SIEB & MEYER

# Drive System SD2T

## Hardware Description

### Devices in table top design: 036216X


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# 1 About this Manual

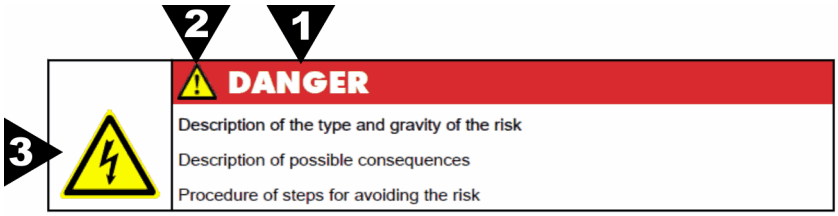


This chapter describes symbols, signal words and abbreviations used in this manual.

You can download more documentation from the SIEB & MEYER website under http://www.sieb-meyer.de/downloads.html.

## 1.1 Illustration of Warnings

Depending on their degree of risk, warnings are classified into different levels. In the manual, the different levels and types of dangers are represented as follows:




[1] Risk level (signal word/warning color)
Classification of the risk

[2] Safety symbol
Risk of injury

[3] Risk symbol
Graphic representation of the source of risk

### Risk levels

| Risk Level | Description |
|---|---|
| DANGER | Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. |
| WARNING | Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. |
| CAUTION | Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or property damage. |
| NOTICE | Indicates a hazardous situation which, if not avoided, may result in property damage. |

### Risk symbols

| Risk symbol | Description |
|---|---|
|  | General hazardous situation |
|  | Risk of injury due to electric shock |
|  | Risk of injury due to hot surfaces |

| Risk symbol | Description |
|---|---|
|  | Potentially risk of injury when working on machines with open covers/ doors |
|  | Risk of injury due to flying objects |
|  | Destruction risk of electrostatically sensitive components |
|  | Risk of property damage |

## 1.2 Illustration of General Notices

| Symbol | Description |
|---|---|
|  | Hint with additional, further information |
|  | Tip with suggestions and useful information |

## 1.3 Technical Symbols

| Symbol | Description |
|---|---|
| ● | LED indicator: LED on |
| ○ | LED indicator: LED off |
| ☼ | LED indicator: LED flashes |

## 1.4 Abbreviations

| | |
|---|---|
| FPAM | flux pulse amplitude modulation |
| HSPAM | high-speed pulse amplitude modulation |
| HSPWM | high-speed pulse width modulation |
| n.c. | not connected |
| PAM | pulse amplitude modulation |
| PWM | pulse width modulation |
| SERVO | servo control |
| SVC | sensorless vector control |
| VF | V/f Characteristic Curve |

| | |
|---|---|
| VCC | voltage at the common collector |
| VECTOR | vector control |

1

# 2 General Information



This manual describes the devices of the series SD2T in table top design. These devices allow operation of synchronous and asynchronous high-frequency spindles.

The devices are equipped with an interface for a NAMUR sensor. In addition, the devices can drive rotary and linear motors. Thus, the number of device variants is reduced for the machine manufacturer.

This manual provides information on:

- Safety instructions and application advice
- Notes about the electromagnetic compatibility
- Description of the device (block diagram, type plate, module designation)
- Technical data, dimensions
- Connector pin assignment
- Wiring examples
- Status and error messages
- General information regarding the wiring (cables and line cross-sections)

This manual has the following demands on the trained staff of machine manufacturers:

| | |
|---|---|
| Transport: | only by skilled employees familiar with handling electrostatically sensitive components. |
| Installation: | only by experts with electromechanical experience |
| Initial operation: | only by experts with experience in the fields of electrical engineering / drive technology |

Information concerning the initial operation and parameterization of the digital drive amplifier can be found in the manual of the software *drivemaster2*.

You can download more documentation from the SIEB & MEYER website under http://www.sieb-meyer.de/downloads.html.

# 3 Safety Instructions

These safety instructions include important information regarding your safety and must be observed during installation and operation of SIEB & MEYER devices. Read them carefully and keep them for later use.

Also adhere to safety instructions in the product documentation and on the device.



## 3.1 Standards and Regulations

SIEB & MEYER devices comply with the regulations of the following standards and directives:

- Low-Voltage Directive 2014/35/EU:
  EU declaration of conformity, DIN EN 61800-5-1
- EMC Directive 2014/30/EU:
  EU manufacturer's certificate, DIN EN 61800-3
- Machinery Directive 2006/42/EC:
  EU manufacturer's certificate, DIN EN 61800-5-2 (safety functions)

SIEB & MEYER products are no products according to the EU Machinery Directive. The appropriate use of SIEB & MEYER devices in machines and installations is prohibited until the manufacturer of the machine or installation confirms the CE conformity of the complete machine or installation.

If the mechanics or the electronics of the device are modified, the conformity with the EC/EEC directives and thus the CE label will expire.

## 3.2 Working on the Device

**⚠ WARNING**

**Trained staff only**

To avoid risks of serious injuries and material damage any works regarding installation, initial operation and maintenance must be carried out by trained staff only. Furthermore, electricians who connect feed-in systems must be approved by the local DSO (distribution system operator).

Trained staff, according to this fundamental safety instruction, are persons familiar with the installation, mounting, initial and permanent operation of the product and they are qualified appropriately for the work. The standards DIN VDE 0100 and DIN VDE 0110 as well as the national accident prevention regulations shall be considered!

When installing feed-in systems adhere to all applicable regulations, special safety instructions and technical connection conditions of the local DSO.

**DANGER**

**Risk of serious damage to property and personal injury may occur:**

- when covers are removed illegally,
- due to improper use,
- when either the installation or the operation is incorrect

Observe the corresponding notes and information in the product documentation of your device.

**WARNING**

**Risk of injuries and material damage due to illegal modifications**

Only change the settings of the device after having contacted SIEB & MEYER.

All Information and advice attached to the device, such as safety instructions or danger warnings and technical data (type plate) are:

- not to be removed
- not to be damaged
- to be kept readably (no covers, no paint over or the like)

## 3.3 Appropriate Use

Use the device according to its appropriate use only. Consider the corresponding information regarding the application fields of the device in the product documentation.

Devices in table top design have all components required for operation integrated in one table top housing to allow operation without switch cabinet.

SIEB & MEYER products are **not** suitable for use in areas exposed to explosion hazards (ATEX zones) without approriate housing.

**Terms according to DIN EN 61800**

Before initial operation, make sure that the machine will not expose danger (e.g. runaway moves). The conformity with the safety standards DIN EN 60204-1 and DIN EN 61800-5-1 must be ensured.

The manufacturer of the system or the machine has to meet the requirements of the legal values regarding the Electromagnetic Compatibility (EMC). SIEB & MEYER units can be operated in industrial areas, provided that the attached EMC information has been taken into consideration.

SIEB & MEYER tests all products in its own EMC laboratory to ensure that the products meet the respective standards, when they are installed properly.

Installation of the device differing from the product documentation and the manual "EMC Guidelines" means that the machine manufacturer has to carry out new measurements to comply with the regulations.

SIEB & MEYER devices meet the requirements of the Low-Voltage Directive 2014/35/EU. The harmonized standards of DIN EN 50178 and DIN EN 60204-1 in combination with the standards DIN EN 60947 and DIN EN 61800-5-1 are applied consequently.

Technical data and the connection specification can be found in the respective product documents.

**Line filters**

If adequate interference suppression measures are applied and the appropriate use in industrial applications of the device is ensured SIEB & MEYER devices comply with the Directive EMC Directive 2014/30/EU in terms of the EMC Product Standard (PDS) DIN EN 61800-3.

The use of line filters helps reaching the following:

- Resistance to interference. The electronic system is protected against high-frequency disturbances, possibly infiltrated via the mains cable.
- Protection against radiation. High-frequency disturbances are reduced to legally authorized measure. This prevents effects of the transients to adjacent components or devices.
- Products, not equipped with an integrated AC supply line filter must be operated with an upstream line filter.
- Using SIEB & MEYER devices in residential or business areas as well in small businesses requires additional interference suppression.
  For detailed information refer to the manual "EMC Guidelines", chapter "EMC Product Standard DIN EN 61800-3 for PDS".

Refer to the product documentation of your device to find out whether or not your device is equipped with a line filter. For detailed information on line filters refer to the manual "EMC Guidelines".

## 3.4 Reasonably Foreseeable Misuse

The Machinery Directive defines a "reasonably foreseeable misuse" as "use of machinery in a way not intended in the instructions but which may result from predictable human behavior".

SIEB & MEYER products are no products according to the EU Machinery Directive.

During design and construction of the machine as well as in the operation manual the machine manufacturer is obliged to give consideration to the intended (appropriate) use of the machine and risks arising from reasonably foreseeable misuse of the machine.

To avoid injuries and material damage any use, installation and setup of SIEB & MEYER products by non-experts which exceed the technical data specified in the product documentation (high voltages, temperatures etc.) is considered to be not intended use and forbidden. Adhere to the safety instructions on the device and in the product documentation.

## 3.5 Transport and Storage

Avoid improper mechanical load of the device. The following points must especially be taken into consideration:

- Protect the device against mechanical damage (max. acceleration = 40 m/s²).
- Protect the device against dirt and humidity.
  Make sure that **dust plugs are plugged on optical fiber connectors equipped with them during transport of the device**. Otherwise, recommissioning is potentially not possible.
- Never touch electronic components.

The following climatic conditions apply to the storage. If required, appropriate measures must be taken to ensure these climatic conditions (installation of heating/air conditioning systems etc.):

- The storage area must be clean (dust-free, if possible), dry and well-ventilated.
- No storage in the open.
- The storage temperature must be in the range of −25 °C to +55 °C (−13 °F to +131 °F). Shortly it may be +70 °C (+158 °F).
- The relative humidity on the storage premises must be in the range of 5 % to 75 % (no bedewing).
- Sudden changes of the temperature or the humidity should be prevented.
- Avoid stacking of the devices during transport and storage.

The maximum storage period is 2 years. Electrolytic capacitors produce high leakage currents when a voltage is applied after a long storage period without applied voltage and must be reformed. For this, the operating voltage is applied via a 1 kΩ series resistor for one hour. Please contact the SIEB & MEYER service department for details.

## 3.6 Installation

**NOTICE**

**Damage of electrostatically sensitive components due to improper handling**

Never touch electronic components.

Consider specific mounting instructions for your device.

**Mechanical installation conditions for the system according to DIN EN 61800-2:**

Vibrations must remain within the limit values of the IEC 60721-3-3, class 3M1, standard for fixed equipment.

| Frequency [Hz] | Amplitude [mm] | Acceleration [m/s²] |
|---|---|---|
| 2 ≤ *f* < 9 | 0,3 | Not applicable |
| 9 ≤ *f* < 200 | Not applicable | 1 |

*Tab. 1: Vibration limits of the system*

Vibrations which exceed these limits, or the use on mobile equipment, are considered as **abnormal mechanical conditions**.

**Operating conditions:**

The following requirements are to be considered for the installation and the operation of the device. Noncompliance with theses requirements is regarded as **abnormal operating condition**:

- The device is conceived according to DIN EN 61800-1 / DIN EN 50178 for the dirt level 2. That means: Ensure to avoid conductive impurities during the operation.
- Devices with air cooling only can be loaded to their maximum up to a height of 1000 m above MSL (3281 ft above MSL). For an operation in areas higher than 1000 m (3281 ft) above MSL the capacity must be reduced by 1.5 % per 100 m (328 ft).
  The maximum site altitude is above MSL.

- The device must be protected against harmful gas, oil vapor and salty air at the place of installation.
- The ambient air must not contain aggressive, grinding, electrically conductive or flammable substances as well as any amount of dust.
- The maximum relative humidity during operation is 85% (no condensation).
- The admissible ambient temperature during operation is +5 °C to +40 °C (+41 °F to +104 °F). Extreme and sudden changes of the temperature should be prevented.
  - Ensure power derating for devices used under ambient temperatures over +40 °C (+104 °F) (see technical data). 1.5 % per 1 °C. Note: F=C×9/5+32; C=(F-32)×5/9
  - Devices with polyester films: The polyester films must not be exposed to direct sunlight for extended periods of time. In conditions of high humidity (>80 %) the ambient temperature must not exceed +40 °C (+104 °F). The polyester films must not come in contact with benzyl alcohol or methylene chloride.
- Make sure that the aeration elements are free and open, so that the air circulation is not restricted.



## 3.7 Electrical Connection

**DANGER**

**Risk of serious injuries due to touch voltages**

After electric devices have been switched off touch voltages may occur depending on the device up to 4 minutes. Longer construction-related discharge times are possible. Refer to the product documentation of your device.

All work at and within the units must only be carried out, when the units are turned off, the mains supply is cut and the DC bus is completely discharged.

Never touch energized parts after a device has been switched. off.

Consider the VDE regulations and the applicable accident prevention regulations (e.g. VBG 1 and VBG 4).

**DANGER**

**Risk of serious injuries due to improper connection to earth**

Incorrect or insufficient connection of the system to earth may cause dangerous currents.

Connection to earth must be realized according to the instructions in the product documentation of your device.

The electrical installation must be carried out according to the relevant electrical codes (e.g. appropriate wire gauges, fuse protection and connections of ground conductors must be considered).

SIEB & MEYER device are conceived for connection to TN mains. For detailed information regading the connection to TN mains or other mains refer to the manual "EMC Guidelines", chapter "Connection to Different Supply System Types".

Recommendations for the installation complying EMC (e.g. shields, connection to earth and line installations) can be found in the technical manuals of your device (only for machine manufacturers). The manufacturer of the system or machine has to meet the requirements of the legislation regarding the EMC.

- Consider that the mains supply must be protected via an overload release with restricted guidance for each mains phase. The mains line should only be connected, when the work is completed.
- Before turning on the unit the first time, make sure that the connected machine will not have runaway axes.
- Never connect capacitive loads to the output phases of the servo amplifiers and frequency converters.
- Prevent cable loops. Therefore, the units must only be connected to earth at the provided PE connection for the mains supply line and the racks only at the provided earth screw.



**DANGER**

**Connection of the power supply unit**

This product may cause touch current in the protective earthing conductor. The current in the protective earthing conductor can exceed 3.5 mA AC or 10 mA DC.

Pay attention to the local safety regulations for electric equipment with high leakage currents, in particular the minimum cross-section of the protective earthing conductor.

**Operation with residual current device (RCD)**

For detailed information regarding the operation with residual current device (RCD) refer to the manual "EMC Guidelines", chapter "Safety-relevant Aspects, Residual Current Device (RCD)".

## 3.8 Operation

**WARNING**

**Risk of serious injuries due to moving machine parts**

During the operation of an installation with open doors or removed covers, persons may seriously be injured by moving machine parts.

Keep the doors closed during the operation and do not remove covers.

**WARNING**

**Risk of injuries and material damage due to flying parts**

Persons may be injured or material be damaged, if screws of the front panels and housing parts are not fastened.

Before the initial operation of the installation ensure that all screws are tightened.

**WARNING**

**Risk of burn due to hot surfaces**

During operation the units can have hot surfaces according to their protection system. In particular this applies to ventilation inlets and outlets.

Never touch device parts during operation apart from operating units.

When using ferrite rings temperatures may exceed 80°C in some cases.

Only use cables suitable for temperatures over 90 °C. This corresponds to the flammability rating UL 94V-0, RTI 105°C.

Consider the relevant notes in the manual.



Systems, into which servo amplifiers and frequency converters are mounted, possibly must be equipped with additional protective devices according to the valid safety instructions (e.g. law about technical material, rules for prevention of accidents, etc.).

## 3.9 Maintenance

The unit must be checked regularly for cleanness and functionality depending on the ambient pollution. This applies in particular for installed fans.

## 3.10 Disposal

Make sure to consider country-specific waste and disposal laws and statutes for the disposal of packing material, used batteries and irreparable devices.

SIEB & MEYER products meet the requirements of the following directive:

- 2011/65/EU (EU-directive RoHS 2 on the restriction of the use of hazardous substances in electrical and electronic equipment)

SIEB & MEYER products do not exceed the limits of the directive 2011/65/EU for hazardous substances.

SIEB & MEYER products labeled with the adjacent symbol also meet the regulations of the following directive:

- SJ/T 11364-2014 (China RoHS 2 on the restriction of the use of hazardous substances in electrical and electronic equipment)

SIEB & MEYER products labeled with the symbol above do not exceed the limits of the directive SJ/T 11364-2014 for hazardous substances.

## 3.11 Legal Warranty

SIEB & MEYER products are liable to a legal warranty of at least one year. Any claims for the products beyond this warranty shall be declared in an additional contractual agreement between SIEB & MEYER and the customer.

Claims for damages are excluded:

- due to improper use of the device

- when the device has been installed nonstandard or improperly, especially by electricians without license
- when the device has been employed although the protection equipment was defective
- when the maximum permissible input voltage has been exceeded
- due to improper operation
- when the device or its equipment have been modified
- when the device was affected by foreign material or force majeure



**NOTICE**

**Due diligence of the machine manufacturer**

A first programming carried out by SIEB & MEYER does not release the machine manufacturer from his duty to check the programmed values for correctness.

# 4 Unit Assembly Complying EMC

The EU guidelines for electromagnetic compatibility (EMC) must be considered for the initial operation of all SIEB & MEYER devices.

The manual "EMC Guidelines" is available in German and English and includes:
- EMC rules
- information regarding the professional grounding and wiring
- safety-relevant aspects
- extracts from the EMC product standard
- possibilities for the connection to different supply system types

**Availability:**
- PDF file under www.sieb-meyer.de/downloads.html



## 4.1 Emission of Line and Field Interferences

According to the EMC product standard DIN EN 61800-3, chapter 6 (emission of line interferences), the devices of the series SD2T meet the interference limit values of the following EMC categories:
- device types 0362160xy and 0362162xy (with PFC):
  - motor connection via shielded circular connector= category C1
  - motor connection via terminal block = category C2
- device type 0362161xy (without PFC) = category C3

**Further information on devices of category C2/C3**

Requirements
- The device is equipped with an internal line filter.
- If no internal line filter is provided, external line filters must be used to reach the category C2/C3.

More detailed information on the installation of the devices and the use of line filters can be found in the manual "Unit Assembly Complying EMC".

**NOTICE**

**High-frequency interferences during the use of the device in a public mains**

With devices of the EMC category C2 or C3 high-frequency interferences may occur, if the device is used in a public mains which supplies residential areas. These interferences may disturb the functioning of other devices.

Do not use the device in a public mains or ensure appropriate interference suppression measures.

# 5 Drive Amplifier SD2T

## 5.1 Type Plate

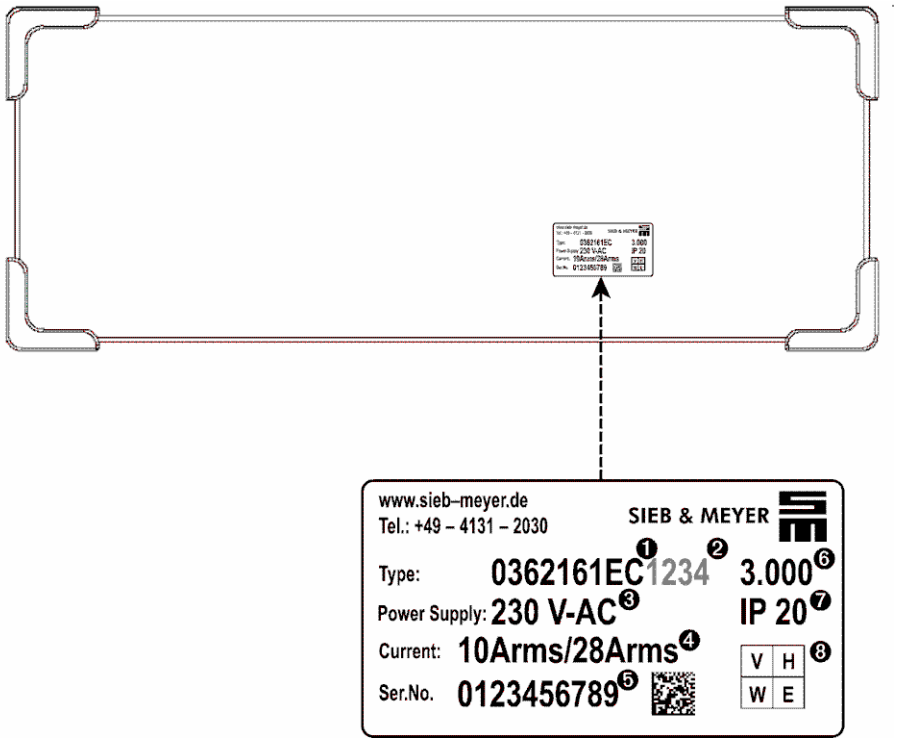
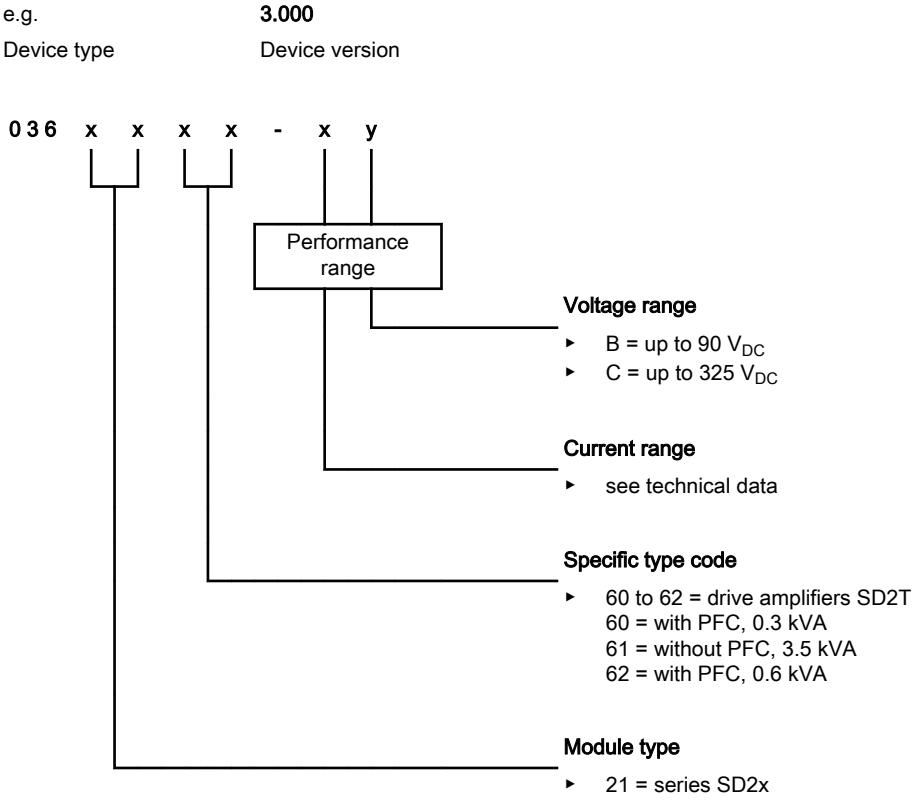



*Fig. 1: Type plate of SD2T on the back of the device*

| No. | Meaning | Explanation |
|---|---|---|
| ❶ | Device designation | Composed of module type with indication of performance range and max. DC link voltage |
| ❷ | Extension for customized devices | Indicates a 4 digit numeral code for customized devices; there is no code for standard devices |
| ❸ | Supply voltage | Indicates the maximum voltage range (if this row is left blank, an external power supply unit is necessary) |
| ❹ | Rated current/peak current | Applies to the output stage; indicated as RMS value |
| ❺ | Serial number | Indicates the individual number of the device |
| ❻ | Device version | Indicates the version of the hardware; if no version is existent, 0.000 is indicated here |
| ❼ | IP Code | Indicates the level of protection of the device against touching or intrusion of solid objects (1st digit) and water ingress (2nd digit) |
| ❽ | QA label | |

# 5.2 Device name




### Device version X.XXX

Serial counter. If there is no device version, 0.000 is indicated here. If a device is exchanged by a device of another version, please contact SIEB & MEYER to check whether the devices are compatible or not.

In addition the device version indicates the update capability of the internal device software, e.g. BIOS, FPGA or Firmware.

# 6 Device Variant 0362160xy

- output power up to 0.3 kVA
- DC link adjustable up to 90 $V_{DC}$


*Fig. 2: Front view 0362160xy*

The device is designed for horizontal setup. Other setup positions are possible but you must consult SIEB & MEYER before.

## 6.1 Dimensions

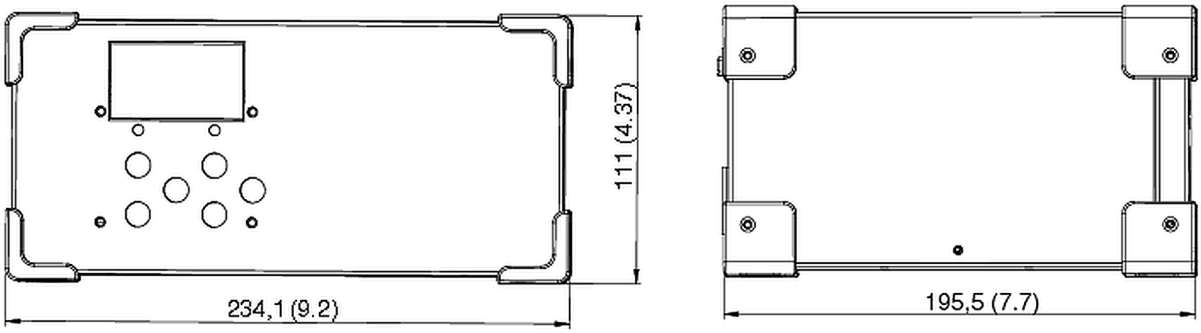
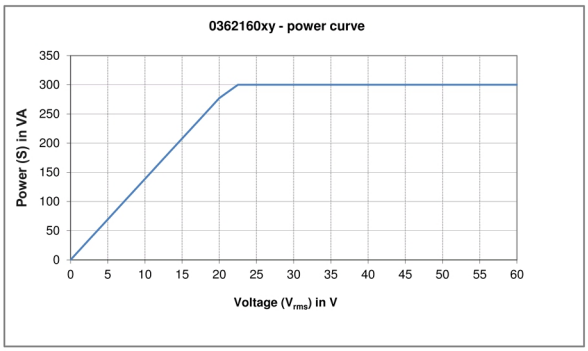



*Fig. 3: Dimensions 0362160xy in mm (inch)*

## 6.2 Technical Data

| Device variant | 0362160DB |
|---|---|
| Continuous phase current of output stage (±3 %) | 11.2 $A_p$ / 8 $A_{rms}$ |
| Peak phase current of output stage (±3 %) | 19.6 $A_p$ / 14 $A_{rms}$ |
| Internal motor phase choke | 3 × 220 µH |
| Max. time for peak current | 5 s |
| Max. temperature of the output stage | 75° C |
| Max. output frequency | 8000 Hz |
| Output frequency stability | ≤ 0.2 % |
| Mains supply (1-phase) | 1 × 115 $V_{AC}$ -10 % to 230 $V_{AC}$ +10 %<br>50 Hz / 60 Hz |
| DC link voltage | adjustable up to 90 $V_{DC}$ |
| Output power S1 | 0,3 kVA |
| Short circuit current rating (SCCR) | 5 kA |
| Power loss logic unit | 12 W |
| Power loss of power unit | Max. 5 % of the output motor power, at least 20 W |
| Internal ballast resistor | 33 Ω / 10 W |
| Ballast threshold | 100 $V_{DC}$ |
| Overvoltage threshold | 110 $V_{DC}$ |
| Undervoltage threshold | 0 $V_{DC}$ |
| Mains fuse | 2 × 6.3 A medium slow (5 × 20 mm) |
| Ambient temperature range | 5 °C to 40 °C at a maximum relative humidity of 85 % (without moisture condensation) |
| IP Code | IP20 |
| Max. weight | 4 kg |

### Rated current derating



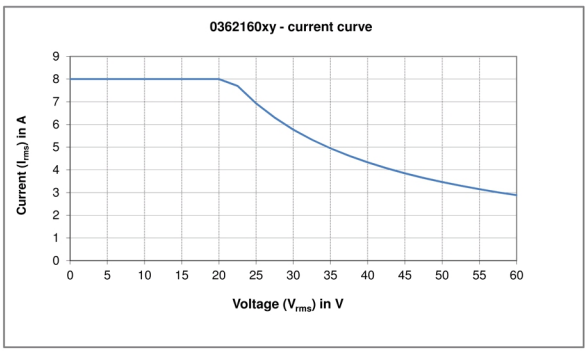




*Fig. 4: Output characteristics 0362160xy*

## 6.3 Connectors

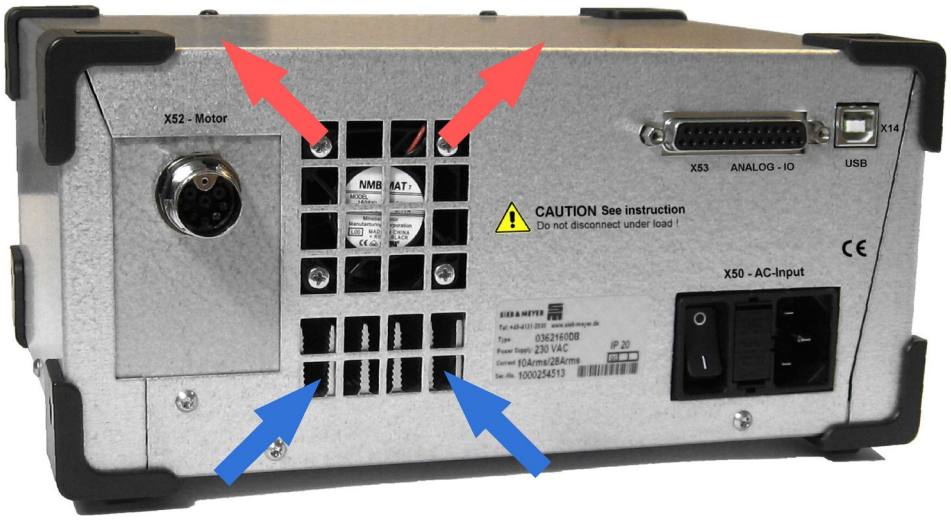



*Fig. 5: Rear view 0362160xy*



**NOTICE**

**Restriction of cooling air flow**

If the air flow cooling the device is obstructed, the device could overheat and possibly become damaged.

When installing the device, pay attention to the direction of air flow through the internally installed fan **[arrows]**.

For sufficient cooling the ventilation inlets and outlets must be kept free by a space of min. 10 cm.

| Connector | Meaning | Pin assignment |
|---|---|---|
| X14 USB | Parameterization of the USB interface | page 43 |
| X50 AC Input | Mains supply power entry module | page 43 |
| X52 Motor | Motor connection | page 45 |
| X53 ANALOG - IO | Analog and digital interface | page 46 |

You can order the appropriate connector/cable kit for the device variant 0362160xy (article No. 322 99 568 or 322 99 574) at SIEB & MEYER.

# 6.4 Block Diagram

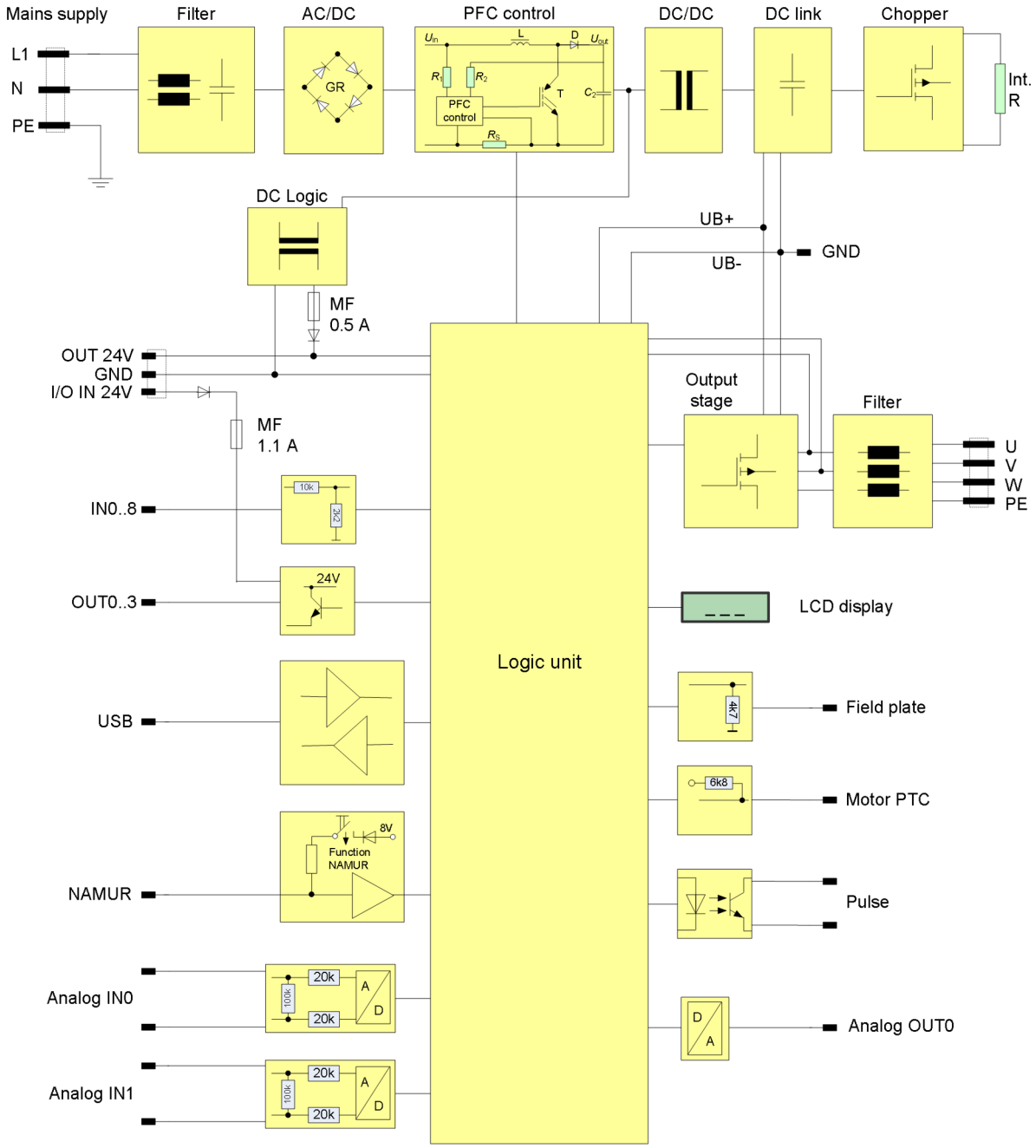



*Fig. 6: Block diagram for device variant 0362160xy*

# 7 Device Variant 0362161xy

- output power up to 3.5 kVA
- DC link adjustable up to 310 $V_{DC}$

### Standard chassis


*Fig. 7: Front view 0362161xyxx0x*

The device is designed for horizontal setup. Other setup positions are possible but you must consult SIEB & MEYER before.

### 19-inch chassis


*Fig. 8: Front view 0362161xyxx5x*

The device is designed for horizontal setup. Other setup positions are possible but you must consult SIEB & MEYER before.

# 7.1 Dimensions

**Standard chassis**

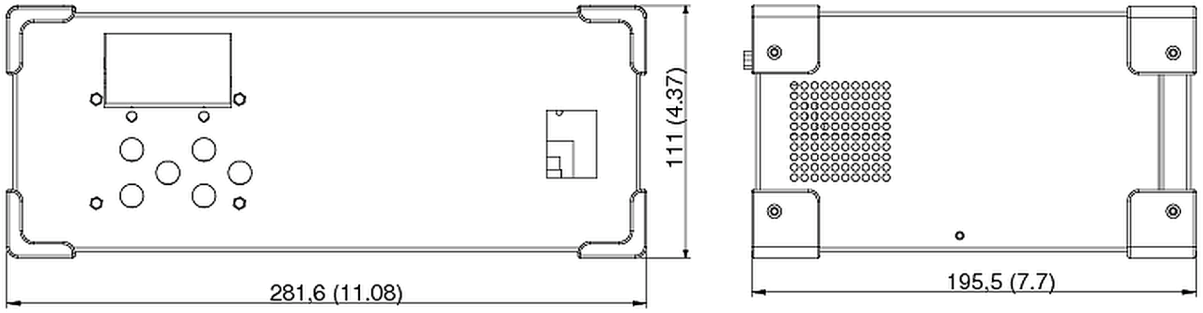



*Fig. 9: Dimensions 0362161xyxx0x in mm (inch)*

### 19-inch chassis

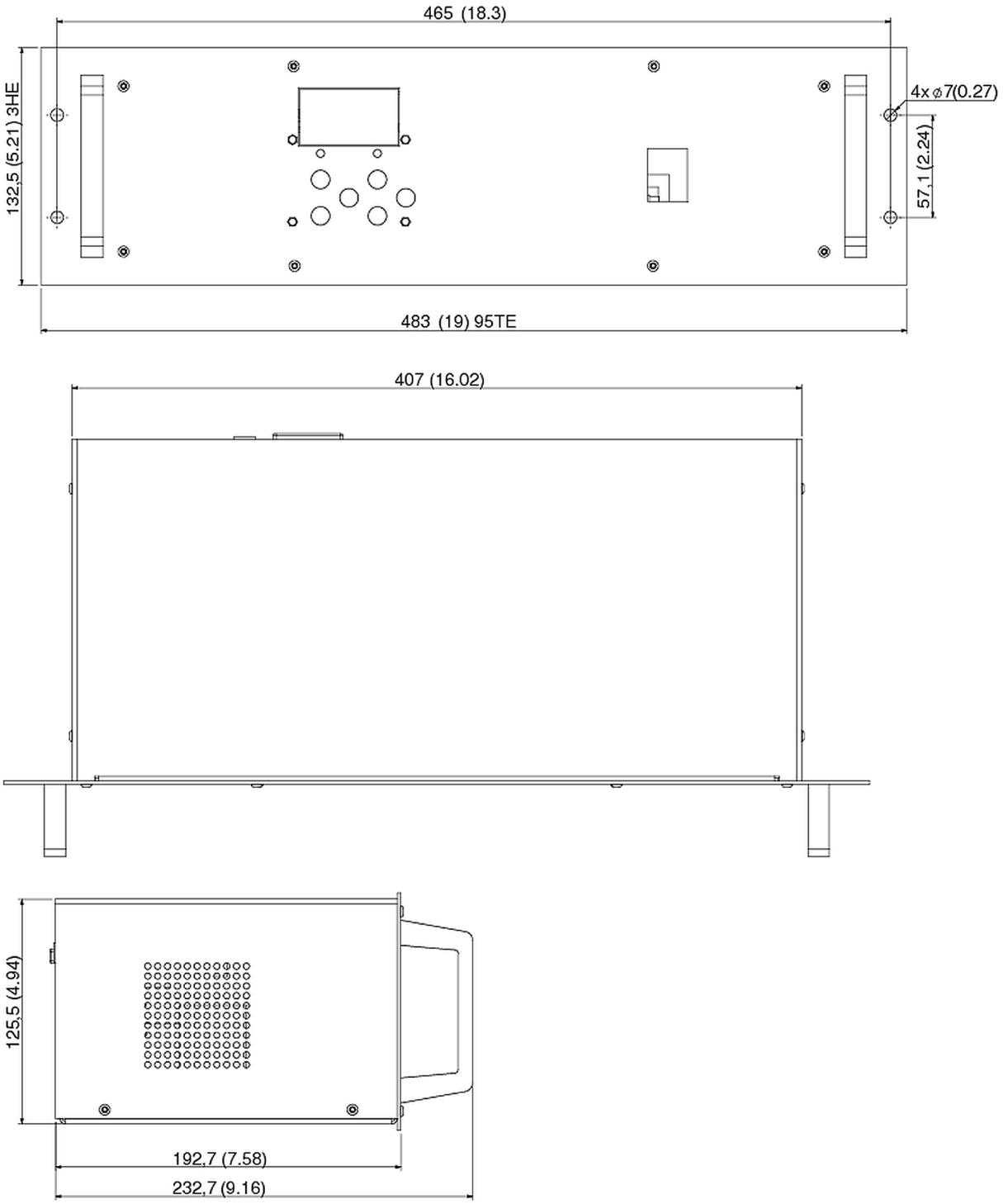


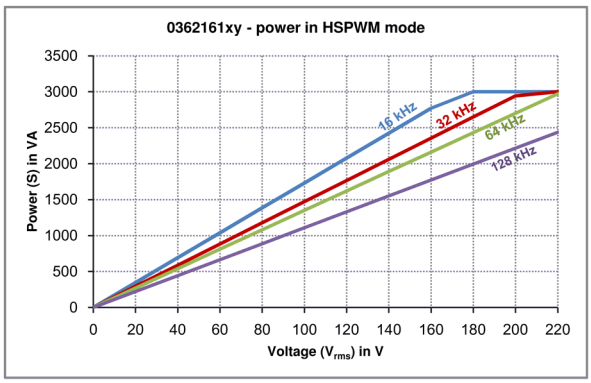

*Fig. 10: Dimensions 0362161xyxx5x in mm (inch)*

# 7.2 Technical Data

| Device variant | 0362161EC |
|---|---|
| Continuous phase current of output stage (±3 %) | 14 $A_p$ / 10 $A_{rms}$ |
| Peak phase current of output stage (±3 %) | 40 $A_p$ / 28 $A_{rms}$ |
| Internal motor phase choke | 3 × 220 µH |
| Max. time for peak current | 2 s |
| Max. temperature of the output stage | 75° C |
| Max. output frequency | 8000 Hz |
| Output frequency stability | ≤ 0.2 % |
| Mains supply (1-phase) | 1 × 115 $V_{AC}$ -10 % to 230 $V_{AC}$ +10 %<br>50 Hz / 60 Hz<br>max. 15 A, max. 3.5 kVA |
| DC link voltage | adjustable up to 310 $V_{DC}$ |
| Output power S1 | 1.75 kVA at 10 $A_{rms}$ / 100 $V_{AC}$<br>3.5 kVA at 10 $A_{rms}$ / 200 $V_{AC}$ |
| Short circuit current rating (SCCR) | 5 kA |
| Power loss of power unit | Max. 20 % of the output motor power, at least 20 W |
| Internal ballast resistor | 20 Ω / 100 W PTC |
| Ballast threshold | 380 $V_{DC}$ |
| Overvoltage threshold | 410 $V_{DC}$ |
| Undervoltage threshold | 0 $V_{DC}$ |
| Mains fuse (internal) | 1 × 15 A slow (6.3 × 32 mm) |
| Ambient temperature range | 5 °C to 40 °C at a maximum relative humidity of 85 % (without moisture condensation) |
| IP Code | IP20 |
| Max. weight | 5 kg |

### Rated current derating

| Drive function | HSPWM | | | | | SVC |
|---|---|---|---|---|---|---|
| PWM frequency [kHz] | 8 | 16 | 32 | 64 | 128 | 16 |
| Rated current S1 [Arms] | 10 | 10 | 8,5 | 7,8 | 6,4 | 8,5 |



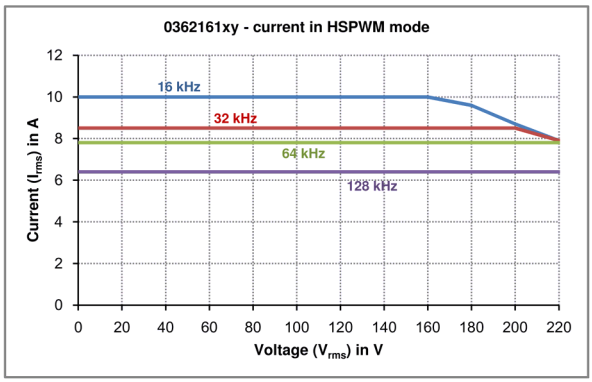




*Fig. 11: Output characteristics for 0362161xy in HSPWM mode*

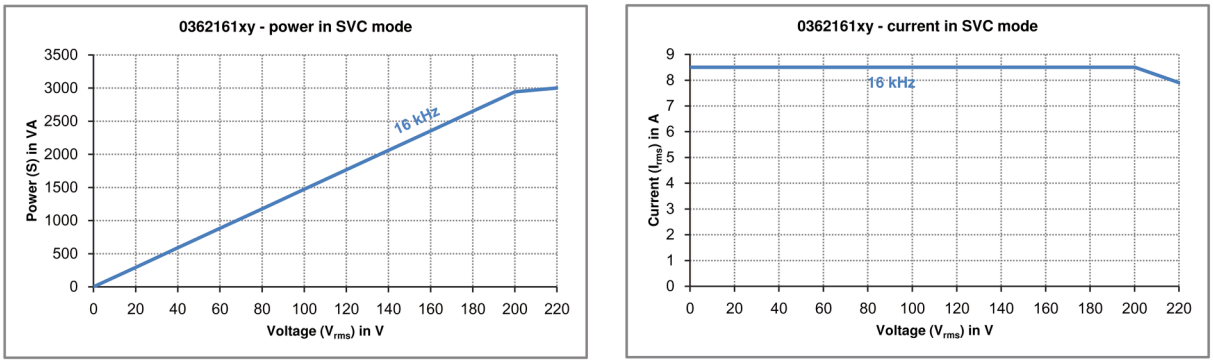



*Fig. 12: Output characteristics for 0362161xy in SVC mode*

## 7.3 Connectors

### Standard chassis


*Fig. 13: Rear view 0362161xyxx0x*

### 19-inch chassis

*Fig. 14: Rear view 0362161xyxx5x*

**NOTICE**

**Restriction of cooling air flow**

If the air flow cooling the device is obstructed, the device could overheat and possibly become damaged.

When installing the device, pay attention to the direction of air flow through the internally installed fan **[arrows]**.

For sufficient cooling the ventilation inlets and outlets must be kept free by a space of min. 10 cm.

| Connector | Meaning | Pin assignment |
|---|---|---|
| X14 USB | USB interface for parameterization | page 43 |
| X51 AC Input | Mains supply connector plug | page 44 |
| X52 Motor | Motor connection | page 45 |
| X53 ANALOG - IO | Analog and digital interface | page 46 |

You can order the appropriate connector/cable kit for the device variant 0362161xy (article No. 322 99 569 or 322 99 575) at SIEB & MEYER.

## 7.4 Block Diagram

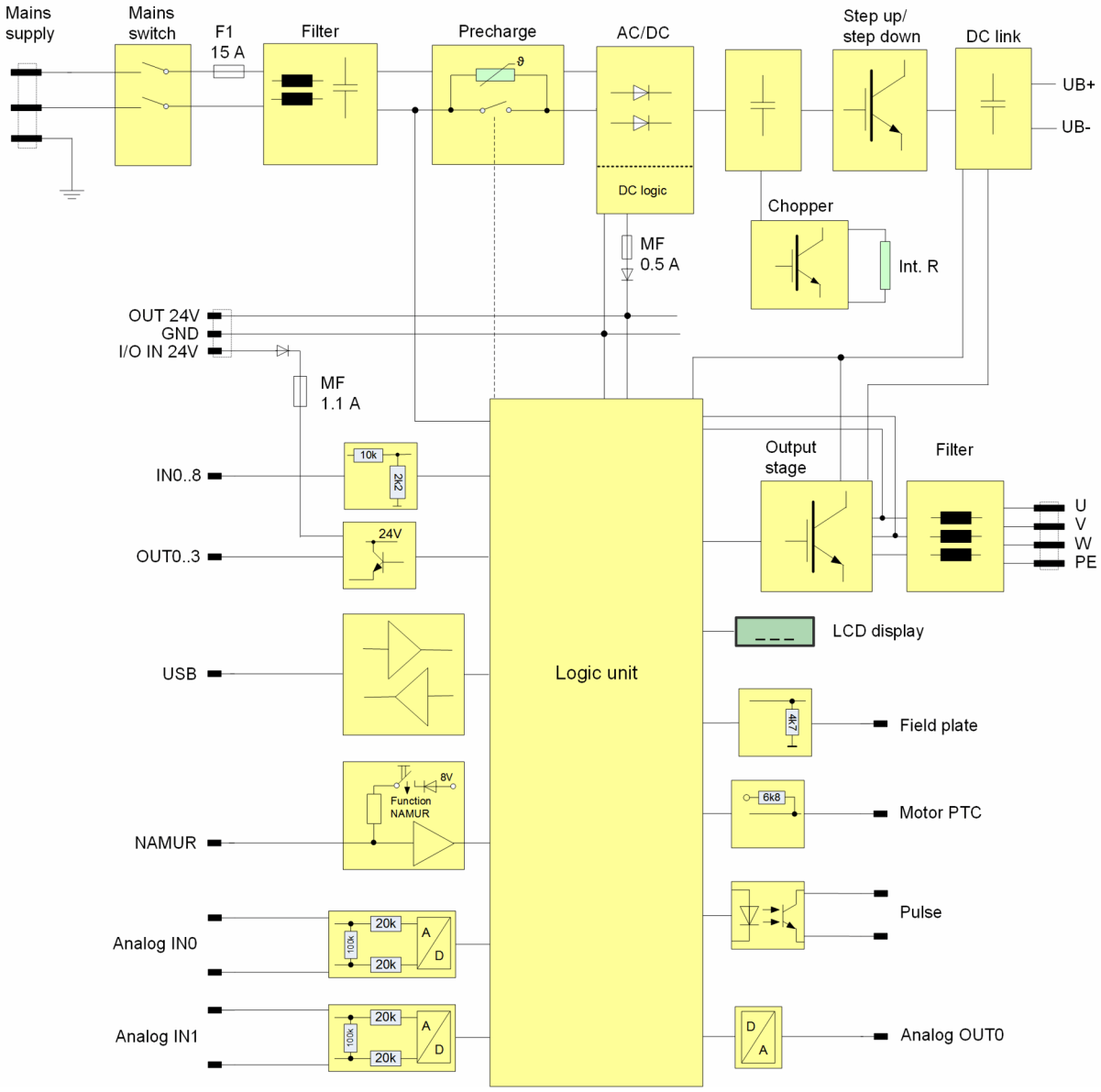



*Fig. 15: Block diagram for device variant 0362161xy*

# 8 Device Variant 0362162xy

- output power up to 0.6 kVA
- DC link adjustable up to 90 $V_{DC}$


*Fig. 16: Front view 0362162xy*

The device is designed for horizontal setup. Other setup positions are possible but you must consult SIEB & MEYER before.



## 8.1 Dimensions

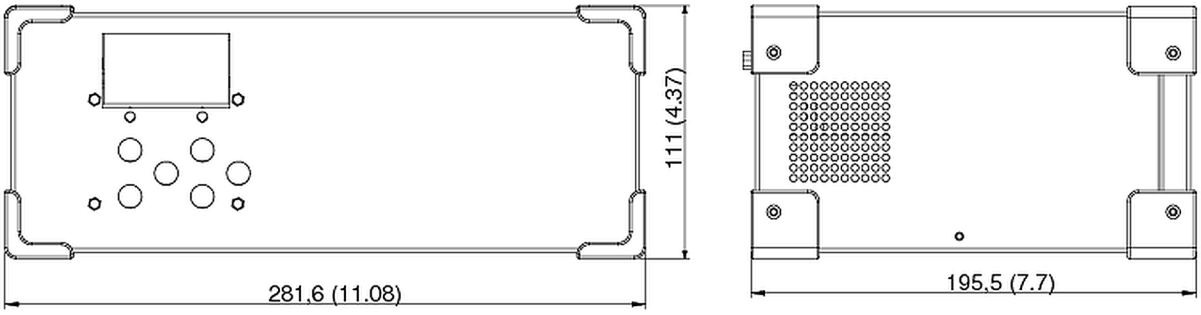



*Fig. 17: Dimensions 0362162xy in mm (inch)*

## 8.2 Technical Data

| Device variant | 0362162EB |
|---|---|
| Continuous phase current of output stage (±3 %) | 20 $A_p$ / 14 $A_{rms}$ |
| Peak phase current of output stage (±3 %) | 40 $A_p$ / 28 $A_{rms}$ |
| Internal motor phase choke | 3 × 220 µH |
| Max. time for peak current | 2 s |
| Max. temperature of the output stage | 75° C |
| Max. output frequency | 8000 Hz |
| Output frequency stability | ≤ 0.2 % |
| Mains supply (1-phase) | 1 × 115 $V_{AC}$ -10 % to 230 $V_{AC}$ +10 %<br>50 Hz / 60 Hz |
| DC link voltage | adjustable up to 90 $V_{DC}$ |
| Output power S1 | 0.6 kVA at 230 $V_{AC}$ input voltage<br>0.3 kVA at 115 $V_{AC}$ input voltage |
| Short circuit current rating (SCCR) | 5 kA |
| Power loss logic unit | 12 W |
| Power loss of power unit | Max. 5 % of the output motor power, at least 20 W |
| Internal ballast resistor | 22 Ω / 50 W |
| Ballast threshold | 100 $V_{DC}$ |
| Overvoltage threshold | 110 $V_{DC}$ |
| Undervoltage threshold | 0 $V_{DC}$ |
| Mains fuse | 2 × 6.3 A medium slow (5 × 20 mm) |
| Ambient temperature range | 5 °C to 40 °C at a maximum relative humidity of 85 % (without moisture condensation) |
| IP Code | IP20 |
| Max. weight | 4.3 kg |

### Rated current derating

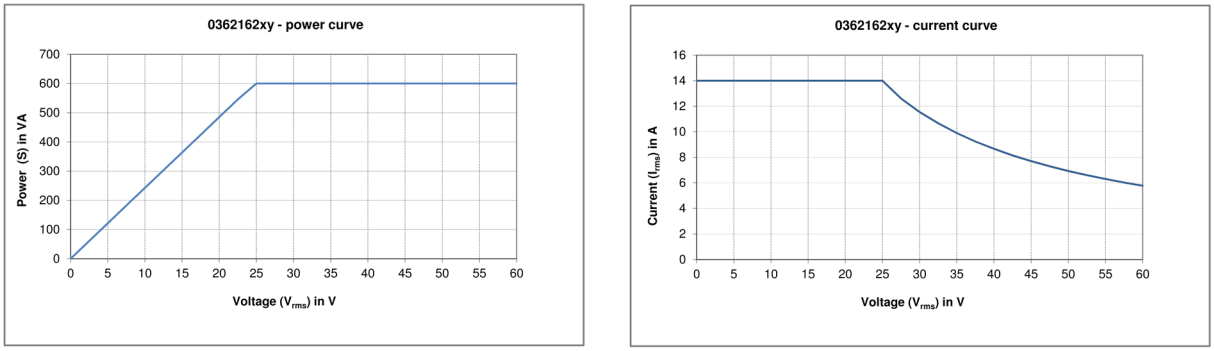



*Fig. 18: Output characteristics 0362162xy*

## 8.3 Connectors

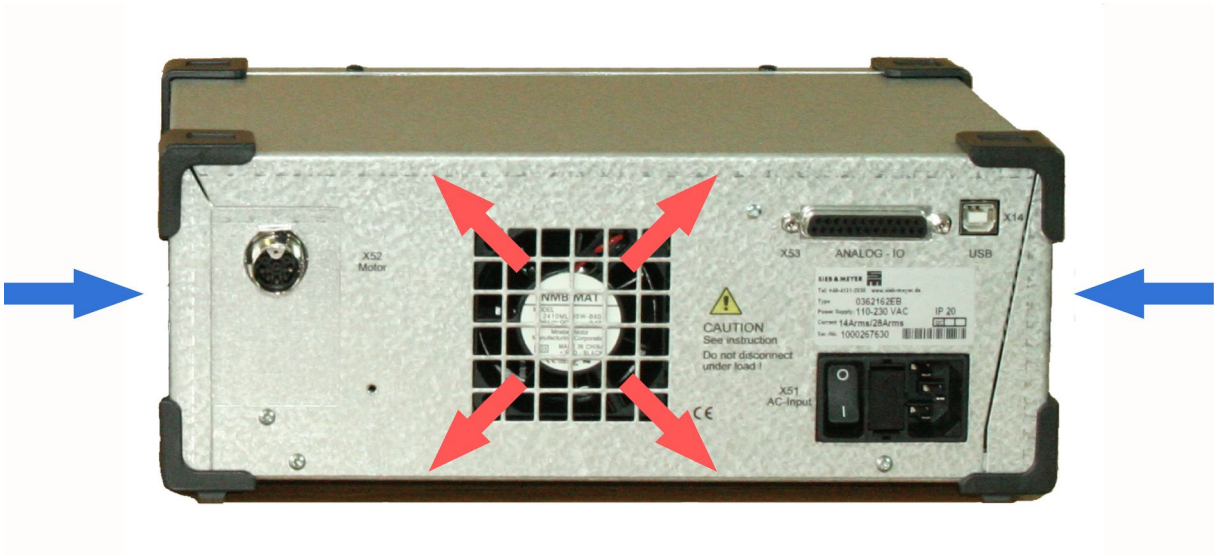



*Fig. 19: Rear view 0362162xy*

**NOTICE**

**Restriction of cooling air flow**

If the air flow cooling the device is obstructed, the device could overheat and possibly become damaged.

When installing the device, pay attention to the direction of air flow through the internally installed fan **[arrows]**.

For sufficient cooling the ventilation inlets and outlets must be kept free by a space of min. 10 cm.

| Connector | Meaning | Pin assignment |
|---|---|---|
| X14 USB | Parameterization of the USB interface | page 43 |
| X50 AC Input | Mains supply power entry module | page 43 |
| X52 Motor | Motor connection | page 45 |
| X53 ANALOG - IO | Analog and digital interface | page 46 |

You can order the appropriate connector/cable kit for the device variant 0362162xy (article No. 322 99 568 or 322 99 574) at SIEB & MEYER.

## 8.4 Block Diagram

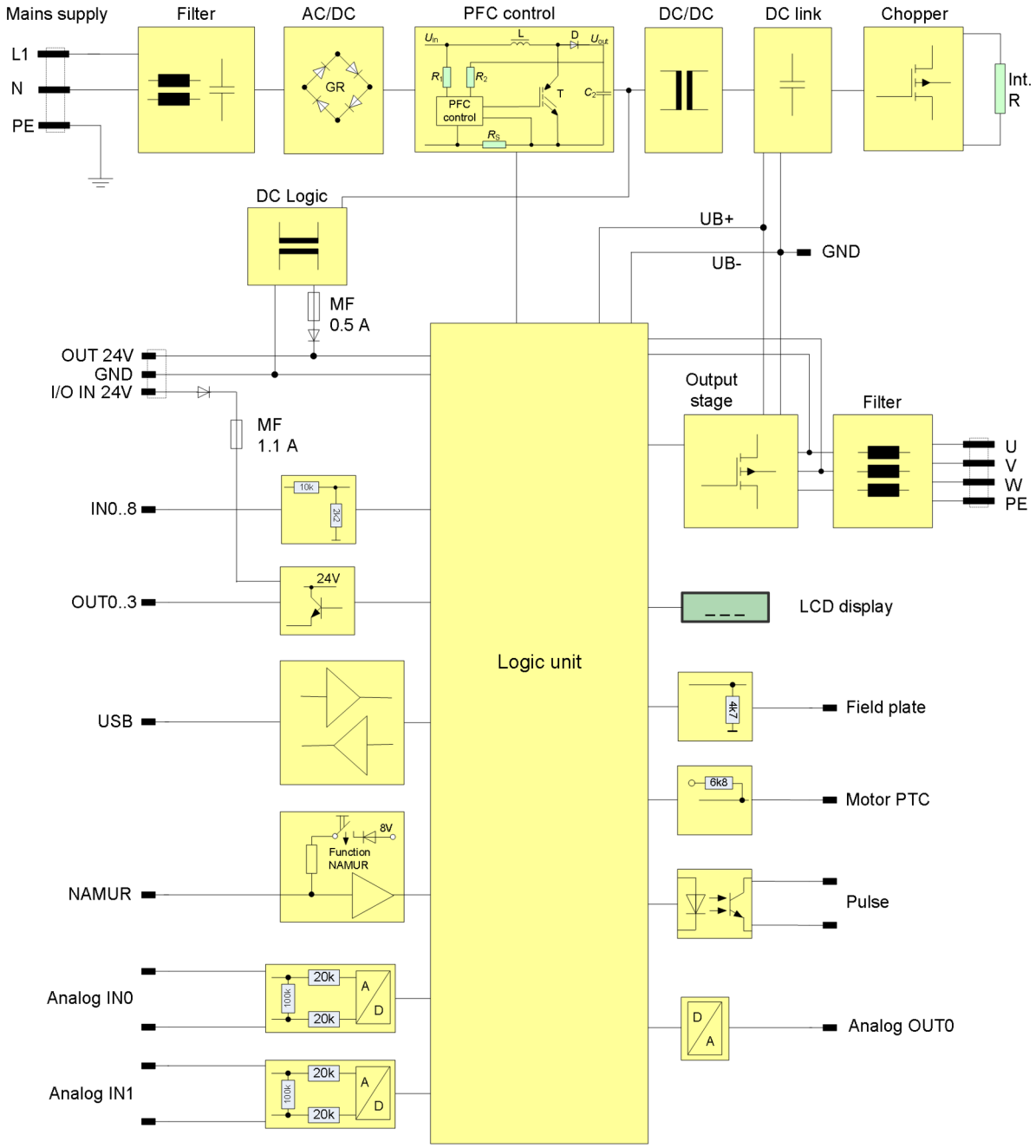


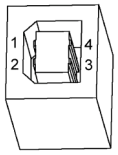

*Fig. 20: Block diagram for device variant 0362162xy*

# 9 Connector Pin Assignment

## 9.1 X14 – USB

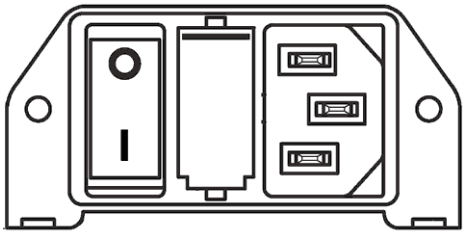
Communication interface to the connected PC

4-pole female USB connector, type B

| X14 | Pin | I/O | Name | Description |
|---|---|---|---|---|
|  | 1 | - | VCC | 5 V voltage supply for USB |
| | 2 | I/O | DM | Data− |
| | 3 | I/O | DP | Data+ |
| | 4 | I/O | GND | Ground |

## 9.2 X50 – Mains Supply

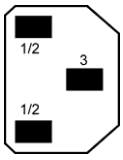
Power entry module (IEC connector with device fuse and switch)



The mains supply is connected via the mains connector and activated via the mains switch. The main fuse of the device is located between both and can be accessed from the outside.

### 9.2.1 Mains Connector

single-phase connection (230 $V_{AC}$, 50/60 Hz) - IEC connector

| | Pin | I/O | Name | Meaning |
|---|---|---|---|---|
|  | 1 | I | L1 | Mains phase L1 |
| | 2 | I | N | Neutral conductor |
| | 3 | | ⏚ | Earth connection |

### 9.2.2 Mains Switch

Switch for switching-on the voltage supply and thus the device.

**DANGER**

**Switch-on of mains switch**

Check all device connections for proper wiring before switching-on. Incorrect wiring can cause serious personal injuries and damage to the device.

A connected motor is started by switching on the mains switch, when it is controlled externally via the analog interface. Secure the motor in a way that it can not cause damage or personal injuries.

**NOTICE**

**Switching off the mains switch on-load**

Never opens the mains connector when under load. If you switch off the mains switch during operation, serious property damage may be caused.

### 9.2.3 Mains Fuse

The fuse drawer located between the connector and the switch can be pulled out. It keeps two fuses inside.

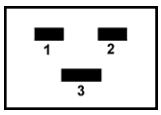
Fuse type:6.3 A medium slow (5 × 20 mm) for 300 W devices



## 9.3 X51 – Mains Supply

Connector plug 16 A

single-phase connection (230 $V_{AC}$, 50/60 Hz) - IEC connector

| X51 | Pin | I/O | Name | Meaning |
|---|---|---|---|---|
|   | 1 | I | L1 | Mains phase L1 |
| | 2 | I | N | Neutral conductor |
| | 3 | | ⏚ | Earth connection |

The main fuse of device variant 0362161xy is integrated internally. Fuse type: 15 A slow (6.3 × 32 mm)

You can order a suitable 16 A female cable connector at SIEB & MEYER, material no. 320 80 161.

## 9.4 X52 – Motor Connection

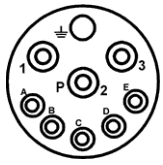
The mounted motor connector depends on the device variant (036216Xxyxxxx). The standard device is supplied with one of the following circular plug-in connectors.

Refer to the manufacturer's documentation for the assembly of the motor connector and make sure that the shield is connected correctly.

### 9.4.1 Motor Connection 036216Xxyx0xx

The device variant 036216Xxyx0xx of the series SD2T provides the following circular plug-in connector for the motor connection.

9-pole M17 connector socket (Intercontec, type: B-EG-A-908-FR-11-00-002A)

| X52 | Pin | I/O | Name | Meaning |
|---|---|---|---|---|
|  | ⏚ | | PE | Protective conductor |
| | 1 | O | U | Motor phase U |
| | 2 | O | V | Motor phase V |
| | 3 | O | W | Motor phase W |
| | A | O | VCC5 | +5 V voltage supply |
| | B | I | PTC | PTC contact(1) |
| | C | I | SENSOR | NAMUR sensor(2) |
| | D | I | FP_IN | Field plate sensor(2) |
| | I | I/O | GND | Ground |

(1) The PTC contact can be configured in the software via the parameter “Motor → Temperature monitoring”.

(2) The sensor inputs NAMUR and magnetoresistive sensor are supported for device version 2.001 and higher. They can be configured in the software via the parameter “Motor measurement system → Type of measurement system”.

See connection examples Motor Connection, page 51.

### 9.4.2 Motor Connection 036216Xxyx6xx

The device variant 036216Xxyx6xx of the series SD2T provides the following circular plug-in connector for the motor connection.

9-pole M23 connector socket (Intercontec, type: B-DF-A-109-FR-06-00-0150-200)

| X52 | Pin | I/O | Name | Meaning |
|---|---|---|---|---|
|  | A | O | U | Motor phase U |
| | B | O | V | Motor phase V |
| | C | O | W | Motor phase W |
| | D / ⏚ | | PE | Protective conductor |
| | I | I | PTC | PTC contact |
| | F | O | VCC5 | +5 V voltage supply |
| | G | I/O | GND | Ground |
| | H | I | SENSOR | NAMUR sensor |
| | L | I | FP_IN | Field plate sensor |

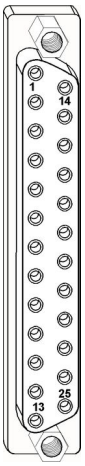
See connection examples Motor Connection, page 51.

## 9.5 X53 – Analog and Digital Interface

25-pole female submin D connector

The available functions of the digital inputs and outputs are different depending on the drive function.

### 9.5.1 Inputs/Outputs – HSPWM, HSPAM / VF

| X53 | Pin | I/O | Name | Meaning / configurable functions |
|---|---|---|---|---|
|  | 1 | I/O | GND | Ground |
| | 2 | O | N Out | Actual speed value, pulse output (configurable) |
| | 3 | I | AIN0- | Reference point of AIN0+ (pin 16) |
| | 4 | I/O | GND | Ground |
| | 5 | I | IN2 | ▸ No function<br>▸ Operation enable<br>▸ Error reset<br>▸ External hardware OK<br>▸ Speed direction<br>▸ Parameter set Bit 1<br>▸ MOP up<br>▸ MOP down |
| | 6 | I | IN0 | ▸ No function<br>▸ Switch on<br>▸ External hardware OK |
| | 7 | I | IN5 | ▸ Switch on<br>▸ Parameter set Bit 2<br>▸ Parameter set Bit 4<br>▸ Internal target value Bit 3 |
| | 8 | I | IN7 | ▸ Operation enable<br>▸ Parameter set Bit 4<br>▸ Internal target value Bit 1 |
| | | | | ▸ No function<br>▸ Error reset<br>▸ External hardware OK<br>▸ Speed direction<br>▸ Teach no-load current<br>▸ MOP up<br>▸ MOP down |
| | 9 | O | OUT0 | ▸ No function<br>▸ Ready type 1 (with power supply okay)<br>▸ Ready type 2 (without power supply okay)<br>▸ M01 – Message power output stage ready<br>▸ M02 – Message operation enabled<br>▸ M03 – Message drive error<br>▸ M10 – Ref. value reached<br>▸ M11 – Torque reached<br>▸ M12 – Speed zero<br>▸ W04 – Power output stage load<br>▸ W05 – Motor load<br>▸ W07 – Motor temperature<br>▸ W09 – Undervoltage power output stage<br>▸ W12 – Speed error<br>▸ W24 – Warning threshold 'current'<br>▸ W26 – Warning threshold 'overload current' |
| | 10 | O | OUT3 | |
| | 11 | I | AIN1- | Reference point of AIN1+ (pin 12) |

| X53 | Pin | I/O | Name | Meaning / configurable functions | |
|---|---|---|---|---|---|
| | 12 | I | AIN1+ | Analog input 1+ for:<br>▸ No function<br>▸ Speed reference value<br>▸ Current limitation<br>▸ W24 – Warning threshold 'current' | |
| | 13 | I/O | GND | Ground | |
| | 14 | O | VCC10 | 10 V for analog measuring systems (max. 0.1 A) | |
| | 15 | O | AOUT0 | Analog output 0 for:<br>▸ No function<br>▸ Target speed<br>▸ Speed reference value<br>▸ Speed actual value<br>▸ Speed error<br>▸ Current reference value<br>▸ Current actual value<br>▸ Motor temperature<br>▸ Power output stage temperature<br>▸ Motor load<br>▸ Power output stage load<br>▸ Voltage of the bus<br>▸ Active power<br>▸ DC link current Idc | |
| | 16 | I | AIN0+ | Analog input 0+ for:<br>▸ No function<br>▸ Speed reference value<br>▸ Current limitation<br>▸ W24 – Warning threshold 'current' | |
| | 17 | I | IN3 | ▸ Error reset<br>▸ External hardware OK<br>▸ Speed direction<br>▸ Teach no-load current<br>▸ Parameter set Bit 0<br>▸ Parameter set Bit 2 | ▸ No function<br>▸ MOP up<br>▸ MOP down |
| | 18 | I | IN1 | ▸ Quick stop type 5 (with slow down ramp and controller off)<br>▸ Quick stop type 6 (with quick stop ramp and controller off)<br>▸ Operation enable<br>▸ Parameter set Bit 0 | |
| | 19 | I | IN4 | ▸ Quick stop type 5 (with slow down ramp and controller off)<br>▸ Quick stop type 6 (with quick stop ramp and controller off)<br>▸ Parameter set Bit 1<br>▸ Parameter set Bit 3 | ▸ No function<br>▸ Error reset<br>▸ External hardware OK<br>▸ Speed direction<br>▸ Teach no-load current<br>▸ MOP up<br>▸ MOP down |
| | 20 | I | IN6 | ▸ Parameter set Bit 3<br>▸ Parameter set Bit 5<br>▸ Internal target value Bit 2 | |
| | 21 | I | IN8 | ▸ Parameter set Bit 5<br>▸ Internal target value Bit 0 | |
| | 22 | O | OUT1 | ▸ No function<br>▸ Ready type 1 (with power supply okay)<br>▸ Ready type 2 (without power supply okay)<br>▸ M01 – Message power output stage ready<br>▸ M02 – Message operation enabled<br>▸ M03 – Message drive error<br>▸ M10 – Ref. value reached<br>▸ M11 – Torque reached<br>▸ M12 – Speed zero<br>▸ W04 – Power output stage load<br>▸ W05 – Motor load | |
| | 23 | O | OUT2 | | |

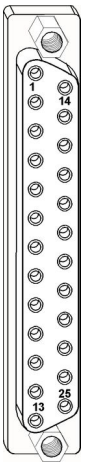
9

| X53 | Pin | I/O | Name | Meaning / configurable functions |
|---|---|---|---|---|
| | | | | ▸ W07 – Motor temperature<br>▸ W09 – Undervoltage power output stage<br>▸ W12 – Speed error<br>▸ W24 – Warning threshold 'current'<br>▸ W26 – Warning threshold 'overload current' |
| | 24 | O | VCC24_OUT | 24 V output for inputs/outputs (max. 0.3 A) |
| | 25 | I | VCC24_EXT | 24 V supply for external inputs/outputs |

Stud bolt flange: max. tightening torque = 0.7 Nm

See connection examples Inputs/Outputs, page 55.

## 9.5.2 Inputs/Outputs – SERVO / VECTOR(SVC)

| X53 | Pin | I/O | Name | Meaning / configurable functions | |
|---|---|---|---|---|---|
|  | 1 | I/O | GND | Ground | |
| | 2 | O | N Out | Actual speed value, pulse output (configurable) | |
| | 3 | I | AIN0- | Reference point of AIN0+ (pin 16) | |
| | 4 | I/O | GND | Ground | |
| | 5 | I | IN2 | ▸ No function<br>▸ Neg. limit switch type 1 (speed contr. as p-contr.)<br>▸ Neg. limit switch type 2 (speed contr. as pi-contr.)<br>▸ Operation enable<br>▸ Error reset<br>▸ External hardware OK<br>▸ Speed direction<br>▸ Parameter set Bit 1<br>▸ MOP up<br>▸ MOP down | |
| | 6 | I | IN0 | ▸ No function<br>▸ Switch on<br>▸ External hardware OK | |
| | 7 | I | IN5 | ▸ Switch on<br>▸ Parameter set Bit 2<br>▸ Parameter set Bit 4<br>▸ Internal target value Bit 3 | ▸ No function<br>▸ Speed direction<br>▸ P-controller<br>▸ Error reset<br>▸ External hardware OK<br>▸ Low gain Kpn<br>▸ Docking function<br>▸ Teach no-load current<br>▸ MOP up<br>▸ MOP down |
| | 8 | I | IN7 | ▸ Parameter set Bit 4<br>▸ Internal target value Bit 1 | |
| | 9 | O | OUT0 | ▸ No function<br>▸ Ready type 1 (with power supply okay)<br>▸ Ready type 2 (without power supply okay)<br>▸ M01 – Message power output stage ready<br>▸ M02 – Message operation enabled<br>▸ M03 – Message drive error<br>▸ M10 – Ref. value reached<br>▸ M11 – Torque reached<br>▸ M12 – Speed zero<br>▸ W04 – Power output stage load<br>▸ W05 – Motor load<br>▸ W07 – Motor temperature | |
| | 10 | O | OUT3 | | |

| X53 | Pin | I/O | Name | Meaning / configurable functions | |
|---|---|---|---|---|---|
| | | | | ▸ W09 – Undervoltage power output stage<br>▸ W11 – Tracking error<br>▸ W12 – Speed error<br>▸ W26 – Warning threshold 'overload current' | |
| | 11 | I | AIN1- | Reference point of AIN1+ (pin 12) | |
| | 12 | I | AIN1+ | Analog input 1+ for:<br>▸ No function<br>▸ Speed reference value<br>▸ Current reference value<br>▸ Current limitation<br>▸ W24 – Warning threshold 'current' | |
| | 13 | I/O | GND | Ground | |
| | 14 | O | VCC10 | 10 V for analog measuring systems (max. 0.1 A) | |
| | 15 | O | AOUT0 | Analog output 0 for:<br>▸ No function<br>▸ Target speed<br>▸ Speed reference value<br>▸ Speed actual value<br>▸ Speed error<br>▸ Current reference value<br>▸ Current actual value<br>▸ Motor temperature<br>▸ Power output stage temperature<br>▸ Motor load<br>▸ Power output stage load<br>▸ Voltage of the bus<br>▸ Active power<br>▸ DC link current Idc | |
| | 16 | I | AIN0+ | Analog input 0+ for:<br>▸ No function<br>▸ Speed reference value<br>▸ Current reference value<br>▸ Current limitation<br>▸ W24 – Warning threshold 'current' | |
| | 17 | I | IN3 | ▸ No function<br>▸ Pos. limit switch type 1 (speed contr. as p-contr)<br>▸ Pos. limit switch type 2 (speed contr. as pi-contr)<br>▸ Parameter set Bit 0 | |
| | 18 | I | IN1 | ▸ No function<br>▸ Quick stop type 1 (with slow down ramp)<br>▸ Quick stop type 2 (with quick stop ramp)<br>▸ Quick stop type 3 (at current limit)<br>▸ Quick stop type 4 (speed enable)<br>▸ Quick stop type 5 (with slow down ramp and controller off)<br>▸ Quick stop type 6 (with quick stop ramp and controller off)<br>▸ Operation enable<br>▸ Parameter set Bit 0<br>▸ MOP up<br>▸ MOP down | |
| | 19 | I | IN4 | ▸ Quick stop type 5<br>▸ Quick stop type 6<br>▸ Enable difference measuring system<br>▸ Parameter set Bit 1<br>▸ Internal target value Bit 3 | ▸ No function<br>▸ Speed direction<br>▸ P-controller<br>▸ Error reset<br>▸ External hardware OK<br>▸ Low gain Kpn<br>▸ Docking function<br>▸ Teach no-load current<br>▸ MOP up<br>▸ MOP down |
| | 20 | I | IN6 | ▸ Parameter set Bit 3<br>▸ Parameter set Bit 5<br>▸ Internal target value Bit 3 | |
| | 21 | I | IN8 | ▸ Parameter set Bit 5<br>▸ Internal target value Bit 0 | |

| X53 | Pin | I/O | Name | Meaning / configurable functions | |
|---|---|---|---|---|---|
| | 22 | O | OUT1 | ▸ Signal motor holding brake | ▸ No function<br>▸ M01 – Message power output stage ready<br>▸ M02 – Message operation enabled<br>▸ M03 – Message drive error<br>▸ M10 – Ref. value reached<br>▸ M11 – Torque reached<br>▸ M12 – Speed zero<br>▸ W04 – Power output stage load<br>▸ W05 – Motor load<br>▸ W07 – Motor temperature<br>▸ W09 – Undervoltage power output stage<br>▸ W11 – Tracking error<br>▸ W12 – Speed error<br>▸ W26 – Warning threshold 'overload current' |
| | 23 | O | OUT2 | | |
| | 24 | O | VCC24_OUT | 24 V output for inputs/outputs (max. 0.3 A) | |
| | 25 | I | VCC24_EXT | 24 V supply for external inputs/outputs | |

Stud bolt flange: max. tightening torque = 0.7 Nm

See connection examples Inputs/Outputs, page 55.

# 10 Connection Examples

The following sections provide connection examples for the individual connectors of the device.

## 10.1 X52 – Motor Connection

Please consider that the pins indicated in the following connection examples depend on the mounted connector and thus on the device variant. The pins of the following connectors are indicated:

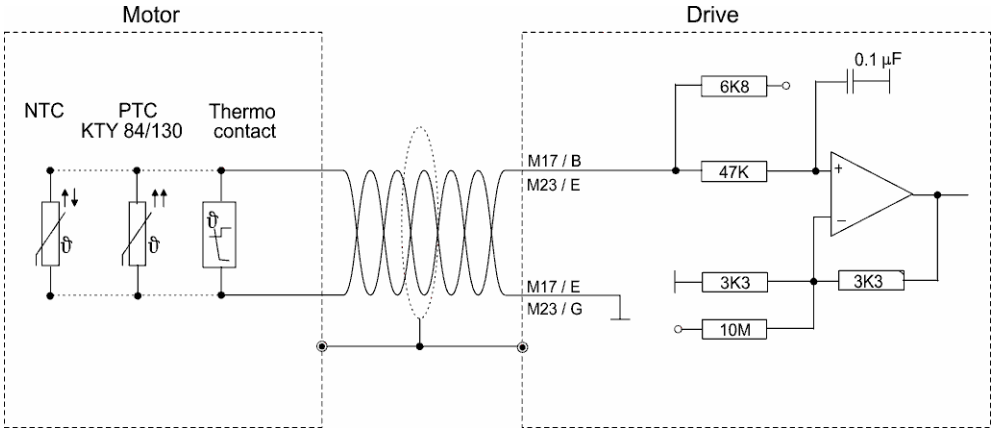
- M17 (9-pole, Intercontec) = device variant 036216Xxyx0xx
- M23 (9-pole, Intercontec) = device variant 036216Xxyx6xx

### 10.1.1 Temperature Sensor of the Motor

INPUT/OUTPUT: The thermal motor protection is evaluated via these connectors.

The drive amplifier supports evaluating the temperature monitoring integrated in the motor. The NTC/PTC behavior of the monitoring is defined in the software (motor parameters). The controller is deactivated as soon as the critical motor temperature is reached.

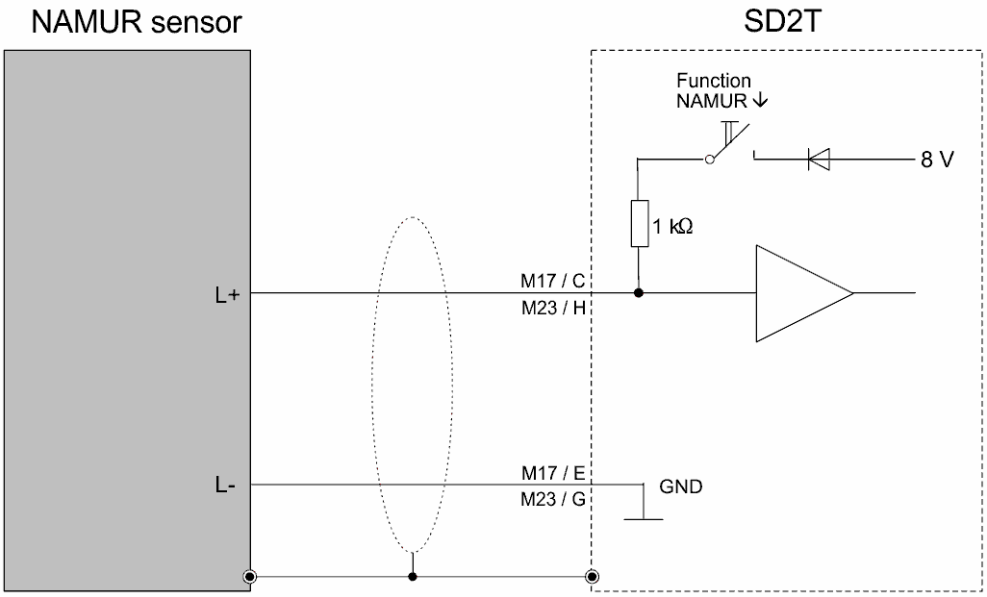
You can configure “None”, “PTC / Thermo switch”, “NTC”, “KTY84/130”, “KTY83/122” and “PT1000”.




The temperature sensor must have an internal resistor between 250 Ω and 2 kΩ.

If no motor temperature sensor is connected, the input must be connected with GND.

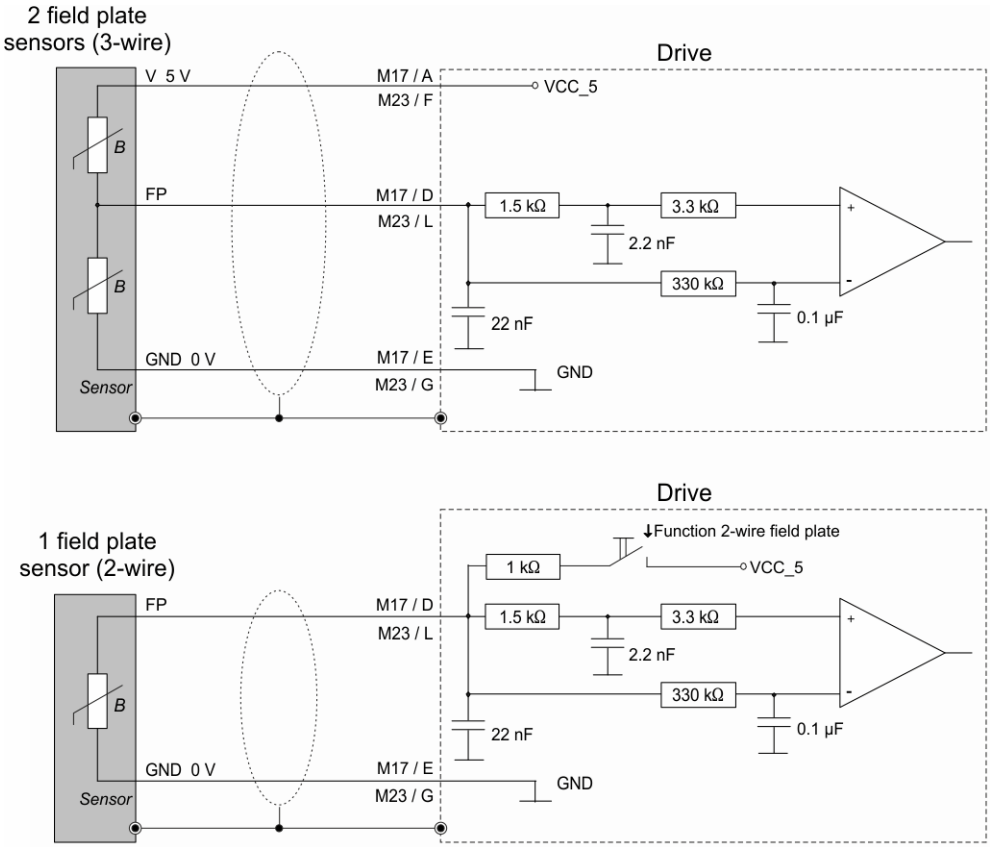
## 10.1.2 NAMUR Sensor



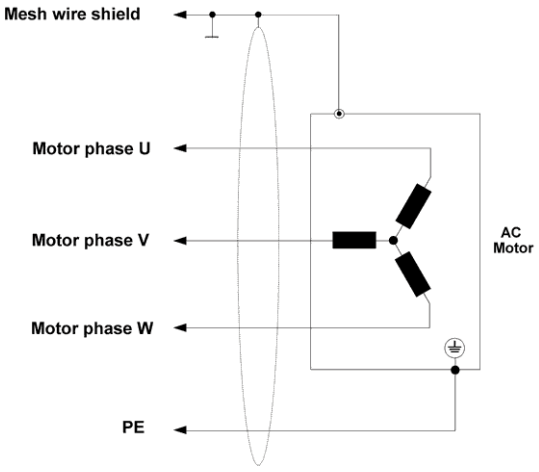

## 10.1.3 GMR Sensor

A GMR sensor (giant magnetoresistance sensor) is only available with a customized connector. Please contact the SIEB & MEYER sales department for more information.

## 10.1.4 Field Plate




## 10.1.5 Motor Phases




Ground the motor housing in the machine!

**DANGER**

**Dangerous shock currents**

Earthing and shielding measures are required to protect devices and persons. To ensure the safety of the operator earthing must be carried out with low impedance. With respect to the ground connection one of the following actions must be done:

- connect the motor housing to the ground of the machine or
- connect the ground terminal of the motor connector to the central ground point of the machine.

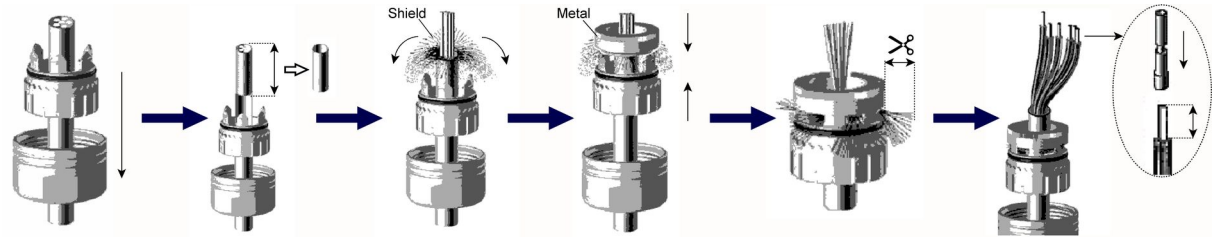
Consider the following with regard to shielding: Always use shielded motor cables.

**Related topics**

Chapter "Motor Cable", page 75

## 10.1.6 Shield Connection

The following figure gives an example for the proper connection of the motor cable shield with the motor connector.



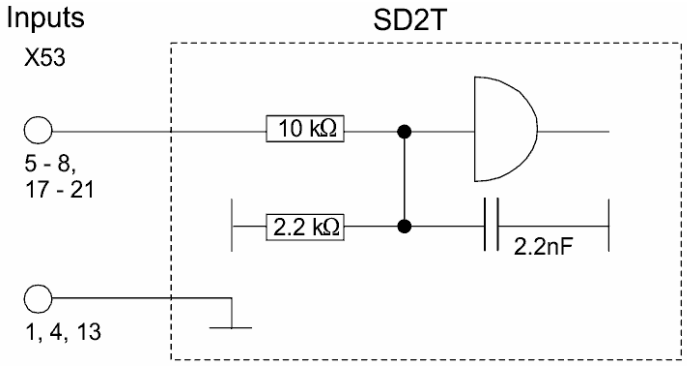

In order to discharge interferences properly and to meet the requirements of the EMC Directive the contact surface between the cable shield and the metal housing of the used connector must be sufficient. Do not use connectors made of plastic only.

Pay attention to the assembly instructions provided by the connector manufacturer.

# 10.2 X53 – Inputs/Outputs

## 10.2.1 Digital Inputs

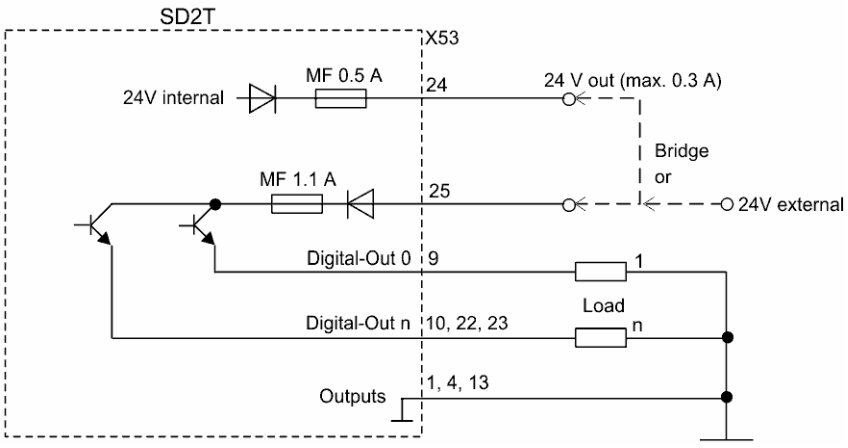
The meanings of the digital inputs can be defined by parameters.



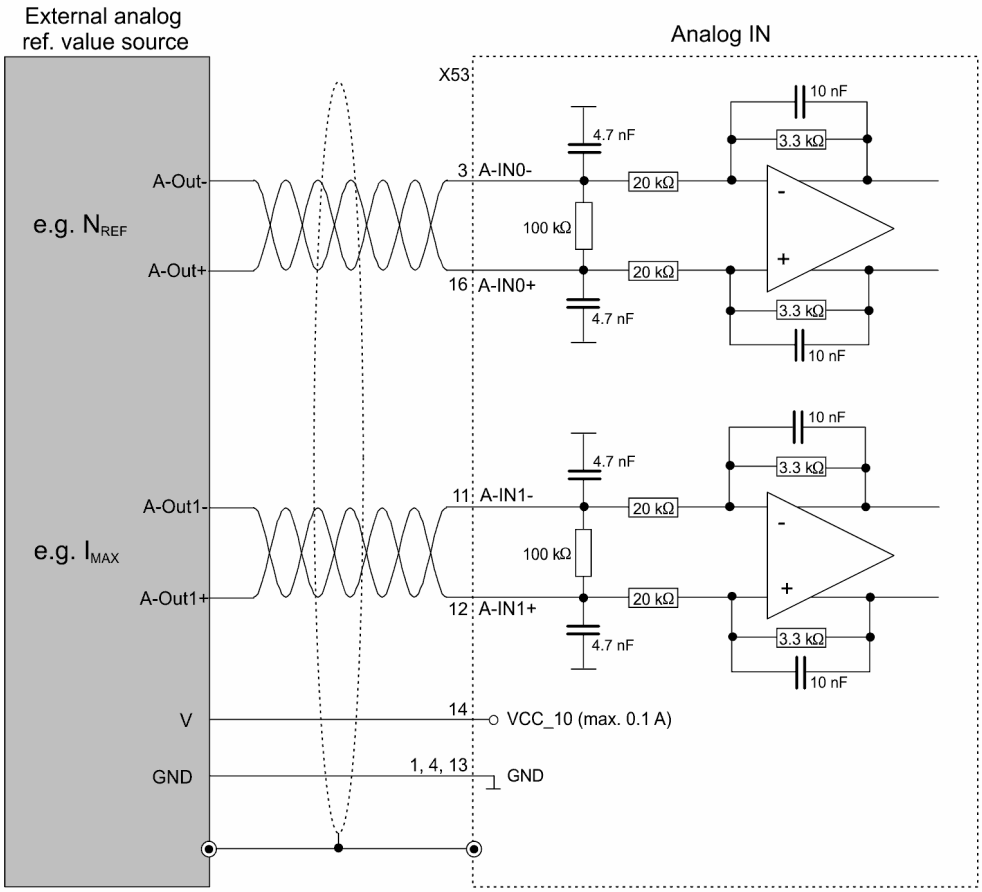

| Signal | State |
|---|---|
| 0 to 11 V | L |
| 12 to 24 V | H |

## 10.2.2 Digital Outputs

The meanings of the digital outputs can be defined by parameters. Every output can be loaded with 100 mA.



## 10.2.3 Analog Inputs




**Voltage interface with input voltage range: ±10 V**

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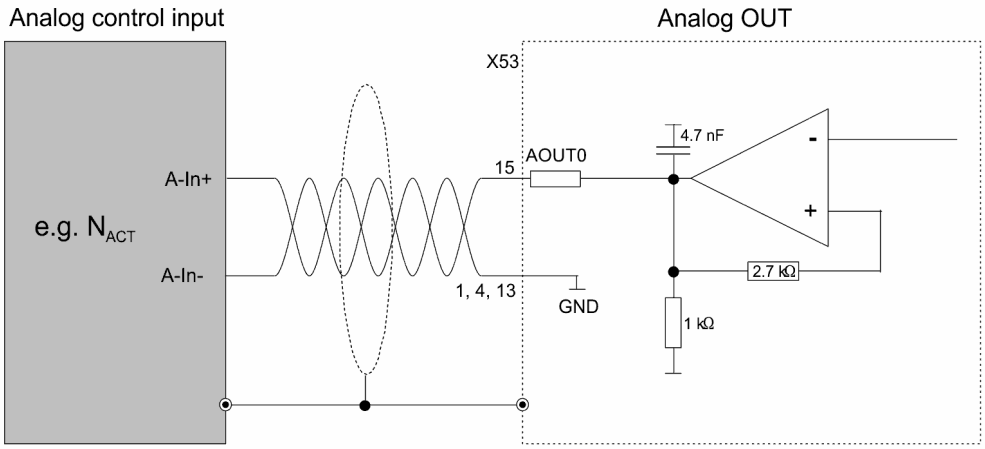
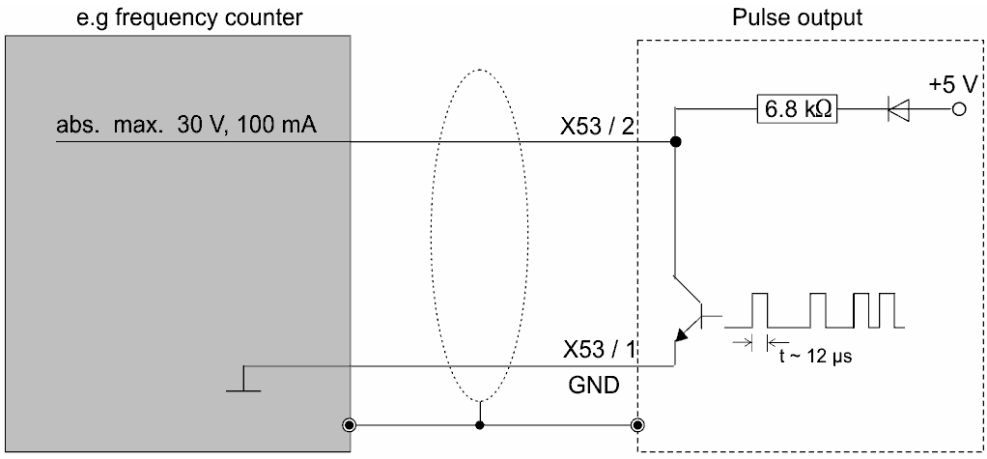
## 10.2.4 Analog Outputs




**Output voltage can be configured: 0 to +10 V, max. 1 mA**

## 10.2.5 Actual Speed Value



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# 11 Functions of the Operating Unit

Using the operating unit integrated in the front panel of the device, you can control the drive amplifier.

- Start / Stop
- Reference speed value setting
- Display of reference speed value
- Error indication
- Load display
- Parameter set selection

## 11.1 Display

The display of the operating unit is made up of 3 × 16 characters. It indicates the current status and parameterization as well as current messages. All text is displayed in English by default.

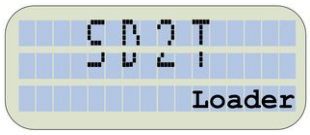
The LEDs M0 and M1 indicate certain device states (see LED description, page 65).

The set reference speed is also displayed when the spindle is stopped or when the device is controlled via the analog interface.

## 11.2 Switch-on

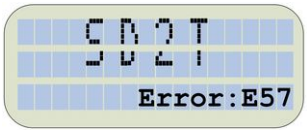
At first push the mains switch for the voltage supply and to switch on the device. You find the mains switch of the devices 0362160/62xy on the back of the modules, for the devices of series 0362161xy the mains switch is integrated in the front panel.

The following display appears short-time when the device is booted and when system software is loaded:




- Device is in boot loader mode: status “Loader” flashes

If an error occurs during boot-up, the corresponding error code is displayed:

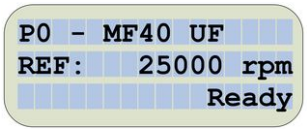



## 11.3 Operation

When the boot-up is finished, the drive switches into the status “Ready”.

## 11.3.1 Ready to Switch On

The following display appears:




- P0 - MF40 UF = active parameter set (designation P0 - MF40 UF)
- REF = active reference speed value in rpm
- Ready = current status (ready to be switched on)

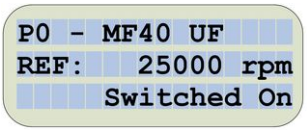

With the START button the drive switches into the status “Switched On”.

Older devices do not feature the status “Switched On”, i.e. operation is enabled by pressing the START button once and the drive immediately accelerates the motor to the set reference speed. (The status “Switched On” is implemented in firmware f08001v02011.x36 and higher versions.)

## 11.3.2 Switched On

In the switched-on status the LED M0 at the device front is on indicating “Controller on”. The parameterized holding current flows. (No current flows, when there is no holding current parameterized or when the set time for the holding current has passed.)

The following display appears:



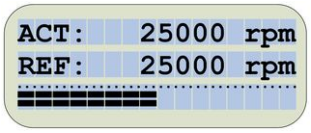

- P0 - MF40 UF = active parameter set (designation P0 - MF40 UF)
- REF = active reference speed value in rpm
- Switched On = current device status


When you press the START button a second time, the drive switches to the status “Operation Enabled”.

## 11.3.3 Operation Enabled

As soon as the operation is enabled the motor accelerates to the set reference speed. The LED M0 at the device front is still on indicating “Controller on”.

The following display appears:




- ACT = actual speed in rpm

- REF = reference speed in rpm
- Progress bar = load in % of the parameterized motor rated current

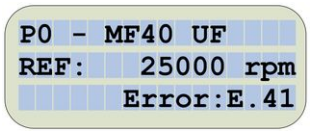
STOP ESC

When you press the STOP button, the drives switches back into the status “Switched On” and the motor is decelerated to speed 0. If available, the parameterized holding current flows.
Press the STOP button a second time to switch the drive back to the status “Ready”. The controller is switched off and the LED M0 goes off. If a holding current is parameterized, it is deactivated now.

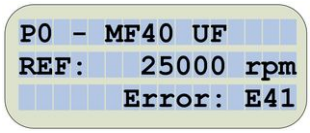
## 11.4 Error

In the event of an error the corresponding error code is displayed.

In the following example the device has stopped due to the error E41. The error is still present (indicated by the dot behind 'E'):

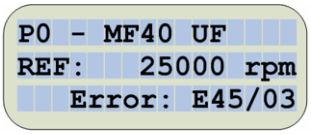



In the next example the device has stopped due to the error E41. The error is not present anymore:




For some errors the LCD displays an additional sub error code. The sub error code provides information on the error cause.

In the following example the device was switched off due to error E45 (Short circuit in power output stage) and sub error 03 (short to ground of a motor phase). The power output stage was deactivated because of the error. Therefore, the device cannot determine whether or not the error is still present. Anyway, the LCD displays that the error is not present anymore:

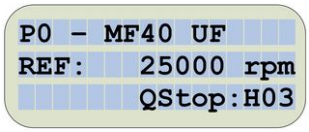



STOP ESC

If the error is not present anymore, you can reset it by pressing the STOP button.

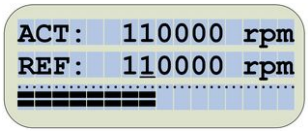
## 11.5 Quick Stop

If the controller can not be switched on due to a quick stop, the corresponding quick stop code is displayed:



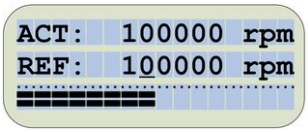

## 11.6 Set Speed Reference Value

In order to set the speed reference values at the device, you must make the following setting in the software *drivemaster2*: Select the Setpoint channel “Cursor Keys” (in “Parameters → Configuration → Drive control”). Then, a cursor appears on the display in the line REF:




By means of the arrow keys cursor left and right you can move the cursor to the desired position.

Use the arrow keys cursor up and down to change the selected digit. The new speed reference value is immediately active for operation.

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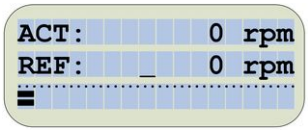
### Input values beyond the speed range

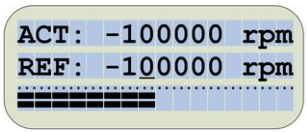
You can not set speed values greater than the maximum speed or smaller than the minimum speed of the motor. Such inputs are corrected directly when entered.

If you enter, for example, a speed value smaller than the minimum speed of the motor, speed 0 automatically appears in the display and the motor is decelerated to standstill:




### Negative speeds

If you continue to press the arrow key cursor down, you can set negative speed values. Thereby, the maximum and minimum speed limits of the motor are considered as well.

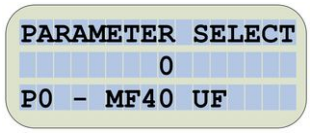



## 11.7 Select Parameter Set (manually)

This function is only available when the operation is stopped.


Hold the button STOP and press the button START for at least 3 seconds to switch to the parameter menu.

The parameter menu displays the designation of the currently used parameter set:



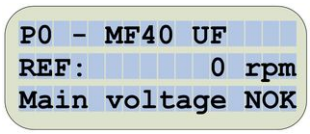

Select the desired parameter set using the arrow buttons cursor up and down.


Press the START button to apply the selected parameter set.


By pressing the STOP button you can cancel the selection.

## 11.8 Switch-off

After switch-off the device continues to run for a certain amount of time due to internal capacities. During this time the following switch-off message is displayed:



# 12 Status Display and Error Messages

## 12.1 LED Status Display

The two LEDs M0 and M1 at the front panel of SD2T indicate certain states of the device.


| LED | Color | Status | Meaning |
|---|---|---|---|
| M0 | Green | ☀ | Controller is switched on |
| M1 | Yellow | ☀ | Warning “W24 – Warning threshold ’current’” (load message) is triggered.(1) |

(1) You can set the thresholds of the warnings in the software *drivemaster2*.

## 12.2 Messages

The drive triggers error, warning and quick stop messages. Current messages are displayed in the device display and in the software *drivemaster2*.

### 12.2.1 List of Drive Error Messages

The following messages apply to the entire SD2 drive series. According to the device type or operating mode, certain messages may not appear.

| Code | Error message | | Error reaction | Possible reason |
|---|---|---|---|---|
| E03 (0x103) (259*d*) | Interpolation error (interpolated position control) | | Motor is stopped by quick stop ramp and drive is disabled (controlled standstill). | ▸ Faulty motion profile of the higher-ranking control |
| | 1 | Acceleration limit exceeded | | |
| | 2 | Speed limit exceeded | | |
| | 3 | Index error | | |
| E05 (0x105) (261*d*) | Error caused by warning | | Motor is stopped by quick stop ramp and drive is disabled (controlled standstill). | ▸ Parameter-driven monitoring stopped the drive. |
| E06 (0x106) (262*d*) | Digital Input 'External Hardware' | | Motor is stopped by parameter-driven ramp and drive is disabled (controlled standstill). | Monitoring of external hardware: |
| | 0 | Digital input | | 0 Digital input “External Hardware OK” is not connected to 24 V. |
| | 1 | Analog input 0: broken cable | | 1 Minimum current monitoring of analog input 0 has triggered. |

| Code | Error message | | Error reaction | Possible reason | |
|---|---|---|---|---|---|
| | 2 | Analog input 1: broken cable | | 2 | Minimum current monitoring of analog input 1 has triggered. |
| | 3 | Analog input 0 and 1: broken cable | | 3 | Minimum current monitorings of analog inputs 0 and 1 have triggered. |
| E07 (0x107) (263*d*) | Error in internal hardware | | Motor is stopped by quick stop ramp and drive is disabled (controlled standstill). | ▸ Overload in digital outputs<br>▸ SD2B plus: Operating voltage not available | |
| E09 (0x109) (265*d*) | Hiperface / EnDat OEM data incorrect | | No "Ready" for startup | ▸ Number of motor pole pairs in EnDat/Hiperface encoder does not match the parameter set. | |
| E10 (0x10A) (266*d*) | drive-setup-tool heartbeat | | Motor is stopped by quick stop ramp and drive is disabled (controlled standstill). | ▸ *drive-setup-tool* was not able to communicate with the drive in the parameterized monitoring time. | |
| E11 (0x10B) (267*d*) | Communication / bus system error<br>▸ [1] SERVOLINK 4<br>▸ [2] DNC 8 Byte<br>▸ [3] CAN bus<br>▸ [4] EtherCAT | | Motor is stopped by parameter-driven ramp and drive is disabled (controlled standstill). | Monitoring of bus communication led to switch-off: | |
| | 1 | Faulty telegram ID [1] | | 1 | Faulty reference value telegram |
| | 2 | Zero data telegram[1] | | 2 | Higher-ranking control not active |
| | 3 | CRC error [1] | | 3 | Check sum error, interferences during transmission |
| | 4 | Synchronization error [1, 4] | | 4 | Drive telegram not synchronized |
| | 5 | Configuration error [4] | | 5 | Faulty configuration of mailbox, PDO, watchdog or synchronization |
| | 6 | NMT error [2, 3, 4] | | 6 | Control channel of bus system was not active during switch-on (pre-operational) |
| | 7 | Addressing error [4] | | 7 | Faulty drive address |
| | 8 | Node Guarding [3] | | 8 | Communication node monitoring: monitoring time expired (configurable) |
| | 9 | EEPROM error [4] | | 9 | Error in EtherCAT EEPROM |
| | 10 | Heartbeat / Watchdog [2, 3, 4] | | 10 | Heartbeat monitoring: monitoring time expired (configurable) |
| E12 (0x10C) (268*d*) | Mains 'Ready for operation' is missing | | Motor is stopped by parameter-driven ramp and drive is disabled (controlled standstill). | ▸ Power output stage was switched on, when mains supply was disconnected/interrupted. | |
| E15 (0x10F) (271*d*) | Endat / Hiperface communication faulty | | Motor is stopped by quick stop ramp and drive is disabled (controlled standstill). | ▸ Communication of EnDat/Hiperface is faulty. | |
| E17 (0x311) (785*d*) | FPGA power output stage shut-down | | Motor is stopped immediately. | ▸ Overload in power supply unit | |
| E17 (0x311) (785*d*) | Zero voltage control DC link (only SD2M) | | Motor is stopped immediately.<br>Mains thyristors are no longer controlled. | ▸ Window range of the zero voltage control has been exceeded.<br>▸ Unbalanced load<br>Please contact SIEB & MEYER. | |

| Code | Error message | Error reaction | Possible reason |
|---|---|---|---|
| E18 (0x312) (786*d*) | Error in spindle selection | Motor is stopped immediately. | ▸ Spindle selection was not valid at “Switch on”. |
| E25 (0x319) (793*d*) | Power supply load too high | Drive is stopped by limitation of motor torque. | ▸ Output power of drive is greater than rated power of power supply unit, since the dimensioning of drive and motor are not compatible. |
| E26 (0x31A) (794*d*) | Motor temperature too high | Motor is stopped by error ramp and current limitation. | ▸ Wrong parameters entered for the motor or wrong dimensioning of the motor |
| E27 (0x31B) (795*d*) | Ambient temperature too high | Motor is stopped by error ramp and current limitation. | ▸ Insufficient device cooling |
| E28 (0x31C) (796*d*) | Power output stage temperature too high | Motor is stopped by error ramp and current limitation. | ▸ Insufficient cooling of power output stage (heat sink) |
| E29 (0x31D) (797*d*) | Motor load too high (Motor I²t) | Motor is stopped by error ramp and current limitation.(1) | ▸ Average motor load is too high due to mechanical problems<br>▸ Wrong dimensioning of the motor |
| E30 (0x31E) (798*d*) | Power output stage load too high (I²t) | Motor is stopped by error ramp and current limitation.(1) | ▸ Average load of output stage is too high due to mechanical problems<br>▸ Wrong dimensioning of the drive |
| E31 (0x31F) (799*d*) | Speed error or slip too high | SERVO / VECTOR: Drive is limited by current monitoring via short-circuit of the motor phases. (1)<br>HSPWM: Drive is stopped by error ramp and current limitation. | ▸ Motor is not able to comply with the set speed (e.g. defective motor, mechanical problems, wrong parameters), failure of the measuring system |
| E33 (0x521) (1313*d*) | Power supply load monitoring -> mains voltage too high | Power supply unit will be disconnected from mains. | ▸ Parameterized mains voltage does not match the connected voltage<br>▸ Device connection is incorrect.<br>▸ Heavy fluctuation of the power supply towards overvoltage |
| E34 (0x522) (1314*d*) | Power supply load monitoring -> mains voltage too low | Power supply unit will be disconnected from mains. | ▸ DC link was not precharged to the minimum voltage level in the set time period; mains voltage is connected to the short-circuited DC link |
| E35 (0x523) (1315*d*) | Error in external power supply unit | Drive is immediately disabled, motor coasts to standstill. | ▸ Error message from external power supply unit; power supply is switched off. |
| E36 (0x524) (1316*d*) | Encoder 0 monitoring | Motor is stopped by current monitoring via short-circuit of the motor phases. | ▸ Connection of encoder 0 is faulty<br>▸ Broken cable |
| E37 (0x525) (1317*d*) | Ballast circuit load (I²t ballast resistor) | Drive is immediately disabled, motor coasts to standstill. | Ballast circuit load due to: |
| | 1 I²t | | 1 Wrong dimensioning, too much energy supplied to $R_{Ballast}$, broken cable, no bridge at $R_{Ballast}$ (int./ ext.) |
| | 2 (VCE) desaturation detection<br>or: DC DC converter overload *(only 0362144xy)* | | 2 Bridge at $R_{Ballast}$ is not correct, short circuit of insulation etc.<br>Or: internal hardware fault *(only 0362144xy)* |

| Code | Error message | Error reaction | Possible reason |
|---|---|---|---|
| E37 (0x525) (1317*d*) | DC DC converter overload *(only 0362161xy)* | Power supply unit will be disconnected from mains. | ▸ Overload at voltage converter of DC link |
| E38 (0x526) (1318*d*) | Actual speed value greater than overspeed threshold | Motor is stopped by current monitoring via short-circuit of the motor phases.(1) | ▸ Wrong parameters<br>▸ Motor connection is incorrect. |
| E39 (0x527) (1319*d*) | Tracking error monitoring and motor slowdown | Motor is stopped by current monitoring via short-circuit of the motor phases.(1) | ▸ Wrong parameters<br>▸ Motor connection is incorrect.<br>▸ Mechanical problems |
| E40 (0x528) (1320*d*) | Motor feedback | Motor is stopped by current monitoring via short-circuit of the motor phases.(1) | ▸ Connection of motor feedback is faulty.<br>▸ Broken cable |
| E41 (0x529) (1321*d*) | Motor phase lost | Motor is stopped by current monitoring via short-circuit of the motor phases.(1) | Motor connection/configuration is faulty: |
| | 1 No motor connected | | 1 No motor connected / incorrect wiring, broken cable |
| | 2 Wrong motor connected | | 2 Wrong parameters |
| E42 (0x52A) (1322*d*) | Overvoltage in DC link | Drive is immediately disabled, motor coasts to standstill. | ▸ No ballast resistor is connected or ballast resistor is dimensioned too small, i.e. X41/X63 not connected |
| E43 (0x52B) (1323*d*) | Undervoltage in DC link | Drive is immediately disabled, motor coasts to standstill. | ▸ DC link not connected |
| E44 (0x52C) (1324*d*) | Commutation lost<br>The following list of error messages includes a note for which drive function the error might appear.<br>▸ [1] HSBLOCK<br>▸ [2] FPAM<br>▸ [3] SVC<br>▸ [4] HSPWM<br>▸ [5] VF | Drive is immediately disabled, motor coasts to standstill. | ▸ The error E44 is triggered in case of wrong current feed of the motor during operation without sensor.<br>▸ Wrong parameters entered for the motor or wrong dimensioning of the motorThe error depends on the drive function. For details, refer to the corresponding setup instructions. |
| | 1 EMF monitoring[1, 2, 3 4] | | |
| | 2 Flux monitoring[4] | | |
| | 3 Over current monitoring[4] | | |
| | 4 Under flux monitoring[4] | | |
| | 5 Minimum speed monitoring[1, 2, 3] | | |
| | 6 Error during alignment[1, 2] | | |
| | 7 Current limitation V/f oscillates[5] | | |
| E45 (0x52D) (1325*d*) | Short circuit in power output stage | Drive is immediately disabled, motor coasts to standstill. | Short circuit of the power output stage due to: |
| | 1 Internal short circuit | | 1 Faulty drive control |
| | 2 (VCE) desaturation detection | | 2 Wrong parameters, output stage defective, broken cable, short circuit etc. |
| | 3 Short to ground | | 3 Short to ground of a motor phase |

| Code | Error message | | Error reaction | Possible reason | |
|---|---|---|---|---|---|
| | 4 | Current measuring range | | 4 | Wrong parameters, output stage defective, broken cable, short circuit etc. |
| | 5 | Overload motor | | 5 | Drive function V/f: incorrect parameter setting of “Flying restart” |
| E46 (0x52E) (1326*d*) | 1 | Safety circuit (Safety X10) | Drive is immediately disabled, motor coasts to standstill without control. | 1 | Safety circuit STO is activated when the output stage is active; input SAFE A and/or input SAFE B were triggered. |
| | 2 | Initialization error: internal hardware of safety controller | | 2 | Safety function SFM/SLOF: error in according hardware components of the safety controller |
| | 3 | Incorrect data/parameters in process sequence | | 3 | Safety function SFM/SLOF: faulty PLC telegrams |
| | 4 | Error in function parameters for a functional part | | 4 | Safety function SFM/SLOF: parameter is out of limits |
| | 5 | Timeout of monitoring functions | | 5 | Safety function SFM/SLOF: error in according hardware components |
| | 6 | Monitoring of OSSD signals and output stage enable | | 6 | Safety function SFM/SLOF:<br>▸ wrong OSSD signals<br>▸ defective OSSD relay<br>▸ defective multiplexer |
| | 7 | Monitoring of motor phases | | 7 | Safety function SFM/SLOF: defective motor cable (broken cable) |
| | 8 | Frequency exceeded | | 8 | Safety function SFM/SLOF:<br>▸ set reference speed value is too high<br>▸ limit value for Safe Limited Output Frequency is parameterized incorrectly<br>▸ OSSD signals are set incorrectly |
| | 9 | Communication error between DSP and safety controller | | 9 | Safety function SFM/SLOF: communication between DSP and safety controller is disturbed |
| E47 (0x52F) (1327*d*) | Drive parameters not activated | | Power output stage can not be activated. | ▸ | Drive start is not acknowledged by master yet (configurable by parameters in software). |
| E55 (0x737) (1847*d*) | Firmware stopped by ESC | | Device stops in BIOS. | ▸ | During boot-up, the device received an ESC sequence at the serial interface. |
| E56 (0x738) (1848*d*) | Device configuration | | Device stops in BIOS. | ▸ | During boot-up the device detected that hardware, firmware parameters and logic are not consistent; A detailed error description is received by a parameter download. |
| E57 (0x739) (1849*d*) | Faulty or no firmware | | Device stops in BIOS. | ▸ | During boot-up the device detected no firmware or a faulty firmware. |
| E58 (0x73A) (1850*d*) | FPGA watchdog triggered | | Device stops in BIOS. | ▸ | FPGA process monitoring has been triggered; Please contact SIEB & MEYER. |

| Code | Error message | Error reaction | Possible reason |
|---|---|---|---|
| E59 (0x73B) (1851*d*) | No drive parameters loaded | Device stops in BIOS. | ▸ Device is not parameterized (status of delivery). |
| E60 (0x73C) (1852*d*) | Drive parameters incorrect | Device stops in BIOS. | ▸ Parameter set of the device is not valid (CRC error). |
| E61 (0x73D) (1853*d*) | Logic coding missing or incorrect | Device stops in BIOS. | ▸ Logic programming of the device is not valid. |
| E62 (0x73E) (1854*d*) | Error in electronic type plate | Device stops in BIOS. | ▸ Type plate is not programmed or faulty; Please contact SIEB & MEYER. |

(1) For servo motors with commutation via an incremental motor measuring system, the warning W17 “Unknown commutation angle ” is signaled. After a restart of the device, the phasing of the motor measuring system starts automatically (magnetic alignment).

## 12.2.2 List of Warning Messages

Warning messages are not displayed on the device display. They can only be seen in the software *drivemaster2* via “Diagnosis → Errors and warnings”.

| Code | Description |
|---|---|
| W00 | Digital input 'Quick stop' active |
| W01 | Digital input 'Positive limit switch' active |
| W02 | Digital input 'Negative limit switch' active |
| W03 | Voltage of mains supply not OK |
| W04 | Power output stage load greater than parameterized warning threshold W04 (power output stage I²t) |
| W05 | Motor load greater than parameterized warning threshold W05 (motor I²t) |
| W06 | Power output stage temperature greater than parameterized warning threshold W06 |
| W07 | Motor temperature greater than parameterized warning threshold W07 |
| W08 | DC link voltage greater than parameterized warning threshold W08 |
| W09 | DC link voltage less than parameterized warning threshold W09 |
| W10 | Speed controller in current limitation / PI limit |
| W11 | Position/tracking error greater than parameterized warning threshold W11 |
| W12 | Speed error greater than parameterized warning threshold W12 |
| W13 | Tracking error of the current too great |
| W14 | Ambient temperature greater than parameterized warning threshold W14 |
| W15 | Ballast resistor load greater than parameterized warning threshold W15 (ballast resistor I²t) |
| W16 | Safety circuit is active |
| W17 | Unknown commutation angle |
| W18 | Hiperface / EnDat OEM data not valid |
| W19 | Dirt signal encoder input 0 |
| W20 | Dirt signal encoder input 1 |
| W21 | Dirt signal encoder input 2 |
| W22 | Power supply unit load greater than 90% of the rated power |
| W23 | Reserved |
| W24 | Current or current rise greater than warning threshold W24 (warning current) |
| W25 | Reference speed less than minimum motor speed |

| Code | Description |
|---|---|
| W26 | Current greater than warning threshold W26 (warning overload current) |
| W27 | Reserved |
| W28 | Reserved |
| W29 | Reserved |
| W30 | Reserved |
| W31 | Reserved |

### 12.2.3 Message of the Quick Stop Functions

| Code | Description |
|---|---|
| H01 | Digital input "Switch on" waits for positive edge to switch the drive on (This function is only active when the input is set as "Switch on type 2 (with positive edge)".) |
| H03 | Software function "Quick stop" |
| H04 | Digital input "Quick stop" |
| H07 | Software positioning error "Negative limit" |
| H08 | Software positioning error "Positive limit" |
| H09 | Bus system "Quick stop" (The quick stop bit is set to 0) |
| H11 | Digital input "Negative limit switch" |
| H12 | Digital input "Positive limit switch" |
| H13 | Digital input "Speed Enable" |

# 13 General Information Regarding the Wiring

## 13.1 Mains Connection

**NOTICE**

**Property damage due to incorrect mains connection**

Direct connection to **ungrounded / asymmetrically grounded mains** (IT mains with start point / IT delta mains) can destroy the devices.

Connecting the device to this mains type is only possible with isolating transformer.

Also consider the manual "Unit Assembly Complying to EMC", chapter "Connection to Different Supply System Types".

## 13.2 Cable Requirements

The cables described in this chapter meet the SIEB & MEYER requirements for cables and connectors in order to ensure their proper function.

**NOTICE**

**Risk of cable damage due to mechanical loads**

Cables that are exposed to mechanical loads, e.g. trailing chains or similar, must be suited for this purpose. Otherwise, damage may occur. SIEB & MEYER cables are not suitable for trailing chains!

The machine manufacturer must ensure that only cables are used that are suitable for this purpose.

In general, the following principles apply for the cables (see also documentation “Unit Assembly Complying EMC”)

- Motor and signal cables must not be wired in the same cable protection hose!
- Motor cables must have a wire-meshed shield. They must be wired separately from signal cables.
- Signal lines must have a wire-meshed shield. Differential signals should only be transmitted with twisted-pair lines. They must be wired separately from motor cables.
- The cable shields must be connected to the connector shell inside of the connectors. In the switch cabinet they should be connected to a ground bus.
- Cable shields not ending in a connector inside of the switch cabinet such as motor cables must be connected to the ground bus.
- Both ends of the shield of shielded cables must generally be connected to the shell.

The line cross-sections should be selected carefully: The maximum admissible current should not be exceeded at the maximum ambient temperature (see technical data). **DIN VDE 0298-4** defines the admissible values for the individual line cross-sections which must absolutely be taken into account.

The current carrying capacity in connection with the line cross-section of copper conductors isolated with PVC or cables according to DIN VDE 0298-4 for different types of wiring are indicated in the following table: All values are related to an ambient temperature of +40 °C and an operating temperature at the conductor of 70 °C.

| Conductor cross-section A [mm²] | Admissible current I [A] | | |
|---|---|---|---|
| | B2 wiring(1) | E wiring (3 cable leads) (2) | F wiring (3 cable leads) (3) |
| 0.75 | 7.6 | 10.4 | – |
| 1.00 | 9.6 | 12.4 | – |
| 1.50 | 12.2 | 16 | – |
| 2.50 | 16.5 | 22 | – |
| 4 | 23 | 30 | – |
| 6 | 29 | 37 | – |
| 10 | 40 | 52 | – |
| 16 | 53 | 70 | – |
| 25 | 67 | 88 | 96 |
| 35 | 83 | 110 | 119 |
| 50 | 100 | 133 | 145 |
| 70 | 130 | 171 | 188 |
| 95 | 150 | 207 | 230 |
| 120 | 175 | 240 | 268 |
| 150 | – | 277 | 309 |
| 185 | – | 317 | 356 |
| 240 | – | 374 | 422 |
| 300 | – | 433 | 488 |
| 400 | – | – | 570 |
| 500 | – | – | 652 |
| 630 | – | – | 744 |

(1) B2 wiring: wiring in installation tubes or closed installation channels.

(2) E wiring: Free wiring of one cable with a min. distance of 0.3 × cable diameter to the wall.

(3) F wiring: Free wiring of several cables with a min. distance of 1 × cable diameter to the wall.

*Tab. 2: Current carrying capacity according to DIN VDE 0298-4*

For detailed information refer to the standard IEC 60364-5-52 and the documents of the cable manufacturer.

The following correction factors are provided for deviating ambient temperatures:

| Ambient temperature T [°C] | Correction factor |
|---|---|
| 30 | 1.15 |
| 35 | 1.08 |
| 40 | 1.00 |
| 45 | 0.91 |
| 50 | 0.82 |
| 55 | 0.71 |
| 60 | 0.58 |

### Cross-sections of round conductors

The standard values of the cross-section of round copper conductors as well as the approximate ratio of metric ISO and AWG/MCM values are shown in the following table.

Standardized cross-sections of round conductors:

| ISO cross-section [mm²] | AWG/MCM | |
|---|---|---|
| | Value | Equivalent cross-section [mm²] |
| 0.2 | 24 | 0.205 |
| – | 22 | 0.324 |
| 0.5 | 20 | 0.519 |
| 0.75 | 18 | 0.82 |
| 1.0 | – | – |
| 1.5 | 16 | 1.3 |
| 2.5 | 14 | 2.1 |
| 4.0 | 12 | 3.3 |
| 6.0 | 10 | 5.3 |
| 10 | 8 | 8.4 |
| 16 | 6 | 13.3 |
| 25 | 4 | 21.2 |
| 35 | 2 | 33.6 |
| 50 | 0 | 53.5 |
| 70 | 00 | 67.4 |
| 95 | 000 | 85.0 |
| – | 0000 | 107.2 |
| 120 | 250 MCM | 127 |
| 150 | 300 MCM | 152 |
| 185 | 350 MCM | 177 |
| 240 | 500 MCM | 253 |
| 300 | 600 MCM | 304 |

The line corresponds to a value when the connection possibilities are taken into account.

## 13.2.1 Motor Cable

**DANGER**

**Dangerous shock currents**

Earthing and shielding measures are required to protect devices and persons. To ensure the safety of the operator earthing must be carried out with low impedance. With respect to the ground connection one of the following actions must be done:

- connect the motor housing to the ground of the machine or
- connect the ground terminal of the motor connector to the central ground point of the machine.

Consider the following with regard to shielding: Always use shielded motor cables.

**NOTICE**

**Disturbing ground loops**

Incorrect connection of protective earth connections in motor cables may cause disturbing ground loops and malfunction of the motor.

Connect the protective earth conductors additionally led in motor cables directly to the shield line and label them with ⏚ or PE.

If the procedure turns out to be impracticable, omit the earth conductor connection in the motor cables and wire a separate earth conductor in parallel to the motor cables.

Ensure that the cable is returned to the drive! Do not wire the cable with another ground loop.

✓ The described measures prevent disturbing ground loops.

Use shielded cables for the motor in order to keep interference as low as possible.

The cable shield must be connected large-area with 360° shield termination. In addition, the motor cable should be as short as possible to reduce electromagnetic radiation and capacitive currents.

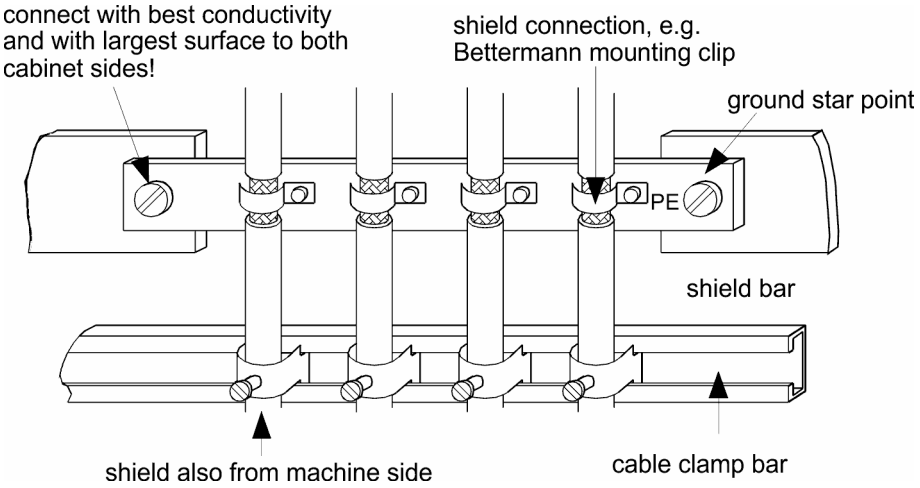



*Fig. 21: Motor connection*

**Requirements to the motor cable**

The maximum admissible length of the motor cable is 100 m. The capacity must not exceed 5.2 nF.

Example: If the cable capacity is 0.26 nF per meter, the maximum admissible length of the motor cable is 20 m.

## 13.2.2 Communication Cable

Please connect the communication interfaces only with high-quality cables according to the relevant standards.

**NOTICE**

**Ungrounded test setups**

So-called "flying test systems" that are not or not sufficiently grounded can cause damage to the communication interfaces or to the connected devices.

### USB

The USB cable must have a maximum length of 5 m according to the USB regulations. We recommend high-quality cables with integrated ferrite cores (available at SIEB & MEYER).

Trouble-free USB communication is also highly dependent on the quality of the USB interface at the used PC/laptop.

### RJ45

Use only high-quality RJ45 cables.

Low priced RJ45 cables can damage the female RJ45 connector. The dimensions of the cable connectors deviate frequently from the standard dimensions. Thus, they cause problems with the electrical contact after only few connecting cycles.

# 14 Appendix

## 14.A Specification of Drive Functions

Devices of the series SD2T can operate with different drive functions depending on the loaded drive software. The different drive functions support different motors and motor measuring systems.

The available drive functions depend on the device type and device version.

- **SERVO / VECTOR (SVC)**
  For rotary synchronous motor:
  - SVC (sensorless vector control): sensorless operation (up to 120,000 rpm)
- **HSPWM** (high-speed pulse-width modulation)
  For rotary synchronous and asynchronous motors:
  - high speeds (up to 480,000 rpm)
  - low losses in the drive
  - sensorless operation
    (Optionally a measuring system for speed monitoring can be used to signal the states “speed zero” and “reference value reached”.)
- **HSPAM / VF** (high-speed pulse amplitude modulation / V/f control system)
  For rotary asynchronous motor:
  - HSPAM (V/f PAM) available for devices with controlled DC link voltage
  - PAM: high speeds (up to 480,000 rpm)
  - V/f characteristic curve for asynchronous motors
  - simple parameterization and unproblematic operation of motors
  - sensorless operation
    (Optionally a measuring system for speed monitoring can be used to signal the states “speed zero” and “reference value reached”.)

The following figure shows the speed ranges of the different drive functions:

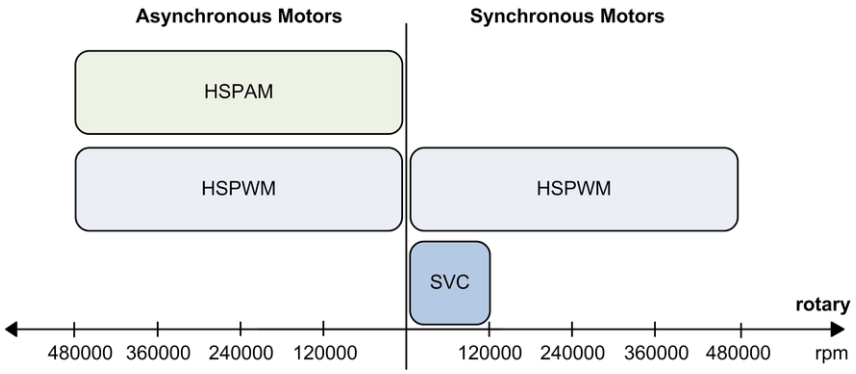



*Fig. 22: Speed ranges of SD2T drive functions*



### Motor

| Drive function | SERVO / VECTOR | HSPWM | HSPAM / VF |
|---|---|---|---|
| Motors | SVC:<br>▸ Synchronous rotative<br>▸ Up to 2000 Hz rotating field frequency | ▸ Synchronous rotative<br>▸ Asynchronous rotative<br>▸ Up to 8000 Hz rotating field frequency at 320 $V_{DC}$ | V/f PAM<br>▸ Asynchronous rotative<br>▸ Up to 8000 Hz rotating field frequency |

### Software

| Drive function | SERVO / VECTOR | HSPWM | HSPAM / VF |
|---|---|---|---|
| Software packages[1] | L08001Vxxxxx & F08002Vxxxxx<br>▸ special function: **SVC**<br>▸ (including V/f) | L08001Vxxxxx & F08001Vxxxxx<br>▸ (including V/f) | L08001Vxxxxx & F08001Vxxxxx<br>▸ (HSPWM included) |
| | | | L08001Vxxxxx & F08002Vxxxxx<br>▸ (SVC included) |

[1] After the firmware and logic software have been detected, the SD2T software packages can be identified by the number '8' contained in the software designation (e.g. logic software = L**8**xxx, firmware = F**8**xxx).

### Measuring system

| Drive function | SERVO / VECTOR | HSPWM | HSPAM / VF |
|---|---|---|---|
| Measuring systems | L08001Vxxxxx & F08002Vxxxxx<br>▸ Sensorless vector control (SVC) | L08001Vxxxxx & F08001Vxxxxx<br>▸ Sensorless<br>▸ Field plate 2-wire<br>▸ Field plate 3-wire<br>▸ Pulse generator NAMUR<br>▸ Pulse generator Hall A<br>▸ Pulse generator 24 V<br>▸ Digital field plate / GMR | L08001Vxxxxx & F08001Vxxxxx<br>▸ Sensorless<br>▸ Field plate 2-wire<br>▸ Field plate 3-wire<br>▸ Pulse generator NAMUR<br>▸ Pulse generator 24 V<br>▸ Pulse generator 5 V<br>▸ Digital field plate / GMR |
| | | | L08001Vxxxxx & F08002Vxxxxx<br>▸ Sensorless<br>▸ Field plate 2-wire<br>▸ Field plate 3-wire<br>▸ Pulse generator NAMUR<br>▸ Pulse generator 24 V<br>▸ Pulse generator 5 V<br>▸ EMF Measuring |

### Operating mode

| Drive function | SERVO / VECTOR | HSPWM | HSPAM / VF |
|---|---|---|---|
| Operating modes | ▸ Speed Mode | | |

### Software Connection

| Drive function | SERVO / VECTOR | HSPWM | HSPAM / VF |
|---|---|---|---|
| Parameterization in software *drivemaster2* | ▸ USB connection | | |

### Communication channels

| Drive function | SERVO / VECTOR | HSPWM | HSPAM / VF |
|---|---|---|---|
| Control channel | ▸ Digital inputs<br>▸ USB<br>▸ Start/Stop keys | | |
| Setpoint channel | ▸ Analog inputs<br>▸ USB<br>▸ Internal setpoints<br>▸ Cursor keys | | |

### Control

| Drive function | SERVO / VECTOR | HSPWM | HSPAM / VF |
|---|---|---|---|
| Operating frequency | 8 / 16 kHz | 8 / 16 / 32 / 64 / 128 kHz | 8 kHz |
| All-digital current control | 16 kHz | 16 / 32 / 64 / 128 / 256 kHz | 8 kHz |
| All-digital speed control | 16 kHz (62.5 µs) | - | - |

### Interfaces

| Drive function | SERVO / VECTOR | HSPWM | HSPAM / VF |
|---|---|---|---|
| Digital inputs | ▸ 9 inputs 24 V<br>▸ 12 – 24 V high / 0 – 5 V low<br>▸ Sampling 4 kHz (250 µs)<br>▸ Function to be configured via software | | |
| Digital outputs | ▸ 4 outputs 24 V (max. 100 mA per output)<br>▸ Sampling 4 kHz (250 µs)<br>▸ Function to be configured via software | | |
| Analog inputs | ▸ 2 differential signal inputs<br>▸ Operating range ±10 V<br>▸ Maximum range ±12 V<br>▸ Resolution internal 14 Bit<br>▸ Sampling 4 kHz (250 µs)<br>▸ Function to be configured via software | | |
| Analog outputs | ▸ 1 output<br>▸ Operating range 0 – 10 V<br>▸ Maximum range 0 – 10 V<br>▸ Resolution internal 14 Bit<br>▸ Sampling 4 kHz (250 µs)<br>▸ Function to be configured via software | | |

### Monitorings

| Drive function | SERVO / VECTOR | HSPWM | HSPAM / VF |
|---|---|---|---|
| Monitoring functions | ▸ Measuring systems<br>▸ Power supply unit: load<br>▸ Power supply unit: load monitoring overvoltage<br>▸ Power supply unit: load monitoring undervoltage<br>▸ Power output stage: load ($I^2t$)<br>▸ Power output stage: temperature<br>▸ Power output stage: short circuit (U, V, W, PE)<br>▸ Motor: load ($I^2t$)<br>▸ Motor: temperature (PTC, NTC, KTY84/130)<br>▸ Motor: motor phase missing<br>▸ DC link: overvoltage<br>▸ DC link: undervoltage<br>▸ Ballast circuit: load<br>▸ Ambient temperature<br>▸ Speed: error / slip<br>▸ Speed: overspeed | | |

14.A

# 14.B Specification of Device Firmware

The following firmware variants are available for the drive amplifiers of the series SD2T.

| Firmware | F08001vxxxxx UF / HSPWM | F08002vxxxxx UF / SVC |
|---|---|---|
| **SERVO / VECTOR** | | ✓ |
| Sensorless vector control (SVC), synchronous | | ✓ |
| **HSPAM / VF, asynchronous rotary** | ✓ | ✓ |
| Sensorless | ✓ | ✓ |
| Field plate 2-wire | ✓ | ✓ |
| Field plate 3-wire | ✓ | ✓ |
| Pulse generator NAMUR | ✓ | ✓ |
| Pulse generator 24 V | ✓ | ✓ |
| Digital field plate / GMR | ✓ | ✓ |
| Flying Restart | ✓ | ✓ |
| Current-controlled startup | ✓ | ✓ |
| **HSPWM, synchronous/asynchronous rotary** | ✓ | |
| Sensorless | ✓ | |
| Field plate 2-wire | ✓ | |
| Field plate 3-wire | ✓ | |
| Pulse generator NAMUR | ✓ | |
| Pulse generator 24 V | ✓ | |
| Digital field plate / GMR | ✓ | |
| **Operating modes** | | |
| Current control(1) | ✓ | ✓ |
| Velocity mode 1 | ✓ | ✓ |
| **Control and setpoint channels** | | |
| Analog + digital inputs | ✓ | ✓ |
| Serial interface / RS485 / USB | ✓ | ✓ |
| DNC 8 Byte | ✓ | ✓ |
| Internal setpoints | ✓ | ✓ |
| **Encoder Emulation** | | |
| Speed pulses | ✓ | ✓ |
| **Others** | | |
| Multi parameter sets | ✓ | ✓ |

(1) Not available with the drive function SVC.

14.B

# 14.C Manufacturers

## 14.C.1 SIEB & MEYER Accessories

In the following you find all accessories for SD2T that you can order at SIEB & MEYER.

Consider the information on accessories suitable for your device in the technical manual.

### 14.C.1.1 Connectors and Cables for the Series SD2T

#### Connector/cable kits

| SIEB & MEYER article number | Device variant | Content |
|---|---|---|
| 322 99 568 | 0362160xyx0xx, 0362162xyx0xx | 9-pole motor connector M17 for cable diameters of 6 – 9.5 mm, submin D connector with housing, connection cable for mains supply, USB cable |
| 322 99 574 | 0362160xyx0xx, 0362162xyx0xx | 9-pole motor connector M17 for cable diameters of 9.5 – 12 mm, submin D connector with housing, connection cable for mains supply, USB cable |
| 322 99 570 | 0362160xy, 0362162xy | Submin D connector with housing, connection cable for the mains supply, USB cable |
| 322 99 569 | 0362161xyx0xx | 9-pole motor connector for cable diameters of 6 – 9.5 mm, submin D connector with housing, IEC plug C19 (16 A) for mains connection, USB cable |
| 322 99 575 | 0362161xyx0xx | 9-pole motor connector for cable diameters of 9.5 – 12 mm, submin D connector with housing, IEC plug C19 (16 A) for mains connection, USB cable |
| 322 99 571 | 0362161xy | Submin D connector with housing, IEC plug C19 (16 A) for mains connection, USB cable |

#### X51 mating connector (mains supply)

| SIEB & MEYER article number | Description |
|---|---|
| 320 80 161 | IEC plug C19 (16 A) for device variant 0362161xy |

#### X52 mating connector (motor connection)

| SIEB & MEYER article number | Description |
|---|---|
| 320 22 176 | 9-pole cable connector M17 (4 × 14 A, 5 × 3.6 A) by Intercontec (type B-ST-A-906-MR-11-85-201A-000) for device variant 036216Xxyx0xx<br>cable diameter: 6 – 9.5 mm |
| 320 22 177 | 9-pole cable connector M17 (4 × 14 A, 5 × 3.6 A) by Intercontec (type B-ST-A-906-MR-11-86-201A-000) for device variant 036216Xxyx0xx<br>cable diameter: 9.5 – 12 mm |

9-pole motor connector M23 (Intercontec) for device variant 036216Xxyx6xx: For appropriate mating connectors refer, for example, to the Intercontec catalog “923”, product key B-KU-A-145-xx-xx-xx-xxxx (x determines the contact type, tightening and locking method).

For the assembly instructions of the connector manufacturer refer to the Technical Information “TIE_320-22-176_AssemblyInstructions”.

### 14.C.1.2 Mains Fuses

| SIEB & MEYER article number | Description |
|---|---|
| 305 20 250 | Fuse: 6.3 A medium slow (5 × 20 mm) for device variant 0362160xy (2x in fuse drawer of IEC connector) |
| 305 20 330 | Fuse: 15 A slow (6.3 × 32 mm) for device variant 0362161xy (internal) |

## 14.C.2 INTERCONTEC - Infinite Connections

http://www.intercontec.biz

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