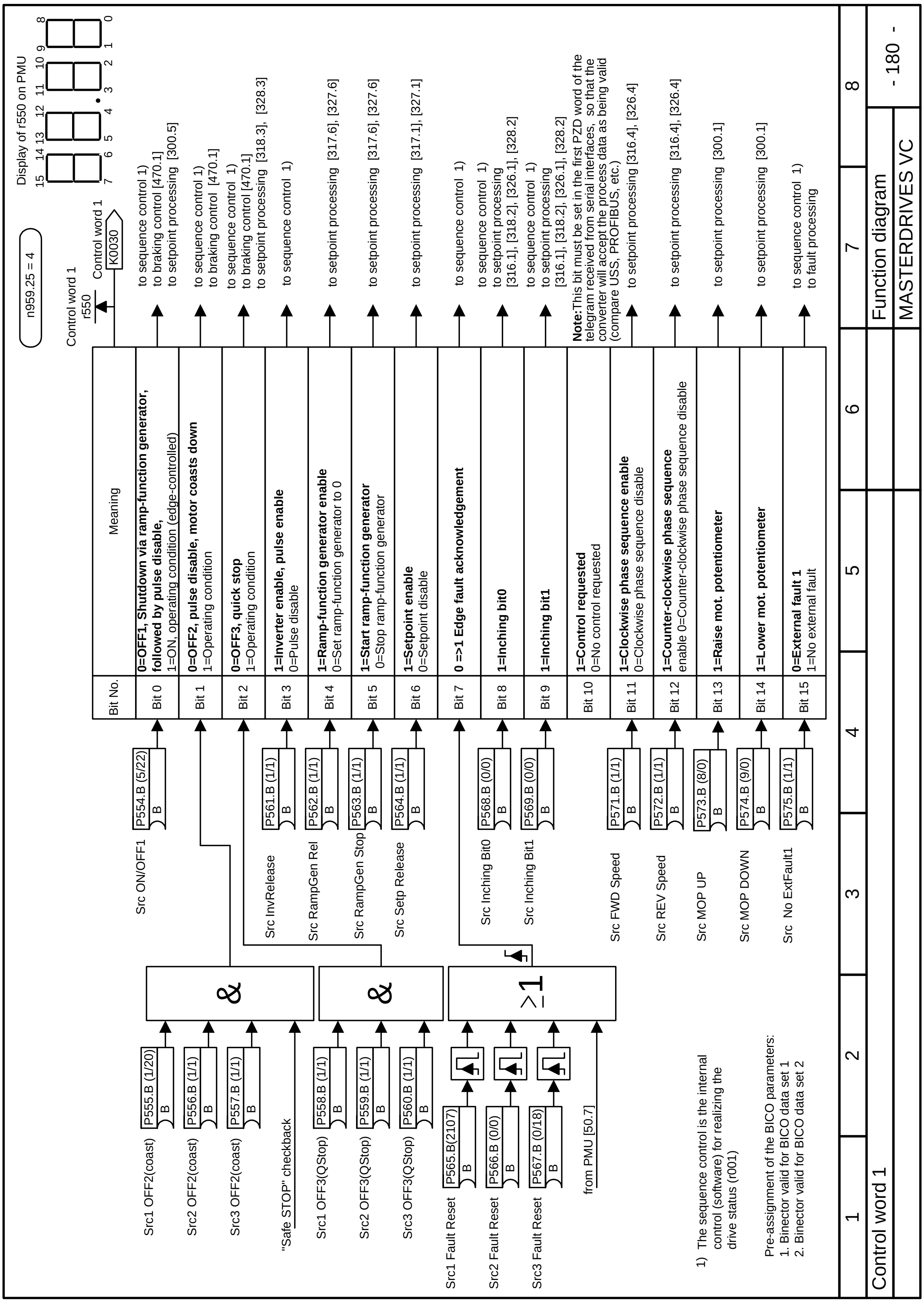
Condition LOW signal

Result
- The parameter settings of data set 1 for all binector and connector commands and signals, are activated.

Bit 31: Main contactor checkback signal command (H "main contactor checkback signal")

Condition HIGH signal, corresponding to the wiring and parameterization of the main contactor (option). The checkback time can be set in P600.

Result
- Checkback signal, "main contactor energized" (closed).



Control word 1
Display of r550 on PMU
15 14 13 12 11 10 9 8
7 6 5 4 3 2 1 0
n959.25 = 4
Control word 1
r550
Control word 1
K0030
Bit No.
Meaning
Bit 0
0=OFF1, Shutdown via ramp-function generator, followed by pulse disable,
1=ON, operating condition (edge-controlled)
to sequence control 1)
to braking control [470.1]
to setpoint processing [300.5]
Bit 1
0=OFF2, pulse disable, motor coasts down
1=Operating condition
to sequence control 1)
to braking control [470.1]
Bit 2
0=OFF3, quick stop
1=Operating condition
to sequence control 1)
to braking control [470.1]
to setpoint processing [318.3], [328.3]
Bit 3
1=Inverter enable, pulse enable
0=Pulse disable
to sequence control 1)
Bit 4
1=Ramp-function generator enable
0=Set ramp-function generator to 0
to setpoint processing [317.6], [327.6]
Bit 5
1=Start ramp-function generator
0=Stop ramp-function generator
to setpoint processing [317.6], [327.6]
Bit 6
1=Setpoint enable
0=Setpoint disable
to setpoint processing [317.1], [327.1]
Bit 7
0 =>1 Edge fault acknowledgement
to sequence control 1)
Bit 8
1=Inching bit0
to sequence control 1)
to setpoint processing
[316.1], [318.2], [326.1], [328.2]
Bit 9
1=Inching bit1
to sequence control 1)
to setpoint processing
[316.1], [318.2], [326.1], [328.2]
Bit 10
1=Control requested
0=No control requested
Note:This bit must be set in the first PZD word of the telegram received from serial interfaces, so that the converter will accept the process data as being valid (compare USS, PROFIBUS, etc.)
Bit 11
1=Clockwise phase sequence enable
0=Clockwise phase sequence disable
to setpoint processing [316.4], [326.4]
Bit 12
1=Counter-clockwise phase sequence enable 0=Counter-clockwise phase sequence disable
to setpoint processing [316.4], [326.4]
Bit 13
1=Raise mot. potentiometer
to setpoint processing [300.1]
Bit 14
1=Lower mot. potentiometer
to setpoint processing [300.1]
Bit 15
0=External fault 1
1=No external fault
to sequence control 1)
to fault processing
Src ON/OFF1 P554.B (5/22) B
Src InvRelease P561.B (1/1) B
Src RampGen Rel P562.B (1/1) B
Src RampGen Stop P563.B (1/1) B
Src Setp Release P564.B (1/1) B
Src Inching Bit0 P568.B (0/0) B
Src Inching Bit1 P569.B (0/0) B
Src FWD Speed P571.B (1/1) B
Src REV Speed P572.B (1/1) B
Src MOP UP P573.B (8/0) B
Src MOP DOWN P574.B (9/0) B
Src No ExtFault1 P575.B (1/1) B
Src1 OFF2(coast) P555.B (1/20) B
Src2 OFF2(coast) P556.B (1/1) B
Src3 OFF2(coast) P557.B (1/1) B
"Safe STOP" checkback
&
Src1 OFF3(QStop) P558.B (1/1) B
Src2 OFF3(QStop) P559.B (1/1) B
Src3 OFF3(QStop) P560.B (1/1) B
&
Src1 Fault Reset P565.B(2107) B
Src2 Fault Reset P566.B (0/0) B
Src3 Fault Reset P567.B (0/18) B
from PMU [50.7]
≥1
1) The sequence control is the internal control (software) for realizing the drive status (r001)
Pre-assignment of the BICO parameters:
1. Binector valid for BICO data set 1
2. Binector valid for BICO data set 2
1 2 3 4 5 6 7 8
Function diagram
MASTERDRIVES VC
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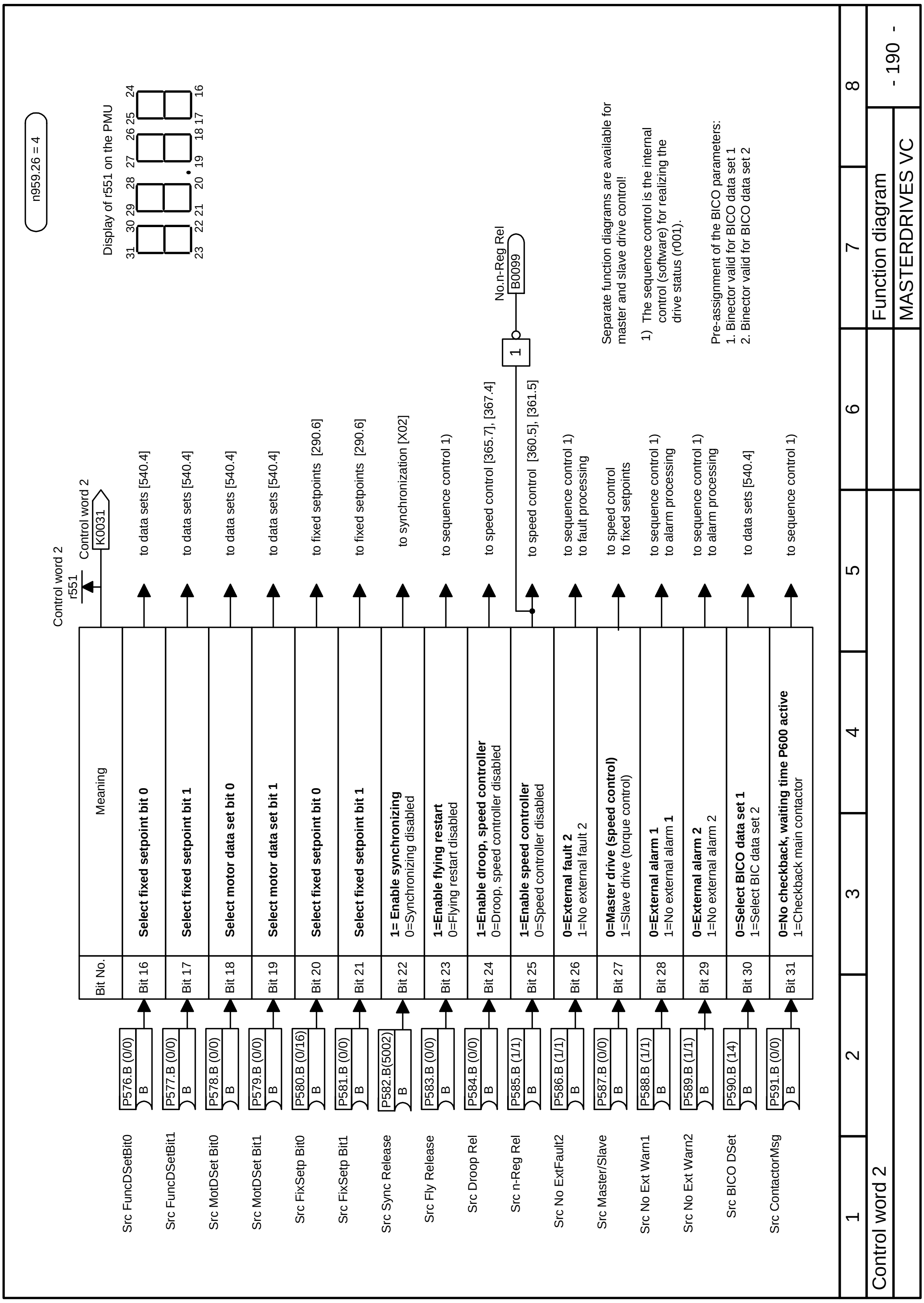
n959.26 = 4
Control word 2
r551
Control word 2
K0031
Bit No.
Meaning
Src FuncDSetBit0
P576.B (0/0)
B
Bit 16
Select fixed setpoint bit 0
to data sets [540.4]
Src FuncDSetBit1
P577.B (0/0)
B
Bit 17
Select fixed setpoint bit 1
to data sets [540.4]
Src MotDSet Bit0
P578.B (0/0)
B
Bit 18
Select motor data set bit 0
to data sets [540.4]
Src MotDSet Bit1
P579.B (0/0)
B
Bit 19
Select motor data set bit 1
to data sets [540.4]
Src FixSetp Bit0
P580.B (0/16)
B
Bit 20
Select fixed setpoint bit 0
to fixed setpoints [290.6]
Src FixSetp Bit1
P581.B (0/0)
B
Bit 21
Select fixed setpoint bit 1
to fixed setpoints [290.6]
Src Sync Release
P582.B(5002)
B
Bit 22
1= Enable synchronizing
0=Synchronizing disabled
to synchronization [X02]
Src Fly Release
P583.B (0/0)
B
Bit 23
1=Enable flying restart
0=Flying restart disabled
to sequence control 1)
Src Droop Rel
P584.B (0/0)
B
Bit 24
1=Enable droop, speed controller
0=Droop, speed controller disabled
to speed control [365.7], [367.4]
Src n-Reg Rel
P585.B (1/1)
B
Bit 25
1=Enable speed controller
0=Speed controller disabled
to speed control [360.5], [361.5]
1
No.n-Reg Rel
B0099
Src No ExtFault2
P586.B (1/1)
B
Bit 26
0=External fault 2
1=No external fault 2
to sequence control 1)
to fault processing
Src Master/Slave
P587.B (0/0)
B
Bit 27
0=Master drive (speed control)
1=Slave drive (torque control)
to speed control
to fixed setpoints
Src No Ext Warn1
P588.B (1/1)
B
Bit 28
0=External alarm 1
1=No external alarm 1
to sequence control 1)
to alarm processing
Src No Ext Warn2
P589.B (1/1)
B
Bit 29
0=External alarm 2
1=No external alarm 2
to sequence control 1)
to alarm processing
Src BICO DSet
P590.B (14)
B
Bit 30
0=Select BICO data set 1
1=Select BIC data set 2
to data sets [540.4]
Src ContactorMsg
P591.B (0/0)
B
Bit 31
0=No checkback, waiting time P600 active
1=Checkback main contactor
to sequence control 1)
Display of r551 on the PMU
31 30 29 28 27 26 25 24
23 22 21 20 19 18 17 16
Separate function diagrams are available for master and slave drive control!
1) The sequence control is the internal control (software) for realizing the drive status (r001).
Pre-assignment of the BICO parameters:
1. Binector valid for BICO data set 1
2. Binector valid for BICO data set 2
1
2
3
4
5
6
7
8
Control word 2
Function diagram
MASTERDRIVES VC
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10.2 Description of the status word bits

Bit 0: Message, "Ready to power-up" (H)

HIGH signal POWER-ON INHIBIT (008) or READY TO POWER-UP (009) status

Significance
- The power supply, the open- and closed-loop control are operational.
- The inverter pulses are inhibited.
- If an external power supply and a main contactor (option)/bypass contactor are available, it is possible to bring the DC link into a no-voltage condition, when the drive converter is in this status!

Bit 1: Message, "Ready" (H)

HIGH signal PRE-CHARGING (010) or READY (011) status

Significance
- The power supply, the open-loop and the closed-loop control are operational.
- The unit is powered-up.
- Pre-charging has been completed.
- The DC link has been ramped-up to the full voltage.
- The inverter pulses are still inhibited.

Bit 2: Message, "Run" (H)

HIGH signal GROUND-FAULT TEST (012), RESTART-ON-THE-FLY (013), RUN (014), OFF1 (015) or OFF3 (016)

Significance
- The unit is functioning.
- The inverter pulses are enabled.
- The output terminals are live.

Bit 3: Message "Fault" (H)

HIGH signal Fault (007) status

Significance
- A fault has occurred.

Bit 4: Message "OFF2" (L)

LOW signal OFF2 command available

Significance
- The OFF2 command was output (control word bit 1).

Bit 5: Message "OFF3" (L)

LOW signal OFF3 (016) status, and/or OFF3 command available

Significance
- The OFF3 command was output (control word bit 2).

Bit 6: Message "Power-on inhibit" (H)

HIGH signal POWER-ON INHIBIT (008) status

Significance

- The power supply, open-loop and closed-loop control are operational.
- If an external power supply and a main contactor (option)/bypass contactor are available, it is possible to bring the DC link voltage in this drive converter status into a no-voltage condition!
- The message is available as long as an OFF2 command is present via control word bit 1 or an OFF3 command is available via control word bit 2 after the setpoint has been ramped-down, or an ON command is available via control word bit 0 (edge evaluation).

Bit 7: Message, "Alarm" (H)

HIGH signal Alarm (Axxx)

Significance

- An alarm has been issued.
- The signal is present until the cause has been resolved.

Bit 8: Message "Setpoint-actual value deviation" (L)

LOW signal Alarm, "Setpoint-actual value deviation“ (A034)

Significance

- The frequency actual value deviates from the frequency setpoint (reference value, by a value which exceeds P794 (setpoint-actual value deviation, frequency), for a time which is longer than P792 (setpoint-actual value deviation time).
- The bit is again set as H signal, if the deviation is less than parameter value P792.

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

HIGH signal Still present.

Bit 10: Message, "Comparison frequency reached" (H)

HIGH signal The parameterized comparison frequency has been reached.

Significance

- The absolute frequency actual value is greater than or equal to the parameterized comparison frequency (P796).
- The bit is again set to L signal, as soon as the absolute value of the comparison frequency (P796), minus the parameterized comparison frequency hysteresis (P797 as %, referred to the comparison frequency (P796)) is fallen below.

Bit 11: Message "Undervoltage" (H)

HIGH signal "Undervoltage in the DC link"

Significance

- The DC link voltage has fallen below the permissible limit value. From drive status (°011) fault message (F008) "DC link undervoltage" is additionally output.

Refer to the Section "Fault- and alarm messages"

Bit 12: Message "Main contactor energized" (H)

HIGH signal The main contactor (AC unit)/precharging contactor (DC unit) (option) is operated.

Significance

- The main contactor/precharging contactor (option) can be driven with the appropriate wiring and parameterization.

Bit 13: Message "RFG active" (H)

HIGH signal Ramp-function generator active

Significance

- The ramp-function generator output (r480 / KK0073) is not equal to the ramp-function generator input (r460 / KK0072).
  A hysteresis, which can be parameterized (P476 as %, referred to the rated system frequency P352), can only be taken into account for an analog setpoint input.
- When the "synchronizing“ function is selected, alarm A069 is initiated, as long as the ramp-function generator is active in the setpoint channel of the synchronizing converter.
  The synchronizing operation is not started as long as the ramp-function generator is active.

Bit 14: Message, "Clockwise rotating field" (H)/ "Counter-clockwise rotating field" (L)

HIGH signal Clockwise rotating field

Significance

- The frequency setpoint for the closed-loop control (speed/frequency setpoint, r482 / KK0075) is greater than or equal to 0.

LOW signal Counter-clockwise rotating field

Significance

- The frequency setpoint for the closed-loop control (speed/frequency setpoint, r482 / KK0075) is less than 0.

Bit 15: Message "KIP/FLN active" (H)

HIGH signal The kinetic buffering (KIP) function or flexible response (FLN) is active.

Significance

- KIP: A brief power failure is bypassed using the kinetic energy of the connected load.
- FLN: The converter can be operated up to a minimum DC link voltage of 50 % of the rated value.

Bit 16: Message "Restart-on-the-fly active" (H)

HIGH signal
The restart-on-the-fly function is active, or the excitation time (P602) is running.

Significance
- The drive converter is switched to a motor which is still rotating.
- Overcurrent is prevented as a result of the restart-on-the-fly function.
- The excitation time (magnetization time) is active.

Bit 17: Message "Synchronism has been reached" (H)

HIGH signal
Synchronism has been reached.

Significance
- Synchronism has been reached.

Prerequisite
TSY (option) available and P100 (open-loop/closed-loop control type) = 2 (V/f characteristic for textile applications) or P100 = 1, 2, 3 at line synchronism (P534 = 2).

Bit 18: Message "Overspeed" (L)

LOW signal
Alarm "Overspeed" (A033)

Significance
- The frequency actual value is either:
- greater than the maximum frequency for the clockwise rotating field (P452) plus a hysteresis (P804 as %, referred to P452) or
- less than the maximum frequency for the counter-clockwise rotating field (P453) plus a hysteresis (P804 as %, referred to P453).
- The bit is again set to an H signal as soon as the absolute value of the frequency actual value is less than or equal to the absolute value of the appropriate maximum frequency.

Bit 19: Message “External fault 1“ (H)

HIGH signal
"External fault 1"

Significance
- A "External fault 1" is present in control word, bit 15.

Output at the terminal strip (PEU, CUVC, TSY, SCI1/2, EB1, EB2) with L signal.

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

HIGH signal
"External fault 2"

Significance
- A "External fault 2" is present in control word bit 26.

Output at the terminal strip (PEU, CUVC, TSY, SCI1/2, EB1, EB2) with L signal.

Bit 21: Message "External alarm" (H)

HIGH signal "External alarm"

Significance

- An "external alarm 1" is present in control word bit 28, or, "external alarm 2" in control word bit 29.

Output at the terminal strip (PEU, CUVC, TSY, SCI1/2, EB1, EB2) with L signal.

Bit 22: Message "Alarm i^2t drive converter" (H)

HIGH signal Alarm "i^2t alarm, inverter" (A025)

Significance

- If the instantaneous load status is maintained, then the drive converter will be thermally overloaded.

Output at the terminal strip (PEU, CUVC, TSY, SCI1/2, EB1, EB2) with L signal.

Bit 23: Message "Fault, converter overtemperature" (H)

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

Significance

- The limiting inverter temperature has been exceeded.

Output at the terminal strip (PEU, CUVC, TSY, SCI1/2, EB1, EB2) with L signal.

Bit 24: Message "Alarm, converter overtemperature" (H)

HIGH signal Alarm, "inverter temperature too high" (A022)

Significance

- The inverter temperature threshold to release an alarm has been exceeded.

Output at the terminal strip (PEU, CUVC, TSY, SCI1/2, EB1, EB2) with L signal.

Bit 25: Message "Alarm, motor overtemperature" (H)

HIGH signal Alarm “Motor overtemperature“

Significance

- it involves an “I^2t alarm, motor“ (A029) or an overtemperature alarm from the KTY (P380 > 1) or PTC thermistor (P380 = 1).
- The alarmis initiated either by calculating the motor load (r008 / K0244) or from the KTY84 sensor (r009 / K0245).
- Parameters involved in the calculation:
  P380 (mot. temp. alarm), P382 (motor cooling),
  P383 (mot. temp.T1), P384 (mot. load limit).

Output at the terminal strip (PEU, CUVC, TSY, SCI1/2, EB1, EB2) with L signal.

Bit 26: Message "Fault, motor overtemperature" (H)

HIGH signal Fault, "Motor overtemperature"

Significance
- It involves an "I^2t fault, motor" (F021) or an overtemperature fault, from KTY (P381 > 1) or PTC thermistor (P381 = 1).

Output at the terminal strip (PEU, CUVC, TSY, SCI1/2, EB1, EB2) with L signal.

Bit 27: Reserve

Bit 28: Message, "Fault, motor stalled/locked" (H)

HIGH signal Fault, “Motor stalled or blocked“ (F015)

Significance
- The drive has either stalled or is locked.

Precondition
- Blocking recognition at P100 = 3, 4 f/n control: setpoint/actual value deviation has occurred (bit 8), torque limit (B0234) reached, speed < 2 % and time in P805 expired
- In the case of M control (P100 = 5) or slave drive (P587), blocking is not recognized.

Output at the terminal strip (PEU, CUVC, TSY, SCI1/2, EB1, EB2) with L signal.

Bit 29: Message "Bypass contactor energized" (H)

HIGH signal The bypass contactor is energized after precharging has ended (applies only to AC units equipped with bypass contactor).

Significance
- A bypass contactor (option) can be energized with the appropriate wiring and parameterization.

Bit 30: Message "Alarm sync. error" (H)

HIGH signal Alarm, "Synchronizing error" (A070)

Significance
- After successful synchronization, the phase deviation is greater than the parameterized tolerance range (P531).

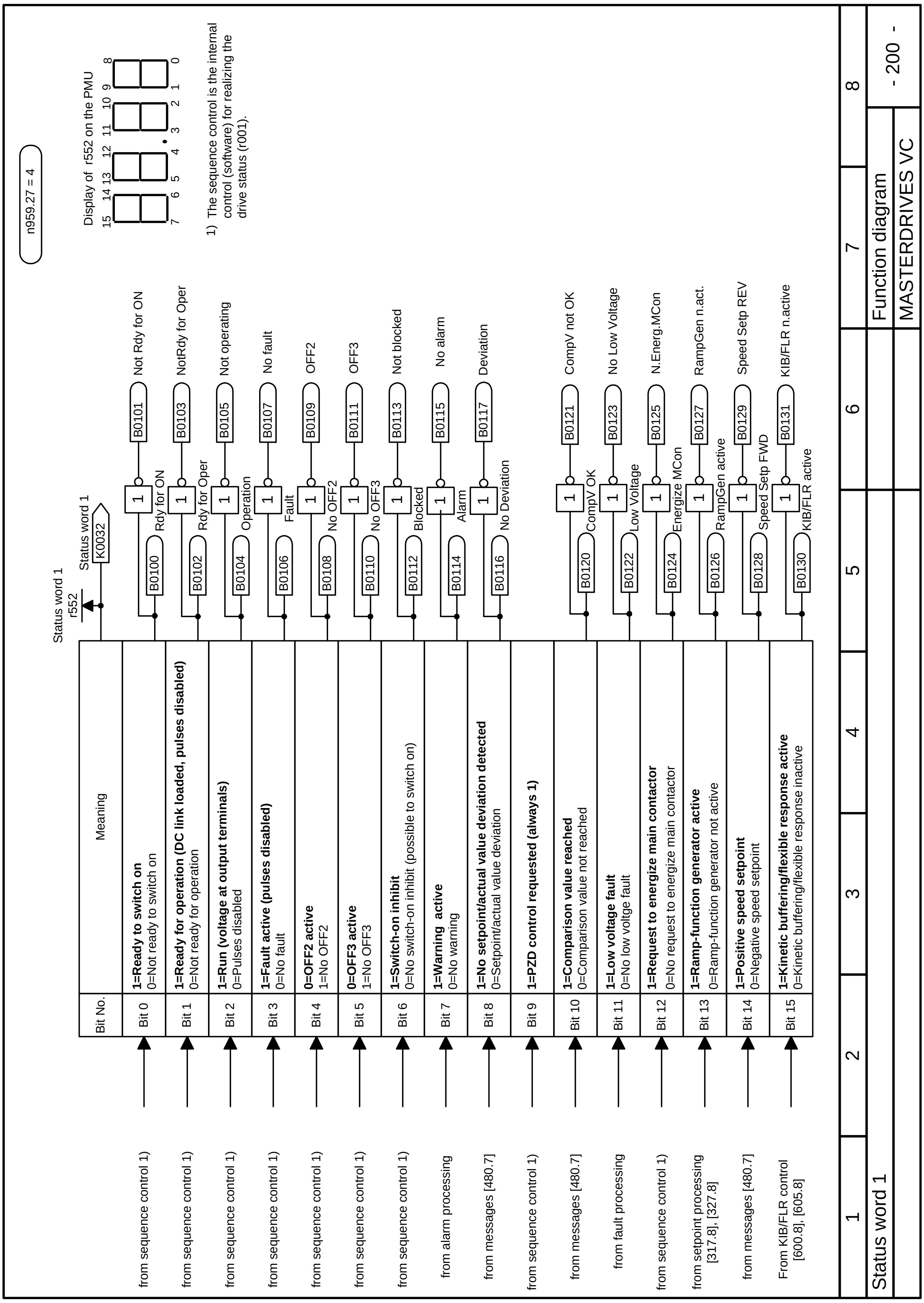
Prerequisite TSY (option) available and P100 (open-loop/closed-loop control type) = 2 (V/f characteristic for textile applications) or P100 = 1, 2, 3 at line synchronism (P534 = 2).

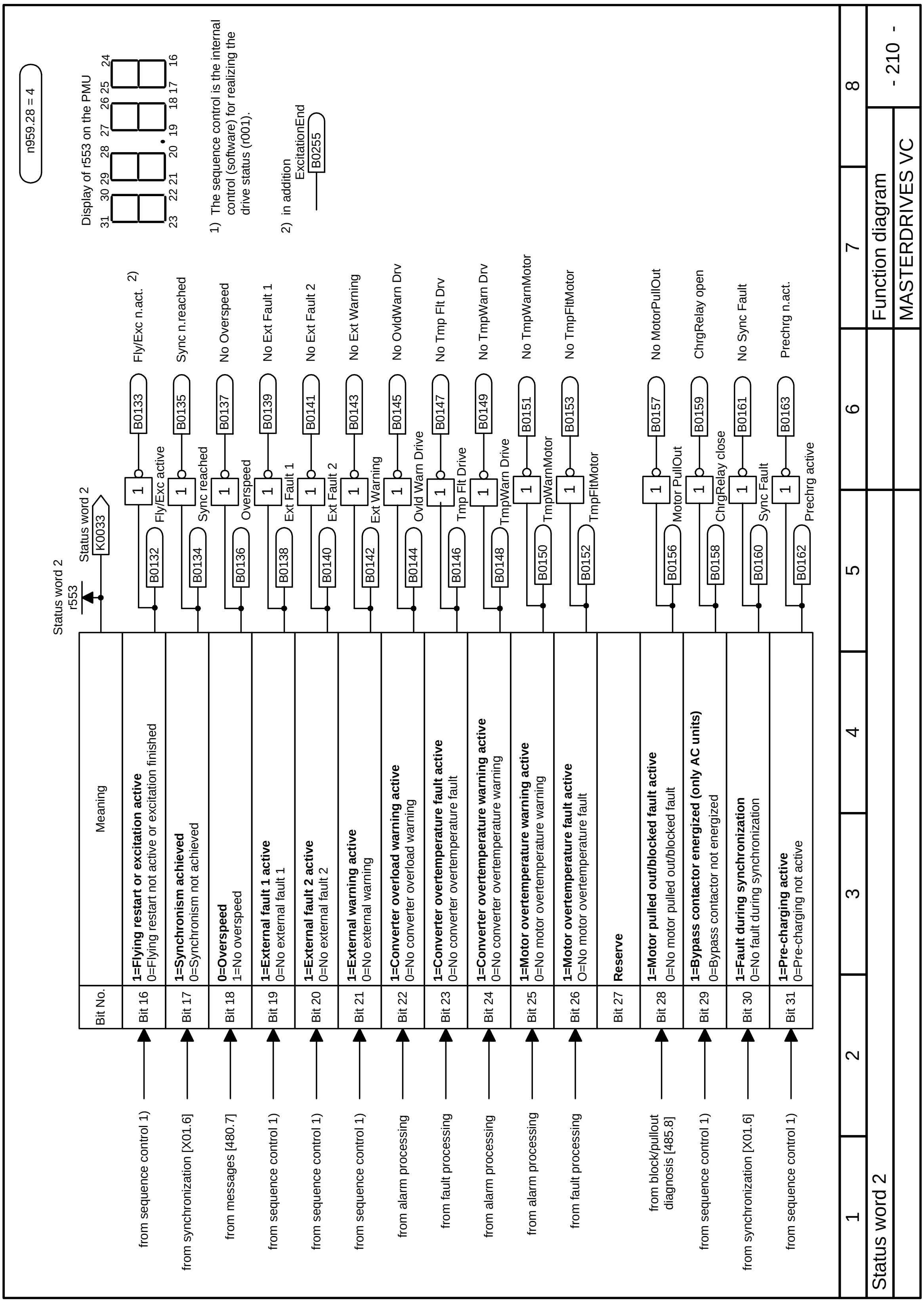
Output at the terminal strip (PEU, CUVC, TSY, SCI1/2, EB1, EB2) with L signal.

Bit 31: Message "Pre-charging active" (H)

HIGH signal PRE-CHARGING (010) condition

Significance
- Pre-charging is realized after an ON command.


n959.27 = 4
Display of r552 on the PMU
15 14 13 12 11 10 9 8
7 6 5 4 3 2 1 0
1) The sequence control is the internal control (software) for realizing the drive status (r001).
Status word 1
r552
Status word 1
K0032
Bit No.
Meaning
from sequence control 1)
Bit 0
1=Ready to switch on
0=Not ready to switch on
B0100
Rdy for ON
B0101
Not Rdy for ON
from sequence control 1)
Bit 1
1=Ready for operation (DC link loaded, pulses disabled)
0=Not ready for operation
B0102
Rdy for Oper
B0103
NotRdy for Oper
from sequence control 1)
Bit 2
1=Run (voltage at output terminals)
0=Pulses disabled
B0104
Operation
B0105
Not operating
from sequence control 1)
Bit 3
1=Fault active (pulses disabled)
0=No fault
B0106
Fault
B0107
No fault
from sequence control 1)
Bit 4
0=OFF2 active
1=No OFF2
B0108
No OFF2
B0109
OFF2
from sequence control 1)
Bit 5
0=OFF3 active
1=No OFF3
B0110
No OFF3
B0111
OFF3
from sequence control 1)
Bit 6
1=Switch-on inhibit
0=No switch-on inhibit (possible to switch on)
B0112
Blocked
B0113
Not blocked
from alarm processing
Bit 7
1=Warning active
0=No warning
B0114
Alarm
B0115
No alarm
from messages [480.7]
Bit 8
1=No setpoint/actual value deviation detected
0=Setpoint/actual value deviation
B0116
No Deviation
B0117
Deviation
from sequence control 1)
Bit 9
1=PZD control requested (always 1)
from messages [480.7]
Bit 10
1=Comparison value reached
0=Comparison value not reached
B0120
CompV OK
B0121
CompV not OK
from fault processing
Bit 11
1=Low voltage fault
0=No low voltge fault
B0122
Low Voltage
B0123
No Low Voltage
from sequence control 1)
Bit 12
1=Request to energize main contactor
0=No request to energize main contactor
B0124
Energize MCon
B0125
N.Energ.MCon
from setpoint processing [317.8], [327.8]
Bit 13
1=Ramp-function generator active
0=Ramp-function generator not active
B0126
RampGen active
B0127
RampGen n.act.
from messages [480.7]
Bit 14
1=Positive speed setpoint
0=Negative speed setpoint
B0128
Speed Setp FWD
B0129
Speed Setp REV
From KIB/FLR control [600.8], [605.8]
Bit 15
1=Kinetic buffering/flexible response active
0=Kinetic buffering/flexible response inactive
B0130
KIB/FLR active
B0131
KIB/FLR n.active
1 2 3 4 5 6 7 8
Status word 1
Function diagram
MASTERDRIVES VC
- 200 -



Bit No.	Meaning
Bit 16	**1=Flying restart or excitation active** 0=Flying restart not active or excitation finished
Bit 17	**1=Synchronism achieved** 0=Synchronism not achieved
Bit 18	**0=Overspeed** 1=No overspeed
Bit 19	**1=External fault 1 active** 0=No external fault 1
Bit 20	**1=External fault 2 active** 0=No external fault 2
Bit 21	**1=External warning active** 0=No external warning
Bit 22	**1=Converter overload warning active** 0=No converter overload warning
Bit 23	**1=Converter overtemperature fault active** 0=No converter overtemperature fault
Bit 24	**1=Converter overtemperature warning active** 0=No converter overtemperature warning
Bit 25	**1=Motor overtemperature warning active** 0=No motor overtemperature warning
Bit 26	**1=Motor overtemperature fault active** O=No motor overtemperature fault
Bit 27	**Reserve**
Bit 28	**1=Motor pulled out/blocked fault active** 0=No motor pulled out/blocked fault
Bit 29	**1=Bypass contactor energized (only AC units)** 0=Bypass contactor not energized
Bit 30	**1=Fault during synchronization** 0=No fault during synchronization
Bit 31	**1=Pre-charging active** 0=Pre-charging not active

11 Maintenance

DANGER

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 (BGV A3 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.

11.1 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.

DANGER

To replace the fan the converter has to be disconnected from the supply and removed.

Construction types E - G

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.

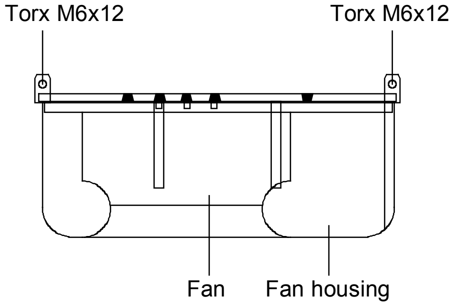


Fig. 11-1 Fan assembly

Construction types J - Q

The fan assembly consists of:

- the fan housing
- one or two fans
- the starting capacitors

The fan assembly is installed at the top in the chassis.

- Withdraw connector X20.
- Unscrew the two M8 screws of the fan assembly.
- In the case of type K with only one fan, you must dismantle the support plate below the fan (2 x M8).
- Pull out the fan assembly towards the front (if necessary, tilt it slightly down at the front) and lay it down securely.

CAUTION

The fan assembly weighs up to 52 kg, depending on its design.

- Undo the cable fastenings and fan connections.
- Take the fan support plate out of the fan assembly and remove the fan from the support plate.
- Install the new fan assembly in the reverse sequence.

For type K and L: Renew contact washers for grounding.

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.

11.2 Replacing the fan fuses (types J to Q)

The fuses are in a fuse holder which is mounted on a DIN rail in the bottom of the unit. The fuse holder has to be opened to replace the fuses.

11.3 Replacing the starting capacitor

The starting capacitor is

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

11.4 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.

Construction types J - Q

The capacitor battery consists of three units. Each unit contains a capacitor support and a DC link bus module.

- Detach the plug-in connections.
- Detach the mechanical fastening (three screws: two on the left, **one** on the right)

Tilt the capacitor battery sideways until its endstop, slightly raise the unit and lift it forwards out of the converter.

CAUTION

The capacitor battery weighs up to 30 kg, depending on the converter output!

11.5 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.

12 Forming

CAUTION

If a unit has been non-operational for more than one year, the DC link capacitors have to be newly formed. 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-N60147512345)

Digit	Example	Meaning
1 and 2	A-	Place of manufacture
3	N	2001
	P	2002
	R	2003
	S	2004
	T	2005
	U	2006
	V	2007
	W	2008
4	1 to 9	January to September
	O	October
	N	November
	D	December
5 to 14		Not relevant for forming

The following applies for the above example:
Manufacture took place in June 2001.

During forming, the DC link of the unit is connected up via a rectifier, a smoothing capacitor and a resistor.

During forming a defined voltage and a limited current are applied to the DC link capacitors and the internal conditions necessary for the function of the DC link capacitors are restored again.

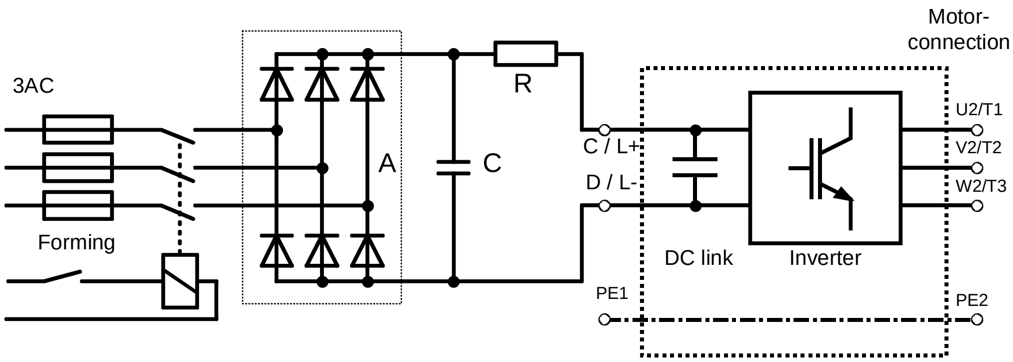


Fig. 12-1 Forming circuit

Components for the forming circuit (suggestion)

Types E - G:

Vrated	A	R	C
DC 270 V to 310 V	SKD 50 / 12	220 Ω / 100 W	22 nF / 1600 V
DC 510 V to 650 V	SKD 62 / 16	330 Ω / 150 W	22 nF / 1600 V
DC 675 V to 810 V	3 x SKKD 81 / 22	470 Ω / 200 W	22 nF / 1600 V
DC 890 V to 930 V	3 x SKKD 81 / 22	470 Ω / 100 W	22 nF / 1600 V

Types J - K:

Vrated	A	R	C
DC 510 V to 650 V	SKD 62 / 16	100 Ω / 500 W	22 nF / 1600 V
DC 675 V to 810 V	3 x SKKD 81 / 22	150 Ω / 500 W	22 nF / 1600 V
DC 890 V to 930 V	3 x SKKD 81 / 22	150 Ω / 500 W	22 nF / 1600 V

Type L:

The capacitors of type L do not require forming.

Type M, Q + R:

The inverters of each inverter unit must be formed individually in the case of type M, Q and R (as for type K).

DANGER

The unit has hazardous voltage levels up to 5 minutes after it has been powered down due to the DC link capacitors. The unit or the DC link terminals must not be worked on until at least after this delay time.

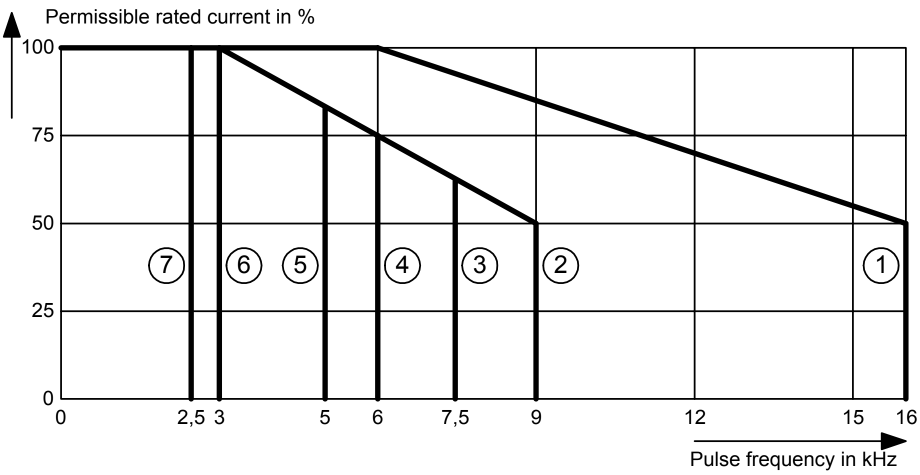
Procedure

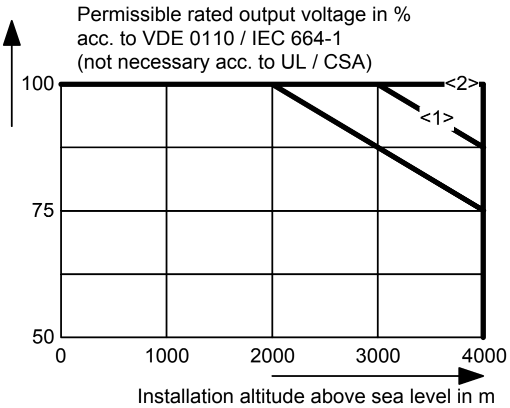
- Before you form the DC link capacitors, all DC link connections must be disconnected.
- The converter incoming power supply must be switched off.
- The unit is **not** permitted to receive a switch-on command (e.g. via the keyboard of the PMU or the terminal strip).
- Connect the required components in accordance with the circuit example.
- Energize the forming circuit. The duration of forming is approx. 1 hour.

13 Technical Data

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 • during storage • during transport	 0° C to +40° C (32° F to 104° F) (up to 50° C see Fig. "Derating curves") -25° C to +70° C (-13° F to 158° F) -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 • Standard • Option	EN 60529 • IP00 • IP20 (Option for types E to G)
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 (BGV A3)
Radio interference suppression • Standard • Options	to EN 61800-3 No radio interference suppression 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 During stationary use: Constant amplitude • of deflection • of acceleration During transport: • of deflection • of acceleration - Shocks (only E, F, and G types of construction)	 To DIN IEC 68-2-6 0.075 mm in the frequency range 10 Hz to 58 Hz 9.8 m/s² in the frequency range > 58 Hz to 500 Hz 3.5 mm in the frequency range 5 Hz to 9 Hz 9.8 m/s² in the frequency range > 9 Hz to 500 Hz to DIN IEC 68-2-27 / 08.89 30 g. 16 ms half-sine shock
Miscellaneous	The devices are ground-fault protected, short-circuit-proof and idling-proof on the motor side

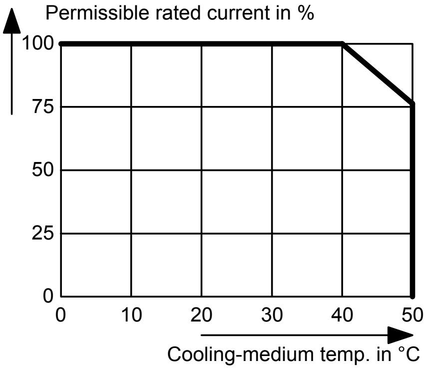
Table 13-1 General data





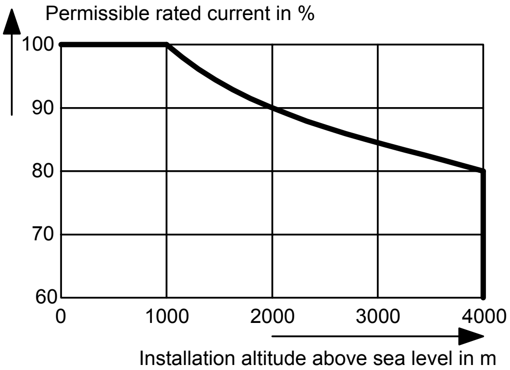
<1>
The derating curve only applies to the following units:
- Sizes E to G with rated input voltage of 510 - 650 V **only** in the case of an actual input voltage of 510 - 540 V
- Sizes J to Q with a rated input voltage of 675 - 810 V

<2>
The derating curve only applies for the following units:
- Sizes J to Q with a rated input voltage of 510 - 650 V
- Sizes J to Q with a rated input voltage of 675 - 810 V **only** in the case of an actual input voltage of 675 V



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. 13-1 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 $K_2 = 1.125$

→ Total derating = 0.845 x 1.125 = 0.95

Rating plate

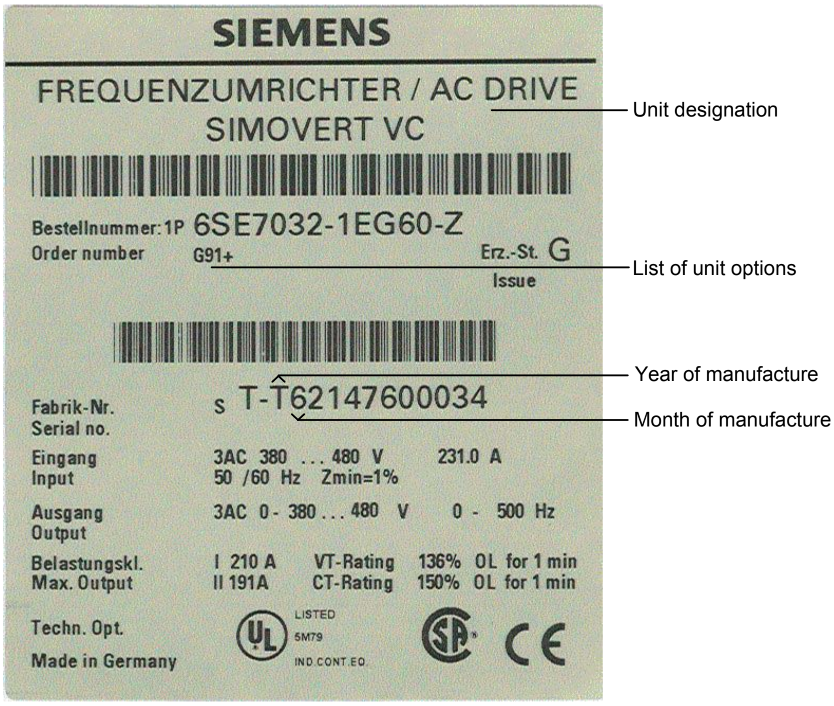


Fig. 13-2 Rating plate

Meaning of the option codes

Option	Meaning	Option	Meaning
	CBP: Profibus		**EB1:** Expansion Board 1
G11	Slot A	G61	Slot A
G13	Slot C	G63	Slot C
G14	Slot D	G64	Slot D
G15	Slot E	G65	Slot E
G16	Slot F	G66	Slot F
G17	Slot G	G67	Slot G
	CBP2: PROFIBUS (sync freq possible)		**EB2:** Expansion Board 2
		G71	Slot A
G91	Slot A	G73	Slot C
G93	Slot C	G74	Slot D
G95	Slot E	G75	Slot E
G97	Slot G	G76	Slot F
	The CBP2 module takes the place of the CB.	G77	Slot G
			LBA backplane bus adapter
	CBC: CAN-Bus	K11	installed in the electronics box
G21	Slot A		
G23	Slot C		
G24	Slot D		**ADB** adapter board
G25	Slot E	K01	Mounting pos. 2 (slot D, E)
G26	Slot F	K02	Mounting pos. 3 (slot F, G)
G27	Slot G		
	SLB: SIMOLINK		
G41	Slot A		
G43	Slot C		
G44	Slot D		
G45	Slot E		
G46	Slot F		
G47	Slot G		

Table 13-2 Meaning of the option codes

Designation	Value					
Order No. 6SE70...	31-0RE60	31-3RE60	31-6RE60	32-0RE60		
Rated voltage [V] • Input • Output	DC 270 (-15 %) to 310 (+15 %) 3 AC 0 up to rated DC voltage x 0.75					
Rated frequency [Hz] • Input • Output: V/f = constant V = constant	--- 0 to 500 8 to 300					
Rated current [A] • Input • Output	119 100	156 131	193 162	240 202		
DC link voltage [V]	= Rated DC voltage					
Rated output [kVA]	35 to 40	45 to 52	56 to 65	70 to 80		
Auxiliary current supply [V]	DC 24 (20 - 30)					
• Max. aux. curr. requirement[A] Standard version at 20 V	1.7					
• Max. aux. curr. requirement[A] Maximum version at 20 V	2.7					
Auxiliary current supply fan [V]	1 AC or 2 AC 230 ± 15 %					
• Aux. curr. requirem. at 50 Hz [A]	0.43					
• Aux. curr. requirem. at 60 Hz [A]	0.49					
Pulse frequency [kHz]	1.7 to 9	1.7 to 9	1.7 to 9	1.7 to 9		
Derating curve (s. Fig. 13-1)	②	②	②	②		
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					
Load class II to EN 60 146-1-1 (addtional)						
Base load current [A]	0.91 x rated output current					
Base load duration [s]	270					
Overload current [A]	1.6 x rated output current					
Overload duration [s]	30					
Losses, cooling, power factor						
Power factor conv. $\cos\varphi U$	< 0.92 ind.					
Efficiency η (rated operation)	0.97	0.98	0.97	0.98		
Power loss (at 2.5 kHz) [kW]	0.90	1.10	1.45	1.50		
Cooling-air requirement [m³/s]	0.10	0.10	0.10	0.10		
Sound pressure levels, types of construction, dimensions, weights						
Sound pressure level IP00 [dB(A)]	69	69	69	69		
Type of construction	E	E	E	E		
Dimensions [mm] • Width • Height • Depth	270 1050 350	270 1050 350	270 1050 350	270 1050 350		
Weight approx. [kg]	55	55	55	55		

Table 13-3 Air-cooled inverter (part 1)

Designation		Value					
Order No.	6SE70...	31-0TE60	31-2TF60	31-5TF60	31-8TF60	32-1TG60	32-6TG60
Rated voltage • Input • Output	[V]	DC 510 (-15 %) to 650 (+10 %) 3 AC 0 up to rated DC voltage x 0.75					
Rated frequency • Input • Output: V/f = constant V = constant	[Hz]	--- 0 to 600 8 to 300					
Rated current • Input • Output	[A]	110 92	148 124	174 146	221 186	250 210	309 260
DC link voltage	[V]	= Rated DC voltage					
Rated output	[kVA]	61 to 76	82 to 103	97 to 121	123 to 154	139 to 174	172 to 216
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 ± 15 %					
• 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]	1.7 to 16	1.7 to 16	1.7 to 9	1.7 to 9	1.7 to 7.5	1.7 to 7.5
Derating curve (see Fig. 13-1)		①	①	②	②	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					
Load class II to EN 60 146-1-1 (additional)							
Base load current	[A]	0.91 x rated output current					
Base load duration	[s]	270					
Overload current	[A]	1.6 x rated output current					
Overload duration	[s]	30					
Losses, cooling, power factor							
Power factor conv. $\cos\varphi C$		< 0.92 ind.					
Efficiency η (rated operation)		≥ 0.98					
Power loss (at 2.5 kHz)	[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 • Width • Height • Depth	[mm]	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 13-4 Air-cooled inverter (part 2)

Designation	Value					
Order No. 6SE70...	33-2TG60	33-7TG60	35-1TJ60	36-0TJ60	37-0TJ60	37-0TK60
Rated voltage [V] • Input • Output	DC 510 (-15 %) to 650 (+10 %) 3 AC 0 up to rated DC voltage x 0.75					
Rated frequency [Hz] • Input • Output: V/f = constant V = constant	--- 0 to 600 8 to 300					
Rated current [A] • Input • Output	375 315	440 370	607 510	702 590	821 690	821 690
DC link voltage [V]	= rated DC voltage					
Rated output [kVA]	208 to 261	244 to 307	336 to 424	389 to 490	455 to 573	455 to 573
Auxiliary current supply [V]	DC 24 (20 - 30)					
• Max. aux. curr. requirement[A] Standard version at 20 V	2.3		3.0			
• Max. aux. curr. requirement[A] Maximum version at 20 V	3.5		4.2			
Auxiliary current supply fan [V]	1 AC or 2 AC 230 ± 15 %					
• Aux. curr. requirem. at 50 Hz [A]	0.95		2.2		4.5	
• Aux. curr. requirem. at 60 Hz [A]	1.4		3.4		6.9	
Pulse frequency [kHz]	1.7 to 6	1.7 to 6	1.7 to 6	1.7 to 5	1.7 to 2.5	1.7 to 2.5
Derating curve (see Fig. 13-1)	④	④	④	⑤	⑦	⑦
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					
Load class II to EN 60 146-1-1 (additional)						
Base load current [A]	0.91 x output current		not additional			
Base load duration [s]	270		not additional			
Overload current [A]	1.6 x output current		not additional			
Overload duration [s]	30		not additional			
Losses, cooling, power factor						
Power factor conv. CosφC	< 0.92 ind.					
Efficiency η (rated operation)	≥ 0.98					
Power loss (at 2.5 kHz) [kW]	3.47	4.05	5.8	6.6	8.2	8.8
Cooling-air requirement [m³/s]	0.41	0.41	0.46	0.46	0.60	0.60
Sound pressure levels, types of construction, dimensions, weights						
Sound pressure level IP00 [dB(A)]	82	82	77	77	80	80
Type of construction	G	G	J	J	J	K
Dimensions [mm] • Width • Height • Depth	508 1450 450	508 1450 450	800 1400 551	800 1400 551	800 1400 551	800 1750 551
Weight approx. [kg]	155	155	250	250	275	500

Table 13-5 Air-cooled inverter (part 3)

Designation		Value					
Order No.	6SE70...	38-6TK60	41-1TK60	41-3TL60	41-6TQ60	41-6TM60	42-1TQ60
Rated voltage • Input • Output	[V]	DC 510 (-15 %) to 650 (+10 %) 3 AC 0 up to rated DC voltage x 0.75					
Rated frequency • Input • Output: V/f = constant V = constant	[Hz]	--- 0 to 600 8 to 300					
Rated current • Input • Output	[A]	1023 860	1310 1100	1551 1300	1940 1630	1940 1630	2490 2090
DC link voltage	[V]	= rated DC voltage					
Rated output	[kVA]	567 to 714	724 to 914	856 to 1080	1073 to 1355	1073 to 1355	1375 to 1737
Auxiliary current supply	[V]	DC 24 (20 - 30)					
• Max. aux. curr. requirement Standard version at 20 V	[A]	3.0	3.0	3.0	5.2 (Master + Slave)		
• Max. aux. curr. requirement Maximum version at 20 V	[A]	4.2	4.2	4.2	6.6 (Master + Slave)		
Auxiliary current supply fan	[V]	1 AC or 2 AC 230 ± 15 %					
• Aux. curr. requirem. at 50 Hz	[A]	4.5	12.8		9		25.6
• Aux. curr. requirem. at 60 Hz	[A]	6.9	22		13.8		44.0
Pulse frequency	[kHz]	1.7 to 2.5	1.7 to 2.5	1.7 to 2.5	1.7 to 2.5	1.7 to 2.5	1.7to 2.5
Derating curve (see Fig. 13-1)		⑦	⑦	⑦	⑦	⑦	⑦
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. $\cos\varphi C$		< 0.92 ind.					
Efficiency η (rated operation)		≥ 0.98					
Power loss (at 2.5 kHz)	[kW]	11.9	13.4	14.5	22.6	23.6	25.4
Cooling-air requirement	[m³/s]	0.60	0.88	0.92	1.20	1.20	1.76
Sound pressure levels, types of construction, dimensions, weights							
Sound pressure level IP00	[dB(A)]	80	82	89	87	87	89
Type of construction		K	K	L	Q 1)	M 2)	Q 1)
Dimensions • Width • Height • Depth	[mm]	800 1750 551	800 1750 551	1100 1750 551	(2 x 800) 1750 551	(2x800+508) 1750 551	(2x800) 1750 551
Weight approx.	[kg]	520	540	850	1040	1200	1080

1) without interphase transformer chassis

2) with interphase transformer chassis

Table 13-6 Air-cooled inverter (part 4)

Designation	Value					
Order No. 6SE70...	42-5TN60					
Rated voltage [V] • Input • Output	DC 510 (-15 %) to 650 (+10 %) 3 AC 0 up to rated DC voltage x 0.75					
Rated frequency [Hz] • Input • Output: V/f = constant V = constant	--- 0 to 600 8 to 300					
Rated current [A] • Input • Output	2940 2470					
DC link voltage [V]	= rated DC voltage					
Rated output [kVA]	1626 to 2053					
Auxiliary current supply [V]	DC 24 (20 - 30)					
• Max. aux. curr. requirement[A] Standard version at 20 V	5.2 (Master + Slave)					
• Max. aux. curr. requirement[A] Maximum version at 20 V	6.6 (Master + Slave)					
Auxiliary current supply fan [V]	1 AC or 2 AC 230 ± 15 %					
• Aux. curr. requirem. at 50 Hz [A]	25.6					
• Aux. curr. requirem. at 60 Hz [A]	44.0					
Pulse frequency [kHz]	1.7 to 2.5					
Derating curve (see Fig. 13-1)	⑦					
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. cosφC	< 0.92 ind.					
Efficiency η (rated operation)	≥ 0.98					
Power loss (at 2.5 kHz) [kW]	27.5					
Cooling-air requirement [m³/s]	1.84					
Sound pressure levels, types of construction, dimensions, weights						
Sound pressure level IP00 [dB(A)]	91					
Type of construction	N[1)]					
Dimensions [mm] • Width • Height • Depth	2x1100 1750 551					
Weight approx. [kg]	1700					

1) without interphase transformer chassis

Table 13-7 Air-cooled inverter (part 5)

Designation	Value					
Order No. 6SE70...	26-1UE60	26-6UE60	28-0UF60	31-1UF60	31-3UG60	31-6UG60
Rated voltage [V] • Input • Output	DC 675 (-15 %) to 810 (+ 10 %) 3 AC 0 up to rated DC voltage x 0.75					
Rated frequency [Hz] • Input • Output: V/f = constant V = constant	--- 0 to 600 8 to 300					
Rated current [A] • Input • Output	73 61	79 66	94 79	129 108	152 128	186 156
DC link voltage [V]	= rated DC voltage					
Rated output [kVA]	53 to 63	58 to 68	69 to 82	94 to 112	111 to 133	136 to 162
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 ± 15 %					
• 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]	1.7 to 16	1.7 to 16	1.7 to 9	1.7 to 7.5	1.7 to 7.5	1.7 to 6
Derating curve (see Fig. 13-1)	①	①	②	③	③	④
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					
Load class II to EN 60 146-1-1 (additional)						
Base load current [A]	0.91 x rated output current					
Base load duration [s]	270					
Overload current [A]	1.6 x rated output current					
Overload duration [s]	30					
Losses, cooling, power factor						
Power factor conv. cosφC	< 0.92 ind.					
Efficiency η (rated operation)	≥ 0.98					
Power loss (at 2.5 kHz) [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 450	508 1450 450	508 1450 450
Weight approx. [kg]	55	55	65	65	155	155

Table 13-8 Air-cooled inverter (part 6)

Designation	Value					
Order No. 6SE70...	32-0UG60	32-3UG60	33-0UJ60	33-5UJ60	34-5UJ60	35-7UK60
Rated voltage [V] • Input • Output	DC 675 (-15 %) to 810 (+ 10 %) 3 AC 0 up to rated DC voltage x 0.75					
Rated frequency [Hz] • Input • Output: V/f = constant V = constant	--- 0 to 600 8 to 300					
Rated current [A] • Input • Output	228 192	268 225	353 297	421 354	538 452	678 570
DC link voltage [V]	= rated DC voltage					
Rated output [kVA]	167 to 199	195 to 233	258 to 308	307 to 367	392 to 469	494 to 592
Auxiliary current supply [V]	DC 24 (20 - 30)					
• Max. aux. curr. requirement[A] Standard version at 20 V	2.3		3.0			
• Max. aux. curr. requirement[A] Maximum version at 20 V	3.5		4.2			
Auxiliary current supply fan [V]	1 AC or 2 AC 230 ± 15 %					
• Aux. curr. requirem. at 50 Hz [A]	0.95		2.2			4.5
• Aux. curr. requirem. at 60 Hz [A]	1.4		3.4			6.9
Pulse frequency [kHz]	1.7 to 6	1.7 to 6	1.7 to 3	1.7 to 3	1.7 to 2.5	1.7 to 2.5
Derating curve (see Fig. 13-1)	④	④	⑥	⑥	⑦	⑦
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					
Load class II to EN 60 146-1-1 (additional)						
Base load current [A]	0.91 x output current		not additional			
Base load duration [s]	270		not additional			
Overload current [A]	1.6 x output current		not additional			
Overload duration [s]	30		not additional			
Losses, cooling, power factor						
Power factor conv. $\cos\varphi C$	< 0.92 ind.					
Efficiency η (rated operation)	≥ 0.98	≥ 0.97	≥ 0.98			
Power loss (at 2.5 kHz) [kW]	2.82	3.40	5.00	5.60	7.00	8.90
Cooling-air requirement [m³/s]	0.41	0.41	0.46	0.46	0.46	0.60
Sound pressure levels, types of construction, dimensions, weights						
Sound pressure level IP00 [dB(A)]	82	82	77	77	77	80
Type of construction	G	G	J	J	J	K
Dimensions [mm] • Width • Height • Depth	508 1450 450	508 1450 450	800 1400 551	800 1400 551	800 1400 551	800 1750 551
Weight approx. [kg]	155	155	250	250	250	500

Table 13-9 Air-cooled inverter (part 7)

Designation	Value					
Order No. 6SE70...	36-5UK60	38-6UK60	41-1UL60	41-2UL60	41-4UQ60	41-6UQ60
Rated voltage [V] • Input • Output	DC 675 (-15 %) to 810 (+ 10 %) 3 AC 0 up to rated DC voltage x 0.75					
Rated frequency [Hz] • Input • Output: V/f = constant V = constant	--- 0 to 600 8 to 300					
Rated current [A] • Input • Output	774 650	1023 860	1285 1080	1464 1230	1666 1400	1880 1580
DC link voltage [V]	= rated DC voltage					
Rated output [kVA]	563 to 675	745 to 893	936 to 1122	1066 to 1278	1213 to 1454	1369 to 1641
Auxiliary current supply [V]	DC 24 (20 - 30)					
• Max. aux. curr. requirement[A] Standard version at 20 V	3.0				5.2 (Master + Slave)	
• Max. aux. curr. requirement[A] Maximum version at 20 V	4.2				6.6 (Master + Slave)	
Auxiliary current supply fan [V]	1 AC or 2 AC 230 ± 15 %					
• Aux. curr. requirem. at 50 Hz [A]	4.5	12.8			25.6	
• Aux. curr. requirem. at 60 Hz [A]	6.9	22.0			44.0	
Pulse frequency [kHz]	1.7 to 2.5	1.7 to 2.5	1.7 to 2.5	1.7 to 2.5	1.7 to 2.5	1.7 to 2.5
Derating curve (see Fig. 13-1)	⑦	⑦	⑦	⑦	⑦	⑦
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. cosφC	< 0.92 ind.					
Efficiency η (rated operation)	≥ 0.98					
Power loss (at 2.5 kHz) [kW]	10.0	11.6	14.2	16.7	19.0	22.0
Cooling-air requirement [m³/s]	0.60	0.88	0.92	0.92	1.76	1.76
Sound pressure levels, types of construction, dimensions, weights						
Sound pressure level IP00 [dB(A)]	80	82	89	89	87	87
Type of construction	K	K	L	L	Q[1)]	Q[1)]
Dimensions [mm] • Width • Height • Depth	800 1750 551	800 1790 551	1100 1750 551	1100 1750 551	(2 x 800) 1750 551	(2 x 800) 1750 551
Weight approx. [kg]	520	520	850	850	1200	1200

1) without interphase transformer chassis

Table 13-10 Air-cooled inverter (part 8)

Designation	Value					
Order No. 6SE70...	41-4UM60	41-6UM60	42-1UN60	42-3UN60		
Rated voltage [V] • Input • Output	DC 675 (-15 %) to 810 (+ 10 %) 3 AC 0 up to rated DC voltage x 0.75					
Rated frequency [Hz] • Input • Output: V/f = constant V = constant	--- 0 to 600 8 to 300					
Rated current [A] • Input • Output	1666 1400	1880 1580	2440 2050	2785 2340		
DC link voltage [V]	= rated DC voltage					
Rated output [kVA]	1213 to 1454	1369 to 1641	1775 to 2130	2026 to 2432		
Auxiliary current supply [V]	DC 24 (20 - 30)					
• Max. aux. curr. requirement[A] Standard version at 20 V	5.2 (Master + Slave)					
• Max. aux. curr. requirement[A] Maximum version at 20 V	6.6 (Master + Slave)					
Auxiliary current supply fan [V]	1 AC or 2 AC 230 ± 15 %					
• Aux. curr. requirem. at 50 Hz [A]	25.6					
• Aux. curr. requirem. at 60 Hz [A]	44.0					
Pulse frequency [kHz]	1.7 to 2.5	1.7 to 2.5	1.7 to 2.5	1.7 to 2.5		
Derating curve (see Fig. 13-1)	⑦	⑦	⑦	⑦		
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. $\cos\varphi C$	< 0.92 ind.					
Efficiency η (rated operation)	≥ 0.98					
Power loss (at 2.5 kHz) [kW]	20.0	23.0	27.0	31.7		
Cooling-air requirement [m³/s]	1.76	1.76	1.84	1.84		
Sound pressure levels, types of construction, dimensions, weights						
Sound pressure level IP00 [dB(A)]	87	87	91	91		
Type of construction	M 2)	M 2)	N 1)	N 1)		
Dimensions [mm] • Width • Height • Depth	(2x800+508) 1750 551	(2x800+508) 1750 551	(2x1100) 1750 551	(2x1100) 1750 551		
Weight approx. [kg]	1500	1500	1700	1700		

1) without interphase transformer chassis

2) with interphase transformer chassis

Table 13-11 Air-cooled inverter (part 9)

Designation	Value					
Order No. 6SE70...	26-0WF60	28-2WF60	31-0WG60	31-2WG60	31-5WG60	31-7WG60
Rated voltage [V] • Input • Output	DC 890 to 930 (± 15 %) 3 AC 0 up to rated DC voltage x 0.75					
Rated frequency [Hz] • Input • Output: V/f = constant V = constant	--- 0 to 600 8 to 300					
Rated current [A] • Input • Output	71 60	98 82	115 97	140 118	173 145	204 171
DC link voltage [V]	= Rated DC voltage					
Rated output [kVA]	69 to 71	94 to 97	111 to 115	135 to 141	166 to 173	196 to 204
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 ± 15 %					
• 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]	1.7 to 7.5	1.7 to 7.5	1.7 to 7.5	1.7 to 7.5	1.7 to 6	1.7 to 6
Derating curve (see Fig. 13-1)	③	③	③	③	④	④
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. cosφC	< 0.92 ind.					
Efficiency η (rated operation)	≥ 0.98					
Power loss (at 2.5 kHz) [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 13-12 Air-cooled inverter (part 10)

Designation	Value					
Order No. 6SE70...	32-1WG60	33-0WJ60	33-5WJ60	34-5WJ60	35-7WK60	36-5WK60
Rated voltage [V] • Input • Output	DC 890 to 930 (± 15 %) 3 AC 0 up to rated DC voltage x 0.75					
Rated frequency [Hz] • Input • Output: V/f = constant V = constant	--- 0 to 600 8 to 300					
Rated current [A] • Input • Output	248 208	353 297	421 354	538 452	678 570	774 650
DC link voltage [V]	= rated DC voltage					
Rated output [kVA]	238 to 284	340 to 354	405 to 423	517 to 540	652 to 681	743 to 776
Auxiliary current supply [V]	DC 24 (20 - 30)					
• Max. aux. curr. requirement[A] Standard version at 20 V	2.3	3.0				
• Max. aux. curr. requirement[A] Maximum version at 20 V	3.5	4.2				
Auxiliary current supply fan [V]	1 AC or 2 AC 230 ± 15 %					
• Aux. curr. requirem. at 50 Hz [A]	1.1	2.2			4.5	
• Aux. curr. requirem. at 60 Hz [A]	1.4	3.4			6.9	
Pulse frequency [kHz]	1.7 to 6	1.7 to 2.5				
Derating curve (see Fig. 13-1)	④	⑦				
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. CosφC	< 0.92 ind.					
Efficiency η (rated operation)	≥ 0.98					
Power loss (at 2.5 kHz) [kW]	3.70	5.80	6.30	7.80	9.40	11.00
Cooling-air requirement [m³/s]	0.41	0.46	0.46	0.46	0.60	0.60
Sound pressure levels, types of construction, dimensions, weights						
Sound pressure level IP00 [dB(A)]	82	77	77	77	80	80
Type of construction	G	J	J	J	K	K
Dimensions [mm] • Width • Height • Depth	508 1450 450	800 1400 551	800 1400 551	800 1400 551	800 1750 551	800 1750 551
Weight approx. [kg]	250	250	250	250	500	520

Table 13-13 Air-cooled inverter (part 11)

Designation	Value					
Order No. 6SE70...	38-6WK60	41-1WL60	41-2WL60	41-4WQ60	41-6WQ60	41-4WM60
Rated voltage [V] • Input • Output	DC 890 to 930 (± 15 %) 3 AC 0 up to rated DC voltage x 0.75					
Rated frequency [Hz] • Input • Output: V/f = constant V = constant	--- 0 to 600 8 to 300					
Rated current [A] • Input • Output	1023 860	1285 1080	1464 1230	1666 1400	1880 1580	1666 1400
DC link voltage [V]	= rated DC voltage					
Rated output [kVA]	984 to 1027	1235 to 1290	1407 to 1469	1601 to 1673	1807 to 1888	1601 to 1673
Auxiliary current supply [V]	DC 24 (20 - 30)					
• Max. aux. curr. requirement[A] Standard version at 20 V	3.0			5.2 (Master + Slave)		
• Max. aux. curr. requirement[A] Maximum version at 20 V	4.2			6.6 (Master + Slave)		
Auxiliary current supply fan [V]	1 AC or 2 AC 230 ± 15 %					
• Aux. curr. requirem. at 50 Hz [A]	12.8			25.6		
• Aux. curr. requirem. at 60 Hz [A]	22.0			44.0		
Pulse frequency [kHz]	1.7 to 2.5					
Derating curve (see Fig. 13-1)	⑦					
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. $\cos\varphi C$	< 0.92 ind.					
Efficiency η (rated operation)	≥ 0.98					
Power loss (at 2.5 kHz) [kW]	13.90	17.20	22.90	22.60	25.50	23.60
Cooling-air requirement [m³/s]	0.88	0.92	0.92	1.76	1.76	1.76
Sound pressure levels, types of construction, dimensions, weights						
Sound pressure level IP00 [dB(A)]	82	89	89	87	87	87
Type of construction	K	L	L	Q 1)	Q 1)	M 2)
Dimensions [mm] • Width • Height • Depth	800 1750 551	1100 1750 551	1100 1750 551	(2 x 800) 1750 551	(2 x 800) 1750 551	(2x800+508) 1750 551
Weight approx. [kg]	520	850	850	1200	1200	1500

1) without interphase transformer chassis
2) with interphase transformer chassis

Table 13-14 Air-cooled inverter (part 12)

Designation	Value					
Order No. 6SE70...	41-6WM60	42-1WN60	42-3WN60			
Rated voltage [V] • Input • Output	DC 890 to 930 (± 15 %) 3 AC 0 up to rated DC voltage x 0.75					
Rated frequency [Hz] • Input • Output: V/f = constant V = constant	--- 0 to 600 8 to 300					
Rated current [A] • Input • Output	1880 1580	2440 2050	2785 2340			
DC link voltage [V]	= Rated DC voltage					
Rated output [kVA]	1807 to 1888	2343 to 2450	2675 to 2797			
Auxiliary current supply [V]	DC 24 (20 - 30)					
• Max. aux. curr. requirement[A] Standard version at 20 V	5.2 (Master + Slave)					
• Max. aux. curr. requirement[A] Maximum version at 20 V	6.6 (Master+Sl.)	5.2 (Master + Slave)				
Auxiliary current supply fan [V]	1 AC or 2 AC 230 ± 15 %					
• Aux. curr. requirem. at 50 Hz [A]	25.6					
• Aux. curr. requirem. at 60 Hz [A]	44.0					
Pulse frequency [kHz]	1.7 to 2.5					
Derating curve (see Fig. 13-1)	⑦					
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. $\cos\varphi$C	< 0.92 ind.					
Efficiency η (rated operation)	≥ 0.98					
Power loss (at 2.5 kHz) [kW]	26.50	32.70	43.50			
Cooling-air requirement [m³/s]	1.76	1.84	1.84			
Sound pressure levels, types of construction, dimensions, weights						
Sound pressure level IP00 [dB(A)]	87	91	91			
Type of construction	M[2]	N[1]	N[1]			
Dimensions [mm] • Width • Height • Depth	(2x800+508) 1750 551	(2x1100) 1750 551	(2x1100) 1750 551			
Weight approx. [kg]	1500	1700	1700			

1) without interphase transformer chassis
2) with interphase transformer chassis

Table 13-15 Air-cooled inverter (part 13)

Water-cooled inverter

Order No.	Power loss (at 2.5 kHz) [kW]	Cooling water requirement *) [l/min]	Maximum additional heat dissipation at Tair ≤ 30 °C [kW]	Typical pressure drop according to volumetric flow
Rated input voltage DC 510 to 650 V				
6SE7031-0TE60-1AA1	1.05	7.25	0.7	0.2 bar at 7.3 l/min
6SE7031-2TF60-1AA1	1.35	9.20	0.7	0.2 bar at 11 l/min
6SE7031-5TF60-1AA1	1.56	10.20	0.7	0.2 bar at 11 l/min
6SE7031-8TF60-1AA1	1.70	11.10	0.7	0.2 bar at 11 l/min
6SE7032-1TG60-1AA1	2.18	16.10	1.5	0.2 bar at 25 l/min
6SE7032-6TG60-1AA1	2.75	18.90	1.5	0.2 bar at 25 l/min
6SE7033-2TG60-1AA1	3.47	22.40	1.5	0.2 bar at 25 l/min
6SE7033-7TG60-1AA1	4.05	25.30	1.5	0.2 bar at 25 l/min
Rated input voltage DC 675 to 810 V				
6SE7026-1UE60-1AA1	0.75	6.20	0.7	0.2 bar at 7.3 l/min
6SE7026-6UF60-1AA1	0.84	6.65	0.7	0.2 bar at 11 l/min
6SE7028-0UF60-1AA1	1.04	7.55	0.7	0.2 bar at 11 l/min
6SE7031-1UF60-1AA1	1.50	9.65	1.5	0.2 bar at 11 l/min
6SE7031-3UG60-1AA1	1.80	14.00	1.5	0.2 bar at 25 l/min
6SE7031-6UG60-1AA1	2.18	15.70	1.5	0.2 bar at 25 l/min
6SE7032-0UG60-1AA1	2.82	18.90	1.5	0.2 bar at 25 l/min
6SE7032-3UG60-1AA1	3.40	21.40	1.5	0.2 bar at 25 l/min
Rated input voltage DC 890 to 930 V				
6SE7026-0WF60-1AA1	0.90	6.75	0.7	0.2 bar at 11 l/min
6SE7028-2WF60-1AA1	1.24	8.40	0.7	0.2 bar at 11 l/min
6SE7031-0WG60-1AA1	1.68	12.45	1.5	0.2 bar at 25 l/min
6SE7031-2WG60-1AA1	2.03	14.75	1.5	0.2 bar at 25 l/min
6SE7031-5WG60-1AA1	2.43	16.70	1.5	0.2 bar at 25 l/min
6SE7031-7WG60-1AA1	3.05	19.25	1.5	0.2 bar at 25 l/min
6SE7032-1WG60-1AA1	3.70	22.35	1.5	0.2 bar at 25 l/min

Table 13-16 Water-cooled inverter

NOTE

These units and the air-cooled inverters are identically constructed. Instead of the heat sink for air, an air/water cooler has been installed.

All the technical data not listed in Table 13-16 for a particular unit are the same as those of the air-cooled inverter. The first 12 positions of the Order No. are identical. The supplement "-1AA1" indicates water cooling.

Refer to the tables in Section 13.1.7 for the data for water-cooled units of types J to Q.

*) The cooling water requirement applies for the unit rating of the inverter and 100% utilization of the additional heat dissipation obtained from a water temperature rise intake/return of ΔT = 5 K.

Cooling, power requirement of fan, sound pressure level

The following values apply to units:
6SE7035-1TJ60, 6SE7036-0TJ60, 6SE7033-0UJ60
6SE7033-5UJ60. 6SE7034-5UJ60, 6SE7033-0WJ60
6SE7033-5WJ60, 6SE7034-5WJ60

Fan voltage / frequency	**[V / Hz]**	**230 / 50**	**230 / 60**
Fan current-requirement	[A]	2.45	3.6
Flow	[m^3/s]	0.46	0.464
Sound pressure level IP00	[dB(A)]	77	77.5
Sound pressure level chassis in IP20 - cabinet	[dB(A)]	70.5	71.5
Sound pressure level chassis in IP42 - cabinet with dust filter, 400 mm high cabinet cover	[dB(A)]	70.5	71

The following values apply to units:
6SE7037-0TJ60, 6SE7037-0TK60, 6SE7038-6TK60,
6SE7035-7UK60, 6SE7036-5UK60, 6SE7035-7WK60,
6SE7036-5WJ60

Fan voltage / frequency	**[V / Hz]**	**230 / 50**	**230 / 60**
Fan current-requirement	[A]	5.0	7.4
Flow	[m^3/s]	0.6	0.6
Sound pressure level IP00	[dB(A)]	80	82
Sound pressure level chassis in IP20 - cabinet	[dB(A)]	76	77
Sound pressure level chassis in IP42 - cabinet with dust filter, 400 mm high cabinet cover	[dB(A)]	74	75

The following values apply to units:
6SE7041-1TK60, 6SE7038-6UK60, 6SE7038-6WK60

Fan voltage / frequency	**[V / Hz]**	**230 / 50**	**230 / 60**
Fan current-requirement	[A]	12.8	22
Flow	[m^3/s]	0.88	0.88
Sound pressure level IP00	[dB(A)]	82	86
Sound pressure level chassis in IP20 - cabinet	[dB(A)]	82	85
Sound pressure level chassis in IP42 - cabinet with dust filter, 400 mm high cabinet cover	[dB(A)]	81	84

The following values apply to units:
6SE7041-3TL60, 6SE7041-1UL60, 6SE7041-2UL60
6SE7041-1WL60, 6SE7041-2WL60

Fan voltage / frequency	**[V / Hz]**	**230 / 50**	**230 / 60**
Fan current-requirement	[A]	12.8	22
Flow	[m^3/s]	0.95	1.06
Sound pressure level IP00	[dB(A)]	89.2	91.3
Sound pressure level chassis in IP20 - cabinet	[dB(A)]	84.5	88.5
Sound pressure level chassis in IP42 - cabinet with dust filter, 400 mm high cabinet cover	[dB(A)]	84.3	87.2

Condition for sound-pressure measurement:

- ♦ Room height: 6 m
- ♦ Distance to nearest reflecting wall: 4 m

NOTE
Type of construction M, N, Q

The values for the power requirement and the volumetric flow have to be doubled respectively: the sound pressure level increases by max. 3 dB(A).

13.1 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).

13.1.1 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.

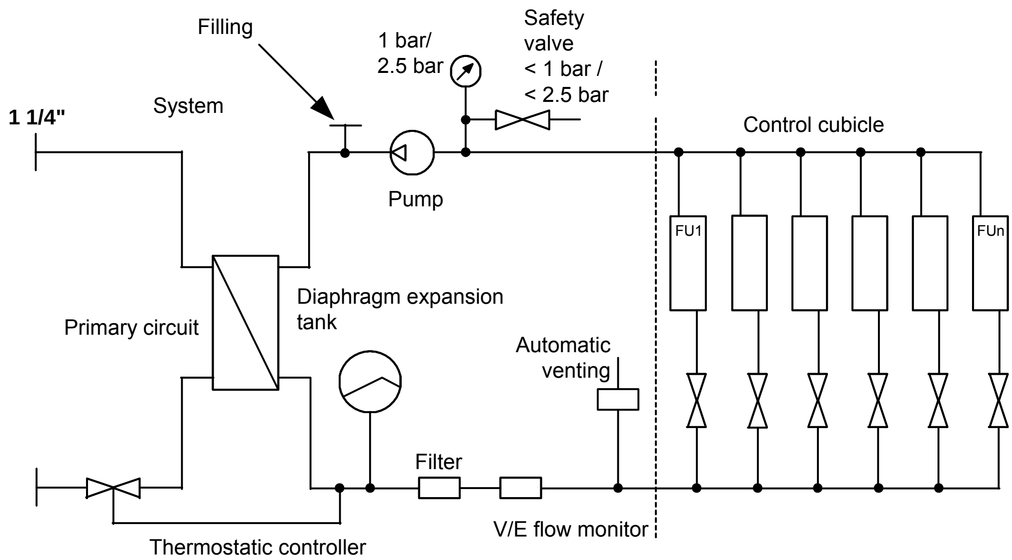


Fig. 13-3 Water-to-water heat exchanger

Water-water heat exchangers

If a water supply system is already available in the plant which does not exceed temperatures above 35 °C but does not fulfil the cooling water requirements, the two cooling systems can be connected using a water-water heat exchanger.

The coolers of the frequency converters are connected via a manifold so that the necessary flow rate is ensured but the pressure does not exceed the permitted value. Factors such as height differences and distances must be taken into account.

For devices without antifreeze, we recommend using Nalco 00GE 056 from ONDEO Nalco. This is an organic corrosion inhibitor specially developed for semi-open and closed cooling systems. It protects metals against corrosion by forming a protective organic film on the surface of the metal.

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 Tables 13-19 to 13-21.
This can be done, for example, by means of valves with flowmeter (e.g. as made by “OSTACO AG”, CH-8902 Urdorf,
Tel. ++41447355555).

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 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 *) and air venting devices.

When the system is filled for the first time, the heat sinks have to be vented (see Section 13.1.7 "Start-up").

Units larger than or equal to type J have a vent valve for this purpose. On type E to G units there are no vent valves. Venting has to take place externally via the free tap (see Fig. 13-3).

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, Reckitt Benckiser Deutschland GmbH, D-68165 Mannheim, Tel.: ++490621/32460.

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).

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*) ≤ 1.2 bar at a permissible operating pressure of 1.0 bar, or ≤ 3 bar at a permissible operating pressure of 2.5 bar

13.1.2 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 Fig. 13-4 and Fig. 13-5 (Curve 1).

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

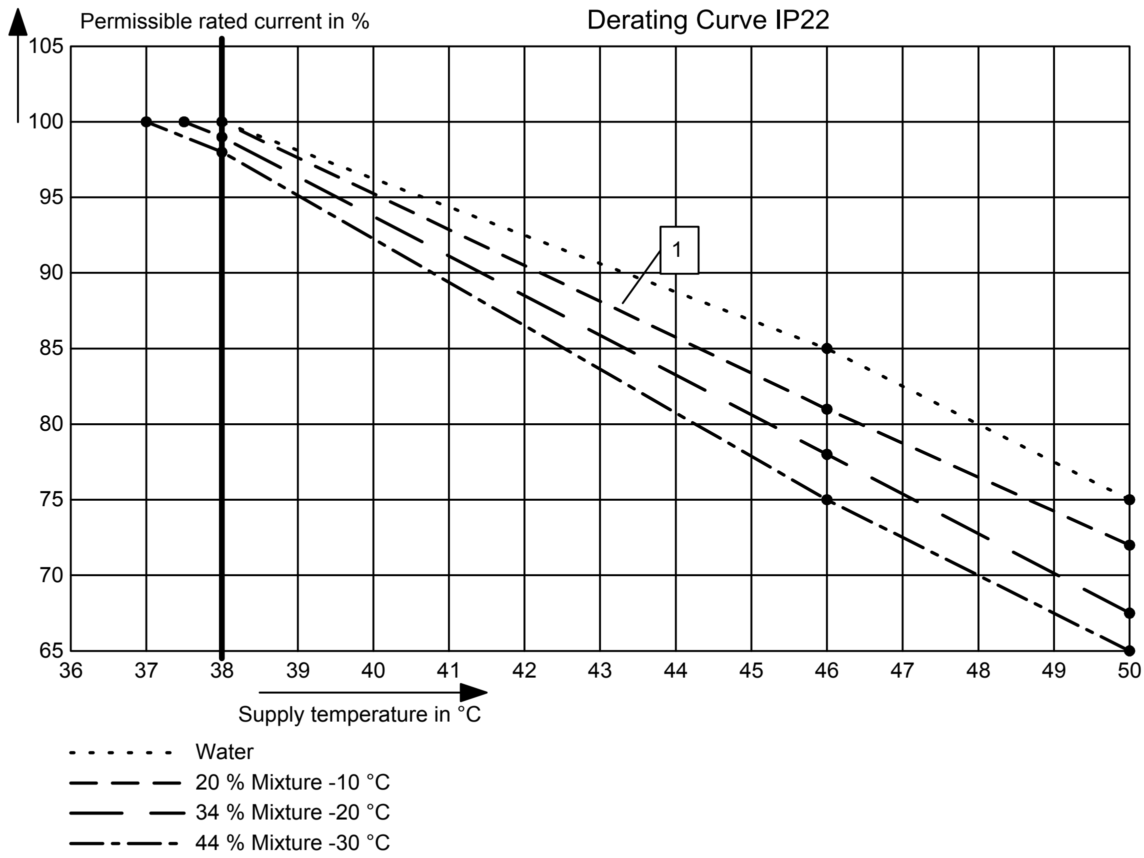

Fig. 13-4 Reduction curve applying to installation in IP22 cabinets

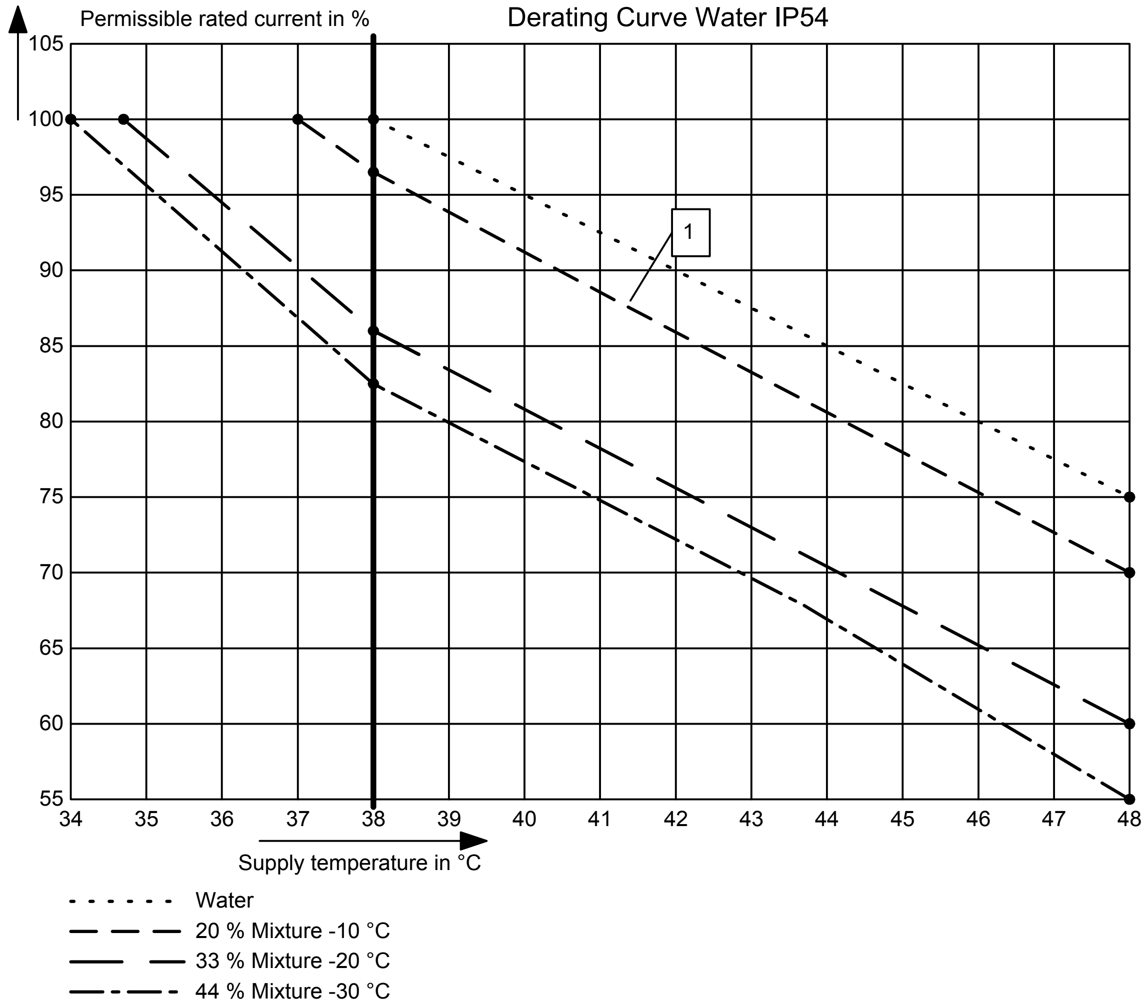

Fig. 13-5 Reduction curve 2 applying to installation in IP54 cabinets

NOTE

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

13.1.3 Coolant

Normal service water with corrosion protection (see section "Corrosion protection agent") or a water/antifreeze mixture (see section "Antifreeze additive") can be used as a coolant.

13.1.3.1 Definition of cooling water

The cooling water must meet the following requirements in the long term:

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	
• Type of construction E to G	≤ 1,0 bar
• Type of construction ≥ J	≤ 2,5 bar

Alternatively, use deionized water ("battery water" in accordance with DIN 43530, Part 4).

NOTICE

No operating pressures higher than 1.0 bar, or 2.5 bar (≥ type of construction J) are permitted!

If the system is operating at a higher pressure, the supply pressure must be reduced to 2.5 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.

13.1.3.2 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" (Figs. 13-4 and 13-5). 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 Clariant, www.clariant.com) is preferred for use as antifreeze.

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 13-17 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.

13.1.3.3 Corrosion protection agent

We recommend the use of a corrosion protection inhibitor for the cooling circuit, e.g. NALCO 00GE056 corrosion protection from ONDEO Nalco (Nalco Deutschland GmbH, www.nalco.com, D-60486 Frankfurt, Tel. +49-697934-0). Concentration of the corrosion protection inhibitor in the cooling water 0.2 ... 0.25 %.

The cooling water should be checked 3 months after the first filling of the cooling circuit and then once a year.

Control kits for testing the inhibitor concentration are available from ONDEO Nalco.

NOTE

Always observe the manufacturer’s instructions when refilling the anti-corrosion agent.

If any clouding, discoloration or bacteria are detected in the cooling water, the cooling circuit has to be flushed out and refilled.

An inspection glass should be installed in the cooling circuit to be able to monitor the cooling water easily.

13.1.4 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 13-18 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. Temperature control is recommended for this purpose (see Fig. 13-3). 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.
2. 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.
3. A humidity alarm can be installed to give a warning when condensation is imminent. Such an alarm is available from ENDRICH (www.endrich.com); when the temperature falls to within 2 K of dew point, a signal contact closes.

13.1.5 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 (Nalco Deutschland GmbH; www.nalco.com; D-60486 Frankfurt, Tel. +49-697934-0).

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".

NOTICE

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").

13.1.6 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.

13.1.7 Characteristic data of water-cooled units, types J, K and L (M, Q, N, R)

The tables listed below give the rated water flow volume in l/min and the pressure difference (in Pa) across the heat sink at rated flow volume.

The water-cooled units have a lower power loss (i.e. a higher efficiency) than the air-cooled units. The power loss is given in tables 13-19 to 13-21.

Background

MASTERDRIVES with water-cooling have the same power rating as the air-cooled units. Since the thermal resistance of the heat sinks for the IGBT is distinctly better than that attainable with air-cooling, the modules are operated with a junction temperature that is 20 K lower. The result of this is that the module losses are about 5 % lower.

This effect also gives the modules a good life expectancy.

Many units are also equipped with small built-in fans. The lower power losses of these can also be taken into account.

NOTE

In the tables below, the data for new units or more exact data are printed in bold type.

MLFB	Flow [l/min]	Differential pressure [Pa]	Sound level IP20 [dBA]*	Sound level IP42 [dBA]*	Sound level IP54 [dBA]*	Water heating [k]	Power loss [kW]
6SE7035-1TJ60-1AA0	24	**16900**	76	75	72	4	5.58
6SE7036-0TJ60-1AA0	26	**19840**	76	75	72	4	6.39
6SE7037-0TJ60-1AA0	**30**	**27270**	**76**	**75**	**72**	**4.5**	**7.74**
6SE7037-0TK60-1AA0	30	**9300**	76	76	73	5	9.05
6SE7038-6TK60-1AA0	40	**16560**	76	76	73	5	10.4
6SE7041-1TK60-1AA0	46	**21900**	76	76	73	5	10.7
6SE7041-3TL60-1AA0	51	**12000**	75	74	71	5	12.3

Table 13-19 Characteristic data of DC units, 510 V to 650 V

MLFB	Flow [l/min]	Differential pressure [Pa]	Sound level IP20 [dBA]*	Sound level IP42 [dBA]*	Sound level IP54 [dBA]*	Water heating [k]	Power loss [kW]
6SE7033-0UJ60-1AA0	20	**11740**	76	75	72	4	4.84
6SE7033-5UJ60-1AA0	22	**14660**	76	75	72	4	5.58
6SE7034-5UJ60-1AA0	27	**22090**	76	75	72	4	6.75
6SE7035-7UK60-1AA0	28	**8100**	76	76	73	5	7.85
6SE7036-5UK60-1AA0	32	**10600**	76	76	73	5	8.8
6SE7038-6UK60-1AA0	38	**14940**	76	76	73	5	9.35
6SE7041-1UL60-1AA0	46	**9750**	75	74	71	5	12.2
6SE7041-2UL60-1AA0	53	**12940**	75	74	71	5	14.8

Table 13-20 Charactersitic data of DC units, 675 V to 810 V

MLFB	Flow [l/min]	Differential pressure [Pa]	Sound level IP20 [dBA]*	Sound level IP42 [dBA]*	Sound level IP54 [dBA]*	Water heating [k]	Power loss [kW]
6SE7033-0WJ60-1AA0	22	**14200**	76	75	72	4	5.6
6SE7033-5WJ60-1AA0	24	**16900**	76	75	72	4	6.0
6SE7034-5WJ60-1AA0	30	**26410**	76	75	72	4	7.5
6SE7035-7WK60-1AA0	31	**9950**	76	76	73	5	8.55
6SE7036-5WK60-1AA0	34	**11960**	76	76	73	5	9.95
6SE7038-6WK60-1AA0	42	**18250**	76	76	73	5	11.1
6SE7041-1WL60-1AA0	55	**13950**	76	75	72	5	15.2
6SE7041-2WL60-1AA0	70	**22600**	76	75	72	5	20.6

Table 13-21 Characteristic data of DC units, 890 V to 930 V

* The sound level was determined under the following boundary conditions:

Distance to the unit 1 m, height above floor level 1 m, distance to the next reflecting wall 4 m, room height 6m.

The chassis were installed in Siemens 8MC cabinets without any special soundproofing measures.

Fan voltage/frequency	**V/Hz**	**230/50**	**230/60**
Current requirement types J and K	A	2.45	3.6
Current requirement type L	A	4.9	7.2
Sound pressure level IP20	dB(A)	See tables	See tables +1.0
Sound pressure level IP42	dB(A)	See tables	See tables +0.5
Sound pressure level IP54	dB(A)	See tables	See tables

Table 13-22 Operating data of fan for types J and K

Type	Water contents (litres)
J	1.4
K	3.0
L	2.8

Table 13-23 Water contents of the heat sinks (± 10 %)

Data for units of types M, Q, N and R

The parallel connected units are configured as follows:

- Type M = 2 × K (with interphase transformer)
- Type Q = 2 × K (without interphase transformer)
- Type N = 2 × L.

Multi-parallel connected units of type R are composed of n × type K or n × type L.

Twice the amount of flow is required for parallel connections (types M, Q and N).

For multi-parallel connected units, the corresponding requirement is calculated from the requirement for the single inverter multiplied by the number of inverters.

Start-up

The heat sinks have to be vented when the units are filled for the first time.

The equipment has to be disconnected from the supply when venting is performed.

- Dismantle the lock screw in front of the actual vent valve.
- Carry out venting.
  Units of type E to G:
  There is no vent valve on these units.
  Venting has to take place externally via the free tap (see Fig. 13-3).
- Close the vent cock.
- Tighten the lock screw again.
- Check for tightness.
- The necessary volumetric flow must be ensured. The filters or strainers have to be cleansed. Cleansing should be repeated at regular intervals.
- If anti-freezing agents are used, the designation of the agent, its manufacturer and its mixing ratio must be documented.

14 Faults and Alarms

14.1 Faults

General information regarding faults

For each fault, the following information is available:

Parameter	r947	Fault number
	r949	Fault value
	r951	Fault list
	P952	Number of faults
	r782	Fault time

If a fault message is not reset before the electronic supply voltage is switched off, then the fault message will be present again when the electronic supply is switched on again. The unit cannot be operated without resetting the fault message. (Exception: Automatic restart has been selected, see P373).

Number / Fault	Cause	Counter-measure
F001 Main contactor checkback	If a main contactor checkback is configured, no checkback occurs within the time set in P600 after the power-up command. In the case of externally excited synchronous motors (P095 = 12), there is no checkback for the excitation current unit.	P591 Src Contactor Msg Parameter value must be in conformance with the connection of the main contactor checkback. Check the checkback loop of the main contactor (or the checkback of the excitation current unit in the case of synchronous motors).
F002 Pre-charging	When pre-charging, the minimum DC link voltage (P071 Line Volts x 1.34) of 80 % has not been reached. The maximum pre-charging time of 3 seconds has been exceeded.	Check the supply voltage, Compare witth P071 Line Volts (Compare P071 with the DC link voltage on DC units). Check the rectifier/regenerative unit on DC units. The rectifier/regenerative unit must be switched on before the inverter is switched on.
F006 DC link overvoltage	Shutdown has occurred due to excessive DC link voltage. Line voltage I DC voltage range I Shutdown value --- 200 V - 230 V I 270 V - 310 V I appr. 410 V 380 V - 480 V I 510 V - 650 V I appr. 820 V 500 V - 600 V I 675 V - 810 V I appr. 1020 V 660 V - 690 V I 890 V - 930 V I appr. 1220 V For parallel-connected converters (BF M,N) r949 = 1: Overvoltage in the DC link of the master r949 = 2: Overvoltage in the DC link of the slave.	Check the supply voltage or input DC voltage. Converter is operating in regenerative mode without feedback possibility. If the converter supply voltage is at the upper tolerance limit and it is operating at full load, F006 can also be caused by a line phase failure. Possibly - Increaase P464 Decel Time, - Activate P515 DC Bus Volts Reg (check P071 beforehand) - Reduce P526 Fly Search Speed. - Reduce P259 Max Regen Power (only for P100 = 3, 4 or 5)

Number / Fault	Cause	Counter-measure
F008 DC link undervoltage	The lower limit value of 76 % of the DC link voltage (P071 Line Volts), or of 61 % when kinetic buffering has been enabled, has been fallen short of. Undervoltage in the DC link in 'normal' operation (i.e. no SIMULATION). Undervoltage in the DC link with active kinetic buffering and speed less than 10 % of the rated motor speed. It was a 'brief power failure' which was not detected until system recovery (auto restart flag).	Check - Input DC voltage - DC link
F010 DC link overvoltage	Due to excessive DC link voltage, shutdown has taken place: Line voltage / DC link range / Shutdown value 380 V - 480 V / 510 V - 650 V / 740 V Note: Only at U800 = 1 and f(Pulse) > f(derating) Lower threshold value than F006 !	Check the supply voltage Check the braking resistor Converter operates regeneratively without a feedback possibility. Braking unit must be set to the lower response threshold (673 V)
F011 Overcurrent	Overcurrent shutdown has occurred. The shutdown threshold has been exceeded.	- Check the converter output for short-circuit or earth fault - Check the load for an overload condition - Check whether motor and converter are correctly matched - Check whether the dynamic requirements are too high
F012 I too low	During excitation of the induction motor, the current did not rise above 12.5 % of the setpoint magnetizing current for no-load operation.	Only for closed loop n/f/T control (P100 = 3, 4 or 5) If no motor is connected, go into the simulation mode P372. Check current detection, check power section.
F014 I too low	During excitation of the motor, the current component is less than 25 % of the motor no-load current. Note: Only for U800 = 1 Irrespective of the type of control (Difference to F012)	Check the output contactor Check the motor cable

Number / Fault	Cause	Counter-measure
F015 Motor stall	Motor has stalled or is locked: - if the static load is too high - if the acceleration or deceleration time is too fast, or if load change is too fast and too great, - due to incorrect parameterization of the pulse encoder pulse number P151 or of the analog tachometer scaling P138 - due to disturbed speed signals (tachometer shield not connected) The fault is only generated after the time set in P805. The binector B0156 is set in the status word 2 r553 Bit 28. To detect whether the drive is blocked, see P792 (Perm Deviation) and P794. With n/f control, this fault is tripped if the torque limits have been reached (B0234). With speed control (P100 = 4) and master drive (see P587), the fault can also point to an interruption in the encoder cable. This case has the same significance as if the drive is locked. With v/f control, the I(max) controller has to be activated (P331). The monitor does not operate with v/f textile applications (P100 = 2). Motor has stalled or is locked: In the case of synchronous motors (P095 = 12, 13): by reaching the maximum frequency In the case of externally excited synchronous motors (P095 = 12): as a result of missing or excessively high excitation current (flux is too small or too great). When the maximum frequency (including control reserves) (B0254) has been reached on synchronous motors, the fault is generated immediately. If the deviations in the rotor flux are too great, first of all, the converter current is switched to zero, the excitation current is reduced and, after some time, the fault message is tripped at the level of the double damping time constant (2*r124.1). During this wait time, the status word bit B0156 (r553.28) is set already.	- Reduce load - Release brake - Increase current limits - Increase P805 PullOut/BlckTime - Increase P792 response threshold for set/actual deviation Only for f/n/T control (P100 = 3, 4, 5) - Increase torque limits or torque setpoint Only n/T control or v/f control with speed controller: (P100 = 0, 4, 5) - Check tachometer cable break - Check pulse encoder pulse number - Check analog tachometer scaling - Connect shield of tachometer cable on motor side and converter side - Reduce smoothing of speed pre-control P216 (only n/T control) only frequency control:(P100 = 3) - Slow down acceleration time (see also P467 ProtRampGen Gain) - Increase current in the lower frequency range (P278, P279, P280) - Switch in speed controller pre-control (P471>0) - Set EMF controller more dynamically (315) to max. approx. 2 - Increase changeover frequency for the EMF model (P313) - Replace by speed control with pulse encoder in the case of overmodulated n/f controller - Track speed setpoint with the speed actual value so that the set/actual deviation is always less than that set in P792. Only for synchronous motor: (P095 = 12) - Check current limits of the excitation unit. - Check excitation current setpoint and actual value (incl. wiring) - Check voltage limits of the excitation unit during dynamic current changes. - Check drive system for resonance oscillations.
F018 F set fly	The found set frequency could not be implemented. Reasons: - Additional setpoint 2 too high - Speed actual-value at standstill negative (signal ripple) and negative direction of rotation locked.	- Check additional setpoint 2 - Release negative directions of rotation with low maximum speed.

Number / Fault	Cause	Counter-measure
F019 Motor not found	During flying restart without tachometer: Search in both directions of rotation not possible (one direction blocked) and motor has not been found.	Power up after coasting. Possibly increase P525 Fly Search Amps. Enable both directions of rotation (P571, P572)
F020 Motor temperature	The motor temperature limit value has been exceeded. r949 = 1 limit value of motor temperature exceeded r949 = 2 short-circuit in the cable to the motor temperature sensor or sensor defective r949 = 4 wire break in the cable to the motor temperature sensor or sensor defective r949 = 5 wire break and limit value exceeded	Check the motor (load, ventilation, etc.). The current motor temperature can be read in r009 Motor Temperature. Check P381 Mot Tmp Fault - check the KTY84 input at connector -X103:29,30, or X104:29,30 (Compact PLUS) for short-circuit.
F021 Motor I2t	Parameterized limit value of the I2t monitoring for the motor has been exceeded.	Check: P383 Mot Tmp T1
F023 Inverter temperature	The limit value of the inverter temperature has been exceeded. Alarm: (r949): Bit0 Inverter overtemperature Bit1 Wire break of cable to temperature sensor Bit4 Number of the temperature sensor Bit5 Bit6 Bit8 Multiparallel circuit: Slave number Bit9 Bit10 Examples: r949 = 1: Limit value of inverter temperature has been exceeded. r949 = 2: Sensor 1: wire break of sensor cable or sensor defective r949 = 18: Sensor 2: wire break of sensor cable or sensor defective r949 = 34: Sensor 3: wire break of sensor cable or sensor defective r949 = 50: Sensor 4: wire break of sensor cable or sensor defective.	- Measure the air intake and ambient temperature (Observe minimum and maximum ambient temperature!) - Observe the derating curves at theta >45°C (Compact PLUS type) or 40°C. - On Compact PLUS units: ≥ 22 kW acknowledgement is only possible after 1 minute Check: - whether the fan -E1 is connected and is rotating in the correct direction - that the air entry and discharge openings are not restricted - temperature sensor at -X30
F025 UCE upper switch/ UCE Ph. L1	UCE upper switch (Compact PLUS) / or UCE has tripped in phase L1	Check: - phase L1 for short-circuit or ground fault (-X2:U2 - including motor) - that CU is correctly inserted - that the switch for "SAFE STOP" (X9/5-6) is open (only for units with order No. ...-11, ...-21,...-31, ...-61).

Number / Fault	Cause	Counter-measure
F026 UCE lower switch / UCE Ph. L2	UCE lower switch (Compact PLUS) / or UCE has tripped in phase L2	Check: - phase L2 for short-circuit or ground fault (-X2:V2 - including motor) - that CU is correctly inserted - that the switch for 'SAFE STOP' (X9/5-6) is open (only for units with order Nos....-11, ...-21,...-31, ...-61)
F027 Fault pulse resistor / UCE Ph. L3	Fault pulse resistor (Compact PLUS) / or UCE has tripped in phase L3	Check: - phase L3 for short-circuit or ground fault (-X2:W2 - including motor) - that CU is correctly inserted - that the switch for 'SAFE STOP' (X9/5-6) is open (only for units with order Nos....-11, ...-21,...-31, ...-61)
F028 Supply phase	The frequency and the amplitude of the DC link ripple indicate a single-phase power failure.	Check the supply voltage.
F029 Meas. value sensing	A fault has occurred in the measured value sensing system: The measured variable at which a fault occurred during offset adjustment is bit-coded and stored in r949 : Bit 0: Current phase L1 Bit 1: Current phase L2 Bit 2: DC link voltage Bit 3: Inverter temperature Bit 4: Motor temperature Bit 5: Analog input 1 Bit 6: Analog input 2 Examples: - (r949 = 1) Offset adjustment in phase L1 not possible - (r949 = 2) Offset adjustment in phase L3 not possible. - (r949 = 3) Offset adjustment in phases L1 and L3 not possible.	Causes in phase L1 and L2: - Fault in measured value sensing system - Fault in power section (valve cannot block) - Fault on CU Causes on all other measured variables: - Fault on CU (SIMA) -> replace CU
F035 Ext. Fault 1	Parameterizable external fault input 1 has been activated	Check: - whether there is an external fault - whether the cable to the appropriate digital input has been interrupted - P575 Src No ExtFault1
F036 Ext. Fault 2	Parameterizable external fault input 2 has been activated	Check: - whether there is an external fault - whether the cable to the appropriate digital input has been interrupted - P585 Src No ExtFault2

Number / Fault	Cause	Counter-measure
F037 Analog input	An analog input is taking place in operating mode 4..20 mA and a wire break has occurred. The number of the analog input concerned is shown in fault value (r949).	Check the connection to - Analog input 1 -X102:15, 16, or -X101:9,10 (Compact PLUS). - Analog input 2 -X102: 17, 18. Check parameters - P632 CU AnaIn Conf - P634 CU AnaIn Smooth - P631 CU AnaIn Offset
F038 Voltage OFF during parameter storage	During a parameter task, a voltage failure has occurred on the board.	Re-enter the parameter. The number of the parameter concerned can be seen in fault value r949.
F040 AS internal	Incorrect operating status	Replace CU (-A10), or replace the unit (Compact PLUS type)
F041 EEPROM fault	A fault has occurred when storing the values in the EEPROM.	Replace CU (-A10), or replace the unit (Compact PLUS)
F042 Calculating time	Calculating time problems At least 10 failures of time slots T2, T3, T4 or T5 (see also parameters r829.2 to r829.5)	Reduce the calculating time load: - Increase P357 Sampling Time - Calculate individual blocks in a slower sampling time Observe r829 CalcTimeHdroom.
F044 BICO manager fault	A fault has occurred during the softwiring of binectors and connectors.	Fault value r949: >1000 : Fault during softwiring of connectors >2000 : Fault during softwiring of binectors - Voltage OFF and ON - Factory setting and new parameterization - Replace the board
F045 Opt. Board HW	A hardware fault has occurred when accessing an option board	- Replace CU (-A10), or replace the unit (Compact PLUS) - Check connection of the board subrack to the option boards and replace if necessary.
F046 Par. Task	A fault has occurred during the transfer of parameters to the gating unit processor.	Power the unit down and up again. Replace CU (-A10), or replace the unit (Compact PLUS type)
F047 Gating Calc Time	The calculating time in the gating unit computer is not sufficient	Replace CU (-A10), or replace the unit (Compact PLUS) In case of synchronous motors (P095 = 12): Pulse frequency set too high (P340>2kHz).
F048 Gating Pulse Freq	The pulse frequency set in P340 is not permissible.	Change P340 Pulse Frequency.
F049 SW version	The firmware versions on the CU have different firmware release.	Use uniform firmware
F050 TSY Init.	Error when initializing the TSY board	Check: - Whether the TSY is correctly inserted

Number / Fault	Cause	Counter-measure
F051 Speed encoder	Digital tachometer or analog tachometer sensing are faulty	Check the parameters: - P130 Src SpdActV - P151 Pulse # - P138 AnalogTachScale - P109 Motor #PolePairs The product of P109 and P138 must be smaller than 19200. Check or replace tachometer. Check connection to tachometer. - Replace CU (-A10), or replace the unit (Compact PLUS type)
F052 n-Cntr.Input	Control track input (-X103/27, or -X104/27 Compact PLUS) is not high: - Tachometer line broken - Tachometer fault The fault input on the TSY was activated.	Unselect tachometer with control track (P130 select motor encoder) Check control track connection (-X103/27, or X104/27 Compact PLUS) Exchange TSY
F053 Tachometer dn/dt	The permissible change value of the speed encoder signal P215 dn(act,perm) has been doubly exceeded.	Check tachometer cables for interruptions. Check earthing of tachometer shield. - The shield must be connected both at the motor and the converter side. - The encoder cable must not be interrupted. - The encoder cable must not be laid together with the power cables. - Only recommended encoders should be used. - In the case of a signal fault, the DT1 board may have to be used. If necessary, change P215 - With P806 (observe parameter description) it is possible during operation to switch over to encoder-free operation.
F054 Sensor board initialization fault	A fault has occurred during initialization of the encoder board.	Fault value r949 1. Board code incorrect 2. TSY not compatible 3. SBP not compatible 7. Board double 20: TSY board double 60: Internal error
F056 SIMOLINK telegram failure	Communication on the SIMOLINK ring is disturbed.	- Check the fiber-optic cable ring - Check whether an SLB in the ring is without voltage - Check whether an SLB in the ring is faulty - Check P741 (SLB TlgOFF)

Number / Fault	Cause	Counter-measure
F057 Brake does not open	The brake has not opened, the output current of the converter has exceeded the parameterized current threshold (U840) for longer than one second (with the rotor locked) Note: Only with U800 = 1	Check brake Check I(max) brake (U840). The set threshold must be at least 10% above the maximum possible acceleration current.
F058 Parameter fault Parameter task	A fault has occurred during the processing of a parameter task.	No remedy
F059 Parameter fault after factory setting/init.	A fault has occurred in the initialization phase during the calculation of a parameter.	The number of the inconsistent parameter is indicated in fault value r949. Correct this parameter (ALL indices) and switch voltage off and on again. Several parameters may be affected, i.e. repeat process.
F060 MLFB is missing	This is set if the MLFB = 0 after exiting INITIALIZATION (0.0 kW). MLFB = order number.	After acknowledgement, in INITIALIZATION enter a suitable MLFB in parameter P070 MLFB (6SE70..). (Only possible with the corresponding access stages to both access parameters).
F061 Incorrect parameterization	A parameter entered during drive setting (e.g. P107 Mot Rtd Freq, P108 Mot Rtd Speed, P340 Pulse Frequency) is not in a permissible range (depending on control type)	Acknowledge the fault and change the corresponding parameter value. The missing parameter is indicated in r949 as a fault value.

Number / Fault	Cause	Counter-measure
F062 Multi-parallel circuit	Fault in connection with the multi-parallel circuit or board ImP1 has been detected.	r949 = 10: Communications card does not reply. When writing the control word, BUSY is not active if CSOUT is inactive. Communications card is probably not inserted. R949 = 11,12: Timeout during BUSY during initialization. BUSY does not become active within 1 sec. R949 = 15: Timeout during BUSY during normal communication. BUSY does not become active within 1 sec. R949 = 18: Timeout when reading out the fault information from the ImPIs. Within one second after activation of FAULT no fault cause can be supplied by the IMP1. R949 = 20+i: HW conflict. This is set if bit HWCONF is set in status word of slave i. (Fault in the configuration of the multi-parallel circuit) r949 = 30+i: HW version of ImPI isnot compatible. The relevant slave number is contained in i. R949 = 40: Number of slaves does not tally with the setpoint number of slaves of the unit. R949 = 50+i Inconsistency in the number of slaves. The number of slaves notified by the ImPI is not in conformance with the number of status words or with the setpoint number of slaves of the MLFB. Counter-measure: - Check ImPI or communications card and replace, if necessary. - Check configuration of multi-parallel circuit. - Check parameterization. - Replace CU. - Replace ImPI.
F065 Scom Telegram	No telegram was received at an Scom interface (Scom/USS protocol) within the telegram failure time.	Fault value r949: 1 = interface 1 (SCom1) 2 = interface 2 (SCom2) - Check the connection CU -X100:1 to 5 and check the connection PMU -X300. - Check the connection CU -X103, or X100/ 35,36 (Compact PLUS type) - Check "SCom/SCB TLG OFF" P704.01 (SCom1) and P704.02 (SCom2) - Replace CU (-A10), or replace the unit (Compact PLUS type)

Number / Fault	Cause	Counter-measure
F070 SCB initialization fault	A fault has occurred during initialization of the SCB board.	Fault value r949: 1: Board code incorrect 2: SCB board not compatible 5: Error in configuration data (Check parameterization) 6: Initialization timeout 7: SCB board double 10: Channel error
F072 EB initialization fault	A fault has occurred during initialization of the EB board.	Fault value r949: 2: 1st EB1 not compatible 3: 2nd EB1 not compatible 4: 1st EB2 not compatible 5: 2nd EB2 not compatible 21: Three EB1 boards 22: Three EB2 boards 110: Fault on 1st EB1 (Analog input) 120: Fault on 2nd EB1 (Analog input) 210: Fault on 1st EB2 (Analog input) 220: Fault on 2nd EB2 (Analog input)
F073 AnInp1SL1	4 mA at analog input 1, slave 1 fallen short of	Check the connection of the signal source to the SCI1 (slave 1) -X428: 4, 5.
F074 AnInp2 SL1	4 mA at analog input 2, slave 1 fallen short of	Check the connection of the signal source to the SCI1 (slave 1) -X428: 7, 8.
F075 AnInp3 SL1	4 mA at analog input 3, slave 1 fallen short of	Check the connection of the signal source to the SCI1 (slave 1) -X428: 10, 11.
F076 AnInp1 SL2	4 mA at analog input 1, slave 2 fallen short of	Check the connection of the signal source to the SCI1 (slave 2) -X428: 4, 5.
F077 AnInp2 SL2	4 mA at analog input 2, slave 2 fallen short of	Check the connection of the signal source to the SCI1 (slave 2) -X428: 7, 8.
F078 AnInp3 SL2	4 mA at analog input 3, slave 2 fallen short of	Check the connection of the signal source to the SCI1 (slave 2) -X428: 10, 11.
F079 SCB telegram failure	No telegram has been received by the SCB (USS, peer-to-peer, SCI) within the telegram failure time.	- Check the connections of the SCB1(2). - Check P704.03"SCom/SCB Tlg OFF" - Replce SCB1(2) - Replace CU (-A10)
F080 TB/CB initialization fault	Fault during initialization of the board at the DPR interface	Fault value r949: 1: Board code incorrect 2: TB/CB board not compatible 3: CB board not compatible 5: Error in configuration data 6: Initialization timeout 7: TB/CB board double 10: Channel error Check the T300/CB board for correct contacting, check the PSU power supply, check the CU / CB / T boards and check the CB initialization parameters: - P918.01 CB Bus Address, - P711.01 to P721.01 CB parameters 1 to 11

Number / Fault	Cause	Counter-measure
F081 OptBrdHeartbeat-Counter	Heartbeat-counter of the optional board is no longer being processed	Fault value r949: 0: TB/CB heatbeat-counter 1: SCB heartbeat-counter 2: Additional CB heartbeat-counter - Acknowledge the fault (whereby automatic reset is carried out) - If the fault re-occurs, replace the board concerned (see fault value) - Replace ADB - Check the connection between the subrack and the optional boards (LBA) and replace, if necessary
F082 TB/CB telegram failure	No new process data have been received by the TB or the CB within the telegram failure time.	Fault value r949: 1 = TB/CB 2 = additional CB - Check the connection to TB/CB - Check P722 (CB/TB TlgOFF) - Replace CB or TB
F085 Add. CB initialization fault	A fault has occurred during initialization of the CB board.	Fault value r949: 1: Board code incorrect 2: TB/CB board not compatible 3: CB board not compatible 5: Error in configuration data 6: Initialization timeout 7: TB/CB board double 10: Channel error Check the T300 / CB board for correct contacting and check the CB initialization parameters: - P918.02 CB Bus Address, - P711.02 to P721.02 CB Parameters 1 to 11
F087 SIMOLINK initialization fault	A fault has occurred during initialization of the SLB board.	- Replace CU (-A10), or replace the unit (Compact PLUS type) - Replace SLB
F090 Mld Param.	An error occurred when attempting to change a parameter from the standstill measurement or the rotating measurement (Mot ID).	Power down and power up again. If it reoccurs, replace CU (-A10), or replace the unit (Compact PLUS type)
F091 Mld Time	The rotating measurement takes longer than programmed in a measured status. The relevant measuring interval is encrypted in parameter r949. Possible causes: Load torque too high Load torque not uniform Ramp-function generator disabled	Eliminate the cause and re-start the measurement (power up the converter again). If it re-occurs, replace CU (-A10), or replace the unit (Compact PLUS type).
F095 Mld n(set)	Due to entries for - Permissible phase sequence - Maximum frequency, - Minimum speed, - Changeover frequency between V and I model, - Start of field-weakening frequency, - Frequency suppression bandwidth it was not possible to determine a permissible frequency range for the rotating measurement.	There must be a 10 % frequency range which lies above 1.1 times the changeover frequency and below 0.9 times the start of field-weakening frequency. Possible counter-measures - Permit both phase sequences - Increase maximum frequency - Reduce minimum speed, - Reduce changeover frequency between the V and I model. - Reduce or remove the frequency suppression bandwidth.

Number / Fault	Cause	Counter-measure
F096 Mld abort	The rotating measurement was aborted due to the inadmissible external intervention.	The fault value in r949 defines the type of intervention: 4 Setpoint inhibit 5 Changeover, setpoint channel 8 Unexpected change in the converter status 12 Motor data set changeover (for function selection "Compl. Mot ID") 13 Changeover to slave drive 14 Motor data set changeover to data set with v/f_charac 15 Controller inhibit is set 16 Ramp-function generator is disabled 17 Selection "Tacho test" for F controller 18 Ramp-function generator stopped Eliminate cause 22 Inverter inhibit: Check inverter release (P561)
F097 Mld meausred value	The measured values for the nominal ramp-up time when optimizing the controller deviate too greatly. Cause: very unsteady load torque	If necessary, increase the torque limit values to 100 percent
F098 Mld Tachof	The rotating measurement has detected a fault in the speed actual value signal. The fault value defines the type of fault. The fault measurement may have been erroneously generated if the drive speed is externally forced (e.g. completely locked drive generates the "no signal" message)	The fault value in r949 defines the type of intervention 4 No speed signal present 5 Sign of the signal is incorrect 6 A track signal is missing 7 Incorrect gain 8 Incorrect pulse number Checking the measurement cables. Checking the parameters - P130 Src Speed ActV - P1151 Encoder Pulse #
F100 GRND Init	During the ground fault test, a current not equal to zero has been measured, or an UCE or overcurrent monitoring has responded, although no value has yet been triggered.	The cause of the fault can be read out from r376 "GrdFltTestResult". Check the converter output for short-circuit or ground fault (-X2:U2, V2, W2 - including motor). Check that the CU is inserted correctly. Sizes 1 and 2: - Check the transistor modules on the PEU board -A23 for short-circuit. Size 3 and 4: - Check the transistor modules -A100, -A200, -A300 for short-circuit

Number / Fault	Cause	Counter-measure
F101 GRND UCE	During the ground fault test, the UCE monitoring has responded in a phase in which no valve has been triggered.	Check valves in the power section for short-circuit, and on converters with fiber-optic gating, check the gating unit wiring and the UCE checkbacks for correct assignment. R376 can be interrogated to indicate which UCE monitoring has responded.
F102 GRND Phase	During the ground fault test, a current flows in a phase in which no valve has been triggered or the UCE monitoring has responded in the phase in which the valve has been triggered.	The fault value can be read out from r949. The digit of the xth position indicates the valve where the fault occurred at power-up. X O O O x = 1 = V+ x = 2 = V- x = 3 = U+ x = 4 = U- x = 5 = W+ x = 6 = W- The figure of the xth digit indicates the phase in which I is 0 and thus a valve must be defective (always conductive). O O O X x = 1 Phase 1 (U) x = 3 = Phase 3 (W) x = 4 = Phase 1 (U) or 3 (W) Examine phase for defective valves (always conductive).
F103 Ground fault	There is a ground fault or a fault in the power section. During the ground fault test, a current flows from the phase in which a valve has been triggered, the overcurrent comparator has responded, or a UCE monitoring has responded in a phase in which a valve has been triggered.	Read out fault value from r949. The digit of the xth position indicates the valve where the fault occurred at power-up. X O O O x = 1 = V+ x = 2 = V- x = 3 =U+ X O O O x = 4 = U- x = 5 = W+ x = 6 = W- Check the motor including the feeder cable for short-circuit. If no ground fault is present, check the power section for defective valves (always conductive). The digit of the xth position indicates the phase in which I is 0 and therefore a valve must be defective (always conductive). O O O X 1 = Current in phase 1 (U) 2 = UCE in phase 2 (V) 3 = Current in phase 3 (W) 4 = Only overcurrent occurred The speed of the motor shaft during the ground-fault test should be less than 10 % of the rated speed! 1) In phase V there is a ground fault or a defective valve or the "SAFE STOP" switch (X9/5-6) is open (only for units with Order No. ...-11, ...-21, ...-31).

Number / Fault	Cause	Counter-measure
F107 MLd = 0	A fault has occurred during the test pulse measurement	Read out fault value from r949. The figures of the grey shaded areas indicate which fault has occurred. O O X X xx = 01: Both current actual values remain 0 xx = 02: Motor-converter cable phase U interrupted xx = 03: Motor converter phase V interrupted xx = 04: Motor-converter phase W interrupted xx = 05: Current actual value I1 remains 0 xx = 06: Current actual value I3 remains 0 xx = 07: Valve U+ does not trigger xx = 08: Valve U- does not trigger xx = 09: Valve V+ does not trigger xx = 10: Valve V- does not trigger xx = 11: Valve W+ does not trigger xx = 12: Valve W- does not trigger xx = 13: Sign I1 incorrect xx = 14: Sign I3 incorrect xx = 15: Sign I1 and I3 incorrect xx = 16: Sign I1 confused with I3 xx = 17: I1 confused with I3 and both currents have an incorrect sign The digit of the xth digit indicates where the fault has occurred. X O O O x = 0 = Single converter x = 1 = Inverter 1 x = 2 = Inverter 2 x = 3 = Inverters 1 and 2 Check that all 3 motor feeder cables and the motor windings do not have any interruption. Check the connection between the current converter and the electronics and check the current converter itself. Check the correct input of the rating plate data for the motor data set valid during the measurement.
F108 Mld Unsym	During the DC measurement, the measurement results for the individual phases differ significantly. The fault value indicates which quantity(ies) is(are) concerned and in which phase the greatest deviation occurred.	Read out fault value from r949. The digit of the xth position indicates; O O O X Transverse voltage too high x = 1 = phase R x = 2 = phase S x = 3 = phase T O O X O Dev. stator resistance (1, 2, 3 as above) X O O O Dev. dead-time compensation (1, 2, 3 as above) X O O O O Dev. valve voltage (1, 2, 3 as above) The motor, power section or actual-value sensing are significantly non-symmetrical.
F109 Mld R(L)	The rotor resistance determined during DC measurement deviates too significantly from the value which was calculated by the automatic parameterization from the rated slip.	- Incorrect input of rated speed or rated frequency - Pole pair number incorrect

Number / Fault	Cause	Counter-measure
F110 MId di/dt	During test pulse measurement, the current has increased significantly faster than was expected. Thus for the 1st test pulse, an overcurrent condition occurred within the first half of the minimum switch-on time	- There may be a short-circuit between two converter outputs. - The motor rating plate data have not been correctly parameterized. - The motor leakage is too low.
F111 Fault e_Func	A fault has occurred while calculating the equalization function.	
F112 Unsym l_sigma	The individual leakage test results deviate too significantly.	
F114 MId OFF	The converter has automatically stopped the automatic measurement due to the time limit up to power-up having been exceeded or due to an OFF command during the measurement, and has reset the function selection in P115.	Re-start with P115 function selection = 2 "Motor identification at standstill". The ON command must be given within 20 sec. after the alarm message A078 = standstill measurement has appeared. Cancel the OFF command and re-start measurement.
F115 KF internal	A fault has occurred during calculations in the context of the MotID.	Power-down the converter and electronics and power-up again.
F116 Technology board fault	See TB documentation	See TB documentation
F117 Technology board fault	See TB documentation	See TB documentation
F118 Technology board fault	See TB documentation	See TB documentation
F119 Technology board fault	See TB documentation	See TB documentation
F120 Technology board fault	See TB documentation	See TB documentation
F121 Technology board fault	See TB documentation	See TB documentation
F122 Technology board fault	See TB documentation	See TB documentation
F123 Technology board fault	See TB documentation	See TB documentation
F124 Technology board fault	See TB documentation	See TB documentation
F125 Technology board fault	See TB documentation	See TB documentation
F126 Technology board fault	See TB documentation	See TB documentation
F127 Technology board fault	See TB documentation	See TB documentation
F128 Technology board fault	See TB documentation	See TB documentation
F129 Technology board fault	See TB documentation	See TB documentation

Number / Fault	Cause	Counter-measure
F130 Technology board fault	See TB documentation	See TB documentation
F131 Technology board fault	See TB documentation	See TB documentation
F132 Technology board fault	See TB documentation	See TB documentation
F133 Technology board fault	See TB documentation	See TB documentation
F134 Technology board fault	See TB documentation	See TB documentation
F135 Technology board fault	See TB documentation	See TB documentation
F136 Technology board fault	See TB documentation	See TB documentation
F137 Technology board fault	See TB documentation	See TB documentation
F138 Technology board fault	See TB documentation	See TB documentation
F139 Technology board fault	See TB documentation	See TB documentation
F140 Technology board fault	See TB documentation	See TB documentation
F141 Technology board fault	See TB documentation	See TB documentation
F142 Technology board fault	See TB documentation	See TB documentation
F143 Technology board fault	See TB documentation	See TB documentation
F144 Technology board fault	See TB documentation	See TB documentation
F145 Technology board fault	See TB documentation	See TB documentation
F146 Technology board fault	See TB documentation	See TB documentation
F147 Technology board fault	See TB documentation	See TB documentation
F148 Fault 1 Function blocks	An active signal is present at binector U061 (1).	Examine cause of fault, see function diagram 710
F149 Fault 2 Function blocks	An active signal is present at binector U062 (1).	Examine cause of fault, see function diagram 710
F150 Fault 3 Function blocks	An active signal is present at binector U063 (1).	Examine cause of fault, see function diagram 710

Number / Fault	Cause	Counter-measure
F151 Fault 4 Function blocks	An active signal is present at binector U064 (1).	Examine cause of fault, see function diagram 710
F153 No valid sign-of-life tool interface	Within the monitoring time of the tool interface no valid sign-of-life has been received from the tool interface.	Cyclically execute write tasks from the tool interface within the monitoring time whereby the sign-of-life has to be increased by 1 for every write task.
F243 Link int.	Fault in internal linking. One of the two linked partners does not reply.	Replace CU (-A10), or replace the unit (Compact PLUS).
F244 ParaLink int.	Fault in the internal parameter linking	Release comparison of gating unit software and operating software regarding the transfer parameters. Replace CU (-A10), or replace the unit (Compact PLUS type).
F255 Fault in EEPROM	A fault has occurred in the EEPROM.	Switch off the unit and switch it on again. If the fault re-occurs, replace CU (-A10), or replace the unit (Compact PLUS).

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

14.2 Alarms

The alarm message is periodically displayed on the PMU by A = alarm/ alarm message and a 3-digit number. An alarm cannot be acknowledged. It is automatically deleted once the cause has been eliminated. Several alarms can be present. The alarms are then displayed one after the other.

When the converter is operated with the OP1S operator control panel, the alarm is indicated in the lowest operating display line. The red LED additionally flashes (refer to the OP1S operating instructions).

Number / Alarm	Cause	Counter-measure
A001 Calculating time	The calculating time utilization is too high a) At least 3 failures of time slots T6 or T7 (see also parameter r829.6 or r829.6) b) At least 3 failures of time slots T2, T3, T4 or T5 (see also parameter r829.2 to r829.5)	- Observe r829 CalcTimeHdroom - Increase P357 Sampling Time or - Reduce P340 Pulse Frequency
A002 SIMOLINK start alarm	Start of the SIMOLINK ring is not functioning.	- Check the fiber-optic cable ring for interruptions - Check whether there is an SLB without voltage in the ring - Check whether there is a faulty SLB in the ring
A014 Simulation active alarm	The DC link voltage is not equal to 0 when the simulation mode is selected (P372 = 1).	- Set P372 to 0. - Reduce DC link voltage (disconnect the converter from the supply)
A015 External alarm 1	Parameterizable external alarm input 1 has been activated.	Check - whether the cable to the corresponding digital input has been interrupted. - parameter P588 Src No Ext Warn1
A016 External alarm 2	Parameterizable external alarm input 2 has been activated.	Check - whether the cable to the corresponding digital input has been interrupted. - parameter P589 Src No Ext Warn2
A017 Safe Stop alarm active	The switch for blocking the inverter pulses (X9 terminal 5-6) has been opened (only for units with Order No. ...-11, ...-21, ...-31, ...61)	Close switch X9 5-6 and thus release the inverter pulses.
A020 Overcurrent	An overcurrent condition has occurred.	Check the driven load for an overload condition. - Are the motor and the converter matched? - Have the dynamic performance requirements been exceeded.
A021 Overvoltage	An overvoltage condition has occurred.	Check the supply voltage. The converter regenerates without regeneration possibility.

Number / Alarm	Cause	Counter-measure
A022 Inverter temperature	The threshold for initiating an alarm has been exceeded.	- Measure intake air or ambient temperature. - Observe the derating curves at theta >45°C (Compact PLUS) or 40°C. Check - Whether the fan -E1 is connected and is rotating in the correct direction. -The air intake and discharge openings for blockage. - The temperature sensor at -X30. - r833 indicates the maximum converter temperature of all existing measuring points (Compact/chassis type unit). - r833.01 indicates the actual converter temperature (Compact PLUS type).
A023 Motor temperature	The parameterizable threshold for initiating an alarm has been exceeded.	Check the motor (load, ventilation, etc.). The current temperature can be read in r009 Motor Tmp. Check the KTY84 input at connector -X103:29,30, or -X104:29,30 (Compact PLUS type) for short-circuit.
A024 Motor movement	The motor has moved during motor data identification.	Lock the motor.
A025 I2t Inverter	If the instantaneous load condition is maintained, then the inverter will be thermally overloaded.	Check: - P72 Rtd Drive Amps - MLFB P70 - P128 Imax - r010 Drive Utilizat
A026 Ud too high	Ud is above the continuously permissible DC link voltage for more than 30sec in a time interval of 90sec	
A029 I2t motor	The parameterized limit value for the I2t monitoring of the motor has been exceeded.	Motor load cycle is exceeded! Check the parameters: P382 Motor Cooling P383 Mot Tmp T1 P384 Mot Load Limits
A033 Overspeed	Bit 3 in r553 status word 2 of the septoint channel. The speed actual value has exceeded the value of maximum speed plus the set hysteresis.	P804 Overspeed Hys plus P452 n/f(max, FWD Spd) or P453 n/f(max, REV Spd) has been exceeded Increase the parameter for the maximum frequencies or reduce the regenerative load.
A034 Setpoint/actual value deviation	Bit 8 in r552 status word 1 of the setpoint channel. The difference between freqeuncy setpoint/actual value is greater than the parameterized value and the control monitoring time has elapsed.	Check - whether an excessive torque requirement is present - whether the motor has been dimensioned too small. Increase values P792 Perm Deviation Frq/ set/actual DevSpeed and P794 Deviation Time
A035 Wire break	The clockwise and/or the counter-clockwise rotating field is not enabled, or a wire breakage is present in the terminal wiring (both control word bits are zero).	Check whether cable(s) to the corresponding digital input(s) P572 Src FWD Spd / P571 Src REV Spd is (are) interrupted or released

Number / Alarm	Cause	Counter-measure
A036 Brake checkback "Brake still closed"	The brake checkback indicates the "Brake still closed" state.	Check brake checkback (see FD 470)
A037 Brake checkback "Brake still open"	The brake checkback indicates the "Brake still open" state.	Check brake checkback (see FD 470)
A041 Vdmax controller inhibit	The line voltage is too high or the drive line voltage (P071) is incorrectly parameterized. The Vdmax controller is disabled despite parameter access (P515), as otherwise the motor would accelerate immediately in operation to the maximum frequency.	Check - the line voltage - P071 Line Volts
A042 Motor stall/lock	Motor is stalled or blocked. The alarm cannot be influenced by P805 "PullOut/BlckTime", but by P794 "Deviation Time"	Check - whether the drive is locked - whether the encoder cable is interruped during speed control and whether the shield is connected. - Whether the drive has stalled - For synchronous motors (P095=12): excitation current injection
A043 n-act jump	The permissible change value of the speed encoder signal (P215) has been exceeded. Additionally for synchronous motors (P095=12): The motor rotates with more than 2% of the rated speed at the time of inverter release. The inverter status "Ready for operation" is not exited.	Check the tachometer cables for interruptions. Check the earthing of the tachometer shield. - The shield must be connected both on the motor and on the converter side. - The encoder cable must not be interrupted. - The encoder cable must not be laid with the power cables. - Only the recommended encoders should be used. - If there is a signal fault, use the DTI board if necessary. If required, change P215. - Additionally for synchronous motors (P095=12): Do not grant inverter release until the motor is at standstill
A044 I too low	Only for synchronous motors (P095=12) in operation: The difference smoothed with P159 between excitation current setpoint and actual value (r160 - r156) deviates from zero by more than 25 % of the rated magnetizing current.	Only for synchronous motors P095=12) Check: - whether the current limitation of the excitation current control is too small, - whether the dynamic performance of the excitation current injection is too low, - whether the excitation current injection function is operating, - whether the wiring of excitation current actual-value P155 is correct, - whether the wiring of excitation current setpoint r160 is correct, - whether there is a wire break between MASTERDRIVES and the excitation device, - whether the voltage limitation is too low for dynamic excitation current control, - whether the analog output for r160 takes place without isolating amplifiers (despite cable length > 4 m)

Number / Alarm	Cause	Counter-measure
A045 DC braking activated	The DC braking function has been activated and the motor frequency is still above the frequency at which DC braking begins (P398).	- Increase frequency at which DC braking begins
A049 No slave	At serial I/O (SCB1 with SCI1/2), no slave is connected or fiber-optic cable is interrupted or slaves are without voltage.	P690 SSCI AnaIn Conf - Check slave. - Check cable.
A050 Slave incorrect	At ser. I/O the slaves required according to a parameterized configuration are not present (slave number or slave type): Analog inputs or outputs or digital inputs or outputs have been parameterized which are not physically present.	Check parameter P693 (analog outputs), P698 (digital outputs). Check connectors K4101...K4103, K4201...K4203 (analog inputs) and binectors B4100...B4115, B4120...B4135, B4200...B4215, B4220...B4235 (digital inputs) for connecting.
A051 Peer baud rate	In a peer-to-peer connection a baud rate has been selected which is too high or too different.	Adjust the baud rate in conjunction with the SCB boards P701 SCom/SCB Baud Rate
A052 Peer PcD L	In a peer-to-peer connection, a PcD length has been set which is too high (>5).	Reduce number of words P703 SCom/SCB PcD #
A053 Peer Lng f.	In a peer-to-peer connection, the pcD length of transmitter and receiver do not match.	Adjust the word length for transmitter and receiver P703 SCom/SCB PcD #
A057 TB Param	Occurs when a TB is logged on and present, but parameter tasks from the PMU, SCom1 or SCom2 have not been answered by the TB within 6 seconds.	Replace TB configuration (software)
A061 Alarm 1 Function blocks	An active signal is present at binector U065 (1).	Check cause of alarm (see FD 710)
A062 Alarm 2 Function blocks	An active signal is present at binector U066 (1).	Check cause of alarm (see FD 710)
A063 Alarm 3 Function blocks	An active signal is present at binector U067 (1).	Check cause of alarm (see FD 710)
A064 Alarm 4 Function blocks	An active signal is present at binector U068 (1).	Check cause of alarm (see FD 710)
A065 Auto restart active	The auto restart option (P373) restarts the drive. A possibly parameterized power-up delay time (P374) expires if flying restart is not selected. During pre-charging of the DC link, there is no time monitoring i.e. with an external electronics power supply, it is also switched-in again.	Caution! Personnel could be in danger when the drive automatically restarts. Check whether the auto restart function is really required!
A066 fsyn > fmax	The measured target frequency of the external converter (or supply) is greater than the parameterized maximum frequency of the synchronizing converter.	Check: - P452 n/f(max, FWD Spd)/ P453 n/f(max,REV Spd) are correct and - correct motor data set P578 Src MotDSet Bit0 are selected
A067 fsyn < fmin	The measured target frequency of the external converter (or supply) is less than the minimum frequency required for synchronizing.	Check: - r533 Sync Target Freq - Synchronizing cable.
A068 fsyn<>fsoll	The setpoint frequency of the synchronizing converter deviates too significantly from the measured target frequency of the external converter (or supply). The permissible deviation can be set in P529.	Adjust total setpoint (main and additional setpoints) to the target frequency displayed in visualization parameter r533.

Number / Alarm	Cause	Counter-measure
A069 RGen active	Synchronizing is not started as long as the ramp-function generator in the synchronizing converter setpoint channel is active. This alarm is only output if synchronizing is selected.	Wait until acceleration has been completed. Check whether - P462 Accel Time - P463 Accel Time Unit have been correctly set.
A070 Sync error	This alarm is output if the phase difference goes outside the synchronizing window (P531) after successful synchronization.	The alarm can only be deleted after synchronization has been exited.
A071 tSY missing	An attempt has been made to start synchronization with either the synchronizing board not inserted or not parameterized.	Insert the TSY board in the subrack
A075 Ls, Rr Dev.	The measured values of the leakage measurement or of rotor resistance deviate significantly.	Usually the leakage reactance P122 is the average value resulting from the measured values in r546.1...12, and the rotor resistance r126 from the values in r542.1..3. If individual measured values significantly deviate from the average values, they are automatically not taken into account for the calculation (for RI) or the value of the automatic parameterization remains (for Ls). It is only necessary to check the results for their plausibility in the case of drives with high requirements on torque or speed accuracy.
A076 t-comp lim	The determined compensation time was limited to the value range of 0.5 µs - 1.5 µs.	Converter output and motor output are too different. Check motor data input P095 to P109.
A077 r-g limit	The measured resistance has been limited to the maximum value of 49 %.	Converter output and motor output are too different. Check motor data input P095 to P109.
A078 Stands. Meas	The standstill measurement is executed when the converter is powered up. The motor can align itself several times in a certain direction with this measurement.	If the standstill measurement can be executed without any danger: - Power up the converter.
A079 Mld Inv Stop	The rotating measurement has been aborted or cannot commence because an inverter stop command is present.	P561 Src InvRelese - Release the inverter If necessary, re-start the measurement by powering-up the converter.
A080 MotId:Dr.M	When the converter is powered up, the rotating measurement automatically accelerates the drive. The drive can then only be externally controlled in a restricted fashion.	If the rotating measurement can be executed without any danger: - Power up the converter.
A081 CB alarm	The following description refers to the 1st CBP. For other CBs or the TB see operating instructions for CB board. The ID byte combinations which are being sent from the DP master in the configuration telegram are not in conformance with the permissible ID byte combinations. (See also Compendium, Chapter 8, Table 8.2-12). Consequence: No connection is made with the PROFIBUS master.	New configuration necessary
A082 CB alarm	The following description refers to the 1st CBP. For other CBs or the TB see the operating instructions for the CB board. No valid PPO type can be identified from the configuration telegram of the DP master. Consequence: No connection is made with the PROFIBUS master.	New configuration necessary.

Number / Alarm	Cause	Counter-measure
A083 CB alarm	The following description refers to the 1st CBP. For other CBs or the TB see the operating instructions for the CB board. No net data or invalid net data (e.g. complete control word STW1=0) are being received from the DP master. Consequence: The process data are not passed on to the dual port RAM. If P722 (P695) is not equal to zero, this will cause the fault message F082 to be tripped.	See operating instructions of the CB board
A084 CB alarm	The following description refers to the 1st CBP. For other CBs or the TB see the operating instructions for the CB board. The telegram traffic between the DP master and the CBP has been interrupted (e.g. cable break, bus cable pulled out or DP master powered down). Consequence: If P722 (P695) is not equal to zero, this will cause the fault message F082 to be tripped.	See operating instructions of the CB board
A085 CB alarm	The following description refers to the 1st CBP. For other CBs or the TB see the operating instructions for the CB board. The CBP does not generate this alarm!	See operating instructions of the CB board
A086 CB alarm	The following description refers to the 1st CBP. For other CBs or the TB see the operating instructions for the CB board. Failure of the heartbeat counter on the basic unit. The heartbeat counter on the basic unit is no longer being incremented. The communication between the CBP and the basic board is disturbed.	See operating instructions of the CB board
A087 CB alarm	The following description refers to the 1st CBP. For other CBs or the TB see the operating instructions for the CB board. Fault in the DPS manager software of the CBP.	See operating instructions of the CB board
A088 CB alarm	See user manual for CB board	See user manual for CB board
A089 CB alarm	See user manual for CB board Alarm of the 2nd CB board corresponds to A81 of the 1st CB board	See user manual for CB board
A090 CB alarm	See user manual for CB board Alarm of the 2nd CB board corresponds to A82 of the 1st CB board	See user manual for CB board
A091 CB alarm	See user manual for CB board Alarm of the 2nd CB board corresponds to A83 of the 1st CB board	See user manual for CB board
A092 CB alarm	See user manual for CB board Alarm of the 2nd CB board corresponds to A84 of the 1st CB board	See user manual for CB board
A093 CB alarm	See user manual for CB board Alarm of the 2nd CB board corresponds to A85 of the 1st CB board	See user manual for CB board
A094 CB alarm	See user manual for CB board Alarm of the 2nd CB board corresponds to A86 of the 1st CB board	See user manual for CB board
A095 CB alarm	Alarm of the 2nd CB board. Corresponds to A87 of the 1st CB board See operating instructions for CB board	See user manual for CB board

Number / Alarm	Cause	Counter-measure
A096 CB alarm	See user manual for CB board Alarm of the 2nd CB board corresponds to A88 of the 1st CB board	See user manual for CB board
A097 TB alarm 1	See user manual for TB board	See user manual for TB board
A098 TB alarm 1	See user manual for TB board	See user manual for TB board
A099 TB alarm 1	See user manual for TB board	See user manual for TB board
A100 TB alarm 1	See user manual for TB board	See user manual for TB board
A101 TB alarm 1	See user manual for TB board	See user manual for TB board
A102 TB alarm 1	See user manual for TB board	See user manual for TB board
A103 TB alarm 1	See user manual for TB board	See user manual for TB board
A104 TB alarm 1	See user manual for TB board	See user manual for TB board
A105 TB alarm 1	See user manual for TB board	See user manual for TB board
A106 TB alarm 1	See user manual for TB board	See user manual for TB board
A107 TB alarm 1	See user manual for TB board	See user manual for TB board
A108 TB alarm 1	See user manual for TB board	See user manual for TB board
A109 TB alarm 1	See user manual for TB board	See user manual for TB board
A110 TB alarm 1	See user manual for TB board	See user manual for TB board
A111 TB alarm 1	See user manual for TB board	See user manual for TB board
A112 TB alarm 1	See user manual for TB board	See user manual for TB board
A113 TB alarm 2	See user manual for TB board	See user manual for TB board
A114 TB alarm 2	See user manual for TB board	See user manual for TB board
A115 TB alarm 2	See user manual for TB board	See user manual for TB board
A116 TB alarm 2	See user manual for TB board	See user manual for TB board
A117 TB alarm 2	See user manual for TB board	See user manual for TB board

Number / Alarm	Cause	Counter-measure
A118 TB alarm 2	See user manual for TB board	See user manual for TB board
A119 TB alarm 2	See user manual for TB board	See user manual for TB board
A120 TB alarm 2	See user manual for TB board	See user manual for TB board
A121 TB alarm 2	See user manual for TB board	See user manual for TB board
A122 TB alarm 2	See user manual for TB board	See user manual for TB board
A123 TB alarm 2	See user manual for TB board	See user manual for TB board
A124 TB alarm 2	See user manual for TB board	See user manual for TB board
A125 TB alarm 2	See user manual for TB board	See user manual for TB board
A126 TB alarm 2	See user manual for TB board	See user manual for TB board
A127 TB alarm 2	See user manual for TB board	See user manual for TB board
A128 TB alarm 2	See user manual for TB board	See user manual 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.

Number / Fault	Cause	Counter-measure
FF01 Time slot overflow	A time slot overflow which cannot be corrected has been detected in the higher-priority time slots.	- Increase sampling time (P357 or reduce pulse frequency (P340) - Replace CU, or replace the unit (Compact PLUS type)
FF03 Access fault Optional board	Serious faults have occurred while accessing external option boards (CB, TB, SCB, TSY ..).	- Replace CU, or replace the unit (Compact PLUS type) - Replace the LBA - Replace the option board
FF04 RAM	A fault has occurred during the test of the RAM.	- Replace CU, or replace the unit (Compact PLUS type)
FF05 EPROM fault	A fault has occurred during the test of the EPROM.	- Replace CU, or replace the unit (Compact PLUS type)
FF06 Stack overflow	Stack has overflowed	For VC: Increase sampling time (P357) For MC: Reduce pulse frequency (P340) - Replace CU, or replace the unit (Compact PLUS type)
FF07 Stack Underflow	Stack underflow	- Replace CU, or replace the unit (Compact PLUS type) - Replace firmware
FF08 Undefined Opcode	Invalid processor command should be processed	- Replace CU, or replace the unit (Compact PLUS type) - Replace firmware
FF09 Protection Fault	Invalid format in a protected processor command	- Replace CU, or replace the unit (Compact PLUS type) - Replace firmware
FF10 Illegal Word Operand Address	Word access to uneven address	- Replace CU, or replace the unit (Compact PLUS type) - Replace firmware
FF11 Illegal Instruction Access	Jump command to uneven address	- Replace CU, or replace the unit (Compact PLUS type) - Replace firmware
FF13 Wrong firmware version	A version conflict between the firmware and the hardware has occurred.	- Replace firmware - Replace CU, or replace the unit (Compact PLUS type)
FF14 FF processing	Unexpected fatal error (During processing of the fatal errors, a fault number has occurred which is unknown to date).	Replace the board
FF15 CSTACK_OVERFLOW	Stack overflow (C-Compiler Stack)	Replace the board
FF16 NMI error	NMI	- Replace firmware - Replace CU, or replace the unit (Compact PLUS type)

Table 14-3 Fatal errors

15 Environmental Friendliness

Environmental aspects during the 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 support panel LOGO	PC:	Covers
LDPE:	Capacitor ring	PP:	Insulating boards bus retrofit
PA6.6:	Fuse holders, mounting rail, capacitor holder, cable retainer, connecting strips, terminal strip, supports, PMU adapter, covers, cable holder	PS:	Fan housing
		UP:	Tensioning profile retaining bolts, tensioning disk

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

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

Environmental aspects during production

Purchased components are generally supplied in recyclable packaging materials (board).

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.

After the service life has expired, the product must be disposed of in accordance with the applicable national regulations.

Bisher sind folgende Ausgaben erschienen:
The following versions have been published so far:

Ausgabe Version	interne Sachnummer Internal item number
AA	476 869 4170 76 J AA-74
AB	476 869 4170 76 J AB-74
AC	476 869 4170 76 J AC-74
AD	A5E00370502
AE	A5E00370502
AF	A5E00370502
AG	A5E00370502

Ausgabe AG besteht aus folgenden Kapiteln:

Kapitel		Änderungen	Seiten-zahl	Ausgabe-datum
1	Definitionen und Warnungen	überarbeitete Ausgabe	6	08.2008
2	Beschre ibung	überarbeitete Ausgabe	1	07.2005
3	Erstinbetri ebsetzung	überarbeitete Ausgabe	2	07.2005
4	Transportieren, Lagern, Auspacken über	arbeitete Ausgabe	1	07.2005
5	Montag e	überarbeitete Ausgabe	13	04.2008
6	EMV-gerec hter Aufbau	überarbeitete Ausgabe	6	07.2005
7	Anschl ießen	überarbeitete Ausgabe	24	08.2008
8	Parametri erung	überarbeitete Ausgabe	26	07.2005
9	Parametri erschritte	überarbeitete Ausgabe	70	05.2006
10	Steuerwort und Zustandswort	überarbeitete Ausgabe	18	07.2005
11	W artung	überarbeitete Ausgabe	4	08.2008
12	F ormieren	überarbeitete Ausgabe	2	07.2005
13	T echnische Daten	überarbeitete Ausgabe	34	08.2008
14	Störungen und Warnungen	überarbeitete Ausgabe	26	07.2005
15	Um weltverträglichkeit	überarbeitete Ausgabe	1	07.2005

Version AG consists of the following chapters:

Chapter		Changes	Pages	Version date
1	Definitions and Warnings	reviewed edition	6	08.2008
2	Descripti on	reviewed edition	1	07.2005
3	First Start-up	reviewed edition	2	07.2005
4	Transport, Storage, Unpacking	reviewed edition	1	07.2005
5	Installati on	reviewed edition	13	04.2008
6	Installation in Conformance with EMC Regulations	reviewed edition	6	07.2005
7	Con necting-up	reviewed edition	24	08.2008
8	Parameter ization	reviewed edition	26	07.2005
9	Parameterizing Steps	reviewed edition	70	05.2006
10	Control Word and Status Word	reviewed edition	18	07.2005
11	Mainte nance	reviewed edition	4	08.2008
12	F orming	reviewed edition	2	07.2005
13	Technical Data	reviewed edition	34	08.2008
14	Faults and Warnings	reviewed edition	26	07.2005
15	Environmental Friendliness	reviewed edition	1	07.2005

Änderungen von Funktionen, technischen Daten, Normen, Zeichnungen und Parametern vorbehalten.

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

Wir haben den Inhalt der Druckschrift auf Übereinstimmung mit der beschriebenen Hard- und Software überprüft. Dennoch können Abweichungen nicht ausgeschlossen werden, so dass wir für die vollständige Übereinstimmung keine Garantie übernehmen. Die Angaben in dieser Druckschrift werden jedoch regelmäßig überprüft und notwendige Korrekturen sind in den nachfolgenden Auflagen enthalten. Für Verbesserungsvorschläge sind wir dankbar.

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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.

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