Operating Manual Edition 11/2003

sinamics

Converter Cabinet Units
SINAMICS G150
75 kW to 800 kW

SIEMENS

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# SINAMICS G150

## Versions A and C

**Operating Instructions**
User Documentation

**Valid for**

| *Converter Type* | *Closed-Loop Control Version* |
|---|---|
| SINAMICS G150 | V1.3 |

**Edition 11/03**

For further information please visit us at:
http://www.ad.siemens.de



We have conscientiously checked the contents of this manual to ensure that they coincide with the hardware and software described. Since deviations cannot be precluded entirely, we cannot guarantee complete conformance. However, the data in this manual is reviewed regularly and any necessary corrections included in subsequent editions. We are thankful for any recommendations or suggestions.

We reserve the right to make technical changes.

Siemens-Aktiengesellschaft

# Preface

## User Documentation

**WARNING**

Before installing and commissioning the converter, make sure that you read all the safety notes and warnings carefully, including the warning labels on the equipment itself. The warning labels must always be legible. Missing or damaged labels must be replaced.

Further information is available from:

## Technical Support

Tel: +49 (0) 180 50 50 222

Fax: +49 (0) 180 50 50 223

E-mail adsupport@siemens.com

## Internet Address

Customers can access general and technical information at the following address: http://www.siemens.com/sinamics.

# Contents

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# Safety Notes

# 1

## 1.1 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.
- Training or instruction in the maintenance and use of appropriate safety equipment in accordance with the technological safety standards.
- First aid training.

**DANGER**

“Danger” indicates that death, severe personal injury, or substantial property damage will result if proper precautions are not taken.

**WARNING**

“Warning” indicates that death, severe personal injury, or substantial property damage can result if proper precautions are not taken.

**CAUTION**

“Caution” with a warning triangle indicates that minor personal injury can result if proper precautions are not taken.

**CAUTION**

"Caution" without a warning triangle indicates that material damage can result if proper precautions are not taken.

**IMPORTANT**

"Important" indicates that an unwanted result or situation can result if the appropriate advice is not taken into account.

**NOTE**

"Note" indicates important information about the product or respective part of the documentation that is essential to highlight.

**WARNING**

Hazardous voltages are present in this electrical equipment during operation.
Non-observance of the warnings can 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 described in this documentation.
The successful and safe operation of this device is dependent on correct transport, proper storage and installation, as well as careful operation and maintenance.
National safety guidelines must be observed.

## Certification

The following certificates can be found under "Safety and Operating Instructions" in the documentation folder:

- EU declaration of conformity
- Certificate of compliance with order
- EU manufacturer's declaration

## 1.2 Safety and Operating Instructions

**DANGER**

This equipment is used in industrial high-voltage installations. During operation, this equipment contains rotating and live, bare parts. For this reason, they could cause severe injury or significant material damage if the required covers are removed, if they are used or operated incorrectly, or have not been properly maintained.
When the machines are used in non-industrial areas, the installation location must be protected against unauthorized access (protective fencing, appropriate signs).

### Prerequisites

Those responsible for protecting the plant must ensure the following:

- The basic planning work for the plant and the transport, assembly, installation, commissioning, maintenance, and repair work is carried out by qualified personnel and/or checked by experts responsible.
- The operating instructions and machine documentation are always available.
- The technical data and specifications regarding the applicable installation, connection, environmental, and operating conditions are always observed.
- The plant-specific assembly and safety guidelines are observed and personal protection equipment is used.
- Unqualified personnel are forbidden from using these machines and working near them.

These operating instructions are intended for qualified personnel and only contain information and notes relating to the intended purpose of the machines.

The operating instructions and machine documentation are written in different languages as specified in the delivery contracts.

**NOTE**

The services and support provided by the SIEMENS service centers are recommended for planning, installation, commissioning, and servicing work.

## Components that can be Destroyed by Electrostatic Discharge (ESD)

**CAUTION**

The board contains components that can be destroyed by electrostatic discharge. These components can be easily destroyed if not handled properly. If you do have to use electronic boards, however, please observe the following:

- You should only touch electronic boards if absolutely necessary.
- If you have to touch boards, however, your body must be electrically discharged beforehand.
- Boards must not come into contact with highly insulating materials (such as 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 (such as metalized plastic boxes or metal containers).
- If the packaging material is not conductive, the boards must be wrapped with a conductive packaging material (such as conductive foam rubber or household aluminum foil).

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

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

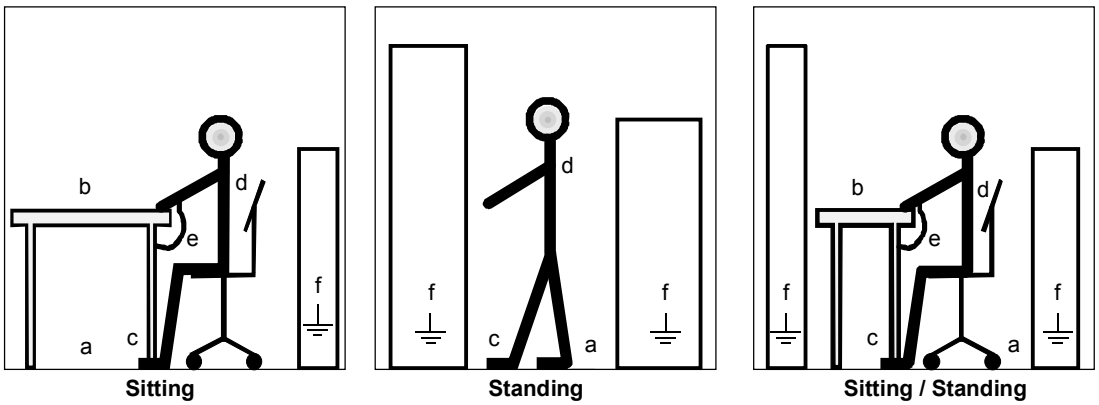


Fig. 1-1 ESD protective measures

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# Device Overview

# 2

## 2.1 Chapter Content

This chapter provides information on the following:

- Introduction to the cabinet units
- The main components and features of the cabinet unit
- The cabinet unit wiring
- Explanation of the type plate

# 2.2 Applications, Features, Design

## 2.2.1 Applications

SINAMICS G150 drive converter cabinet units are ideally suited to variable-speed drives with a quadratic load torque $M \sim n^2$, such as:

- Pumps
- Fans
- Turbo-compressors

## 2.2.2 Features

Drives with a quadratic load torque do not normally require a high overload reserve, nor do they require high-performance closed-loop control with a high dynamic response, or a speed sensor.

SINAMICS G150 takes this into account and, as a result, offers a low-cost drive solution tailored to actual requirements.

In addition, factors have been considered to ensure easy handling of the drive from the planning and design phase through to operation. These factors include:

- Compact, modular, service-friendly design
- Straightforward planning and design
- Ready to connect to facilitate the installation process
- Quick, menu-driven commissioning with no complex parameterization
- Clear and convenient operation via a user-friendly graphical operator panel with measured values and messages displayed in plain text and a quasi-analog bar display for measured values.
- SINAMICS is an integral part of Totally Integrated Automation (TIA). The TIA concept offers an optimized range of products for automation and drive technology. This concept is characterized by planning / design, communication, and data management procedures that are consistent throughout the product range. SINAMICS is totally integrated in the TIA concept.

### Quality

The SINAMICS G150 cabinet units are manufactured to meet high standards of quality and exacting demands.

This results in a high level of reliability, availability, and functionality for our products.

The development, design, and manufacturing processes, as well as order processing and the logistics supply center have been independently certified to DIN ISO 9001.

### Service

Our worldwide sales and service network offers our customers individual consultations, provides support with planning and design, and offers a range of training courses.

Our Web site offers comprehensive online support with product information, downloads, operating instructions, and FAQs.

Helplines and field services are available 24 hours a day, 7 days a week, for support and advice for servicing and ordering spare parts.

## 2.3 Design

The SINAMICS G150 cabinet units are characterized by their compact, modular, and service-friendly design.

A wide range of electrical and mechanical components enable the drive system to be optimized for the appropriate requirements.

Two cabinet unit versions are available depending on the options that are chosen.

## 2.3.1 Version A

All the required power supply connection components, such as the main circuit-breaker, circuit-breakers, main contactor, line fuses, radio interference suppression filter, motor components, and additional protection and monitoring devices, can be installed as required.

The cabinet unit comprises up to two cabinet panels with a total width of between 800 and 1600 mm, depending on the output.

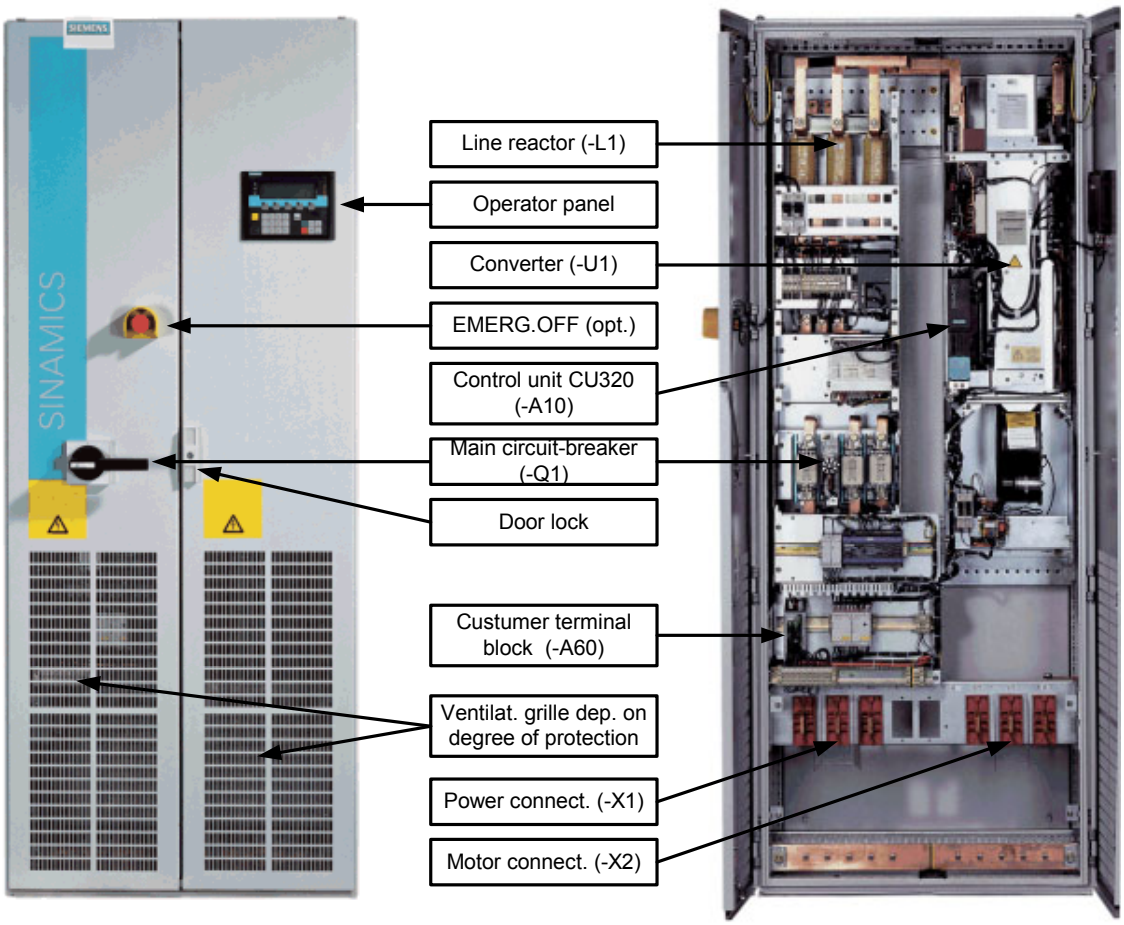



Fig. 2-1 Example of a cabinet unit, version A (e.g. 132 kW, 400 V)

## 2.3.2 Version C

This version is particularly compact in design with an in-built line reactor.

It can be used, for example, when the power supply connection components, such as the main contactor and main circuit-breaker with fuses for conductor protection and semi-conductor protection, are installed in an existing central low-voltage distribution unit (MCC).

The advantage here is that the cabinet unit can be sited decentrally and in the immediate vicinity of the motor, thereby avoiding the need for long motor cables and additional output filters.

Line fuses are required for conductor protection (VDE 636, Part 10). Line fuses can also be used to protect the semi-conductors of the line-commutated converter (VDE 636, Part 40/ EN 60 269-4).

The cabinet unit simply comprises a single cabinet with a width of 400 mm, 600 mm, or 1000 mm.

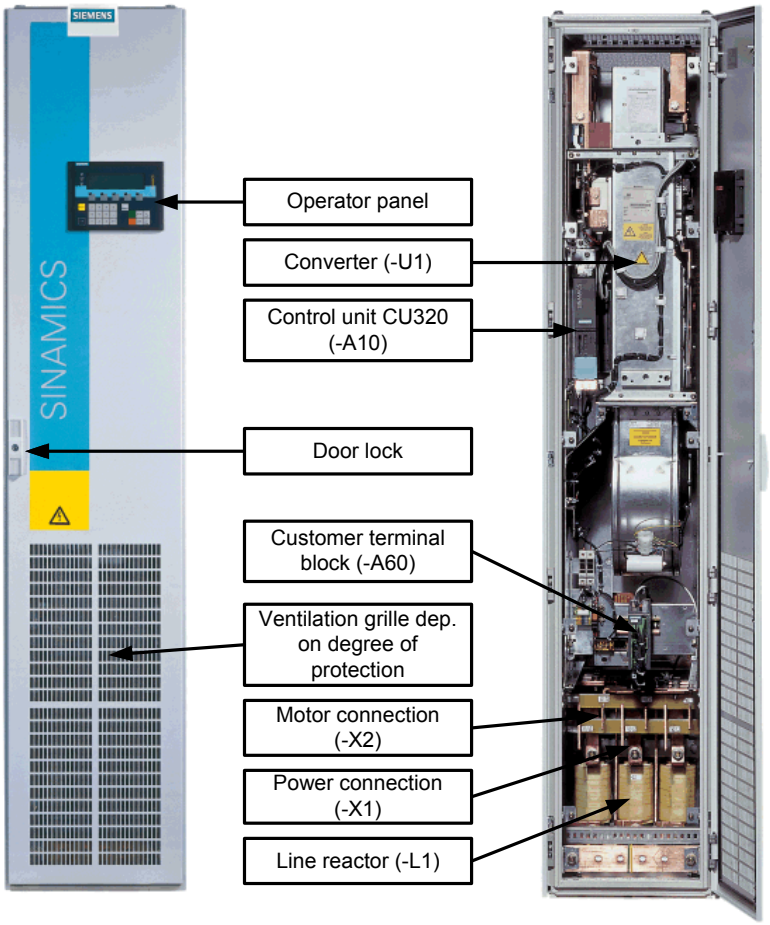
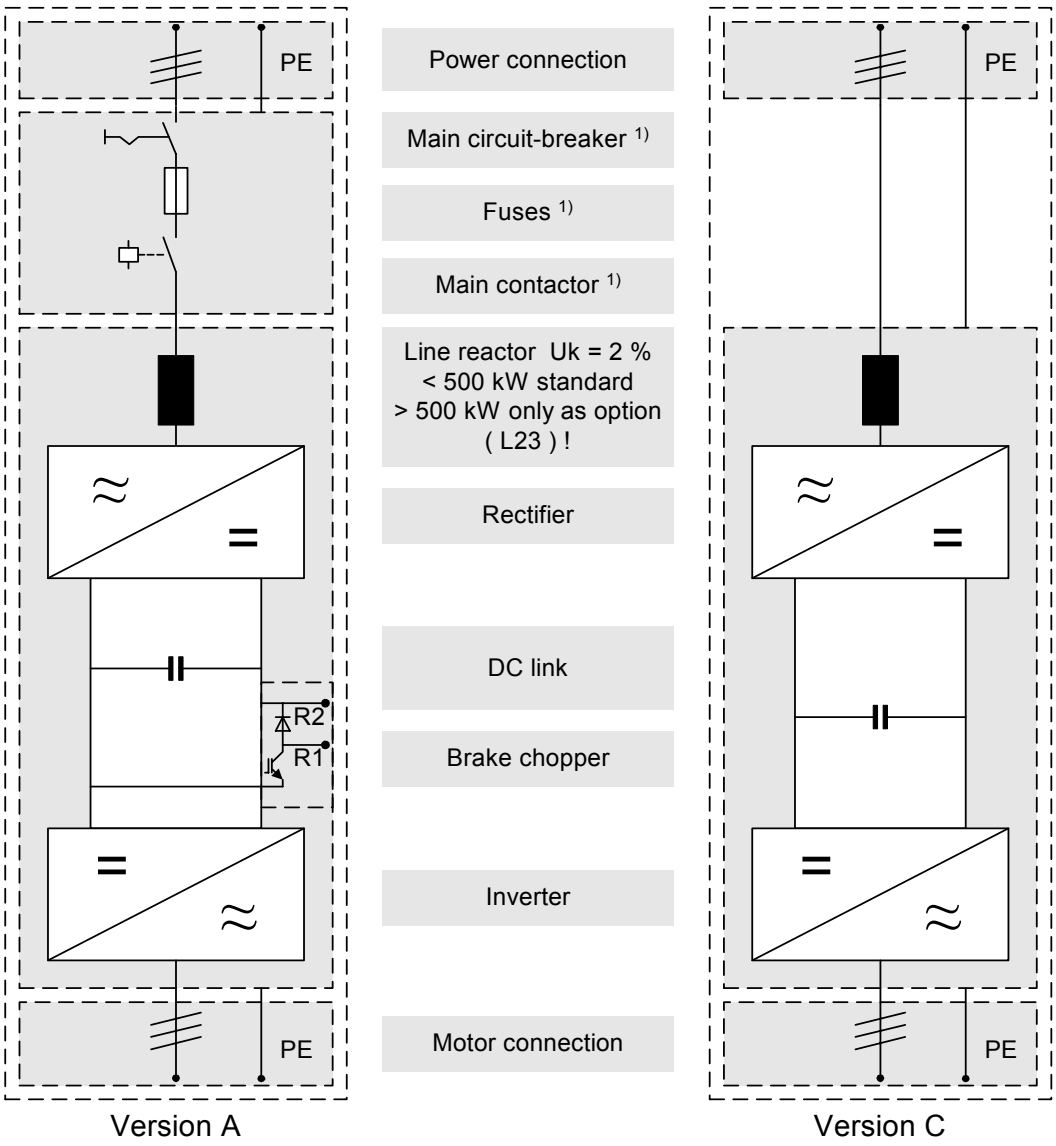



Fig. 2-2 Example of a cabinet unit, version C (e.g. 315 kW, 690 V)

## 2.4 Wiring Principle

### Wiring principle: versions A and C




1) From an output current of > 800 A, the main circuit-breaker, fuses and main contactor functions are implemented by means of circuit-breakers

Fig. 2-3 Wiring principle: versions A and C

**IMPORTANT**

The motor earth must be fed back directly to the cabinet unit.

## 2.5 Type Plate

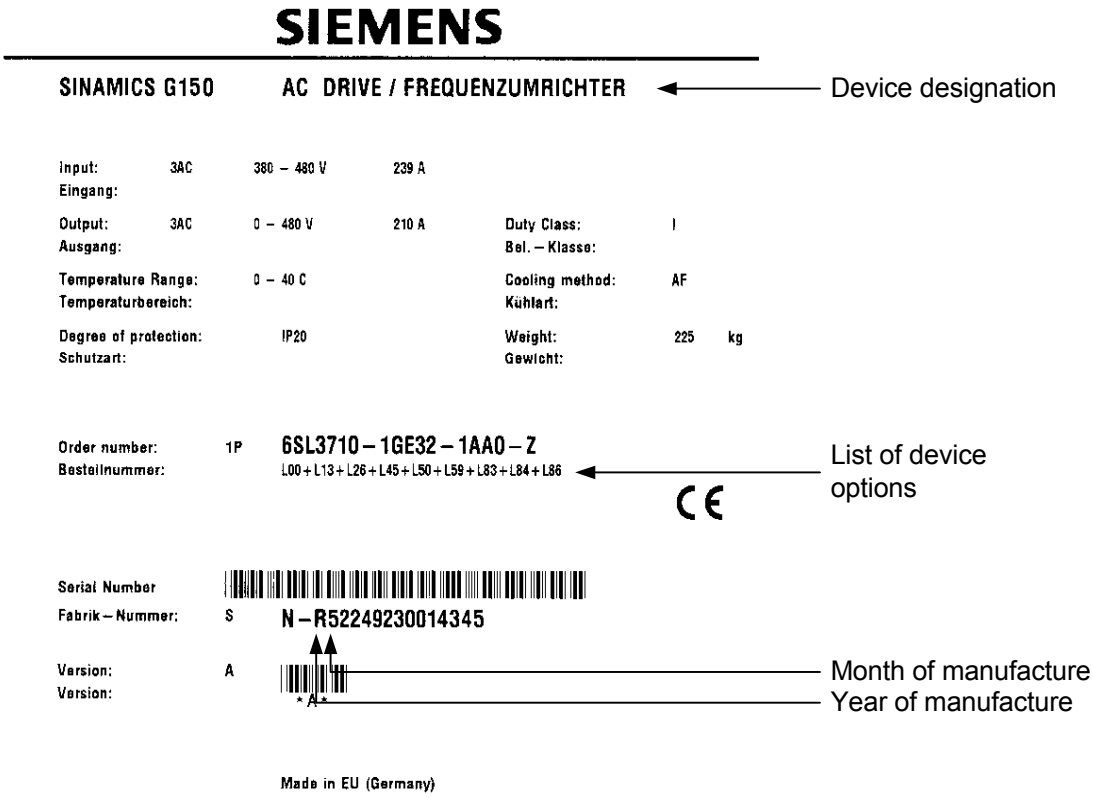



Fig. 2-4 Type plate for the cabinet unit

### Date of Manufacture

The date of manufacture can be ascertained as follows:

Table 2-1 Year and month of manufacture

| Letter / number | Year of manufacture | | Letter / number | Month of manufacture |
|---|---|---|---|---|
| R | 2003 | | 1 to 9 | January to September |
| S | 2004 | | O | October |
| T | 2005 | | N | November |
| U | 2006 | | D | December |

## Type Plate Data (from Type Plate on Previous Page)

Table 2-2 Type plate data

| Specification | Value | Explanation |
|---|---|---|
| Input | 3AC<br>380 – 480 V<br>239 A | Three-phase connection<br>Rated input voltage<br>Rated input current |
| Output | 3AC<br>0 – 480 V<br>210 A | Three-phase connection<br>Rated output voltage<br>Rated output current |
| Temperature range | 0 -40 °C | Ambient temperature range within which the cabinet unit can operate under 100 % load |
| Degree of protection | IP20 | Degree of protection |
| Duty class | I | I: Duty class I to EN 60146-1-1 = 100 % (continuously)<br>(with the specified current values, the cabinet unit can operate continuously under 100 % load) |
| Cooling method | AF | A: coolant: air<br>F: circulation method: forced cooling, drive unit (fan) in the device |
| Weight | | Weight of the cabinet unit |

## Explanation of the Option Short Codes

Table 2-3 Explanation of the option codes

| | | Version | |
|---|---|---|---|
| | | A | C |
| **Input options** | | | |
| L00 | Radio interference suppression filter, limit class A1 (TN, TT systems) | ● | — |
| L13 | Main contactor (for currents < 800 A) | ● | — |
| L22 | Without line reactor in power range P < 500 kW (available soon) | ● | ● |
| L23 | Line reactor $u_k$ = 2 % for P > 500 kW | ● | ● |
| L26 | Main circuit-breaker (incl. fuses/circuit-breakers) | ● | — |
| **Output options** | | | |
| L08 | Output filter | ● | — |
| **Input and output options** | | | |
| M70 | EMC shield bus | ● | ● |
| M75 | PE busbar | ● | ● |

| | | Version | |
|---|---|---|---|
| | | A | C |
| **Motor protection and safety functions** | | | |
| L45 | EMERGENCY OFF button in the cabinet unit door | ● | – |
| L57 | EMERGENCY OFF category 0 (230 V AC or 24 V DC, uncontrolled stop) | ● | – |
| L59 | EMERGENCY OFF category 1 (230 V AC, controlled stop) | ● | – |
| L60 | EMERGENCY OFF category 1 (24 V AC, controlled stop) | ● | – |
| L83 | Thermistor motor protection unit with PTB approval (warning) | ● | – |
| L84 | Thermistor motor protection unit with PTB approval (shutdown) | ● | – |
| L86 | PT100 evaluation unit (for 6 PT100) | ● | – |
| L87 | Insulation monitoring | ● | – |
| M60 | Additional shock-hazard protection | ● | ● |
| **Increase in degree of protection** | | | |
| M21 | IP21 degree of protection | ● | ● |
| M23 | IP23 degree of protection | ● | ● |
| M54 | IP54 degree of protection | ● | ● |
| **Mechanical options** | | | |
| M06 | Plinth, 100 mm high, RAL 7022 | ● | ● |
| M07 | Cable wiring compartment, 200 mm high, RAL 7035 | ● | ● |
| M13 | Line connection from above | ● | – |
| M78 | Motor connection from above | ● | – |
| M90 | Top-mounted crane transport assembly for cabinets | ● | ● |
| Y09 | Special paint finish for cabinet | ● | ● |
| **Miscellaneous options** | | | |
| L19 | Connection for external auxiliary equipment (controlled max. 10 A) | ● | – |
| L50 | Cabinet illumination with service socket | ● | – |
| L55 | Anti-condensation heating for standard cabinet | ● | – |
| L61 | 100 kW braking unit | ● | – |
| L62 | 200 kW braking unit | ● | – |
| D58 | Documentation in English / French | ● | ● |
| D60 | Documentation in English / Spanish | ● | ● |
| D80 | Documentation in English / Italian | ● | ● |
| T58 | Type plate and operator panel in English / French | ● | ● |
| T60 | Type plate and operator panel in English / Spanish | ● | ● |
| T80 | Type plate and operator panel in English / Italian | ● | ● |

● indicates that this option is available for that version.

– indicates that this option is not available for that version.

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# Mechanical Installation

# 3

## 3.1 Chapter Content

This chapter provides information on the following:

- The conditions for transporting, storing, and installing the cabinet unit
- Preparing and installing the cabinet unit

## 3.2 Transportation and Storage

### Transportation

**WARNING**

The following must be taken into account when the devices are transported:

- The devices are heavy. Their center of gravity is displaced, and they can be top heavy.
- Suitable hoisting gear operated by trained personnel is essential due to the weight of the devices.
- The devices must only be transported in the upright position indicated. The devices must not be transported upside down or horizontally.
- Serious injury or even death and substantial material damage can occur if the devices are not lifted or transported properly.

**NOTES regarding transportation**

- The devices are packaged by the manufacturers in accordance with the climatic conditions and stress encountered during transit and in the recipient country.
- The notes on the packaging for transportation, storage, and proper handling must be observed.
- The devices must be carried on a wooden palette when transported with fork-lift trucks.
- When the devices are unpacked, they can be transported using the optional transport eyebolts (option M90) or rails on the cabinet unit. The load must be distributed evenly. Heavy blows or impacts must be avoided during transit and when the devices are being set down, for example.
- Permissible ambient temperatures:
  Ventilation: -25°C to +70°C, class 2K3 to IEC 60 721-3-2
  Up to -40°C for max. 24 hours

**NOTES regarding built-in system-side components**

If built-in system-side components are to be installed on doors or side panels, you must take into account the following points:

- The degree of protection (IP20, IP21, IP23, IP54) must not be reduced as a result.
- The electromagnetic compatibility of the cabinet unit must not be adversely affected.
- When control elements are installed on side or rear panels, the panels must be grounded separately.

**NOTES regarding damage in transit**

- Carry out a thorough visual inspection of the device before accepting the delivery from the transportation company.
- Ensure that you have received all the items specified on the delivery note.
- Notify the transportation company immediately of any missing components or damage.
- If you identify any hidden deficiencies or damage, contact the transportation company immediately and ask them to examine the device.
- If you fail to contact them immediately, you may lose your right to claim compensation for the deficiencies and damage.
- If necessary, you can request the support of your local Siemens branch.

**WARNING**

Damage in transit indicates that the device was subject to unreasonable stress. The electrical safety of the device can no longer be ensured. It must not be connected until a thorough high-voltage test has been carried out.

Death, serious injury, or substantial material damage can result if these factors are not taken into account.

## Storage

The devices must be stored in clean, dry rooms. Permissible temperatures: between –25°C and +70°C. Temperature variations greater than 20 K per hour are not permitted.

If the device is stored for a prolonged period once it has been unpacked, cover it or take other appropriate measures to ensure that it does not become dirty and that it is protected against environmental influences. If such measures are not taken, the guarantee becomes invalid in the event of a claim for damages.

**WARNING**

The storage period should not exceed two years. If the device is stored for more than two years, the DC link capacitors of the devices must be reformed during commissioning.

The reforming procedure is described in "Maintenance and Servicing”.

## 3.3 Installation

**WARNING**
To ensure that the devices operate safely and reliably, they must be properly installed and put into operation by qualified personnel, taking into account the warning messages provided in these operating instructions.

In particular, both the general and national installation and safety guidelines for high-voltage installations (e.g. VDE – the Union of German Technical Engineers) and the guidelines relating to the professional use of tools and the use of personal protective equipment must be observed.

Death, serious injury, or substantial material damage can result if these factors are not taken into account.

### 3.3.1 Mechanical Installation: Checklist

Use the following checklist to guide you through the mechanical installation procedure for the cabinet unit. Read the safety notes at the start of these operating instructions before you start working on the device.

**NOTE**

Check the boxes accordingly in the right-hand column if the activity applies to the cabinet unit in your scope of supply. In the same way, check the boxes once you have finished the installation procedure to confirm that the activities are complete.

| Item | Activity | Fulfilled/Complete | |
|---|---|---|---|
| 1 | The ambient conditions must be permissible. See "Technical Data, General Technical Data".<br>The cabinet unit must be firmly attached to the fixing points provided. With version C with a width of 400 mm, the cabinet unit can, if required, be secured to a non-flammable vertical surface by means of the wall support supplied (see Section 3.3.2).<br>The cooling air can flow unobstructed. | ☐ | ☐ |
| 2 | The minimum ceiling height (for unhindered air outlet) specified in the operating instructions must be observed. The cooling air supply must be not be obstructed (see Section 3.3.2). | ☐ | ☐ |
| 3 | Components that are supplied separately for transport reasons (canopy or hood) must be fitted (see Section 3.3.4). | ☐ | ☐ |
| 4 | The clearance around an open door (escape route) specified in the applicable accident prevention guidelines must be observed. | ☐ | ☐ |
| 5 | For option M13/M78:<br>Choose the required metric screw connections or conduit thread connections on the basis of the cable cross-section and drill the required holes in the blanking plates. When the cable is fed in from above, ensure that enough room is available if the cable has to be bent because of the cable feeder. The cable should be fed in vertically to minimize transverse forces on the entries. | ☐ | ☐ |

## 3.3.2 Preparatory Steps

### On-Site Requirements

The cabinet units are suitable for installation in general operating areas (DIN VDE 0558 / Edition 7.87, Part 1 / Section 5.4.3.2.4).
The standard specifies the following:
When power conversion units are installed in general operating areas, live parts must be protected in such a way that they cannot be touched either directly or indirectly.
The operating areas must be dry and free of dust. The air supplied must not contain any electrically conductive gas, vapors, or dust, which could impair the function of the devices. It may be necessary to filter the air supplied to the installation room. If the air contains dust, filter mats (option M54) can be installed in front of the hoods (IP54) and the ventilation grilles on the cabinet doors.
The ambient conditions for the units in the operating rooms must not exceed the values of code F in accordance with EN 60146. At temperatures > 40°C (104°F) and altitudes > 2000 m, the devices must be derated.
The basic version of the cabinet units complies with the IP20 degree of protection in accordance with EN 60529.
The cabinet units are installed in accordance with the dimension drawings supplied. The clearance between the top of the cabinet unit and the ceiling is also specified on the dimension drawings.
The cooling air for the power unit is drawn in from the front through the ventilation grilles in the lower part of the cabinet doors. The warmed air is expelled through the perforated top cover or the ventilation grilles in the top cover (with option M23/M54). Cooling air can also be supplied from below through raised floors or air ducts, for example. To allow this, you have to create openings in the 3-section bottom plate.
According to EN 61800-3, the cabinet units are not suitable for use in low-voltage public networks that supply residential buildings. High-frequency interference may occur if they are used in this type of network.

### Unpacking the Cabinet Units

Check the delivery against the delivery note to ensure that all the items have been delivered. Check that the cabinet is intact.
The packaging material must be discarded in accordance with the applicable country-specific guidelines and rules.

### Required Tools

To install the connections, you will require:

- Spanner or socket spanner (w/f 10)
- Spanner or socket spanner (w/f 13)
- Spanner or socket spanner (w/f 18/19)
- Hexagon-socket spanner (size 8)
- Torque spanner (max. 50 Nm)
- Screwdriver (size 2)
- Screwdriver (Torx T20)
- Screwdriver (Torx T30)

## 3.3.3 Installation

### Lifting the Device off the Transport Palette

The applicable local guidelines regarding the transportation of the cabinet from the transport palette to the installation location must be observed.

A crane transport assembly (option M90) can also be fitted on the top of the cabinet.

### Installation

Four holes for M12 screws are provided on each cabinet panel to secure the cabinet to the ground. The fixing dimensions are specified on the dimension drawings enclosed.

Two wall supports for attaching the top of the cabinet to the wall are also supplied for 400 mm-wide cabinets to provide extra security.

## 3.3.4 Additional Canopies (Option M21) or Hoods (Option M23, M54)

To increase the degree of protection of the cabinets from IP20 (standard) to IP21, IP23, or IP54, additional canopies or hoods are supplied. These must be fitted once the cabinets have been installed.

### Description

The degree of protection can be increased to IP21 by fitting an additional canopy. The canopy is flush-mounted with the cabinet unit and is fitted using spacers at a distance of 250 mm above the top of the cabinet. As a result, cabinets with a canopy are 250 mm higher.

Cabinet units with degree of protection IP23 are supplied with additional hoods, as well as plastic ventilation grilles and braided plastic in the air inlet (doors) and outlet (hoods). The hoods are flush with the cabinets at the side and front and have a recess at the rear so that air can escape even if the cabinet is wall mounted. Air escapes from the front and back. The hood is secured by means of the four holes for the crane hook in the cabinet. Hoods increase the height of the cabinet by 400 mm.

Cabinet units with degree of protection IP54 are supplied with additional hoods, plastic ventilation grilles, and a filter medium in the air inlet (doors) and outlet (hoods). The filter mediums can be easily fitted and replaced from the outside. Air escapes from the front and back. Compliance with degree of protection IP54 requires an intact filter medium, which must be replaced on a regular basis due to the prevailing ambient conditions.

### Attaching a Canopy to Increase the Degree of Protection (Option M21)

1. Remove the crane transport assembly (if fitted).
2. Attach the spacers to the roof of the cabinet at the positions specified. You may have to remove the protective grille.
3. Fit the canopy to the spacers.

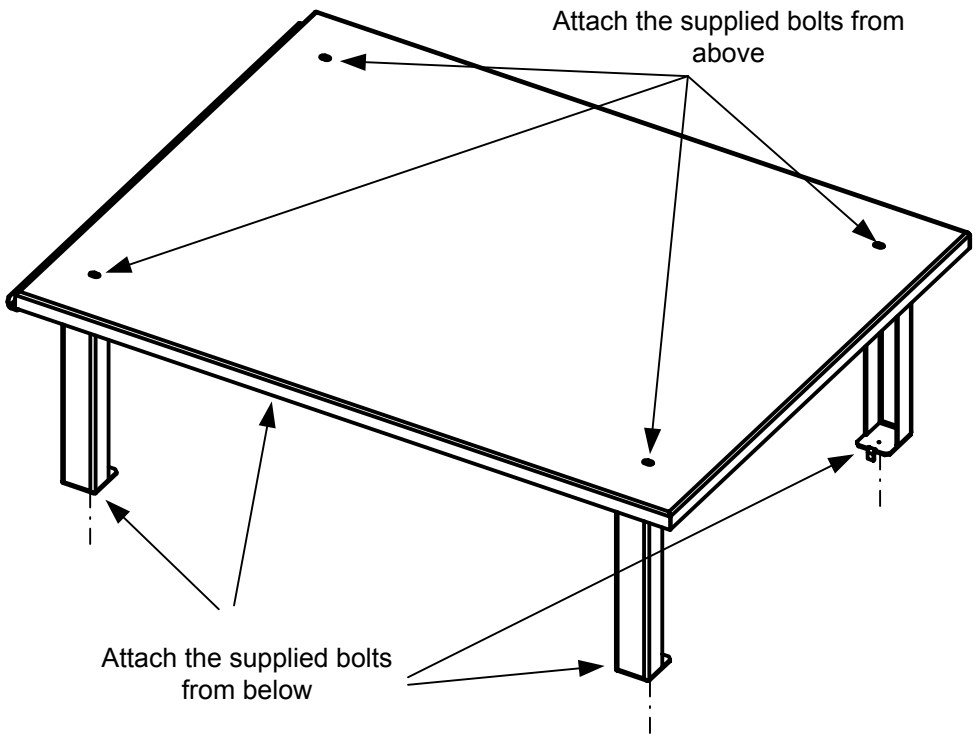


Fig. 3-1 Cabinet with attached canopy

### Attaching a Hood to Increase the Degree of Protection to IP23 / IP54 (Option M23 / M54)

- Remove the crane transport assembly (if fitted).
- Make sure that the perforated top cover is not fitted on the top of the cabinet (depending on production requirements, this can be fitted at a later stage).
- For option M54 only:
  Secure the contact surfaces of the hood on top of the cabinet using the sealing tape provided.
- Fit the hood to the roof of the cabinet at the positions specified (fixing points for the crane transport assembly).

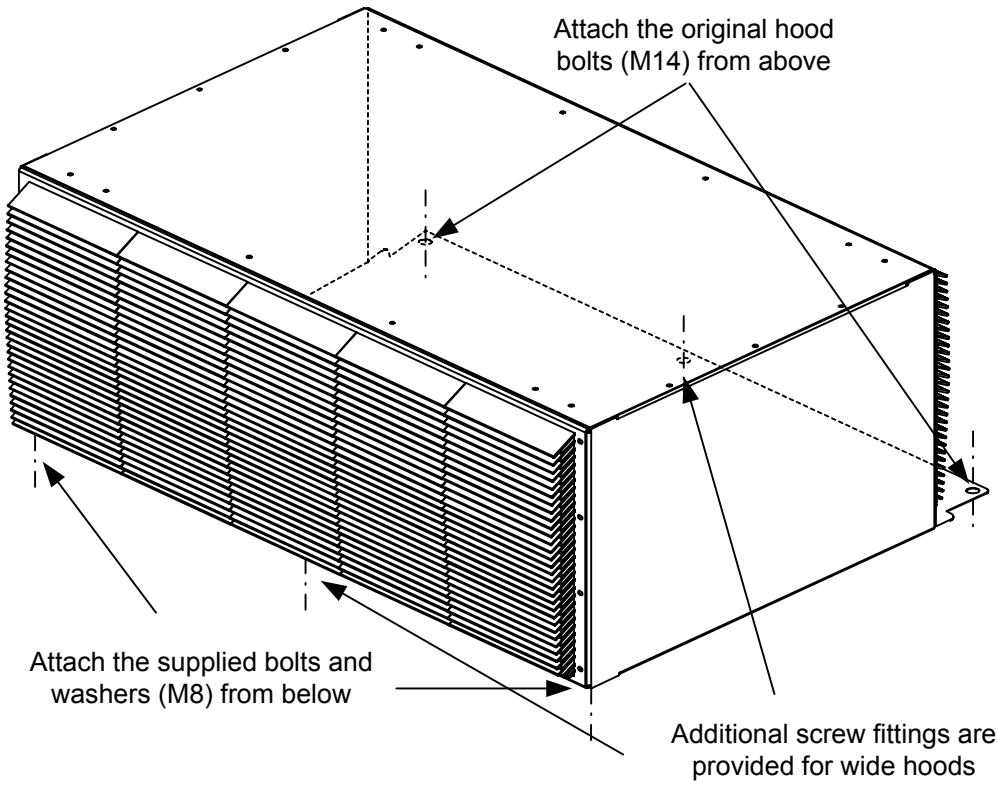


Fig. 3-2 Attaching a hood

## 3.3.5 Cable Entry from Above (Option M13), Motor Connection from Above (Option M78)

### Cable Entry from Above

With options M13 and M78, the cabinet unit is equipped with an additional hood. The connection straps for the power cables, the clamping bar for mechanically securing the cables, an EMC shield bus, and a PE busbar are located within the hood.

The hood adds an extra 405 mm to the cabinet height. The busbars for connection from above are fully mounted when the system is delivered. For transport reasons, the hoods are delivered separately and must be mounted on site. With options M23 and M54, plastic ventilation grilles and filter mats are also supplied.

A 5 mm aluminum mounting plate (with no holes) is fitted in the roof of the cover for feeding in the cables. Depending on the number of cables and the cross-sections used, holes for attaching cable glands for feeding in the cables must be drilled in this mounting plate on site.

**NOTE**

The control cables and optional brake resistors are connected as before from below.

### Attaching the Hood

- Remove the crane transport assembly (if fitted).
- For option M54 too:
  Secure the contact surfaces of the hood on top of the cabinet using the sealing tape provided.
- Fit the hood to the roof of the cabinet at the positions specified (fixing points for the crane transport assembly).
- To secure the power cables, remove the front panel of the hood.

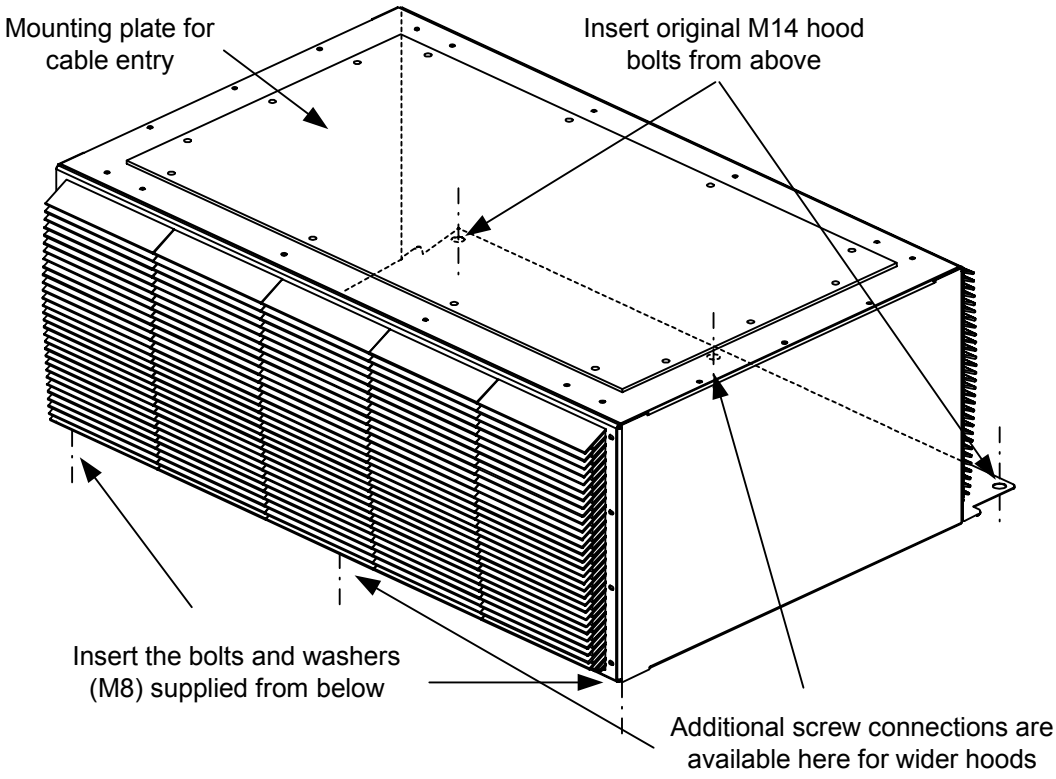


Fig. 3-3 Attaching the hood with M13 / M78

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# Electrical Installation

# 4

## 4.1 Chapter Content

This chapter provides information on the following:

- Establishing the electrical connections for the cabinet unit
- Adjusting the fan voltage and the internal power supply to local conditions (supply voltage)
- The customer terminal block and its interfaces
- The interfaces for additional options

## 4.2 Electrical Installation: Checklist

Use the following checklist to guide you through the electrical installation procedure for the cabinet unit. Read the safety notes at the start of these operating instructions before you start working on the device.

**NOTE**

Check the boxes accordingly in the right-hand column if the activity applies to the cabinet unit in your scope of supply. In the same way, check the boxes once you have finished the installation procedure to confirm that the activities are complete.

| Item | Activity | Fulfilled/Complete | |
|---|---|---|---|
| | **Power Connections** | | |
| 1 | The line-side and motor-side power cables must be dimensioned and routed in accordance with the ambient and routing conditions. The maximum permissible cable lengths between the converter and motor must be observed depending on the type of cable used (see Section 4.6.1).<br>The motor ground must be fed back directly to the cabinet unit.<br>The cables must be properly connected with a torque of 50 Nm to the cabinet unit terminals. The cables for the motor and low-voltage switchgear must also be connected with the required torques. | ☐ | ☐ |
| 2 | The cables between the low-voltage switchgear and the cabinet unit must be protected with line fuses for conductor protection (VDE 636, Part 10). With version C, combined fuses must be used for conductor and semi-protection (VDE636, Part 40 / EN60269-4). See “Technical Data” for the appropriate fuses. | ☐ | ☐ |
| 3 | For strain relief, the cables must be clamped on the cable clamping bar (C-bar). | ☐ | ☐ |
| 4 | When EMC-shielded cables are used, screwed glands that connect the shield to ground with the greatest possible surface area must be provided on the motor terminal box. On the cabinet, the cables must be grounded with the clips supplied with the EMC shield bar with the greatest possible surface area (shield bar supplied with option L00 or can be ordered separately with option M70 – see Chapter 4.5). | ☐ | ☐ |
| 5 | The cable shields must be properly applied and the cabinet properly grounded at the appropriate points (see Chapter 4.5). | ☐ | ☐ |
| 6 | The voltage for the fan transformer (-U1-T10) for versions A and C, and the internal power supply (-A1-T10) for version A must be adapted to the supply voltage of the cabinet unit (see Section 4.6.3). | ☐ | ☐ |
| 7 | Before the cabinet is operated from an ungrounded supply/IT supply, the connection bracket for the basic interference suppression device must be removed (see Section 4.6.5). | ☐ | ☐ |

| Item | Activity | | Fulfilled/Complete |
|---|---|---|---|
| 8 | The type plate can be used to ascertain the date of manufacture. If the period from the date of manufacture to initial commissioning or the cabinet unit downtime is less than two years, the DC link capacitors do not have to be reformed. If the downtime period is longer than two years, they must be reformed in accordance with the description in the "Maintenance and Servicing" section. | | ☐ ☐ |
| 9 | With an external auxiliary supply, the cable for the 230 V AC supply must be connected to terminal -X40, while the cable for the 24 V DC supply must be connected to terminal –X9 (see Section 4.7). | | ☐ ☐ |
| 10 | Option L50<br>Cabinet illumination with socket | The 230 V auxiliary supply for the cabinet illumination with an integrated service socket must be connected to terminal X390 and, on the system side, protected with a fuse (max. 10 A) (see Section 4.9.5). | ☐ ☐ |
| 11 | Option L19<br>Connection for external auxiliary equipment | To supply auxiliary equipment (e.g. separately-driven fan for motor), the drive must be properly connected to terminals -X155:1 (L1) to -X155:3 (L3). The supply voltage of the auxiliary equipment must match the input voltage of the cabinet unit and the load current must not be greater than 10 A (see Section 4.9.2). | ☐ ☐ |
| 12 | Option L55<br>Anti-condensation heating for cabinet | The 230 V auxiliary supply for the anti-condensation heating for the cabinet (230 V / 50 Hz, 100 W / or 230 V / 50 Hz 2 x 100 W for cabinets with a width of 800 to 1200 mm) must be connected to terminals -X240: 1 to 3 and protected with fuses (max. 16 A) (see Section 4.9.6). | ☐ ☐ |
| | **Signal Connections** | | |
| 13 | Cabinet unit operation by higher-level controller / control room. The control cables must be connected in accordance with the interface assignment and the shield applied. Taking into account electrical interference and the distance from power cables, the digital and analog signals must be routed with separate cables. | | ☐ ☐ |
| | **Connecting protection and monitoring devices** | | |
| 14 | Option L45<br>EMERGENCY OFF button | The contacts for the EMERGENCY OFF button are connected to terminal -X120 and can be picked off so that they can be integrated in a higher-level installation protection concept (see Section 4.9.4). | ☐ ☐ |
| 15 | Option L57<br>EMERGENCY OFF category 0 (230 V AC / 24 V DC) | EMERGENCY OFF category 0 stops the drive in an uncontrolled manner. No additional wiring is necessary when implemented in conjunction with option L45.<br>If the cabinet unit is integrated in an external safety circuit, however, the contact must be looped in via terminal block -X120 (see Section 4.9.7). | ☐ ☐ |

| Item | Activity | | Fulfilled/Complete |
|---|---|---|---|
| 16 | Option L59<br>EMERGENCY OFF category 1 (230 V AC) | EMERGENCY OFF category 1 stops the drive in a controlled manner. With this option, it may be necessary to implement braking units (brake chopper and external braking resistors) due to the load characteristic and to achieve the required shutdown times. No additional wiring is necessary when implemented in conjunction with option L45. If the cabinet unit is integrated in an external safety circuit, however, the contact must be looped in via terminal block -X120 (see Section 4.9.8). | ☐ ☐ |
| 17 | Option L60<br>EMERGENCY OFF category 1 (24 V DC) | EMERGENCY OFF category 1 stops the drive in a controlled manner. With this option, it may be necessary to implement braking units (brake chopper and external braking resistors) due to the load characteristic and to achieve the required shutdown times. No additional wiring is necessary when implemented in conjunction with option L45. If the cabinet unit is integrated in an external safety circuit, however, the contact must be looped in via terminal block -X120 (see Section 4.9.9). | ☐ ☐ |
| 18 | Option L61/L62<br>Braking unit | The connecting cables and ground for the braking resistor must be connected to terminal block –X5: R1/R2. A connection must be established between the braking resistor thermostat and customer terminal block –A60. The settings for evaluating the thermostat as "External Fault 3" must be made (see 4.9.10). | ☐ ☐ |
| 19 | Option L83<br>Thermistor motor protection unit (warning) | The PTC thermistor sensors (PTC resistor type A) must be connected to the thermistor motor protection unit -F127 at terminals T1 and T2 for warning (see Section 4.9.11). | ☐ ☐ |
| 20 | Option L84<br>Thermistor motor protection unit (shutdown) | The PTC thermistor sensors (PTC resistor type A) must be connected to the thermistor motor protection unit -F125 at terminals T1 and T2 for shutdown (see Section 4.9.11). | ☐ ☐ |
| 21 | Option L86<br>PT100 evaluation unit | The resistor thermometers must be connected to evaluation unit -A140 for the PT100 evaluation. The two-wire or three-wire system can be used here to connect the PT100 sensors. The sensors are divided into two groups (see Section 4.9.12). This must be taken into account when the evaluation is performed (factory setting). | ☐ ☐ |

| Item | Activity | | Fulfilled/Complete |
|---|---|---|---|
| 22 | Option L87<br>Insulation monitoring | The insulation monitor can only be operated with the insulated-neutral system. Only one insulation monitor may be used in one electrically connected network. For system-side control, the signaling relays must be connected accordingly or, with individual drives (the cabinet unit is fed via a converter transformer assigned to the cabinet unit), integrated in the cabinet unit warning train (see 4.9.13).<br>Point 7 must also be taken into account: Before the cabinet is operated from an ungrounded supply/IT supply, the connection bracket for the interference-suppression capacitor must be removed (see 4.6.5). | ☐ ☐ |

## Required Tools

To install the connections, you will require:

- Spanner or socket spanner (w/f 10)
- Spanner or socket spanner (w/f 13)
- Spanner or socket spanner (w/f 18/19)
- Hexagon-socket spanner (size 8)
- Torque spanner, max. 50 Nm
- Screwdriver, size 2
- Screwdriver Torx T20
- Screwdriver Torx T30

## 4.3 Important Safety Precautions

**WARNING**

The cabinet units are operated with high voltages.
All connection procedures must be carried out with the cabinet de-energized.
All work on the units must be carried out by trained personnel only.
Death, serious injury, or substantial material damage can result if these warnings are not taken into account.

Work on an open device must be carried out with extreme caution because external supply voltages may be present. The power and control terminals may be live even when the motor is not running.
Dangerously high voltage levels are still present in the cabinet up to five minutes after it has been disconnected due to the DC link capacitors. For this reason, the cabinet should not be opened until after a reasonable period of time has elapsed.

Reforming the DC link capacitors:
The storage period should not exceed two years. If the device is stored for more than two years, the DC link capacitors of the devices must be reformed during commissioning.
The reforming procedure is described in "Maintenance and Servicing”.

The operator is responsible for ensuring that the motor, converter, and other devices are installed and connected in accordance with the recognized technical rules in the country of installation and applicable regional guidelines. Special attention should be paid to cable dimensioning, fuses, grounding, shutdown, disconnection, and overcurrent protection.

If an item of protective gear trips in a branch circuit, a leakage current may have been disconnected. To reduce the risk of fire or an electric shock, the current-carrying parts and other components in the cabinet unit should be inspected and damaged parts replaced. When an item of protective gear trips, the cause of the trip must be identified and rectified.

**NOTE**

The standard version of the cabinet units are equipped with shock-hazard protection in accordance with BGV A 2 (formerly VBG 4) to DIN 57 106, Part 100 / VDE 0106, Part 100.

The version with option M60 features additional protective covers that offer a higher level of shock-hazard protection for current-carrying parts when the cabinet doors are open.
These protective covers may have to be removed during installation and connection procedures. Once work has been completed, the protective covers must be properly refitted.

## 4.4 Introduction to EMC

Electromagnetic compatibility (EMC) describes the capability of an electrical device to function satisfactorily in an electromagnetic environment without itself causing interference unacceptable for other devices in the environment.

EMC, therefore, represents a quality standard for the following:

- Internal noise immunity: resistance against internal electrical disturbances
- External noise immunity: resistance against external electromagnetic disturbances
- Noise emission level: environmental effects caused by electromagnetic emissions

To ensure that the cabinet unit functions satisfactorily in the system, the environment subject to interference must not be neglected. For this reason, special requirements exist regarding the structure and the EMC of the system.

### Operational Reliability and Noise Immunity

Measures must be taken by the converter manufacturer and the operator to ensure the greatest possible level of operational reliability and noise immunity within the entire system (converters, automation systems, drive motors, and so on). Only when all of these measures have been taken are the satisfactory function of the converter and compliance with the legal requirements (89/336/EEC) ensured.

### Noise Emissions

Product standard EN 61800 - 3 specifies requirements for converters with operating voltages less than 1000 V. Provided that the following are taken into account, the converters meet the requirements for use in industrial applications.

## 4.5 EMC-Compliant Installation

The following section provides some basic information and guidelines that will help you comply with the EMC and CE guidelines.

### Cabinet Assembly

- Connect painted or anodized metal components using toothed self-locking screws or remove the insulating layer.
- Use unpainted, de-oiled mounting plates.
- Establish a central connection between ground and the protective conductor system (ground).

### Shield Gaps

- Bridge shield gaps (at terminals, circuit-breakers, contactors, and so on) with minimum impedance and the greatest possible surface area.

### Using Large Cross-Sections

- Use underground and grounding cables with large cross-sections or, better still, with litz wires or flexible cables.

### Laying the Motor Supply Cable Separately

- The distance between the motor supply cable and signal cable should be > 20 cm. Do not lay power cables and motor supply cables in parallel to each other.

### Securing the Potential to Ground Between Modules with Widely Differing Interference Potential

- Lay an equalizing cable parallel to the control cable (the cable cross-section must be at least 16 mm²).
- If relays, contactors, and inductive or capacitive loads are connected, the switching relays or contactors must be provided with anti-interference elements.

### Cable Installation

- Cables that are subject to or sensitive to interference should be laid as far apart from each other as possible.
- Noise immunity increases when the cables are laid close to the ground potential. For this reason, you are advised to lay these cables in corners and on the ground potential.
- Ground the spare cables at at least one end.
- Long cables should be shortened or laid in noise resistant areas to avoid additional connecting points.
- Conductors or cables that carry signals of different classes must cross at right angles, especially if they carry sensitive signals that are subject to interference.
  - Class 1:
    unshielded cables for ≤ 60 V DC
    unshielded cables for ≤ 25 V AC
    shielded analog signal cables
    shielded bus and data cables
    operator panel interface, incremental/absolute encoder lines
  - Class 2:
    unshielded cables for > 60 V DC and ≤ 230 V DC
    unshielded cables for > 25 V AC and ≤ 230 V AC
  - Class 3:
    unshielded cables for > 230 V AC/DC and ≤ 1000 V AC/DC

### Shield Connection

- Shields must not be used to conduct electricity. In other words, they must not simultaneously act as neutral or PE conductors.
- Apply the shield so that it covers the greatest possible surface area. You can use ground clamps, ground terminals, or ground screw connections.
- Avoid extending the shield to the grounding point using a wire (pigtail) because this will reduce the effectiveness of the shield by up to 90%.
- Attach the shield to a shield bar directly after the line inlet into the cabinet. Insulate the entire shielded cable and route the shield up to the device connection, but do not connect it again.

### I/O Connection

- Create a low-impedance ground connection for additional cabinets, system components, and distributed devices with the largest possible cross-section (at least 16 mm²).
- Ground unused lines at one end in the cabinet.
- Choose the greatest possible clearance between the power and signal cables (at least 20 cm). The greater the distance over which the cables are routed in parallel, the greater the clearance must be. If a sufficient clearance cannot be maintained, you must install additional shields.
- Avoid unnecessarily long cable loops.

### Filtering Cables

- Line supply cables and power supply cables for devices and modules may have to be filtered in the cabinet to reduce incoming or outgoing disturbances.
- To improve the EMC properties and depending on the installation location, a radio interference suppression filter is recommended (e.g. option L00 (radio interference suppression filter to EN55011, limit class A1)).

# 4.6 Power Connections

**WARNING**

- Swapping the input and output terminals can destroy the cabinet unit!
- Swapping or short-circuiting the DC link terminals can destroy the cabinet unit!
- The contactor and relay operating coils that are connected to the same supply network as the cabinet unit or are located near the cabinet unit must be connected to overvoltage limiters (e.g. RC elements).
- The cabinet unit must not be operated via a residual current operated device (DIN VDE 0160).

## 4.6.1 Connection Cross-Sections and Cable Lengths

### Connection Cross-Sections

The connection cross-sections for the input power connection, motor connection, and cabinet grounding for your cabinet unit are specified in the tables provided in the "Technical Data" section.

### Cable Lengths

The following table shows the maximum permissible cable lengths (with output filter (option L08) and without output filter) for standard cable types or cable types recommended by SIEMENS. Longer cables can only be used after consultation.

The cable lengths specified represent the actual distance between the cabinet unit and the motor, taking into account parallel routing, current-carrying capacity, and the cable-laying factor.

Table 4-1 Max. permissible cable lengths

| Cabinet unit | | w/o output filter | | |
|---|---|---|---|---|
| Voltage | Output | Protoflex EMC 3 Plus | Shielded cable (e.g. Protodur NYCWY) | Unshielded cable (e.g. Protodur NYY) |
| 380 - 480 V | 110 kW | 300 m | 200 m | 300 m |
| 380 - 480 V | 132 - 560 kW | 300 m | 300 m | 450 m |
| 660 - 690 V | 75 - 800 kW | 300 m | 100 m | 150 m |
| | | with output filter | | |
| 380 - 480 V | 110 kW | 300 m | 300 m | 450 m |
| 380 - 480 V | 132 - 560 kW | 300 m | Not required up to 300 m | Not required up to 450 m |
| 660 - 690 V | 75 - 800 kW | 300 m | 200 m | 300 m |

**NOTE**

The PROTOFLEX-EMV-3 PLUS shielded cable recommended by Siemens is the protective conductor and comprises three symmetrically arranged protective conductors. The individual protective conductors must each be provided with cable eyes and be connected to ground. The cable also has a concentric flexible braided copper shield. To comply with EN55011 regarding radio interference suppression, the shield must contact at both ends and with the greatest possible surface area.

On the motor side, cable glands that contact the shield with the greatest possible surface area are recommended for the terminal boxes.

## 4.6.2 Connecting the Motor and Power Cables

### Connecting the Motor and Power Cables on the Cabinet Unit

**NOTE**

The location of the connections is indicated in the layout diagrams provided in 3.

1. Open the cabinet, remove the covers (if necessary) in front of the connection panel for motor cables (terminals U2/T1, V2/T2, W2/T3; X2) and power cables (terminals U1/L1, V1/L2, W1/L3; X1).
2. Move or remove the bottom plate below the connection panel through which the motor cables are fed.
3. Screw the protective earth (PE) into the appropriate terminal (with earth symbol) (50 Nm with M12) at the points provided in the cabinet.

**NOTE**

With version C, connect the power cables first and then the motor cables.

4. Screw the motor cables into the terminals.
   Ensure that you have followed the correct sequence for connecting the conductors: U2/T1, V2/T2, W2/T3 and U1/L1, V1/L2, W1/L3!

**CAUTION**

Tighten the screws with the appropriate torque (50 Nm with M12), otherwise the terminal contacts could catch fire during operation.

**NOTE**

The motor ground must be fed back directly to the cabinet unit and connected.

### Direction of Motor Rotation

With induction machines with a clockwise phase sequence (looking at the drive shaft), the motor must be connected to the cabinet unit as follows.

Table 4-2 Connection terminals on the cabinet unit and motor

| Cabinet unit (connection terminals) | Motor (connection terminals) |
|---|---|
| U2/T1 | U |
| V2/T2 | V |
| W2/T3 | W |

In contrast to the connection for the clockwise phase sequence, two phases have to be reversed with a counter-clockwise phase sequence (looking at the drive shaft).

**NOTE**

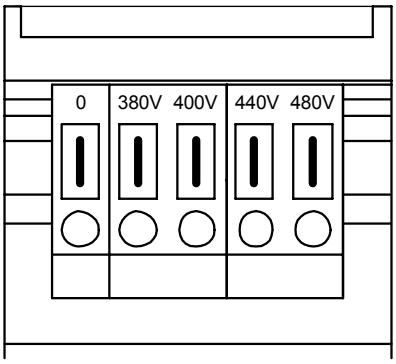
If an incorrect phase sequence was connected when the cables were routed, and the phase sequence cannot be corrected by subsequently swapping the motor cables, it can be corrected by means of a negative command value or by parameterizing the cabinet unit.

With motors that can be operated in a star/delta configuration, the windings must be checked to ensure that they have been connected properly. Please refer to the relevant documentation for the motor and note the required insulation voltage for operating the cabinet unit.

## 4.6.3 Adjusting the Fan Voltage (-U1 -T10)

A transformer is installed to ensure that the operating voltage of the 230 V fan is correct. The location of the fan transformer is indicated in the layout diagrams supplied.

The primary terminals of the transformer may need to be reconnected to the existing supply voltage. The terminals must be connected to "0" and the supply voltage.



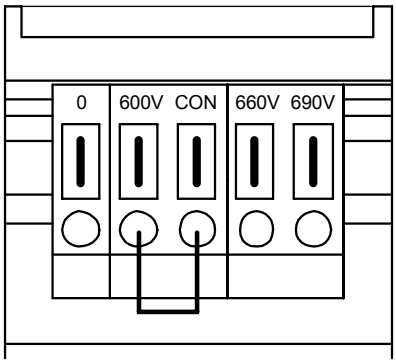



Fig. 4-1 Setting terminals for the fan transformer (380 V – 480 V / 660 V – 690 V)

The supply voltage assignments for making the appropriate setting on the fan transformer are indicated in the following table.

**NOTE**

With the 660 V – 690 V fan transformer, a jumper is inserted between terminal “600 V” and terminal “CON”. Terminal “CON” is for internal use.

**IMPORTANT**

If the terminals are not reconnected to the actual supply voltage:

- the required cooling capacity cannot be provided because the fan rotates too slowly
- the fan fuses may blow due to an overcurrent.

**NOTE**

The order numbers for fan fuses that have blown can be found in the spare parts list.

Table 4-3 Supply voltage assignments for the fan transformer setting (380 V - 480 V)

| Supply voltage | Fan transformer tap (-U1 -T10) |
|---|---|
| 342 V - 390 V | 380 V |
| 391 V - 430 V | 400 V |
| 431 V - 460 V | 440 V |
| 461 V - 528 V | 480 V |

Table 4-4 Supply voltage assignments for the fan transformer setting (660 V - 690 V)

| Supply voltage | Fan transformer tap (-U1 -T10) |
|---|---|
| 600 V - 630 V | 600 V |
| 631 V - 680 V | 660 V |
| 681 V - 759 V | 690 V |

### 4.6.4 Adjusting the Internal Power Supply (-A1 -T10, Only with Version A)

A transformer is installed for the internal power supply of the cabinet. The location of the transformer is indicated in the layout diagrams supplied.

The primary terminals of the transformer may need to be reconnected to the existing supply voltage.

The supply voltage assignments for making the appropriate setting on the transformer for the internal power supply are indicated in the following table.

**IMPORTANT**

If the terminals are not reconnected to the actual supply voltage, the internal power supply will not be correct.

Table 4-5 Supply voltage assignments for the internal power supply (380 V - 480 V)

| Supply Voltage Range | Tapping | Matching transformer taps (A1 -T10) LH1 – LH2 |
|---|---|---|
| 342 V - 390 V | 380 V | 1 – 2 |
| 391 V - 410 V | 400 V | 1 – 3 |
| 411 V - 430 V | 415 V | 1 – 4 |
| 431 V - 450 V | 440 V | 1 – 5 |
| 451 V - 470 V | 460 V | 1 – 6 |
| 471 V - 528 V | 480 V | 1 – 7 |

Table 4-6 Supply voltage assignments for the internal power supply (660 V - 690 V)

| Supply Voltage Range | Tapping | Matching transformer taps (A1 -T10) LH1 – LH2 |
|---|---|---|
| 591 V - 630 V | 600 V | 1 – 12 |
| 631 V - 680 V | 660 V | 1 – 14, terminals 12 and 13 are bridged |
| 681 V - 759 V | 690 V | 1 –15, terminals 12 and 13 are bridged |

### 4.6.5 Removing the Connection Bracket for the Interference-Suppression Capacitor with Operation from an Ungrounded Supply

If the cabinet unit is operated from an ungrounded supply/IT supply, the connection bracket for the interference-suppression capacitor of the converter (-U1) must be removed.

Unscrew bolts M4 (Torx T20) and remove the connection bracket

Fig. 4-2 Removing the connection bracket for the interference-suppression capacitor

# 4.7 External Supply of the Auxiliary Supply from a Secure Line

## Description

An external auxiliary supply is always recommended when communication and closed-loop control are to be independent of the main supply system or an automatic restart function, for example, is activated. An external auxiliary supply is particularly recommended for low-power lines susceptible to short-time voltage dips or power failures.

Note the optional version of the cabinet unit. Different connection options are available depending on the options selected.

Table 4-7 Connection options for the external auxiliary voltage depending on the selected options.

| **Cabinet unit option** | **External supply of auxiliary voltage independent of the main supply** | | | |
|---|---|---|---|---|
| | 24 V DC terminal –X9 | 230 V AC terminal –X40 | 24 V DC (terminal –X9) 230 V AC (terminal –X40) *1) | 230 V AC (terminal –X40) with options L13 / L26 (when I > 800 A) |
| - With no further options<br>- Version C | X | | | |
| L13 | | X | | |
| L26 (when I > 800 A) | | X | | |
| L83 | | | X | X |
| L84 | | | X | X |
| L86 | | | X | X |
| L87 | | | X | X |

*1) This is required when not only the open and closed-loop control but also the 230 V AC consumer (thermistor motor protection, PT100 evaluation unit, or insulation monitor) is to remain in operation if the main supply fails.

With an external supply independent of the main supply, warnings and fault messages may still be displayed on the operator panel and internal protection and monitoring devices if the main supply fails.

### 4.7.1 230 V AC Auxiliary Supply

The maximum fuse rating is 16 A. The cables must be capable of supplying 630 VA for the transformer.

#### Connection

- On terminal block -X40, remove the jumpers between terminals 1 and 2 as well as 5 and 6.
- Connect the external 230 V AC supply to terminals 2 (L1) and 6 (N).

### 4.7.2 24 V DC Auxiliary Supply

The power requirement is 4 A.

#### Connection

Connect the external 24 V DC supply to terminals 1 (P 24 V) and 2 ($M_{ext}$) of terminal block –X9.

# 4.8 Signal Connections

## 4.8.1 Customer Terminal Block (-A60)

**NOTE**

The factory setting and description of the customer terminal block can be found in the circuit diagrams.

The location of the customer terminal block in the cabinet unit is indicated in the layout diagram.

### Shield Connection

The shield connection of shielded control cables on the customer terminal block –A60 is established in the immediate vicinity of the terminal block. For this purpose, the customer terminal block –A60 and the mounting plates have cut-out sections which are used to snap the enclosed shield springs into place. The shields of incoming and outgoing cables must be applied directly to these shield connections. It is important here to establish the greatest possible area of contact and a good conductive connection.

**NOTE**

These shield springs can be used for all control cables in the cabinet unit because all the shield connections are identical in design.

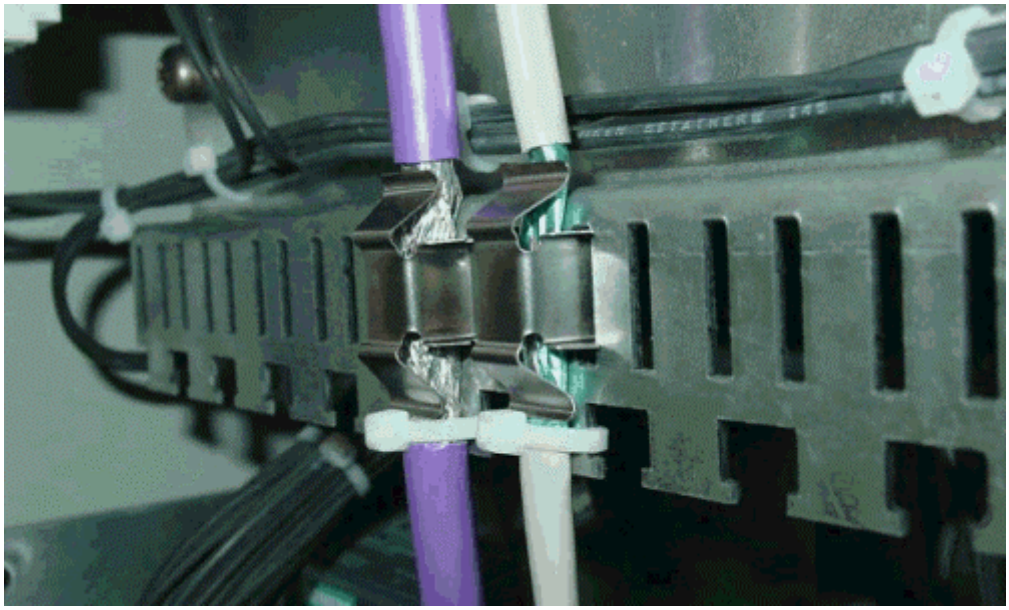


Fig. 4-3 Shield connection

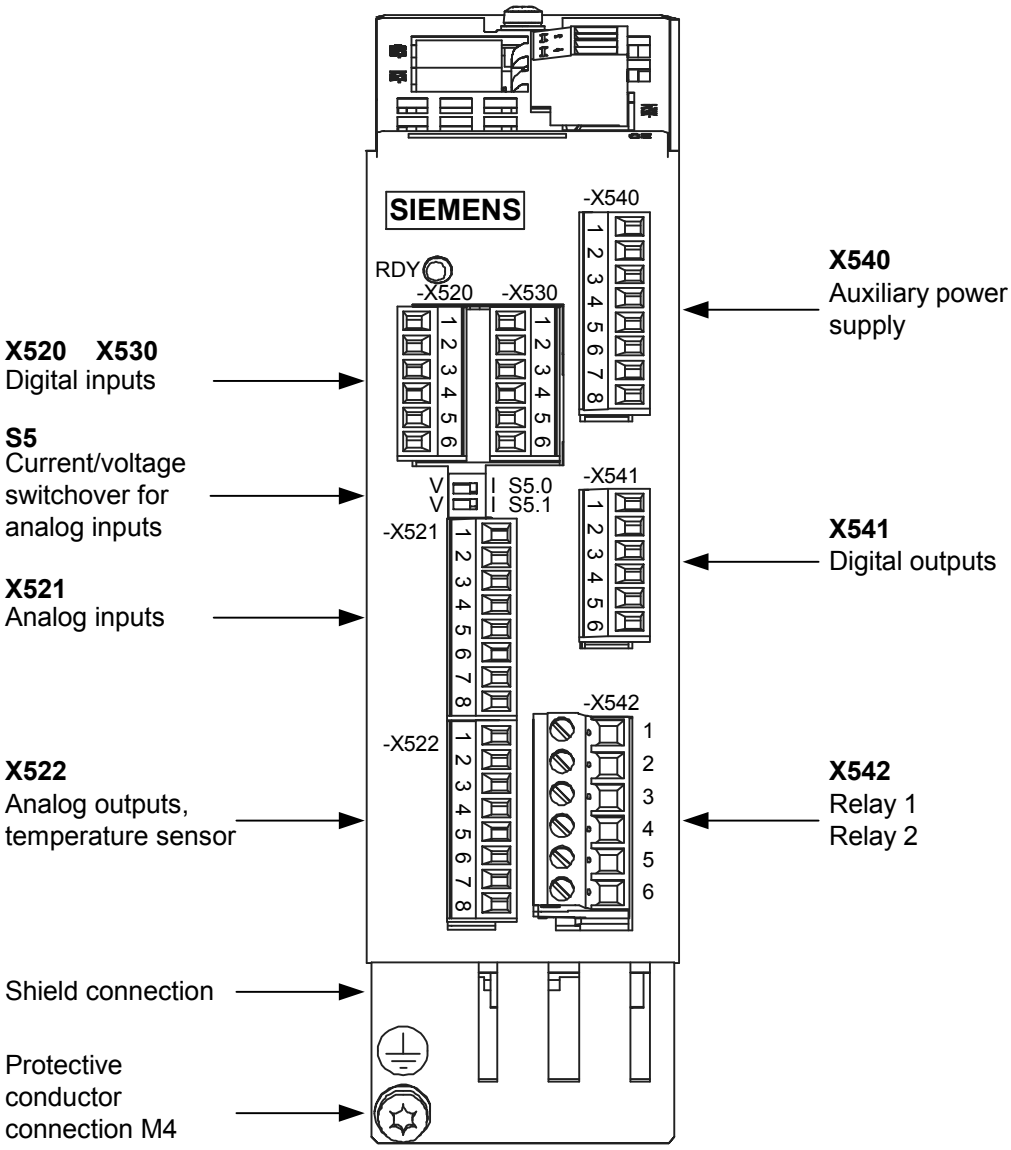



Fig. 4-4 Customer terminal block TM31

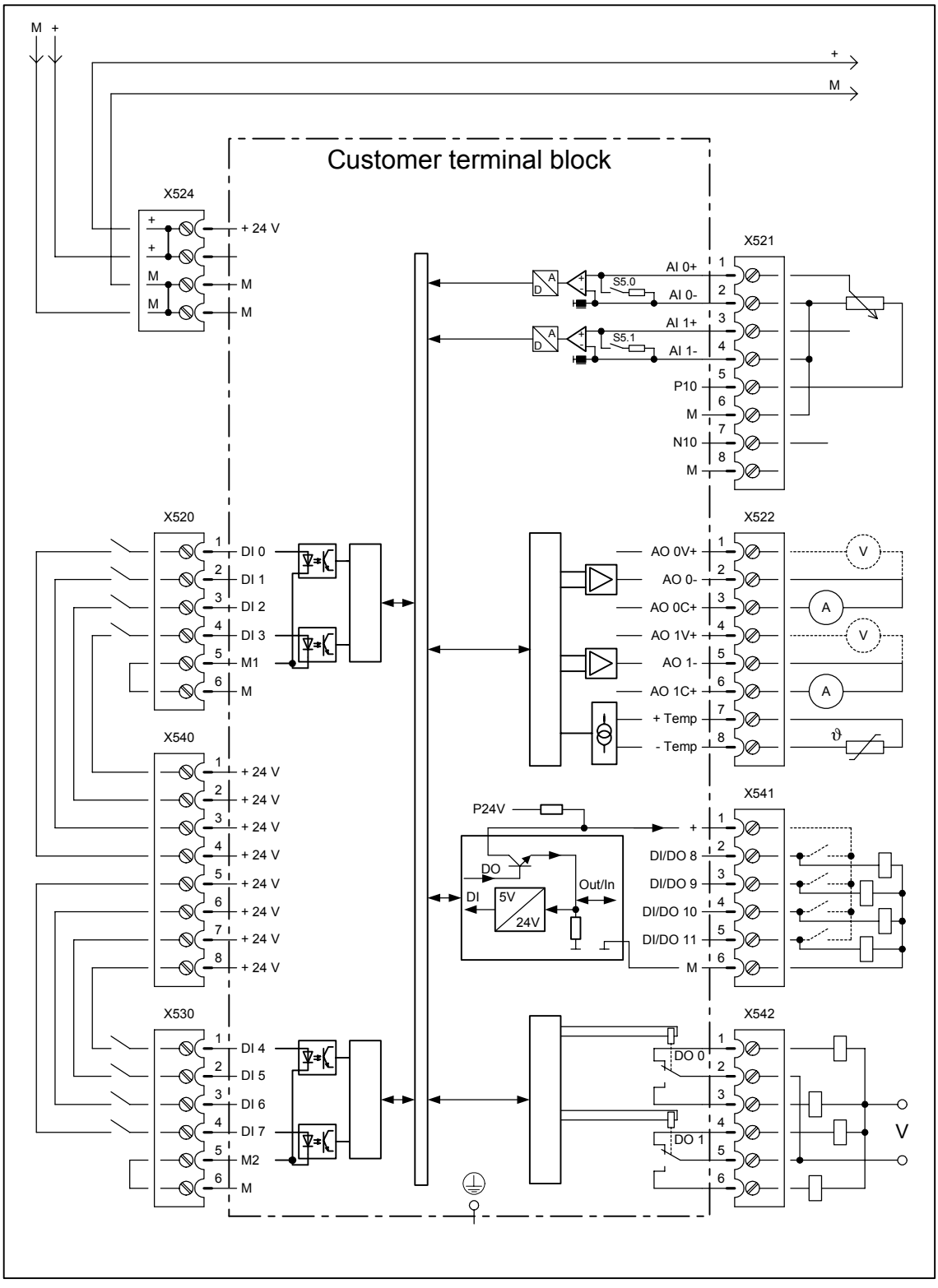



Fig. 4-5 Connection overview for customer terminal block TM31

**NOTE**

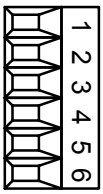
The diagram of the customer terminal block shows the factory setting. The digital inputs (terminals -X520 and -X530) in the example are powered by the internal 24 V supply of the customer terminal block (terminal -X540).

The two groups of digital inputs (optocoupler inputs) have a common reference potential (ground reference M1 or M2). In order to close the circuit when the internal 24 V supply is used, the ground references M1 / M2 must be connected to internal ground (M).

If power is not supplied from the internal 24 V supply (terminal -X540), the jumper between ground M1 and M or M2 and M must be removed in order to avoid potential rounding.

## X520: 4 Digital Inputs

Table 4-8 Terminal block X520

| | Terminal | Designation [1)] | Technical data | Factory Setting |
|---|---|---|---|---|
|  | 1 | DI 0 | Voltage: -3 V to 30 V | ON / OFF1 |
| | 2 | DI 1 | Current input (typical): 10 mA at 24 V | Motor pot. higher |
| | 3 | DI 2 | | Motor pot. lower |
| | 4 | DI 3 | With electrical isolation: Reference potential is terminal M1 | Acknowledge error |
| | 5 | M1 | | |
| | 6 | M | Level: High level: 15 V to 30 V | |
| | | | Low level: -3 V to 5 V | |

[1)] DI: digital input; M1: ground reference; M: electronic ground

Max. connectable cross-section: 1.5 mm² (AWG 14)

**NOTE**

An open-circuit input is interpreted as “low“.

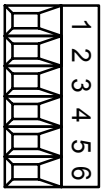
Terminal M1 must be connected so that the digital inputs can function correctly. The following solutions are possible:

1) The provided ground reference of the digital inputs, or

2) A jumper to terminal M (Important: electrical isolation for the digital inputs is revoked as a result).

## X530: 4 Digital Inputs

Table 4-9 Terminal block X530

| | Terminal | Designation [1] | Technical data | Factory Setting |
|---|---|---|---|---|
|  | 1 | DI 4 | Voltage: -3 V to 30 V<br>Current input (typical): 10 mA at 24 V<br>With electrical isolation: Reference potential is terminal M2<br>High level: 15 V to 30 V<br>Low level: -3 V to 5 V | Command data set selection CDS bit 0 |
| | 2 | DI 5 | | LOCAL mode disable |
| | 3 | DI 6 | | Fixed speed setpoint selection bit 0 |
| | 4 | DI 7 | | Fixed speed setpoint selection bit 1 |
| | 5 | M2 | | |
| | 6 | M | | |



[1] DI: digital input; M2: ground reference; M: electronic ground

Max. connectable cross-section: 1.5 mm² (AWG 14)

**NOTE**

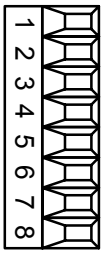
An open-circuit input is interpreted as “low“.

Terminal M1 must be connected so that the digital inputs can function correctly. The following solutions are possible:

1) The provided ground reference of the digital inputs, or
2) A jumper to terminal M (Important: electrical isolation for the digital inputs is revoked as a result).

## X521: 2 Analog Inputs (Differential Inputs)

Table 4-10 Terminal block X521

| | Terminal | Designation [1] | Technical data | Factory Setting |
|---|---|---|---|---|
|  | 1 | AI 0+ | -10 V - +10 V, $R_i$ = 70 kΩ<br>+4 mA - +20 mA<br>-20 mA - +20 mA, $R_i$ = 250 Ω<br>0 mA - +20 mA | Speed setpoint: 0 – 20 mA |
| | 2 | AI 0- | | |
| | 3 | AI 1+ | | |
| | 4 | AI 1- | | |
| | 5 | P10 | +10 V ± 1 %, $I_{max}$ 5 mA | |
| | 6 | M | Reference potential for AI 0 | |
| | 7 | N10 | -10 V ± 1 %, $I_{max}$ 5 mA | |
| | 8 | M | Reference potential for AI 1 | |



[1] AI: analog input; P10/N10: auxiliary voltage, M: ground reference

Max. connectable cross-section: 1.5 mm² (AWG 14)

**CAUTION**

The input current of the analog inputs must not exceed 35 mA when current measurements are performed.

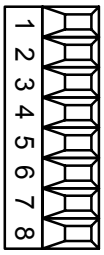
## S5: Selector for Voltage/Current AI0, AI1

Table 4-11 Selector for voltage/current S5

| Switch | Function | Technical data |
|---|---|---|
| S5.0 | Selector voltage/current AI0 | Voltage V V I S5.0 I S5.1 Current |
| S5.1 | Selector voltage/current AI1 | |

## X522: 2 Analog Outputs, Temperature Sensor Connection

Table 4-12 Terminal block X522

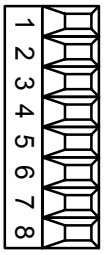
| | Terminal | Designation [1] | Technical data | Factory Setting |
|---|---|---|---|---|
|  | 1 | AO 0 V+ | -10 V - +10 V<br>+4 mA - +20 mA<br>-20 mA - +20 mA<br>0 mA - +20 mA | |
| | 2 | AO 0 ref. | | Actual speed value:<br>0 – 20 mA |
| | 3 | AO 0 A+ | | |
| | 4 | AO 1 V+ | | |
| | 5 | AO 1 ref. | | Motor current actual value:<br>0 – 20 mA |
| | 6 | AO 1 A+ | | |
| | 7 | KTY+ | KTY84: 0...200 °C<br>PTC: $R_{PTC} \leq 1.5$ kΩ | |
| | 8 | KTY- | | |

[1] AO: analog output; KTY: temperature sensor connection

Max. connectable cross-section: 1.5 mm² (AWG 14)

## X540: Common Auxiliary Voltage for Digital Inputs

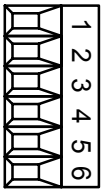
Table 4-13 Terminal block X540

| | Terminal | Designation | Technical data | Factory Setting |
|---|---|---|---|---|
|  | 1 | P24 | 24 V DC<br>Imax = 150 mA (total of all P24 terminals) | |
| | 2 | P24 | | |
| | 3 | P24 | | |
| | 4 | P24 | | |
| | 5 | P24 | | |
| | 6 | P24 | | |
| | 7 | P24 | | |
| | 8 | P24 | | |

Max. connectable cross-section: 1.5 mm² (AWG 14)

## X541: 4 Non-Floating Digital Inputs/Outputs

Table 4-14 Terminal block X541

| | Terminal | Designation [1] | Technical data | Factory Setting |
|---|---|---|---|---|
|  | 1 | P24 | As input: | |
| | 2 | DI/DO 8 | Voltage: -3 V to 30 V | DO8: ready to start |
| | 3 | DI/DO 9 | Current input (typical): 10 mA at 24 V DC | DO9: LOCAL mode active |
| | 4 | DI/DO 10 | | DO10: Enable pulses |
| | 5 | DI/DO 11 | As output: | |
| | 6 | M | Max. load current per output: 20 mA | |
| | | | Sustained short circuit proof | |

[1] DI/DO: digital input/output; M: electronic ground

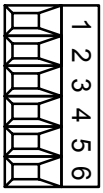
Max. connectable cross-section: 1.5 mm² (AWG 14)

**NOTE**

An open-circuit input is interpreted as "low".

## X542: 2 Relay Outputs (Two-Way Contacts)

Table 4-15 Terminal block X542

| | Terminal | Designation [1] | Technical data | Factory Setting |
|---|---|---|---|---|
|  | 1 | DO 0.NC | Max. load current: 8 A | Checkback Enable pulses |
| | 2 | DO 0.NC | Max. switching voltage: 250 V AC, 30 V DC | |
| | 3 | DO 0.NO | | |
| | 4 | DO 1.NC | Max. switching capacity: at 250 V AC: 2000 VA at 30 V DC: 240 W (ohmic load) | Checkback No fault |
| | 5 | DO 1.COM | | |
| | 6 | DO 1.NO | Required minimum load: 20 mA | |

[1] NO: normally open contact, NC: normally closed contact, COM: mid-position contact

Max. connectable cross-section: 2.5 mm² (AWG 12)

**NOTE**

If 230 V AC is applied to the relay outputs, the customer terminal block must also be grounded via a 6 mm² protective conductor.

# 4.9 Other Connections

Depending on the options installed, further connections have to be established, for example, main contactor, connection for external auxiliary equipment, main circuit-breaker including fuses or circuit-breaker, EMERGENCY OFF button, cabinet illumination with service socket, cabinet anti-condensation heating, contactor combination (EMERGENCY OFF), thermistor motor protection unit, PT100 evaluation unit and insulation monitor.

Detailed information on connecting these options with interfaces can be found in “Additional Operating Instructions” in the documentation folder.

## 4.9.1 Main Contactor (Option L13)

### Description

The SINAMICS G150 cabinet unit is designed as standard without a line contactor. Option L13 (main contactor) is needed if a switching element is required for disconnecting the cabinet from the supply (necessary with EMERGENCY OFF). The contactor is energized and supplied within the cabinet.

### Connection

Table 4-16 Terminal block X50 – checkback contact “main contactor closed“

| Terminal | Designation [1)] | Technical data |
|---|---|---|
| 4 | NO | Max. load current: 10 A<br>Max. switching voltage: 250 V AC<br>Max. switching capacity: 250 VA<br>Required minimum load: ≥1 mA |
| 5 | NC | |
| 6 | COM | |

[1)] NO: normally open contact, NC: normally closed contact, COM: mid-position contact

Max. connectable cross-section: 4 mm² (AWG 10)

## 4.9.2 Connection for External Auxiliary Equipment (Option L19)

### Description

This option includes a connection fused at max. 10 A for external auxiliary equipment (for example, separately driven fan for motor). The voltage is tapped at the converter input and, therefore, has the same level as the supply voltage. The connection can be controlled internally or externally.

### Connection

Table 4-17 Terminal block X155 – connection for external auxiliary equipment

| Terminal | Designation | Technical data |
|---|---|---|
| 1 | L1 | 3 AC 380 – 480 V<br>3 AC 660 -690 V |
| 2 | L2 | |
| 3 | L3 | |
| 11 | Contactor control | 230 V AC |
| 12 | | |
| 13 | Checkback from circuit-breaker | 230 V AC / 0.5 A<br>24 V DC / 2 A |
| 14 | | |
| 15 | Checkback from contactor | 240 V AC / 6 A |
| 16 | | |
| PE | PE | PE |

Max. connectable cross-section: 4 mm² (AWG 10)

### Circuit Proposal for Controlling the Auxiliary Contactor from Within the Converter

The following circuit, for example, can be used if the auxiliary contactor is to be controlled from within the converter. The “Operation” message is then no longer available for other purposes.

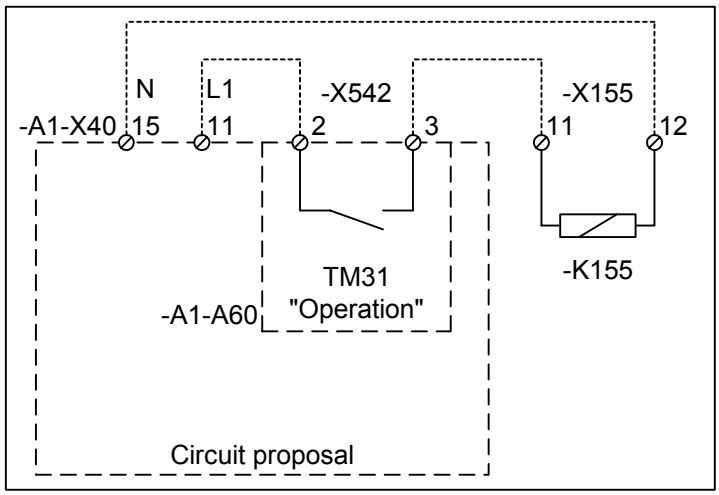



Fig. 4-6 Circuit proposal for controlling the auxiliary conductor from within the converter

**NOTE**

If 230 V AC is applied to the relay outputs, the customer terminal block must also be grounded via a 6 mm² protective conductor.

## 4.9.3 Main Circuit-Breaker incl. Fuses/Circuit-Breaker (Option L26)

### Description

The main circuit-breaker of cabinet units with an output current of up to 800 A is a load interruptor with externally mounted fuses. Cabinets with an output current greater than 800 A are fitted with a circuit-breaker instead of a load interruptor.

### Connection

Table 4-18 Terminal block X50 – checkback contact “main circuit-breaker/circuit-breaker closed“

| Terminal | Designation [1)] | Technical data |
|---|---|---|
| 1 | NO | Max. load current: 10 A |
| 2 | NC | Max. switching voltage: 250 V AC |
| 3 | COM | Max. switching capacity: 250 VA |
| | | Required minimum load: ≥1 mA |

[1)] NO: normally open contact, NC: normally closed contact, COM: mid-position contact

Max. connectable cross-section: 4 mm² (AWG 10)

## 4.9.4 EMERGENCY OFF Button (Option L45)

### Description

The EMERGENCY OFF button with protective collar is integrated in the door of the cabinet unit. The contacts of the button are connected to terminal block –X120. Category 0 and 1 EMERGENCY OFF functions can be activated in conjunction with options L57, L59, and L60.

A braking unit may be necessary to achieve the required shutdown times.

### Connection

Table 4-19 Terminal block X120 – checkback contact “EMERGENCY OFF button in cabinet door“

| Terminal | Designation [1] | Technical data |
|---|---|---|
| 1 | NC | Checkback contacts of EMERGENCY OFF button in cabinet door<br>Max. load current: 10 A<br>Max. switching voltage: 250 V AC<br>Max. switching capacity: 250 VA<br>Required minimum load: ≥1 mA |
| 2 | NC | |
| 3 | NC [2] | |
| 4 | NC [2] | |

[1] NC: normally closed contact

[2] Factory setting in converter for options L57, L59, and L60

Max. connectable cross-section: 4 mm² (AWG 10)

## 4.9.5 Cabinet Illumination with Service Socket (Option L50)

### Description

One universal lamp with an integrated service socket is installed for each cabinet panel. The power supply for the cabinet illumination and socket must be provided externally and fused at max. 10 A. The cabinet illumination is switched on manually via a slide switch or automatically by means of an integrated motion detector. The mode is switch-selected.

### Connection

Table 4-20 Terminal block X390 – connection for cabinet illumination with service socket

| Terminal | Designation | Technical data |
|---|---|---|
| 1 | L1 | 230 V AC |
| 2 | N | |
| 3 | PE | |

Max. connectable cross-section: 4 mm² (AWG 10)

## 4.9.6 Cabinet Anti-Condensation Heating (Option L55)

### Description

The anti-condensation heating is used at low ambient temperatures and high levels of humidity to prevent condensation forming.
A 100-W heater is installed for a 400 mm and 600 mm cabinet panel, and 2 100-W heaters for an 800/1000 and 1200 mm cabinet panel. The power supply for the heating (110 V – 230 V AC) must be provided externally and fused at max. 16 A.

### Connection

Table 4-21 Terminal block X240 – connection for cabinet anti-condensation heating

| Terminal | Designation | Technical data |
|---|---|---|
| 1 | L1 | 110 V -230 V AC |
| 2 | N | power supply |
| 3 | PE | Protective conductor |

Max. connectable cross-section: 4 mm² (AWG 10)

## 4.9.7 EMERGENCY OFF Category 0; 230 V AC or 24 V DC (Option L57)

### Description

EMERGENCY OFF category 0 for uncontrolled stop to EN 60 204. This function involves disconnecting the cabinet from the supply via the line contactor bypassing the electronics by means of a safety combination to EN 60 204-1. The motor then coasts to a stop. To prevent the main contactor from switching under load, a pulse block is triggered at the same time via an external fault. A restart is only possible after the fault has been acknowledged. The operational status is indicated by means of three LEDs.

In the factory setting, this version is set with a 230 V AC button circuit.

### Connection

Table 4-22 Terminal X120 – connection for EMERGENCY OFF category 0, 230 V AC and 24 V DC

| Terminal | 230 V AC and 24 V DC button circuit |
|---|---|
| 7 | Loop in EMERGENCY OFF button from system side, remove jumper 7-8 |
| 8 | |
| 15 | "On" for monitored start: remove jumper 15–16 and connect button |
| 16 | |
| 17 | Checkback "trip safety combination" |
| 18 | |

Max. connectable cross-section: 4 mm² (AWG 10)

### Reconnection to the 24 V DC Button Circuit

When using the 24 V DC button circuit, you must remove the following jumpers at terminal X120:

4-5, 9-10, and 11-14

You must also insert the following jumpers at terminal X120:

4-11, 5-10, and 9-14

### Diagnostics

Messages output during operation and in the event of faults (meaning of LEDs) are described in “Additional Operating Instructions” in the operating manual.

## 4.9.8 EMERGENCY OFF Category 1; 230 V AC (Option L59)

### Description

EMERGENCY OFF category 1 for controlled stop to EN 60 204. This function involves stopping the drive by means of a rapid stop using a deceleration ramp that can be parameterized by the user. The cabinet unit is then disconnected from the supply via the line contactor bypassing the electronics by means of a safety combination to EN 60 204-1. A braking unit may be necessary to achieve the required shutdown times.
The operational status is indicated by a total of eight LEDs.

### Connection

Table 4-23 Terminal block X120 – connection for EMERGENCY OFF category 1 (230 V AC)

| Terminal | Technical data |
|---|---|
| 7 | Loop in EMERGENCY OFF button from system side, remove jumper 7-8 |
| 8 | |
| 15 | "On" for monitored start: remove jumper 15–16 and connect button |
| 16 | |
| 17 | Checkback "trip safety combination" |
| 18 | |

Max. connectable cross-section: 4 mm² (AWG 10)

### Setting

When the emergency stop function (OFF3 ramp-down time, p1135) is used to shut down the drive, the ramp-down time should be less than (or at the most equal to) the time set on the contactor combination, after which the converter is de-energized.

### Diagnostics

Messages output during operation and in the event of faults (meaning of LEDs) are described in “Additional Operating Instructions” in the operating manual.

## 4.9.9 EMERGENCY OFF Category 1; 24 V DC (Option L60)

### Description

EMERGENCY OFF category 1 for controlled stop to EN 60 204. This function involves stopping the drive by means of a rapid stop using a deceleration ramp that can be parameterized by the user. The cabinet unit is then disconnected from the supply via the line contactor bypassing the electronics by means of a safety combination to EN 60 204-1. A braking unit may be necessary to achieve the required shutdown times.
The operational status is indicated by means of five LEDs.

### Connection

Table 4-24 Terminal block X120 – connection for EMERGENCY OFF category 1 (24 V DC)

| Terminal | Button circuit 24 V DC |
|---|---|
| 7 | Loop in EMERGENCY OFF button from system side, remove jumper 7-8 |
| 8 | |
| 15 | "On" for monitored start: remove jumper 15–16 and connect button |
| 16 | |
| 17 | Checkback "trip safety combination" |
| 18 | |

Max. connectable cross-section: 4 mm² (AWG 10)

### Setting

When the emergency stop function (OFF3 ramp-down time, p1135) is used to shut down the drive, the ramp-down time should be less than (or at the most equal to) the time set on the contactor combination, after which the converter is de-energized.

### Diagnostics

Messages output during operation and in the event of faults (meaning of LEDs) are described in “Additional Operating Instructions” in the operating manual.

## 4.9.10 100 kW Braking Unit (Option L61); 200 kW Braking Unit (Option L62)

### Description

Braking units are used when regenerative energy occurs occasionally and briefly, for example when the brake is applied to the drive (emergency stop). The braking units comprise a chopper power unit and a load resistor, which must be attached externally. A thermostat, which is integrated in the shutdown train of the cabinet unit, is installed in the braking resistor to monitor it.

Table 4-25 Load data for the braking units

| Line voltage | Cont. chopper power $P_{DB}$ | Chopper power $P_{40}$ | Rated chopper power $P_{20}$ | Peak chopper power $P_{15}$ | Braking resistor $R_B$ | Max. current |
|---|---|---|---|---|---|---|
| 380 V – 480 V | 25 kW | 50 kW | 100 kW | 125 kW | 4.4 Ω ± 7.5 % | 189 A |
| 380 V – 480 V | 50 kW | 100 kW | 200 kW | 250 kW | 2.2 Ω ± 7.5 % | 378 A |
| 660 V – 690 V | 25 kW | 50 kW | 100 kW | 125 kW | 9.8 Ω ± 7.5 % | 127 A |
| 660 V – 690 V | 50 kW | 100 kW | 200 kW | 250 kW | 4.9 Ω ± 7.5 % | 255 A |

### Installing the Braking Resistor

The braking resistor should not be installed in the vicinity of the converter. The maximum cable length between the cabinet unit and the braking resistor is 50 m. Sufficient space must be available for dissipating the energy converted by the braking resistor. There must be sufficient clearance to flammable objects. The braking resistor must installed as a free-standing unit. Objects must not be placed on or anywhere above the braking resistor.

**CAUTION**

A ventilation clearance of 200 m must be maintained on all sides of the braking resistor (with ventilation grilles).

Table 4-26 Braking resistor dimensions

| | Unit | 100 kW resistor (option L61) | 200 kW resistor (option L62) |
|---|---|---|---|
| Length | mm | 740 | 810 |
| Width | mm | 485 | 485 |
| Height | mm | 605 | 1325 |

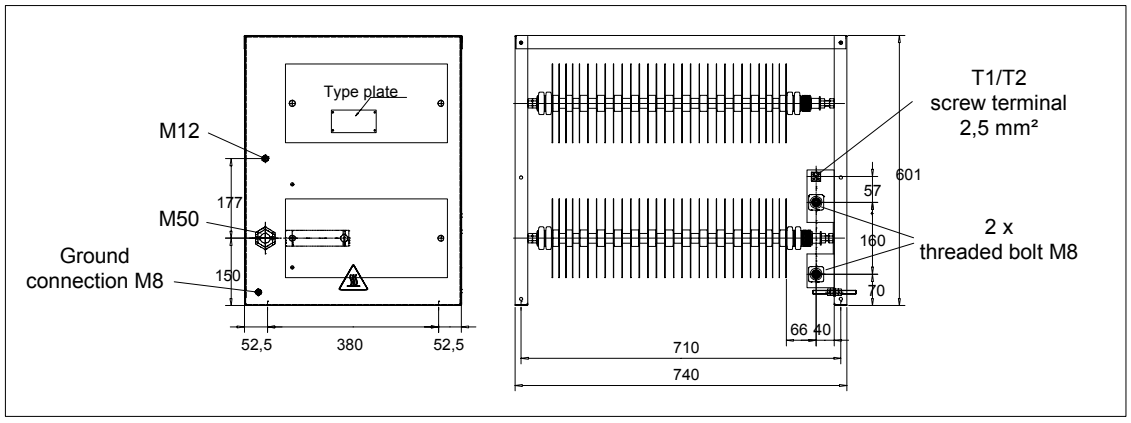



Fig. 4-7 Dimension drawing of the braking resistor for option L61

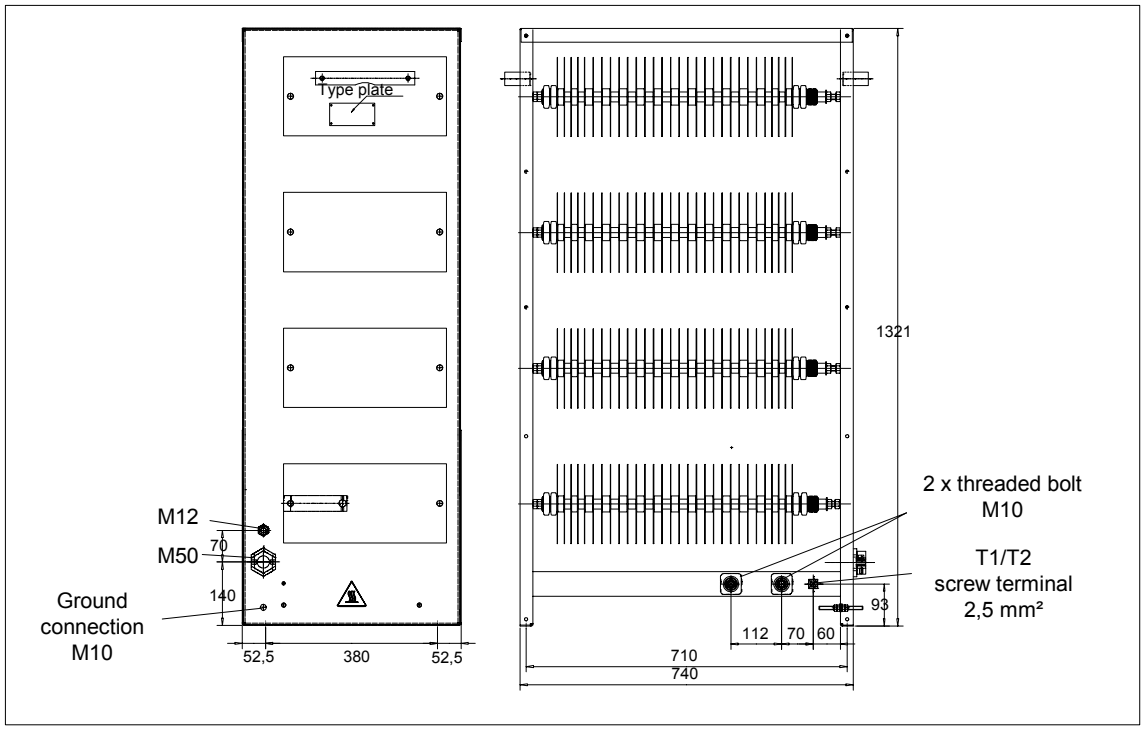



Fig. 4-8 Dimension drawing of the braking resistor for option L62

## Connecting the Braking Resistor

**WARNING**

The cables must only be connected to terminal block -X5 when the cabinet unit is switched off and the DC link capacitors are discharged.

**CAUTION**

The braking resistor cables must be laid in such a way that they are short-circuit and ground-fault proof!

The length of the connection cables between the cabinet unit and external braking resistor must not exceed 50 m.

Table 4-27 Terminal block X5 – connection for external braking resistor

| Terminal | Function description |
|---|---|
| R1 | Braking resistor connection |
| R2 | Braking resistor connection |

Max. connectable cross-section: 70 mm² (AWG 000)

Recommended cable cross-sections:

- For L61 (100 kW): 35 mm² (AWG 0)
- For L62 (200 kW): 50 mm² (AWG 00)

Table 4-28 Installing the thermostat for the external braking resistor in the monitoring train of the cabinet unit

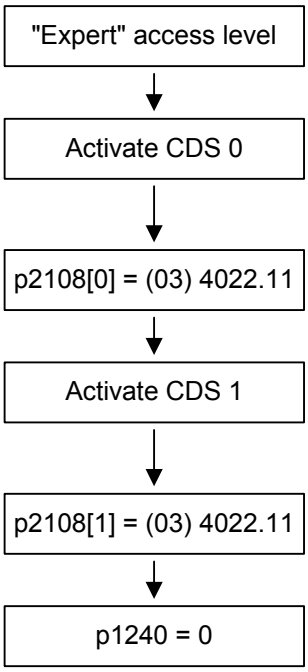
| Terminal | Function description |
|---|---|
| T1 | Thermostat connection: connection with terminal X541:1 (P24 V) |
| T2 | Thermostat connection: connection with terminal X541:5 (DI11) |

Max. connectable cross-section: 2.5 mm² (AWG 12)

## Cabinet Unit Settings

If the braking resistor thermostat is connected to digital input 11, appropriate settings have to be made so that the drive is brought to a standstill if a fault occurs.

Once the device has been successfully commissioned, you have to make the following changes:




**Setting the "Expert" access level on the operator panel**
<Key pushbutton> - <access level> - set "Expert" and confirm - enter activation code "47".

MENU - Settings - Data Set Selection - Command Data Set - Set (CDS) to "0".
The following query is displayed: "Save data in drive too?". Choose "No".

For PROFIBUS operation:
Connect "External Fault 3" to DI 11.

MENU - Settings - Data Set Selection - Command Data Set Set (CDS) to "1".
The following query is displayed: "Save data in drive too?". Choose "No".

For operation via terminal strip:
Connect "External Fault 3" to DI 11.

**Blocking the Vdc-max controller**
The vdc-max controller must be switched off when the brake chopper is used.

Fig. 4-9 Activating the connection for "External Fault 3"

## Diagnostics

If the thermostat is opened due to a thermal overload on the braking resistor, fault F7862 ("External Fault 3") is triggered and the drive is switched off with OFF2.

The braking chopper is not monitored using the software because it has a self-protection function. It can be monitored using the status bit for digital input 4 (parameter r0721.4):

- r0721.4 = 1: Chopper is functioning properly
- r0721.4 = 0: Chopper is malfunctioning

You can acknowledge malfunctions by pressing the "Acknowledge" key on the operator panel (when the DC link voltage is present).

## Duty Cycles

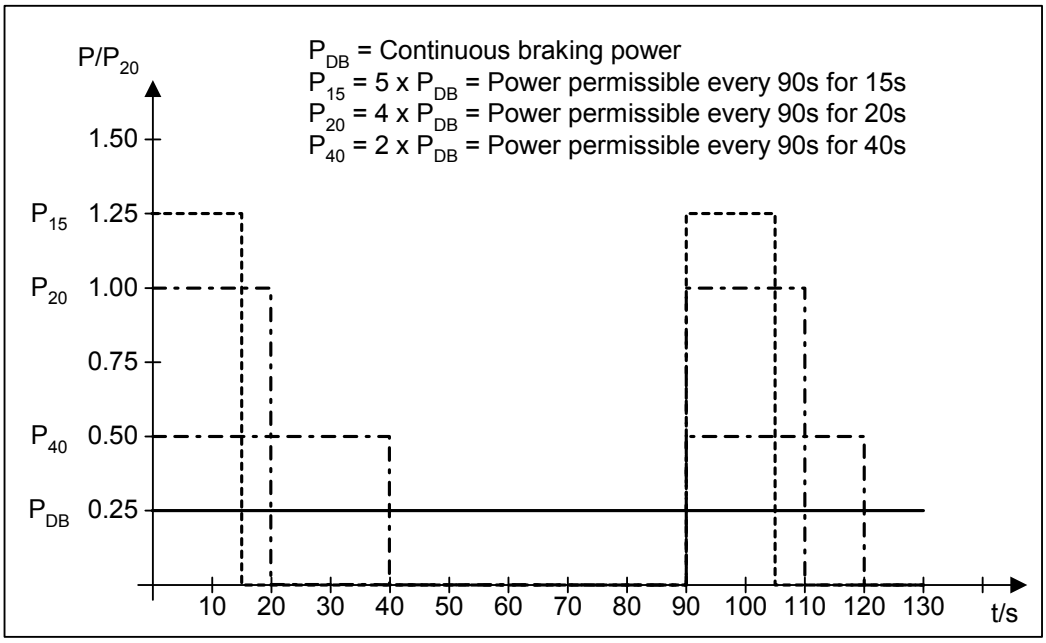



Fig. 4-10 Duty cycles for the braking resistors

## Threshold Switch

The response threshold at which the braking unit is activated and the DC link voltage generated during braking are specified in the following table.

**WARNING**

The threshold switch must only be used when the cabinet unit is switched off and the DC link capacitors are discharged.

Table 4-29 Response thresholds for the braking units

| Rated voltage | Response threshold | Switch position | Comments |
|---|---|---|---|
| 380 V -480 V | 774 V | 1 | 774 V is the default factory setting. With supply voltages of between 380 V and 400 V, the response threshold can be set to 673 V to reduce the voltage stress on the motor and converter. This does, however, reduce the possible peak power ($P_{15}$) with the square of the voltage (677/774)² = 0.75.<br>The possible peak power is, therefore, max. 75 % of $P_{15}$. |
| | 673 V | 2 | |
| 660 V -690 V | 1158 V | 1 | 1158 V is the default factory setting. With a supply voltage of 660 V, the response threshold can be set to 1070 V to reduce the voltage stress on the motor and converter. This does, however, reduce the possible peak power ($P_{15}$) with the square of the voltage (1070/1158)² = 0.85.<br>The possible peak power is, therefore, max. 85 % of $P_{15}$. |

## 4.9.11 Thermistor Motor Protection Unit (Option L83/L84)

### Description

This option includes the thermistor motor protection unit (with PTB approval) for PTC thermistor sensors (PTC resistor type A) for warning and shutdown. The power supply for the thermistor motor protection unit is provided inside the converter where the evaluation is also performed.

### Connection

Table 4-30 F127/F125 – connection for thermistor motor protection unit

| Equipment designation | Function description |
|---|---|
| F127 T1, T2 | Thermistor motor protection (warning) |
| F125 T1, T2 | Thermistor motor protection (shutdown) |

The PTC thermistor sensors are connected directly to terminals T1 and T2 of the evaluation unit.

Table 4-31 Maximal line length for the sensor circuit

| Line cross-section in mm² | Line length in m |
|---|---|
| 2.5 | 2 x 2800 |
| 1.5 | 2 x 1500 |
| 0.5 | 2 x 500 |

### Diagnostics

Messages output during operation and in the event of faults (meaning of LEDs) are described in "Additional Operating Instructions" in the operating manual.

## 4.9.12 PT100 Evaluation Unit (Option L86)

### Description

**NOTE**

The PT100 evaluation unit and the parameters for the measurement channels are described in "Additional Operating Instructions".

The PT100 evaluation unit can monitor up to 6 sensors. The sensors can be connected using a two-wire or three-wire system. With the two-wire system, inputs Tx1 and Tx3 must be assigned. With the three-wire system, input Tx2 must also be

connected (x = 1, 2, ...6). The limit values can be programmed by the user for each channel.

In the factory setting, the measurement channels are divided into two groups of three channels. With motors, for example, three PT100 can, therefore, be monitored in the stator windings and two PT100 in the motor bearings. Channels that are not used can be masked out using appropriate parameter settings.

The output relays are integrated in the internal fault and warning train of the cabinet unit. The messages can also be picked up by the customer via two spare fault signaling relays. Two user-programmable analog outputs are also available (0/4 to 20 mA and 0/2 to 10 V) for integration in a higher-level controller.

## Connection

Table 4-32 Terminal block -A1-A140 – connection for evaluation unit PT100 resistors

| Terminal | Designation | Technical data |
|---|---|---|
| T11-T13 | | 90 – 240 V AC/DC; PT100; sensor 1; group 1 |
| T21-T23 | | 90 – 240 V AC/DC; PT100; sensor 2; group 1 |
| T31-T33 | | 90 – 240 V AC/DC; PT100; sensor 3; group 1 |
| T41-T43 | | 90 – 240 V AC/DC; PT100; sensor 1; group 2 |
| T51-T53 | | 90 – 240 V AC/DC; PT100; sensor 2; group 2 |
| T61-T63 | | 90 – 240 V AC/DC; PT100; sensor 3; group 2 |
| 51/52/54 | | 90 – 240 V AC/DC<br>relay output limit value group 1 reached; (two-way contact) |
| 61/62/64 | | 90 – 240 V AC/DC<br>relay output limit value group 2 reached; (two-way contact) |
| Ground _ | OUT 1 | 0/4 – 20 mA<br>0/2 – 10 V<br>analog output Out 1; sensor group 1 |
| U1 | OUT 1 | |
| I1 | OUT 1 | |
| Ground _ | OUT 2 | 0/4 – 20 mA<br>0/2 – 10 V<br>analog output Out 2; sensor group 2 |
| U2 | OUT 2 | |
| I2 | OUT 2 | |

Max. connectable cross-section: 2.5 mm² (AWG 12)

## Diagnostics

Messages output during operation and in the event of faults (meaning of LEDs) are described in "Additional Operating Instructions" in the operating manual.

## 4.9.13 Insulation Monitor (Option L87))

### Description

This device monitors the complete electrically connected circuit for insulation faults. The insulation resistance as well as all the insulation faults that occur in the DC link and on the motor side of the cabinet are detected. Two response values (between 1 kΩ ...10 MΩ) can be set. If a response value in undershot, a warning is output to the terminal. A system fault is output via the signaling relay system.

When the cabinet unit is delivered from the plant, the plant configuration (one or several loads in one electrically connected network) and the protection philosophy (immediate shutdown in the event of an insulation fault or restricted continued motion) can vary. This means that the signaling relays of the insulation monitor are not integrated in the fault and warning train. These relay outputs would have to be integrated in the fault/warning train of the cabinet unit on the system side providing the plant configuration and protection philosophy permit this.

**IMPORTANT**

Only one insulation monitor can be used in an electrically connected network.

### Connection

Table 4-33 Terminal block A1-A101 – connection for one insulation monitor

| Terminal | Technical data |
|---|---|
| 11 | Signaling relay ALARM 1 (mid-position contact) |
| 12 | Signaling relay ALARM 1 (NC contact) |
| 14 | Signaling relay ALARM 1 (NO contact) |
| 21 | Signaling relay ALARM 2 (mid-position contact) |
| 22 | Signaling relay ALARM 2 (NC contact) |
| 24 | Signaling relay ALARM 2 (NO contact) |
| M+ | External kΩ display, analog output (0 µA ... 400 µA) |
| M- | External kΩ display, analog output (0 µA ... 400 µA) |
| R1 | External reset key (NC contact or wire jumper otherwise the fault code is not stored) |
| R2 | External reset key (NC contact or wire jumper) |
| T1 | External test button |
| T2 | External test button |

Max. connectable cross-section: max. 2.5 mm² (AWG 12)

### Diagnostics

Messages output during operation and in the event of faults (meaning of LEDs) are described in "Additional Operating Instructions" in the operating manual.

■

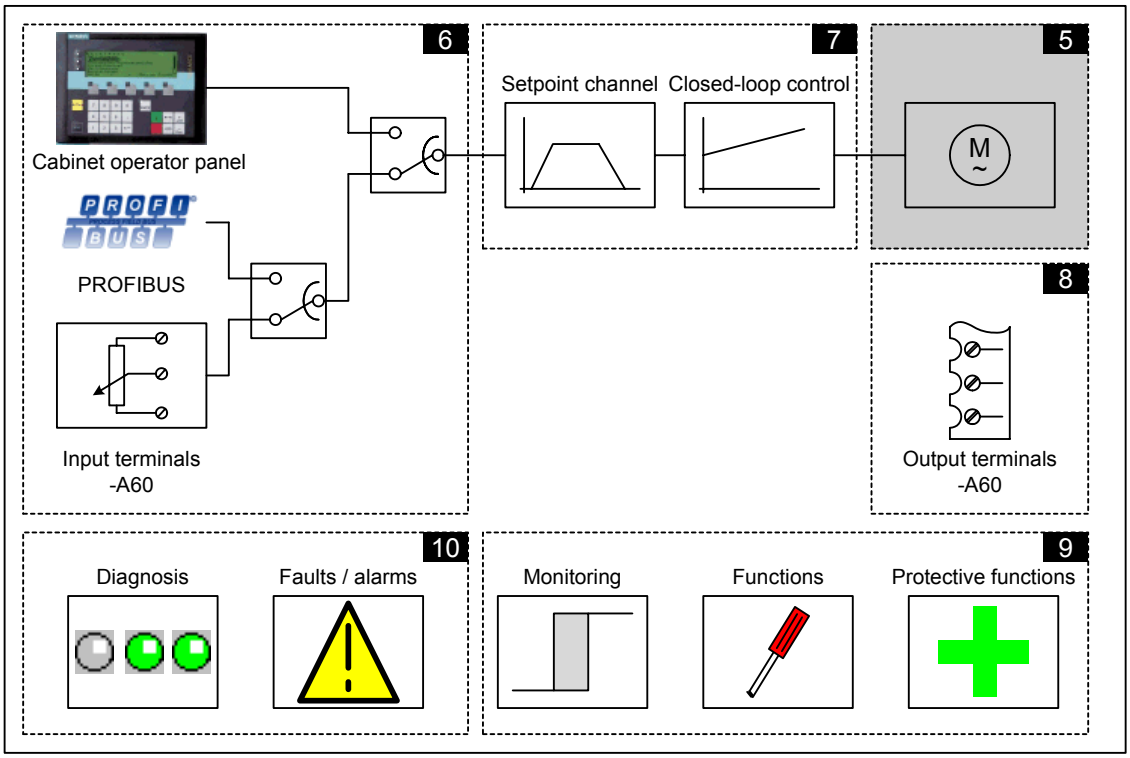
# Commissioning

# 5

## 5.1 Chapter Content

This chapter provides information on the following:

- An overview of the operator panel functions
- Initial commissioning of the cabinet (initialization)
  - Entering the motor data (drive commissioning)
  - Entering the most important parameters (basic commissioning), concluding with the motor ID
- Data backup
- Resetting parameters to the factory settings



# 5.2 The Operator Panel

## Description

An operator panel is located in the cabinet door of the converter for operation, monitoring, and commissioning tasks. It has the following features:

- Graphical LCD with backlighting for plain-text display and a "bar display" of process variables
- LEDs for displaying the operational statuses
- Help function describing causes of and remedies for faults and alarms
- Keypad for controlling drives during operation
- LOCAL/REMOTE switchover for selecting the control terminal (master control assigned to operator panel or customer terminal block / PROFIBUS)
- Numeric keypad for entering setpoint or parameter values
- Function keys for prompted navigation through the menus
- Two-stage security concept to protect against accidental or unauthorized changes to settings
- Degree of protection IP 54 (when installed)

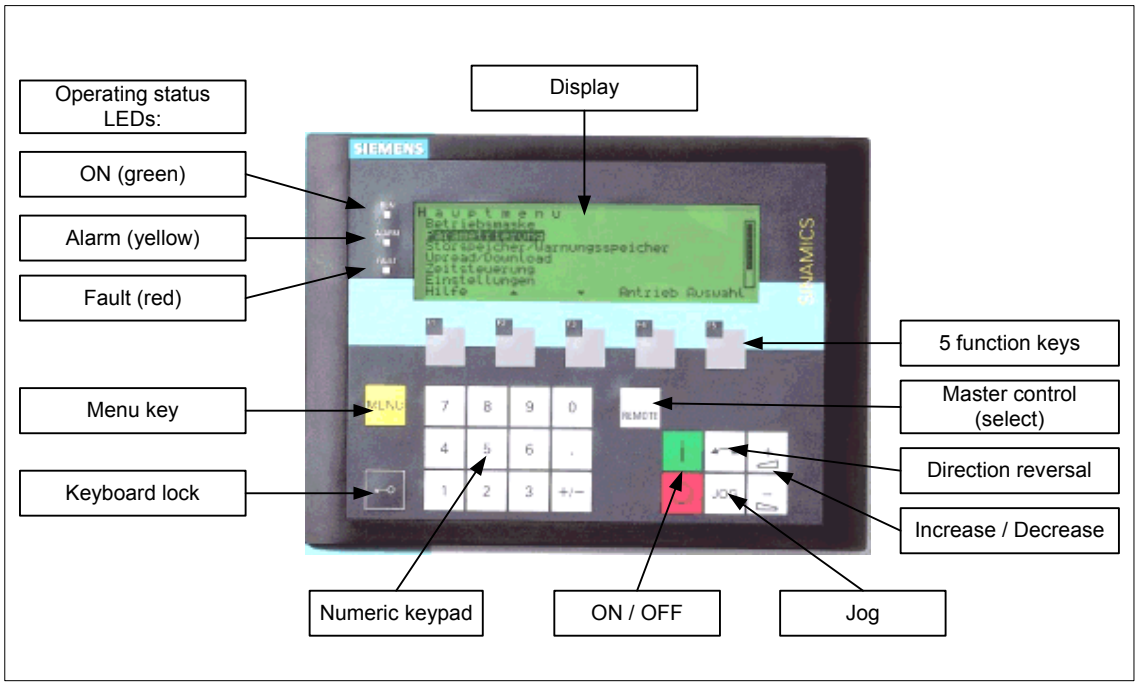



Fig. 5-1 Components of the cabinet operator panel

# 5.3 Initial Commissioning

## 5.3.1 Initial Ramp-Up

### Start Screen

When the system is switched on for the first time, the control unit (CPU) is initialized automatically. The following screen is displayed:

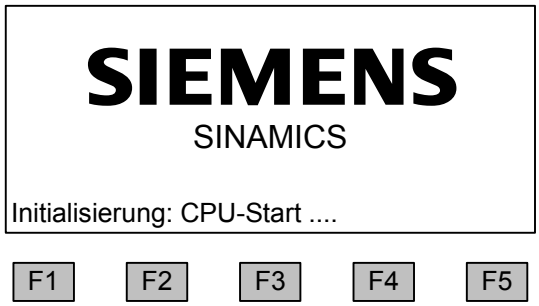



Fig. 5-2 Initial screen

While the system is ramping up, the internal statuses are displayed in the bottom line of the operator panel.

Once the system has successfully ramped up, the drive has to be commissioned when the system is switched on for the first time after it has been delivered. The converter can then be switched on.

When the system is then ramped up again, it can be operated immediately.

## 5.3.2 Basic Commissioning

### Entering the Motor Data

During initial commissioning, you have to enter motor data using the operator panel. Use the data shown on the motor type plate.

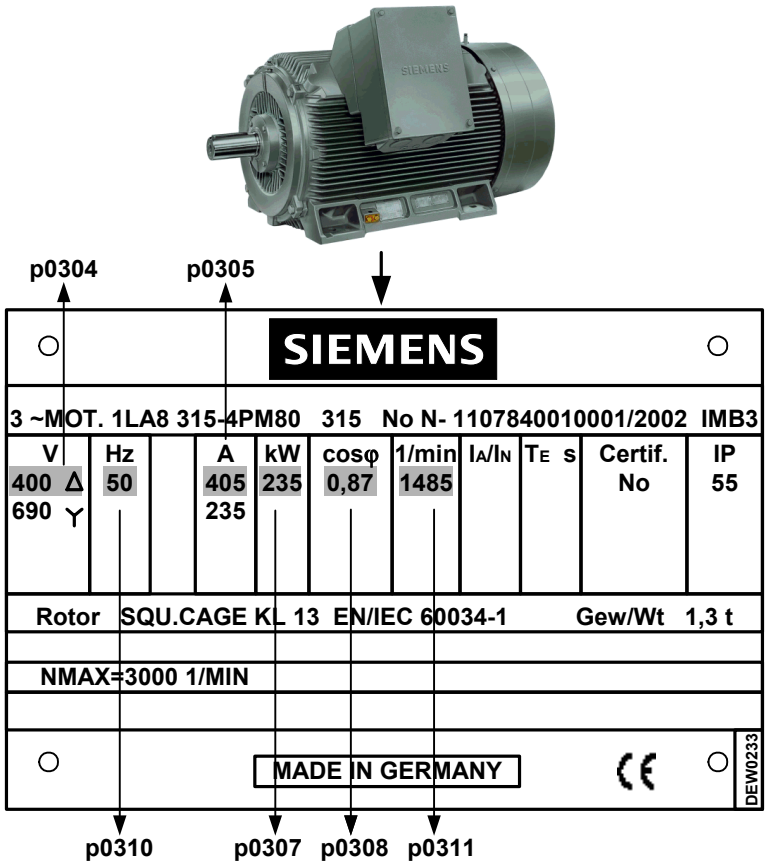
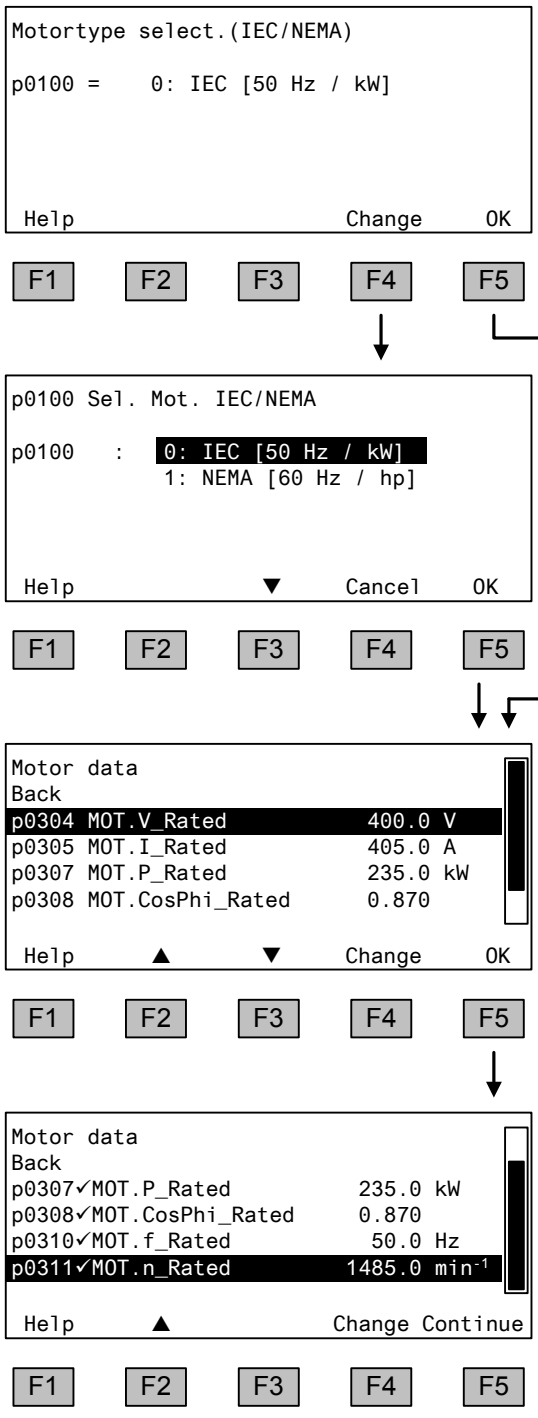



Fig. 5-3 Example of a motor type plate

Table 5-4 Motor data

| | Parameter no. | Values | Unit |
|---|---|---|---|
| System of units for line frequency and entering motor data | p0100 | 0<br>1 | IEC [50 Hz / kW]<br>NEMA [60 Hz / hp] |
| Motor: | | | |
| Rated voltage | p0304 | | [V] |
| Rated current | p0305 | | [A] |
| Rated output | p0307 | | [kW] / [hp] |
| Rated power factor Cos φ (at p0100 = 0 only) | p0308 | | |
| Rated efficiency η (at p0100 = 1 only) | p0309 | | [%] |
| Rated frequency | p0310 | | [Hz] |
| Rated speed | p0311 | | [min-1] / [rpm] |

## Basic Commissioning: Selecting the Motor Type




In the first dialog screen, select the line frequency and motor data in kW or hp.

Change the values with <F4>
Confirm the values with <F5>

Defined as follows:
0: line frequency 50 Hz, motor data in kW
1: line frequency 60 Hz, motor data in hp

With <F2> and <F3> you can select the possible settings.

Press <F4> to abort motor selection
Press <F5> to confirm the setting.

Entering motor data specified on the type plate

Change the values with <F4>:
A screen appears in which you can enter the respective values.

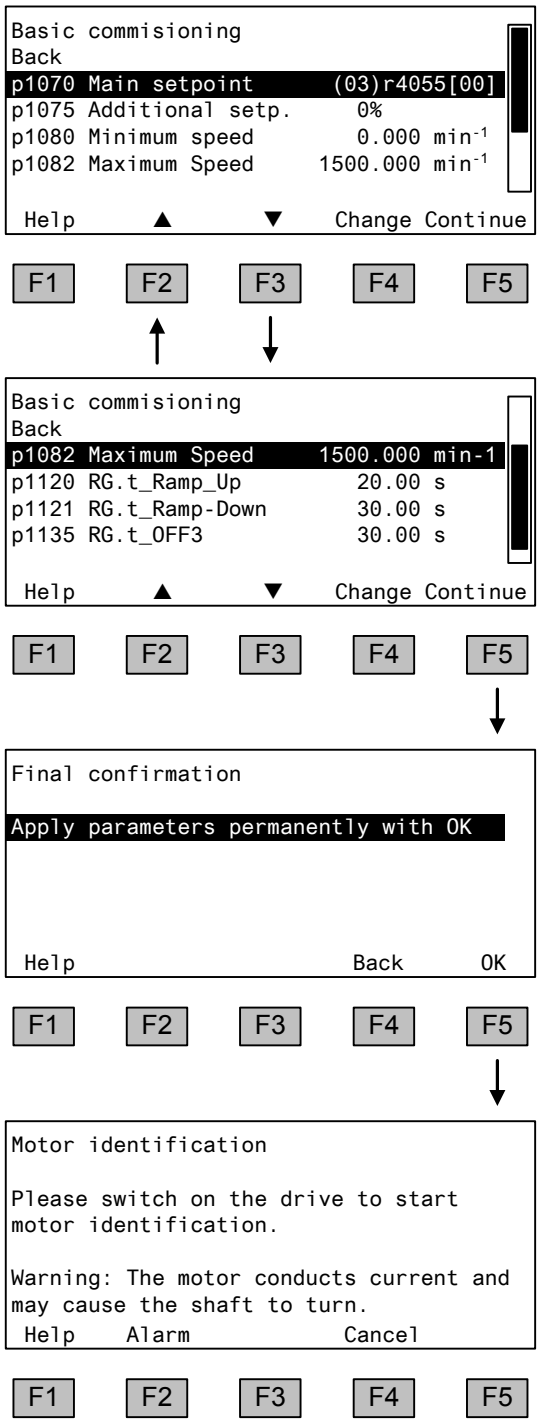
Press <Back> to return to the previous dialog screen

Once you have set the values, press <F5> to confirm them. The confirmed values are displayed with a tick ✓ behind the parameter number.

Once you have set and confirmed all the values, press <F5> to continue with basic commissioning.

Bild 5-5 Selecting the motor type and entering the motor data

## Basic Commissioning: Entering the Basic Parameters




**Entering the parameters for basic commissioning**

p1070 Main setpoint (03)r4055[00] means:

In the factory setting, the main setpoint (p1070) is defaulted by analog input 0 (parameter r4055[00]) on the customer terminal block (node address 03).

Press <F3> and <F2> to select the basic parameters.

Press <F4> to change the values:
The system displays a screen in which you can enter the relevant values.

Press <F5> to continue.

**Final confirmation**

Confirm the basic parameters to save them.

Press <Back> to return to the previous dialog screen
Press <F5> to continue.

The entered basic parameters are permanently stored and the necessary calculations for the control are carried out.

**Motor identification**

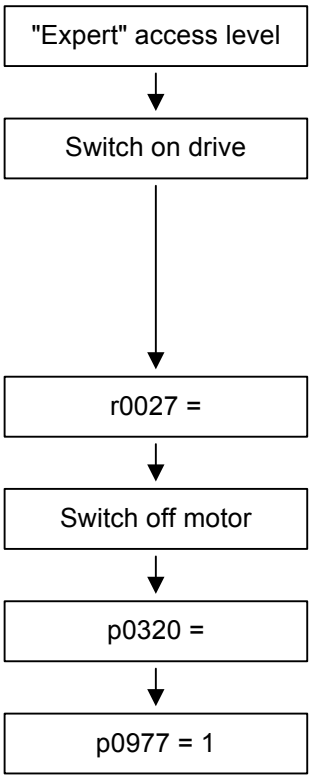
You activate this function by pressing the LOCAL key (wait until the LED in the LOCAL key lights up) and then ON.

If you abort the motor ID function (<F4>), the motor control does not operate with the measured values but with the motor characteristic values calculated from the type plate data. The measurement increases the control performance as deviations in the electrical characteristic values are minimized on account of deviations in the material properties and manufacturing tolerances.

Fig. 5-6 Basic commissioning – Further dialog screens, concluding with the motor ID

## NOTE on Improving Closed-Loop Control

A marked improvement in closed-loop control can be achieved if you know the rated magnetization current of the motor and enter it after commissioning.




**Setting "Expert" access level on the operator panel**
Set <key pushbutton> - <access level> - "Expert" and confirm (enter activation code "47")

**In no-load operation and when the load is not connected, increase the speed to 80 % of the rated motor speed:**
- Activate LOCAL mode
- Switch on
- Use the "increase" key to set the speed to 80 % of the rated motor speed (press <F2> in the operation screen to call up the mode for entering speed directly and enter the required speed).

**Reading the current in parameter r0027**
This is displayed in the lower bar display on the operator panel.

Switch the motor off and allow it to coast to a standstill (wait until the status "ready to operate" is displayed in the top left of the operator panel).

**Entering the rated magnetization current**
Enter the value read in r0027 in p0320

**Storing the parameters**
All the parameter settings will be stored on the CompactFlash Card.

Fig. 5-7 Procedure for improving closed-loop control

## 5.4 Status After Commissioning

Once drive and basic commissioning have been carried out using the parameters specified in Chapter 5.3.2, you can operate the cabinet unit as follows:

### REMOTE Mode 1 (Control via Terminal Block)

- Control (ON/OFF) is carried out via terminal X520:1.
- The speed setpoint is specified as a current in the range 0 to 20 mA via analog input 0 at terminals X521:1 and 2.
  An input current of 20 mA is equal to the maximum speed in p1082 entered during basic commissioning.

### REMOTE Mode 0 (Control via PROFIBUS)

- Control (ON/OFF) is carried out via control word 1, bit 0.
- The speed setpoint is specified via the PROFIBUS setpoint (displayed in r2050[01]).
  A setpoint of 100% is equal to the maximum speed in p1082 entered during basic commissioning.

### Switching Between Remote Mode 0 and 1

- Switching between REMOTE mode 0 and REMOTE mode 1 is carried out via terminal X530:1. In the factory setting, REMOTE mode 1 (control via terminal block) is active.

### LOCAL Mode (Control via Operator Panel)

- You switch to LOCAL mode by pressing the "LOCAL/REMOTE" key.
  Switching can be blocked by applying a HIGH signal at terminal X530:2.
- Control (ON/OFF) is carried out via the "ON" and "OFF" keys.
- You specify the setpoint using the "increase" and "decrease" keys or by entering the appropriate numbers using the numeric keypad.

### Analog Outputs

- The actual speed (r0063) is output as a current output in the range 0 to 20 mA at analog output 0 (X522:2 and 3).
  A current of 20 mA is equal to the maximum speed in p1082.
- The actual current value (r0068) is output as a current output in the range 0 to 20 mA at analog output 1 (X522:5 and 6).
  A current of 20 mA is equal to the current limit (p0640) set to 1.5 x rated motor current (p0305).

**Digital Outputs**

- The "Enable pulses" signal is output at digital output 0 (X542:2 and 3).
- The "no fault" signal is output at digital output 1 (X542:5 and 6) (fail safe).
- The "ready to start" signal is output at digital output 8 (X541:2).
- The "LOCAL mode active" signal is output at digital output 9 (X541:3).
- The "Enable pulses" signal is output at digital output 10 (X541:4).

**Vdc-max Controller is Active (p1240 = 1)**

If the ramp-down time is too short and the permitted DC link voltage is violated when the drive is decelerated, the ramp-down time is automatically increased so that the cabinet unit does not have to be shut down with the error "overvoltage in DC link".

**Flying Restart Function is Active (p1200 = 1)**

When the drive is switched on, the motor may be rotating:

- due to external influences (water flow for pumps, air from fan drives)
- due to a previous shutdown or power failure, whereby the kinetic energy stored causes the drive to coast to a standstill slowly.

When the flying restart function is activated, the output frequency of the converter is varied until the current motor speed is found. The motor then ramps up in accordance with the settings for the ramp-up generator until the defined setpoint is reached.

## 5.5 Data Backup

### 5.5.1 Saving the CompactFlash Card Parameter Settings

After commissioning, you are advised to store the CompactFlash Card data on an external storage medium (hard disk, data media).

To do so, use a card reader connected to a PC. Ensure that all the files and directories are stored in the same form as on the CompactFlash card.

If required, you can restore the device status after the drive has been commissioned by transferring the stored data to the CompactFlash card.

**NOTE**

You should only remove the CompactFlash card when the system is switched off. If you remove it while the system is switched on, warning A1100 ("CompactFlash Card removed") is output.

### 5.5.2 Restoring the Saved Configuration

To restore the saved configuration, you have to delete all the files on the CompactFlash card and transfer the saved copy to the CompactFlash card.

**IMPORTANT**

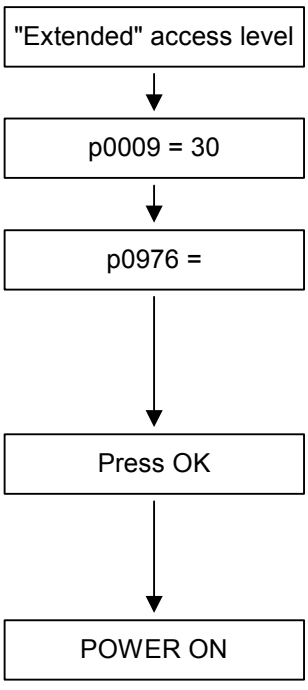
When you delete the files on the CompactFlash card, the saved drive parameters are permanently lost!

When re-importing the saved files, you must ensure that none of the files in the "User" sub-folder on the CompactFlash card has a write-protection attribute. This can occur, for example, if the copy of the CompactFlash card was stored temporarily on a CD.
The CompactFlash card directory must be structured in the same way as before. If you move individual files to sub-folders, you may not be able to use the CompactFlash card.

## 5.6 Resetting Parameters to the Factory Settings

The factory settings represent the defined original status of the cabinet unit on delivery.

Resetting the parameters to the factory settings means that all the parameter settings made since the system was delivered are reset.




**Setting the "Extended" access level on the operator panel**
Set <key pushbutton> - <access level> - <"Extended">

**Setting the parameter filter to "Parameter reset"**
<MENU> <device commissioning> <select>
Set p0009 = 30 in the following dialog screen

**Resetting all the parameters to the factory settings**
All the cabinet unit parameters are reset the SINAMICS G150 factory settings
- 380 V - 480 V, 110 kW - 250 kW: p0976 = 20
- 380 V - 480 V, 315 kW - 560 kW: p0976 = 21
- 660 V - 690 V, 75 kW - 800 kW: p0976 = 22

**Saving the parameters**
When you press F5 (OK), all the parameter settings are set to the factory setting and saved to the CompactFlash Card.
The system has finished saving the data when the text "busy ..." in the status bar is no longer displayed.

**POWER ON**
To activate the parameter reset to factory setting, switch the power supply off and then on again.

Fig. 5-8 Procedure for resetting parameters to the factory settings

■

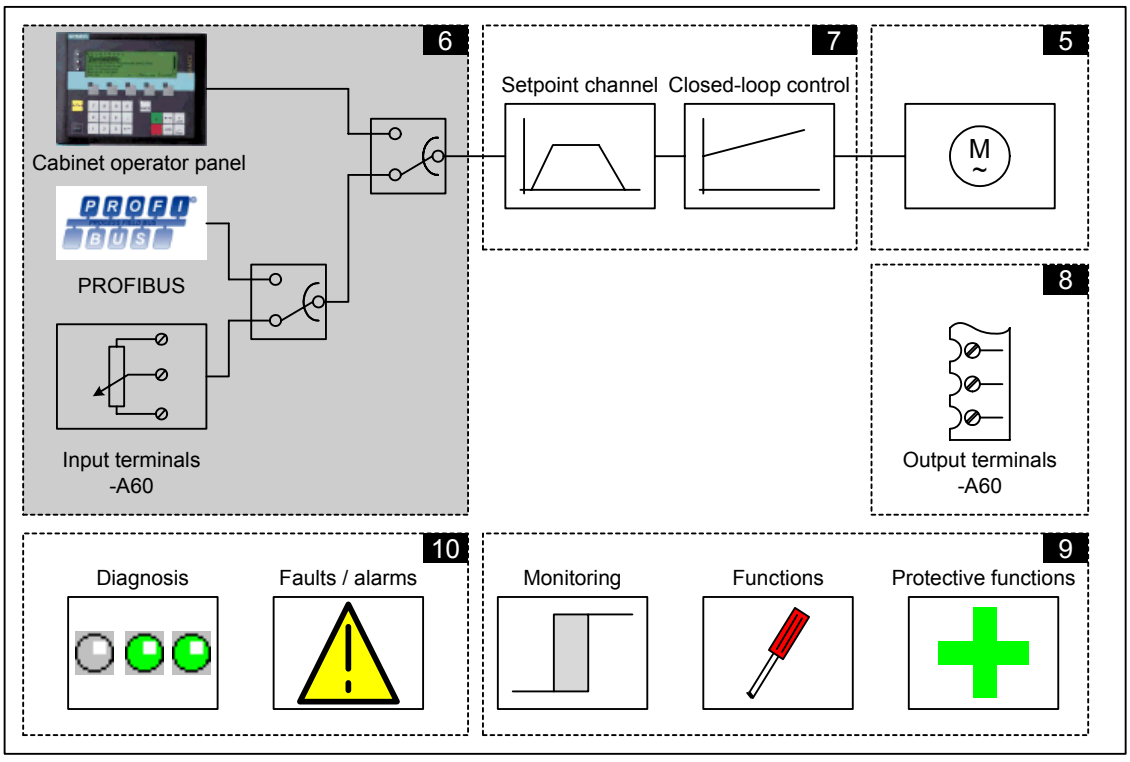
# Operation

# 6

## 6.1 Chapter Content

This chapter provides information on the following:

- Control via the operator panel
- Control via the terminal block
- Control via PROFIBUS



## Control Sources

The system can be controlled via the operator panel, terminal block, or PROFIBUS.

Control via PROFIBUS

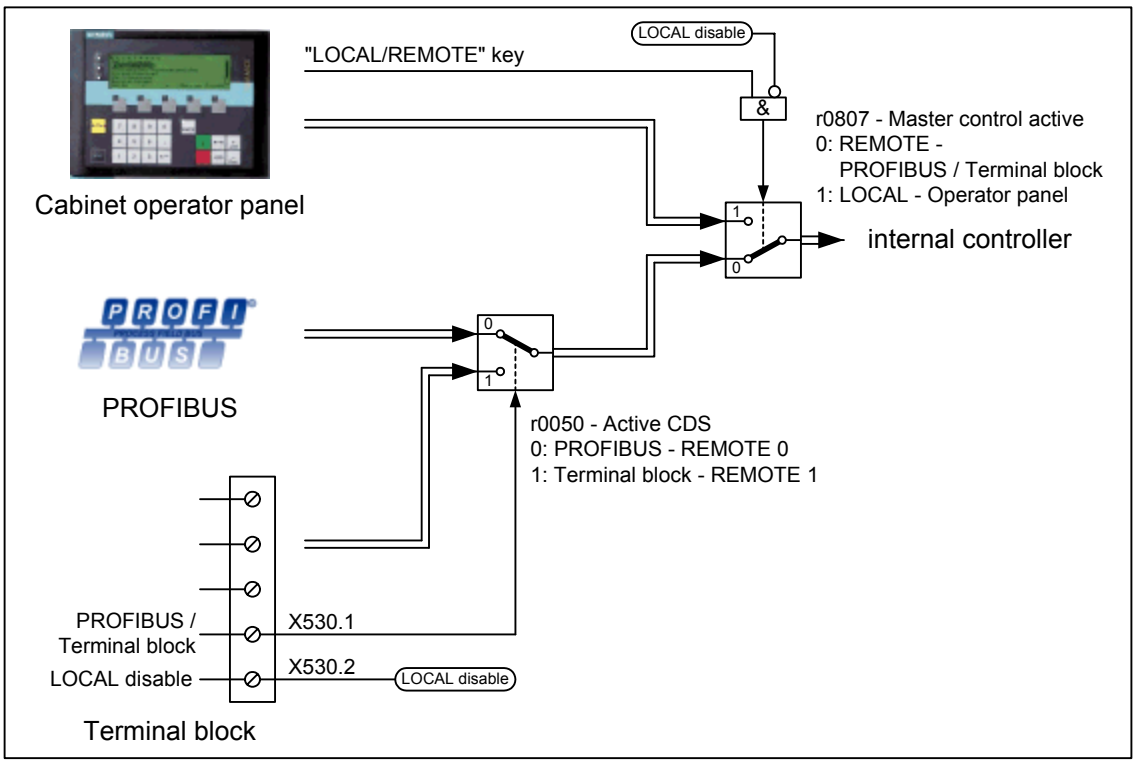



Fig. 6-1 Control sources

## Priority

The priority of the control sources is shown in Fig. 6-1.

**NOTE**

Emergency OFF signals (L57, L59, L60) and motor protection signals (L83, L84) are always active (regardless of the control source).

# 6.2 Control via the Operator Panel

## 6.2.1 Operator Panel (AOP30) Overview

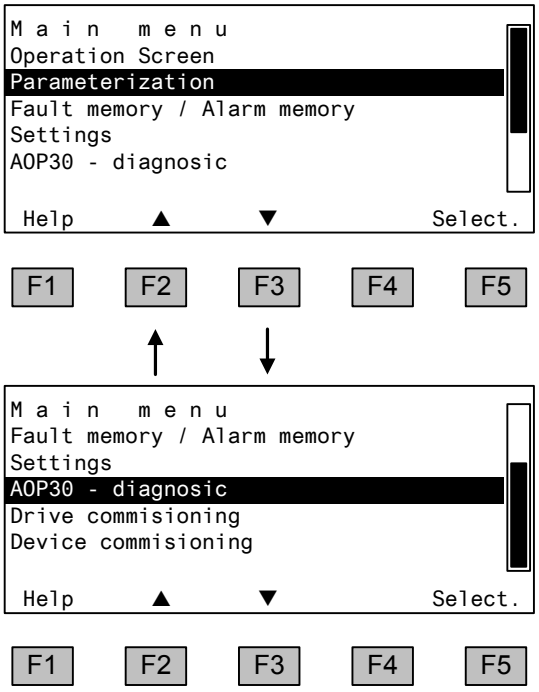
### Description

The operator panel can be used for the following activities:

- Parameterization (commissioning)
- Monitoring status variables
- Controlling the drive
- Diagnosing faults and alarms

All the functions can be accessed via a menu.

Your starting point is the main menu, which you can always call up using the yellow MENU key:




Dialog screen for the main menu:
Press the "MENU" key to access this from anywhere in the system.

Press "F2" and "F3" to navigate through the menu options in the main menu.

Fig. 6-2 Main menu

## 6.2.2 Menu Structure of the Operator Panel

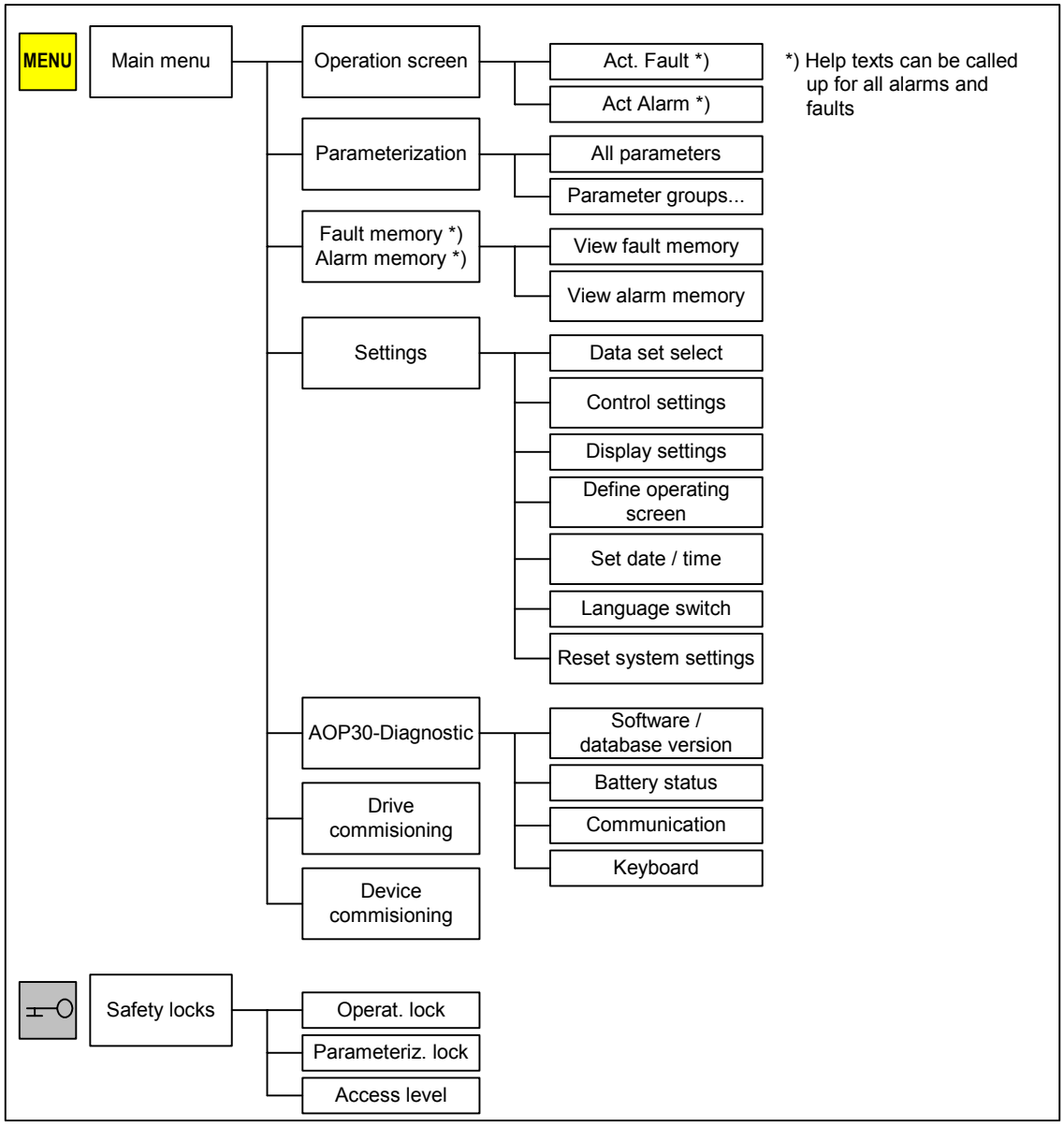



Fig. 6-3 Menu structure of the operator panel

### 6.2.2.1 Operation Screen Menu

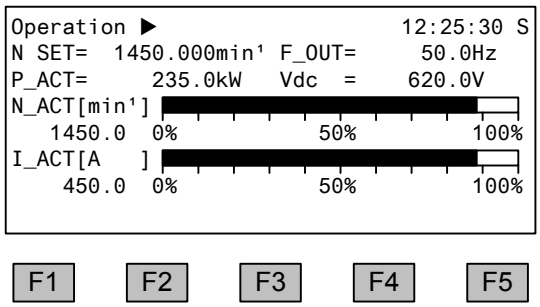
#### Description

The operation screen displays the most important status variables for the cabinet units:

It displays the operating status of the drive, the direction of rotation, the time, as well as four drive variables (parameters) numerically and two in the form of a bar display for continuous monitoring.

You can call up the operation screen in one of three ways:

1. After the power supply has been switched on and the system has ramped up.
2. If you do not make any entries for two minutes, the system calls up the operation screen automatically.
3. By pressing the MENU key twice and then F5 OK







If a fault occurs, the system automatically displays the fault screen (see Section 6.2.4).

In LOCAL control mode, you can choose to enter the setpoint numerically (F2: setpoint).

#### Settings

When you choose Settings – Define operation screen, you can adjust the type of display and the values displayed as required.

See Section 6.2.2.3

### 6.2.2.2 Parameterization Menu

In the parameterization menu, you can adjust the cabinet unit settings.

Parameters are also arranged in function groups so that you can find them more easily. You can, however, call up a list displaying all the parameters.

In both cases, the parameters displayed depend on the access level that has been set. You can set the access level in the menu for inhibit functions, which you can call up by pressing the key pushbutton.

### 6.2.2.3 Menu Settings

#### Selecting Data Sets

In this menu, you select the active data set for displaying and processing parameters which, although relevant to both REMOTE mode 0 and 1, can be set differently.

For example, the main setpoint for terminal operation (p1070[1], REMOTE mode 1) and the main setpoint for PROFIBUS operation (p1070[0], REMOTE mode 0) can be set via two separate command data sets.

The command data set that must be activated for setting the relevant main setpoint is indicated in square parentheses [].

In the factory setting, command data set 1 is active.

#### Control Settings

This defines the settings for the control keys in LOCAL mode.

See Section 6.2.3.

#### Display Settings

In this menu, you set the lighting, brightness, and contrast for the display.

#### Defining the Operation Screen

In this menu, you can switch between four operation screens. By pressing F3 – "Values", you can set the parameters that are to be displayed.

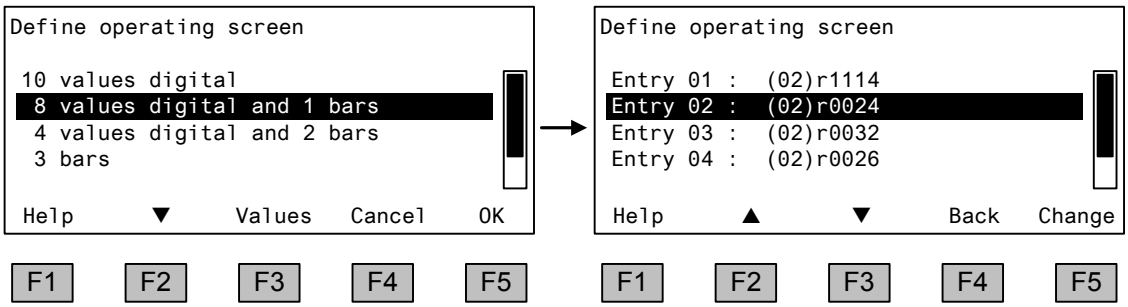



Fig. 6-4 Defining the operation screen

The following image shows how the entries are assigned to the screen positions:

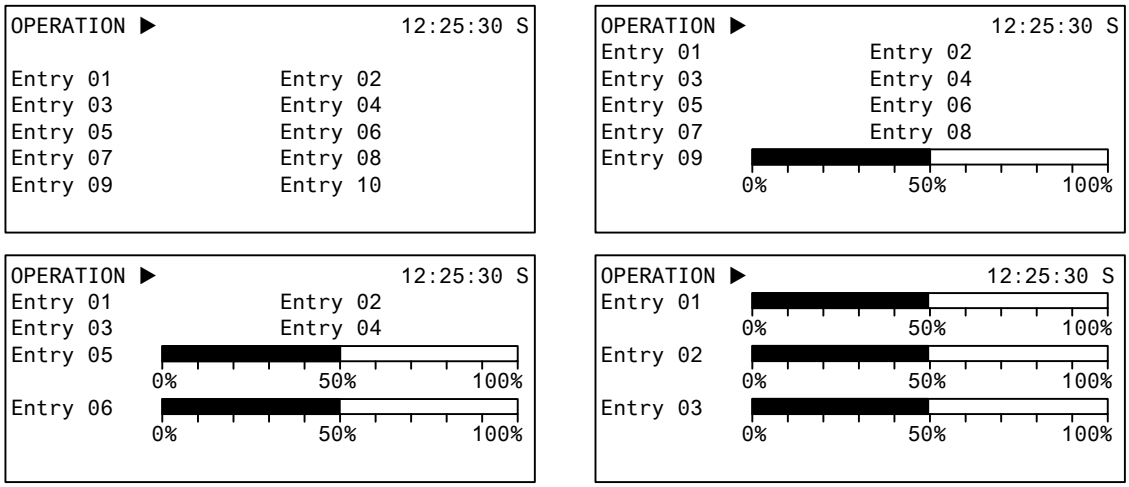



Fig. 6-5 Position of the entries in the operation screen

## List of Signals for the Operation Screen

Table 6-1 List of signals for the operation screen

| Signal | Parameter | Short name | Unit | Scaling (100 % = ...) (see Table 6-2) |
|---|---|---|---|---|
| **Factory Setting (entry no.)** | | | | |
| Speed setpoint upstream of ramp generator (1) | r1114 | N_SET | 1/min | p2000 |
| Output frequency (2) | r0024 | F_OUT | Hz | Reference frequency |
| Output smoothed (3) | r0032 | P_ACT | kW | r2004 |
| DC link voltage smoothed (4) | r0026 | VDC | V | p2001 |
| Actual speed smoothed (5) | r0021 | N_ACT | 1/min | p2000 |
| Absolute actual current smoothed (6) | r0027 | I_ACT | A | p2002 |
| Motor temperature (7) | r0035 | T_MOT | °C | Reference temperature |
| Converter temperature (8) | r0037 | T_LT | °C | Reference temperature |
| Actual torque smoothed (9) | r0031 | M_ACT | Nm | p2003 |
| Converter output voltage smoothed (10) | r0025 | V_OUT | V | p2001 |
| **For diagnostic purposes** | | | | |
| Speed setpoint smoothed | r0020 | N_SET | 1/min | p2000 |
| Control factor smoothed | r0028 | | % | Reference control factor |
| Field-producing current component | r0029 | | A | p2002 |
| Torque-producing current component | r0030 | | A | p2002 |
| Converter overload Degree of thermal overload | r0036 | | % | 100 % = Shutdown |
| Speed setpoint downstream of filter | r0062 | N_ACT | 1/min | p2000 |
| Actual speed after smoothing | r0063 | N_ACT | 1/min | p2000 |
| Control deviation | r0064 | | 1/min | p2000 |
| Slip frequency | r0065 | | Hz | Reference frequency |
| Output frequency | r0066 | | Hz | Reference frequency |
| Output voltage | r0072 | V_ACT | V | p2001 |
| Control factor | r0074 | | % | Reference control factor |
| Torque-producing actual current | r0078 | | A | p2002 |
| Actual torque value | r0080 | | Nm | p2003 |
| **For further diagnostic purposes** | | | | |
| Fixed speed setpoint active | r1024 | | 1/min | p2000 |
| Active motor potentiometer setpoint | r1050 | | 1/min | p2000 |
| Resulting speed setpoint | r1119 | | 1/min | p2000 |
| Speed controller output | r1508 | | Nm | p2003 |
| I component of speed controller | r1482 | | Nm | p2003 |
| PROFIBUS setpoint | r2050 | | 1/min | p2000 |
| Analog input 0 [V, mA] | r4052[0] | | V, mA | V: 100 V mA: 100 mA |
| Analog input 1 [V, mA] | r4052[1] | | V, mA | V: 100 V mA: 100 mA |
| Analog input 0, scaled | r4055[0] | | % | V: 10 V mA: 20 mA |
| Analog input 1, scaled | r4055[1] | | % | V: 10 V mA: 20 mA |

## Scaling

Table 6-2 Scaling

| Variable | Scaling parameter | Default for quick commissioning |
|---|---|---|
| Reference speed | 100 % = p2000 | p2000 = Maximum speed (p1082) |
| Reference voltage | 100 % = p2001 | p2001 = 1000 V |
| Reference current | 100 % = p2002 | p2002 = Current limit (p0640) |
| Reference torque | 100 % = p2003 | p2003 = 2 x rated motor torque |
| Reference power | 100 % = r2004 | $r2004 = \frac{p2003 \times p2000 \times \pi}{30}$ |
| Reference frequency | $100\ \% = \frac{p2000}{60}$ | |
| Reference control factor | 100 % = Maximum output voltage without overload | |
| Reference flux | 100 % = Rated motor flux | |
| Reference temperature | 100% = 100 °C | |

## Setting the Date / Time

In this menu, you set the date and time.

## Setting the Language

In this menu, you can select the active language.

You have a choice between the two languages currently stored in the operator panel.

If the language you require is not available, you can load it separately (see Chapter 11).

## Menu for Resetting System Settings

You can choose this menu option to reset the following settings to the factory settings:

- Language
- Display (brightness, contrast)
- Operation screen
- Control settings

The settings do not become effective until the power supply is next switched on.

**IMPORTANT**

When you reset parameters, all settings that are different to the factory settings are reset immediately. This may cause the cabinet unit to switch to a different, unwanted operational status.

For this reason, you should always take great care when resetting parameters.

### 6.2.2.4 AOP30 – Diagnosis Menu

#### Software / Database Version

You can use this menu to display the firmware and database versions.

The database version must be compatible with the drive software status (you can check this in parameter r0018).

#### Battery Status

In this menu, you can display the battery voltage numerically (in Volts) or as a bar display. The battery ensures that the data in the database and the current time are retained.

When the battery voltage is represented as a percentage, a battery voltage of ≤ 2 V is equal to 0%, and a voltage of ≥ 3 V to 100%.

The data is secure up to a battery voltage of 2 V.

- If the battery voltage is ≤ 2.45 V, the message "Replace battery" is displayed in the status bar.
- If the battery voltage is ≤ 2.30V, the system displays a popup window with the following information "Warning: weak battery".
- If the battery voltage is ≤ 2 V, the system displays a popup window with the following information: "Warning: battery is empty".
- If the time and/or database are not available after the system has been switched off for a prolonged period due to the voltage being too low, the loss is established by means of a CRC check when the system is switched on again. This triggers a message instructing the user to replace the battery and then load the database and/or set the time.

For instructions on replacing batteries, see Chapter 11 ("Maintenance and Servicing").

#### Communication

In this menu, you can call up information on the communications status between the AOP and the drive.

#### Keyboard

In this screen, you can check that the keys are functioning properly. Keys that you press are represented on a symbolic keyboard on the display. You can press the keys in any order you wish. You cannot exit the screen (F5 – "back") until you have pressed each key at least once.

#### 6.2.2.5 Drive Commissioning Menu

This option enables you to re-commission the drive from the main menu.

#### 6.2.2.6 Device Commissioning Menu

In this menu, you can enter the device commissioning status directly. This is the only way that you can reset parameters to the factory setting for example.

You can use this menu to create motor data sets in subsequent drive software versions.

### 6.2.3 Operation via the Operator Panel (LOCAL Mode)

You activate the control keys by switching to LOCAL mode. If the green LED in the LOCAL-REMOTE key does not light up, the control keys are not active.

#### 6.2.3.1 Timeout Monitoring

**Settings: MENU – Settings – Control Settings**

**Timeout monitoring** (factory setting: 3000 ms)

The monitoring time continuously monitors communication between the operator panel and drive.

If, when the drive is in LOCAL mode, no communication signal has been received once the monitoring time has elapsed, the drive is stopped with OFF1 and fault F1030 ("control priority monitoring: sign-of-life failure") is displayed.

#### 6.2.3.2 LOCAL/REMOTE Key


**Activate LOCAL mode:** press the LOCAL key

**LOCAL mode:** LED lights up

**REMOTE mode**: LED does not light up: the ON, OFF, JOG, direction reversal, faster, and slower keys are not active.

**Settings: MENU – Settings – Control Settings**

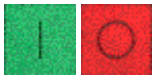
**Save LOCAL mode** (factory setting: yes)

- **Yes**: "LOCAL" or "REMOTE" operating mode is saved when the supply voltage is switched off, and restored when the supply voltage is switched back on.
- **No**: "LOCAL" or "REMOTE" operating mode is not saved. "REMOTE" is active when the supply voltage is switched back on.

**LOCAL/REMOTE also during operation** (factory setting: no)

- **Yes**: You can switch between LOCAL and REMOTE when the drive is switched on (motor is running).
- **No**: Before the system switches to LOCAL, a check is carried out to determine whether the drive is in the operational status. If so, the system does not switch to LOCAL and outputs the message "Local not possible". Before the system switches to REMOTE, the drive is switched off and the setpoint is set to 0.

### 6.2.3.3 ON / OFF Key



**ON key**: always active in LOCAL when the operator input inhibit is deactivated.

**OFF key**: in the factory setting, acts as OFF1 = ramp-down on the deceleration ramp (p1121), when n = 0: voltage disconnection (only if a main contactor is installed).

**Settings: MENU – Settings – Control Settings**

**Red OFF key acts as**: (factory setting: OFF1)

- **OFF1**: Ramp-down on the deceleration ramp (p1121)
- **OFF2**: Immediate pulse block, motor coasts to a standstill
- **OFF3**: Ramp-down on the emergency stop ramp (p1135)

### 6.2.3.4 Switching Between Clockwise and Counter-Clockwise Rotation

**Settings: MENU – Settings – Control Settings**

**Switching between CW/CCW** (factory setting: no)

- **Yes**: Switching between CW/CCW rotation by means of the CW/CCW key possible in LOCAL mode
- **No**: The CW/CCW key has no effect in LOCAL mode

For safety reasons, the CW/CCW key is disabled in the factory setting (pumps and fans must normally only be operated in one direction).

In the operation status in LOCAL mode, the current direction of rotation is indicated by an arrow next to the operating mode.

### 6.2.3.5 Jog (reserved for future use)


### 6.2.3.6 Increase Setpoint / Decrease Setpoint


You can use the “increase” and “decrease” keys to set the setpoint with a resolution of 1 % of the maximum speed.
(e.g. if the resolution is 15 $min^{-1}$ at p1082 = 1500 $min^{-1}$)

You can also enter the setpoint numerically. To do so, press F2 in the operation screen. The system displays an inverted edit field for entering the required speed. Enter the required value using the numeric keypad. Press F5 OK to confirm the setpoint.

When you enter values numerically, you can enter any speed between the minimum speed (p1080) and the maximum speed (p1082).

Setpoint entry in LOCAL mode is unipolar. You can change the direction of rotation by pressing the +/- keys (see Section 6.2.3.4).

### 6.2.3.7 Motor potentiometer

**Settings: MENU – Settings – Control Settings**

**Save motor potentiometer setpoint** (factory setting: no)

- **Yes**: In LOCAL mode, the last setpoint (once you have released the INCREASE or DECREASE key or confirmed a numeric entry) is saved.
  The next time you switch the system on in LOCAL mode, the saved value is selected. This is also the case if you switched to REMOTE in the meantime or the power supply was switched off.
  When the system is switched from REMOTE to LOCAL mode while the drive is switched on (motor is running), the actual value that was last present is set as the output value for the motor potentiometer setpoint and saved.
  If the system is switched from REMOTE to LOCAL mode while the drive is switched off, the motor potentiometer setpoint that was last saved is used.
- **No**: When you switch the system on in LOCAL mode, setpoint 0 is always selected. When the system is switched from REMOTE to LOCAL mode while the drive is switched on (motor is running), the actual value that was last present is set as the output value for the motor potentiometer setpoint.

**Motor potentiometer ramp-up time** (factory setting: 20 s)

**Motor potentiometer ramp-down time** (factory setting: 30 s)

- **Recommendation**: set as ramp-up/ramp-down time (p1120 / p1121)

### 6.2.3.8 Operator Input Inhibit / Parameterization Inhibit

To prevent users from accidentally actuating the control keys and changing parameters, you can activate an operator input / parameterization inhibit using a key pushbutton. Two key icons appear in the top right of the display when these inhibit functions are enabled.

Table 6-3 Display for operator input / parameterization inhibit

| Inhibit type | Online operation | Offline operation |
|---|---|---|
| No inhibit | | |
| Operator Input Inhibit | | |
| Parameterization Inhibit | | |
| Operator input inhibit + parameterization inhibit | | |

## Settings

**Operator input inhibit** (factory setting: no)

- **Yes**: The parameters can still be viewed, but a parameter value cannot be saved (message in the status bar: "Operator input inhibit – parameterization disabled"). The OFF key (red) is enabled. The LOCAL, REMOTE, ON (green), JOG, CW/CCW, INCREASE, and DECREASE keys are disabled.

**Parameterization inhibit** (factory setting: no)

- **Yes**: Parameters cannot be changed unless a password is entered. The parameterization process is the same as with the operator input inhibit. If you try and change parameters, the message "Parameterization inhibit – no change rights" is displayed in the status bar. All the control keys can, however, still be actuated.

---

**NOTE**

If you have forgotten your password, you can switch off the parameterization inhibit as follows:

1. Switch off the power supply
2. Disconnect the RS232 data cable
3. When switching the power supply back on, press the key pushbutton and hold down for 20 s.
4. When the key symbol in the top right of the display disappears, the access protection function has been reset.

---

**Access level** (standard factory setting):

The different parameters required for this complex application are filtered so that they can be displayed as clearly as possible. You select them according to the access level.

An expert level, which must only be used by expert personnel, is required for certain actions. You need a password to activate this level. To activate expert mode, enter code number "47".

The "Expert" access level is not stored permanently, which means that it must be reactivated every time the power is switched on.

## 6.2.4 Faults and Alarms

### Indicating Faults and Alarms

If a fault occurs, the drive displays the fault and/or alarm on the operator panel. Faults are indicated by the red "FAULT" LED and a fault screen is automatically displayed. You can use the F1 Help function to call up information about the cause of the fault and how to remedy it. You can use F5 Ack. to acknowledge a stored fault.

Any alarms are displayed by the yellow "ALARM" LED. The system also displays a note in the status bar providing information on the cause.

### What is a Fault?

A fault is a message from the drive indicating an error or other exceptional (unwanted) status. This could be caused by a fault within the converter or an external fault triggered, for example, from the winding temperature monitor for the asynchronous motor. The faults are displayed and can be reported to a higher-level control system via PROFIBUS. In the factory default setting, the message "converter fault" is also sent to a relay output. Once you have rectified the cause of the fault, you have to acknowledge the fault message.

The list of faults and alarms in Chapter 10 indicates the type of response (OFF1, OFF2, and so on) for each fault message.

### What is an Alarm?

An alarm is the response to a fault condition identified by the drive. It does not result in the drive being switched off and does not have to be acknowledged. Alarms are "self acknowledging", that is, they are reset automatically when the cause of the alarm has been eliminated.

### Fault and Alarm Displays

Every fault and alarm is entered in the fault/alarm buffer along with time the error occurred and the time it was rectified. The time stamp relates to the relative system time in milliseconds (r0969).

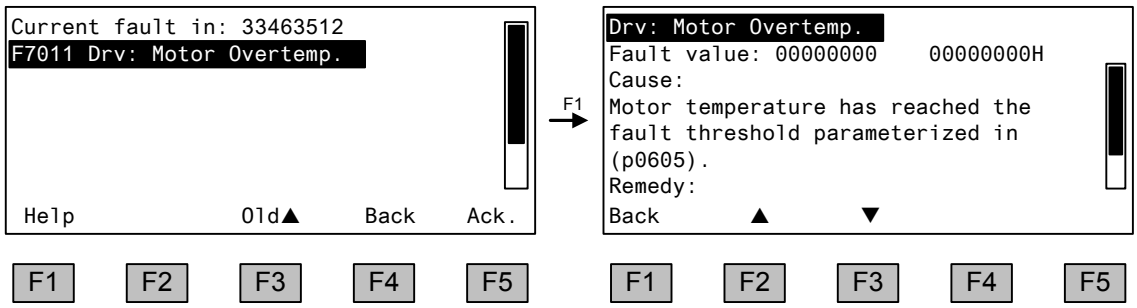



Fig. 6-6 Fault screen

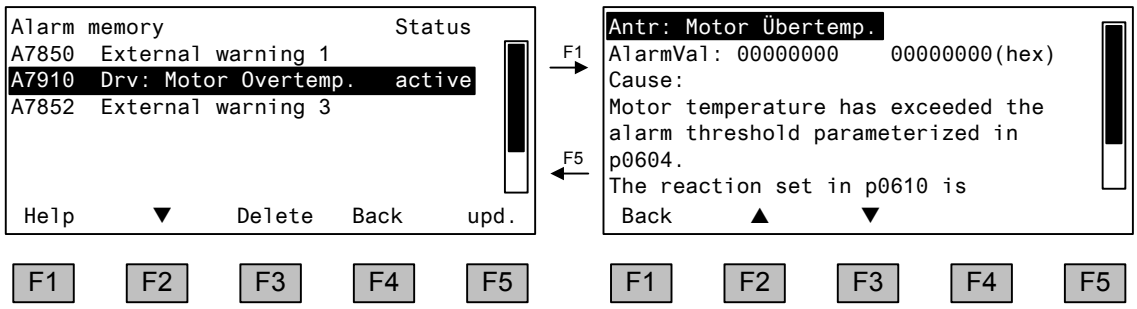



Fig. 6-7 Alarm screen

## 6.2.5 Saving the Parameters Permanently

### Description

If parameters have been changed on the operator panel (press OK in the Parameter Editor to confirm), the new values are initially stored in a volatile memory (RAM). An "S" flashes in the top right of the display until they are saved to a permanent memory. This indicates that at least 1 parameter has been changed and not yet stored permanently.

Two methods are available for permanently saving parameters that have been changed:

- Call up the Help function from any screen and press F4 EEPROM
- When confirming a parameter setting with OK, press the OK key for > 1s. The system displays a message asking you whether the setting is to be saved in the EEPROM.
  If you press "Yes", the system saves the setting in the EEPROM. If you press "No", the setting is not saved permanently and the "S" starts flashing.

In both cases, **all** changes that have not yet been saved permanently are stored in the EEPROM.

### 6.2.6 Parameterization Errors

If an error occurs while parameters are being read or written, this is indicated in the status bar on the operator panel (the eighth or lowest line in the operation screen, or the seventh line in all other screens).

The system displays:

Parameter write error (d)pxxxx.yy:0xnn

and a plain-text explanation of the type of parameterization error.

## 6.3 Control via the Terminal Block

### 6.3.1 General

The customer terminal block (-A60) is available as a control interface for the customer. You can use this interface to connect the system to the higher-level controller using analog and digital signals, or connect additional devices.

The customer terminal block is a type TM31 module.

## 6.3.2 Analog Inputs

### Description

The customer terminal block features two analog inputs for specifying setpoints via current or voltage signals. In the factory setting, analog input 0 (terminal X521:1/2) is used as the current input.

### Prerequisite

| | |
|---|---|
| p1070 = r4055[00] | **Main setpoint is specified by analog input 0**<br><MENU> - <parameterization> - <all parameters> - Select p1070 and set to r4055 - Select index [00] |

### Proposed Connection Assignment

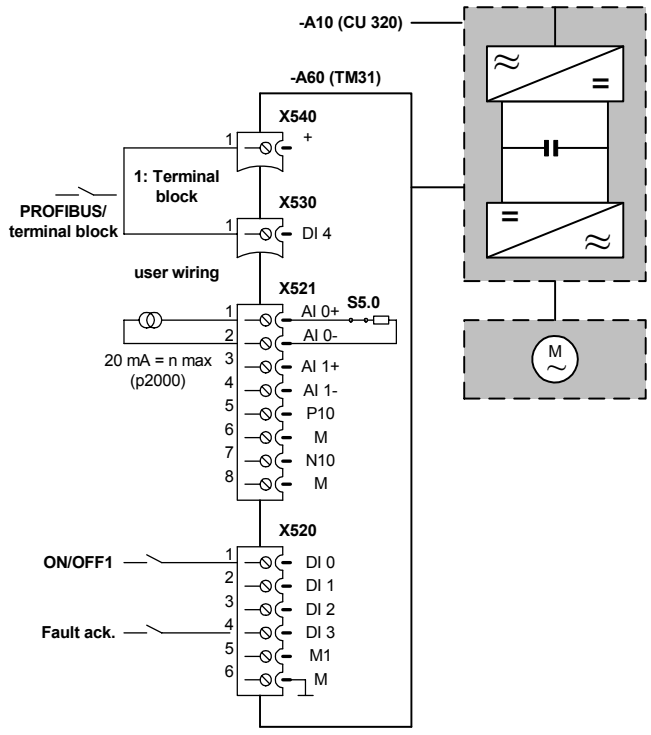



Fig. 6-8 Proposed connection assignment

## Signal Flow Diagram

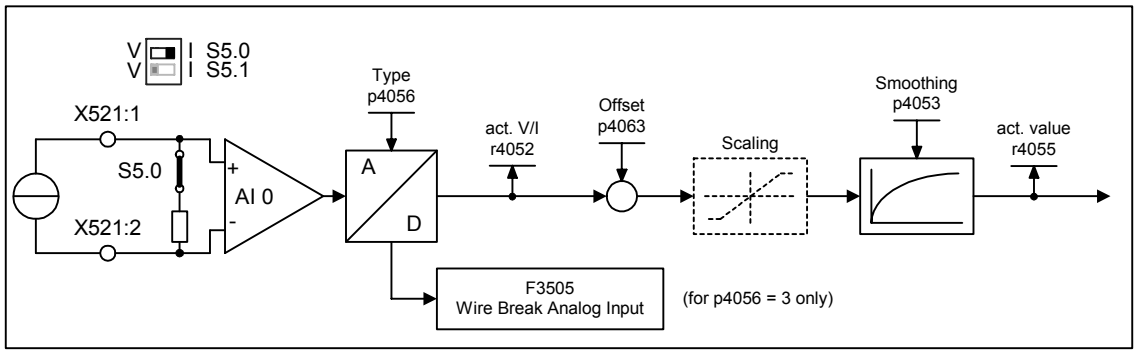



Fig. 6-9 Signal flow diagram: Analog input 0

## Setting Parameters

| p4056 | Analog input type | Setting range: 0 / 2 / 3 / 4 / 5<br>Factory setting: 2: 0 ... 20 mA |
|---|---|---|

Setting parameter for the type of the analog inputs on the customer terminal block.

Values: 0: 0 ... 10 V
2: 0 ... 20 mA
3: 4 ... 20 mA with open-circuit monitoring
4: -10 ... +10 V
5: -20 ... +20 mA

Settings 0 and 4: switch S5.0 on the customer terminal block (-A60) must be set to "V".

Settings 2, 3, and 5: switch S5.0 on the customer terminal block (-A60) must be set to "I".

Setting 3 with open-circuit monitoring: fault F3505 is triggered if the input current is less than 2 mA.

| r4052 | Current input voltage/current | Unit: V or mA |
|---|---|---|

The current input voltage is displayed in V when the analog input is set as a voltage input (p4056 = 0 / 4) and switch S5.0 is set to "V".

The current input current is displayed in mA when the analog input is set as a current input (p4056 = 2 / 3 / 5) and switch S5.0 is set to "I".

| p4063 | Analog input offset | Setting range: -20.000 ... 20.000 V or mA<br>Factory setting: 0.000 V or mA |
|---|---|---|

Setting parameter for the offset added to the input signal upstream of the scaling characteristic.

The unit is V when the analog input is set as a voltage input (p4056 = 0 / 4) and switch S5.0 is set to "V".

The unit is mA when the analog input is set as a current input (p4056 = 2 / 3 / 5) and switch S5.0 is set to "I".

| p4053 | Smoothing time constant analog inputs | Setting range: 0.0 ... 1000.0 ms<br>Factory setting: 0.0 ms |
|---|---|---|
| Setting parameter for the time constant of the 1st order low-pass filter for the analog inputs. | | |

| r4055 | Current per-unit input value | Unit: % |
|---|---|---|
| Display the current input value of the analog input in %. | | |

**NOTE**

In the factory setting and after basic commissioning, an input current of 20 mA is equal to the main setpoint 100 % reference speed (p2000), which has been set to the maximum speed (p1082).

## Example: Changing Analog Input 0 from Current to Voltage Input –10 to +10 V

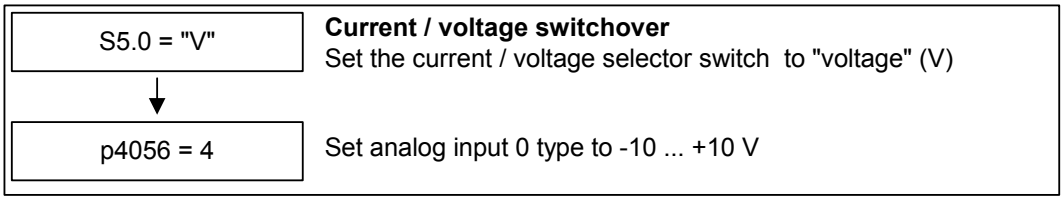



Fig. 6-10 Example: Setting analog input 0

## F3505 – Fault: "Analog input cable breakage"

This fault is triggered when analog input type (p4056) is set to 3 (4 ... 20 mA with open-circuit monitoring) and the input current of 2 mA has been undershot.

The fault value can be used to determine the analog input in question.

## Example

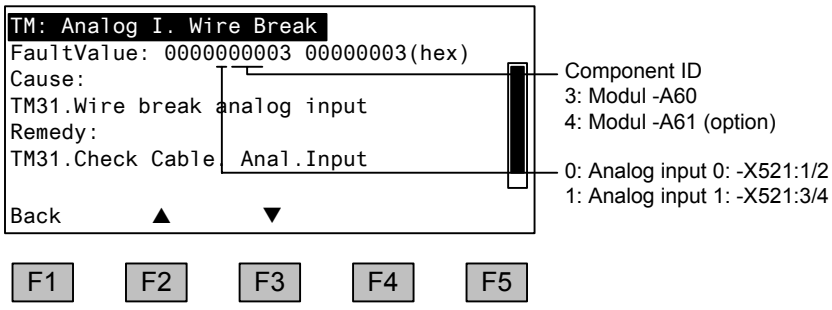



Fig. 6-11 Fault screen

## 6.3.3 Motor Potentiometer

### Description

The digital motor potentiometer enables you to set speeds remotely using switching signals (+/- keys). This is activated via terminals X520:2 and X520:3. Provided that a logical 1 is present at terminal -X520:2 (increase setpoint), the internal counter adopts this setpoint. You can set the integration time (time taken for the setpoint to increase) via the operator panel using parameter p1047. The setpoint can be decreased in the same way via terminal -X520:3 (decrease setpoint). You can set the deceleration ramp via the operator panel using parameter p1048.

### Prerequisite

| |
|---|
| p1070 = r1050 |

**Main setpoint is specified by motor potentiometer**
<MENU> - <parameterization> - <all parameters> - Select p1070 and set to r1050

### Proposed Connection Assignment

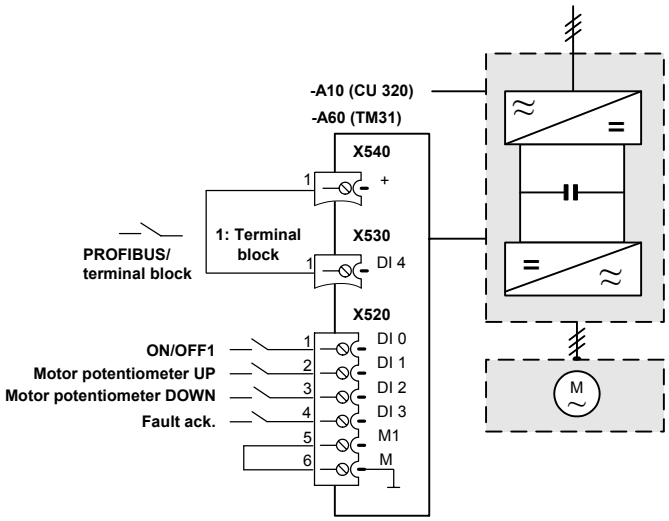



Fig. 6-12 Circuit proposal

## Signal Flow Diagram

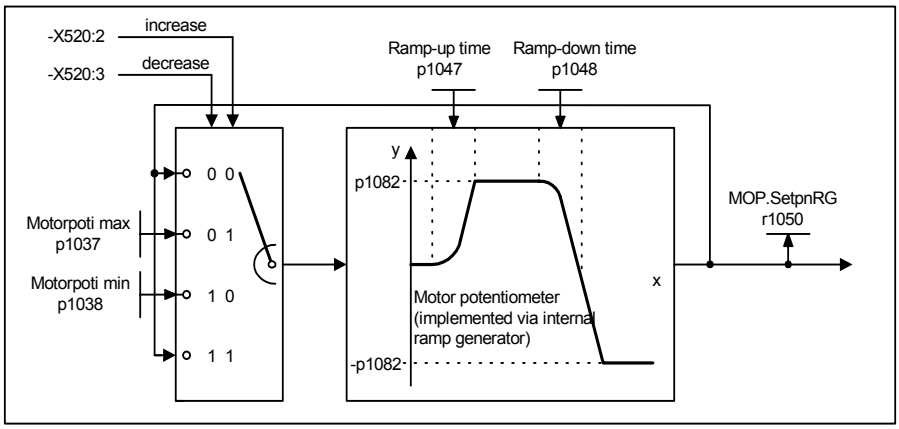



Fig. 6-13 Signal flow diagram: Motor potentiometer

## Setting Parameters

| | | |
|---|---|---|
| **p1037** | **Motor potentiometer maximum speed** | **Setting range: -210000.000 … +210000.000 1/min**<br>**Factory setting: p1082 (maximum speed)** |
| Maximum speed entry for the motor potentiometer. | | |

| | | |
|---|---|---|
| **p1038** | **Motor potentiometer minimum speed** | **Setting range: -210000.000 … +210000.000 1/min**<br>**Factory setting: -p1082 (maximum speed)** |
| Minimum speed entry for the motor potentiometer. | | |

| | | |
|---|---|---|
| **p1047** | **Motor potentiometer ramp-up time** | **Setting range: 0.000 ... 1000.000 s**<br>**Factory setting: 10.000 s** |
| Ramp-up time entry for the motor potentiometer. | | |

| | | |
|---|---|---|
| **p1048** | **Motor potentiometer ramp-down time** | **Setting range: 0.000 ... 1000.000 s**<br>**Factory setting: 10.000 s** |
| Ramp-down time entry for the motor potentiometer. | | |

| | | |
|---|---|---|
| **r1050** | **Motor potentiometer speed setpoint downstream of ramp generator** | **Unit: 1/min** |
| Display the setpoint downstream of the motor potentiometer. | | |

## 6.3.4 Fixed Speed Setpoints

### Description

Three settable fixed speed setpoints are available. These can be selected via terminals X530:3 and X530:4.

### Prerequisite

| |
|---|
| p1070 = r1024 |

**Main setpoint is specified by fixed speed setpoint**
<MENU> - <parameterization> - <all parameters> - Select p1070 and set to r1024

### Proposed Connection Assignment

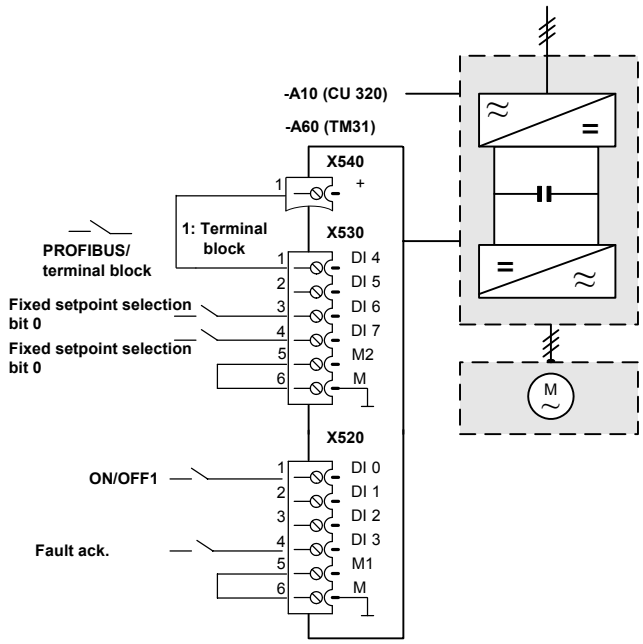



Fig. 6-14 Proposed connection assignment

## Signal Flow Diagram

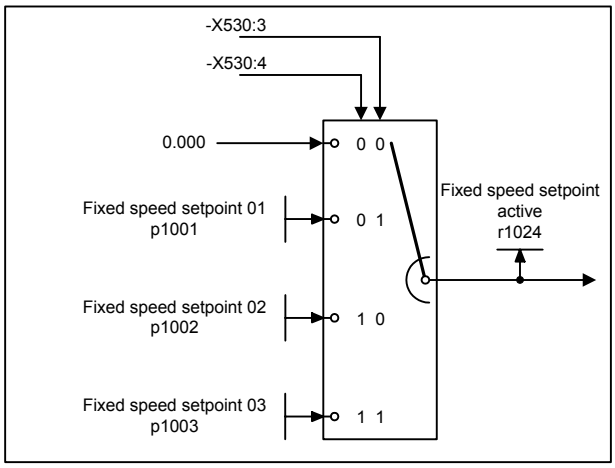



Fig. 6-15 Signal flow diagram: Fixed speed setpoints

## Setting Parameters

| p1001 | Fixed speed setpoint 01 | Setting range: -210000.000 ... +210000.000 1/min<br>Factory setting: 300,000 1/min |
|---|---|---|
| Entry for the first fixed speed setpoint. | | |

| p1002 | Fixed speed setpoint 02 | Setting range: -210000.000 … +210000.000 1/min<br>Factory setting: 600.000 1/min |
|---|---|---|
| Entry for the second fixed speed setpoint. | | |

| p1003 | Fixed speed setpoint 03 | Setting range: -210000.000 ... +210000.000 1/min<br>Factory setting: 1500.000 1/min |
|---|---|---|
| Entry for the third fixed speed setpoint. | | |

| r1024 | Fixed speed setpoint active | Unit: 1/min |
|---|---|---|
| Display the active fixed speed setpoint. | | |

## 6.3.5 Further Settings for Analog Inputs

### Description

In addition to the settings described in Chapter 6.3.2, a function for scaling input signals is available.

### Signal Flow Diagram

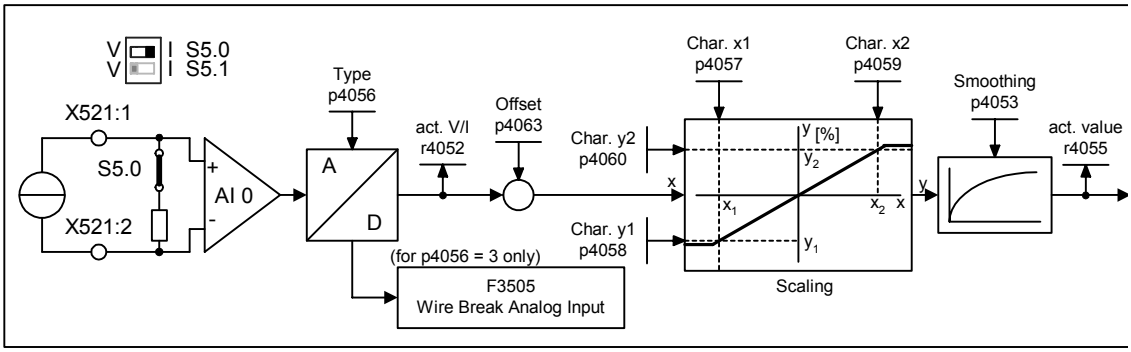



Fig. 6-16 Signal flow diagram: Analog input 0

### Setting Parameters for Scaling

| p4057[0] | Value x1 for the analog input characteristic | Setting range: -20.000 ... +20.000 V or mA<br>Factory setting: 0.000 mA |
|---|---|---|
| Setting for the x coordinate in V or mA of the first point on the scaling characteristic.<br>The unit is V when analog input 0 is set as a voltage input (p4056 = 0 / 4) and switch S5.0 is set to "V".<br>The unit is mA when analog input 0 is set as a current input (p4056 = 2 / 3 / 5) and switch S5.0 is set to "I". | | |

| p4058[0] | Value y1 for the analog input characteristic | Setting range: -1000.00 ... +1000.00 %<br>Factory setting: 0.00 % |
|---|---|---|
| Setting for the y coordinate in % of the first point on the scaling characteristic. | | |

| p4059[0] | Value x2 for the analog input characteristic | Setting range: -20.000 ... +20.000 V or mA<br>Factory setting: 20.000 mA |
|---|---|---|
| Setting for the x coordinate in V or mA of the second point on the scaling characteristic.<br>The unit is V when analog input 0 is set as a voltage input (p4056 = 0 / 4) and switch S5.0 is set to "V".<br>The unit is mA when analog input 0 is set as a current input (p4056 = 2 / 3 / 5) and switch S5.0 is set to "I". | | |

| p4060[0] | Value y2 for the analog input characteristic | Setting range: -1000.00 ... +1000.00 %<br>Factory setting: 100.00 % |
|---|---|---|
| Setting for the y coordinate in % of the second point on the scaling characteristic. | | |

# 6.4 Control via PROFIBUS

## 6.4.1 PROFIBUS Connection

### PROFIBUS Connection Position, Address Switch, and Diagnostic LED

The PROFIBUS connection, address switch, and diagnostics LED are located on the control unit.

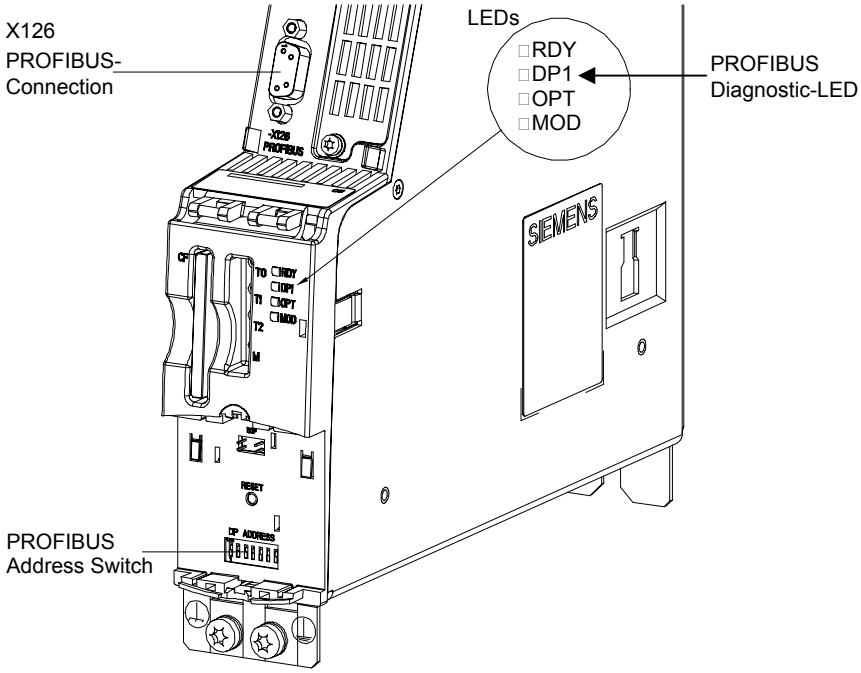
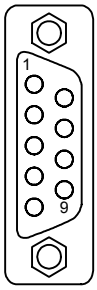



Fig. 6-17 View of the control unit with PROFIBUS interface

## PROFIBUS Connection

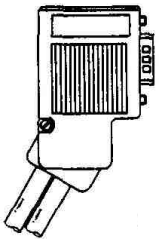
The PROFIBUS is connected by means of a 9-pin Sub-D socket (X126). The connections are electrically isolated.

Table 6-4 X126 - PROFIBUS connection

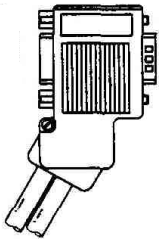
| | Pin | Signal name | Meaning | Range |
|---|---|---|---|---|
|  | 1 | SHIELD | Ground connection | |
| | 2 | M24_SERV | Power supply for teleservice, ground | 0 V |
| | 3 | RxD/TxD-P | Receive / transmit data P (B/B') | RS485 |
| | 4 | CNTR-P | Control signal | TTL |
| | 5 | DGND | PROFIBUS data reference potential (C/C') | |
| | 6 | VP | Supply voltage plus | 5 V ± 10 % |
| | 7 | P24_SERV | Power supply for teleservice P, + (24 V) | 24 V (20.4 V -28.8 V) |
| | 8 | RxD/TxD-N | Receive / transmit data N (A/A') | RS485 |
| | 9 | - | Not used | |

## Connectors

The cables must be connected via PROFIBUS connectors because they contain terminating resistors.



PROFIBUS connector without programming device / PC connection 6ES7972-0BA41-0XA0



PROFIBUS connector with programming device / PC connection 6ES7972-0BB41-0XA0

Fig. 6-18 PROFIBUS connectors

## Bus Terminating Resistor

The bus terminating resistor must be switched on or off depending on its position in the bus, otherwise the data will not be transmitted properly.

Principle: the terminating resistors must only be switched on at both ends of the bus line; the resistors must be switched off at all other connectors.

The cable shield must be connected at both ends with the greatest possible surface area.

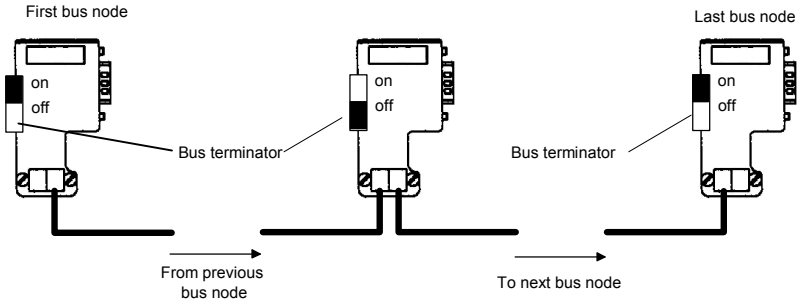



Fig. 6-19 Position of the bus terminating resistors

## Cable Routing

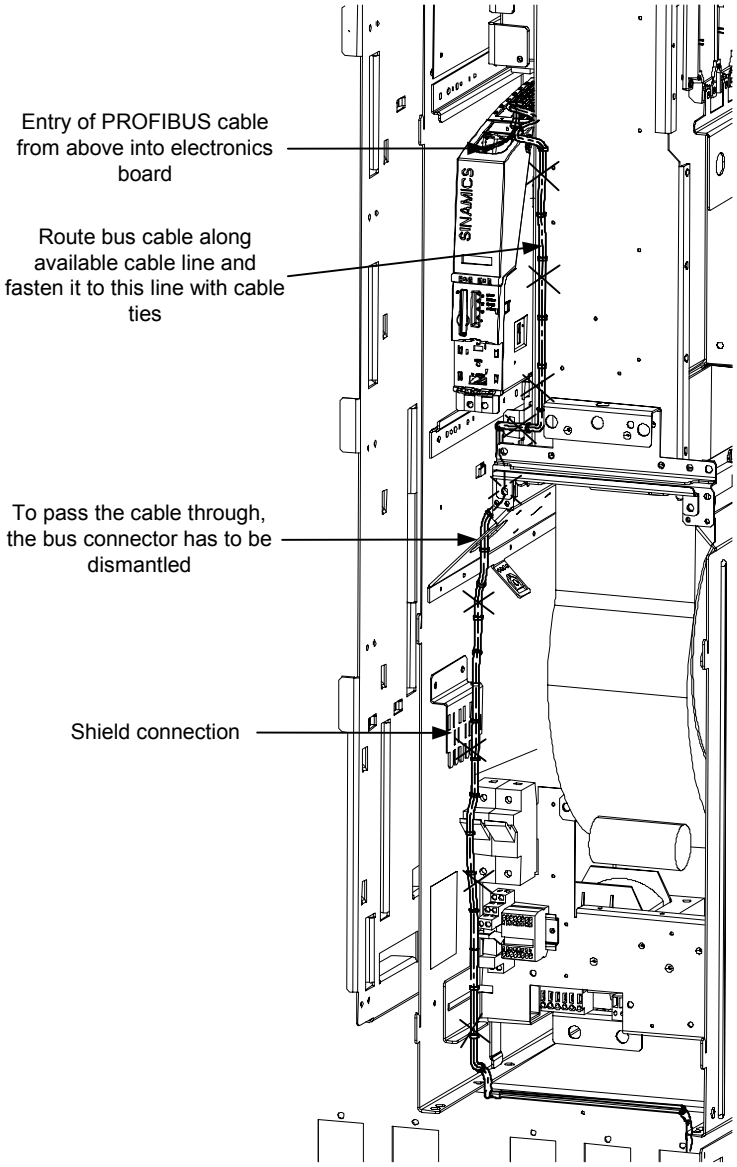



Fig. 6-20 Cable routing

## 6.4.2 Control via PROFIBUS

### 6.4.2.1 General

#### "DP1 (PROFIBUS)" Diagnostics LED

The PROFIBUS diagnostics LED is located on the front of the control unit (see Section 6.4) Its statuses are described in the following table.

Table 6-5 Description of the LEDs

| Color | State | Description |
|---|---|---|
| ------ | Off | No voltage applied to control unit |
| Green | Continuously lit | PROFIBUS is ready for communication and cyclic communication is taking place |
| Green | Flashing 0.5 Hz | PROFIBUS is ready for communication and cyclic communication is not taking place |
| Red | Continuously lit | At least one PROFIBUS fault is present. PROFIBUS is not ready for operation (e.g. after power-on) |

### 6.4.2.2 Setting the PROFIBUS Address

Two methods are available for setting the PROFIBUS address:

- The address switches (DIP switches) on the front of the control unit behind the cover plate (see Section 6.4.1).
  If you use the address switch, parameter p0918 is read only and displays the address that is set.
  If the switch is reset, the new setting does not become effective until the control unit is reset.
- Entering parameter p0918 on the operator panel.
  You can **only** do this if the address has been set to 0 or 127 using the address switch, that is, all switches from S1 to S7 are set to ON or OFF.
  In this case, changes become effective immediately.

Table 6-6 PROFIBUS address switches

| Switch | Significance | Technical data |
|---|---|---|
| S1 | $2^0 = 1$ | Significance $2^0$ $2^1$ $2^2$ $2^3$ $2^4$ $2^5$ $2^6$ / 1 2 4 8 16 32 64 |
| S2 | $2^1 = 2$ | |
| S3 | $2^2 = 4$ | |
| S4 | $2^3 = 8$ | |
| S5 | $2^4 = 16$ | |
| S6 | $2^5 = 32$ | |
| S7 | $2^6 = 64$ | ON / OFF, S1 ... S7 |
| | | Example: ON / OFF, 1 + 4 + 32 = 37 |

## 6.4.3 Process Data

### 6.4.3.1 Control Word 1

Table 6-7 Description of control word 1

| Bit | Meaning | Explanation | Operating condition |
|---|---|---|---|
| 0 | **0 = OFF1 (OFF1)** | 0 : Deceleration on the deceleration ramp (p1121), then pulse block, main contactor (if fitted) is opened. | 1 |
| | 1 = ON | | |
| 1 | **0 = Coast to stop (OFF2)** | 0 : Pulse block, main contactor (if fitted) is opened | 1 |
| | 1 = Do not coast to stop | | |
| 2 | **0 = Emergency stop (OFF3)** | 0: Deceleration on the rapid-stop ramp (p1115), then pulse block, main contactor (if fitted) is opened. | 1 |
| | 1 = No emergency stop | | |
| 3 | 0 = Disable operation<br>**1 = Enable operation** | | 1 |
| 4 | **0 = Set ramp generator to zero** | 0: The ramp generator output is set to setpoint "0". | 1 |
| | 1 = Enable ramp generator | | |
| 5 | **0 = Freeze ramp generator** | 0: The current setpoint is frozen at the ramp generator output. | 1 |
| | 1 = Restart ramp generator | | |
| 6 | **1 = Enable speed setpoint** | The setpoint is enabled at the ramp generator input. | 1 |
| 7 | **0 -> 1 = Acknowledge error** | A positive signal transition acknowledges all the current faults | – |
| 8 | reserved | | – |
| 9 | reserved | | – |
| 10 | **1 = Control via PLC** | 1: Control words and setpoints are analyzed | 1 |
| | | 0: Control words and setpoints are not analyzed | |
| 11 | **1 = Direction reversal** | | – |
| 12 | reserved | | – |
| 13 | **1 = Increase motor potentiometer** | | – |
| 14 | **1 = Decrease motor potentiometer** | | – |
| 15 | reserved | | – |

### 6.4.3.2 Status Word 1

Table 6-8 Description of status word 1

| Bit | Meaning |
|---|---|
| 0 | **1 = Ready to start** |
| 1 | **1 = Ready to operate** |
| 2 | **1 = Operation enabled** |
| 3 | **1 = Fault present** |
| 4 | **0 = Coast to stop active (OFF2)** |
| 5 | **0 = Emergency stop active (OFF3)** |
| 6 | **1 = Power-on disable** |
| 7 | **1 = Alarm present** |
| 8 | **1 = Speed setpoint/actual deviation within tolerance band** |
| 9 | **1 is always present** |
| 10 | **1 = f or n comparison value reached or exceeded** |
| 11 | **1 = I, M, or P limit reached** |
| 12 | **reserved** |
| 13 | **0 = Alarm motor overtemperature** |
| 14 | **1 = Motor rotating forwards (nact >= 0)**<br>**0 = Motor rotating backwards (nact < 0)** |
| 15 | **1 = Alarm thermal overload in power section** |

### 6.4.3.3 Selecting the Message Frame Type

#### Description

By selecting predefined message frame types, you can define the volume of send and receive data transmitted.

Table 6-9 Message frame type options

| Type | PZD 1 | PZD 2 | PZD 3 | PZD 4 | PZD 5 | PZD 6 |
|---|---|---|---|---|---|---|
| 1 | CW 1<br>SW 1 | N_SETP<br>N_ACT | | | | |
| 20 | CW 1<br>SW 1 | N_SETP<br>N_ACT | I_ACT | M_ACT | P_ACT | FAULT |

■

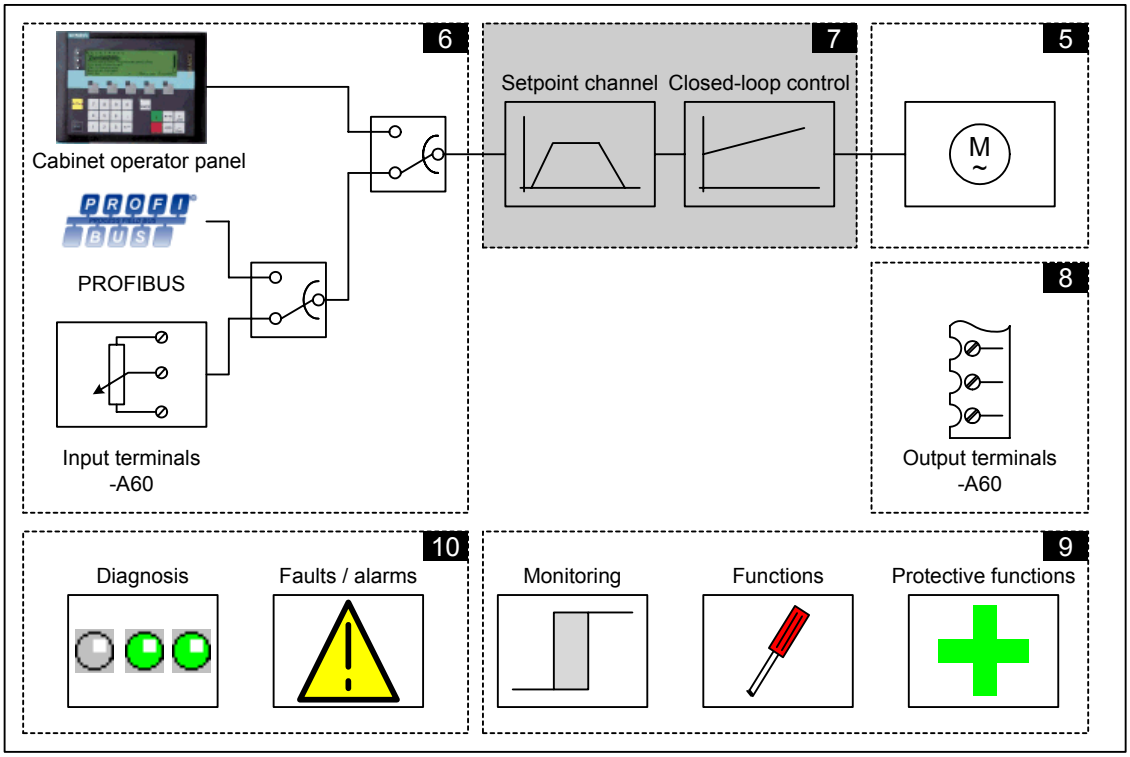
# Setpoint Channel and Closed-Loop Control

# 7

## 7.1 Chapter Content

This chapter provides information on the setpoint channel and closed-loop control functions.

- Setpoint channel
  - Direction reversal
  - Suppression speed
  - Minimum speed
  - Speed limitation
  - Ramp generator
- Closed-loop control (in preparation)



# 7.2 Setpoint Channel

## 7.2.1 Direction Reversal

### Description

If an incorrect phase sequence was connected when the cables were installed, and the phase sequence cannot be corrected by swapping the motor cables, it can be corrected by means of a negative command value or by parameterizing the cabinet unit, thereby enabling the direction to be reversed. This is mainly used for operating the drive in both directions of rotation.

### Prerequisites

Direction reversal is triggered:

- via PROFIBUS by means of control word 1, bit 11
- via the cabinet operator panel (LOCAL mode) with the "direction reversal" key.

## 7.2.2 Minimum Speed

### Description

Specifying a minimum speed allows you to disable a specific range about speed 0 1/min for stationary operation.

### Signal Flow Diagram

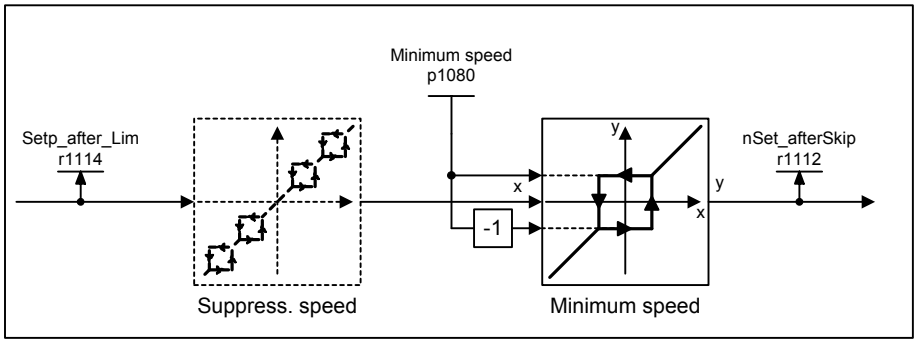



Fig. 7-1 Signal flow diagram: Minimum speed

### Setting Parameters

| p1080 | Minimum speed | Setting range: 0.000 ... 19500.000 1/min |
|---|---|---|
| | | Factory setting: 0.000 1/min |
| Setting parameter for the minimum speed. This speed is not undershot during operation. | | |

| r1112 | Speed setpoint after minimum limit | Unit: 1/min |
|---|---|---|
| Display of speed setpoint after the minimum limit. | | |

## 7.2.3 Speed Limitation

### Description

Speed limitation aims to limit the maximum permissible speed of the entire drive train to protect the drive and load machine / process against damage caused by excessive speeds.

### Signal Flow Diagram

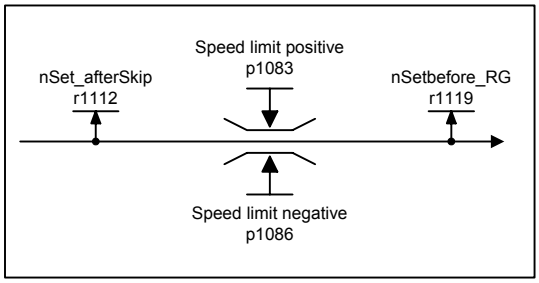



Fig. 7-2 Signal flow diagram: Speed limitation

### Setting Parameters

| | | |
|---|---|---|
| **p1082** | **Speed limit** | **Setting range: 0.000 ... 210000.000 1/min**<br>**Factory setting: 1500.000 1/min** |
| Setting parameter for the maximum speed. This parameter is the reference speed for all ramp-up and ramp-down times (motor potentiometer, ramp generator). | | |

| | | |
|---|---|---|
| **p1083** | **Speed limit positive direction of rotation** | **Setting range: 0.000 ... 210000.000 1/min**<br>**Factory setting: 210000.000 1/min** |
| Setting parameter for the speed limit in a positive direction of rotation. | | |

| | | |
|---|---|---|
| **p1086** | **Speed limit negative direction of rotation** | **Setting range: -210000.000 ... 0.000 1/min**<br>**Factory setting: -210000.000 1/min** |
| Setting parameter for the speed limit in a negative direction of rotation. If required, this parameter can be used to disable the negative direction of rotation. | | |

## 7.2.4 Ramp Generator

### Description

The ramp generator limits the rate at which the setpoint changes when the drive is accelerating or decelerating. This prevents excessive setpoint step changes from damaging the drive train. You can also set additional rounding times in the lower and upper speed ranges to improve control quality and prevent load surges, thereby protecting mechanical components, such as shafts and couplings.

The ramp-up and ramp-down times relate to the maximum speed (p1082). The rounding times that can be set can prevent the actual speed value from being overshot when the setpoint is approached, thereby improving control quality.

Caution: if rounding times are too long, this can cause the setpoint to be overshot if the setpoint is reduced abruptly during ramp-up. Rounding is also effective in the zero crossover; in other words, when the direction is reversed, the ramp generator output is reduced to zero via start rounding, the ramp-down time, and end rounding before the new, inverted setpoint is approached via start rounding, the ramp-up time, and end rounding. Rounding has no effect in the event of an emergency stop (OFF3). The actual ramp-up/ramp-down times increase with active rounding.

### Signal Flow Diagram

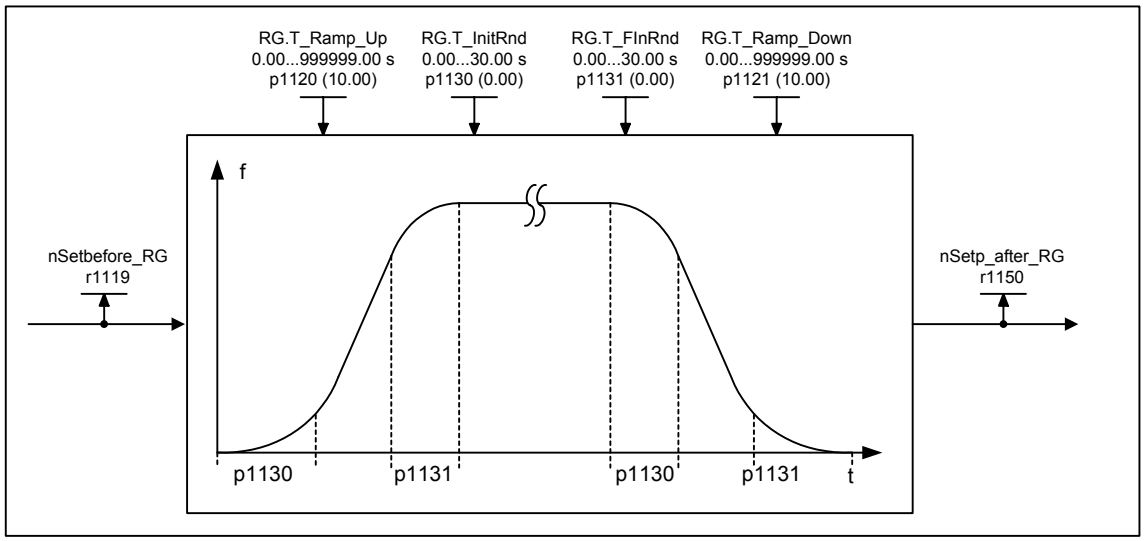



Fig. 7-3 Signal flow diagram: Ramp generator

## Setting Parameters

| p1120 | Ramp generator ramp-up time | **Setting range: 0.00 ... 999999.00 s** |
|---|---|---|
| | | **Factory setting: 10.00 s** |
| During this interval, the setpoint increases from zero to the speed limit (p1082). | | |

| p1121 | Ramp generator ramp-down time | **Setting range: 0.00 ... 999999.00 s** |
|---|---|---|
| | | **Factory setting: 10.00 s** |
| During this interval, the setpoint decreases from the speed limit (p1082) to zero. | | |

| p1130 | Ramp generator start rounding time | **Setting range: 0.00 ... 30.00 s** |
|---|---|---|
| | | **Factory setting: 0.00 s** |
| Setting for the start rounding time. The value applies to ramp-up and ramp-down. | | |

| p1131 | Ramp generator end rounding time | **Setting range: 0.00 ... 30.00 s** |
|---|---|---|
| | | **Factory setting: 0.00 s** |
| Setting for the end rounding time. The value applies to ramp-up and ramp-down. | | |

**NOTE**

The effective ramp-up time increases when you enter a start and end rounding time.

Effective ramp-up time = p1120 + (0.5 x p1130) + (0.5 x p1131)

## 7.2.5 Further Settings

### 7.2.5.1 Suppression Speed and Minimum Speed

#### Description

Variable-speed drives can generate critical whirling speeds within the control range of the entire drive train. This prevents steady-state operation in their proximity; in other words, although the drive can pass through this range, it must not stop because resonant oscillations may be excited. The skip frequency bands allow this range to be blocked for steady-state operation. Because the points at which critical whirling speeds occur in a drive train can vary depending on age or thermal factors, a larger control range must be blocked. To ensure that the speed does not constantly increase and decrease in the skip frequency band range (speeds), the bands are assigned a hysteresis.

#### Signal Flow Diagram

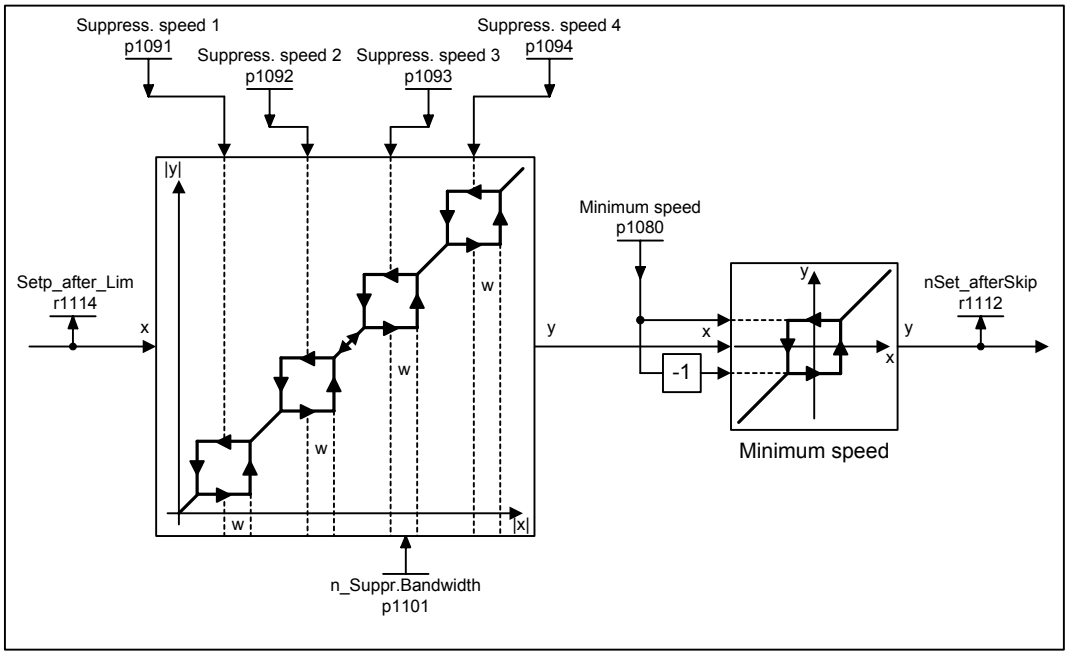



Fig. 7-4 Signal flow diagram: Suppression speeds and minimum speeds

### Setting Parameters for Suppression Speeds

| | | |
|---|---|---|
| **p1091** | **Suppression speed 1** | **Setting range: 0.000 ... 210000.000 1/min**<br>**Factory setting: 0.000 1/min** |
| Setting parameter for suppression speed 1. | | |

| | | |
|---|---|---|
| **p1092** | **Suppression speed 2** | **Setting range: 0.000 ... 210000.000 1/min**<br>**Factory setting: 0.000 1/min** |
| Setting parameter for suppression speed 2. | | |

| | | |
|---|---|---|
| **p1093** | **Suppression speed 3** | **Setting range: 0.000 ... 210000.000 1/min**<br>**Factory setting: 0.000 1/min** |
| Setting parameter for suppression speed 3. | | |

| | | |
|---|---|---|
| **p1094** | **Suppression speed 4** | **Setting range: 0.000 ... 210000.000 1/min**<br>**Factory setting: 0.000 1/min** |
| Setting parameter for suppression speed 4. | | |

| | | |
|---|---|---|
| **p1101** | **Suppression speed bandwidth** | **Setting range: 0.000 ... +210000.000 1/min**<br>**Factory setting: 0.000 1/min** |
| Setting for the bandwidth for suppression speeds 1 to 4. | | |

## 7.3 Closed-Loop Control

(in preparation)

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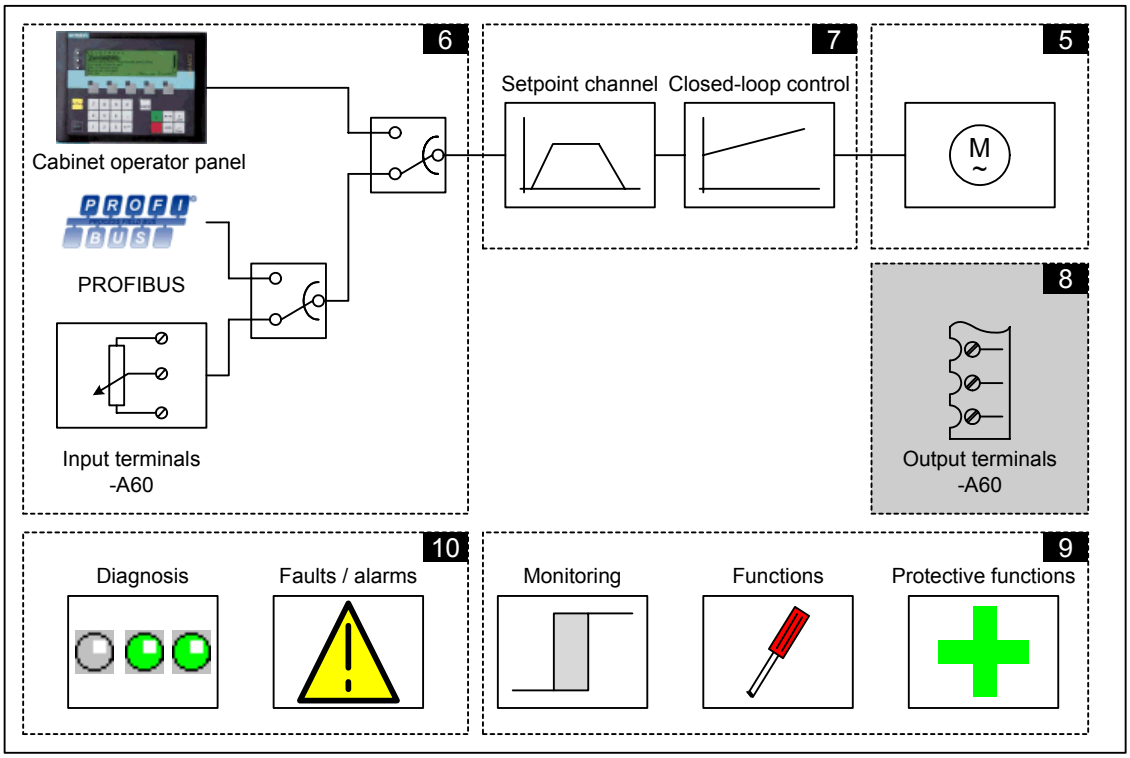
# Output Terminals

# 8

## 8.1 Chapter Content

This chapter provides information on:

- Analog outputs
- Digital outputs



# 8.2 Analog Outputs

## Description

The customer terminal block features two analog outputs for outputting setpoints via current or voltage signals.

## Signal Flow Diagram

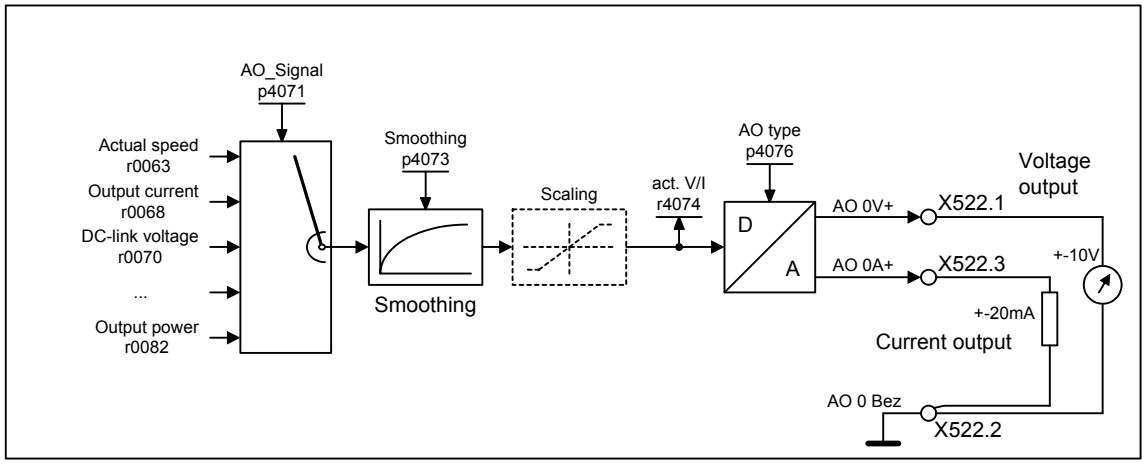



Fig. 8-1 Signal flow diagram: Analog output 0

## Setting Parameters for Analog Output 0 (AO0)

| p4071[0] | Signal source for the analog output | Setting range: see list<br>Factory setting: r1445 (N_ACT) |
|---|---|---|
| Setting parameter for the signal to be output for analog output 0 on the customer terminal block. | | |

| p4073[0] | Smoothing time for analog output | Setting range: 0 ... 1000 ms<br>Factory setting: 0 ms |
|---|---|---|
| Setting parameter for the time constant of the 1st order low-pass filter for analog output 0. | | |

| r4074[0] | Current output voltage/current | Unit: V or mA |
|---|---|---|
| The current output voltage is displayed in V when analog output 0 is set as a voltage output (p4076 = 1 / 4) and terminals X522: 1 and 2 are used.<br>The current output current is displayed in mA when analog output 0 is set as a current output (p4076 = 0 / 2 /3) and terminals X522: 3 and 2 are used. | | |

| p4076[0] | Analog output type | Setting range: 0 / 1 / 2 / 3 / 4<br>Factory setting: 0: 0 ... 20 mA |
|---|---|---|

Setting parameter for the type of analog output 0 on the customer terminal block.

Values: 0: 0 ... 20 mA
1: 0 ... 10 V
2: 4 ... 20 mA
3: -20 ... +20 mA
4: -10 ... +10 V

Settings 0, 2, and 3: terminals X522: 3 and 2 must be used.

Settings 1 and 4: terminals X522: 1 and 2 must be used.

## Setting Parameters for Analog Output 1 (AO1)

| p4071[1] | Signal source for the analog output | Setting range: see list<br>Factory setting: r0068 (I_ACT) |
|---|---|---|

Setting parameter for the signal to be output for analog output 1 on the customer terminal block.

| p4073[1] | Smoothing time for analog output | Setting range: 0 ... 1000 ms<br>Factory setting: 0 ms |
|---|---|---|

Setting parameter for the time constant of the 1st order low-pass filter for analog output 1.

| r4074[1] | Current output voltage/current | Unit: V or mA |
|---|---|---|

The current output voltage is displayed in V when analog output 1 is set as a voltage output (p4076 = 1 / 4) and terminals X522: 4 and 5 are used.

The current output current is displayed in mA when analog output 1 is set as a current output (p4076 = 0 / 2 /3) and terminals X522: 6 and 5 are used.

| p4076[1] | Analog output type | Setting range: 0 / 1 / 2 / 3 / 4<br>Factory setting: 0: 0 ... 20 mA |
|---|---|---|

Setting parameter for the type of analog output 1 on the customer terminal block.

Values: 0: 0 ... 20 mA
1: 0 ... 10 V
2: 4 ... 20 mA
3: -20 ... +20 mA
4: -10 ... +10 V

Settings 0, 2, and 3: terminals X522: 6 and 5 must be used.

Settings 1 and 4: terminals X522: 4 and 5 must be used.

## List of Signals for the Analog Outputs

| Signal | Parameter | Unit | Scaling (100 % = ...) (see Table 8-1) |
|---|---|---|---|
| Speed setpoint upstream of setpoint filter | r0060 | 1/min | p2000 |
| Motor speed unsmoothed | r0061 | 1/min | p2000 |
| Actual speed after smoothing | r0063 | 1/min | p2000 |
| Output frequency | r0066 | Hz | Reference frequency |
| Output current | r0068 | Aeff | p2002 |
| DC link voltage | r0070 | V | p2001 |
| Torque setpoint | r0079 | Nm | p2003 |
| Output power | r0082 | kW | r2004 |
| **For diagnostic purposes** | | | |
| Control deviation | r0064 | 1/min | p2000 |
| Slip frequency | r0065 | Hz | Reference frequency |
| Actual phase current | r0069 | A | p2002 |
| Control factor | r0074 | % | Reference control factor |
| Field-producing current setpoint | r0075 | A | p2002 |
| Field-producing actual current | r0076 | A | p2002 |
| Torque-producing current setpoint | r0077 | A | p2002 |
| Torque-producing actual current | r0078 | A | p2002 |
| Flux setpoint | r0083 | % | Reference flux |
| Actual flux | r0084 | % | Reference flux |
| DC link voltage setpoint | r0088 | V | p2001 |
| Phase voltage | r0089 | V | p2001 |
| **For further diagnostic purposes** | | | |
| Speed controller output | r1480 | Nm | p2003 |
| I component of speed controller | r1482 | Nm | p2003 |

## Scaling

Table 8-1 Scaling

| Variable | Scaling parameter | Default for quick commissioning |
|---|---|---|
| Reference speed | 100 % = p2000 | p2000 = Maximum speed (p1082) |
| Reference voltage | 100 % = p2001 | p2001 = 1000 V |
| Reference current | 100 % = p2002 | p2002 = Current limit (p0640) |
| Reference torque | 100 % = p2003 | p2003 = 2 x rated motor torque |
| Reference power | 100 % = r2004 | $r2004 = \frac{p2003 \times p2000 \times \pi}{30}$ |
| Reference frequency | $100\ \% = \frac{p2000}{60}$ | |
| Reference control factor | 100 % = Maximum output voltage without overload | |
| Reference flux | 100 % = Rated motor flux | |
| Reference temperature | 100% = 100 °C | |

## Example: Changing Analog Output 0 from Current to Voltage Output –10 to +10 V

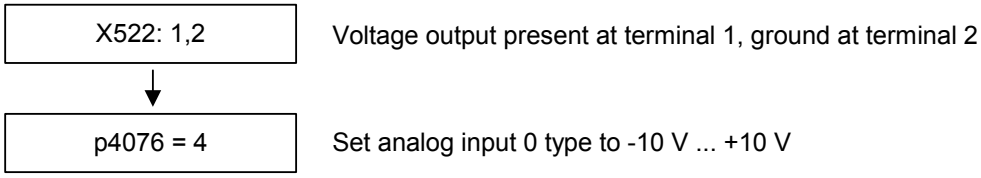



Fig: 8-2 Example: Setting analog output 0

# 8.3 Digital Outputs

## Description

Four bi-directional digital outputs (terminal X541) and two relay outputs (terminal X542) are available. These outputs are, for the most part, freely parameterizable.

## Signal Flow Diagram

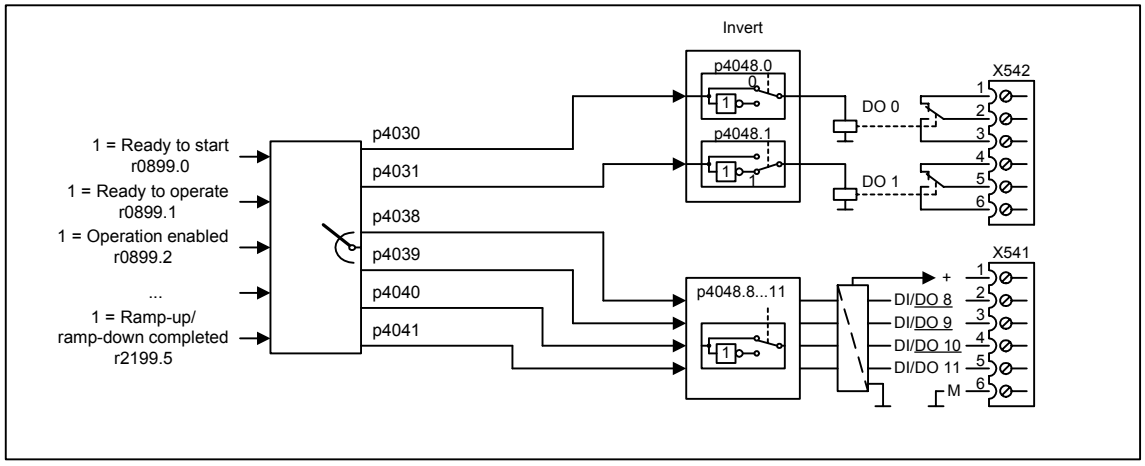



Fig. 8-3 Signal flow diagram: Digital outputs

## Factory Setting

| Digital output | Terminal | Factory Setting |
|---|---|---|
| DO0 | X542: 2,3 | "Enable pulses" |
| DO1 | X542: 5,6 | "No fault" |
| DI/DO8 | X541: 2 | "Ready to start" |
| DI/DO9 | X541: 3 | "LOCAL mode active" |
| DI/DO10 | X541: 4 | "Enable pulses" |
| DI/DO11 | X541: 5 | |

## Selection of possible connections for the digital outputs

| Signal | Bit in status word 1 | Parameter |
|---|---|---|
| 1 = Ready to start | 0 | r0889.0 |
| 1 = Ready to operate (DC link loaded, pulses blocked) | 1 | r0889.1 |
| 1 = Operation enabled (drive follows n_setp) | 2 | r0889.2 |
| 1 = Fault present | 3 | r2139.3 |
| 0 = Coast to stop active (OFF2) | 4 | r0889.4 |
| 0 = Emergency stop active (OFF3) | 5 | r0889.5 |
| 1 = Power-on disable | 6 | r0889.6 |
| 1 = Alarm present | 7 | r2139.7 |
| 1 = Speed setpoint/actual deviation within tolerance band (p2163, p2166) | 8 | r2197.7 |
| 1 = Control required to PLC | 9 | r0899.9 |
| 1 = f or n comparison value reached or exceeded (p2141, p2142) | 10 | r2199.1 |
| 1 = I, M, or P limit reached (p0640, p1520, p1521) | 11 | r1407.7 |
| reserved | 12 | |
| 0 = Alarm motor overtemperature (A7910) | 13 | r2129.14 |
| reserved | 14 | |
| 0 = Alarm thermal overload in power section (A5000) | 15 | r2129.15 |
| | | |
| 1 = Pulses enabled (inverter is clocking, drive is carrying current) | | r0899.11 |
| 1 = n_act ≤ p2155 | | r2197.1 |
| 1 = n_act > p2155 | | r2197.2 |
| 1 = Ramp-up/ramp-down completed | | r2199.5 |
| 1 = n_act < p2161 (preferably as n_min or n=0 message) | | r2199.0 |
| 1 = Torque setpoint < p2174 | | r2198.10 |
| 1 = LOCAL mode active (control via operator panel) | | r0807.0 |
| 0 = Motor blocked | | r2198.6 |
| Active command data set (CDS):<br>0 = CDS 0 (PROFIBUS), 1 = CDS 1 (terminal block) | | r0836.0 |

# 8.4 Further Settings for Analog Outputs

## Description

The customer terminal block (–A60) features two analog outputs for outputting setpoints via current or voltage signals.

In addition to the settings described in Chapter 8.2, a function for scaling output signals is available.

## Signal Flow Diagram

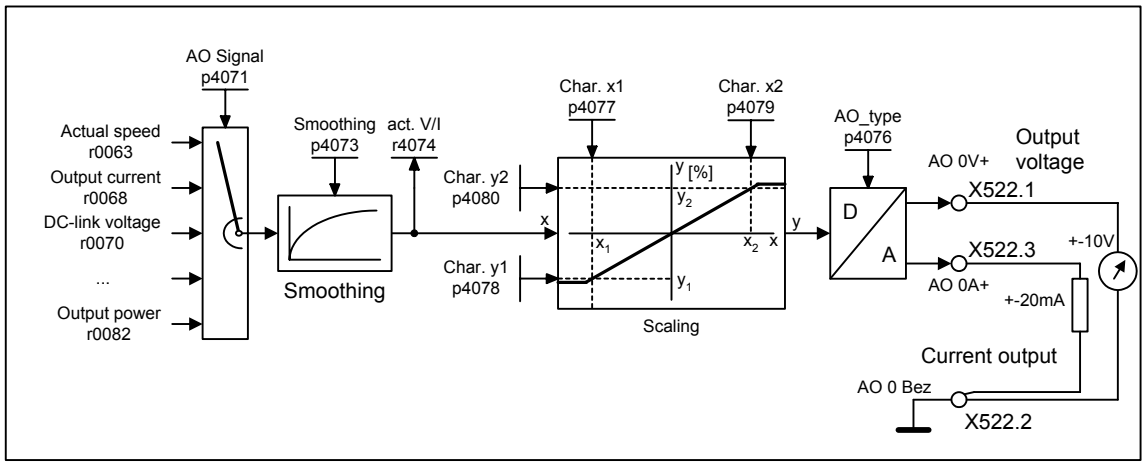



Fig. 8-4 Signal flow diagram: Analog output 0

## Additional Setting Parameters for Analog Output 0 (AO0)

| p4077[0] | Value x1 for the analog output characteristic | Setting range: -1000.00 ... +1000.00 %<br>Factory setting: 0.00 % |
|---|---|---|
| Setting for the x coordinate in % of the first point on the scaling characteristic. | | |

| p4078[0] | Value y1 for the analog output characteristic | Setting range: -20.000 ... +20.000 V or mA<br>Factory setting: 0.000 mA |
|---|---|---|
| Setting for the y coordinate in V or mA of the first point on the scaling characteristic.<br>The unit is V when analog output 0 is set as a voltage output (p4076[0] = 1 / 4) and terminals X522: 1 and 2 are used.<br>The unit is mA when analog output 0 is set as a current output (p4076[0] = 0 / 2 / 3) and terminals X522: 3 and 2 are used. | | |

| p4079[0] | Value x2 for the analog output characteristic | Setting range: -1000.00 ... +1000.00 %<br>Factory setting: 100.00 % |
|---|---|---|
| Setting for the x coordinate in % of the second point on the scaling characteristic. | | |

| p4080[0] | Value y2 for the analog output characteristic | Setting range: -20.000 ... +20.000 V or mA<br>Factory setting: 20.000 mA |
|---|---|---|
| Setting for the y coordinate in V or mA of the second point on the scaling characteristic.<br>The unit is V when analog output 0 is set as a voltage output (p4076[0] = 1 / 4) and terminals X522: 1 and 2 are used.<br>The unit is mA when analog output 0 is set as a current output (p4076[0] = 0 / 2 / 3) and terminals X522: 3 and 2 are used. | | |

## Additional Setting Parameters for Analog Output 1 (AO1)

| p4077[1] | Value x1 for the analog output characteristic | Setting range: -1000.00 ... +1000.00 %<br>Factory setting: 0.00 % |
|---|---|---|
| Setting for the x coordinate in % of the first point on the scaling characteristic. | | |

| p4078[1] | Value y1 for the analog output characteristic | Setting range: -20.000 ... +20.000 V or mA<br>Factory setting: 0.000 mA |
|---|---|---|
| Setting for the y coordinate in V or mA of the first point on the scaling characteristic.<br>The unit is V when analog output 1 is set as a voltage output (p4076[1] = 1 / 4) and terminals X522: 4 and 5 are used.<br>The unit is mA when analog output 1 is set as a current output (p4076[1] = 0 / 2 / 3) and terminals X522: 6 and 5 are used. | | |

| p4079[1] | Value x2 for the analog output characteristic | Setting range: -1000.00 ... +1000.00 %<br>Factory setting: 100.00 % |
|---|---|---|
| Setting for the x coordinate in % of the second point on the scaling characteristic. | | |

| p4080[1] | Value y2 for the analog output characteristic | Setting range: -20.000 ... +20.000 V or mA<br>Factory setting: 20.000 mA |
|---|---|---|
| Setting for the y coordinate in V or mA of the second point on the scaling characteristic.<br>The unit is V when analog output 1 is set as a voltage output (p4076[1] = 1 / 4) and terminals X522: 4 and 5 are used.<br>The unit is mA when analog output 1 is set as a current output (p4076[1] = 0 / 2 / 3) and terminals X522: 6 and 5 are used. | | |

### Example: Changing Analog Output 0 from Current to Voltage Output –10 - +10 V and Setting the Characteristic

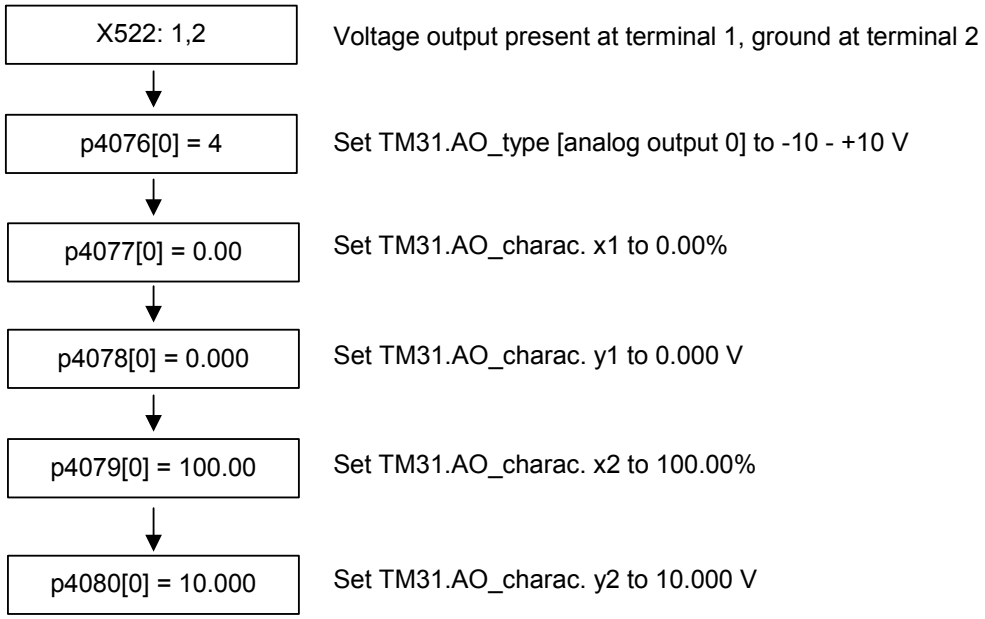



Fig: 8-5 Example: Setting analog output 0 and the characteristic

■

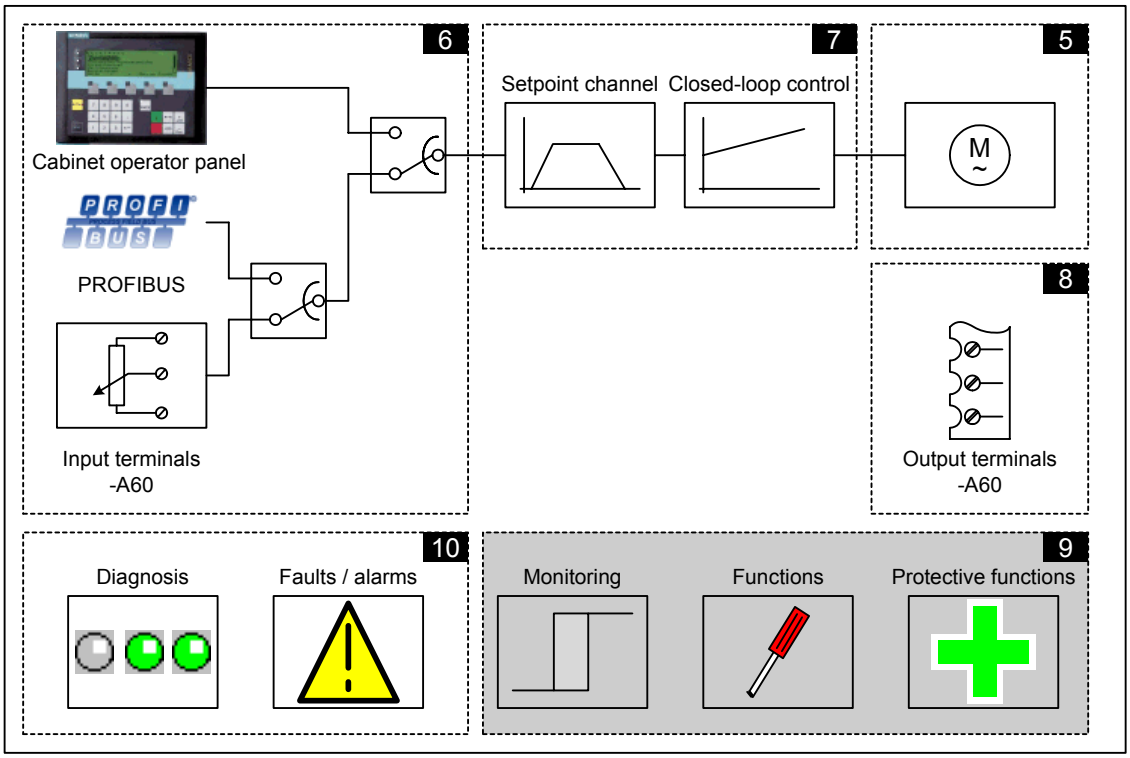
# Monitoring, Functions, and Protective Functions

# 9

## 9.1 Chapter Content

This chapter provides information on:

- Monitoring
- Functions
  - Vdc-max closed-loop control
  - Automatic restart
  - Flying restart
- Protective functions



## 9.2 Monitoring

(in preparation)

# 9.3 Functions

## 9.3.1 Vdc-max Controller

### Description

The Vdc-max controller enables (restricted) braking operation of a drive with a diode supply to the DC link. During braking operation, the machine supplies power back to the DC link. Due to the configuration, however, a diode supply cannot supply this power back to the line. The Vdc controller controls the supply of power back from the machine to compensate for losses from the drive system and prevent the DC link voltage from exceeding the maximum value. This prevents potential shutdowns on faults caused by braking ramps that are too short, and the drive coasts to a standstill in a controlled manner. The ramp-down times may increase as a result.

### Setting Parameters

| p1240 | Vdc controller configuration | Setting range: 0 ... 3<br>Factory setting: 1 |
|---|---|---|
| Setting for the controller configuration for the voltage DC link (Vdc controller)<br>Values: 0: Disable Vdc controller<br>1: Enable Vdc-max controller<br>The Vdc-max controller increases the ramp-down times automatically to keep the DC link voltage within the permissible limits. | | |

| r1242 | Vdc-max controller switch-on level | Unit: V |
|---|---|---|
| Display the switch-on level of the Vdc-max controller. | | |

| p1243 | Vdc-max controller dynamic factor | Setting range: 10 ... 200 %<br>Factory setting: 100 % |
|---|---|---|
| Setting for the dynamic factor of the Vdc-max controller.<br>100 % means that p1250, p1251, and p1252 (gain, integral time, and derivative time) are used in accordance with their basic settings based on theoretical controller optimization.<br>The dynamic factor can be used if subsequent optimization is required, whereby p1250, p1251, and p1252 are evaluated with dynamic factor p1243. | | |

| p1250 | Vdc controller proportional gain | Setting range: 0.00 ... 10.00<br>Factory setting: 1.00 |
|---|---|---|
| Setting for the proportional gain of the Vdc-max controller.<br>The effective proportional gain can be determined using p1243. | | |

| p1251 | Vdc controller integral time | Setting range: 1 ... 1000 ms<br>Factory setting: 40 ms |
|---|---|---|
| Setting for the integral time of the Vdc-max controller.<br>The effective integral time can be determined using p1243. | | |

| p1252 | Vdc controller derivative-action time | Setting range: 0 ... 1000 ms<br>Factory setting: 1 ms |
|---|---|---|
| Setting for the derivative-action time of the Vdc-max controller.<br>The active derivative-action time can be determined using p1243. | | |

| p1254 | Vdc-max controller automatic detection of EIN level | Setting range: 0 / 1<br>Factory setting: 0 |
|---|---|---|
| Activates / deactivates automatic detection of the switch-on level for the Vdc-max controller.<br>Values: 0: Automatic detection disabled<br>1: Automatic detection enabled | | |

## Settings

Parameter p1240 functions as enable: 0: controller disabled, 1: controller enabled. You use p1242 to define the starting point of the Vdc-max controller. This is the maximum value of the DC link voltage that cannot be exceeded. If the DC link voltage is below the starting point, the controller remains inactive. The controller gain can be changed by means of p1250. The set ramp-down remains inactive while the Vdc-max controller is active. The ramp-down time increases the more excess kinetic energy is stored in the drive train.

## 9.3.2 Automatic Restart

### Description

The automatic restart function automatically restarts the cabinet unit after an undervoltage or a power failure. The alarms present are acknowledged and the drive is restarted automatically. The drive can be restarted using the standard procedure starting from standstill or using a flying restart. For drives with small inertia loads and load torques where the drive can be brought to a standstill within seconds (such as pump drives with water gauges), the start from standstill is recommended. For drives with large inertia loads (such as fan drives), the flying restart function can also be activated. This enables you to switch to the motor that is still rotating.

**WARNING**

If p1210 is set to 2 or higher, the motor can be restarted automatically without the need to issue the ON command.

In the event of prolonged power failures and when the automatic restart function is activated (p1210 > 1), the drive may have been at a standstill for a long time and mistakenly considered to have been switched off.

For this reason, entering the area around the drive when it is in this condition can cause death, serious injury, or considerable material damage.

### Setting Parameters

| p1210 | Automatic restart mode | Setting range: 0 ... 6<br>Factory setting: 0 |
|---|---|---|
| Setting the automatic restart mode.<br>Values: 0: Disable automatic restart mode<br>1: Acknowledge fault after blackout, no automatic restart<br>2: Automatic restart after blackout<br>3: Automatic restart after brownout with any fault<br>4: Automatic restart after brownout<br>5: Automatic restart after blackout with any fault<br>6: Automatic restart after blackout or brownout with any fault<br>A blackout is a supply fault that also affects the electronics power supply.<br>A brownout is a supply fault that does not affect the electronics power supply. | | |

| p1211 | Automatic restart starting attempts | Setting range: 1 ... 10<br>Factory setting: 3 |
|---|---|---|

Setting for the automatic restart attempts of the automatic restart function.

If the active faults could not be acknowledged within the current waiting time (derived from p1212 and p1213) or if new faults are present, this number is decremented internally.

Automatic restart is aborted as soon as all starting attempts have been made.

The internal counter is set to p1211, however, as soon as 4 seconds of waiting time have elapsed since the last successful starting attempt.

This parameter setting is active when p1210 = 2 ... 6.

| p1212 | Automatic restart waiting time first starting attempt | Setting range: 0.5 ... 10.0 s<br>Factory setting: 1.0 s |
|---|---|---|

Setting for the waiting time after the first starting attempt.

Another startup is not possible until the waiting time has elapsed.

This parameter setting is active when p1210 = 2 ... 6.

| p1213 | Automatic restart waiting time increment | Setting range: 0.0 ... 10.0 s<br>Factory setting: 0.0 s |
|---|---|---|

Setting for the waiting time increment of the automatic restart function.

The active waiting time is determined with p1212 and p1213. With every unsuccessful starting attempt, the time is increased by p1213 (exception: p1213 is not taken into account with the first starting attempt).

This parameter setting is active when p1210 = 2 ... 6.

## Settings

To prevent the motor from switching into phase opposition when the drive is being restarted, there is a delay while the motor demagnetizes (t = 2.3 x motor magnetization time constant). Once this time has elapsed, the inverter is enabled and the motor is supplied with power.

## 9.3.3 Flying Restart

### Description

This function allows the cabinet unit to switch to a motor that is still rotating. Switching the cabinet unit on without the flying restart function would cause an overcurrent because the flow in the motor still has to build up and the open-loop/closed-loop control must be set in accordance with the speed of the motor. Two different situations are possible here:

a.) The drive rotates as a result of external influences, such as water (pump drives) or air (fan drives). In this case, the drive can also rotate against the direction of rotation.

b.) The drive rotates as a result of a previous shutdown, such as OFF 2 or a power failure. The drive slowly coasts to a stop as a result of the kinetic energy stored in the drive train (example: induced-draft fan with a high inertia load and a steeply descending load characteristic in the lower speed range).

**NOTE**

The flying restart function must be used when the motor may still be running or is being driven by the load to prevent shutdowns due to overcurrent.

### Setting Parameters

| p1200 | Flying restart operating mode | Setting range: 0 ... 6<br>Factory setting: 1 |
|---|---|---|

Setting the flying restart mode.

Values: 0: Flying restart is disabled
1: Flying restart is always active, start in direction of setpoint
2: Flying restart is active, with line ON, error, OFF2, start in direction of setpoint
3: Flying restart is active, with error, OFF2, start in direction of setpoint
4: Flying restart is always active, in direction of setpoint only
5: Flying restart is active, with line ON, error, OFF2, in direction of setpoint only
6: Flying restart is active, with error, OFF2, in direction of setpoint only

In operating modes 1 to 3, the search is carried out in both directions; in operating modes 4 to 6, the search is carried out in the setpoint direction only.

| p1202 | Flying restart detection current | Setting range: 10 ... 400 %<br>Factory setting: 100 % |
|---|---|---|

Defines the detection current for the flying restart function. The value refers to the rated motor current.

| p1203 | Flying restart search rate | Setting range: 10 ... 400 %<br>Factory setting: 100 % |
|---|---|---|

This factor influences the rate at which the output frequency changes during the flying restart.

The higher the value, the longer the search time.

### Settings

## 9.4 Protective Functions

(in preparation)

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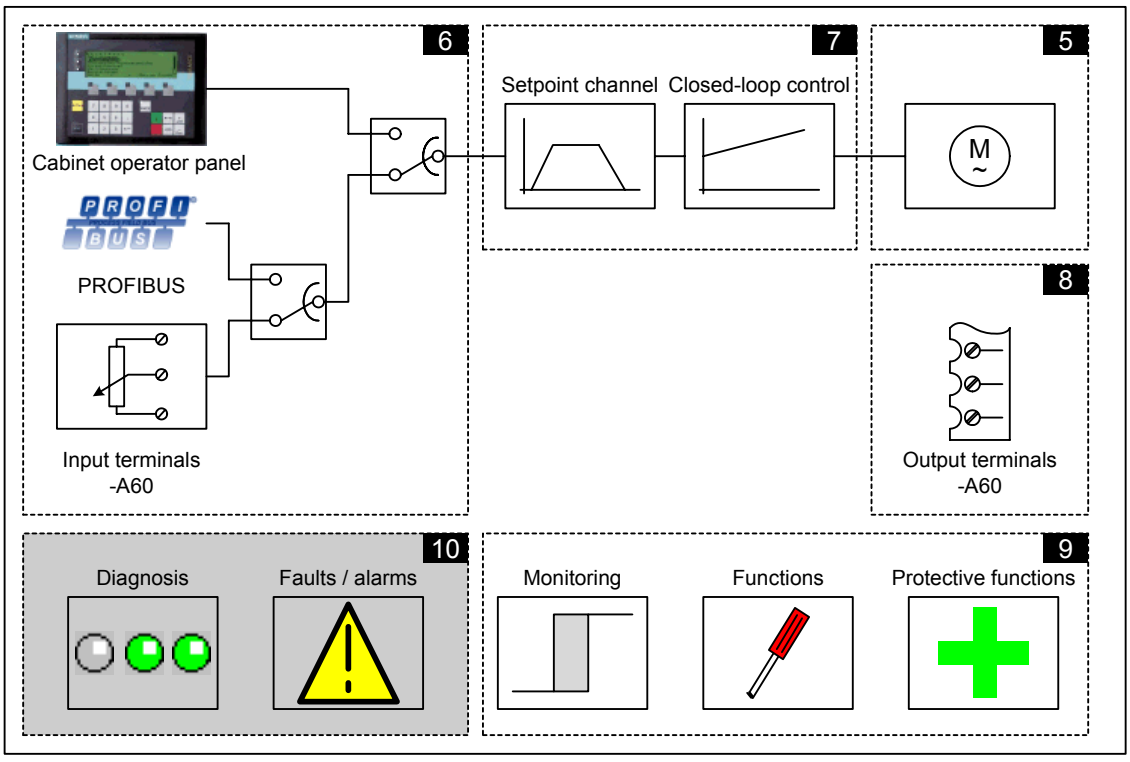
# Diagnosis / Faults and Alarms

# 10

## 10.1 Chapter Content

This chapter provides information on the following:

- Troubleshooting
- Service and support offered by Siemens AG



## 10.2 Troubleshooting

This section describes procedures for identifying the causes of problems and the measures you need to take to rectify them.

**NOTE**

If errors or malfunctions occur in the cabinet unit, you must carefully check the possible causes and take the necessary steps to rectify them. If you cannot identify the cause of the problem or you discover that components are defective, your regional office or sales office should contact Siemens Service and describe the problem in more detail.

### 10.2.1 Fault Diagnosis with LEDs

#### Control Unit CU 320 (-A10)

Table 10-1 Description of the LEDs

| LED | Color | State | Description |
|---|---|---|---|
| RDY (ready) | --- | OFF | Electronics power supply out of permissible tolerance range |
| | Green | Continuously lit | Control unit 320 is ready for operation |
| | | Flashing 2 Hz | Writing to CompactFlash Card |
| | Red | Continuously lit | At least one fault is present (e.g. RESET, watchdog monitoring, basic system error). Control unit 320 is booting |
| | | Flashing 0.5 Hz | Boot error (e.g. firmware cannot be loaded to the RAM) |
| | Green Red | Flashing 0.5 Hz | Control unit 320 is ready for operation No software licenses for the device |
| | Orange | Continuously lit | Firmware loading to RAM |
| | | Flashing 0.5 Hz | Unable to load firmware to RAM |
| | | Flashing 2 Hz | Firmware CRC error |
| DP1 (PROFIBUS cyclic operation) | --- | OFF | Electronics power supply outside the permissible tolerance range Control unit 320 is not ready for operation No Option Board |
| | Green | Continuously lit | PROFIBUS is ready for communication and cyclic communication is taking place |
| | | Flashing 0.5 Hz | PROFIBUS is ready for communication and cyclic communication is not taking place |
| | Red | Continuously lit | Cyclic communication has been interrupted. |

| | | | |
|---|---|---|---|
| OPT (option) | --- | OFF | Electronics power supply outside the permissible tolerance range<br>Control unit 320 is not ready for operation<br>No Option Board |
| | Green | Continuously lit | Option is ready for operation |
| | | Flashing 0.5 Hz | Depends on the board option used |
| | Red | Continuously lit | At least one fault is present in the board<br>Board option not ready for operation (e.g. after power-on) |
| MOD (SIMOTION) | --- | OFF | Reserved |
| | Green | Continuously lit | Reserved |

## Customer Terminal Block TM 31 (-A60)

Table 10-2 Description of the LEDs

| LED | Color | State | Description |
|---|---|---|---|
| READY | --- | OFF | Electronics power supply out of permissible tolerance range |
| | Green | Continuously lit | Customer terminal block ready for operation |
| | Orange | Continuously lit | DRIVE CliQ communication is being established. |
| | Red | Continuously lit | Fault present |
| | Red<br>Green | Flashing 2 Hz | Firmware is being downloaded.<br>Component recognition via LED is activated (p0154) |

## CIB – Converter Interface Module (-U1)

Table 10-3 Description of the LEDs

| LED | Color | State | Description |
|---|---|---|---|
| READY | --- | Off | Electronics power supply out of permissible tolerance range |
| | Green | Continuously lit | Motor Module ready for operation |
| | Orange | Continuously lit | DRIVE CliQ communication is being established. |
| | Red | Continuously lit | At least one fault is present. |
| DC LINK | --- | Off | Electronics power supply out of permissible tolerance range |
| | Yellow | Continuously lit | DC link voltage in the permissible tolerance range (only when the Motor Module is ready for operation) |
| | Red | Continuously lit | DC link voltage outside the permissible tolerance range (only when the Motor Module is ready for operation) |

## 10.2.2 Diagnosis via Parameters

### Diagnostic Parameters for the Device Status

| r0002 | Drive status |
|---|---|
| Display of drive status. | |

| r0046 | Missing enable signals | |
|---|---|---|
| Display of the missing enable signals. | | |
| Bit 00: Enable OFF1 | 0: present | 1: missing |
| Bit 01: Enable OFF2 | 0: present | 1: missing |
| Bit 02: Enable OFF3 | 0: present | 1: missing |
| Bit 03: Operation enabled | 0: present | 1: missing |
| Bit 08: Enable SH | 0: present | 1: missing |
| Bit 09: Enable infeed | 0: present | 1: missing |
| Bit 10: Enable ramp generator | 0: present | 1: missing |
| Bit 11: Ramp generator start | 0: present | 1: missing |
| Bit 12: Enable setpoint | 0: present | 1: missing |
| Bit 17: Int. enable OFF2 | 0: present | 1: missing |
| Bit 18: Int. enable OFF3 | 0: present | 1: missing |
| Bit 21: Int. enable STOP2 | 0: present | 1: missing |
| Bit 27: Demagnetization | 0: complete | 1: not complete |
| Value 0 indicates that all the enable signals for this drive are present. | | |
| Bit 00 = 1 (no enable) when: | The signal source in p0840 is set to 0 signal.<br>Power-on disable is present. | |
| Bit 01 = 1 (no enable) when: | The signal source in p0844 or p0845 is set to 0 signal. | |
| Bit 02 = 1 (no enable) when: | The signal source in p0848 or p0849 is set to 0 signal. | |
| Bit 03 = 1 (no enable) when: | The signal source in p0852 is set to 0 signal. | |
| Bit 08 = 1 (no enable) when: | No pulse enable on the motor module (X21.3, X21.4) | |
| Bit 09 = 1 (no enable) when: | The signal source in p0864 is set to 0 signal. | |
| Bit 10 = 1 (no enable) when: | The signal source in p1140 is set to 0 signal. | |
| Bit 11 = 1 (no enable) when: | The signal source in p1141 is set to 0 signal. | |
| Bit 12 = 1 (no enable) when: | The signal source in p1142 is set to 0 signal. | |
| Bit 17 = 1 (no enable) when: | Commissioning mode is set (p0009 > 0 or p0010 > 0). | |
| Bit 18 = 1 (no enable) when: | OFF3 or fault reaction OFF3 is not yet complete.<br>The bit is reset with the power-on disable function. | |
| Bit 21 = 1 (no enable) when: | The holding brake is applied or has not yet been released.<br>The motor is not yet magnetized. | |
| Bit 27 = 1 (no enable) when: | Demagnetization is not yet complete. | |

| r0050 | Active command data set (CDS) |
|---|---|
| Display of the active command data set (CDS). | |

## Diagnostic Parameters for Digital Inputs/Outputs

| r0721 | Actual terminal value CU320 digital inputs | |
|---|---|---|
| Display of the digital input status. | | |
| Bit 00: DI 0 (X122.1) | 0: OFF | 1: ON |
| Bit 01: DI 1 (X122.2) | 0: OFF | 1: ON |
| Bit 02: DI 2 (X122.3) | 0: OFF | 1: ON |
| Bit 03: DI 3 (X122.4) | 0: OFF | 1: ON |
| Bit 04: DI 4 (X132.1) | 0: OFF | 1: ON |
| Bit 05: DI 5 (X132.2) | 0: OFF | 1: ON |
| Bit 06: DI 6 (X132.3) | 0: OFF | 1: ON |
| Bit 07: DI 7 (X132.4) | 0: OFF | 1: ON |
| Bit 08: DI/DO 8 (X122.7) | 0: OFF | 1: ON |
| Bit 09: DI/DO 9 (X122.8) | 0: OFF | 1: ON |
| Bit 10: DI/DO 10 (X122.10) | 0: OFF | 1: ON |
| Bit 11: DI/DO 11 (X122.11) | 0: OFF | 1: ON |
| Bit 12: DI/DO 12 (X132.7) | 0: OFF | 1: ON |
| Bit 13: DI/DO 13 (X132.8) | 0: OFF | 1: ON |
| Bit 14: DI/DO 14 (X132.10) | 0: OFF | 1: ON |
| Bit 15: DI/DO 15 (X132.11) | 0: OFF | 1: ON |

| r0747 | Status of digital outputs (CU320) | |
|---|---|---|
| Display of the digital output status. | | |
| Bit 08: DI/DO 8 (X122.7) | 0: OFF | 1: ON |
| Bit 09: DI/DO 9 (X122.8) | 0: OFF | 1: ON |
| Bit 10: DI/DO 10 (X122.10) | 0: OFF | 1: ON |
| Bit 11: DI/DO 11 (X122.11) | 0: OFF | 1: ON |
| Bit 12: DI/DO 12 (X132.7) | 0: OFF | 1: ON |
| Bit 13: DI/DO 13 (X132.8) | 0: OFF | 1: ON |
| Bit 14: DI/DO 14 (X132.10) | 0: OFF | 1: ON |
| Bit 15: DI/DO 15 (X132.11) | 0: OFF | 1: ON |

| r4022 | Status of TM31 digital inputs | |
|---|---|---|
| Display of the digital input status. | | |
| Bit 00: DI 0 (X520.1) | 0: OFF | 1: ON |
| Bit 01: DI 1 (X520.2) | 0: OFF | 1: ON |
| Bit 02: DI 2 (X520.3) | 0: OFF | 1: ON |
| Bit 03: DI 3 (X520.4) | 0: OFF | 1: ON |
| Bit 04: DI 4 (X530.1) | 0: OFF | 1: ON |
| Bit 05: DI 5 (X530.2) | 0: OFF | 1: ON |
| Bit 06: DI 6 (X530.3) | 0: OFF | 1: ON |
| Bit 07: DI 7 (X530.4) | 0: OFF | 1: ON |
| Bit 08: DI/DO 8 (X541.2) | 0: OFF | 1: ON |
| Bit 09: DI/DO 9 (X541.3) | 0: OFF | 1: ON |
| Bit 10: DI/DO 10 (X541.4) | 0: OFF | 1: ON |
| Bit 11: DI/DO 11 (X541.5) | 0: OFF | 1: ON |

| r4047 | Status of TM31 digital outputs | |
|---|---|---|
| Display of the TM31 digital output status. | | |
| Bit 00: DO 0 (X542.1-3) | 0: OFF | 1: ON |
| Bit 01: DO 1 (X542.4-6) | 0: OFF | 1: ON |
| Bit 08: DO 8 (X541.2) | 0: OFF | 1: ON |
| Bit 09: DO 9 (X541.3) | 0: OFF | 1: ON |
| Bit 10: DO 10 (X541.4) | 0: OFF | 1: ON |
| Bit 11: DO 11 (X541.5) | 0: OFF | 1: ON |

## 10.2.3 Indicating and Rectifying Faults

The cabinet unit features a wide range of functions that protect the drive against damage if a fault occurs (faults and alarms).

### Indicating Faults and Alarms

If a fault occurs, the drive indicates the fault and/or alarm on the cabinet operator panel. Faults are indicated by the red "FAULT" LED and a fault screen is automatically displayed. You can use the F1 Help function to call up information about the cause of the fault and how to remedy it. You can use F5 Ack. to acknowledge a stored fault.

Any alarms are displayed by the yellow flashing "ALARM" LED. The system also displays a note in the status bar providing information on the cause.

Every fault and alarm is entered in the fault/alarm buffer along with time the error occurred and the time it was rectified. The time stamp relates to the relative system time in milliseconds (r0969).

### What is a Fault?

A fault is a message from the drive indicating an error or other exceptional (unwanted) status. This could be caused by a fault within the converter or an external fault triggered, for example, from the winding temperature monitor for the asynchronous motor. The faults are displayed and can be reported to a higher-level control system via PROFIBUS. In the factory default setting, the message "converter fault" is also sent to a relay output. Once you have rectified the cause of the fault, you have to acknowledge the fault message.

### What is an Alarm?

An alarm is the response to a fault condition identified by the drive. It does not result in the drive being switched off and does not have to be acknowledged. Alarms are "self acknowledging", that is, they are reset automatically when the cause of the alarm has been eliminated.

## 10.3 Service and Support

**Service and Support Helpline**

If you need help and do not know who to contact, we make sure that you receive all the help you need as quickly as possible.

The helpline ensures that a specialist in your area can provide you with professional support. The helpline (in Germany, for example) is available 24 hours a day, 365 days a year. German and English are spoken.

Tel.: 0180 50 50 111

**Online Support**

Our round-the-clock, worldwide online support service provides quick and efficient support in five languages. The comprehensive Internet-based information system, which is available round the clock, provides product support, services, and support tools in the shop.

Online support provides a wide range of technical information:

- FAQs, tips and tricks, downloads, current news
- Manuals
- Helpful programs and software products

http://www.siemens.de/automation/service&support

**Field Service**

If your plant is down and you need fast, on-site help, we can provide the specialists with the required expertise wherever you are.

With our comprehensive service network, we offer professional and reliable expertise to get your plant up and running again as quickly as possible.

Experts are available 24 hours a day, 365 days a year.

Tel.: 0180 50 50 444

Of course, we can also arrange special service contracts tailored to your specific requirements. For details, please contact your Siemens office.

**Spare Parts and Repairs**

Our global network of regional spare parts warehouses and repair centers enables us to respond quickly and reliably with modern logistics procedures.

During the operational phase of your machinery, we provide a comprehensive repairs and spare parts service to ensure maximum operational reliability. Our service includes expert advice with technical problems, and a wide range of product and system support services tailored to your needs.

For more information about repairs or spare parts, please call the following number (in Germany):

Tel.: 0180 50 50 446

You can call this number outside office hours and at the weekend to contact our emergency spare parts service.

**Technical Support**

We offer technical support in both German and English for deploying products, systems, and solutions in drive and automation technology.

In special cases, help is available from professional, trained, and experienced specialists via teleservice and video conferencing.

Free Contact – providing you with free technical support

- In Europe / Africa
  Tel.: +49 (0)180 50 50 222
  Fax: +49 (0)180 50 50 223
  E-mail: adsupport@siemens.com
- in America
  Tel.: +14232622522
  Fax: +14232622289
  E-mail: simatic.hotline@sea.siemens.com
- Asia / Pacific region
  Tel.: +86 1064 757575
  Fax: +86 1064 747474
  E-mail: adsupport.asia@siemens.com

## 10.4 Alarms and Faults

If a fault occurs, the drive indicates the fault and/or alarm. Faults and alarms are listed in a fault/alarm list together with the following information:

- Fault/alarm number
- Standard drive response
- Description of the possible cause of the fault/alarm
- Description of the procedure for rectifying the problem
- Standard fault acknowledgement after it has been rectified

### 10.4.1 "External Warning 1"

**Causes**

Warning A7850 ("External Warning 1") is triggered by the following optional protection devices in the cabinet unit:

- Thermistor motor protection unit alarm (option L83)
- PT100 evaluation unit (option L86)

**Remedy**

When a fault is indicated, the following procedure is recommended:

1. Identify the cause by examining the specified devices (display or LEDs).
2. Check the fault display on the relevant protection device and establish the fault.
3. Rectify the displayed fault with the help of the appropriate operating instructions provided in "Additional Operating Instructions".

### 10.4.2 "External Fault 1"

**Causes**

Fault code F7860 ("External Fault 1") is triggered by the following optional protection devices in the cabinet unit:

- Thermistor motor protection unit shutdown (option L84)
- PT100 evaluation unit (option L86)

**Remedy**

When a fault is indicated, the following procedure is recommended:

1. Identify the cause by examining the specified devices (display or LEDs).
2. Check the fault display on the relevant protection device and establish the fault.
3. Rectify the displayed fault with the help of the appropriate operating instructions provided in "Additional Operating Instructions".

### 10.4.3 "External Fault 3"

**Causes**

Fault code F7862 ("External Fault 3") is triggered when the braking resistor available with options L61 and L62 is subject to thermal overload, thereby activating the thermostat. The drive is switched off with OFF2.

**Remedy**

The cause of the braking resistor overload must be eliminated and the fault code acknowledged.

# 10.5 List of Faults and Alarms

## 10.5.1 Explanation of the List of Faults and Alarms

The data in the following example has been chosen at random. A description can contain the information listed below. Some of the information is optional.

The list of faults and alarms has the following layout:

**Fault**

| **Fxxxx** | **Fault name** |
|---|---|
| Reaction: | Details of the response when a fault occurs (OFF1, OFF2, NONE, and so on). |
| Cause: | Description of the possible cause of the fault/alarm. |
| Fault value (r0949): | Detailed troubleshooting information. |
| Remedy: | Description of a procedure for rectifying the problem. |
| Acknowl.: | Description of the fault acknowledgement process after the cause has been rectified. |

**Alarm**

| **Axxxx** | **Name of the alarm** |
|---|---|
| Cause: | Description of the possible cause of the alarm. |
| Alarm value (r2124): | Detailed troubleshooting information. |
| Remedy: | Description of a procedure for rectifying the alarm. |

## 10.5.2 List of Faults and Alarms

Table 10-4 List of Faults and Alarms

| | |
|---|---|
| **F1000** | **Internal software error** |
| Reaction: | OFF2 |
| Cause: | An internal software error has occurred. |
| Fault value (r0949): | To be diagnosed by Siemens only. |
| Remedy: | - POWER ON for all components (switch off/on).<br>- Upgrade firmware.<br>- Contact hotline.<br>- Replace control unit. |
| Acknowl.: | POWER ON |
| **F1005** | **Firmware download DRIVE-CLiQ component failed** |
| Reaction: | NONE |
| Cause: | Firmware download to a DRIVE-CLiQ component failed. |
| Fault value (r0949): | 011: The DRIVE-CliQ component has recognized a checksum error.<br>015: The content of the firmware file is not accepted by the selected DRIVE-CliQ component.<br>140: The firmware file for the DRIVE-CliQ component does not exist on the CompactFlash card.<br>156: The component with the specified component number does not exist.<br>Other values:<br>To be diagnosed by Siemens only. |
| Remedy: | - Check the selected component number (p7828).<br>- Store the appropriate firmware file for download in the /siemens/sinamics/code/sac/ directory. |
| Acknowl.: | Immediate |
| **F1010** | **Unknown drive type** |
| Reaction: | NONE |
| Cause: | Unknown drive type found. |
| Fault value (r0949): | Drive object number |
| Remedy: | Check EEPROM data of the drive objects. |
| Acknowl.: | Immediate |
| **F1030** | **Monitoring master control: Sign-of-life failure PC** |
| Reaction: | OFF1 |
| Cause: | No signs-of-life were received during active PC control priority within the monitoring time.<br>Control priority has been returned to the active BICO interconnection. |
| Remedy: | Increase the monitoring time on the PC/AOP or switch it off.<br>WARNING:<br>The monitoring time must be as short as possible. A long monitoring time results in a delayed reaction if communication fails! |
| Acknowl.: | Immediate |
| **F1040** | **You must save your parameter settings and perform a POWER ON** |
| Reaction: | OFF2 |
| Cause: | A parameter which requires the system to reboot, e.g. p0110, has been changed in the drive system, e. g. p0110. |
| Remedy: | - Save parameters (p0971/p0977)<br>- Perform POWER ON for all components (deactivate/activate) |
| Acknowl.: | POWER ON |
| **F1041** | **You must save your parameter settings** |

| | |
|---|---|
| Reaction: | NONE |
| Cause: | Defective files detected on CompactFlash Card during startup. |
| Remedy: | - Repair files<br>- Save parameters (p0977).<br>- Fault can be acknowledged after saving |
| Acknowl.: | Immediate |

| **A1100** | **CU: CompactFlash Card removed** |
|---|---|
| Cause: | The CompactFlash card (non-volatile memory) was removed during operation.<br>Caution:<br>The CompactFlash card must not be removed or inserted when the system is live. |
| Remedy: | - Switch off the drive system.<br>- Reinsert the CompactFlash Card that is suitable for the plant.<br>- Switch the drive system back on. |

| **F1105** | **CU: Insufficient memory** |
|---|---|
| Reaction: | OFF1 |
| Cause: | Too many functions, data sets or drives are configured on this control unit. |
| Remedy: | - Change configuration on this control unit.<br>- Use a different control unit. |
| Acknowl.: | Immediate |

| **F1107** | **CU: Save to CompactFlash Card failed** |
|---|---|
| Reaction: | NONE |
| Cause: | Unable to save data on CompactFlash Card.<br>- CompactFlash Card defective.<br>- Insufficient memory on CompactFlash Card. |
| Remedy: | - Try again.<br>- Use another CompactFlash card. |
| Acknowl.: | Immediate |

| **F1110** | **CU: Only one SINAMICS G at a time may be operated at a Control Unit.** |
|---|---|
| Reaction: | NONE |
| Cause: | More than one drive of type SINAMICS G is in operation with the control unit. |
| Remedy: | Only one drive of type SINAMICS G is permitted. |
| Acknowl.: | Immediate |

| **F1111** | **CU: Drive types SINAMICS S/G cannot be combined at a CU** |
|---|---|
| Reaction: | NONE |
| Cause: | The drive units SINAMICS S and G are operating together on one control unit. |
| Remedy: | You may only operate equipment of one drive type on one CU. |
| Acknowl.: | Immediate |

| **F1205** | **CU: Time slice overflow** |
|---|---|
| Reaction: | OFF2 |
| Cause: | Insufficient processing time for existing topology. |
| Remedy: | Reduce the number of axes or increase the sampling times. |
| Acknowl.: | POWER ON |

| **F1210** | **CU: Basic clock cycle does not match DRIVE-CLiQ clock cycle** |
|---|---|
| Reaction: | NONE |
| Cause: | The parameter for selecting the basic clock cycle does not match the drive topology. Drives connected to the same DRIVE-CLiQ port of the control unit have been assigned different basic clock cycles.<br>See also: p0111 |
| Remedy: | The same basic clock must be selected for drives connected to one and the same. DRIVE-CLiQ port of the CU (e.g. in series).<br>See also: p0111 |
| Acknowl.: | Immediate |

| | |
|---|---|
| **F1220** | **CU: Basic clock cycle too small** |
| Reaction: | NONE |
| Cause: | The parameter for the basic clock cycle is set too short for the number of connected drives.<br>See also: p0110 |
| Remedy: | - Increase the basic clock cycle.<br>- Reduce the number of connected drives and start commissioning the unit again.<br>See also: p0110 |
| Acknowl.: | Immediate |
| **F1221** | **CU: Basic clock cycle too short (application cannot maintain its clock cycle)** |
| Reaction: | NONE |
| Cause: | The application cannot maintain its clock cycle.<br>Application runtime is simply too long for the particular clock cycle, or the remaining system time is not sufficient for the application. |
| Remedy: | Increase basic clock cycle of DRIVE-CLiQ communication. |
| Acknowl.: | Immediate |
| **F1250** | **CU: CU-EEPROM Initialization** |
| Reaction: | NONE |
| Cause: | Error during initialization of the EEPROM on the control unit. |
| Fault value (r0949): | 1: Read error RO structure<br>2: Checksum error RO structure<br>3: Block setup error RO data |
| Remedy: | POWER ON durchführen |
| Acknowl.: | POWER ON |
| **F1255** | **CU: Option-Slot-EEPROM Initialization** |
| Reaction: | NONE |
| Cause: | Error on initializing the option slot EEProm. |
| Fault value (r0949): | 1: Read error RO structure<br>2: Checksum error RO structure<br>3: Block structure error RO data |
| Remedy: | POWER ON durchführen |
| Acknowl.: | POWER ON |
| **F1300** | **Topology: No topology detected or specified** |
| Reaction: | NONE |
| Cause: | The number of components connected via DRIVE-CLiQ (incl. the TBxx) or the target device topology type is zero.<br>See also: r0098, p0099 |
| Remedy: | Connect topology components via DRIVE-CLiQ and switch on CU again.<br>Accept r0098 in p0099.<br>See also: p0099 |
| Acknowl.: | Immediate |
| **F1305** | **Topology: Component number missing** |
| Reaction: | NONE |
| Cause: | The component number from the topology has not been parameterized (p0121(for AFE only, s.p0107), p0131(for Servo/Vector drives only, see. p0107), p0141, p0151, p0161).<br>See also: p0121, p0131, p0141, p0142, p0151, p0161, p0185, p0186, p0187, p0188, p0189 |
| Fault value (r0949): | Fault value contains relevant dataset number.<br>Fault also occurs if speed sensor was configured (p0187 ... p0189) but no component number exist for them.<br>The fault value contains the drive data set number in this case, plus. 100*sensor number (e. g. 3xx, if no component number is entered for the third sensor (p0189) in p0141). |
| Remedy: | Enter the missing component number or remove component and restart commissioning.<br>See also: p0121, p0131, p0141, p0142, p0151, p0161, p0185, p0186, p0187, p0188, p0189 |
| Acknowl.: | Immediate |

| **A1320** | **Topology: Drive object number missing in configuration** |
|---|---|
| Cause: | Drive object number missing in p0978. |
| Alarm value (r2124): | Index of p0101 under which the missing drive object number can be determined. |
| Remedy: | Set p0009 = 1 and modify p0978:<br>Rules:<br>- p0978 must include all drive object numbers (see p0101).<br>- A drive object number must not be repeated.<br>- 0 may be entered to distinguish between drive with/without PZD. |

| **A1321** | **Topology: Drive object number does not exist in the configuration** |
|---|---|
| Cause: | p0978 contains a non-existent drive object number. |
| Alarm value (r2124): | Index of p0978 under which the drive object number can be determined. |
| Remedy: | Set p0009 = 1 and modify p0978:<br>Rules:<br>- p0978 must include all drive object numbers (see p0101).<br>- A drive object number must not be repeated.<br>- 0 may be entered to distinguish between drive with/without PZD. |

| **A1322** | **Topology: Drive object number present twice in configuration** |
|---|---|
| Cause: | p0978 contains a drive object number more than once. |
| Alarm value (r2124): | Index p0978 where the affected drive object number is located. |
| Remedy: | Set p0009 = 1 and modify p0978:<br>Rules:<br>- p0978 must include all drive object numbers (see p0101).<br>- A drive object number must not be repeated.<br>- 0 may be entered to distinguish between drive with/without PZD. |

| **A1330** | **Topology: Quick commissioning not possible** |
|---|---|
| Cause: | Unable to perform a quick commissioning. The existing actual topology does not meet the set requirements. |
| Alarm value (r2124): | Byte 1<br>1: Invalid connections were detected for a component.<br>Byte 2: Component number<br>Byte 3: Port type<br>Byte 4: Connection number<br>2: The topology contains too many components of one type. Byte 2 indicates the number of requirements not met.<br>Byte 2 = 1 means: More than one master control unit present<br>Byte 2 = 2 means: More than one Active Line Module present<br>Byte 2 = 3 means: More than 6 motor modules present<br>Byte 2 = 4 means: More than 6 sensors present<br>Byte 2 = 5 means: More than 2 Terminal Modules present<br>Byte 2 = 6 means: More than one option slot component present<br>3: More than 16 components are connected to one DRIVE-CLiQ socket of the control unit.<br>Byte 2 = 1, 2, 3, 4 means e. g. DRIVE-CLiQ socket X101, X102, X103, X104<br>4: The number of components connected in sequence is higher than 7.<br>Byte 2 = Component number of 8th component<br>Note:<br>The connection type and number are described in F1375. |
| Remedy: | - Adapt the actual topology to the permissible requirements.<br>- Perform commissioning via STARTER. |

| **A1331** | **Topology: Quick commissioning not supported** |
|---|---|
| Cause: | Unable to automatically assign a speed sensor and a drive during quick commissioning. |

| | |
|---|---|
| Alarm value (r2124): | Component number of non-assigned component |
| Remedy: | Assign speed sensor and evaluation to a drive.<br>- Increase the number of sensor data sets (p0140)<br>- Assign evaluation (p0141)<br>- Assign speed sensor (p0142) |

| **F1340 – F1343** | **Topology: Too many components on one line** |
|---|---|
| Reaction: | NONE |
| Cause: | Communication clock cycle of DRIVE-CLiQ ports insufficient for all write transfers.<br>The reason is that there are too many DRIVE-CLiQ components for the set communication clock cycle on a line of the CU. |
| Remedy: | - Increase basic clock cycle<br>- Check DRIVE-CLiQ cabling: The DRIVE-CLiQ ports of the CU should be interconnected to the same number of components. |
| Acknowl.: | Immediate |

| **F1344 – F1346** | **Topology: too many components connected** |
|---|---|
| Reaction: | NONE |
| Cause: | Internal buffer overrun for useful data of a DRIVE-CLiQ connection. |
| Remedy: | Check DRIVE-CLiQ connection: The DRIVE-CLiQ ports of the CU should be interconnected to the same number of components. |
| Acknowl.: | Immediate |

| **F1350** | **Topology: Unable to read actual topology** |
|---|---|
| Reaction: | NONE |
| Cause: | An error has occurred reading the actual topology from r9900 and r9901. |
| Remedy: | Execute a POWER ON |
| Acknowl.: | POWER ON |

| **F1351** | **Topology: Actual topology Unable to write** |
|---|---|
| Reaction: | NONE |
| Cause: | Cannot write actual topology internally in r9900 and r9901. As a result, the actual topology cannot be read out correctly. |
| Remedy: | Execute a POWER ON |
| Acknowl.: | POWER ON |

| **F1352** | **Topology: Unable to determine actual topology** |
|---|---|
| Reaction: | NONE |
| Cause: | Unable to determine actual topology.<br>- Insufficient memory.<br>- Internal access to parameter failed.<br>- Unknown node identifier for a component |
| Remedy: | - Reduce the number of data sets or drives.<br>- Perform POWER ON. |
| Acknowl.: | POWER ON |

| **F1355** | **Topology: Actual topology modified** |
|---|---|
| Reaction: | NONE |
| Cause: | The number of components connected via DRIVE-CLiQ (incl. TBxx) is zero or it has been changed after initial start-up.<br>This error occurs only if the topology is commissioned via the internal automatic option and not with the PC tool.<br>See also: r0098, p0099 |

| | |
|---|---|
| Remedy: | The following remedial actions are available if no errors have occurred in the topology detection run:<br>- restore the original wiring and reapply voltage to the CU.<br>- Change the unit parameterization to match the wiring (only possible via ES tool).<br>- Restore factory settings for the entire unit (all drives) and enable automatic self-commissioning.<br>See also: r0098 |
| Acknowl.: | Immediate |

| **F1360** | **Topology: Actual topology No. of components exceeded** |
|---|---|
| Reaction: | NONE |
| Cause: | Too many components detected at the Control Unit during determination of the actual topology. The maximum permissible number of components is 199. |
| Remedy: | Change the configuration. Link less than 199 components to the control unit. |
| Acknowl.: | Immediate |

| **F1370** | **Topology: Actual topology Ring connection** |
|---|---|
| Reaction: | NONE |
| Cause: | A ring-shaped connection was detected during detection of the actual topology. |
| Fault value (r0949): | Byte 1: Component number of a component contained in the ring<br>Byte 2: Connection type<br>Byte 3: Connection number<br>Note:<br>The connection type and number are described in F1375. |
| Remedy: | Output the fault value and remove the specified connection. |
| Acknowl.: | Immediate |

| **F1371** | **Topology: Actual topology Ring connection with Control Unit** |
|---|---|
| Reaction: | NONE |
| Cause: | A ring-shaped connection including the control unit was detected during detection of the actual topology. |
| Fault value (r0949): | Byte 1: Component number on components connected to the control unit<br>Byte 2: Connection type<br>Byte 3: Connection number<br>Note:<br>The connection type and number are described in F1375. |
| Remedy: | Output the fault value and remove the specified connection. |
| Acknowl.: | Immediate |

| **F1375** | **Topology: Actual topology Duplicate connection between two components** |
|---|---|
| Reaction: | NONE |
| Cause: | A duplicate connection between 2 components was detected in the actual topology. |

| | |
|---|---|
| Fault value (r0949): | Byte 1: Component number of a component connected twice<br>Byte 2: Connection type<br>Byte 3: Connection number 1 of duplicated connection<br>Byte 4: Connection number 2 of duplicated connection<br><br>Example:<br>Fault value = 33751316 dec = 2030114 hex<br>Byte 4 = 02 hex = 2 dec, Byte 3 = 03 hex = 3 dec, Byte 2 = 01 hex = 1 dec, Byte 1 = 14 hex = 20 dec<br><br>Connection type:<br>1: DRIVE-CLiQ<br>2: Option slot<br>3: Other connections (e.g. EnDat, SSI)<br>4: Power connection<br>5: Incremental sensor connection<br>6: Resolver connection<br>7: Incremental sensor connection<br><br>Connection number:<br>A number that corresponds to the relevant connection or socket number consecutively starting at one (e.g. DRIVE- CLiQ connection X100 on the CU has connection number 1) |
| Remedy: | Output the fault values and remove one or both of the specified connections. |
| Acknowl.: | Immediate |

**F1380 Topology: Actual topology Defective EEPROM detected**

| | |
|---|---|
| Reaction: | NONE |
| Cause: | A component with a defective EEPROM was detected during actual topology recognition. |
| Fault value (r0949): | Byte 1: Component number of the defective component |
| Remedy: | Output the fault value and remove the defected component. |
| Acknowl.: | POWER ON |

**F1400 Topology: Comparison not possible**

| | |
|---|---|
| Reaction: | NONE |
| Cause: | Unable to perform comparison between actual and target topology. |
| Fault value (r0949): | 1: Insufficient dynamic memory<br>2: No target topology present<br>3: No actual topology present |
| Remedy: | Execute a POWER ON |
| Acknowl.: | Immediate |

**F1405 Topology: Comparison error cannot be cleared automatically**

| | |
|---|---|
| Reaction: | NONE |
| Cause: | Unable to correct differences between actual and target topology automatically. |
| Fault value (r0949): | Byte 1: Number of differences that cannot be corrected automatically<br>Byte 2: Number of differences that can be corrected automatically (p9904)<br>Byte 3: Number of differences that can be corrected by unit specialization (p9905)<br>Automatically correctable differences<br>- Topology: Serial number comparison different (correctable)<br>- Topology: Component comparison moved<br>- Topology: Connection number comparison different (correctable) |
| Remedy: | Changes only one clearable difference in the actual topology. Perform 'clear topology error automatically' (p9904). |
| Acknowl.: | Immediate |

**F1410 Topology: Comparison Component moved**

| | |
|---|---|
| Reaction: | NONE |

| | |
|---|---|
| Cause: | The topology comparison has detected a moved component in the actual topology compared to the target topology.<br>Byte 1 of the fault value indicates the component number of the moved component.. Bytes 2, 3 and 4 describes the connection in the actual topology where the shifted component was detected. |
| Fault value (r0949): | Byte 1: Component number of shifted component<br>Byte 2: Component number<br>Byte 3: Connection type<br>Byte 4: Connection number<br>Note:<br>The connection type and number are described in F1375. |
| Remedy: | Adapt the topologies:<br>- Undo moving components in the actual topology<br>- Load target topology that matches the actual topology (commissioning software).<br>- Correct topology errors automatically (p9904) |
| Acknowl.: | Immediate |

**F1415** **Topology: Comparison Additional component in target topology**

| | |
|---|---|
| Reaction: | NONE |
| Cause: | Topology comparison has detected a component in the target topology that is not used in the actual topology. |
| Fault value (r0949): | Component number of additional target component |
| Remedy: | - Remove the additional components in the target topology and reload the target topology.<br>- Check the actual topology in line with the target topology and reconnect if necessary. |
| Acknowl.: | Immediate |

**A1416** **Topology comparison: Component also in actual topology**

| | |
|---|---|
| Cause: | The topology comparison has found a component in the actual topology which is not specified in the target topology. The supplementary info describes the connection at which the additional component was detected. |
| Alarm value (r2124): | Byte 1: Component number<br>Byte 2: Connection type<br>Byte 3: Connection number<br>Note:<br>The connection type and number are described in F1375. |
| Remedy: | Adapting the topologies:<br>- Remove the additional components in the actual topology<br>- Load target topology that matches the actual topology (commissioning software). |

**F1420** **Topology: Comparison Different components (F1420: correctable)**
**F1421**

| | |
|---|---|
| Reaction: | NONE |
| Cause: | The topology comparison has detected differences in the actual and target topologies in relation to one component. The node identifier or order number are different. |
| Fault value (r0949): | Byte 1: Component number<br>Byte 2:<br>1: Different type in node identifier<br>2: Different order number<br>3: Different node identifier |
| Remedy: | Adapting the topologies:<br>- Check the component cabling in the ES tool against the hardware configuration of the drive unit and adapt the differences<br>- Parameterize the topology comparison of all components (p9906)<br>- Parameterize the topology comparison of one component |
| Acknowl.: | Immediate |

**F1424** **Topology: Comparison Different serial numbers (F1424: correctable)**
**F1425**

| | |
|---|---|
| Reaction: | NONE |
| Cause: | The topology comparison has detected differences in the actual and target topologies in relation to one component. Different serial number. |
| Fault value (r0949): | Component number |
| Remedy: | Adapting the topologies<br>- Undo the change made in the actual topology<br>- Load target topology that matches the actual topology using the ES tool<br>- Correct topology errors automatically (p9904)<br>- Parameterize topology comparison of all components (p9906)<br>- Parameterize topology comparison for one component(p9907, p9908) |
| Acknowl.: | Immediate |

**F1428 Topology: comparison Different port numbers (F1428: correctable)**
**F1429**

| | |
|---|---|
| Reaction: | NONE |
| Cause: | The topology comparison has detected differences in the actual and target topologies in relation to one component. A component was connected to a different connection. The fault value describes the different connections of the component. |
| Fault value (r0949): | Byte 1: Component number<br>Byte 2: Connection type<br>Byte 3: Connection number in actual topology<br>Byte 4: Connection number in target topology<br>Note:<br>The connection type and number are described in F1375. |
| Remedy: | Adapting the topologies:<br>- Reconnect the actual topology in line with the target topology.<br>- Load the target topology that matches the actual topology (commissioning software).<br>- Correct the topology error automatically (p9904) |
| Acknowl.: | Immediate |

**F1431 Topology: Comparison Different component connection types**

| | |
|---|---|
| Reaction: | NONE |
| Cause: | The topology comparison has detected differences in the actual and target topologies in relation to one component. The connection types or the number of connections are different. |
| Fault value (r0949): | Byte 1: Component number<br>Byte 2: Connection type<br>Note:<br>The connection type and number are described in F1375. |
| Remedy: | Check that the component cabling in ES tool matches the hardware configuration of the drive unit and adapt any differences. |
| Acknowl.: | Immediate |

**F1450 Topology: Unable to read target topology**

| | |
|---|---|
| Reaction: | NONE |
| Cause: | Error reading target topology from p9902 and p9903. |
| Remedy: | Reload the target topology using the commissioning software. |
| Acknowl.: | Immediate |

**F1451 Topology: Unable to write target topology**

| | |
|---|---|
| Reaction: | NONE |
| Cause: | Error writing target topology to p9902 and p9903. |
| Remedy: | Reload the target topology using the commissioning software. |
| Acknowl.: | Immediate |

**F1470 Topology: Target topology: Ring connection**

| | |
|---|---|
| Reaction: | NONE |
| Cause: | Ring connection originating from the control unit detected on writing target topology to p9902 and p9903. |

| | |
|---|---|
| Fault value (r0949): | Byte 1: Component number of a component contained in the ring<br>Byte 2: Connection type<br>Byte 3: Connection type<br>Note:<br>The connection type and number are described in F1375. |
| Remedy: | Output the fault value and remove one of the specified connections. Then reload the target topology using the commissioning software. |
| Acknowl.: | Immediate |

**F1471** **Topology: Target topology: Ring connection with control unit**

| | |
|---|---|
| Reaction: | NONE |
| Cause: | Ring connection originating from the control unit detected on writing target topology to p9902 and p9903 |
| Fault value (r0949): | Byte 1: Component number of the component connected to the control unit<br>Byte 2: Connection type<br>Byte 3: Connection number<br>Note:<br>The connection type and number are described in F1375. |
| Remedy: | Output the fault value and remove one of the specified connections. Then reload the target topology using the commissioning software. |
| Acknowl.: | Immediate |

**F1475** **Topology: Target topology Duplicate connection between two components**

| | |
|---|---|
| Reaction: | NONE |
| Cause: | Double connection between 2 components detected on entering the target topology in p9902 and p9903 |
| Fault value (r0949): | Byte 1: Component number of a double-connected component<br>Byte 2: Connection type<br>Byte 3: Connection number 1 of double connection<br>Byte 4: Connection number 2 of double connection<br>Note:<br>The connection type and number are described in F1375. |
| Remedy: | Output the fault value and remove the two specified connections. Then reload the target topology using the commissioning software. |
| Acknowl.: | Immediate |

**F1505** **BICO: Interconnection cannot be set up**

| | |
|---|---|
| Reaction: | NONE |
| Cause: | The chosen interconnection cannot be set up. |
| Fault value (r0949): | Parameter to be modified.<br>Exceptions:<br>922: Interconnection must not be changed because the current selection of the PROFIBUS telegram in P0922 requires the present one. |
| Remedy: | Set up another interconnection. |
| Acknowl.: | Immediate |

**F1511** **BICO: Message: BICO Interconnection Between Different Scalings**

| | |
|---|---|
| Reaction: | NONE |
| Cause: | Message: The required interconnection has been established, but a conversion is being carried out between the BICO output and BICO input.<br>This occurs when the BICO output is scaled differently to the BICO input, or when you switch between drives whose p2000 ff reference values are different.<br>The conversion is carried out using the p2000 ff reference values.<br>Example:<br>The BICO output is a voltage and the BICO input is a current. Factor p2002/p2001 is calculated between the BICO output and BICO input. |
| Fault value (r0949): | Parameter number of the signal sink. |
| Remedy: | No action required |

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|---|---|
| Acknowl.: | Immediate |

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|---|---|
| **F1800** | **DRIVE-CLiQ: Hardware/configuration defective** |
| Reaction: | OFF2 |
| Cause: | An error occurred on the DRIVE-CLiQ interface. |
| Fault value (r0949): | 0..3: Port 0..3 has not switched to cyclic mode.<br>The cause may be an incorrect setup or configuration that produces inconsistent bus timings.<br>10 : Loss of Drive-CLiQ connection<br>Cause, e.g. Drive-CLiQ cable has been removed from CU.<br>This error cannot be acknowledged until communication is cyclic again.<br>11 : Repeated error for connection ID.<br>This error cannot be acknowledged until communication is cyclic again.<br>12 : A connection was detected but exchange of the station ID does not work.<br>probable cause: defective component.<br>This error cannot be acknowledged until communication is cyclic again. |
| Remedy: | For fault values 0 ... 3:<br>- Ensure that the software statuses of the DRIVE-CliQ components are the same.<br>- Avoid long topologies with short current controller cycles.<br>For fault value 10:<br>- Check the DRIVE-CliQ cables on the control unit.<br>- POWER ON.<br>For fault value 11:<br>- Ensure that the cabinet and cabling are EMC compliant.<br>For fault value 12:<br>- Replace the affected component. |
| Acknowl.: | Immediate |

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|---|---|
| **F1801** | **DRIVE-CLiQ: No communication to component** |
| Reaction: | OFF2 |
| Cause: | A communication with the DRIVE-CLiQ component indicated by the fault value is not possible.<br>Cause may be that a Drive-CLiQ cable has been pulled out. |
| Remedy: | - Check the DRIVE-CliQ cables.<br>- POWER ON. |
| Acknowl.: | Immediate |

| | |
|---|---|
| **F1802** | **CU DRIVE-CLiQ: Modification of DRIVE-CLiQ basic clock cycle times requires POWER ON** |
| Reaction: | OFF2 |
| Cause: | Modification of DRIVE-CLiQ basic clock cycle times p0110 is not possible during operation. |
| Fault value (r0949): | Index of p0110. |
| Remedy: | Save (p0971 = 1), switch OFF and ON again. |
| Acknowl.: | POWER ON |

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|---|---|
| **A1900** | **PROFIBUS: Configuration telegram faulted** |
| Cause: | PROFIBUS master is attempting to set up a connection using a wrong configuration telegram. |
| Alarm value (r2124): | 50: Syntax error<br>51: Connection setup to more drives than configured in the unit<br>52: More than 16 input or output data words for a drive<br>53: Uneven number of input or output bytes |
| Remedy: | Check the bus configuration:<br>- Slave configuration |

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|---|---|
| **A1901** | **PROFIBUS: Parameteriz. telegram faulted** |
| Cause: | A PROFIBUS master is attempting to set up a connection using an incorrect configuration telegram. |

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|---|---|
| Alarm value (r2124): | 10: Impermissible length of an optional parameterization block<br>11: Impermissible ID of an optional parameterization block<br>20: Duplicate parameterization block for isochronous operation<br>21: Errored parameterization block for isochronous operation<br>22: Errored parameterization bits for isochronous operation |
| Remedy: | Check the bus configuration:<br>- Bus addresses<br>- Slave configuration |

**A1902** **PROFIBUS: Parameterizing telegram not permitted**

| | |
|---|---|
| Cause: | - |
| Alarm value (r2124): | 0: Bus cycle time Tdp < 1 ms<br>1: Bus cycle time Tdp > 32 ms<br>2: Bus cycle time Tdp is not a whole multiple of the current control clock cycle.<br>3: Time of actual value recording Ti > Bus cycle time Tdp<br>4: Time of actual value recording Ti is not a whole multiple of the current control clock cycle.<br>5: Time of setpoint transfer To > Bus cycle time Tdp<br>6: Time of setpoint transfer To is not a whole multiple of the current control clock cycle.<br>7: Master application cycle time Tmapc is not a whole multiple of the speed control clock cycle.<br>8: Bus reserve bus cycle time Tdp - data exchange time Tdx less than two current controller clock cycles.<br>9: Bus cycle time Tdp changed compared to first connection setup. |
| Remedy: | - Adapt parameterizing telegram.<br>- Adapt current or speed control clock cycle. |

**F1910** **PROFIBUS: Setp. Timeout**

| | |
|---|---|
| Reaction: | OFF1 |
| Cause: | The receipt of setpoints from the PROFIBUS interface is interrupted because the bus connection is interrupted or the PROFIBUS master is switched off or in the STOP state. |
| Remedy: | Restore the bus link and set the PROFIBUS master to RUN. |
| Acknowl.: | Immediate |

**F1911** **PROFIBUS: Clock synchronous clock failure**

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|---|---|
| Reaction: | OFF1 |
| Cause: | The global control telegram for synchronizing the clock cycles has failed in cyclic mode for several DP clock cycles or has violated the specified time grid specified in the parameterization telegram over several consecutive DP clock cycles (see bus cycle times Tdp and Tpllw). |
| Remedy: | - Check PROFIBUS cable and plug-in connections.<br>- Check whether the communication interruption is short-term or permanent.<br>- Check bus or master. for overload (e. g. bus cycle time Tdp set too short). |
| Acknowl.: | Immediate |

**F1912** **PROFIBUS: clock synchronous sign of life**

| | |
|---|---|
| Reaction: | OFF1 |
| Cause: | The maximum permissible number of sign-of-life failures on the master (isochronous PROFIBUS) has been exceeded in cyclic operation. |
| Remedy: | - Correct the connection of the master sign of life (p2045).<br>- Check whether the signal of life is being transmitted correctly by the master.<br>- Check the permissible failure rate of telegrams (p0925).<br>- Check bus or master for. for overload (e. g. bus cycle time Tdp set too short). |
| Acknowl.: | Immediate |

**F1920** **PROFIBUS: Interruption in cyclic link**

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|---|---|
| Reaction: | OFF1 |
| Cause: | The cyclic link to the PROFIBUS master is interrupted. |
| Remedy: | Set up the PROFIBUS link and activate PROFIBUS master in cyclic mode. |
| Acknowl.: | Immediate |

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|---|---|
| **A1921** | **PROFIBUS: Clock cycle synchronization** |
| Cause: | Output data of PROFIBUS master (setpoints) received at wrong time within the PROFIBUS clock cycle. |
| Remedy: | Check the bus configuration:<br>- Parameter for clock cycle synchronization: Ensure that time for setpoint acceptance To > Data Exchange time Tdx |
| **A1930** | **PROFIBUS: Current controller clock cycle not identical** |
| Cause: | Current controller clock cycle of all drives must be set identically for clock-synchronous PROFIBUS. |
| Alarm value (r2124): | Number of drive object with different current controller clock cycle. |
| Remedy: | - Set current controller clock cycles to identical values (p0115[0]).<br>See also: p0115 |
| **A1931** | **PROFIBUS: Speed controller clock cycle not clock-synchronous** |
| Cause: | Speed controller clock cycle of all drives for clock synchronous PROFIBUS must be set identically. |
| Alarm value (r2124): | Number of the drive object with different speed controller clock cycle. |
| Remedy: | - Set speed controller clock cycles to identical value (p0115[1]).<br>See also: p0115 |
| **A1940** | **PROFIBUS: Clock synchronism not achieved** |
| Cause: | The PROFIBUS is in the Data Exchange state and isochronous operation has been selected via the parameterizing telegram. Synchronization to the clock cycle specified by the master and to the master sign-of-life was not possible.<br>- Master does not send global control telegram although isochronous mode was selected via bus configuration.<br>- Master uses a different isochronous DP clock cycle than transferred to the slave in the parameterization telegram.<br>- Master does not increment its sign-of-life (CTW2 Bit 12-15) in the configured time frame Tmapc. |
| Remedy: | - Check master application and bus configuration.<br>- Check consistency between clock cycle input for slave configuration and clock cycle setting at the master.<br>If the bus clock cycle Tdp is not equal to master application cycle time Tmapc:<br>- Correct interconnection of the master sign of life (p2045).<br>- Check whether the sign of life was sent correctly by the master. |
| **A1941** | **PROFIBUS: Clock cycle signal missing for bus setup** |
| Cause: | The PROFIBUS is in the Data Exchange state and isochronous operation has been selected via the parameterizing telegram. The global control telegram for synchronization is not being received. |
| Remedy: | Check master application and bus configuration. |
| **A1943** | **PROFIBUS: Clock cycle faulted during bus setup** |
| Cause: | The PROFIBUS is in the Data Exchange state and isochronous operation has been selected via the parameterizing telegram. The global control telegram for synchronism is received irregularly.<br>- The master sends an irregular global control telegram.<br>- The master uses a different isochronous DP clock cycle than the one transferred to the slave in the parameterization telegram. |
| Remedy: | - Check master application and bus configuration.<br>- Check consistency of the clock cycle entered for the slave configuration and the clock cycle setting at the master. |
| **F1950** | **PROFIBUS: Synchronization clock-synchronous mode failed** |
| Reaction: | OFF1 |

| | |
|---|---|
| Cause: | Synchronization of the internal clock cycle with the global control telegram has failed. The internal clock cycle exhibits an unexpected shift. |
| Remedy: | Siemens-internal |
| Acknowl.: | Immediate |

| **A2000** | **Function generator: Start not possible** |
|---|---|
| Cause: | The function generator has already been started. |
| Remedy: | Stop and, if necessary, restart the function generator.<br>See also: p4800 |

| **A2005** | **Function generator: Specified drive does not exist** |
|---|---|
| Cause: | The drive object specified for connection does not exist. |
| Remedy: | Use an existing drive object with the appropriate number.<br>See also: p4815 |

| **A2006** | **Function generator: No drive specified for connection** |
|---|---|
| Cause: | No drive specified for connection in p4815.<br>See also: p4815 |
| Remedy: | At least one drive must be specified for connection in p4815.<br>See also: p4815 |

| **A2007** | **Function generator: Drive for connection is not a servo drive** |
|---|---|
| Cause: | The drive object specified for connection is not a SERVO.<br>See also: p4815 |
| Remedy: | Use a SERVO drive object with the appropriate number. |

| **A2010** | **Function generator: Speed setpoint of a drive not equal to zero** |
|---|---|
| Cause: | The speed setpoint of a drive specified for connection is greater than the value set via p1226 for zero speed detection. |
| Alarm value (r2124): | Number of the affected drive object. |
| Remedy: | Set the speed setpoints of all drives specified for connection to zero. |

| **A2011** | **Function generator: Speed value of a drive not equal to zero** |
|---|---|
| Cause: | The actual speed value of a drive specified for connection is greater than the value set via p1226 for zero speed detection. |
| Alarm value (r2124): | Number of the affected drive object. |
| Remedy: | Before you start the function generator, set the drive speed to zero. |

| **A2020** | **Function generator: Parameter cannot be changed** |
|---|---|
| Cause: | No configuration parameter may be changed when the function generator is active (p4800=1).<br>See also: p4810, p4812, p4813, p4815, p4820, p4821, p4822, p4823, p4824, p4825, p4826, p4827, p4828, p4829 |
| Remedy: | - Stop the function generator before parameterization (p4800 = 0).<br>- If necessary, start the function generator (p4800 = 1).<br>See also: p4800 |

| **A2025** | **Function generator: Period too short** |
|---|---|
| Cause: | The value for the pulse duration is too small.<br>See also: p4821 |
| Remedy: | Check and adapt the value for the period.<br>See also: p4821 |

| **A2026** | **Function generator: Pulse width too long** |
|---|---|
| Cause: | The set pulse width is too long.<br>See also: p4821, p4822 |
| Remedy: | The pulse width must be shorter than the period. Reduce the pulse width.<br>See also: p4822 |

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|---|---|
| **A2030** | **Function generator: Physical address equals zero** |
| Cause: | The specified physical address has the value zero.<br>See also: p4812 |
| Remedy: | Set the physical address to a different value than zero.<br>See also: p4812 |
| **A2040** | **Function generator: Impermissible value for offset** |
| Cause: | Offset value greater than upper limit or less than the lower limit.<br>See also: p4826 |
| Remedy: | Change the offset accordingly.<br>See also: p4826, p4828, p4829 |
| **A2041** | **Function generator: Impermissible value for bandwidth** |
| Cause: | The set bandwidth is either too small or too large.<br>See also: p4823 |
| Remedy: | Check value for bandwidth and adapt if necessary.<br>See also: p4823 |
| **A2045** | **Function generator: Inconsistent limit values** |
| Cause: | The values for the upper and lower limits are inconsistent.<br>The value for the lower limit must always be less than the value for the upper limit.<br>See also: p4828, p4829 |
| Remedy: | Check the limit values and adjust if necessary.<br>See also: p4828, p4829 |
| **A2050** | **Trace: Unable to start** |
| Cause: | Trace already started.<br>See also: p4700 |
| Remedy: | Stop and, if necessary, restart the trace. |
| **A2055** | **Trace: Trace duration too short** |
| Cause: | The value for the trace duration is too short. Minimum length = twice the value of the trace cycle.<br>See also: p4720, p4721 |
| Remedy: | Check the value for the trace duration and adjust if necessary. |
| **A2056** | **Trace: Trace cycle too small** |
| Cause: | The selected trace cycle is less than the set basic clock cycle 0 (p0110[0]).<br>See also: p0110, p4720 |
| Remedy: | Increase the value for the trace cycle. |
| **A2060** | **Trace: Signal to be traced is missing** |
| Cause: | - You have not specified a signal to be traced.<br>- The specified signals are not valid.<br>See also: p4730, p4731, p4732, p4733 |
| Remedy: | - Specify a signal to be traced (p4730 ... p4733).<br>- Check whether the relevant signal can be traced. |
| **A2061** | **Trace: Invalid signal** |
| Cause: | The selected signal is invalid. Possible causes:<br>- Specified signal does not exist<br>- Specified signal cannot be traced.<br>See also: p4730, p4731, p4732, p4733 |
| Remedy: | - Specify a signal to be traced (p4730 ... p4733).<br>- Check whether the signal can be traced. |
| **A2062** | **Trace: Trigger signal invalid** |

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|---|---|
| Cause: | The selected trigger signal is invalid. Possible causes:<br>- No trigger signal specified (required only if p4710 not equal to 1)<br>- Specified signal does not exist<br>- Specified signal cannot be used as a trigger signal for the trace.<br>See also: p4711 |
| Remedy: | Specify a valid trigger signal (p4711).<br>See also: p4711 |

| **A2063** | **Trace: Invalid data type** |
|---|---|
| Cause: | The data type specified for signal selection via the physical address is invalid.<br>See also: p4711, p4730, p4731, p4732, p4733 |
| Remedy: | Use a valid data type. |

| **A2070** | **Trace: Parameter cannot be changed** |
|---|---|
| Cause: | When the trace is active (p4700 = 1), you cannot change its parameters.<br>See also: p4700, p4710, p4711, p4712, p4713, p4714, p4715, p4716, p4720, p4721, p4722, p4730, p4731, p4732, p4733, p4755, p4780, p4781, p4782, p4783, p4789 |
| Remedy: | - Stop the trace before parameterization (p4800 = 0).<br>- If necessary, start the trace (p4700 = 1). |

| **A2075** | **Trace: Pretrigger time too long** |
|---|---|
| Cause: | The set pretrigger time must be smaller than the trace duration.<br>See also: p4721, p4722 |
| Remedy: | Check the pretrigger time and adjust if necessary. |

| **A2099** | **Trace: Out of memory** |
|---|---|
| Cause: | The remaining memory on the control unit is not sufficient for the trace function.<br>Note:<br>The available memory on the control unit can be read via r4795.<br>The memory requirement of the trace is displayed in r4708. |
| Remedy: | Reduce memory requirement as follows:<br>- Reduce the trace duration<br>- Increase the trace clock cycle<br>- Reduce the number of signals to be traced<br>See also: r4708, r4799 |

| **F3500** | **TM: Initialization** |
|---|---|
| Reaction: | OFF2 |
| Cause: | An internal software error occurred while initializing the TM, the CU terminals, or the TB30. |
| Fault value (r0949): | The thousands digit = 1... 3<br>Ones, tens and hundreds places indicate the component ID of the affected TM. |
| Remedy: | Switch the power supply to the CU off and on again. Check DRIVE-CLiQ connection. The TM should be connected directly to a DRIVE-CLiQ port at the CU. If the error recurs, replace the TM module. |
| Acknowl.: | Immediate |

| **F3505** | **TM: Analog Input Wire Break** |
|---|---|
| Reaction: | OFF2 |
| Cause: | Input current of analog input of TM has exceeded the threshold parameterized in p4061[x].<br>This fault can only occur if p4056[x] = 3 (4... 20mA with monitoring).<br>Index x = 0: analog input 0 (X522.1 to .3)<br>Index x = 1: analog input 1 (X522.4 to .5) |
| Fault value (r0949): | The ones, tens and hundreds places indicate the component ID (r0151) of the affected TM.<br>The thousands place indicates the affected analog input : 0: analog input 0 (AI0), 1: analog input 1 (AI1) |
| Remedy: | Check connection to signal source for interruptions. Check level of induced current (infeed signal may be too low). Ensure that the input has a load resistance of 250Ohm. The input current measured by the TM can be output in r4052[x]. |
| Acknowl.: | Immediate |

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|---|---|
| **F3590** | **TM: Module not ready** |
| Reaction: | OFF2 |
| Cause: | The affected terminal module is not sending a ready signal or valid cyclic data. |
| Fault value (r0949): | Drive object number |
| Remedy: | - Check the 24 V supply.<br>- Check the DRIVE CliQ connection. |
| Acknowl.: | Immediately |
| **A5000** | **Power section: Overtemperature heatsink** |
| Cause: | Warning threshold for overtemperature on inverter heatsink has been reached. The reaction is set in p0290. |
| Remedy: | Check the following points:<br>- Does the ambient temperature lie within the defined limits?<br>- Are the load conditions and the duty cycle configured correctly?<br>- Has the cooling failed? |
| **A5001** | **Power section: Overtemperature Chip** |
| Cause: | Warning threshold for overtemperature of power semiconductors of inverter has been reached. The reaction is set in p0290. |
| Remedy: | Check the following points:<br>- Does the ambient temperature lie within the defined limits?<br>- Are the load conditions and the duty cycle configured correctly?<br>- Has the cooling failed?<br>- Pulse frequency too high? |
| **A5002** | **Power section: Overtemperature Intake air** |
| Cause: | Warning threshold for inlet air overtemperature has been reached. The reaction is set in p0290. |
| Remedy: | Check the following points:<br>- Does the ambient temperature lie within the defined limits?<br>- Has the cooling failed? |
| **A5003** | **Power section: Overtemperature Electronic module** |
| Cause: | Warning threshold for overtemperature of Ebox has been reached. The reaction is set in p0290. |
| Remedy: | Check the following points:<br>- Does the ambient temperature lie within the defined limits?<br>- Has the cooling failed? |
| **A5004** | **Power section: Over temperature DC converter** |
| Cause: | Warning threshold for rectifier overtemperature has been reached. The reaction is set in p0290. |
| Remedy: | Check the following points:<br>- Does the ambient temperature lie within the defined limits?<br>- Are the load conditions and the duty cycle configured correctly?<br>- Has the cooling failed?<br>- Line phase failure?<br>- Branch of input DC converter defective? |
| **F7011** | **Drive: Motor Overtemperature** |
| Reaction: | OFF2 |
| Cause: | Motor temperature has reached the fault threshold parameterized in (p0605).<br>- Motor is overloaded.<br>- Motor ambient temperature too high. |
| Remedy: | - Reduce motor load.<br>- Check ambient temperature. |
| Acknowl.: | Immediate |

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|---|---|
| **A7015** | **Drive: Motor temperature sensor** |
| Cause: | Temperature sensor error due to wire break, short-circuit or sensor not connected. The model value is applied for monitoring the temperature of asynchronous motors. Temperature monitoring deactivated for synchronous machines. |
| Remedy: | - Check sensor for correct connection.<br>- Check parameterization (p0600). |
| **F7016** | **Drive: Motor temperature sensor error** |
| Reaction: | OFF2 |
| Cause: | Temperature sensor error occurred while evaluating the temperature sensor specified in p0600.<br>Possible causes: wire break, short-circuit, sensor not properly connected. |
| Remedy: | - Check sensor for correct connection.<br>- Check parameterization (p0600). |
| Acknowl.: | Immediate |
| **F7080** | **Drive: Open-loop/closed-loop control parameterization error** |
| Reaction: | NONE |
| Cause: | Closed-loop control parameters have been parameterized incorrectly (e. B. p0350 = Rstator = 0).<br>See also: p0300, p0311, p0341, p0344, p0350, p0354, p0356, p0358, p0360, p0400, p0640, p1082, p1300 |
| Fault value (r0949): | Fault value contains the affected parameter number. |
| Remedy: | Modify parameter indicates in fault value (r0949) (e. g. p0640 = current limit > 0).<br>See also: p0311, p0341, p0344, p0350, p0354, p0356, p0358, p0360, p0400, p0640, p1082 |
| Acknowl.: | Immediate |
| **F7085** | **Drive: Open-loop/closed-loop control parameters modified** |
| Reaction: | NONE |
| Cause: | Forced modification of open-loop/closed-loop control parameters, since they have exceeded the dynamic limits of other parameters.<br>See also: p0640, p1082, p1300, p1800 |
| Fault value (r0949): | Fault value contains the number of the modified parameter. |
| Remedy: | You do not need to change the parameters again as they have already been correctly limited. |
| Acknowl.: | Immediate |
| **F7090** | **Drive: Upper torque limit less than lower torque limit** |
| Reaction: | OFF2 |
| Cause: | The upper torque limit is less than the lower torque limit. |
| Remedy: | If you connect parameter P1 to p1522 and parameter P2 to p1523, you must make sure that P1 >= P2. |
| Acknowl.: | Immediate |
| **F7100** | **Drive: Sampling times cannot be reset** |
| Reaction: | NONE |
| Cause: | The sampling times in p0111, p0112, p0115 cannot be reset at the same time as the drive parameters (p0971).<br>See also: p0110 |
| Remedy: | Continue working with the set sampling times or reset the basic clock cycle p0110.0 to its original value before you reset the drive parameters.<br>See also: p0110 |
| Acknowl.: | Immediate |
| **F7110** | **Drive: Sampling times are not congruent with the basic clock** |
| Reaction: | NONE |

Cause: The parameterized sampling times are not congruent with the basic clock cycle.
See also: p0110, p0111, p0115
Remedy: Enter sampling times as integral of basic clock cycle. Note which basic clock cycle is selected in p0111. Furthermore, the sampling times in p0115 can only be changed manually in the sampling times preset 'Expert' (p0112).
See also: p0110, p0111, p0112, p0115
Acknowl.: Immediate

**A7200 Drive: Master control ON/OFF1 command present**

Cause: The ON/OFF1 command is not 0, either via binector input p0840 (current CDS) or in control word p3982 bit 0.
Remedy: The signal at binector input p0840 (current CDS) as well as p3982 bit 0 must be 0.

**F7220 Drive: PLC control removed during operation**

Reaction: OFF1
Cause: PLC control signal removed during operation.
- Interconnection of binector input for PLC control wrong (p0854).
- Superimposed control has removed the PLC control signal during operation.
- Field bus connector (master drive) withdrawn during operation.
- If this drive is to continue to run after removal of PLC control , the error reaction should be parameterized to no reaction.

Remedy:
- Check interconnection of binector input for PLC control (p0854).
- Check signal PLC control and activate if necessary.
- Check field bus connector (master drive).
- If this drive is to continue to run after removal of PLC control , the error reaction should be parameterized to no reaction.

Acknowl.: Immediate

**F7300 Drive: Main contactor no checkback**

Reaction: OFF2
Cause:
- Unable to activate the main contactor within the time parameterized in p0861.
- Unable to deactivate the main contactor within the time parameterized in .
- Main contactor closed during operation.
- Main contactor activated although converter is deactivated.

Remedy:
- Check setting of p0860.
- Check feedback loop of main contactor.
- Increase monitoring time in p0861.

Acknowl.: Immediate

**F7320 Drive: Automatic restart aborted**

Reaction: OFF2
Cause:
- The specified number of restart attempts (p1211) has been used up since the alarms could not be acknowledged within the waiting time defined by p1212 and p1213.. On each start, the number of restart attempts (p1211) is decremented.
- No active ON command present.
- If p1210 = 2, the start attempt is aborted because at least one alarm is present.
- If p1210 = 3 or 4, the start attempt is aborted because at least one alarm is present following activation of the electronics.
- The monitoring time of the power section (p0857) has expired.
- Restart is not possible after incorrect motor identification.

Remedy:
- Increase number of restart attempts (p1211). The current number of restart attempts is displayed in r1214.
- Increase the waiting time in p1212 and/or in p1213.
- Apply an ON command (p0840).
- Increase the monitoring time of the power section in p0857 or deactivate.

Acknowl.: Immediate

**A7350 Drive: Probe terminal parameterized as digital output**

Cause: Probe is connected to a bidirectional digital input/output and the terminal is set as output.

| | |
|---|---|
| Alarm value (r2124): | 9: DI/DO 9 (X122.8)<br>10: DI/DO 10 (X122.10)<br>11: DI/DO 11 (X122.11)<br>13: DI/DO 13 (X132.8)<br>14: DI/DO 14 (X132.10)<br>15: DI/DO 15 (X132.11) |
| Remedy: | - Set terminal as input (p0728).<br>- Deselect probe (p0488, p0489). |

**A7400** **Drive:: DC link voltage maximum controller active**

Cause: DC-link voltage controller has been activated because the voltage has exceeded the upper activation threshold (r1242).
Ramp down times are increased automatically to keep the DC link voltage (r0026) within the permissible limit. Control deviation between set and actual speed. The output of the RFG is therefore set to the actual speed on deactivation of the DC link voltage controller.
See also: p1240

Remedy: none

**A7401** **Drive: DC link voltage maximum controller deactivated**

Cause: The Vdc max controller could not hold the DC Link voltage (r0026) below the limit (r1242) and was therefore deactivated.
- Line voltage is permanently higher than specified for the power section.
- Motor is permanently in regenerative mode (driven by a load).

Remedy:
- Check whether the input voltage lies inside the permissible range.
- Check whether the load cycle and load limits lie inside the permissible ranges.

**A7402** **Drive: Link minimum controller active**

Cause: The DC-link voltage controller has been activated because the voltage has dropped below the lower activation limit (r1246). The motor's kinetic energy is used to buffer the DC link. This decelerates the drive.
See also: p1240

Remedy: Warning disappears when power supply returns.

**F7410** **Drive: Current controller output limited**

Reaction: OFF2

Cause:
- Motor not corrected or motor contactor open.
- No DC link voltage present.
- Motor module defective.

Remedy:
- Connect motor or check motor contactor.
- Check DC link voltage (r0070).
- Check motor module.

Acknowl.: Immediate

**F7411** **Drive: Flux controller output limited**

Reaction: OFF2

Cause: Unable to achieve specified flux setpoint, although 90 % of maximum current is specified.
- Wrong motor data.
- Motor data and motor switching mode (star/delta) do not match.
- Current limit set too low for motor.
- Motor module too small.

Remedy:
- Correct motor data.
- Check switching mode of motor.
- Correct current limits (p0640, p0323).
- If necessary, use a larger motor module.

Acknowl.: Immediate

**F7420** **Drive: Current setpoint filter natural frequency > Shannon frequency**

Reaction: NONE

| | |
|---|---|
| Cause: | One of the filter natural frequencies is higher than the Shannon frequency. The Shannon frequency is calculated according to the following formula: 0.5 / p0115[0]. |
| Fault value (r0949): | Bit 0: Filter 1 (p1658, p1660)<br>Bit 1: Filter 2 (p1663, p1665)<br>Bit 2: Filter 3 (p1668, p1670)<br>Bit 3: Filter 4 (p1673, p1675) |
| Remedy: | - Reduce the numerator or denominator natural frequency of affected current setpoint filter.<br>- Reduce current controller sampling time (p0115[0]).<br>- Deactivate affected filter (p1656). |
| Acknowl.: | Immediate |

**F7421 Drive: Speed setpoint filter natural frequency > Shannon frequency**

| | |
|---|---|
| Reaction: | NONE |
| Cause: | One of the filter natural frequencies is higher than the Shannon frequency. The Shannon frequency is calculated according to the following formula: 0.5 / p0115[1]. |
| Fault value (r0949): | Bit 0: Filter 1 (p1417, p1419)<br>Bit 1: Filter 2 (p1423, p1425) |
| Remedy: | - Reduce the numerator or denominator natural frequency of the affected speed setpoint filter.<br>- Reduce the speed controller sampling time (p0115[1]).<br>- Deactivate the affected filter (p1414). |
| Acknowl.: | Immediate |

**F7422 Drive: Speed controller reference module natural frequency > Shannon frequency**

| | |
|---|---|
| Reaction: | NONE |
| Cause: | The filter natural frequency of the PT2 element for the reference model (p1433) is higher than the Shannon frequency. The Shannon frequency is calculated according to the following formula: 0.5 / p0115[0]. |
| Remedy: | - Reduce natural frequency of PT2 element for reference model (p1433).<br>- Reduce speed control sampling time (p0115[1]). |
| Acknowl.: | Immediate |

**F7430 Drive: Converter cannot switch to torque-controlled operation**

| | |
|---|---|
| Reaction: | NONE |
| Cause: | When operating in sensorless mode, the converter cannot switch to torque-controlled operation (BI: p1501). |
| Remedy: | Do not attempt to switch to torque-controlled operation. |
| Acknowl.: | Immediate |

**F7500 Drive: Power section data set PDS not configured**

| | |
|---|---|
| Reaction: | NONE |
| Cause: | For closed-loop I/RF only:<br>Power section dataset not parameterized, i.e. no data set number entered in the associated drive data set. |
| Fault value (r0949): | Drive data set number of p0185 |
| Remedy: | The index of the power section data set associated with the drive data set must be entered in p0185.<br>See also: p0185 |
| Acknowl.: | Immediate |

**F7501 Drive: Motor data set MDS not configured**

| | |
|---|---|
| Reaction: | NONE |
| Cause: | For power sections only:<br>The motor data set has not been configured, e. g. no data set number entered in the associated drive data set. |
| Fault value (r0949): | Fault value contains the drive data set number of p0186. |
| Remedy: | The index of the motor data set associated with the drive data set must be entered in p0186. |

| | |
|---|---|
| Acknowl.: | Immediate |
| **F7800** | **Drive: No power section present** |
| Reaction: | NONE |
| Cause: | The power section parameters cannot be read or no parameters are stored in the power section.<br>See also: r0200 |
| Remedy: | Connect data line to power section and restart control unit (POWER ON). |
| Acknowl.: | Immediate |
| **F7801** | **Drive: Power section Overcurrent** |
| Reaction: | OFF2 |
| Cause: | Permissible motor limit current exceeded.<br>- Effective current limit set too low.<br>- Current controller not set correctly.<br>- Motor decelerated with stall torque factor set too high.<br>- V/f mode: Start-up ramp set too low or load to high.<br>- V/f mode: Short-circuit in motor cable or ground fault<br>- V/f mode: Motor current does not match motor module current. |
| Remedy: | - Check current limits (p0323, p0640).<br>- Check current controller (p1715, p1717).<br>- Reduce stall torque correction factor (p0326).<br>- Reduce start-up ramp (p1318) or reduce load.<br>- Check motor and motor cable for short-circuits and ground fault.<br>- Check motor module and motor combination. |
| Acknowl.: | Immediate |
| **F7802** | **Drive: Infeed or power section not ready** |
| Reaction: | OFF2 |
| Cause: | Infeed or drive signals not ready after internal ON command.<br>- Monitoring time too short.<br>- DC link voltage not present.<br>- Associated infeed or drive of component signaling the fault is defective. |
| Remedy: | - Increase monitoring time (p0857).<br>- Provide DC link voltage. Check the DC-link busbar. Enable infeed module.<br>- Replace associated infeed or drive of component signaling the fault. |
| Acknowl.: | Immediate |
| **A7805** | **Drive: Power section I2T overload** |
| Cause: | Warning threshold for I2t overload (p0294) exceeded.<br>The reaction is set in p0290 is initiated.<br>See also: p0290 |
| Remedy: | - Reduce permanent load.<br>- Adapt duty cycle.<br>- Check assignment of rated currents for motor and motor modules. |
| **F7810** | **Drive: Power section EEPROM without rated data** |
| Reaction: | NONE |
| Cause: | No rated data are stored in the power section EEPROM.<br>See also: p0205, r0206, r0207, r0208, r0209 |
| Remedy: | Replace power section or inform Siemens Customer Service. |
| Acknowl.: | Immediate |
| **F7815** | **Drive: Power section has been changed** |
| Reaction: | NONE |
| Cause: | Code number of the current power sections does not match the stored number.<br>See also: r0200, p0201 |
| Fault value (r0949): | Number of the incorrect parameter. |

| | |
|---|---|
| Remedy: | Connect the original power section and activate the control unit again (POWER ON) or set p0201 = r0200 and initiate commissioning with p0010 = 0.<br>If the new power section is accepted, the current limit p0640 can be reduced by means of a lower maximum power section current (r0209) (torque limits are retained).<br>If the motor is replaced in addition to the power section, the motor must be re-commissioned (e.g. via p0010=1).<br>See also: r0200 |
| Acknowl.: | Immediate |

| **F7820** | **Drive: Temperature sensor not connected** |
|---|---|
| Reaction: | OFF2 |
| Cause: | Temperature sensor specified in p600 for motor temperature monitoring is not available. |
| Remedy: | Connect temperature sensor or activate a different temperature sensor according to p600. |
| Acknowl.: | Immediate |

| **F7840** | **Drive: Infeed not ready** |
|---|---|
| Reaction: | OFF2 |
| Cause: | No ready signal present for infeed although enable signals for drive available for some time.<br>- Infeed not ready or not enabled.<br>- Wrong interconnection of binector input for ready signal (p0864). |
| Remedy: | - Enable infeed.<br>- Check the interconnection of the binector input for the ready signal (p0864).<br>- Increase monitoring time (p0857).<br>See also: p0857 |
| Acknowl.: | Immediate |

| **F7841** | **Drive: Infeed signal Ready in operation canceled** |
|---|---|
| Reaction: | OFF2 |
| Cause: | Infeed has canceled the ready signal during operation.<br>- Wrong interconnection of binector input for ready signal (p0864).<br>- The enable signals for the infeed had been deactivated.<br>- Infeed removes the ready signal on account of an error.<br>- If this drive is to be used to generate support for the DC link, the error reaction should be set to no reaction if the motor module is to continue to operate. |
| Remedy: | - Check interconnection of binector input for ready signal for infeed (p0864).<br>- Check enable signals for infeed and activate if necessary.<br>- Correct fault in infeed and acknowledge message.<br>- If this drive is to be used to generate support for the DC link, the error reaction should be set to no reaction if the drive is to continue to operate when the DC link voltage breaks down. |
| Acknowl.: | Immediate |

| **A7850** | **External warning 1** |
|---|---|
| Cause: | BICO signal external warning triggered. This condition for this external warning is met.<br>See also: p2112 |
| Remedy: | Eliminate the causes of this warning. |

| **A7851** | **External warning 2** |
|---|---|
| Cause: | BICO signal external warning triggered. This condition for this external warning is met.<br>See also: p2116 |
| Remedy: | Eliminate the causes of this warning. |

| **A7852** | **External warning 3** |
|---|---|
| Cause: | BICO signal external warning triggered. This condition for this external warning is met.<br>See also: p2117 |
| Remedy: | Eliminate the causes of this warning. |

| **F7860** | **External fault 1** |
|---|---|
| Reaction: | OFF2 |

| | |
|---|---|
| Cause: | BICO signal external fault triggered.<br>See also: p2106 |
| Remedy: | Eliminate the causes of this fault. |
| Acknowl.: | Immediate |

**F7861** **External fault 2**

| | |
|---|---|
| Reaction: | OFF2 |
| Cause: | BICO signal external fault triggered.<br>See also: p2107 |
| Remedy: | Eliminate the causes of this fault. |
| Acknowl.: | Immediate |

**F7862** **External fault 3**

| | |
|---|---|
| Reaction: | OFF2 |
| Cause: | BICO signal external fault triggered.<br>See also: p2108 |
| Remedy: | Eliminate the causes of this fault. |
| Acknowl.: | Immediate |

**F7900** **Drive: Motor blocked**

| | |
|---|---|
| Reaction: | OFF2 |
| Cause: | Motor operates longer at the torque limit than the time specified in p2177 and below the speed threshold set in p2175. |
| Remedy: | - Check free rotation of motor.<br>- Check torque limit: r1538 for positive direction of rotation, r1539 for negative direction of rotation.<br>- Check setting parameters p2175 and p2177 and correct if necessary. |
| Acknowl.: | Immediate |

**F7901** **Drive: Motor overspeed**

| | |
|---|---|
| Reaction: | OFF2 |
| Cause: | The maximum permissible positive or negative speed has been exceeded.<br>The maximum permissible positive speed is calculated as follows: Minimum(p1082, CI:p1085) + p2162. The maximum permissible negative speed is calculated as follows: Maximum(-p1082, CI:1088) - p2162. |
| Remedy: | In positive direction:<br>-r1084 check and if nec. correct p1082, CI: p1085 and p2162.<br>In negative direction:<br>-r1087 check and if nec. correct p1082, CI: p1088 and p2162. |
| Acknowl.: | Immediate |

**A7910** **Drive: Motor Overtemperature**

| | |
|---|---|
| Cause: | Motor temperature has exceeded the alarm threshold parameterized in p0604.<br>The reaction set in p0610 is initiated:<br>See also: p0610 |
| Alarm value (r2124): | 1: No output current reduction.<br>2: Output current reduction active. |
| Remedy: | - Check motor load.<br>- Check motor ambient temperature. |

**F7950** **Drive: Motor parameter defective**

| | |
|---|---|
| Reaction: | NONE |
| Cause: | Wrong motor parameters have been entered during commissioning, e. g. p0300 = Motor type = 0 = No motor.<br>See also: p0300, p0301, p0304, p0305, p0307, p0310, p0311, p0314, p0316, p0320, p0322, p0323 |
| Fault value (r0949): | Fault value contains affected parameter number. |

| | |
|---|---|
| Remedy: | Compare motor data with type plate data and correct if necessary.<br>See also: p0300, p0301, p0304, p0305, p0307, p0310, p0311, p0314, p0316, p0320, p0322, p0323, p0323 |
| Acknowl.: | Immediate |

| **F7990** | **Drive: Motor data identification** |
|---|---|
| Reaction: | OFF2 |
| Cause: | An error has occurred during the identification run. |
| Fault value (r0949): | 1: Current limit reached.<br>2: Identified stator resistance outside range 0.1% to 100% of Zn.<br>3: Identified rotor resistance outside range 0.1% to 100% of Zn.<br>4: Identified stator reactance outside range 50% to 500% of Zn.<br>5: Identified main reactance outside range 50% to 500% of Zn.<br>6: Identified rotor time constant outside range 10ms to 5s.<br>7: Identified total leakage reactance outside range 5% to 50% of Zn.<br>8: Identified stator leakage reactance outside range 25% to 250% of Zn.<br>9: Identified rotor leakage reactance outside range 25% to 250% of Zn.<br>10: Motor is defective or not connected.<br>20: Identified threshold voltage outside range 0.5V to 10V.<br>30: Current controller in voltage limitation.<br>40: At least one identification contains errors. The identified parameters are not saved to prevent inconsistencies.<br>50: Pulse frequency cannot be implemented with the set current controller sampling rate.<br>The percentages are referred to the rated impedance of the motors:<br>Zn = Vmot.nom / sqrt(3) / Imot,nom |
| Remedy: | Fault value 0: Check whether the motor is connected correctly. Check connection type (star-delta).<br>Fault value 1-40: Check whether motor data are entered correctly in P0300, P0304 - P0311. Is the ratio between the power of the motor and the converter appropriate? The ratio between converter current and motor current should not be less than 0.5 and not greater than 4. Check connection type (star/delta).<br>Fault value 50: Reduce current controller sampling rate. |
| Acknowl.: | Immediate |

| **A7991** | **Drive: Motor data identification activated** |
|---|---|
| Cause: | Motor data identification activated. Motor identification is performed with the next ON command.<br>See also: p1910 |
| Remedy: | Warning disappears after motor identification has been successfully completed.<br>See also: p1910 |

| **F30001** | **Power section: Overcurrent** |
|---|---|
| Reaction: | OFF2 |
| Cause: | Power section has detected an overcurrent.<br>- Control incorrectly parameterized.<br>- Motor short-circuit or ground fault.<br>- V/f mode: Ramp-up set too low.<br>- V/f mode: Rated current of motor much higher that that of motor module<br>- Power line not properly connected.<br>- Power lines exceed maximum permissible length.<br>- Power section defective. |
| Fault value (r0949): | Bit 0: Phase R<br>Bit 1: Phase S<br>Bit 2: Phase T |

Remedy: - Check motor data, perform commissioning if necessary.
- Check motor switching mode (star/delta)
- V/f mode: Increase ramp-up.
- V/f mode: Check assignment of rated currents for motor and motor modules.
- Check power line connections.
- Check power lines for short-circuit or ground fault.
- Check length of power lines.
- Replace power section.

Acknowl.: Immediate

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**F30002** **Power section: DC link Overvoltage**

Reaction: OFF2

Cause: Power section has detected overvoltage in DC link.
- Motor returns too much energy.
- Line voltage too high.

Remedy: - Increase feedback time.
- Activate DC link voltage controller.
- Use braking resistor or Active Line Module.
- Activate DC link voltage controller.
- Increase current limit for infeed or use larger module (for Active Line Module).
- Check line voltage.

See also: p0210, p1240

Acknowl.: Immediate

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**F30003** **Power section: DC link Undervoltage**

Reaction: OFF2

Cause: Power section has detected undervoltage in DC link.
- Line failure.
- Line voltage below permissible value.

Remedy: Check line voltage

See also: p0210

Acknowl.: Immediate

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**F30004** **Power section: Overtemperature Heatsink AC converter**

Reaction: OFF2

Cause: Power section temperature at heatsink of AC converter has exceeded permissible limit.
- Insufficient ventilation, fan failure.
- Overload.
- Ambient temperature too high.
- Pulse frequency too high.

Remedy: - Check that fan is running.
- Check fan mats.
- Check that ambient temperature lies within permissible range.
- Check motor load.
- Reduce pulse frequency if higher than rated pulse frequency.

Caution:
This fault cannot be acknowledged until the value is below the warning threshold for warning A5000.

See also: p1800

Acknowl.: Immediate

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**F30005** **Power section: Overload I2T**

Reaction: OFF2

Cause: Power section overloaded.
- Permissible rated current of power section exceeded permanently.
- Permissible duty cycle not observed.

| | |
|---|---|
| Remedy: | - Reduce permanent load.<br>- Adapt duty cycle.<br>- Check rated currents of motor and power section.<br>See also: r0036, r0206, p0307 |
| Acknowl.: | Immediate |

| **F30011** | **Power section: Line phase failure detected** |
|---|---|
| Reaction: | OFF1 |
| Cause: | Line phase failure detected by power section.<br>- Fuse in main power circuit. |
| Remedy: | Check fuses in main power circuit. |
| Acknowl.: | Immediate |

| **F30012** | **Power section: Temperature sensor Heatsink Wirebreak** |
|---|---|
| Reaction: | OFF2 |
| Cause: | The connection to one of the heatsink temperature sensors in the power section is interrupted.<br>See also: r0949 |
| Fault value (r0949): | Bit0: Module duct (electronic module)<br>Bit1: Intake air<br>Bit2: AC converter 1<br>Bit3: AC converter 2<br>Bit4: AC converter 3<br>Bit5: AC converter 4<br>Bit6: AC converter 5<br>Bit7: AC converter 6<br>Bit8: DC converter 1<br>Bit9: DC converter 2 |
| Remedy: | Contact the manufacturer. |
| Acknowl.: | Immediate |

| **F30013** | **Power section: Temperature sensor Heatsink Short-circuit** |
|---|---|
| Reaction: | OFF2 |
| Cause: | The heat sink temperature sensor in the motor module is shorted. |
| Fault value (r0949): | Bit0: Module duct (electronic module)<br>Bit1: Intake air<br>Bit2: AC converter 1<br>Bit3: AC converter 2<br>Bit4: AC converter 3<br>Bit5: AC converter 4<br>Bit6: AC converter 5<br>Bit7: AC converter 6<br>Bit8: DC converter 1<br>Bit9: DC converter 2 |
| Remedy: | Contact the manufacturer. |
| Acknowl.: | Immediate |

| **F30017** | **Power section: Hardware current limit tripped too may times** |
|---|---|
| Reaction: | OFF2 |
| Cause: | The hardware current limit in the various phases (see A30031, A30032, A30033) has tripped too many times. The maximum permissible number of trips depends on the power section type.<br>- Control incorrectly parameterized.<br>- Fault in motor or in power lines.<br>- Power lines exceed maximum permissible length.<br>- Motor load too high.<br>- Power section defective. |

| | |
|---|---|
| Remedy: | - Check motor data.<br>- Check motor switching mode (star/delta)<br>- Check motor load.<br>- Check power line connections.<br>- Check power lines for short-circuit or ground fault.<br>- Check length of power lines.<br>- Replace power section |
| Acknowl.: | Immediate |

**F30021** **Power section: Ground fault**

| | |
|---|---|
| Reaction: | OFF2 |
| Cause: | Power section has detected a ground fault.<br>- Ground fault in power lines.<br>- Winding fault or ground fault. Ground fault at motor<br>- Current converter defective. |
| Remedy: | - Check power line connections.<br>- Check motor.<br>- Check current converter. |
| Acknowl.: | Immediate |

**F30022** **Power section: Monitoring U_ce**

| | |
|---|---|
| Reaction: | OFF2 |
| Cause: | Monitoring of the collector-emitter voltage (Uce) triggered in power section of the semiconductor.<br>- Short-circuit on the motor module output.<br>- Defective semiconductor in power section<br>See also: r0949 |
| Fault value (r0949): | Bit0: Phase R<br>Bit1: Phase S<br>Bit2: Phase T<br>Bit3: Phototransmitter enable defective<br>Bit4: Uce checksum error signal interrupted |
| Remedy: | - Check power line connections.<br>- Select defective semiconductor and replace. |
| Acknowl.: | POWER ON |

**F30025** **Power section: Overtemp. Chip**

| | |
|---|---|
| Reaction: | OFF2 |
| Cause: | Chip Temperature of semiconductor has exceed permissible limit.<br>- Permissible duty cycle not observed.<br>- Insufficient ventilation, fan failure.<br>- Overload.<br>- Ambient temperature too high.<br>- Pulse frequency too high |
| Remedy: | - Adapt duty cycle.<br>- Check that fan is running.<br>- Check fan mats<br>- Check that ambient temperature lies within permissible range<br>- Check motor load<br>- Reduce pulse frequency if higher than rated pulse frequency |
| Acknowl.: | Immediate |

**F30027** **Power section: Precharging DC link Monitoring**

| | |
|---|---|
| Reaction: | OFF2 |

| | |
|---|---|
| Cause: | Unable to precharge DC link of power section within the expected time.<br>- Power supply too low.<br>- Defective line phase.<br>- Short-circuit or ground fault in DC link.<br>- Precharging circuit defective.<br>See also: p0210 |
| Remedy: | - Check line voltage.<br>- Check line connection.<br>See also: p0210 |
| Acknowled.: | Immediate |

| **F30029** | **Power section: Motor/line filter Temperature sensor Wire break** |
|---|---|
| Reaction: | NONE |
| Cause: | Connection between power section and motor/line filter temperature sensor is interrupted. |
| Remedy: | Check temperature sensor for correct connection. |
| Acknowl.: | Immediate |

| **F30030** | **Power section: Motor/line filter temperature sensor short-circuit** |
|---|---|
| Reaction: | NONE |
| Cause: | Power section motor/line filter short- circuit in temperature sensor. |
| Remedy: | Check temperature sensor for correct connection. |
| Acknowl.: | Immediate |

| **A30031** | **Power section: Hardware current limit tripped in phase R** |
|---|---|
| Cause: | Current in Phase R has reached permissible current limit of power section. Pulsing is blocked for one pulse period.<br>- Control incorrectly parameterized.<br>- Fault in motor or in power lines.<br>- Power lines exceed maximum permissible length.<br>- Motor load too high.<br>- Power section defective. |
| Remedy: | - Check motor data.<br>- Check motor switching mode (star/delta)<br>- Check motor load.<br>- Check power line connections.<br>- Check power lines for short-circuit or ground fault.<br>- Check the length of the power lines. |

| **A30032** | **Power section: Hardware current limit tripped in phase S** |
|---|---|
| Cause: | Current in Phase S has reached permissible current limit of power section. Pulsing is blocked for one pulse period.<br>- Control incorrectly parameterized.<br>- Fault in motor or in power lines.<br>- Power lines exceed maximum permissible length.<br>- Motor load too high.<br>- Power section defective. |
| Remedy: | - Check motor data.<br>- Check motor switching mode (star/delta)<br>- Check motor load.<br>- Check power line connections.<br>- Check power lines for short-circuit or ground fault.<br>- Check length of power lines. |

**A30033** **Power section: Hardware current limit tripped in phase T**

| | |
|---|---|
| Cause: | Current in phase T has reached permissible current limit for power section. Pulsing is blocked for one pulse period.<br>- Control incorrectly parameterized.<br>- Fault in motor or in power lines.<br>- Power lines exceed maximum permissible length.<br>- Motor load too high.<br>- Power section defective. |
| Remedy: | - Check motor data.<br>- Check motor switching mode (star/delta)<br>- Check motor load.<br>- Check power line connections.<br>- Check power lines for short-circuit or ground fault.<br>- Check length of power lines. |

**F30035** **Power section: Overtemperature Intake air**

| | |
|---|---|
| Reaction: | OFF2 |
| Cause: | Power section air-intake temperature has exceeded the permissible limit.<br>- Ambient temperature too high.<br>- Insufficient ventilation, fan failure |
| Remedy: | - Check that fan is running.<br>- Check fan mats.<br>- Check that ambient temperature lies within permissible range.<br>Caution:<br>This fault cannot be acknowledged until the value is below the warning threshold for warning A5002. |
| Acknowl.: | Immediate |

**F30036** **Power section: Overtemperature Electronic module**

| | |
|---|---|
| Reaction: | OFF2 |
| Cause: | Power section Temperature in module duct of converter has exceeded permissible limit.<br>- Insufficient ventilation, fan failure.<br>- Overload.<br>- Ambient temperature too high. |
| Remedy: | - Check that fan is running.<br>- Check fan mats.<br>- Check that ambient temperature lies within permissible range.<br>Caution:<br>This fault cannot be acknowledged until the value is below the warning threshold for warning A5003. |
| Acknowl.: | Immediate |

**F30037** **Power section: Overtemperature DC converter**

| | |
|---|---|
| Reaction: | OFF2 |
| Cause: | Power section DC converter temperature has exceeded permissible limit.<br>- Insufficient ventilation, fan failure.<br>- Overload.<br>- Ambient temperature too high.<br>- Line phase failure |
| Remedy: | - Check that fan is running.<br>- Check fan mats.<br>- Check that ambient temperature lies within permissible range.<br>- Check motor load.<br>- Check line phases.<br>Caution:<br>This fault cannot be acknowledged until the value is below the warning threshold for warning A5004. |
| Acknowl.: | Immediate |

**F30040** **Power section undervoltage 24V**

| | |
|---|---|
| Reaction: | OFF2 |
| Cause: | Failure in 24V power supply for power section.<br>- Below the 16 V threshold for longer than 3 ms. |
| Remedy: | Check 24V DC voltage of power section. |
| Acknowl.: | POWER ON |

**F30801 Power section DRIVE-CLiQ: Sign of life missing**

| | |
|---|---|
| Reaction: | OFF2 |
| Cause: | DRIVE-CLiQ communication between control unit and affected power section defective. |
| Remedy: | - Check cabinet design and cabling for EMC conformity.<br>- Replace affected component.<br>See also: p9916 |
| Acknowl.: | Immediate |

**F30805 Power section: Checksum EPROM not correct**

| | |
|---|---|
| Reaction: | OFF2 |
| Cause: | Internal parameter data damaged |
| Remedy: | Replace module |
| Acknowl.: | Immediate |

**F30808 Power section: Power ON required**

| | |
|---|---|
| Reaction: | OFF2 |
| Cause: | When a project is downloaded to a drive that has been put into operation, the power must be switched on. |
| Remedy: | POWER ON for all components (switch off/on). |
| Acknowl.: | POWER ON |

**F30820 - F30825 Power section DRIVE-CLiQ: Telegram faulted**

| | |
|---|---|
| Reaction: | OFF2 |
| Cause: | DRIVE-CLiQ communication between control unit and affected power section defective. |
| Remedy: | - Check cabinet design and cabling for EMC conformity.<br>- Replace affected component.<br>See also: p9916 |
| Acknowl.: | Immediate |

**F30826 F30827 Power section DRIVE-CLiQ: fault in cyclic data transfer**

| | |
|---|---|
| Reaction: | OFF2 |
| Cause: | DRIVE-CLiQ communication between control unit and affected power section defective. |
| Remedy: | - Check firmware states of affected components.<br>- Replace Control Unit. |
| Acknowl.: | Immediate |

**F30828 Power section DRIVE-CLiQ: Receive ALARM bit**

| | |
|---|---|
| Reaction: | OFF2 |
| Cause: | DRIVE-CLiQ communication between control unit and affected power section defective. |
| Remedy: | Replace affected component. |
| Acknowl.: | Immediate |

**F30829 F30830 Power section DRIVE-CLiQ: fault in cyclic data transfer**

| | |
|---|---|
| Reaction: | OFF2 |
| Cause: | DRIVE-CLiQ communication between control unit and affected power section defective. |
| Remedy: | - Check firmware states of affected components.<br>- Replace affected component.<br>See also: p9916 |
| Acknowl.: | Immediate |

**F30831 Power section DRIVE-CLiQ: Telegram faulted**

| | |
|---|---|
| Reaction: | OFF2 |
| Cause: | DRIVE-CLiQ communication between control unit and affected power section defective. |
| Remedy: | Replace affected component. |
| Acknowl.: | Immediate |

**F30832** **Power section DRIVE-CLiQ: Telegram failure**

| | |
|---|---|
| Reaction: | OFF2 |
| Cause: | DRIVE-CLiQ communication between control unit and affected power section defective. |
| Remedy: | - Check for break in DRIVE-CLiQ or faulty contacts in connector.<br>- Check 24 V supply of affected component.<br>- Replace affected component.<br>See also: p9916 |
| Acknowl.: | Immediate |

**F30833** **Power section DRIVE-CLiQ: fault in cyclic data transfer**

| | |
|---|---|
| Reaction: | OFF2 |
| Cause: | DRIVE-CLiQ communication between control unit and affected power section defective. |
| Remedy: | - Check firmware states of affected components.<br>- Replace affected component. |
| Acknowl.: | Immediate |

**F30834** **Power section DRIVE-CLiQ: Hardware defect**

| | |
|---|---|
| Reaction: | OFF2 |
| Cause: | DRIVE-CLiQ communication between control unit and affected power section defective. |
| Remedy: | Replace affected component. |
| Acknowl.: | Immediate |

**F30835**
**F30836** **Power section DRIVE-CLiQ: fault in cyclic data transfer**

| | |
|---|---|
| Reaction: | OFF2 |
| Cause: | DRIVE-CLiQ communication between control unit and affected power section defective. |
| Remedy: | - Check firmware states of affected components.<br>- Replace affected component. |
| Acknowl.: | Immediate |

**F30837**
**F30838** **Power section DRIVE-CLiQ: Hardware defect**

| | |
|---|---|
| Reaction: | OFF2 |
| Cause: | DRIVE-CLiQ communication between control unit and affected power section defective. |
| Remedy: | Replace affected component. |
| Acknowl.: | Immediate |

**F30860 -**
**F30871** **CU DRIVE-CLiQ: Data transfer faulted / Telegram faulted**

| | |
|---|---|
| Reaction: | OFF2 |
| Cause: | DRIVE-CLiQ communication between control unit and at least one other component is defective. |
| Fault value (r0949): | Bit 0 - 7: Number of the affected component<br>Bit 8 - 31: Reserved |
| Remedy: | - Check cabinet design and cabling for EMC conformity.<br>- Replace affected component. |
| Acknowl.: | Immediate |

**F30872**
**F30873** **CU DRIVE-CLiQ: fault in cyclic data transfer**

| | |
|---|---|
| Reaction: | OFF2 |
| Cause: | Reserved for later use. |
| Remedy: | Reserved for later use. |
| Acknowl.: | Immediate |

| | |
|---|---|
| **F30874** | **CU DRIVE-CLiQ: Data transfer faulted** |
| Reaction: | OFF2 |
| Cause: | DRIVE-CLiQ communication between control unit and at least one other component is defective. |
| Fault value (r0949): | Bit 0 - 7: Number of the affected component<br>Bit 8 - 31: Reserved |
| Remedy: | Replace affected component. |
| Acknowl.: | Immediate |
| **F30875** | **CU DRIVE-CLiQ: Receive ALARM bit** |
| Reaction: | OFF2 |
| Cause: | DRIVE-CLiQ communication between control unit and at least one other component is defective. |
| Fault value (r0949): | Bit 0 - 7: Number of the affected component<br>Bit 8 - 31: Reserved |
| Remedy: | Replace affected component. |
| Acknowl.: | Immediate |
| **F30876 - F30879** | **CU DRIVE-CLiQ: fault in cyclic data transfer** |
| Reaction: | OFF2 |
| Cause: | DRIVE-CLiQ communication between control unit and at least one other component is defective. |
| Fault value (r0949): | Bit 0 - 7: Number of the affected component<br>Bit 8 - 31: Reserved |
| Remedy: | - Check cabinet design and cabling for EMC conformity.<br>- Replace affected component. |
| Acknowl.: | Immediate |
| **F30880** | **CU DRIVE-CLiQ: Telegram faulted** |
| Reaction: | OFF2 |
| Cause: | DRIVE-CLiQ communication between control unit and at least one other component is defective. |
| Fault value (r0949): | Bit 0 - 7: Number of the affected component<br>Bit 8 - 31: Reserved |
| Remedy: | Replace affected component. |
| Acknowl.: | Immediate |
| **F30881** | **CU DRIVE-CLiQ: Telegram failure** |
| Reaction: | OFF2 |
| Cause: | DRIVE-CLiQ communication between control unit and at least one other component is defective. |
| Fault value (r0949): | Bit 0 - 7: Number of the affected component<br>Bit 8 - 31: Reserved |
| Remedy: | - Check for break in DRIVE-CLiQ or faulty contacts in connector.<br>- Check 24 V supply of affected component.<br>- Replace affected component. |
| Acknowl.: | Immediate |
| **F30882** | **CU DRIVE-CLiQ: fault in cyclic data transfer** |
| Reaction: | OFF2 |
| Cause: | DRIVE-CLiQ communication between control unit and at least one other component is defective. |
| Fault value (r0949): | Bit 0 - 7: Number of the affected component<br>Bit 8 - 31: Reserved |
| Remedy: | - Check firmware states of affected components.<br>- Replace affected component. |
| Acknowl.: | Immediate |

| | |
|---|---|
| **F30883** | **CU DRIVE-CLiQ: Hardware defect** |
| Reaction: | OFF2 |
| Cause: | DRIVE-CLiQ communication between control unit and at least one other component is defective. |
| Fault value (r0949): | Bit 0 - 7: Number of the affected component<br>Bit 8 - 31: Reserved |
| Remedy: | - Replace Control Unit. |
| Acknowl.: | Immediate |
| **F30884** | **CU DRIVE-CLiQ: Redundancy link error** |
| Reaction: | OFF2 |
| Cause: | Reserved for later use. |
| Remedy: | Reserved for later use. |
| Acknowl.: | Immediate |
| **F30885** | **CU DRIVE-CLiQ: fault in cyclic data transfer** |
| Reaction: | OFF2 |
| Cause: | DRIVE-CLiQ communication between control unit and at least one other component is defective. |
| Fault value (r0949): | Bit 0 - 7: Number of the affected component<br>Bit 8 - 31: Reserved |
| Remedy: | - Check firmware states of affected components.<br>- Replace affected component. |
| Acknowl.: | Immediate |
| **F30886** | **CU DRIVE-CLiQ: Data transfer faulted** |
| Reaction: | OFF2 |
| Cause: | DRIVE-CLiQ communication between control unit and at least one other component is defective. |
| Fault value (r0949): | Bit 0 - 7: Number of the affected component<br>Bit 8 - 31: Reserved |
| Remedy: | - Check firmware states of affected components.<br>- Replace affected component. |
| Acknowl.: | Immediate |
| **F30887**<br>**F30888** | **CU DRIVE-CLiQ: Hardware defect** |
| Reaction: | OFF2 |
| Cause: | DRIVE-CLiQ communication between control unit and at least one other component is defective. |
| Fault value (r0949): | Bit 0 - 7: Number of the affected component<br>Bit 8 - 31: Reserved |
| Remedy: | Replace Control Unit. |
| Acknowl.: | Immediate |
| **F30889** | **CU DRIVE-CLiQ: Data transfer faulted** |
| Reaction: | OFF2 |
| Cause: | DRIVE-CLiQ communication between control unit and at least one other component is defective. |
| Fault value (r0949): | Bit 0 - 7: Number of the affected component<br>Bit 8 - 31: Reserved |
| Remedy: | - Check for break in DRIVE-CLiQ or faulty contacts in connector.<br>- Check 24 V supply of affected component.<br>- Replace affected component. |
| Acknowl.: | Immediate |
| **F30890** | **CU DRIVE-CLiQ: Connection setup** |
| Reaction: | OFF2 |

| | |
|---|---|
| Cause: | DRIVE-CLiQ communication between control unit and at least one other component is defective. |
| Fault value (r0949): | Bit 0 - 7: Number of the affected component<br>Bit 8 - 31: Reserved |
| Remedy: | - Check for break in DRIVE-CLiQ or faulty contacts in connector.<br>- Check 24 V supply of affected component.<br>- Replace affected component. |
| Acknowl.: | Immediate |

**F30891 CU DRIVE-CLiQ: Transition to cyclic mode**

| | |
|---|---|
| Reaction: | OFF2 |
| Cause: | DRIVE-CLiQ communication between control unit and at least one other component is defective. |
| Fault value (r0949): | Bit 0 - 7: Number of the affected component<br>Bit 8 - 31: Reserved |
| Remedy: | - Check firmware states of affected components.<br>- Replace affected component. |
| Acknowl.: | Immediate |

**F30899 Power section: unknown fault**

| | |
|---|---|
| Reaction: | NONE |
| Cause: | Version Sensor module does not match |
| Remedy: | Upgrade drive |
| Acknowl.: | Immediate |

**A30920 Power section: Temperature sensor error**

| | |
|---|---|
| Cause: | An error has occurred while evaluating the temperature sensor. |
| Alarm value (r2124): | 1: Wire break or sensor not connected.<br>2: Short-circuit has occurred.<br>3: Measured resistance lies below permissible evaluation range.<br>4: No sensor selected.<br>5: Internal buffer does not contain the required number of stored values.<br>6: Negative difference voltage measured. |
| Remedy: | - Check sensor connection.<br>- Replace sensor. |

**A35200 TM: Calibration data**

| | |
|---|---|
| Cause: | Error detected in calibration data of TM. |
| Alarm value (r2124): | The hundred thousands and ten thousands places specify the component ID of the TMxx at which the error occurred.<br>The thousands place specifies whether an analog input (==0) or analog output (==1) is affected.<br>The hundreds place specifies the error type:<br>0 == No calibration data stored<br>1 == Offset too large (> 100 mV)<br>The tens and units places specify the number of the affected input. |
| Remedy: | Switch the unit off and on again. If the fault persists, replace the module. |

**F35207 TM: Temperature threshold exceeded**

| | |
|---|---|
| Reaction: | OFF2 |
| Cause: | The temperature measured (r4105) during TM temperature measurement has exceeded the threshold that triggers this fault (p4402[1]). Note that this fault can only be triggered when temperature evaluation is active (p4100 = 2 for KTY sensor or p4100 = 1 for PTC sensor)<br>Warning:<br>Note that fault F35207 only causes the drive to be switched off if at least one BICO interconnection exists between the drive and TM31. |
| Fault value (r0949): | The hundred thousands and ten thousands places indicate the component ID of the TMxx at which the error occurred. |
| Remedy: | Cool off temperature sensor. |

| | |
|---|---|
| Acknowl.: | Immediate |
| **A35208** | **TM: Temperature input short circuit** |
| Cause: | The resistance measured for the temperature sensor is too low (R_Sensor <= 30 Ohm). The inputs for the temperature sensor on the TM31 (X522.7, X522.8) may be shorted. |
| Alarm value (r2124): | The hundred thousands and ten thousands places indicate the component ID of the TMxx where the error occurred. |
| Remedy: | Check the cable connection between the temperature sensor and the terminals of the TM for shorting or insulation faults. Check the temperature sensor. You can read the measured sensor resistance in r4101. |
| **A35209** | **TM: KTY resistance below permissible range** |
| Cause: | The measured resistance for the temperature sensor is outside the permissible range. This error message is generated when the sensor resistance drops below 340 ohms (corresponding to -40 degrees C for a KTY84-130). |
| Alarm value (r2124): | The hundred thousands and ten thousands places indicate the component ID of the TMxx at which the error occurred. |
| Remedy: | Check whether the supply cables from terminals X522.7 and X522.8 to the temperature sensor are interrupted. Check whether the sensor temperature has dropped to below -40 degrees C. Check whether the temperature sensor is working correctly. |
| **A35210** | **TM: KTY resistance above permissible range** |
| Cause: | The measured sensor resistance is above the permissible range. This error message is triggered if the measured sensor resistance exceeds 1630 ohms (corresponding to a temperature of 180 degrees C for a KTY84-130). |
| Alarm value (r2124): | The hundred thousands and ten thousands places indicate the component ID of the TMxx at which the error occurred. |
| Remedy: | Check whether the supply cables from terminals X522.7 and X522.8 to the temperature sensor are interrupted. Check whether the sensor temperature has exceeded 180 degrees C. Check whether the temperature sensor is working correctly. |
| **A35211** | **TM: Temperature threshold exceeded** |
| Cause: | The temperature measured (r4105) during TM temperature measurement has exceeded the threshold that triggers this warning (p4402[0]). |
| Alarm value (r2124): | The hundred thousands and ten thousands places indicate the component ID of the TMxx at which the error occurred. |
| Remedy: | Cool off temperature sensor. |
| **F35800** | **TM: Group alarm** |
| Reaction: | OFF2 |
| Cause: | The terminal module has detected at least one error. |
| Remedy: | Assesses other current messages. |
| Acknowl.: | Immediate |
| **A35801** | **TM DRIVE-CLiQ: Sign of life missing** |
| Cause: | There is a DRIVE-CLiQ communication error between the control unit and the affected terminal module. |
| Remedy: | Check DRIVE-CLiQ connection.<br>- Replace TM. |
| **A35802** | **TM: Time slice overflow** |
| Cause: | Time slice overflow on TM |
| Remedy: | Replace TM. |
| **A35803** | **TM: Memory test** |
| Cause: | An error occurred during the RAM test on the TM. |
| Remedy: | Check whether the permissible ambient temperature has been observed for the TM.<br>Replace TM. |
| **A35804** | **TM: CRC** |

Cause: Checksum error encountered while reading out program memory on TM.
Remedy: - Check whether the permissible ambient temperature has been observed for the TM .
- Replace TM.

**A35805 TM: Checksum EPROM not correct**

Cause: Internal parameter data corrupted.
Remedy: - Check whether the permissible ambient temperature has been observed for the module.
- Replace module.

**A35806 TM: Initialization**

Cause: An error occurred on the TM during initialization.
Remedy: none

**A35807 TM: Process control Watchdog**

Cause: Error timeout Process control on TM
Remedy: Replace TM.

**F35820 - F35825 TM DRIVE-CLiQ: Telegram faulted**

Reaction: OFF2
Cause: There is a DRIVE-CLiQ communication error between the control unit and the affected terminal module.
Remedy: - Check cabinet design and cabling for EMC conformity.
- Replace affected component.
See also: p9916
Acknowl.: Immediate

**F35826 F35827 TM DRIVE-CLiQ: fault in cyclic data transfer**

Reaction: OFF2
Cause: There is a DRIVE-CLiQ communication error between the control unit and the affected terminal module.
Remedy: - Check firmware states of affected components.
- Replace Control Unit.
Acknowl.: Immediate

**F35828 TM DRIVE-CLiQ: Receive ALARM bit**

Reaction: OFF2
Cause: There is a DRIVE-CLiQ communication error between the control unit and the affected terminal module.
Remedy: Replace affected component.
Acknowl.: Immediate

**F35829 F35830 TM DRIVE-CLiQ: Fault in cyclic data transfer**

Reaction: OFF2
Cause: There is a DRIVE-CLiQ communication error between the control unit and the affected terminal module.
Remedy: - Check firmware states of affected components.
- Replace affected component.
See also: p9916
Acknowl.: Immediate

**F35831 TM DRIVE-CLiQ: Telegram faulted**

Reaction: OFF2
Cause: There is a DRIVE-CLiQ communication error between the control unit and the affected terminal module.
Remedy: Replace affected component.
Acknowl.: Immediate

| | |
|---|---|
| **F35832** | **TM DRIVE-CLiQ: Telegram failure** |
| Reaction: | OFF2 |
| Cause: | There is a DRIVE-CLiQ communication error between the control unit and the affected terminal module. |
| Remedy: | - Check for break in DRIVE-CLiQ or faulty contacts in connector.<br>- Check 24 V supply of affected component.<br>- Replace affected component.<br>See also: p9916 |
| Acknowl.: | Immediate |
| **F35833** | **TM DRIVE-CLiQ: fault in cyclic data transfer** |
| Reaction: | OFF2 |
| Cause: | There is a DRIVE-CLiQ communication error between the control unit and the affected terminal module. |
| Remedy: | - Check firmware states of affected components.<br>- Replace affected component. |
| Acknowl.: | Immediate |
| **F35834** | **TM DRIVE-CLiQ: Hardware defect** |
| Reaction: | OFF2 |
| Cause: | There is a DRIVE-CLiQ communication error between the control unit and the affected terminal module. |
| Remedy: | Replace affected component. |
| Acknowl.: | Immediate |
| **F35835**<br>**F35836** | **TM DRIVE-CLiQ: fault in cyclic data transfer** |
| Reaction: | OFF2 |
| Cause: | There is a DRIVE-CLiQ communication error between the control unit and the affected terminal module. |
| Remedy: | - Check firmware states of affected components.<br>- Replace affected component. |
| Acknowl.: | Immediate |
| **F35837**<br>**F35838** | **TM DRIVE-CLiQ: Hardware defect** |
| Reaction: | OFF2 |
| Cause: | There is a DRIVE-CLiQ communication error between the control unit and the affected terminal module. |
| Remedy: | Replace affected component. |
| Acknowl.: | Immediate |
| **F35860 - F35871** | **CU DRIVE-CLiQ: Data transfer faulted / Telegram faulted** |
| Reaction: | OFF2 |
| Cause: | DRIVE-CLiQ communication between control unit and at least one other component is defective. |
| Fault value (r0949): | Bit 0 - 7: Number of the affected component<br>Bit 8 - 31: Reserved |
| Remedy: | - Check cabinet design and cabling for EMC conformity.<br>- Replace affected component. |
| Acknowl.: | Immediate |
| **F35872**<br>**F35873** | **CU DRIVE-CLiQ: fault in cyclic data transfer** |
| Reaction: | OFF2 |
| Cause: | Reserved for later use. |
| Remedy: | Reserved for later use. |
| Acknowl.: | Immediate |

| | |
|---|---|
| **F35874** | **CU DRIVE-CLiQ: Data transfer faulted** |
| Reaction: | OFF2 |
| Cause: | DRIVE-CLiQ communication between control unit and at least one other component is defective. |
| Fault value (r0949): | Bit 0 - 7: Number of the affected component<br>Bit 8 - 31: Reserved |
| Remedy: | Replace affected component. |
| Acknowl.: | Immediate |
| **F35875** | **CU DRIVE-CLiQ: Receive ALARM bit** |
| Reaction: | OFF2 |
| Cause: | DRIVE-CLiQ communication between control unit and at least one other component is defective. |
| Fault value (r0949): | Bit 0 - 7: Number of the affected component<br>Bit 8 - 31: Reserved |
| Remedy: | Replace affected component. |
| Acknowl.: | Immediate |
| **F35876 - F35879** | **CU DRIVE-CLiQ: fault in cyclic data transfer** |
| Reaction: | OFF2 |
| Cause: | DRIVE-CLiQ communication between control unit and at least one other component is defective. |
| Fault value (r0949): | Bit 0 - 7: Number of the affected component<br>Bit 8 - 31: Reserved |
| Remedy: | - Check cabinet design and cabling for EMC conformity.<br>- Replace affected component. |
| Acknowl.: | Immediate |
| **F35880** | **CU DRIVE-CLiQ: Telegram faulted** |
| Reaction: | OFF2 |
| Cause: | DRIVE-CLiQ communication between control unit and at least one other component is defective. |
| Fault value (r0949): | Bit 0 - 7: Number of the affected component<br>Bit 8 - 31: Reserved |
| Remedy: | Replace affected component. |
| Acknowl.: | Immediate |
| **F35881** | **CU DRIVE-CLiQ: Telegram failure** |
| Reaction: | OFF2 |
| Cause: | DRIVE-CLiQ communication between control unit and at least one other component is defective. |
| Fault value (r0949): | Bit 0 - 7: Number of the affected component<br>Bit 8 - 31: Reserved |
| Remedy: | - Check for break in DRIVE-CLiQ or faulty contacts in connector.<br>- Check 24 V supply of affected component.<br>- Replace affected component. |
| Acknowl.: | Immediate |
| **F35882** | **CU DRIVE-CLiQ: fault in cyclic data transfer** |
| Reaction: | OFF2 |
| Cause: | DRIVE-CLiQ communication between control unit and at least one other component is defective. |
| Fault value (r0949): | Bit 0 - 7: Number of the affected component<br>Bit 8 - 31: Reserved |
| Remedy: | - Check firmware states of affected components.<br>- Replace affected component. |
| Acknowl.: | Immediate |

| | |
|---|---|
| **F35883** | **CU DRIVE-CLiQ: Hardware defect** |
| Reaction: | OFF2 |
| Cause: | DRIVE-CLiQ communication between control unit and at least one other component is defective. |
| Fault value (r0949): | Bit 0 - 7: Number of the affected component<br>Bit 8 - 31: Reserved |
| Remedy: | - Replace Control Unit. |
| Acknowl.: | Immediate |
| **F35884** | **CU DRIVE-CLiQ: Redundancy link error** |
| Reaction: | OFF2 |
| Cause: | Reserved for later use. |
| Remedy: | Reserved for later use. |
| Acknowl.: | Immediate |
| **F35885** | **CU DRIVE-CLiQ: fault in cyclic data transfer** |
| Reaction: | OFF2 |
| Cause: | DRIVE-CLiQ communication between control unit and at least one other component is defective. |
| Fault value (r0949): | Bit 0 - 7: Number of the affected component<br>Bit 8 - 31: Reserved |
| Remedy: | - Check firmware states of affected components.<br>- Replace affected component. |
| Acknowl.: | Immediate |
| **F35886** | **CU DRIVE-CLiQ: Data transfer faulted** |
| Reaction: | OFF2 |
| Cause: | DRIVE-CLiQ communication between control unit and at least one other component is defective. |
| Fault value (r0949): | Bit 0 - 7: Number of the affected component<br>Bit 8 - 31: Reserved |
| Remedy: | - Check firmware states of affected components.<br>- Replace affected component. |
| Acknowl.: | Immediate |
| **F35887**<br>**F35888** | **CU DRIVE-CLiQ: Hardware defect** |
| Reaction: | OFF2 |
| Cause: | DRIVE-CLiQ communication between control unit and at least one other component is defective. |
| Fault value (r0949): | Bit 0 - 7: Number of the affected component<br>Bit 8 - 31: Reserved |
| Remedy: | Replace Control Unit. |
| Acknowl.: | Immediate |
| **F35889** | **CU DRIVE-CLiQ: Data transfer faulted** |
| Reaction: | OFF2 |
| Cause: | DRIVE-CLiQ communication between control unit and at least one other component is defective. |
| Fault value (r0949): | Bit 0 - 7: Number of the affected component<br>Bit 8 - 31: Reserved |
| Remedy: | - Check for break in DRIVE-CLiQ or faulty contacts in connector.<br>- Check 24 V supply of affected component.<br>- Replace affected component. |
| Acknowl.: | Immediate |
| **A35890** | **CU DRIVE-CLiQ: Connection setup** |
| Cause: | DRIVE-CLiQ communication between control unit and at least one other component is defective. |

| | |
|---|---|
| Alarm value (r2124): | Bit 0 - 7: Number of the affected component<br>Bit 8 - 31: Reserved |
| Remedy: | - Check for break in DRIVE-CLiQ or faulty contacts in connector.<br>- Check 24 V supply of affected component.<br>- Replace affected component. |

| **F35891** | **CU DRIVE-CLiQ: Transition to cyclic mode** |
|---|---|
| Reaction: | OFF2 |
| Cause: | DRIVE-CLiQ communication between control unit and at least one other component is defective. |
| Fault value (r0949): | Bit 0 - 7: Number of the affected component<br>Bit 8 - 31: Reserved |
| Remedy: | - Check firmware states of affected components.<br>- Replace affected component. |
| Acknowl.: | Immediate |

| **F35899** | **TM: Unknown fault** |
|---|---|
| Reaction: | NONE |
| Cause: | A fault has occurred on the TM for which there is no name in the firmware. This fault may occur when the TM firmware is more recent than the firmware on the CU. |
| Remedy: | Replace TM. If nec. adapt the TM firmware version (r0158) to the firmware version used on the CU. |
| Acknowl.: | Immediate |

| **A35900** | **TM DRIVE-CLiQ: Synchronization** |
|---|---|
| Cause: | TM cannot synchronize to DRIVE-CLiQ. |
| Remedy: | Check DRIVE-CLiQ connections between CU and TM. |

| **A35901** | **TM DRIVE-CLiQ: Communication faulted** |
|---|---|
| Cause: | Signal received by the TM via the DRIVE-CLiQ is of poor quality |
| Remedy: | Check DRIVE-CLiQ connections between CU and TM. |

| **A35903** | **TM: Error I2C bus** |
|---|---|
| Cause: | An error occurred on access via the TM-internal I2C bus. |
| Remedy: | Replace TM. |

| **A35904** | **TM: EEPROM** |
|---|---|
| Cause: | An error occurred while accessing the flash memory of the TM. |
| Remedy: | Replace TM. |

| **A35905** | **TM: Parameter access** |
|---|---|
| Cause: | CU has attempted to write an impermissible parameter value to the TM. |
| Remedy: | Check whether the firmware version of the TM (r0158) matches that of the CU (r0018). Replace. TM. The readme.txt file on the flash card states the matching TM firmware version for a given CU firmware version. |

| **A35920** | **TM: Temperature sensor error** |
|---|---|
| Cause: | An error has occurred while evaluating the temperature sensor. |
| Alarm value (r2124): | 1: Wire break or sensor not connected.<br>2: Short-circuit has occurred.<br>3: Measured resistance lies below permissible evaluation range.<br>4: No sensor selected.<br>5: Internal buffer does not contain the required number of stored values.<br>6: Negative difference voltage measured. |
| Remedy: | - Check sensor connection.<br>- Replace sensor. |

■

# Maintenance and Servicing 11

## 11.1 Chapter Content

This chapter provides information on the following:

- Maintenance and servicing procedures that have to be carried out on a regular basis to ensure the availability of the cabinet unit
- Exchanging device components when the unit is serviced
- Reforming the DC link capacitors
- Upgrading the Cabinet Unit Firmware
- Load the new operator panel firmware and database from the PC.

**DANGER**

Before carrying out any maintenance or repair work on the de-energized cabinet unit, wait for 5 minutes after switching off the supply voltage. This allows the capacitors to discharge to a harmless level (< 25 V) after the supply voltage has been switched off.

Before starting work, you should also measure the voltage after the 5 minutes have elapsed!

## 11.2 Maintenance

The cabinet unit mainly comprises electronic components. Apart from the fan(s), the unit contains very few components that are subject to wear or require maintenance or servicing. Maintenance aims to preserve the specified condition of the cabinet unit. Dirt and contamination must be removed regularly and parts subject to wear replaced.
The following points must generally be observed.

### 11.2.1 Cleaning

#### Dust deposits

Dust deposits inside the cabinet unit must be removed at regular intervals (or at least once a year) by qualified personnel in line with the relevant safety regulations. The cabinet must be cleaned using a brush and vacuum cleaner, and dry compressed air (max. 1 bar) for areas that cannot be easily reached.

#### Ventilation

The ventilation openings in the cabinet must never be obstructed. The fan must be checked to make sure that it is functioning correctly.

#### Cable and Screw Terminals

Cable and screw terminals must be checked regularly to ensure that they are secure in position, and if necessary, retightened. Cabling must be checked for defects. Defective parts must be replaced immediately.

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**NOTE**

The actual intervals at which maintenance procedures are to be performed depend on the installation conditions (cabinet environment) and the operating conditions.

Siemens offers its customers support in the form of a service contract. For further details, contact your regional office or sales office.

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### 11.2.2 Replacing the Filter Mats

The filter mats must be checked at regular intervals. If the mats are too dirty to allow the air supply to flow normally, they must be replaced.

**NOTE**

Not replacing contaminated filter mats can cause premature drive shutdown.

## 11.3 Servicing

Servicing involves activities and procedures for maintaining and restoring the operating condition of the cabinet unit.

### 11.3.1 Replacing the Fan

The service life of the device fans is normally 50,000 hours. The actual service life, however, depends on various factors, such as the ambient temperature and the degree of protection for the cabinet and can, therefore, differ. The fans must be replaced promptly to ensure that the cabinet unit is always available.

#### Removal

1. Unscrew the fastening screws on the fan (3x/ Torx M6)
2. Disconnect the fan cable from the terminal and remove it (2x)
3. Pull out the fan
4. Detach the fan from the fixing bracket by removing the bolts M6 (2x)
5. Remove the fixing bracket

#### Installation

1. Mount the fixing bracket
2. Secure the fan to the fixing bracket by tightening the bolts M6 (2x) to a torque of 10 Nm
3. Push the fan into place
4. Connect the fan cable (2x/ 1.2 Nm)
5. Tighten the fastening screws on the fan (3x/ Torx M6) to a torque of 10 Nm

### 11.3.2 Replacing the Fan Fuses

The order numbers for replacing fan fuses that have blown can be found in the spare parts list.

**WARNING**

Make sure that the cause of the fault is found before the fuse is replaced.

### 11.3.3 Replacing the Fuses for the Auxiliary Power Supply (-F11/-F12)

The order numbers for replacing auxiliary power supply fuses that have blown can be found in the spare parts list in section 8of the documentation folder.

**WARNING**

You must carry out the following:

- First disconnect the auxiliary power supply
- Identify the cause of the fault
- Then replace the fuse.

### 11.3.4 Replacing Fuse -F21

1. Open the cabinet
2. Remove the defective fuse
3. Fit the replacement fuse and close the fuse holder
4. Close the cabinet

The order numbers for replacing fuses that have blown can be found in the spare parts list.

**WARNING**

You must carry out the following:

- First disconnect the auxiliary power supply
- Identify the cause of the fault
- Then replace the fuse.

## 11.3.5 Replacing the Cabinet Operator Panel

1. Open the main circuit-breaker
2. Open the cabinet
3. Disconnect the power supply and communications line on the operator panel
4. Release the fastenings on the operator panel
5. Remove the operator panel
6. Install the new operator panel
7. Carry out any other work by reversing the sequence

## 11.3.6 Replacing the Backup Battery of the Cabinet Operator Panel

Table 11-1 Technical data for the backup battery

| | |
|---|---|
| **Type** | CR2032 3V lithium battery |
| **Manufacturer** | Maxell, Sony, Panasonic |
| **Rated capacity** | 220 mAh |
| **Maximum permissible charging current** | 10 mA (restricted to <2 mA in operator panel) |
| **Self-discharge at 20°C** | 1 %/year |
| **Service life (in backup mode)** | > 1 year at 70°C; >1.5 years at 20 °C |
| **Service life (in operation)** | > 2 years |

### Replacing the Battery

1. Switch off the main circuit-breaker
2. Open the cabinet
3. Disconnect the 24 V DC power supply and communications line on the operator panel
4. Open the cover of the battery compartment
5. Remove the old battery
6. Insert the new battery
7. Close the cover of the battery compartment
8. Reconnect the 24 V DC power supply and communications line
9. Close the cabinet

**WARNING**

To ensure that no data is lost when you replace the battery, you must replace the battery within one minute.


Fig. 11-1 Replacing the backup battery in the cabinet operator panel

## 11.4 Reforming the DC Link Capacitors

### Description

If the cabinet unit is kept in storage for more than 2 years, the DC link capacitors have to be reformed. If this is not carried out, the cabinet may be damaged when the supply voltage is switched on.

If the cabinet is commissioned within two years of its date of manufacture, the DC link capacitors do not need to be reformed. The date of manufacture is indicated in the serial number on the type plate (see "Device Overview").

**NOTE**

It is important that the period of storage is calculated as of the date of manufacture and not as of the delivery date.

### Procedure

The DC link capacitors are reformed by applying the rated voltage without load for at least 30 minutes at room temperature.

- Operation via PROFIBUS (CDS 0):
  - Set bit 3 of control word 1 (operation enable) permanently to "0".
  - Switch on the converter by means of an ON signal (bit 0 of the control word); all the other bits must be set in such a way that the converter can be operated.
  - Once the waiting time has elapsed, switch off the converter and restore the original PROFIBUS setting.
- Operation via the terminal block (CDS 1):
  - Set p0852[1] to "0" (factory setting is "1").
  - Switch on the converter (via digital input 0 on the customer terminal block).
  - Once the waiting time has elapsed, switch off the converter and restore the original setting for p0852[1].

**NOTE**

Reforming cannot be carried out in LOCAL mode via the AOP30.

## 11.5 Upgrading the Cabinet Unit Firmware

When you upgrade the cabinet unit firmware (by installing a new CompactFlash Card with a new firmware version, for example), you may also have to upgrade the firmware for the components in the cabinet unit.

When you implement new firmware on the CompactFlash Card, the firmware for the CU320 is upgraded automatically when you install it and switch it on.

The cabinet unit components (power section and customer terminal block) are supplied with the firmware by means of the procedure described below.

The firmware versions for the individual components can be read in the following parameters:

- r0128 – Firmware version of the power section
- r0158 – Firmware version of the customer terminal block

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**NOTE**

The power supply to the components must not be interrupted while the firmware is being upgraded.

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**CAUTION**

New firmware should only be installed if there is a problem with the cabinet unit.

Problems with the cabinet unit cannot be ruled out after the firmware has been upgraded.

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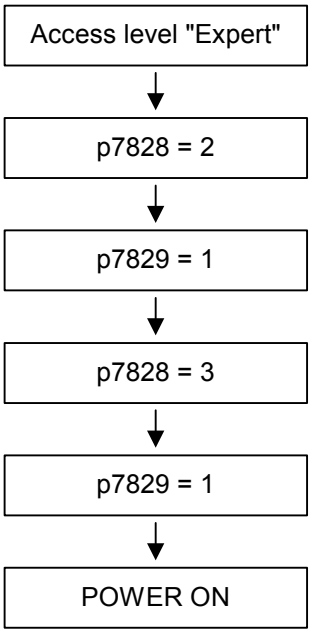
## Upgrading the Firmware for the Cabinet Unit Components




**Set the "Expert" access level on the operator panel**
<Key pushbutton> - <Access level> - Enter the activation code "47"

**Select the node number of the power section**
The node number of the power section is "2".

**Upgrade the firmware**
This process lasts a few minutes. It has been completed successfully when p7829 automatically switches to "0".

**Select the node number of the customer terminal block**
The node number of the customer terminal block (-A60) is "3".

**Upgrade the firmware**
This process lasts a few minutes. It has been completed successfully when p7829 automatically switches to "0".

**POWER ON**
To activate the new firmware, switch the power supply off and then on.

**Fault during the upgrade**
Faults that occur while the firmware is being upgraded are indicated by fault F1005 and a fault value.

Fig. 11-2 Upgrading the cabinet unit firmware

**NOTE**

Once the firmware has been upgraded, the firmware for the operator panel must also be upgraded.

## 11.6 Loading New Operator Panel Firmware and the Database from the PC

### Description

You have to load the database for the operator panel each time you require a language other than that stored in the operator panel, or

if the firmware of the cabinet unit has been upgraded to enhance its functionality or rectify problems.

The load program LOAD_AOP30 and the database files are available on the CD.

### Procedure for Loading the Database

1. Establish the RS232 connection from the PC to the AOP30.
2. Connect the 24 V power supply.
3. Start the LOAD_AOP30 program on the PC.
4. Choose the PC interface (COM1, COM2).
5. Depending on the language you require, choose a file (AOP30_DB.V01.02.12.D.E.BIN, for example) and open it to start loading the database.
6. Once the database has been loaded, "Database loaded" is displayed on the AOP30.
7. Switch the power on (switch the power supply off and then back on).

### Procedure for Loading Firmware and the Database

1. Establish the RS232 connection from the PC to the AOP30.
2. Connect the 24 V power supply.
3. Start the LOAD_AOP30 program on the PC.
4. Choose the PC interface (COM1, COM2).
5. Choose and open the firmware (AOP30.H86).
6. Follow the instructions in the status window of the program and connect the power supply for the AOP30 while pressing the red key (O).
7. The load procedure is started automatically.
8. If a current database has not been loaded, the system switches to the "loading database" screen once the loading procedure has finished.
9. Depending on the language you require, choose a file (AOP30_DB.V01.02.12.D.E.BIN, for example) and open it to start loading the database.
10. Once the database has been loaded, "Database loaded" is displayed on the AOP30.
11. Switch the power on (switch the power supply off and then back on).

## 11.7 Using a Replacement CompactFlash Card

### Description

When you replace a flash card with a new card from Siemens, you have to activate the cabinet settings before carrying out commissioning.

### Procedure

- When you switch the system on for the first time, the message "Configuration?" appears on the operator panel.

  Confirm with "YES" (soft key).
- After initialization, the initial motor commissioning screen is displayed. Before you start commissioning, however, you first have to load the cabinet factory setting.
- Call up the main menu.
- Set the "Expert" access level.
- MENU – Parameterization – All Parameters
- p0009 = 30
- p0976 = 20, 21, or 22
  - 380 V - 480 V, 110 kW - 250 kW: p0976 = 20
  - 380 V - 480 V, 315 kW - 560 kW: p0976 = 21
  - 660 V - 690 V, 75 kW - 800 kW: p0976 = 22
- When the parameter list is displayed again, the basic settings are loaded (ignore any faults).

Switch on the power and start commissioning as normal.

■

# Technical Data

# 12

## 12.1 Chapter Content

This chapter provides information on the following:

- General and specific technical data for the SINAMICS G150 cabinet units
- Information on restrictions that apply when the cabinets are used in unfavorable ambient conditions (derating)

## 12.2 General Data

Table 12-1 General technical data

| | | | |
|---|---|---|---|
| **Electrical data** | | | |
| Power frequency | 47 Hz to 63 Hz | | |
| Output frequency | 0 Hz to 83 Hz | | |
| Power factor<br>Fundamental mode<br>Total | <br>≥ 0.98<br>0.93 to 0.96 | | |
| Converter efficiency | > 98 % | | |
| Switching at input | Once every 3 minutes | | |
| **Mechanical data** | | | |
| Degree of protection | IP 20 (higher degrees of protection up to IP 54 optional) | | |
| Type of cooling | Forced air cooling | | |
| Sound pressure level | ≤ 72 dB(A) at 50 Hz line frequency<br>≤ 75 dB(A) at 60 Hz line frequency | | |
| Shock-hazard protection | BGV A2 | | |
| Cabinet system | Rittal TS 8, doors with double-barb lock | | |
| Paint finish | RAL 7035 (indoor requirements) | | |
| **Compliance with standards** | | | |
| Standards | EN 60 146-1, EN 61 800-2, EN 61 800-3, EN 50 178, EN 60 204-1, EN 60 529 | | |
| CE marking | According to EMC directive No. 89/336/EC and low voltage directive No. 73/23/EC | | |
| Electromagnetic compatibility | RI suppression filter according to EN 55 011, Class A1, available as option (for TN/TT systems) | | |
| RI suppression | According to EMC product standard for variable-speed drives EN 61 800-3 (restricted distribution) | | |
| **Ambient conditions** | | | |
| | Operation | Storage | Transport |
| Ambient temperature | 0 °C to +40 °C<br>Up to + 50 °C with derating | -25 °C to +55 °C | -25 °C to +70 °C<br>Above –40 °C for 24 hours |
| Humidity range (non-condensing)<br>Corresponds to class | 5 % to 95 %<br><br>3K3 to IEC 60 721-3-3 | 5 % to 95 %<br><br>1K4 to IEC 60 721-3-1 | 5 % to 95 % at 40 °C<br><br>2K3 to IEC 60 721-3-2 |
| Site altitude | Up to 2000 m above sea level without derating,<br>> 2000 m above sea level with derating, see Section 12.2.1 | | |
| **Mechanical stability** | | | |
| Vibratory load:<br>Deflection<br><br>Acceleration<br><br>Corresponds to class | <br>0.075 mm at 10 Hz - 58 Hz<br>10 m/s² at > 58 Hz - 200 Hz<br>- | <br>1.5 mm at 5 Hz - 9 Hz<br>5 m/s² at > 9 Hz - 200 Hz<br><br>1M2 to IEC 60 721-3-1 | <br>3.5 mm at 5 Hz - 9 Hz<br>10 m/s² at > 9 Hz - 200 Hz<br><br>2M2 to IEC 60 721-3-2 |
| Shock load:<br>Acceleration<br>Corresponds to class | <br>100 m/s² at 11 ms<br>3M4 to IEC 60 721-3-3 | <br>40 m/s² at 22 ms<br>1M2 to IEC 60 721-3-1 | <br>100 m/s² at 11 ms<br>2M2 to IEC 60 721-3-2 |

## 12.2.1 Derating Data

### Current Derating as a Function of the Site Altitude and Ambient Temperature

If the cabinet units are operated at a site altitude >2000 m above sea level, the maximum permissible output current can be calculated using the following tables. The site altitude and ambient temperature are compensated here. The degree of protection selected for the cabinet units must also be taken into account.

Table 12-2 Current derating as a function of the ambient temperature and site altitude for cabinet units with degree of protection IP20 / IP21 and IP23

| Site altitude above sea level in m | Ambient temperature in °C | | | | | | |
|---|---|---|---|---|---|---|---|
| | 20 | 25 | 30 | 35 | 40 | 45 | 50 |
| 0 to 2000 | 100% | 100% | 100% | 100% | 100% | 95.0% | 90.0% |
| Up to 2500 | | | | | 96.3% | 91.4% | 86.6% |
| Up to 3000 | | | | 96.2% | 92.5% | 87.9% | 83.3% |
| Up to 3500 | | | 96.7% | 92.3% | 88.8% | 84.3% | 79.9% |
| Up to 4000 | | 97.8% | 92.7% | 88.4% | 85.0% | 80.8% | 76.5% |

Table 12-3 Current derating as a function of the ambient temperature and site altitude for cabinet units with degree of protection IP54

| Site altitude above sea level in m | Ambient temperature in °C | | | | | | |
|---|---|---|---|---|---|---|---|
| | 20 | 25 | 30 | 35 | 40 | 45 | 50 |
| 0 to 2000 | 100% | 100% | 98.0% | 93.0% | 90.0% | 85.0% | 81.0% |
| Up to 2500 | | 99.0% | 94.0% | 90.0% | 86.0% | 82.0% | 77.0% |
| Up to 3000 | | 95.0% | 90.0% | 86.0% | 83.0% | 79.0% | 74.0% |
| Up to 3500 | 96.0% | 91.0% | 87.0% | 83.0% | 80.0% | 75.0% | 71.0% |
| Up to 4000 | 92.0% | 87.0% | 83.0% | 79.0% | 76.0% | 72.0% | 68.0% |

### Voltage Derating as a Function of the Site Altitude

In addition to current derating, voltage derating must also be considered at site altitudes >2000 m above sea level.

Table 12-4 Voltage derating as a function of the site altitude, 380 V - 480 V

| Site altitude above sea level in m | Max. input voltage in V | Rated converter input voltage | | | | | |
|---|---|---|---|---|---|---|---|
| | | 380 V | 400 V | 420 V | 440 V | 460 V | 480 V |
| 0 to 2000 | 480 | | | | | | |
| Up to 2250 | 461 | | | | | | 96% |
| Up to 2500 | 451 | | | | | 98% | 94% |
| Up to 2750 | 432 | | 100% | | 98% | 94% | 90% |
| Up to 3000 | 422 | | | | 95% | 91% | 88% |
| Up to 3250 | 408 | | | 97% | 93% | 89% | 85% |
| Up to 3500 | 394 | | 98% | 93% | 89% | 85% | 82% |
| Up to 3750 | 380 | | 95% | 91% | 87% | 83% | 79% |
| Up to 4000 | 365 | 96% | 92% | 87% | 83% | 80% | 76% |

Table 12-5 Voltage derating as a function of the site altitude, 660 V - 690 V

| Site altitude above sea level in m | Max. input voltage in V | Rated converter input voltage | |
|---|---|---|---|
| | | 660 V | 690 V |
| 0 to 2000 | 690 | 100% | |
| Up to 2250 | 660 | | 96% |
| Up to 2500 | 648 | 98% | 94% |
| Up to 2750 | 621 | 95% | 90% |
| Up to 3000 | 607 | 92% | 88% |
| Up to 3250 | 586 | 89% | 85% |
| Up to 3500 | 565 | 85% | 82% |
| Up to 3750 | 545 | 83% | 79% |
| Up to 4000 | 524 | 80% | 76% |

## 12.3 Technical Data

**NOTE**

The current, voltage, and output values specified in the following tables are rated values.
The cables to the cabinet unit are protected with fuses with gL characteristic.
The connection cross-sections are calculated for three-core copper cables installed horizontally in free air at an ambient temperature of 30 °C (86 °F) (in accordance with DIN VDE 0298 Part 2 / Group 5) and the recommended line protection in accordance with DIN VDE 0100 Part 430.
AWG (American Wire Gauge for cross-sections < 120 mm²); MCM (Mille Circular Mil): American wire gauge for cross-sections > 120 mm².

## 12.3.1 Cabinet Unit Version A, 380 V – 480 V

Table 12-6 Version A, 380 V – 480 V, part 1

| Category | Unit | | | |
|---|---|---|---|---|
| Order no. **6SL3710-** | | **1GE32-1AA0** | **1GE32-6AA0** | **1GE33-1AA0** |
| Rated motor output | kW | 110 | 132 | 160 |
| Rated connection voltage | V | 3 AC 380 V to 480 V ±10 % (-15 % < 1 min) | | |
| Rated input current | A | 239 | 294 | 348 |
| Rated output current | A | 210 | 260 | 310 |
| Base load current | A | 205 | 250 | 302 |
| Power loss | kW | 2.9 | 3.8 | 4.4 |
| Cooling air requirement | m³/s | 0.17 | 0.23 | 0.36 |
| Sound pressure level at 50/60 Hz | dB(A) | 67/68 | 69/73 | 69/73 |
| **Power connection** | | | | |
| Recommended: DIN VDE<br>AWG / MCM | $mm^2$ | 2 x 70<br>2 x (000) | 2 x 95<br>2 x (4/0) | 2 x 120<br>2 x (300) |
| Maximum: DIN VDE<br>AWG / MCM | $mm^2$ | 4 x 240<br>4 x (600) | 4 x 240<br>4 x (600) | 4 x 240<br>4 x (600) |
| Fastening screw | | M12 (2 holes) | M12 (2 holes) | M12 (2 holes) |
| **Motor connection** | | | | |
| Recommended: DIN VDE<br>AWG / MCM | $mm^2$ | 2 x 70<br>2 x (000) | 2 x 95<br>2 x (4/0) | 2 x 120<br>2 x (300) |
| Maximum: DIN VDE<br>AWG / MCM | $mm^2$ | 2 x 150<br>2 x (400) | 2 x 150<br>2 x (400) | 2 x 150<br>2 x (400) |
| Fastening screw | | M12 (2 holes) | M12 (2 holes) | M12 (2 holes) |
| **Protective earth connection** | | | | |
| Fastening screw | | M12 (2 holes) | M12 (2 holes) | M12 (2 holes) |
| Approx. weight (standard version) | kg | 320 | 320 | 390 |
| Dimensions (w x h x d) | mm | 800 x 2000 x 600 | 800 x 2000 x 600 | 800 x 2000 x 600 |
| **Recommended protection** | | | | |
| Conductor protection<br>(with option L26)<br>Rated current<br>Size to DIN 43 620-1 | <br><br>A<br> | <br>3NA3 252<br>315<br>2 | <br>3NA3 254<br>355<br>2 | <br>3NA3 365<br>500<br>3 |
| Cond./semi-cond. protection<br>(without option L26)<br>Rated current<br>Size to DIN 43 620-1 | <br><br>A<br> | <br>3NE1 230-2<br>315<br>1 | <br>3NE1 231-2<br>350<br>2 | <br>3NE1 334-2<br>500<br>2 |

Table 12-7 Version A, 380 V – 480 V, part 2

| Category | Unit | | | |
|---|---|---|---|---|
| Order no. **6SL3710-** | | **1GE33-8AA0** | **1GE35-0AA0** | **1GE36-1AA0** |
| Rated motor output | kW | 200 | 250 | 315 |
| Rated connection voltage | V | 3 AC 380 V to 480 V ±10 % (-15 % < 1 min) | | |
| Rated input current | A | 405 | 519 | 639 |
| Rated output current | A | 380 | 490 | 605 |
| Base load current | A | 370 | 477 | 590 |
| Power loss | kW | 5.3 | 6.4 | 8.2 |
| Cooling air requirement | m³/s | 0.36 | 0.36 | 0.78 |
| Sound pressure level at 50/60 Hz | dB(A) | 69/73 | 69/73 | 70/73 |
| **Power connection** | | | | |
| Recommended: DIN VDE<br>AWG / MCM | $mm^2$ | 2 x 120<br>2 x (300) | 2 x 185<br>2 x (500) | 2 x 240<br>2 x (600) |
| Maximum: DIN VDE<br>AWG / MCM | $mm^2$ | 4 x 240<br>4 x (600) | 4 x 240<br>4 x (600) | 4 x 240<br>4 x (600) |
| Fastening screw | | M12 (2 holes) | M12 (2 holes) | M12 (2 holes) |
| **Motor connection** | | | | |
| Recommended: DIN VDE<br>AWG / MCM | $mm^2$ | 2 x 120<br>2 x (300) | 2 x 185<br>2 x (500) | 2 x 240<br>2 x (600) |
| Maximum: DIN VDE<br>AWG / MCM | $mm^2$ | 2 x 150<br>2 x (400) | 2 x 240<br>2 x (600) | 4 x 240<br>4 x (600) |
| Fastening screw | | M12 (2 holes) | M12 (2 holes) | M12 (2 holes) |
| **Protective earth connection** | | | | |
| Fastening screw | | M12 (2 holes) | M12 (2 holes) | M12 (2 holes) |
| Approx. weight (standard version) | kg | 480 | 480 | 860 |
| Dimensions (w x h x d) | mm | 1000 x 2000 x 600 | 1000 x 2000 x 600 | 1200 x 2000 x 600 |
| **Recommended protection** | | | | |
| Conductor protection<br>(with option L26)<br>Rated current<br>Size to DIN 43 620-1 | <br><br>A<br> | <br>3NA3 365<br>500<br>3 | <br>3NA3 372<br>630<br>3 | <br>3NA3 475<br>800<br>4 |
| Cond./semi-cond. protection<br>(without option L26)<br>Rated current<br>Size to DIN 43 620-1 | <br><br>A<br> | <br>3NE1 334-2<br>500<br>2 | <br>3NE1 436-2<br>630<br>3 | <br>3NE1 438-2<br>800<br>3 |

Table 12-8 Version A, 380 V – 480 V, part 3

| Category | Unit | | | |
|---|---|---|---|---|
| Order no. **6SL3710-** | | **1GE37-5AA0** | **1GE38-4AA0** | **1GE41-0AA0** |
| Rated motor output | kW | 400 | 450 | 560 |
| Rated connection voltage | V | 3 AC 380 V to 480 V ±10 % (-15 % < 1 min) | | |
| Rated input current | A | 785 | 883 | 1034 |
| Rated output current | A | 745 | 840 | 985 |
| Base load current | A | 725 | 820 | 960 |
| Power loss | kW | 9.6 | 10.1 | 14.4 |
| Cooling air requirement | m³/s | 0.78 | 0.78 | 1.48 |
| Sound pressure level at 50/60 Hz | dB(A) | 70/73 | 70/73 | 72/75 |
| **Power connection** | | | | |
| Recommended: DIN VDE<br>AWG / MCM | $mm^2$ | 2 x 300<br>2 x (800) | 4 x 150<br>4 x (400) | 4 x 185<br>4 x (500) |
| Maximum: DIN VDE<br>AWG / MCM | $mm^2$ | 4 x 240<br>4 x (600) | 8 x 240<br>8 x (600) | 8 x 240<br>8 x (600) |
| Fastening screw | | M12 (2 holes) | M12 (4 holes) | M12 (4 holes) |
| **Motor connection** | | | | |
| Recommended: DIN VDE<br>AWG / MCM | $mm^2$ | 2 x 300<br>2 x (800) | 4 x 150<br>4 x (400) | 4 x 185<br>4 x (500) |
| Maximum: DIN VDE<br>AWG / MCM | $mm^2$ | 4 x 240<br>4 x (600) | 4 x 240<br>4 x (600) | 6 x 240<br>6 x (600) |
| Fastening screw | | M12 (2 holes) | M12 (2 holes) | M12 (3 holes) |
| **Protective earth connection** | | | | |
| Fastening screw | | M12<br>(10 holes) | M12<br>(16 holes) | M12<br>(18 holes) |
| Approx. weight (standard version) | kg | 865 | 1075 | 1360 |
| Dimensions (w x h x d) | mm | 1200 x 2000 x 600 | 1200 x 2000 x 600 | 1600 x 2000 x 600 |
| **Recommended protection** | | | | |
| Conductor protection<br>(with option L26)<br>Rated current<br>Size to DIN 43 620-1 | <br><br>A<br> | <br>3NA3 475<br>800<br>4 | <br>Protective device<br><br>Circuit-breaker | <br>Protective device<br><br>Circuit-breaker |
| Cond./semi-cond. protection<br>(without option L26)<br>Rated current<br>Size to DIN 43 620-1 | <br><br>A<br> | <br>3NE1 448-2<br>850<br>3 | | |

## 12.3.2 Cabinet Unit Version C, 380 V – 480 V

Table 12-9 Version C, 380 V – 480 V, part 1

| Category | Unit | | | |
|---|---|---|---|---|
| Order no. **6SL3710-** | | **1GE32-1CA0** | **1GE32-6CA0** | **1GE33-1CA0** |
| Rated motor output | kW | 110 | 132 | 160 |
| Rated connection voltage | V | 3 AC 380 V to 480 V ±10 % (-15 % < 1 min) | | |
| Rated input current | A | 239 | 294 | 348 |
| Rated output current | A | 210 | 260 | 310 |
| Base load current | A | 205 | 250 | 302 |
| Power loss | kW | 2.9 | 3.8 | 4.4 |
| Cooling air requirement | m³/s | 0.17 | 0.23 | 0.36 |
| Sound pressure level at 50/60 Hz | dB(A) | 67/68 | 69/73 | 69/73 |
| **Power connection** | | | | |
| Recommended: DIN VDE<br>AWG / MCM | $mm^2$ | 2 x 70<br>2 x (000) | 2 x 95<br>2 x (4/0) | 2 x 120<br>2 x (300) |
| Maximum: DIN VDE<br>AWG / MCM | $mm^2$ | 2 x 240<br>2 x (600) | 2 x 240<br>2 x (600) | 2 x 240<br>2 x (600) |
| Fastening screw | | M12 (1 hole) | M12 (1 hole) | M12 (1 hole) |
| **Motor connection** | | | | |
| Recommended: DIN VDE<br>AWG / MCM | $mm^2$ | 2 x 70<br>2 x (000) | 2 x 95<br>2 x (4/0) | 2 x 120<br>2 x (300) |
| Maximum: DIN VDE<br>AWG / MCM | $mm^2$ | 2 x 150<br>2 x (400) | 2 x 150<br>2 x (400) | 2 x 150<br>2 x (400) |
| Fastening screw | | M12 (1 hole) | M12 (1 hole) | M12 (1 hole) |
| **Protective earth connection** | | | | |
| Fastening screw | | M12 (2 holes) | M12 (2 holes) | M12 (2 holes) |
| Approx. weight (standard version) | kg | 225 | 225 | 300 |
| Dimensions (w x h x d) | mm | 400 x 2000 x 600 | 400 x 2000 x 600 | 400 x 2000 x 600 |
| **Recommended protection** | | | | |
| Cond./semi-cond. protection<br>Rated current<br>Size to DIN 43 620-1 | A | 3NE1 230-2<br>315<br>1 | 3NE1 231-2<br>350<br>2 | 3NE1 334-2<br>500<br>2 |

Table 12-10 Version C, 380 V – 480 V, part 2

| Category | Unit | | | |
|---|---|---|---|---|
| Order no. **6SL3710-** | | **1GE33-8CA0** | **1GE35-0CA0** | **1GE36-1CA0** |
| Rated motor output | kW | 200 | 250 | 315 |
| Rated connection voltage | V | 3 AC 380 V to 480 V ±10 % (-15 % < 1 min) | | |
| Rated input current | A | 405 | 519 | 639 |
| Rated output current | A | 380 | 490 | 605 |
| Base load current | A | 370 | 477 | 590 |
| Power loss | kW | 5.3 | 6.4 | 8.2 |
| Cooling air requirement | m³/s | 0.36 | 0.36 | 0.78 |
| Sound pressure level at 50/60 Hz | dB(A) | 69/73 | 69/73 | 70/73 |
| **Power connection** | | | | |
| Recommended: DIN VDE<br>AWG / MCM | $mm^2$ | 2 x 120<br>2 x (300) | 2 x 185<br>2 x (500) | 2 x 240<br>2 x (600) |
| Maximum: DIN VDE<br>AWG / MCM | $mm^2$ | 2 x 240<br>2 x (600) | 2 x 240<br>2 x (600) | 8 x 240<br>8 x (600) |
| Fastening screw | | M12 (1 hole) | M12 (1 hole) | M12 (4 holes) |
| **Motor connection** | | | | |
| Recommended: DIN VDE<br>AWG / MCM | $mm^2$ | 2 x 120<br>2 x (300) | 2 x 185<br>2 x (500) | 2 x 240<br>2 x (600) |
| Maximum: DIN VDE<br>AWG / MCM | $mm^2$ | 2 x 150<br>2 x (400) | 2 x 240<br>2 x (600) | 8 x 240<br>8 x (600) |
| Fastening screw | | M12 (1 hole) | M12 (1 hole) | M12 (4 holes) |
| **Protective earth connection** | | | | |
| Fastening screw | | M12 (2 holes) | M12 (2 holes) | M12 (2 holes) |
| Approx. weight (standard version) | kg | 300 | 300 | 670 |
| Dimensions (w x h x d) | mm | 400 x 2000 x 600 | 400 x 2000 x 600 | 600 x 2000 x 600 |
| **Recommended protection** | | | | |
| Cond./semi-cond. protection<br>Rated current<br>Size to DIN 43 620-1 | A | 3NE1 334-2<br>500<br>2 | 3NE1 436-2<br>630<br>3 | 3NE1 438-2<br>800<br>3 |

Table 12-11 Version C, 380 V – 480 V, part 3

| Category | Unit | | | |
|---|---|---|---|---|
| Order no. **6SL3710-** | | **1GE37-5CA0** | **1GE38-4CA0** | **1GE41-0CA0** |
| Rated motor output | kW | 400 | 450 | 560 |
| Rated connection voltage | V | 3 AC 380 V to 480 V ±10 % (-15 % < 1 min) | | |
| Rated input current | A | 785 | 883 | 1034 |
| Rated output current | A | 745 | 840 | 985 |
| Base load current | A | 725 | 820 | 960 |
| Power loss | kW | 9.6 | 10.1 | 14.4 |
| Cooling air requirement | m³/s | 0.78 | 0.78 | 1.48 |
| Sound pressure level at 50/60 Hz | dB(A) | 70/73 | 70/73 | 72/75 |
| **Power connection** | | | | |
| Recommended: DIN VDE<br>AWG / MCM | $mm^2$ | 2 x 300<br>2 x (800) | 4 x 150<br>4 x (400) | 4 x 185<br>4 x (500) |
| Maximum: DIN VDE<br>AWG / MCM | $mm^2$ | 8 x 240<br>8 x (600) | 8 x 240<br>8 x (600) | 8 x 240<br>8 x (600) |
| Fastening screw | | M12 (4 holes) | M12 (4 holes) | M12 (4 holes) |
| **Motor connection** | | | | |
| Recommended: DIN VDE<br>AWG / MCM | $mm^2$ | 2 x 300<br>2 x (800) | 4 x 150<br>4 x (400) | 4 x 185<br>4 x (500) |
| Maximum: DIN VDE<br>AWG / MCM | $mm^2$ | 8 x 240<br>8 x (600) | 8 x 240<br>8 x (600) | 8 x 240<br>8 x (600) |
| Fastening screw | | M12 (4 holes) | M12 (4 holes) | M12 (4 holes) |
| **Protective earth connection** | | | | |
| Fastening screw | | M12 (8 holes) | M12 (8 holes) | M12<br>(10 holes) |
| Approx. weight (standard version) | kg | 670 | 670 | 980 |
| Dimensions (w x h x d) | mm | 600 x 2000 x 600 | 600 x 2000 x 600 | 1000 x 2000 x 600 |
| **Recommended protection** | | | | |
| Cond./semi-cond. protection<br>Rated current<br>Size to DIN 43 620-1 | A | 3NE1 448-2<br>850<br>3 | Circuit-breaker | Circuit-breaker |

## 12.3.3 Cabinet Unit Version A, 660 V – 690 V

Table 12-12 Version A, 660 V – 690 V, part 1

| Category | Unit | | | |
|---|---|---|---|---|
| Order no. **6SL3710-** | | **1GH28-5AA0** | **1GH31-0AA0** | **1GH31-2AA0** |
| Rated motor output | kW | 75 | 90 | 110 |
| Rated connection voltage | V | 3 AC 660 V to 690 V ±10 % (-15 % < 1 min) | | |
| Rated input current | A | 103 | 119 | 141 |
| Rated output current | A | 85 | 100 | 120 |
| Base load current | A | 80 | 95 | 115 |
| Power loss | kW | 1.7 | 2.1 | 2.7 |
| Cooling air requirement | m³/s | 0.17 | 0.17 | 0.17 |
| Sound pressure level at 50/60 Hz | dB(A) | 67/68 | 67/68 | 67/68 |
| **Power connection** | | | | |
| Recommended: DIN VDE<br>AWG / MCM | $mm^2$ | 50<br>(00) | 50<br>(00) | 70<br>(000) |
| Maximum: DIN VDE<br>AWG / MCM | $mm^2$ | 4 x 240<br>4 x (600) | 4 x 240<br>4 x (600) | 4 x 240<br>4 x (600) |
| Fastening screw | | M12 (2 holes) | M12 (2 holes) | M12 (2 holes) |
| **Motor connection** | | | | |
| Recommended: DIN VDE<br>AWG / MCM | $mm^2$ | 50<br>(00) | 50<br>(00) | 70<br>(000) |
| Maximum: DIN VDE<br>AWG / MCM | $mm^2$ | 2 x 70<br>2 x (000) | 2 x 150<br>2 x (400) | 2 x 150<br>2 x (400) |
| Fastening screw | | M12 (2 holes) | M12 (2 holes) | M12 (2 holes) |
| **Protective earth connection** | | | | |
| Fastening screw | | M12 (2 holes) | M12 (2 holes) | M12 (2 holes) |
| Approx. weight (standard version) | kg | 320 | 320 | 320 |
| Dimensions (w x h x d) | mm | 800 x 2000 x 600 | 800 x 2000 x 600 | 800 x 2000 x 600 |
| **Recommended protection** | | | | |
| Conductor protection<br>(with option L26)<br>Rated current<br>Size to DIN 43 620-1 | <br><br>A<br> | <br>3NA3 132-6<br>125<br>1 | <br>3NA3 132-6<br>125<br>1 | <br>3NA3 136-6<br>160<br>1 |
| Cond./semi-cond. protection<br>(without option L26)<br>Rated current<br>Size to DIN 43 620-1 | <br><br>A<br> | <br>3NE1 022-2<br>125<br>00 | <br>3NE1 022-2<br>125<br>00 | <br>3NE1 224-2<br>160<br>1 |

Table 12-13 Version A, 660 V – 690 V, part 2

| Category | Unit | | | |
|---|---|---|---|---|
| Order no. **6SL3710-** | | **1GH31-5AA0** | **1GH31-8AA0** | **1GH32-2AA0** |
| Rated motor output | kW | 132 | 160 | 200 |
| Rated connection voltage | V | 3 AC 660 V to 690 V ±10 % (-15 % < 1 min) | | |
| Rated input current | A | 174 | 201 | 234 |
| Rated output current | A | 150 | 175 | 215 |
| Base load current | A | 140 | 171 | 208 |
| Power loss | kW | 2.8 | 3.8 | 4.2 |
| Cooling air requirement | m³/s | 0.17 | 0.36 | 0.36 |
| Sound pressure level at 50/60 Hz | dB(A) | 67/68 | 69/73 | 69/73 |
| **Power connection** | | | | |
| Recommended: DIN VDE<br>AWG / MCM | $mm^2$ | 95<br>(4/0) | 120<br>(300) | 2 x 70<br>2 x (000) |
| Maximum: DIN VDE<br>AWG / MCM | $mm^2$ | 4 x 240<br>4 x (600) | 4 x 240<br>4 x (600) | 4 x 240<br>4 x (600) |
| Fastening screw | | M12 (2 holes) | M12 (2 holes) | M12 (2 holes) |
| **Motor connection** | | | | |
| Recommended: DIN VDE<br>AWG / MCM | $mm^2$ | 95<br>(4/0) | 120<br>(300) | 2 x 70<br>2 x (000) |
| Maximum: DIN VDE<br>AWG / MCM | $mm^2$ | 2 x 150<br>2 x (400) | 2 x 150<br>2 x (400) | 2 x 150<br>2 x (400) |
| Fastening screw | | M12 (2 holes) | M12 (2 holes) | M12 (2 holes) |
| **Protective earth connection** | | | | |
| Fastening screw | | M12 (2 holes) | M12 (2 holes) | M12 (2 holes) |
| Approx. weight (standard version) | kg | 320 | 390 | 390 |
| Dimensions (w x h x d) | mm | 800 x 2000 x 600 | 800 x 2000 x 600 | 800 x 2000 x 600 |
| **Recommended protection** | | | | |
| Conductor protection<br>(with option L26)<br>Rated current<br>Size to DIN 43 620-1 | <br><br>A<br> | <br>3NA3 240-6<br>200<br>2 | <br>3NA3 244-6<br>250<br>2 | <br>3NA3 252-6<br>315<br>2 |
| Cond./semi-cond. protection<br>(without option L26)<br>Rated current<br>Size to DIN 43 620-1 | <br><br>A<br> | <br>3NE1 225-2<br>200<br>1 | <br>3NE1 227-2<br>250<br>1 | <br>3NE1 230-2<br>315<br>1 |

Table 12-14 Version A, 660 V – 690 V, part 3

| Category | Unit | | | |
|---|---|---|---|---|
| Order no. **6SL3710-** | | **1GH32-6AA0** | **1GH33-3AA0** | **1GH34-1AA0** |
| Rated motor output | kW | 250 | 315 | 400 |
| Rated connection voltage | V | 3 AC 660 V to 690 V ±10 % (-15 % < 1 min) | | |
| Rated input current | A | 280 | 353 | 436 |
| Rated output current | A | 260 | 330 | 410 |
| Base load current | A | 250 | 320 | 400 |
| Power loss | kW | 5.0 | 6.1 | 8.1 |
| Cooling air requirement | m³/s | 0.36 | 0.36 | 0.78 |
| Sound pressure level at 50/60 Hz | dB(A) | 69/73 | 69/73 | 72/75 |
| **Power connection** | | | | |
| Recommended: DIN VDE<br>AWG / MCM | $mm^2$ | 2 x 95<br>2 x (4/0) | 2 x 120<br>2 x (300) | 2 x 185<br>2 x (500) |
| Maximum: DIN VDE<br>AWG / MCM | $mm^2$ | 4 x 240<br>4 x (600) | 4 x 240<br>4 x (600) | 4 x 240<br>4 x (600) |
| Fastening screw | | M12 (2 holes) | M12 (2 holes) | M12 (2 holes) |
| **Motor connection** | | | | |
| Recommended: DIN VDE<br>AWG / MCM | $mm^2$ | 2 x 95<br>2 x (4/0) | 2 x 120<br>2 x (300) | 2 x 185<br>2 x (500) |
| Maximum: DIN VDE<br>AWG / MCM | $mm^2$ | 2 x 185<br>2 x (500) | 2 x 240<br>2 x (600) | 4 x 240<br>4 x (600) |
| Fastening screw | | M12 (2 holes) | M12 (2 holes) | M12 (2 holes) |
| **Protective earth connection** | | | | |
| Fastening screw | | M12 (2 holes) | M12 (2 holes) | M12 (2 holes) |
| Approx. weight (standard version) | kg | 390 | 390 | 860 |
| Dimensions (w x h x d) | mm | 800 x 2000 x 600 | 800 x 2000 x 600 | 1200 x 2000 x 600 |
| **Recommended protection** | | | | |
| Conductor protection<br>(with option L26)<br>Rated current<br>Size to DIN 43 620-1 | <br><br>A<br> | <br>3NA3 354-6<br>355<br>3 | <br>3NA3 365-6<br>500<br>3 | <br>3NA3 365-6<br>500<br>3 |
| Cond./semi-cond. protection<br>(without option L26)<br>Rated current<br>Size to DIN 43 620-1 | <br><br>A<br> | <br>3NE1 331-2<br>350<br>2 | <br>3NE1 334-2<br>500<br>1 | <br>3NE1 334-2<br>500<br>1 |

Table 12-15 Version A, 660 V – 690 V, part 4

| Category | Unit | | | |
|---|---|---|---|---|
| Order no. **6SL3710-** | | **1GH34-7AA0** | **1GH35-8AA0** | **1GH37-4AA0** |
| Rated motor output | kW | 450 | 560 | 710 |
| Rated connection voltage | V | 3 AC 660 V to 690 V ±10 % (-15 % < 1 min) | | |
| Rated input current | A | 493 | 608 | 774 |
| Rated output current | A | 465 | 575 | 735 |
| Base load current | A | 452 | 560 | 710 |
| Power loss | kW | 9.1 | 10.8 | 13.5 |
| Cooling air requirement | m³/s | 0.78 | 0.78 | 1.48 |
| Sound pressure level at 50/60 Hz | dB(A) | 72/75 | 72/75 | 72/75 |
| **Power connection** | | | | |
| Recommended: DIN VDE<br>AWG / MCM | $mm^2$ | 2 x 185<br>2 x (500) | 2 x 240<br>2 x (600) | 3 x 185<br>3 x (500) |
| Maximum: DIN VDE<br>AWG / MCM | $mm^2$ | 4 x 240<br>4 x (600) | 4 x 240<br>4 x (600) | 8 x 240<br>8 x (600) |
| Fastening screw | | M12 (2 holes) | M12 (2 holes) | M12 (4 holes) |
| **Motor connection** | | | | |
| Recommended: DIN VDE<br>AWG / MCM | $mm^2$ | 2 x 185<br>2 x (500) | 2 x 240<br>2 x (600) | 3 x 185<br>3 x (500) |
| Maximum: DIN VDE<br>AWG / MCM | $mm^2$ | 4 x 240<br>4 x (600) | 4 x 240<br>4 x (600) | 6 x 240<br>6 x (600) |
| Fastening screw | | M12 (2 holes) | M12 (2 holes) | M12 (3 holes) |
| **Protective earth connection** | | | | |
| Fastening screw | | M12 (2 holes) | M12 (2 holes) | M12 (18 holes) |
| Approx. weight (standard version) | kg | 860 | 860 | 1320 |
| Dimensions (w x h x d) | mm | 1200 x 2000 x 600 | 1200 x 2000 x 600 | 1600 x 2000 x 600 |
| **Recommended protection** | | | | |
| Conductor protection<br>(with option L26)<br>Rated current<br>Size to DIN 43 620-1 | <br><br>A<br> | <br>3NA3 352-6<br>2 x 315<br>2 | <br>3NA3 354-6<br>2 x 355<br>3 | <br>3NA3 365-6<br>2 x 500<br>3 |
| Cond./semi-cond. protection<br>(without option L26)<br>Rated current<br>Size to DIN 43 620-1 | <br><br>A<br> | <br>3NE1 435-2<br>560<br>3 | <br>3NE1 447-2<br>670<br>3 | <br>3NE1 448-2<br>850<br>3 |

Table 12-16 Version A, 660 V – 690 V, part 5

| Category | Unit | | | |
|---|---|---|---|---|
| Order no. **6SL3710-** | | **1GH38-1AA0** | | |
| Rated motor output | kW | 800 | | |
| Rated connection voltage | V | 3 AC 660 V to 690 V ±10 % (-15 % < 1 min) | | |
| Rated input current | A | 852 | | |
| Rated output current | A | 810 | | |
| Base load current | A | 790 | | |
| Power loss | kW | 14.7 | | |
| Cooling air requirement | m³/s | 1.48 | | |
| Sound pressure level at 50/60 Hz | dB(A) | 72/75 | | |
| **Power connection** | | | | |
| Recommended: DIN VDE<br>AWG / MCM | $mm^2$ | 4 x 150<br>4 x (400) | | |
| Maximum: DIN VDE<br>AWG / MCM | $mm^2$ | 8 x 240<br>8 x (600) | | |
| Fastening screw | | M12 (4 holes) | | |
| **Motor connection** | | | | |
| Recommended: DIN VDE<br>AWG / MCM | $mm^2$ | 4 x 150<br>4 x (400) | | |
| Maximum: DIN VDE<br>AWG / MCM | $mm^2$ | 6 x 240<br>6 x (600) | | |
| Fastening screw | | M12 (3 holes) | | |
| **Protective earth connection** | | | | |
| Fastening screw | | M12 (18 holes) | | |
| Approx. weight (standard version) | kg | 1360 | | |
| Dimensions (w x h x d) | mm | 1600 x 2000 x 600 | | |
| **Recommended protection** | | | | |
| Conductor protection<br>(with option L26)<br>Rated current<br>Size to DIN 43 620-1 | <br><br>A<br> | Circuit-breaker | | |
| Cond./semi-cond. protection<br>(without option L26)<br>Rated current<br>Size to DIN 43 620-1 | <br><br>A<br> | Circuit-breaker | | |

## 12.3.4 Cabinet Unit Version C, 660 V – 690 V

Table 12-17 Version C, 660 V – 690 V, part 1

| Category | Unit | | | |
|---|---|---|---|---|
| Order no. **6SL3710-** | | **1GH28-5CA0** | **1GH31-0CA0** | **1GH31-2CA0** |
| Rated motor output | kW | 75 | 90 | 110 |
| Rated connection voltage | V | 3 AC 660 V to 690 V ±10 % (-15 % < 1 min) | | |
| Rated input current | A | 103 | 119 | 141 |
| Rated output current | A | 85 | 100 | 120 |
| Base load current | A | 80 | 95 | 115 |
| Power loss | kW | 1.7 | 2.1 | 2.7 |
| Cooling air requirement | m³/s | 0.17 | 0.17 | 0.17 |
| Sound pressure level at 50/60 Hz | dB(A) | 67/68 | 67/68 | 67/68 |
| **Power connection** | | | | |
| Recommended: DIN VDE<br>AWG / MCM | $mm^2$ | 50<br>(00) | 50<br>(00) | 70<br>(000) |
| Maximum: DIN VDE<br>AWG / MCM | $mm^2$ | 2 x 240<br>2 x (600) | 2 x 240<br>2 x (600) | 2 x 240<br>2 x (600) |
| Fastening screw | | M12 (1 hole) | M12 (1 hole) | M12 (1 hole) |
| **Motor connection** | | | | |
| Recommended: DIN VDE<br>AWG / MCM | $mm^2$ | 50<br>(00) | 50<br>(00) | 70<br>(000) |
| Maximum: DIN VDE<br>AWG / MCM | $mm^2$ | 2 x 70<br>2 x (000) | 2 x 150<br>2 x (400) | 2 x 150<br>2 x (400) |
| Fastening screw | | M12 (1 hole) | M12 (1 hole) | M12 (1 hole) |
| **Protective earth connection** | | | | |
| Fastening screw | | M12 (2 holes) | M12 (2 holes) | M12 (2 holes) |
| Approx. weight (standard version) | kg | 225 | 225 | 225 |
| Dimensions (w x h x d) | mm | 400 x 2000 x 600 | 400 x 2000 x 600 | 400 x 2000 x 600 |
| **Recommended protection** | | | | |
| Cond./semi-cond. protection<br>Rated current<br>Size to DIN 43 620-1 | A | 3NE1 022-2<br>125<br>00 | 3NE1 022-2<br>125<br>00 | 3NE1 224-2<br>160<br>1 |

Table 12-18 Version C, 660 V – 690 V, part 2

| Category | Unit | | | |
|---|---|---|---|---|
| Order no. **6SL3710-** | | **1GH31-5CA0** | **1GH31-8CA0** | **1GH32-2CA0** |
| Rated motor output | kW | 132 | 160 | 200 |
| Rated connection voltage | V | 3 AC 660 V to 690 V ±10 % (-15 % < 1 min) | | |
| Rated input current | A | 174 | 201 | 234 |
| Rated output current | A | 150 | 175 | 215 |
| Base load current | A | 140 | 171 | 208 |
| Power loss | kW | 2.8 | 3.8 | 4.2 |
| Cooling air requirement | m³/s | 0.17 | 0.36 | 0.36 |
| Sound pressure level at 50/60 Hz | dB(A) | 67/68 | 69/73 | 69/73 |
| **Power connection** | | | | |
| Recommended: DIN VDE<br>AWG / MCM | $mm^2$ | 95<br>(4/0) | 120<br>(300) | 2 x 70<br>2 x (000) |
| Maximum: DIN VDE<br>AWG / MCM | $mm^2$ | 2 x 240<br>2 x (600) | 2 x 240<br>2 x (600) | 2 x 240<br>2 x (600) |
| Fastening screw | | M12 (1 hole) | M12 (1 hole) | M12 (1 hole) |
| **Motor connection** | | | | |
| Recommended: DIN VDE<br>AWG / MCM | $mm^2$ | 95<br>(4/0) | 120<br>(300) | 2 x 70<br>2 x (000) |
| Maximum: DIN VDE<br>AWG / MCM | $mm^2$ | 2 x 150<br>2 x (400) | 2 x 150<br>2 x (400) | 2 x 150<br>2 x (400) |
| Fastening screw | | M12 (1 hole) | M12 (1 hole) | M12 (1 hole) |
| **Protective earth connection** | | | | |
| Fastening screw | | M12 (2 holes) | M12 (2 holes) | M12 (2 holes) |
| Approx. weight (standard version) | kg | 225 | 300 | 300 |
| Dimensions (w x h x d) | mm | 400 x 2000 x 600 | 400 x 2000 x 600 | 400 x 2000 x 600 |
| **Recommended protection** | | | | |
| Cond./semi-cond. protection<br>Rated current<br>Size to DIN 43 620-1 | A | 3NE1 225-2<br>200<br>1 | 3NE1 227-2<br>250<br>1 | 3NE1 230-2<br>315<br>1 |

Table 12-19 Version C, 660 V – 690 V, part 3

| Category | Unit | | | |
|---|---|---|---|---|
| Order no. **6SL3710-** | | **1GH32-6CA0** | **1GH33-3CA0** | **1GH34-1CA0** |
| Rated motor output | kW | 250 | 315 | 400 |
| Rated connection voltage | V | 3 AC 660 V to 690 V ±10 % (-15 % < 1 min) | | |
| Rated input current | A | 280 | 353 | 436 |
| Rated output current | A | 260 | 330 | 410 |
| Base load current | A | 250 | 320 | 400 |
| Power loss | kW | 5.0 | 6.1 | 8.1 |
| Cooling air requirement | m³/s | 0.36 | 0.36 | 0.78 |
| Sound pressure level at 50/60 Hz | dB(A) | 69/73 | 69/73 | 72/75 |
| **Power connection** | | | | |
| Recommended: DIN VDE<br>AWG / MCM | $mm^2$ | 2 x 95<br>2 x (4/0) | 2 x 120<br>2 x (300) | 2 x 185<br>2 x (500) |
| Maximum: DIN VDE<br>AWG / MCM | $mm^2$ | 2 x 240<br>2 x (600) | 4 x 240<br>4 x (600) | 4 x 240<br>4 x (600) |
| Fastening screw | | M12 (1 hole) | M12 (1 hole) | M12 (2 holes) |
| **Motor connection** | | | | |
| Recommended: DIN VDE<br>AWG / MCM | $mm^2$ | 2 x 95<br>2 x (4/0) | 2 x 120<br>2 x (300) | 2 x 185<br>2 x (500) |
| Maximum: DIN VDE<br>AWG / MCM | $mm^2$ | 2 x 185<br>2 x (500) | 2 x 240<br>2 x (600) | 4 x 240<br>4 x (600) |
| Fastening screw | | M12 (1 hole) | M12 (1 hole) | M12 (2 holes) |
| **Protective earth connection** | | | | |
| Fastening screw | | M12 (2 holes) | M12 (2 holes) | M12 (2 holes) |
| Approx. weight (standard version) | kg | 300 | 300 | 670 |
| Dimensions (w x h x d) | mm | 400 x 2000 x 600 | 400 x 2000 x 600 | 600 x 2000 x 600 |
| **Recommended protection** | | | | |
| Cond./semi-cond. protection<br>Rated current<br>Size to DIN 43 620-1 | A | 3NE1 331-2<br>350<br>2 | 3NE1 334-2<br>500<br>2 | 3NE1 334-2<br>500<br>2 |

Table 12-20 Version C, 660 V – 690 V, part 4

| Category | Unit | | | |
|---|---|---|---|---|
| Order no. **6SL3710-** | | **1GH34-7CA0** | **1GH35-8CA0** | **1GH37-4CA0** |
| Rated motor output | kW | 450 | 560 | 710 |
| Rated connection voltage | V | 3 AC 660 V to 690 V ±10 % (-15 % < 1 min) | | |
| Rated input current | A | 493 | 608 | 774 |
| Rated output current | A | 465 | 575 | 735 |
| Base load current | A | 452 | 560 | 710 |
| Power loss | kW | 9.1 | 10.8 | 13.5 |
| Cooling air requirement | m³/s | 0.78 | 0.78 | 1.48 |
| Sound pressure level at 50/60 Hz | dB(A) | 72/75 | 72/75 | 72/75 |
| **Power connection** | | | | |
| Recommended: DIN VDE<br>AWG / MCM | $mm^2$ | 2 x 185<br>2 x (500) | 2 x 240<br>2 x (600) | 3 x 185<br>3 x (500) |
| Maximum: DIN VDE<br>AWG / MCM | $mm^2$ | 4 x 240<br>4 x (600) | 4 x 240<br>4 x (600) | 8 x 240<br>8 x (600) |
| Fastening screw | | M12 (2 holes) | M12 (2 holes) | M12 (4 holes) |
| **Motor connection** | | | | |
| Recommended: DIN VDE<br>AWG / MCM | $mm^2$ | 2 x 185<br>2 x (500) | 2 x 240<br>2 x (600) | 3 x 185<br>3 x (500) |
| Maximum: DIN VDE<br>AWG / MCM | $mm^2$ | 4 x 240<br>4 x (600) | 4 x 240<br>4 x (600) | 6 x 240<br>6 x (600) |
| Fastening screw | | M12 (2 holes) | M12 (2 holes) | M12 (3 holes) |
| **Protective earth connection** | | | | |
| Fastening screw | | M12 (2 holes) | M12 (2 holes) | M12 (18 holes) |
| Approx. weight (standard version) | kg | 670 | 670 | 940 |
| Dimensions (w x h x d) | mm | 600 x 2000 x 600 | 600 x 2000 x 600 | 1000 x 2000 x 600 |
| **Recommended protection** | | | | |
| Cond./semi-cond. protection<br>Rated current<br>Size to DIN 43 620-1 | A | 3NE1 435-2<br>560<br>3 | 3NE1 447-2<br>670<br>3 | 3NE1 448-2<br>850<br>3 |

Table 12-21 Version C, 660 V – 690 V, part 5

| Category | Unit | | | |
|---|---|---|---|---|
| Order no. **6SL3710-** | | **1GH38-1CA0** | | |
| Rated motor output | kW | 800 | | |
| Rated connection voltage | V | 3 AC 660 V to 690 V ±10 % (-15 % < 1 min) | | |
| Rated input current | A | 852 | | |
| Rated output current | A | 810 | | |
| Base load current | A | 790 | | |
| Power loss | kW | 14.7 | | |
| Cooling air requirement | m³/s | 1.48 | | |
| Sound pressure level at 50/60 Hz | dB(A) | 72/75 | | |
| **Power connection** | | | | |
| Recommended: DIN VDE<br>AWG / MCM | $mm^2$ | 4 x 150<br>4 x (400) | | |
| Maximum: DIN VDE<br>AWG / MCM | $mm^2$ | 8 x 240<br>8 x (600) | | |
| Fastening screw | | M12 (4 holes) | | |
| **Motor connection** | | | | |
| Recommended: DIN VDE<br>AWG / MCM | $mm^2$ | 4 x 150<br>4 x (400) | | |
| Maximum: DIN VDE<br>AWG / MCM | $mm^2$ | 6 x 240<br>6 x (600) | | |
| Fastening screw | | M12 (3 holes) | | |
| **Protective earth connection** | | | | |
| Fastening screw | | M12 (18 holes) | | |
| Approx. weight (standard version) | kg | 980 | | |
| Dimensions (w x h x d) | mm | 1000 x 2000 x 600 | | |
| **Recommended protection** | | | | |
| Cond./semi-cond. protection<br>Rated current<br>Size to DIN 43 620-1 | A | Circuit-breaker | | |

■

# Abbreviations

| | |
|---|---|
| A... | Alarm |
| AC | Alternating current |
| AD, ADC | Analog / digital converter |
| ADR | Address |
| AI | Analog input |
| AO | Analog output |
| AOP | Advanced Operator Panel (with plain-text display) |
| BERO | Company name for a proximity switch |
| BI | Binector input |
| BICO | Binector / connector |
| BO | Binector output |
| C | Capacity |
| CAN | Serial bus system |
| CB | Communication module |
| CD | Compact disc |
| CDS | Command data set |
| CI | Connector input |
| CMD | Command |
| COM | Mid-position contact of a changeover contact |
| CPU | Central processing unit |
| CT | Constant torque |
| CU | Control Unit |
| DA, DAC | Digital / analog converter |
| DC | Direct current |
| DDS | Drive data set |
| DI | Digital input |
| DI/DO | Bi-directional digital input / output |
| DO | Digital output |
| EGB | Electrostatic-sensitive devices |
| EMC | Electromagnetic compatibility |
| EN | European standard |
| F ... | Fault |
| FAQ | Frequently asked questions |
| FI | Residual current-operated device |
| Float | Floating point number |

| | |
|---|---|
| FW | Firmware |
| I/O | Input / Output |
| IEC | International Electrotechnical Commission |
| IGBT | Bipolar transistor with insulated gate electrode |
| L | Inductance |
| LED | Light-emitting diode |
| MB | Megabyte |
| MDS | Motor data set |
| MLFB | Machine-readable product designation |
| NC | NC contact (normally closed) |
| NEMA | Standards institute in USA |
| NO | NO contact (normally open) |
| OEM | Original equipment manufacturer |
| p ... | Setting parameter |
| PDS | Power section data set |
| PE | Protective earth |
| PROFIBUS | Serial data bus |
| PTC | Positive temperature coefficient |
| r ... | Read-only parameter |
| RAM | Random access memory (read / write) |
| RS232 | Serial interface |
| RS485 | Standard that describes hardware design of a digital serial interface |
| S1 | Continuous operation |
| S3 | Intermittent operation |
| SH | Safe standstill |
| SI | Safety integrated |
| SPS | Programmable logic controller |
| STW | PROFIBUS control word |
| TIA | Totally integrated automation |
| TM | Terminal module |
| UL | Underwriters Laboratories Inc. |
| Vdc | DC link voltage |
| VDE | Verband Deutscher Elektrotechniker<br>(Association for Electrical, Electronic, and Information Technologies) |
| VDI | Verein Deutscher Ingenieure<br>(Association of German Engineers) |
| VT | Variable torque |

# Index

# Parameterlist

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