Operating instructions Compax3 I10T10

Step/Direction and Analog Command Input

192-120100 N16 C3I10T10

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nonwarranty clause

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Inhalt

1. Introduction

In this chapter you can read about:

1.1 Device assignment

This manual is valid for the following devices:

- Compax3S025V2 + supplement
- Compax3S063V2 + supplement
- Compax3S100V2 + supplement
- Compax3S150V2 + supplement
- Compax3S015V4 + supplement
- Compax3S038V4 + supplement
- Compax3S075V4 + supplement
- Compax3S150V4 + supplement
- Compax3S300V4 + supplement
- Compax3H050V4 + supplement
- Compax3H090V4 + supplement
- Compax3H125V4 + supplement
- Compax3H155V4 + supplement
- Compax3M050D6 + supplement
- Compax3M100D6 + supplement
- Compax3M150D6 + supplement
- Compax3M300D6 + supplement
- PSUP10D6
- PSUP20D6

With the supplement:

- F10 (Resolver)
- F11 (SinCos©)
- F12 (linear and rotary direct drives)
- I10 T10

1.2 Scope of delivery

The following items are furnished with the device:

- Manuals*
  - Installation manual (German, English, French)
  - Compax3 DVD
  - Startup Guide (German / English)

*Comprehensiveness of documentation depends on device type

- Device accessories
  Device accessories for Compax3S
  - Cable clamps in different sizes for large area shielding of the motor cable, the screw for the cable clamp as well as
  - the mating plug connectors for the Compax3S plug connectors X1, X2, X3, and X4
  - a toroidal core ferrite for one cable of the motor holding brake
  - Lacing cord

- Device accessories for Compax3M
  - Cable clamps in different sizes for large area shielding of the motor cable, the screw for the cable clamp as well as
  - the matching plug for the Compax3M connectors X14, X15, X43
  - a toroidal core ferrite for one cable of the motor holding brake
  - an interface cable (SSK28/23) for communication within the axis combination

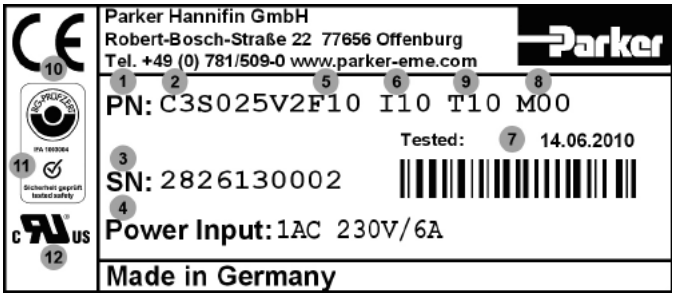
- Device accessories for PSUP
  - Matching plug for the PSUP connectors X9, X40, X41
  - 2 bus terminal connectors (BUS07/01) for mains module and the last axis controller in the combination

- Device accessories for Compax3H
  - Mating connector for X3 and X4
  - SSK32/20: RS232 adapter cable (programming port C3HxxxV4 - SSK1 - PC)
  - VBK17/01: SubD jumper mounted

1.3 Type specification plate

The present device type is defined by the type specification plate (on the housing):

Compax3 - Type specification plate (example):



Explanation:

1	Type designation The complete order designation of the device (2, 5, 6, 9, 8).
2	**C3:**Abbreviation for Compax3 **S025:**Single axis device, nominal device current in 100mA (025=2.5A) **M050:**Multi-axis device, nominal device current in 100mA (050=5A) **H050:**High power device, nominal device current in 1A (050=50A)
	D6: Designation nominal supply **V2:**Mains supply voltage (2=230VAC/240VAC, 4=400VAC/480VAC)
3	Unique number of the particular device
4	Nominal supply voltage Power Input: Input supply data Power Output: Output data
5	Designation of the feedback system **F10:**Resolver **F11:**SinCos© / Single- or Multiturn **F12:** Feedback module for direct drives
6	Device interface **I10:**Analog, step/direction and encoder input **I11 / I12:**Digital Inputs / Outputs and RS232 / RS485 **I20:**Profibus DP / **I21:**CANopen / **I22:**DeviceNet / **I30:**Ethernet Powerlink / **I31:** EtherCAT / **I32:** Profinet **C20:** integrated controller C3 *power*PL*m*C, Linux & Web server
7	Date of factory test
8	Options **Mxx:** I/O extension, HEDA **Sx:** optional safety technology on C3M
9	Technology function **T10:**Servo drive **T11:**Positioning **T30:**Motion control programmable according to IEC61131-3 **T40:**Electronic cam
10	CE compliance
11	Certified safety technology (corresponding to the logo displayed)
12	UL certified (corresponding to the logo displayed)

1.4 Packaging, transport, storage

Packaging material and transport

Caution!

The packaging material is inflammable, if it is disposed of improperly by burning, lethal fumes may develop.

The packaging material must be kept and reused in the case of a return shipment. Improper or faulty packaging may lead to transport damages.

Make sure to transport the drive always in a safe manner and with the aid of suitable lifting equipment (**Weight** (see on page 210, see on page 222)). Do never use the electric connections for lifting. Before the transport, a clean, level surface should be prepared to place the device on. The electric connections may not be damaged when placing the device.

First device checkup

- Check the device for signs of transport damages.
- Please verify, if the indications on the **Type identification plate** (see on page 11) correspond to your requirements.
- Check if the consignment is complete.

Disposal

This product contains materials that fall under the special disposal regulation from 1996, which corresponds to the EC directory 91/689/EEC for dangerous disposal material. We recommend to dispose of the respective materials in accordance with the respectively valid environmental laws. The following table states the materials suitable for recycling and the materials which have to be disposed of separately.

Material Option	suitable for recycling	Disposal
Metal	yes	no
Plastic materials	yes	no
Circuit boards	no	yes

Please dispose of the circuit boards according to one of the following methods:

- Burning at high temperatures (at least 1200°C) in an incineration plant licensed in accordance with part A or B of the environmental protection act.
- Disposal via a technical waste dump which is allowed to take on electrolytic aluminum condensers. Do under no circumstances dump the circuit boards at a place near a normal waste dump.

Storage

If you do not wish to mount and install the device immediately, make sure to store it in a dry and clean **environment** (see on page 224). Make sure that the device is not stored near strong heat sources and that no metal chippings can get into the device.

Please note in the event of storage >1 year:

Forming the capacitors

Forming the capacitors only required with 400VAC axis controllers and PSUP mains module

If the device was stored longer than one year, the intermediate capacitors must be re-formed!

Forming sequence:

- Remove all electric connections
- Supply the device with 230VAC single phase for 30 minutes
  - via the L1 and L2 terminals on the device or
  - multi axis devices via L1 and L2 on the PSUP mains module

1.5 Safety instructions

In this chapter you can read about:

1.5.1. General hazards

General Hazards on Non-Compliance with the Safety Instructions

The device described in this manual is designed in accordance with the latest technology and is safe in operation. Nevertheless, the device can entail certain hazards if used improperly or for purposes other than those explicitly intended.

Electronic, moving and rotating components can

- constitute a hazard for body and life of the user, and
- cause material damage

Usage in accordance with intended purpose

The device is designed for operation in electric power drive systems (VDE0160). Motion sequences can be automated with this device. Several motion sequences can be combined by interconnecting several of these devices. Mutual interlocking functions must be incorporated for this purpose.

1.5.2. Safety-conscious working

This device may be operated only by qualified personnel.

Qualified personnel in the sense of these operating instructions consists of:

- Persons who, by virtue to their training, experience and instruction, and their knowledge of pertinent norms, specifications, accident prevention regulations and operational relationships, have been authorized by the officer responsible for the safety of the system to perform the required task and in the process are capable of recognizing potential hazards and avoiding them (definition of technical personnel according to VDE105 or IEC364),
- Persons who have a knowledge of first-aid techniques and the local emergency rescue services.
- persons who have read and will observe the safety instructions.
- Those who have read and observe the manual or help (or the sections pertinent to the work to be carried out).

This applies to all work relating to setting up, commissioning, configuring, programming, modifying the conditions of utilization and operating modes, and to maintenance work.

This manual and the help information must be available close to the device during the performance of all tasks.

1.5.3. Special safety instructions

- Check the correct association of the device and its documentation.
- Never detach electrical connections while voltage is applied to them.
- Safety devices must be provided to prevent human contact with moving or rotating parts.
- Make sure that the device is operated only when it is in perfect condition.
- Implement and activate the stipulated safety functions and devices.
- Operate the device only with the housing closed.
- Make sure that all devices are sufficiently fixed.
- Check that all live terminals are secured against contact. Perilous voltage levels of up to 850V occur.
- Do not bypass power direct current

Caution!

Due to movable machine parts and high voltages, the device can pose a lethal danger. Danger of electric shock in the case of non-respect of the following instructions. The device corresponds to DIN EN 61800-3, i.e. it is subject to limited sale. The device can emit disturbances in certain local environments. In this case, the user is liable to take suitable measures.

- The device must be permanently grounded due to high earth leakage currents.
- The drive motor must be grounded with a suitable protective lead.
- The devices are equipped with high voltage DC condensers. Before removing the protective cover, the discharging time must be awaited. After switching off the supply voltage, it may take up to 10 minutes to discharge the capacitors. Danger of electric shock in case of non respect.
- Before you can work on the device, the supply voltage must be switched off at the L1, L2 and L3 clamps. Wait at least 10 minutes so that the power direct current may sink to a secure value (<50V). Check with the aid of a voltmeter, if the voltage at the DC+ and DC- clamps has fallen to a value below 50V. Danger of electric shock in case of non respect.
- Do never perform resistance tests with elevated voltages (over 690V) on the wiring without separating the circuit to be tested from the drive.
- Please exchange devices only in currentless state and, in an axis system, only in a defined original state.
- In the event of a axis controller device exchange it is absolutely necessary to transfer the configuration determining the correct operation of the drive to the device, before the device is put into operation. Depending on the operation mode, a machine zero run will be necessary.
- The device contains electrostatically sensitive components. Please heed the electrostatic protection measures while working at/with the device as well as during installation and maintenance.
- Operation of the PSUP30 only with mains filter.

Attention - hot surface!

The heat dissipator can reach very high temperatures (>70°C)

Protective seals

Caution!

The user is responsible for protective covers and/or additional safety measures in order to prevent damages to persons and electric accidents.

Please note in the event of storage >1 year:

Forming the capacitors

Forming the capacitors only required with 400VAC axis controllers and PSUP mains module

If the device was stored longer than one year, the intermediate capacitors must be re-formed!

Forming sequence:

- Remove all electric connections
- Supply the device with 230VAC single phase for 30 minutes
  - via the L1 and L2 terminals on the device or
  - multi axis devices via L1 and L2 on the PSUP mains module

1.6 Warranty conditions

- The device must not be opened.
- Do not make any modifications to the device, except for those described in the manual.
- Make connections to the inputs, outputs and interfaces only in the manner described in the manual.
- Fix the devices according to the **mounting instructions** (see on page 67, see on page 73).
  We cannot provide any guarantee for other mounting methods.

Note on exchange of options

Device options must be exchanged in the factory to ensure hardware and software compatibility.

- When installing the device, make sure the heat dissipators of the device receive sufficient air and respect the recommended mounting distances of the devices with integrated ventilator fans in order to ensure free circulation of the cooling air.
- Make sure that the mounting plate is not exposed to external temperature influences.

1.7 Conditions of utilization

In this chapter you can read about:

1.7.1. Conditions of utilization for CE-conform operation

- Industry and trade -

The EC guidelines for electromagnetic compatibility 2004/108/EC and for electrical operating devices for utilization within certain voltage limits 2006/95/EC are fulfilled when the following boundary conditions are observed:

Operation of the devices only in the condition in which they were delivered, i.e. with all housing panels.

In order to ensure contact protection, all mating plugs must be present on the device connections even if they are not wired.

Please respect the specifications of the manual, especially the technical characteristics (mains connection, circuit breakers, output data, ambient conditions,...).

1.7.1.1 Conditions of utilization mains filter

Mains filter:

A mains filter is required in the mains input line if the motor cable exceeds a certain length. Filtering can be provided centrally at the system mains input or separately for each device or with C3M for each axis system.

Use of the devices in a commercial and residential area (limit value class in accordance with EN 61800-3)

The following mains filters are available for independent utilization:

Device: Compax3S	Limit value class	Motor cable length	Mains filter Order No.:
S0xxV2	C2	< 10 m	without
	C2	> 10 m, < 100 m	NFI01/01
S1xxV2, S0xxV4, S150V4	C2	< 10 m	without
	C2	> 10 m, < 100 m	NFI01/02
S300V4	C3	< 10 m	without
	C2, C3	> 10 m, < 100 m	NFI01/03

Device: Compax3H	Limit value class	Motor cable length	Mains filter Order No.:
H050V4	C2	< 10 m	without
	C2	> 10 m, < 50 m	NFI02/01
H090V4	C2	< 10 m	without
	C2	> 10 m, < 50 m	NFI02/02
H1xxV4	C2	< 10 m	without
	C2	> 10 m, < 50 m	NFI02/03

Use of the devices in the industrial area (limit values class C3 in accordance with EN 61800-3)

The following mains filters are available for independent utilization:

Device: PSU	Limit value class	Reference: Axis system with motor cable	Mains filter Order No.:
P10	C3	< 6 x 10 m	NFI03/01
P10	C3	< 6 x 50 m	NFI03/02
P20	C3	< 6 x 50 m	NFI03/03
P30	C3	< 6 x 50 m	NFI03/03

Connection length: Connection between mains filter and device:

unshielded: < 0.5 m

shielded < 5 (fully shielded on ground - e.g. ground of control cabinet)

1.7.1.2 Conditions of utilization for cables / motor filter

Motor and Feedback cable:

Operation of the devices only with motor and feedback cables whose plugs contain a special full surface area screening.

Compax3S motor cable

< 100 m (the cable should not be rolled up!)

A **motor output filter** (see on page 178) is required for motor cables >20 m:

- MDR01/04 (max. 6.3 A rated motor current)
- MDR01/01 (max. 16 A rated motor current)
- MDR01/02 (max. 30 A rated motor current)

Compax3H motor cable

A motor output filter is required for motor cables >50m. Please contact us.

Compax3M motor cable

<80m per axis (the cable must not be rolled up!)

The entire length of the motor cable per axis combination may not exceed 300m.

A **motor output filter** (see on page 178) is required for motor cables >20 m:

- MDR01/04 (max. 6.3 A rated motor current)
- MDR01/01 (max. 16 A rated motor current)
- MDR01/02 (max. 30 A rated motor current)

Shielding connection of the motor cable

The cable must be fully-screened and connected to the Compax3 housing. Use the cable clamps/shield connecting terminals furnished with the device.

The shield of the cable must also be connected with the motor housing. The fixing (via plug or screw in the terminal box) depends on the motor type.

Compax3 encoder cable:

< 100 m

Compax3M encoder cable:

< 80m

Cable for Compax3S, Compax3M

Corresponding to the specifications of the terminal clamp with a temperature range of up to 60°C.

Cable for Compax3H Corresponding to the specifications of the terminal clamp with a temperature range of up to 75°C.

Cable installation:
- Signal lines and power lines should be installed as far apart as possible.
- Signal lines should never pass close to excessive sources of interference (motors, transformers, contactors etc.).
- Do not place mains filter output cable parallel to the load cable.

1.7.1.3 Additional conditions of utilization

Motors: Operation with standard motors.

Control: Use only with aligned controller (to avoid control loop oscillation).

Grounding: Connect the filter housing and the device to the cabinet frame, making sure that the contact area is adequate and that the connection has low resistance and low inductance.

Never mount the filter housing and the device on paint-coated surfaces!

Compax3S300V4 For CE and UL conform operation of the Compax3S300V4, a mains filter is compulsory:
- 400 VAC / 0.740 mH certified in accordance with EN 61558-1 bzw. 61558-2-2
- We offer the mains filter as an accessory: LIR01/01

Accessories: Make sure to use only the accessories recommended by Parker

Connect all cable shields at both ends, ensuring large contact areas!

Warning:

This is a product in the restricted sales distribution class according to EN 61800-3. In a domestic area this product can cause radio frequency disturbance, in which case the user may be required to implement appropriate remedial measures.

1.7.2. Conditions of utilization for UL certification Compax3S

UL certification for Compax3S

conform to UL:	◆ according to UL508C
Certified	◆ E-File_No.: E235342

The UL certification is documented by a "UL" logo on the device (type specification plate).

"UL" logo:

Conditions of utilization

- The devices are only to be installed in a degree of contamination 2 environment (maximum).
- The devices must be appropriately protected (e.g. by a switching cabinet).
- The X2 terminals are not suitable for field wiring.
- Tightening torque of the field wiring terminals (green Phoenix plugs)
  - C3S0xxV2 — 0.57 - 0.79Nm — 5 - 7Lb.in
  - C3S1xxV2, C3S0xxV4, C3S150V4 — 0.57 - 0.79Nm — 5 - 7Lb.in
  - C3S300V4 — 1.25 - 1.7Nm — 11 - 15Lb.in
- Temperature rating of field installed conductors shall be at least 60°C Use copper lines only
  Please use the cables described in the **accessories chapter** (see on page 165, see on page 166), they feature a temperature rating of at least 60°C.
- Maximum Surrounding Air Temperature: 45°C.
- Suitable for use on a circuit capable of delivering not more than 5000 rms symmetrical amperes and 480 volts maximum.

ATTENTION
Danger of electric shock.
Discharge time of the bus condenser is 10 minutes.

- The drive provides internal motor overload protection.
  This must be set so that 200% of the motor nominal current are not exceeded.
- Cable cross-sections
  - Mains input: corresponding to the recommended fuses.
  - Motor cable: corresponding to the **Nominal output currents** (see on page 213, see on page 214)
  - Maximum cross-section limited by the terminals mm^2 / AWG
    - C3S0xxV2 — 2.5mm^2 — AWG 12
    - C3S1xxV2, C3S0xxV4, C3S150V4 — 4.0mm^2 — AWG 10
    - C3S300V4 — 6.0mm^2 — AWG 7
- Circuit breaker
  In addition to the main circuit breaker, the devices must be equipped with a S271 K or S273 K circuit breaker with K characteristic made by ABB.
  - C3S025V2: ABB, nom 480V 10A, 6kA
  - C3S063V2: ABB, nom 480V, 16A, 6kA
  - C3S100V2: ABB, nom 480V, 16A, 6kA
  - C3S150V2: ABB, nom 480V, 20A, 6kA
  - C3S015V4: ABB, nom 480V, 6A, 6kA
  - C3S038V4: ABB, nom 480V, 10A, 6kA
  - C3S075V4: ABB, nom 480V, 16A, 6kA
  - C3S150V4: ABB, nom 480V, 20A, 6kA
  - C3S300V4: ABB, nom 480V, 25A, 6kA

1.7.3. Conditions of utilization for UL certification Compax3M

UL-approval for PSUP/Compax3M

conform to UL:	◆according to UL508C
Certified	◆E-File_No.: E235342

The UL certification is documented by a “UL” logo on the device (type specification plate).

Conditions of utilization

- The devices are only to be installed in a degree of contamination 2 environment (maximum).
- The devices must be appropriately protected (e.g. by a switching cabinet).
- Tightening torque of the field wiring terminals (green Phoenix plugs)

Device	X40: Ballast resistor	X41: Mains connector	X9: 24VDC
PSUP10	0.5 Nm (4.43Lb.in)	1.2 Nm (10.62Lb.in)	1.2 Nm (10.62Lb.in)
PSUP20	0.5 Nm (4.43Lb.in)	1.7 Nm (15Lb.in)	1.2 Nm (10.62Lb.in)
PSUP30	UL approval in preparation		
Device	**X43: Motor connector**	**X15: Temperature monitoring**	
C3M050-150	0.5Nm (4.43Lb.in)	0.22Nm (1.95Lb.in)	
C3M300	1.2Nm (10.62Lb.in)	0.22Nm (1.95Lb.in)	

- Temperature rating of field installed conductors shall be at least 60°C Use copper lines only
  Please use the cables described in the **accessories chapter** (see on page 165, see on page 166), they feature a temperature rating of at least 60°C.
- Maximum Surrounding Air Temperature: 40°C.
- Suitable for use on a circuit capable of delivering not more than 5000 rms symmetrical amperes and 480 volts maximum.

Caution!

Danger of electric shock.
Discharge time of the bus capacitor is 10 minutes.

- The drive provides internal motor overload protection.
  This must be set so that 200% of the motor nominal current are not exceeded.
- Cable cross-sections
  - Mains input: corresponding to the recommended fuses.
  - Motor cable: corresponding to the **Nominal output currents** (see on page 213, see on page 214)
- Maximum cross-section limited by the terminals mm^2 / AWG

Line cross-sections of the power connections (on the device bottoms)

Compax3 device:	Cross-section: Minimum... Maximum [with conductor sleeve]
M050, M100, M150	0.25 ... 4 mm^2 (AWG: 23 ... 11)
M300	0.5 ... 6 mm^2 (AWG: 20 ... 10)
PSUP10	Mains supply: 0.5 ... 6 mm^2 (AWG: 20 ... 10) Braking resistor: 0.25 ... 4 mm^2 (AWG: 23 ... 11)
PSUP20 & PSUP30	Mains supply: 0.5 ... 16 mm^2 (AWG: 20 ... 6) Braking resistor: 0.25 ... 4 mm^2 (AWG: 23 ... 11)

1.7.4. Conditions of utilization for UL certification Compax3H

UL certification for Compax3H

Conform to UL:	◆ according to UL508C
Certified	◆ E-File_No.: E235342

The UL certification is documented by a "UL" logo on the device (type specification plate).

"UL" logo:

Conditions of utilization

- The devices are only to be installed in a degree of contamination 2 environment (maximum).
- The devices must be appropriately protected (e.g. by a switching cabinet).
- Tightening Torque of the Field Wiring Terminals.

Terminal clamps - max. line cross sections

The line cross sections must correspond to the locally valid safety regulations. The local regulations have always priority.

	Power clamps (minimum/maximum section)	
C3H050V4	2.5 / 16mm^2	
	Massive	Multiwire
C3H090V4	16 / 50mm^2	25 / 50mm^2
C3H1xxV4	25 / 95mm^2	35 / 95mm^2

The standard connection clamps of Compax3H090V4 and Compax3H1xxV4 are not suitable for flat line bars.

Temperature rating of field installed conductors shall be at least 75°C. Do only use copper lines.

- Maximum Surrounding Air Temperature: 45°C.
- Short Circuit Rating - Suitable for use on a circuit capable of delivering not more than 10000 RMS symmetrical amperes and 480 volts maximum.

CAUTION Danger of electric shock.

Upon removing power to the equipment, wait minimum 10 minutes before accessing the drive to ensure internal voltage levels are less than 50VDC.

- The drive provides internal motor overload protection.
  This must be set so that 200% of the motor nominal current are not exceeded.
- Cable cross-sections
  - Mains input: corresponding to the recommended fuses.
  - Motor cable: corresponding to the **Nominal output currents** (see on page 213, see on page 214)
  - This device is provided with Solid State Short Circuit (output) Protection.

1.7.5. Current on the mains PE (leakage current)

Caution!

This product can cause a direct current in the protective lead. If a residual current device (RCD) is used for protection in the event of direct or indirect contact, only a type B (all current sensitive) RCD is permitted on the current supply side of this product . Otherwise, a different protective measure must be taken, such as separation from the environment by doubled or enforced insulation or separation from the mains power supply by means of a transformer.

Please heed the connection instructions of the RCD supplier.

Mains filters do have high leakage currents due to their internal capacity. An internal mains filter is usually integrated into the servo controllers. Additional leakage currents are caused by the capacities of the motor cable and of the motor windings. Due to the high clock frequency of the power output stage, the leakage currents do have high-frequency components. Please check if the FI protection switch is suitable for the individual application.

If an external mains filter is used, an additional leakage current will be produced.

The figure of the leakage current depends on the following factors:

- Length and properties of the motor cable
- Switching frequency
- Operation with or without external mains filter
- Motor cable with or without shield network
- Motor housing grounding (how and where)

Remark:

- The leakage current is important with respect to the handling and usage safety of the device.
- A pulsing leakage current occurs if the supply voltage is switched on.

Please note:

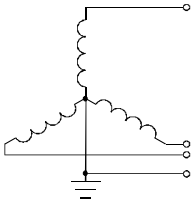
The device must be operated with effective grounding connection, which must comply with the local regulations for high leakage currents (>3.5mA).

Due to the high leakage currents it is not advisable to operate the servo drive with an earth leakage circuit breaker.

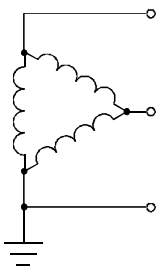
1.7.6. Supply networks

This product is designed for fixed connection to TN networks (TN-C, TN-C-S or TN-S). Please note that the line-earth voltage may not exceed 300VAC.

- When grounding the neutral conductor, mains voltages of up to 480VAC are permitted.



- When grounding an external conductor (delta mains, two-phase mains), mains voltages (external conductor voltages) of up to 240VAC are permitted.



Devices which are to be connected to an IT network must be provided with a separating transformer. Then the devices are operated locally as in a TN network. The secondary sided center of the separating transformer must be grounded and connected to the PE connector of the device.

2. Compax3 with analogue and step/direction input

The complete modular structure of the Compax3 optimizes the integration of intelligent servo-drives for various applications efficiently. With its analogue interface or alternatively with step/direction or encoder step signals, the Compax3 I10 gives you easy and reasonably priced access to the world of servo-drive technology. With its simple, standardized setpoint interface, the Compax3 I10 is particularly suitable if you want to migrate to servo-drive systems for technical reasons. Irrelevant of whether you have a PLC or PC central control unit, this remains unchanged. The Compax3 I10 represents an ideal way of migrating from analog +/- 10V drives to digital, intelligent servo-drives.

Compax3 control technology

High-performance control technology and openness for various sender systems are fundamental requirements for a fast and high-quality automation of movement.

Model / standards / auxiliary material

The structure and size of the device are of considerable importance. High-quality electronics are a fundamental requirement for the particularly small and compact form of the Compax3 devices. All connectors are located on the front of the Compax3S.

Partly integrated mains filters permit connection of motor cables up to a certain length without requiring additional measures. EMC compatibility is within the limits set by EN 61800-3, Class A. The Compax3 is CE-conform.

The intuitive user interface familiar from many applications, together with the oscilloscope function, wizards and online help, simplifies making and modifying settings via the PC.

The optional **Operator control module (BDM01/01)** (see on page 202) for Compax3S/F makes it possible to exchange devices quickly without requiring a PC.

Operating modes

You can choose between 3 different operating modes:

- ±10V speed command interface with encoder simulation as current value feedback.
- ±10V predefined current setpoint with encoder emulation for actual position value feedback and configurable holding functions.
- Step/direction command Input
  - With step/direction signals as 24V logic levels or
  - With step/direction logic signals conforming to RS422.
- Encoder input
  - RS422
  - 24V level

Configuration

Configuration is made with a PC with the help of the Compax3 ServoManager.

General proceeding (see on page 98)

3. Compax3 device description

In this chapter you can read about:

3.1 Meaning of the status LEDs - Compax3 axis controller

Device status LEDs	Right LED (red)	Left LED (green)
Voltages missing	off	off
During the booting sequence	alternately flashing	
◆ No configuration present. ◆ SinCos© feedback not detected. ◆ Compax3 IEC61131-3 program not compatible with Compax3 Firmware. ◆ no Compax3 IEC61131-3 program ◆ For F12: Hall signals invalid.	flashes slowly	off
Axis without current excitation	off	flashes slowly
Power supplied to axis; commutation calibration running	off	flashes quickly
Axis with current excitation	off	on
Axis in fault status / fault present / axis energized (error reaction 1)	flashes quickly	on
Axis in fault status / fault present / axis currentless (error reaction 2)	on	off
Compax3 faulty: please contact us	on	on

Note on Compax3H: The **internal** device status LEDs are only connected to the **external** housing LEDs, if the RS232 jumper at X10 is fitted to the control and the upper dummy cover is fitted.

3.2 Meaning of the status LEDs - PSUP (mains module)

PSUP Status LEDs	Left LED (green)	Right LED (red)
Control voltage 24 VDC is missing	off	off
Error of mains module*	off	on
DC power voltage is built up	-	flashes quickly
Phase failure / mains power supply undervoltage	on	flashes slowly
Address assignment CPU active	flashes quickly	-
Address assignment CPU completed	flashes slowly	-
PSUPxx Ready - State	on	off
Incorrect wiring of internal communication X30/31	flashes slowly	flashes quickly
Device in bootloader state	flashes slowly	flashes slowly

*can be read out in each axis controller

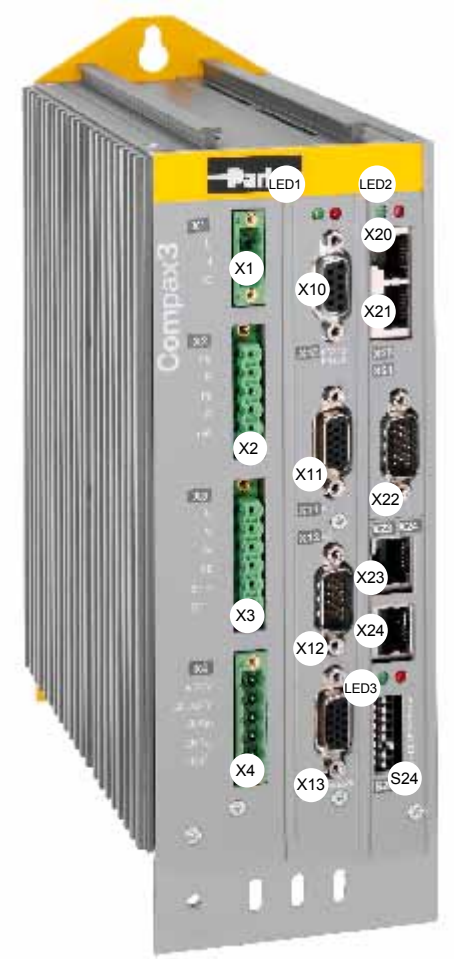
Caution!

When the control voltage is missing there is no indication whether or not high voltage supply is available.

3.3 Connections of Compax3S

In this chapter you can read about:

3.3.1. Compax3S connectors



X1	AC Supply	**X20**	HEDA in (Option)	
X2	Ballast / DC power voltage	**X21**	HEDA out (Option)	
X3	Motor / Brake	**X22**	Inputs Outputs (Option M10/12)	
X4	24VDC / Enable	**X23/ X24**	Bus (Option)	Connector type depends on the bus system!
X10	RS232/RS485	**S24**	bus settings	
X11	Analog/Encoder	**LED1**	Device status LEDs	
X12	Inputs/Outputs	**LED2**	HEDA LEDs	
X13	Motor position feedback	**LED3**	Bus LEDs	

Caution - Risk of Electric Shock!

Always switch devices off before wiring them!

Dangerous voltages are still present until 10 min. after switching off the power supply.

Caution!

When the control voltage is missing there is no indication whether or not high voltage supply is available.

Attention - PE connection!

PE connection with 10mm^2 via a grounding screw at the bottom of the device.

Attention - hot surface!

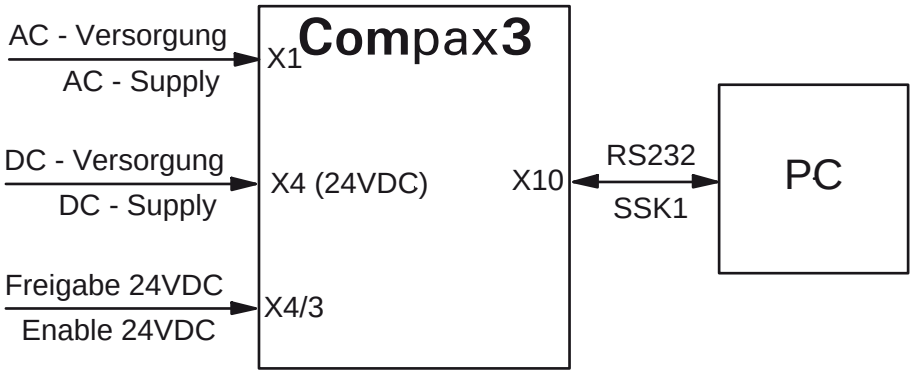
The heat dissipator can reach very high temperatures (>70°C)

Line cross sections of the line connections X1, X2, X3

Compax3 device:	Cross-section: Minimum... Maximum[mm^2]
S025V2, S063V2	0.25 ... 2.5 (AWG: 24 ... 12)
S100V2, S150V2 **S015V4, S038V4, S075V4, S150V4**	0.25 ... 4 (AWG: 24 ... 10)
S300V4	0.5 ... 6 (AWG: 20 ... 7)

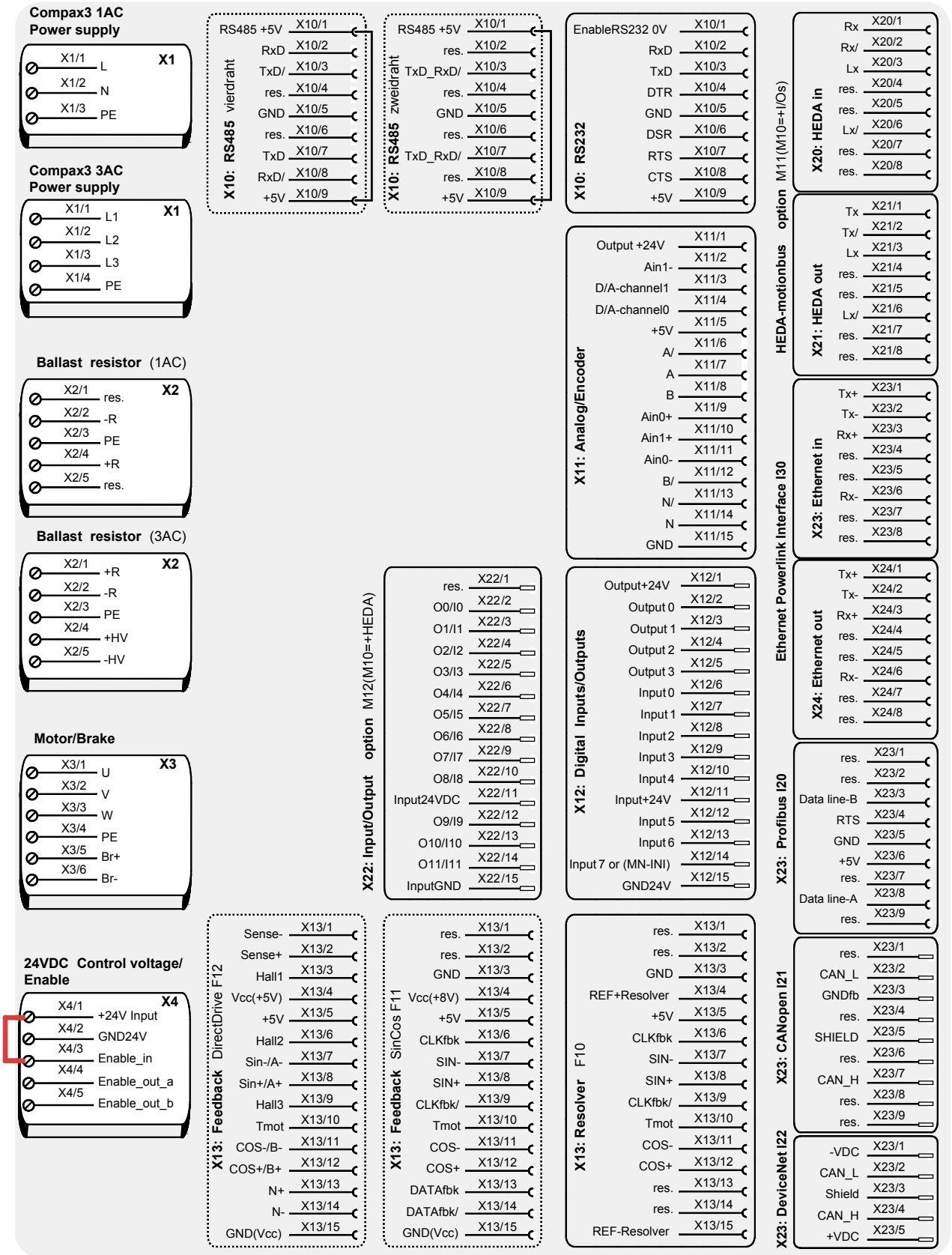
3.3.2. Connector and pin assignment C3S

Overview:



Further information on the assignment of the plug mounted at the particular device can be found below!

In detail: The fitting of the different plugs depends on the extension level of Compax3. In part, the assignment depends on the Compax3 option implemented.



The jumper drawn in at X4 (at the left side in red) is used to enable the device for testing purposes. During operation, the enable input is in most cases switched externally.

3.3.3. Control voltage 24VDC / enable connector X4 C3S

PIN	Description
1	+24V (supply)
2	Gnd24V
3	Enable_in
4	Enable_out_a
5	Enable_out_b

Line cross sections:
minimum: 0.25mm²
maximum: 2.5mm²
(AWG: 24 ... 12)

Control voltage 24VDC Compax3S and Compax3H

Controller type	Compax3
Voltage range	21 - 27VDC
Current drain of the device	0.8 A
Total current drain	0.8 A + Total load of the digital outputs + current for the motor holding brake
Ripple	0.5Vpp
Requirement according to safe extra low voltage (SELV)	yes
Short-circuit proof	conditional (internally protected with 3.15AT)

Hardware - enable (input X4/3 = 24VDC)

This input is used as safety interrupt for the power output stage.

Tolerance range: 18.0V - 33.6V / 720Ω

"Safe torque off (X4/3=0V)

For implementation of the "safety torque off" safety feature in accordance with the “protection against unexpected start-up” described in EN1037. Observe instructions in the corresponding **chapter** (see on page 76) with the circuitry examples!

The energy supply to the drive is reliably shut off, the motor has no torque.

A relay contact is located between X4/4 and X4/5 (normally closed contact)

Enable_out_a - Enable_out_b	Power output stage is
Contact opened	activated
Contact closed	disabled

Series connection of these contacts permits certain determination of whether all drives are de-energized.

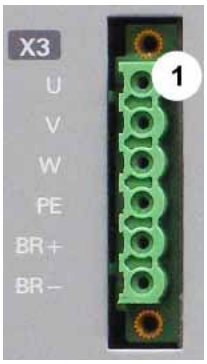
Relay contact data:

Switching voltage (AC/DC): 100mV - 60V

Switching current: 10mA - 0.3A

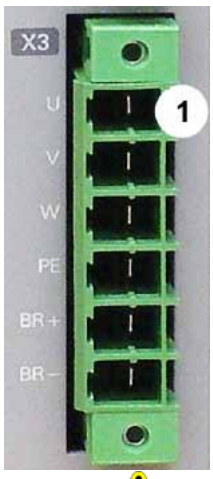
Switching power: 1mW...7W

3.3.4. Motor / Motor brake (C3S connector X3)



PIN	Designation		Motor cable lead designation*		
1	U (motor)		U / L1 / C / L+	1	U1
2	V (motor)		V / L2	2	V2
3	W (motor)		W / L3 / D / L-	3	W3
4	PE (motor)		YE / GN	YE / GN	YE / GN
5	BR+	Motor holding brake	WH	4	Br1
6	BR-	Motor holding brake	BK	5	Br2

* depending on the cable type



Requirements for motor cable

< 100m (the cable should not be rolled up!)

A **motor output filter** (see on page 178) is required for motor cables >20 m:

Shielding connection of the motor cable

The cable must be fully-screened and connected to the Compax3 housing. Use the cable clamps/shield connecting terminals furnished with the device.

The shield of the cable must also be connected with the motor housing. The fixing (via plug or screw in the terminal box) depends on the motor type.

Attention - Please wire the motor holding brake!

Connect the brake only on motors which have a holding brake! Otherwise make no brake connections at all.

Requirements cables for motor holding brake

If a motor holding brake is present, **one cable** of the motor holding brake must be fed on the device side through the toroidal core ferrite provided as accessory ZBH0x/xx (63Ω @1MHz, di=5.1mm), in order to ensure error-free switching on and off of the motor holding brake.

Motor holding brake output

Motor holding brake output	Compax3
Voltage range	21 – 27VDC
Maximum output current (short circuit proof)	1.6A

Motor cable

3.3.5. Compax3Sxxx V2

In this chapter you can read about:

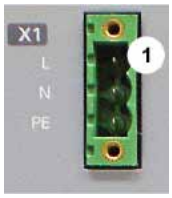
3.3.5.1 Main voltage supply C3S connector X1

Device protection

By cyclically switching on and off the power voltage, the input current limitation can be overloaded, which will cause a device error.

Therefore please wait at least 2 minutes after switching off before you switch the device on again!

Power supply plug X1 for 1 AC 230VAC/240VAC devices



PIN	Designation
1	L
2	N
3	PE

Mains connection Compax3S0xxV2 1AC

Controller type	S025V2	S063V2
Supply voltage	Single phase 230VAC/240VAC 80-253VAC / 50-60Hz	
Input current	6Arms	13Arms
Maximum fuse rating per device (=short circuit rating)	10 A (MCB miniature circuit breaker, K characteristic)	16A (automatic circuit breaker K)

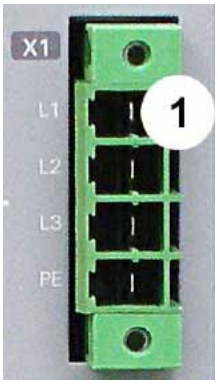
* for **UL conform operation** (see on page 20), a miniature circuit breaker, K characteristic, Type S203 is to be used.

Caution - Risk of Electric Shock!

Always switch devices off before wiring them!

Dangerous voltages are still present until 10 min. after switching off the power supply.

Power supply plug X1 for 3AC 230VAC/240VAC devices



PIN	Designation
1	L1
2	L2
3	L3
4	PE

Mains connection Compax3S1xxV2 3AC

Controller type	S100V2	S150V2
Supply voltage	Three phase 3* 230VAC/240VAC 80-253VAC / 50-60Hz	
Input current	10Arms	13Arms
Maximum fuse rating per device (=short circuit rating)	16A	20A
	MCB miniature circuit breaker, K characteristic	

* for **UL conform operation** (see on page 20), a miniature circuit breaker, K characteristic, Type S203 is to be used.

Caution!

The 3AC V2 devices must only be operated with three phases!

Caution - Risk of Electric Shock!

Always switch devices off before wiring them!

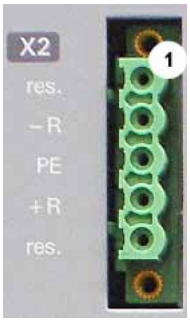
Dangerous voltages are still present until 10 min. after switching off the power supply.

3.3.5.2 Braking resistor / high voltage DC C3S connector X2

The energy generated during braking operation is absorbed by the Compax3 storage capacity.

If this capacity is too small, the braking energy must be drained via a braking resistor.

Braking resistor / high voltage supply plug X2 for 1AC 230VAC/240VAC devices



PIN	Designation
1	factory use
2	- braking resistor (not short-circuit protected!)
3	PE
4	+ braking resistor (not short-circuit protected!)
5	factory use

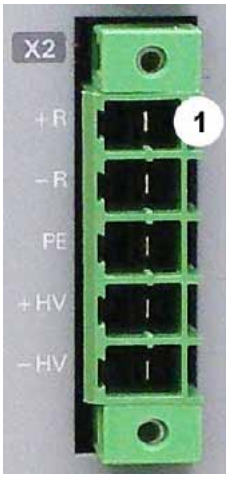
Braking operation Compax3S0xxV2 1AC

Controller type	S025V2	S063V2
Capacitance / storable energy	560µF / 15Ws	1120µF / 30Ws
Minimum braking- resistance	100Ω	56Ω
Recommended nominal power rating	20 ... 60W	60 ... 180W
Maximum continuous current	8A	15A

Caution!

The power voltage DC of two Compax3 1AC V2 devices (230VAC/240VAC devices) must not be connected.

Braking resistor / high voltage supply plug X2 for 3AC 230VAC/240VAC devices



PIN	Description	
1	+ Braking resistor	no short-circuit protection!
2	- Braking resistor	
3	PE	
4	+ DC high voltage supply	
5	- DC high voltage supply	

Braking operation Compax3S1xxV2 3AC

Controller type	S100V2	S150V2
Capacitance / storable energy	780µF / 21Ws	1170µF / 31Ws
Minimum braking- resistance	22Ω	15Ω
Recommended nominal power rating	60 ... 450W	60 ... 600W
Maximum continuous current	20A	20A

Connection of a braking resistor

Minimum line cross section: 1.5mm^2

Maximum line length: 2m

Maximum output voltage: 400VDC

3.3.6. Compax3Sxxx V4

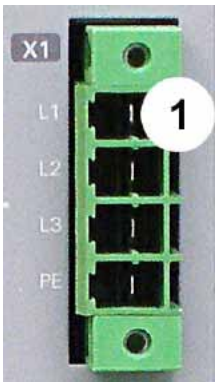
In this chapter you can read about:

3.3.6.1 Power supply connector X1 for 3AC 400VAC/480VAC-C3S devices

Device protection

By cyclically switching on and off the power voltage, the input current limitation can be overloaded, which will cause a device error.

Therefore please wait at least 2 minutes after switching off before you switch the device on again!



PIN	Designation
1	L1
2	L2
3	L3
4	PE

Mains connection Compax3SxxxV4 3AC

Controller type	S015V4	S038V4	S075V4	S150V4	S300V4
Supply voltage	Three phase 3*400VAC/480VAC 80-528VAC / 50-60Hz				
Input current	3Aeff	6Arms	10Arms	16Arms	22Arms
Maximum fuse rating per device(=short circuit rating)	6A	10A	16A	20A	25A
	MCB miniature circuit breaker, K characteristic				D*

* for **UL conform operation** (see on page 20), a miniature circuit breaker, K characteristic, Type S203 is to be used.

Caution!

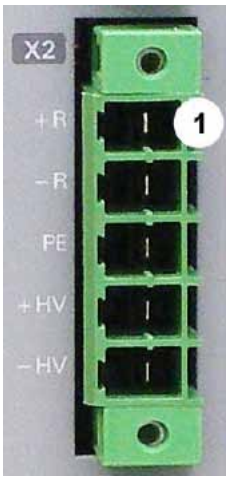
The 3AC V4 devices must only be operated with three phases!

Caution - Risk of Electric Shock!

Always switch devices off before wiring them!

Dangerous voltages are still present until 10 min. after switching off the power supply.

3.3.6.2 Braking resistor / high voltage supply connector X2 for 3AC 400VAC/480VAC_C3S devices



PIN	Description	
1	+ Braking resistor	no short-circuit protection!
2	- Braking resistor	
3	PE	
4	+ DC high voltage supply	
5	- DC high voltage supply	

Braking operation Compax3SxxxV4 3AC

Controller type	S015V4	S038V4	S075V4	S150V4	S300V4
Capacitance / storable energy 400V / 480V	235µF 37 / 21 Ws	235µF 37 / 21 Ws	470µF 75 / 42 Ws	690µF 110 / 61 Ws	1230µF 176 / 98 Ws
Minimum braking- resistance	100Ω	100Ω	56Ω	33Ω	15Ω
Recommended nominal power rating	60 ... 100W	60 ... 250W	60 ... 500 W	60 ... 1000 W	60 ... 1000 W
Maximum continuous current	10A	10A	15A	20A	30A

Connection of a braking resistor

Minimum line cross section: 1.5mm²

Maximum line length: 2m

Maximum output voltage: 800VDC

3.3.6.3 Connection of the power voltage of 2 C3S 3AC devices

Caution!

The power voltage DC of the single phase Compax3 servo axes must not be connected!

In order to improve the conditions during brake operation, the DC power voltage of 2 servo axes may be connected.

The capacity as well as the storable energy are increased; furthermore the braking energy of one servo axis may be utilized by a second servo axis, depending on the application.

It is not permitted to connect the power voltage in order to use one brake circuit for two servo axes, as this function cannot be ensured reliably.

Note the following:

Caution! In case of non-compliance with the following instructions, the device may be destroyed!

- You can only connect two similar servo axes (same power supply; same rated currents)
- Connected servo axes must always be fed separately via the AC power supply.

If the external pre-fuse of one of the servo axes takes action, the second servo axis must also be disconnected automatically.

Please connect as follows:

Servo axis 1 X2/4 to servo axis 2 X2/4

Servo axis 1 X2/5 to servo axis 2 X2/5

3.4 Installation instructions Compax3M

General introductory notes

- Operation of the Compax3M multi-axis combination is only possible in connection with a PSUP (mains module).
- Axis controllers are aligned at the right of the mains module.
- Arrangement within the multi-axis combination sorted by power (with the same device types according to device utilization), the axis controller with the highest power is placed directly at the right of the mains module.
  e.g. first the device type with high utilization, at the right of this, the same device type with a lower utilization.
- Max. 15 Compax3M (axis controllers) per PSUP (mains module) are permitted (please respect the total capacity of max. 2400µF for PSUP10, max. 5000µF for PSUP20).
- The continuation of the current rail connection outside the axis combination is not permitted and will lead to a loss of the CE and UL approbation.
- External components **may not** be connected to the rail system.

Required tools:

- Allen key M5 for fixing the devices in the control cabinet.
- Crosstip screwdriver M4 for connection rails of the DC rail modules.
- Crosstip screwdriver M5 for grounding screw of the device.
- Flat-bladed screwdriver 0.4x2.5 / 0.6x3.5 / 1.0x4.0 for wiring and mounting of the phoenix clamps.

Order of installation

- Fixing the devices in the control cabinet.
  - Predrilling the mounting plate in the control cabinet according to the specifications. Dimensions. Fit M5 screws loosely in the bores.
  - Fit device on the upper screws and place on lower screw. Tighten screws of all devices. The tightening torque depends on the screw type (e.g. 5.9Nm for M5 screw DIN 912 8.8).
- Connection of the internal supply voltage.
  The Compax3M axis controllers are connected to the supply voltages via the rail modules. **Details** (see on page 42).
  - Deblocking the yellow protective cover with a flat-bladed screwdriver on the upper surface (click mechanism). Remove the closing devices (contact protection) that are not required from between the devices.
  - Connecting the rail modules, beginning with the mains module.
    For this, loosen crosshead screws (5 screws at the right in the mains module, all 10 screws in the next axis controller), push the rails one after the other against to the left and tighten screws. Proceed accordingly for all adjacent axis controllers in the combination.
    Max. tightening torque: 1.5Nm.
  - Close all protective covers. The protective covers must latch audibly.

Please note:

Insufficiently fixed screw connections of the DC power voltage rails may lead to the destruction of the devices.

Protective seals

Caution - Risk of Electric Shock!

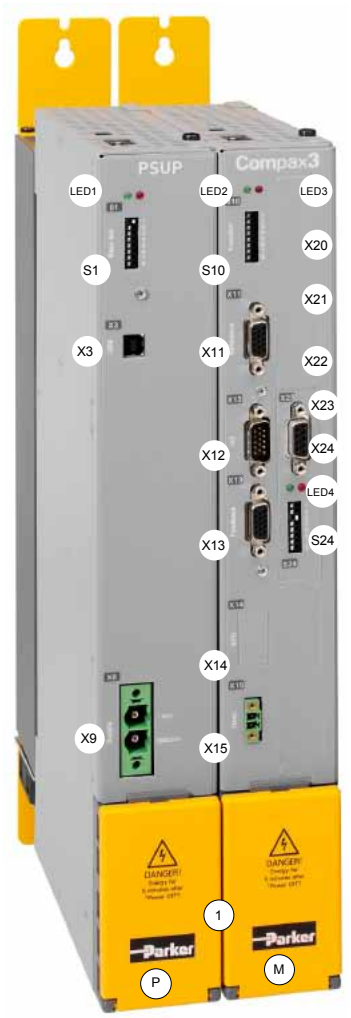
In order to secure the contact protection against the alive rails, it is absolutely necessary to respect the following:

- Insert the yellow plastic comb at the left or right of the rails.
  Make sure that the yellow plastic combs are placed at the left of the first device and at the right of the last device in the system and have not been removed.
- Setup of the devices only with closed protective covers.
- Connect protective earth to mains module (M5 crosshead screw on front of device bottom).
- Connecting the internal communication. **Details** (see on page 60).
- Connecting the signal and fieldbus connectors. **Details** (see on page 62).
- Connection of mains power supply **Details** (see on page 44) ballast resistor **details** (see on page 46) and motor **details** (see on page 48).
- Connecting the configuration interface to the PC. **Details** (see on page 60).

3.5 PSUP/Compax3M Connections

In this chapter you can read about:

3.5.1. Front connector



P	Mains module PSUP
LED1	Status LEDs Mains module
S1	Basic address
X3	Configuration interface (USB)
X9	Supply voltage 24VDC
M	**Axis controller**
LED2	Status LEDs of the axis
S10	Function
X11	Analog/Encoder
X12	Inputs/Outputs
X13	Motor position feedback
X14	Safety technology (option)
X15	Motor temperature monitoring
LED3	HEDA LEDs
X20	HEDA in (Option)
X21	HEDA out (Option)
X22	Inputs Outputs (Option M10/12)
X23	Bus (option) connector type depends on the bus system!
X24	Bus (option) depends on the bus system!
LED4	Bus LEDs
S24	bus settings
1	Behind the yellow protective covers you can find the rails for the supply voltage connection. ◆ Supply voltage 24VDC ◆ DC power voltage supply

3.5.2. Connections on the device bottom

Caution - Risk of Electric Shock!

Always switch devices off before wiring them!

Dangerous voltages are still present until 10 min. after switching off the power supply.

Caution!

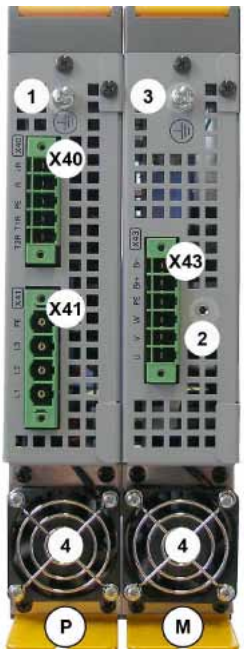
When the control voltage is missing there is no indication whether or not high voltage supply is available.

Attention - PE connection!

PE connection with 10mm² via a grounding screw at the bottom of the device.

Attention - hot surface!

The heat dissipator can reach very high temperatures (>70°C)



P	Mains module PSUP
X40	Ballast resistor
X41	Mains supply VAC/PE
1	Central ground connection for the axis system, with 10mm² to the ground screw on the housing.
4	Fan*
M	**Axis controller**
X43	Motor / Brake
2	Fixing for motor shield clamp
4	Fan*
3	optionally, the axis controller features a ground screw on the housing, if the grounding is not possible via the back plate.

* is internally supplied.

Line cross-sections of the power connections (on the device bottoms)

Compax3 device:	Cross-section: Minimum... Maximum [with conductor sleeve]
M050, M100, M150	0.25 ... 4 mm² (AWG: 23 ... 11)
M300	0.5 ... 6 mm² (AWG: 20 ... 10)
PSUP10	Mains supply: 0.5 ... 6 mm² (AWG: 20 ... 10) Braking resistor: 0.25 ... 4 mm² (AWG: 23 ... 11)
PSUP20 & PSUP30	Mains supply: 0.5 ... 16 mm² (AWG: 20 ... 6) Braking resistor: 0.25 ... 4 mm² (AWG: 23 ... 11)

3.5.3. Connections of the axis combination

The axis controllers are connected to the supply voltages via rails.

- Supply voltage 24VDC
- DC power voltage supply

The rails can be found behind the yellow protective covers. In order to connect the rails of the devices, you may have to remove the yellow plastic device inserted at the side.

CAUTION: Risk of Electric Shock

Caution - Risk of Electric Shock!

Please note before opening:

- **Warning** - Possible risk of electric shock; disconnect power before removing cover.
- **Caution!** - Dangerous electric voltage! Respect discharge time.

Caution - Risk of Electric Shock!

Always switch devices off before wiring them!

Dangerous voltages are still present until 10 min. after switching off the power supply.

Caution!

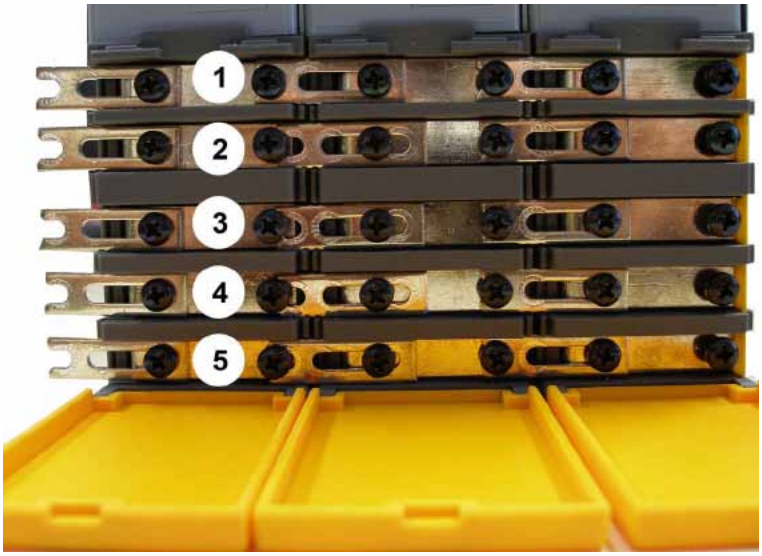
When the control voltage is missing there is no indication whether or not high voltage supply is available.

Protective seals

Caution - Risk of Electric Shock!

In order to secure the contact protection against the alive rails, it is absolutely necessary to respect the following:

- Insert the yellow plastic comb at the left or right of the rails.
  Make sure that the yellow plastic combs are placed at the left of the first device and at the right of the last device in the system and have not been removed.
- Setup of the devices only with closed protective covers.



1 24VDC
2 GND24V
3 -HV DC
4 PE
5 +HV DC

Note: External components **may not** be connected to the rail system.

Maximum capacity in the axis system:

- PSUP10: 2400 µF
- PSUP20 & PSUP30: 5000 µF

Reference value for the required capacity in an axis system

100 µF per kW of the temporal medium value of the total power (transmissions + power dissipation) in the axis system

Example: PSUP20 (1175 µF) with one axis controller (440 µF)

Total power 15 kW, 100 µF/kW => 1500 µF required in the axis system.

Axis system: 1615 µF are sufficient.

Protective seals

Caution!

The user is responsible for protective covers and/or additional safety measures in order to prevent damages to persons and electric accidents.

3.5.4. Control voltage 24VDC PSUP (mains module)

Connector X9

Pin	Designation
1	+24 V
2	GND24V

Line cross sections:
minimum: 0.5mm² with conductor sleeve
maximum: 6mm² with conductor sleeve
(AWG: 20 ... 10)

Control voltage 24 VDC PSUP

Device type	PSUP
Voltage range	21 - 27VDC
Ripple	0.5Vpp
Requirement according to safe extra low voltage (SELV)	yes (class 2 mains module)
Current drain PSUP	PSUP10: 0.2A PSUP20 / PSUP30: 0.3A
Electric current drain Compax3M	C3M050D6: 0.85 3M100D6: 0.85A C3M150D6: 0.85A C3M300D6: 1.0 A + Total load of the digital outputs + current for the motor holding brake

3.5.5. Mains supply PSUP (mains module) X41

Device protection

By cyclically switching on and off the power voltage, the input current limitation can be overloaded, which may cause damage to the device.

Wait at least one minute between two switching on processes!

Operation of the PSUP30 only with mains filter!

Connector X41

Pin	Designation
PE	Earth conductor
L3	Phase 3
L2	Phase 2
L1	Phase 1

Mains connection PSUP10D6

Device type PSUP10	230V	400V	480V
Supply voltage	230VAC ±10% 50-60Hz	400VAC ±10% 50-60Hz	480VAC ±10% 50-60Hz
Rated voltage	3AC 230V	3AC 400V	3AC 480V
Input current	22Arms	22Arms	18Arms
Output voltage	325VDC ±10%	565VDC ±10%	680VDC ±10%
Output power	6kW	10 kW	10 kW
Pulse power (<5s)	12kW	20kW	20kW
Power dissipation	60W	60W	60W
Maximum fuse rating per device (=short circuit rating)	Measure for line and device protection: MCB miniature circuit breaker (K characteristic) 25A in accordance with UL category DIVQ Recommendation: (ABB) S203UP-K 25(480VAC)		

Mains connection PSUP20D6

Device type PSUP20	230V	400V	480V
Supply voltage	230VAC ±10% 50-60Hz	400VAC ±10% 50-60Hz	480VAC ±10% 50-60Hz
Rated voltage	3AC 230V	3AC 400V	3AC 480V
Input current	44Arms	44Arms	35Arms
Output voltage	325VDC ±10%	565VDC ±10%	680VDC ±10%
Output power	12kW	20kW	20kW
Pulse power (<5s)	24kW	40kW	40kW
Power dissipation	120W	120W	120W
Maximum fuse rating per device (=short circuit rating) 2 circuit breakers in line are required	**Cable protection measure:** MCB (K characteristic) with a rating of 50A / 4xxVAC (depending on the input voltage) Recommendation: (ABB) S203U-K50 (440VAC) **Device protection measure:** Circuit breakers 80A / 700VAC per supply leg in accordance with UL category JFHR2 Requirement: Bussmann 170M1366 or 170M1566D		

PSUP30D6 Mains connection

Device type PSUP30	230V	400V	480V
Supply voltage	230VAC ±10% 50-60Hz	400VAC ±10% 50-60Hz	480VAC ±10% 50-60Hz
Rated voltage	3AC 230V	3AC 400V	3AC 480V
Input current	50Arms	50Arms	42Arms
Output voltage	325VDC ±10%	565VDC ±10%	680VDC ±10%
Output power	17kW	30kW	30kW
Pulse power (<5s)	34kW	60kW	60kW
Power dissipation	140W	140W	140W
Maximum fuse rating per device (=short circuit rating) 2 circuit breakers in line are required	**Cable protection measure:** MCB (K characteristic) with a rating of 63A / 4xxVAC (depending on the input voltage) Recommendation: (ABB) S203U-K63 (440VAC) **Device protection measure:** Circuit breakers 125A / 700VAC per supply leg in accordance with UL category JFHR2 Requirement: Bussmann 170M1368 or 170M1568D		

Caution!

Only three-phase operation of the PSUP devices is permitted!

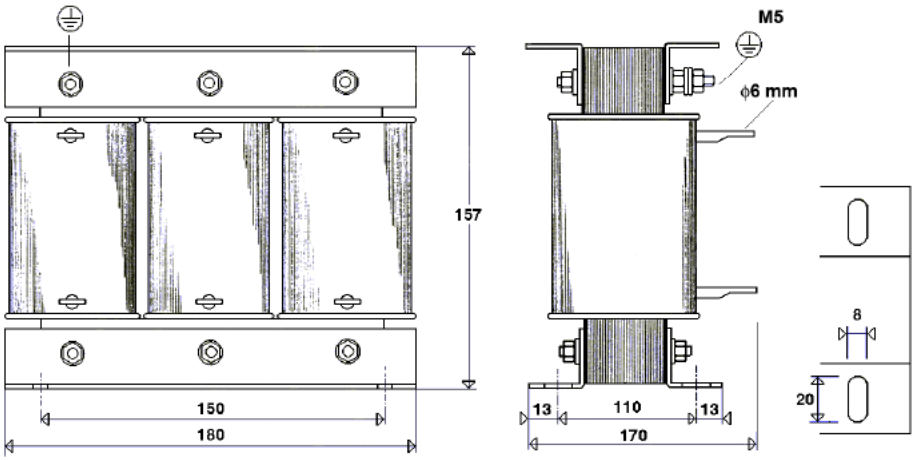
The PSUP30 mains module may only be operated with** mains filter **(see on page 180)

Required mains filter for the PSUP30: 0.45 mH / 55 A

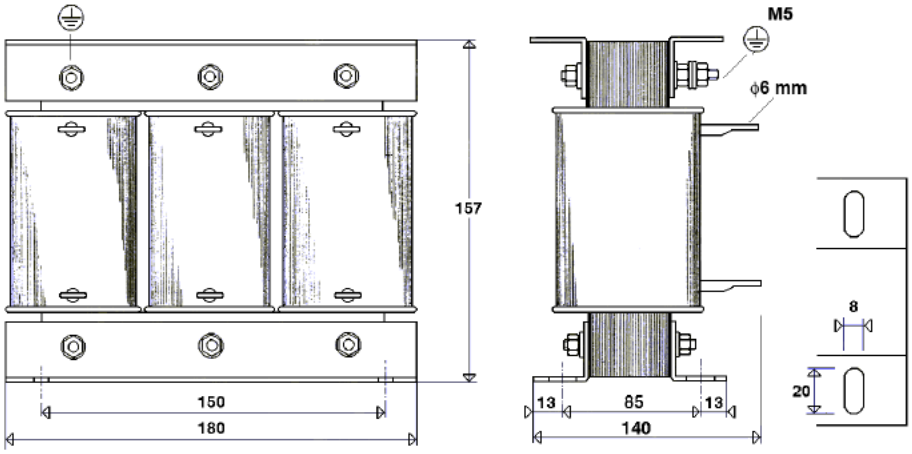
We offer the following mains filters:

- LCG-0055-0.45 mH (WxDxH: 180 mm x 140 mm x 157 mm; 10 kg)
- LCG-0055-0.45 mH-UL (with UL approval) (WxDxH: 180 mm x 170 mm x 157 mm; 15 kg)

Dimensional drawing: LCG-0055-0.45 mH



Dimensional drawing: LCG-0055-0.45 mH-UL



Caution - Risk of Electric Shock!

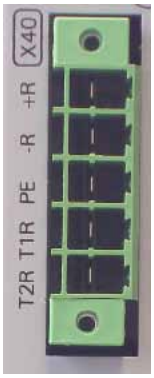
Always switch devices off before wiring them!

Dangerous voltages are still present until 10 min. after switching off the power supply.

3.5.6. Braking resistor / temperature switch PSUP (mains module)

The energy generated during braking operation must be dissipated via a braking resistor.

Connector X40



Pin	Description	
+R	+ Braking resistor	short-circuit proof!
-R	- Braking resistor	
PE	PE	
T1R	Temperature Switch	
T2R	Temperature Switch	

Braking operation PSUPxxD6 (mains module)

Device type	PSUP10	PSUP20	PSUP30
Capacitance / storable energy	550 µF/ 92 Ws at 400 V 53 Ws at 480 V	1175 µF/ 197 Ws at 400 V 114 Ws at 480 V	1175 µF/ 197 Ws at 400 V 114 Ws at 480 V
Minimum braking-resistance	27 Ω	15 Ω	10 Ω
Recommended nominal power rating	500 ... 1500 W	500 ... 3500 W	500 ... 5000 W
Pulse power rating for 1s	22 kW	40 kW	60 kW
Maximum permissible continuous current	13 A	15 A	15 A

Maximum capacity in the axis system:

- PSUP10: 2400 µF
- PSUP20 & PSUP30: 5000 µF

Reference value for the required capacity in an axis system

100 µF per kW of the temporal medium value of the total power (transmissions + power dissipation) in the axis system

Example: PSUP20 (1175 µF) with one axis controller (440 µF)

Total power 15 kW, 100 µF/kW => 1500 µF required in the axis system.

Axis system: 1615 µF are sufficient.

Connection of a braking resistor on PSUP (mains module)

Minimum line cross section:	1.5 mm^2
Maximum line length:	2 m
Maximum intermediate circuit voltage:	810 VDC
Switch-on threshold:	780 VDC
Hysteresis	20 VDC

Braking operation Compax3MxxxD6 (axis controller)

Device type Compax3	M050	M100	M150	M300
Capacity/ storable energy	110µF/ 18Ws at 400V 10Ws at 480V	220µF/ 37Ws at 400V 21Ws at 480V	220µF/ 37Ws at 400V 21Ws at 480V	440µF/ 74Ws at 400V 42Ws at 480V

3.5.6.1 Temperature switch PSUP (mains module)

Connector X40 Pin T1R, T2R

Temperature monitoring:

The temperature switch (normally closed contact) must be connected, unless an error message will be issued.

Temperature switch/relay

No galvanic separation, the temperature sensor (normally closed contact) must comply with the safe separation according to EN 60664.

If there is no temperature monitoring due to the connected braking resistor, the T1R and T2R connections must be connected by a jumper.

Caution!

Without temperature monitoring, the braking resistor might be destroyed.

3.5.7. Motor / motor brake Compax3M (axis controller)

Connector X43

PIN	Designation	Motor cable lead designation*		
BR-	Motor holding brake *	BK	5	Br2
BR+	Motor holding brake *	WH	4	Br1
PE	PE (motor)	YE / GN	YE / GN	YE / GN
W	W (motor)	W / L3 / D / L-	3	U3
V	V (motor)	V / L2	2	U2
U	U (motor)	U / L1 / C / L+	1	U1

* depending on the cable type

Compax3M motor cable

<80m per axis (the cable must not be rolled up!)

The entire length of the motor cable per axis combination may not exceed 300m.

A **motor output filter** (see on page 178) is required for motor cables >20 m:

- MDR01/04 (max. 6.3 A rated motor current)
- MDR01/01 (max. 16 A rated motor current)
- MDR01/02 (max. 30 A rated motor current)

Shielding connection of the motor cable

The cable must be fully-screened and connected to the Compax3 housing. Use the cable clamps/shield connecting terminals furnished with the device.

The shield of the cable must also be connected with the motor housing. The fixing (via plug or screw in the terminal box) depends on the motor type.

Motor cables can be found in the accessories chapter of the device description.

Motor holding brake output

Motor holding brake output	Compax3
Voltage range	21 – 27VDC
Maximum output current (short circuit proof)	1.6A

Attention - Please wire the motor holding brake!

Connect the brake only on motors which have a holding brake! Otherwise make no brake connections at all.

Requirements cables for motor holding brake

If a motor holding brake is present, **one cable** of the motor holding brake must be fed on the device side through the toroidal core ferrite provided as accessory ZBH0x/xx (63Ω @1MHz, di=5.1mm), in order to ensure error-free switching on and off of the motor holding brake.

3.5.7.1 Measurement of the motor temperature of Compax3M (axis controller)

Connector X15

The acquisition of the motor temperature by the axis controller can either take place via the connection of X15 (Tmot) or via the feedback cable and the corresponding connection on X13 PIN10.

Pin	Description
1	+5V
2	Sensor

The temperature acquisition on X15 Tmot can not be connected at the same time as X13 Pin 10.

3.5.8. Safety technology option for Compax3M (axis controller)

Connector X14

Pin	Description	
1	STO1/	+24VDC
2	STO-GND	GND
3	STO2/	+24VDC
4	STO-GND	GND

Note!

If the Compax3M axis controller features a safety option, these connections must also be wired, otherwise it is not possible to set up the axis.

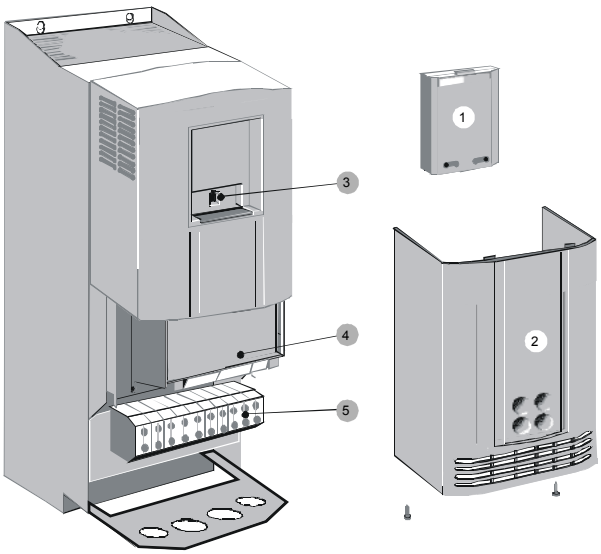
3.6 Connections of Compax3H

In this chapter you can read about:

3.6.1. Compax3H plugs/connections

The following figure is an example for all sizes.

The fitting of the different controller plugs depends on the extension level of Compax3.



(1): Dummy cover with display of the **external** device status LEDs.

(2): lower clamp cover, fixed by 2 screws at the device bottom.

(3): RS232 programming interface
Connection to the PC via adapter cable SSK32/20 (furnished with the device) and standard RS232 cable SSK1.

(4): Control

(5): Power connections

Always switch devices off before wiring them!

Dangerous voltages are still present until 5 minutes after switching off the power supply!

Caution!

If the control voltage is missing and if the X10-X10 jumper is not fitted (VBK17/01) on the control part, the availability of power voltage is not displayed.

PE connection

PE connection with 10mm^2 via a grounding screw at the bottom of the device.

Attention hot surface!

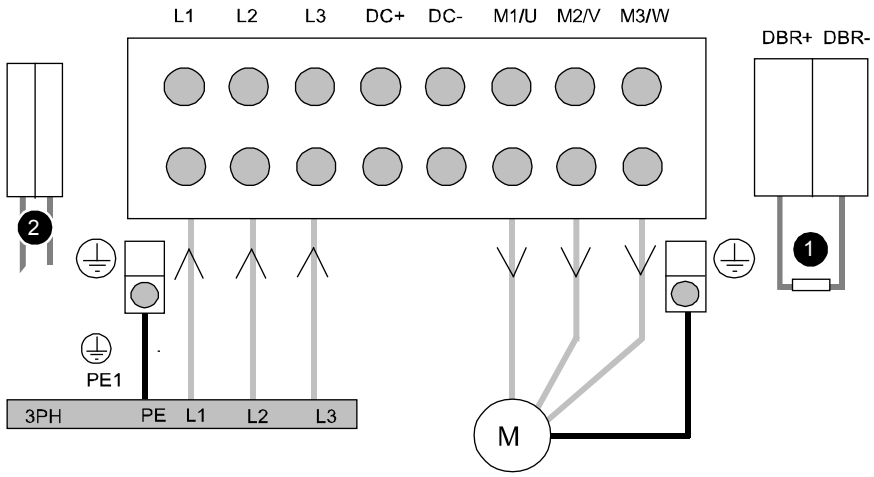
Metal parts can heat up to a temperature of 90°C during operation.

3.6.2. Connection of the power voltage

The terminal block of the drive can be found under the front cover. It is secured with 2 screws at the bottom of the device. Remove the bottom cover in order to access the connection clamps.

Make sure that all live parts are covered by the housing after installation.

Illustration of the connection clamps exemplarily for all sizes:



L1, L2, L3: 3 phase mains connection

M1, M2, M3: Motor connections

DC+, DC-: DC link voltage

(1) DBR+ und DBR-: Connection of external braking resistor

(2) AUX1, AUX2: only with C3H1xxV4 external supply (AC) for device ventilator L, N

- **All** shields must be connected via a cable joint to the cable feed through plate.
- Braking resistor and cable must be shielded if they are not installed in a control cabinet.
- The standard connection clamps of C3H090V4 and C3H1xxV4 are **not** suitable for flat line bars.

Attention: The MOT/TEMP connection is not supported by the Compax3H050; do therefore not wire this connection!

Terminal clamps - max. line cross sections

The line cross sections must correspond to the locally valid safety regulations. The local regulations have always priority.		
	Power clamps (minimum/maximum section)	
C3H050V4	2.5 / 16mm^2	
	Massive	Multiwire
C3H090V4	16 / 50mm^2	25 / 50mm^2
C3H1xxV4	25 / 95mm^2	35 / 95mm^2
The standard connection clamps of Compax3H090V4 and Compax3H1xxV4 are not suitable for flat line bars.		

Cover plate for cable feed through

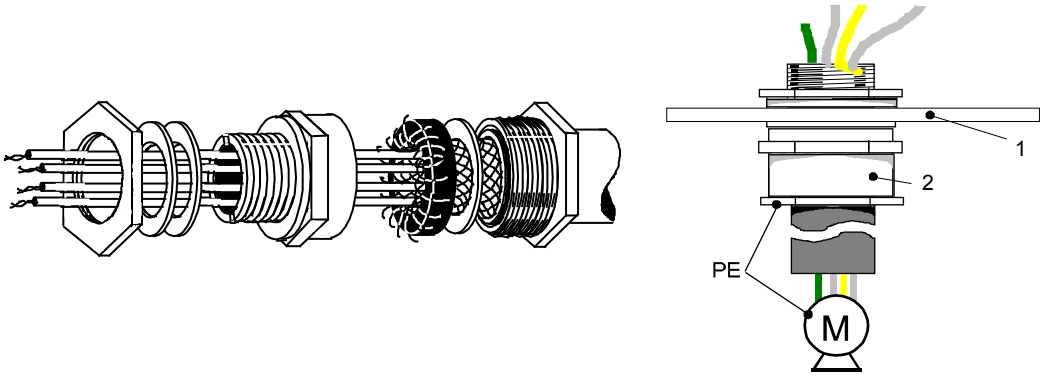
The cable feed through holes have the following dimensions:	
C3H050V4	28.6mm for M20, PG16 and ½" NPT (America). 37.3mm for M32, PG29 and 1" NPT (America).
C3H090V4	22.8mm for M20, PG16 und ½" NPT (America). 28.6mm for M25, PG21 and ¾" NPT (America). 47.3mm for M40, PG36 and 1¼" NPT (America). 54.3mm for M50, PG42and 1½" NPT (America).
C3H1xxV4	22.8mm for M20, PG16 and ½" NPT (America) 28.6mm for M25, PG21 and ¾" NPT (America)

Recommended tightening torques

	High voltage supply	**Ballast resistor**	**Grounding**
C3H050V4	4Nm / 35lb-in	4Nm / 35lb-in	4.5Nm / 40lb-in
C3H090V4	6-8Nm / 53-70lb-in	6-8Nm / 53-70lb-in	6-8Nm / 53-70lb-in
C3H1xxV4	15-20Nm / 132-177lb-in	0.7Nm / 6.1lb-in	42Nm / 375lb-in

Cable joints

Use metallic cable joints permitting a 360° shielding in order to comply with the EMC directive.



1: Cable feed through plate

2: metallic joint with 360° shielding for EMC compliant design

The device must be grounded without interruption according to EN 61800-5-1. The mains supply lines must be protected with a suitable fuse or a circuit breaker (FI switches or earth fault fuses are not recommended).

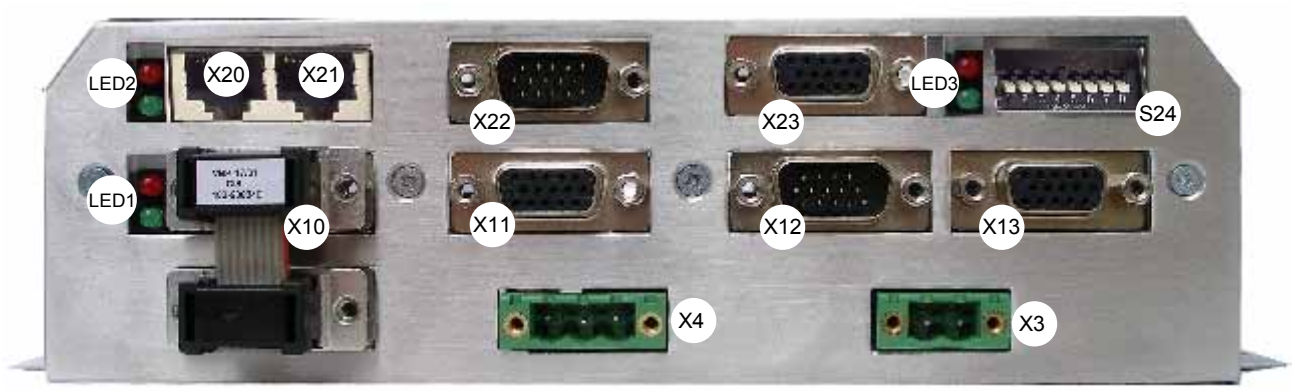
For installation in accordance with EN 61800-5-1 mm Europe:

- For grounding without interruption, two separate protective leads (˚ cross-section) or one lead (>10mm˚ cross-section) are required. Each protective lead must meet the requirements according to EN 60204.

3.6.3. Compax3H connections front plate

Communication and signal interfaces

Showcase front plate of the control (number of connectors depends on the extension level of the Compax3)



X3	Motor brake	**X20**	HEDA in (Option)	
X4	24VDC	**X21**	HEDA out (Option)	
X10	RS232/RS485 with jumper to the programming interface	**X22**	Inputs Outputs (Option M10/12)	
X11	Analog/Encoder	**X23**	Bus (Option)	Connector type depends on the bus system!
X12	Inputs/Outputs	**S24**	Bus settings	
X13	Motor position feedback	**LED1**	Device status LEDs	
		LED2	HEDA LEDs	
		LED3	Bus LEDs	

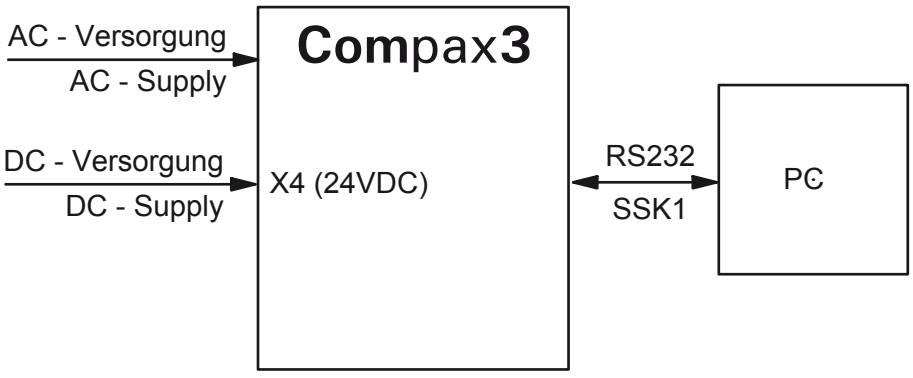
Note on Compax3H:

The **internal** device status LEDs are only connected to the **external** housing LEDs, if the RS232 jumper at X10 is fitted to the control and the upper dummy cover is fitted.

The RS232 programming interface under the upper dummy cover is only available if the X10 jumper at the controller is fitted.

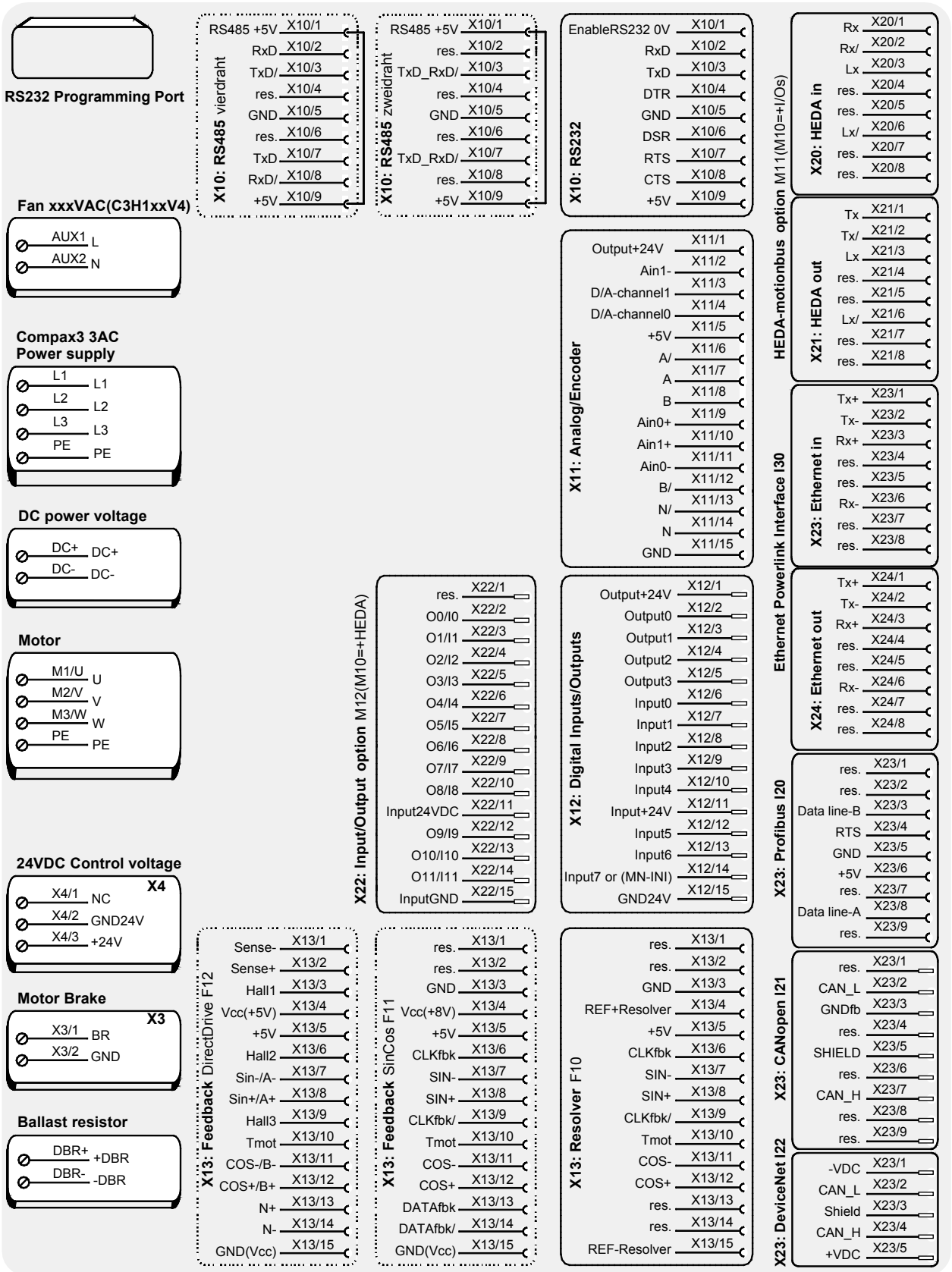
3.6.4. Plug and pin assignment C3H

Overview



Further information on the assignment of the plug mounted at the particular device can be found below!

In detail: The fitting of the different plugs depends on the extension level of Compax3. In part, the assignment depends on the Compax3 option implemented.



The RS232 programming interface under the upper dummy cover is only available if the X10 jumper at the controller is fitted.

Please note C3H1xxV4 uses a ventilator fan which must be externally supplied via separate connections. The ventilator fan is available in two versions for single phase feed: 220/240VAC; 110/120VAC

3.6.5. Motor / Motor brake C3H

Motor connection clamps - figure **(see on page 51)**

PIN	Designation	Motor cable lead designation*		
M1/U	U (motor)	U / L1 / C / L+	1	U1
M2/V	V (motor)	V / L2	2	U2
M3/W	W (motor)	W / L3 / D / L-	3	U3
PE	PE (motor)	YE / GN	YE / GN	YE / GN

* depending on the cable type

Compax3H motor cable

A motor output filter is required for motor cables >50m. Please contact us.

Shielding connection of the motor cable

The motor cable should be fully shielded and connected to the Compax3 housing. The shield of the motor cable must also be connected with the motor housing. The fixing (via plug or screw in the terminal box) depends on the motor type.

Attention - Please wire the motor holding brake!

Connect the brake only on motors which have a holding brake! Otherwise make no brake connections at all.

Requirements cables for motor holding brake

If a motor holding brake is present, **one cable** of the motor holding brake must be fed on the device side through the toroidal core ferrite provided as accessory ZBH0x/xx (63Ω @1MHz, di=5.1mm), in order to ensure error-free switching on and off of the motor holding brake.

Connection of motor brake X3 - figure **(see on page 53)**

PIN	Designation	Motor cable lead designation*		
1	BR	WH	4	Br1
2	GND	BK	5	Br2

Motor holding brake output

Motor holding brake output	Compax3
Voltage range	21 – 27VDC
Maximum output current (short circuit proof)	1.6A

3.6.6. Control voltage 24 VDC C3H

Connection of control voltage 24VDC figure **(see on page 53)**

Connector X4 Pin	Description	
1	NC	NC
2	GND24V	GND
3	+24 V	24 VDC (power supply)

Control voltage 24VDC Compax3S and Compax3H

Controller type	Compax3
Voltage range	21 - 27VDC
Current drain of the device	0.8 A
Total current drain	0.8 A + Total load of the digital outputs + current for the motor holding brake
Ripple	0.5Vpp
Requirement according to safe extra low voltage (SELV)	yes
Short-circuit proof	conditional (internally protected with 3.15AT)

3.6.7. Mains connection Compax3H

Device protection

Avoid permanent switching on and off so that the charging connection is not overloaded. Therefore wait at least 1 minute before switching on the device again.

Connection of mains voltage figure **(see on page 51)**

Mains connection Compax3HxxxV4 3*400VAC

Device type Compax3	H050V4	H090V4	H125V4	H155V4
Supply voltage	Three-phase 3*400VAC 350-528VAC / 50-60Hz			
Input current	66Arms	95Arms	143Arms	164Arms
Output current	50Arms	90Arms	125Arms	155Arms
Maximum fuse rating per device(=short circuit rating)	80A	100A	160A	200A
Branch circuit protection according to UL	JDDZ Class K5 or H JDRX Class H			

Mains connection Compax3HxxxV4 3*480VAC

Device type Compax3	H050V4	H090V4	H125V4	H155V4
Supply voltage	Three-phase 3*480VAC 350-528VAC / 50-60Hz			
Input current	54Arms	82Arms	118Arms	140Arms
Output current	43Arms	85Arms	110Arms	132Arms
Maximum fuse rating per device(=short circuit rating)	80A	100A	160A	200A
Branch circuit protection according to UL	JDDZ Class K5 or H JDRX Class H			

3.6.8. Braking resistor / supply voltage C3H

The energy generated during braking operation is absorbed by the Compax3 storage capacity.

If this capacity is too small, the braking energy must be drained via a braking resistor.

3.6.8.1 Connect braking resistor C3H

Connection of braking resistor - figure **(see on page 51)**

PIN	Designation
DBR+	+ Braking resistor
DBR-	- Braking resistor

Braking operation of Compax3HxxxV4

Controller type	H050V4	H090V4	H125V4	H155V4
Capacitance / storable energy 400V / 480V	2600 µF 602 / 419 Ws	3150 µF 729 / 507 Ws	5000 µF 1158 / 806 Ws	5000 µF 1158 / 806 Ws
Minimum braking- resistance	24 Ω	15 Ω	8 Ω	8 Ω
Maximum continuous current	11 A	17 A	31 A	31 A

Minimum line cross section: 2.5mm²

Maximum line length: 2m

Maximum output voltage: 830VDC

3.6.8.2 Power supply voltage DC C3H

Connection of power voltage DC -figure **(see on page 51)**

PIN	Description
DC+	+ DC high voltage supply
DC-	- DC high voltage supply

Warning!

Do not connect any braking resistor on DC+/DC- .

3.6.8.3 Connection of the power voltage of 2 C3H 3AC devices

In order to improve the conditions during brake operation, the DC power voltage of 2 servo axes may be connected.

The capacity as well as the storable energy are increased; furthermore the braking energy of one servo axis may be utilized by a second servo axis, depending on the application.

It is not permitted to connect the power voltage in order to use one brake circuit for two servo axes, as this function cannot be ensured reliably.

Note the following:

Caution! In case of non-compliance with the following instructions, the device may be destroyed!

- You can only connect two similar servo axes (same power supply; same rated currents)
- Connected servo axes must always be fed separately via the AC power supply.
- If the external pre-fuse of one of the servo axes takes action, the second servo axis must also be disconnected automatically.

Please connect as follows:

Servo axis 1 DC+ with servo axis 2 DC+

Servo axis 1 DC- with servo axis 2 DC-

- figure (see on page 51)

3.7 Communication interfaces

In this chapter you can read about:

3.7.1. RS232/RS485 interface (plug X10)

Interface selectable by contact functions assignment of X10/1:

X10/1=0V RS232

X10/1=5V RS485

PIN X10	RS232 (Sub D)
1	(Enable RS232) 0V
2	RxD
3	TxD
4	DTR
5	GND
6	DSR
7	RTS
8	CTS
9	+5V

RS485 2-wire

PIN X10	RS485 2-wire Sub D Pin 1 and 9 externally jumpered
1	Enable RS485 (+5V)
2	res.
3	TxD_RxD/
4	res.
5	GND
6	res.
7	TxD_RxD
8	res.
9	+5V

RS485 4-wire

PIN X10	RS485 4-wire Sub D Pin 1 and 9 externally jumpered
1	Enable RS485 (+5V)
2	RxD
3	TxD/
4	res.
5	GND
6	res.
7	TxD
8	RxD/
9	+5V

USB - RS232/RS485 converter

The following USB - RS232 converters were tested:

- ATEN UC 232A
- USB GMUS-03 (available under several company names)
- USB / RS485: **Moxa Uport 1130 http://www.moxa.com/product/UPort_1130.htm**
- Ethernet/RS232/RS485: **NetCom 113 http://www.vscom.de/666.htm**

3.7.2. Communication Compax3M

In this chapter you can read about:

3.7.2.1 PC - PSUP (Mains module)

Connector X3

USB2.0

Connect your PC to the USB sleeve X3 of the mains module via an USB cable (SSK33/03).

3.7.2.2 Communication in the axis combination (connector X30, X31)

The communication in the axis combination is implemented via a SSK28 cable and double RJ45 sleeves on the device top.

Beginning with the PSUP (mains module) the connection is always made from X30 to X31 of the next device. On the first device (X31) and the last device (X30) in the multi-axis combination, a bus termination plug (BUS07/01) is required.

Orientation to the back side

Orientation to the front plate

	PSUP (Mains module)
X30	out
X31	in
res.	factory use
	Compax3M (axis)
X30	out
X31	in
res.	factory use

3.7.2.3 Adjusting the basic address

On the mains module, the basic address of the device combination is set in steps of 16 with the aid of the first three dip switches.

The mains module contains the set basic address while the axes placed at the right in the combination contain the following addresses.

Switch S1

Address setting

Basic addresses

Switch	Value upon ON
1	16
2	32
3	64

Settings:

left: OFF

right: ON

Settable value range: 0, 16, 32, 48, 64, 80, 96, 112

Address of the 1st axis = basic address+1

The addresses of the axis controllers are newly assigned after PowerOn.

Example:

Basic address = 48; mains module with 6 axis controllers in the combination

1. Axis right: Address = 49

2. Axis right: Address = 50

...

6. Axis right: Address = 54

3.7.2.4 Setting the axis function

Switch S10

Function settings for T30 and T40

The value of switch S10 on the axis controller is stored in object O110.1 C3plus.Switch_DeviceFunction and can be evaluated with the aid of a program.

This helps realize a more simple function selection.

3.8 Signal interfaces

In this chapter you can read about:

3.8.1. Resolver / feedback (plug X13)

PIN X13	Feedback /X13 High Density /Sub D (depending on the Feedback module)		
	Resolver (F10)	**SinCos (F11)**	**EnDat 2.1 (F12)**
1	factory use	factory use	Sense -*
2	factory use	factory use	Sense +*
3	GND	GND	factory use
4	REF-Resolver+	Vcc (+8V)	Vcc (+5V) * max. 350mA load
5	+5V (for temperature sensor)		
6	factory use	factory use	CLKfbk
7	SIN-	SIN-	SIN- / A- (Encoder)
8	SIN+	SIN+	SIN+ / A+ (Encoder)
9	factory use	factory use	CLKfbk/
10	Tmot*	Tmot*	Tmot*
11	COS-	COS-	COS- / B- (Encoder)
12	COS+	COS+	COS+ / B+ (Encoder)
13	factory use	DATAfbk	DATAfbk
14	factory use	DATAfbk/	DATAfbk/
15	REF-Resolver-	GND (Vcc)	GND (Vcc)

*X13 Pin10 Tmot may not be connected at the same time as X15 (on Compaxx3M).

Resolver cables (see on page 182) can be found in the accessories chapter of the device description.

SinCos© **cables** (see on page 183) can be found in the accessories chapter of the device description.

The **EnDat cable GBK38** (see on page 184) can be found in the accessories chapter of the device description.

PIN X13	Feedback /X13 High Density /Sub D
	Direct drives (F12)
1	Sense -*
2	Sense +*
3	Hall1 (digital)
4	Vcc (+5V)* max. 350 mA load
5	+5 V (for temperature sensors und Hallsensoren)
6	Hall2 (digital)
7	SIN-, A- (Encoder) or analog Hall sensor
8	SIN+, A+, (Encoder) or analog Hall sensor
9	Hall3 (digital)
10	Tmot*
11	COS-, B- (Encoder) or analog Hall sensor
12	COS+, B+ (Encoder) or analog Hall sensor
13	N+
14	N-
15	GND (Vcc)

*X13 Pin10 Tmot may not be connected at the same time as X15 (on Compaxx3M).

Note on F12:

*+5V (Pin 4) is measured and controlled directly at the end of the line via Sense+ and Sense-.

Maximum cable length: 100m

Caution!
- Pin 4 and Pin 5 must under no circumstances be connected!
- Plug in or pull out feedback connector only in switched off state (24VDC switched off).

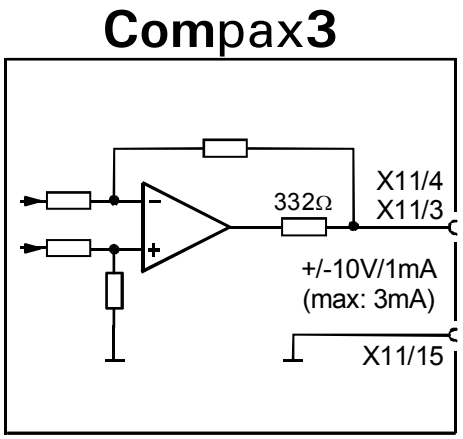
3.8.2. Analogue / encoder (plug X11)

PIN X11	Reference High Density Sub D	
1	+24V (output for encoder) max. 70mA	
2	factory use	
3	D/A monitor channel 1 (±10V, 8-bit resolution)	
4	D/A monitor channel 0 (±10V, 8-bit resolution)	
5	+5 V (output for encoder) max. 150 mA	
6	- Input: steps RS422 (5V - level)	**A/** (Encoder- input / -simulation)
7	+ Input: steps RS422 (5V - level)	**A** (Encoder- input / -simulation)
8	+ Input: direction RS422 (5V - level)	**B** (Encoder- input / -simulation)
9	Ain0 +: analog setpoint input + (14Bit; +/-10V)	
10	factory use	
11	Ain0 -; analog setpoint input - (14Bit) +/-10V)	
12	- Input: direction RS422 (5V - level)	**B/** (Encoder- input / -simulation)
13	factory use	**N/** (Encoder simulation)
14	factory use	**N** (Encoder simulation)
15	GND	

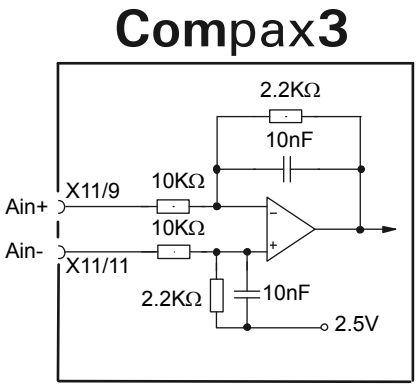
Encoder simulation exists with an analogue input command interface of ±10V.

3.8.2.1 Wiring of analog interfaces

Output



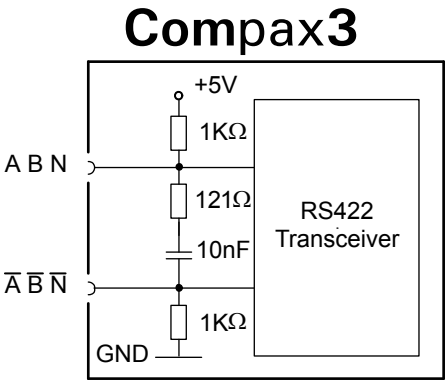
Input



Perform an **offset adjustment** (see on page 142)!

Structure image of the internal signal processing of the analog inputs

3.8.2.2 Connections of the encoder interface



The input connection is available in triple (for A & /A, B & /B, N & /N)

3.8.3. Digital inputs/outputs (plug X12)

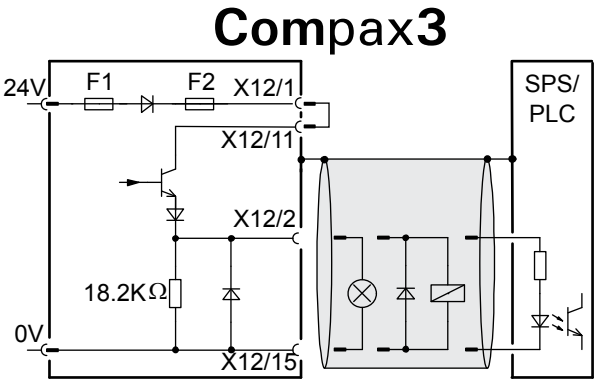
Pin X12/	Input/output	I/O /X12 High density/Sub D	
1	Output	+24 V DC output (max. 400mA)	
2	O0 = "1"	no error (max. 100mA)	
3	O1 = "1"	Actual value in setpoint window (max. 100mA)	
4	O2 = "1"	Power stage without current (max.) 100 mA)	
5	O3 = "1"	Motor energized with a setpoint of 0 (max. 100 mA)	
6	I0 = "1"	**Energize motor** (see on page 65) & **deactivate motor holding brake** (see on page 143) Motor stationary in controlled state with setpoint = 0	
7	I1 = "1"	Enable Setpoint value	
8	I2 = "1"	Quit (positive edge)	
9	I3 = "1"	Open brake	
10	I4 = "1"	Keep position / speed 0 (configurable) (only in the **"±10V analog current" setpoint"** (see on page 106)mode Keep position / speed 0 (configurable)(only in the **"±10V analog velocity/speed setpoint"** (see on page 103)mode"	
11	I	24V input for the digital outputs Pins 2 to 5	
12	-	n.c.	Zero pulse
13	I	Step input (24V level)	A (24V level)
14	I	Direction input (24V level)	B (24V level)
15	Output	GND24V	

All inputs and outputs have 24V level.

Maximum capacitive loading of the outputs: 50nF (max. 4 Compax3 inputs)

3.8.3.1 Connection of the digital Outputs/Inputs

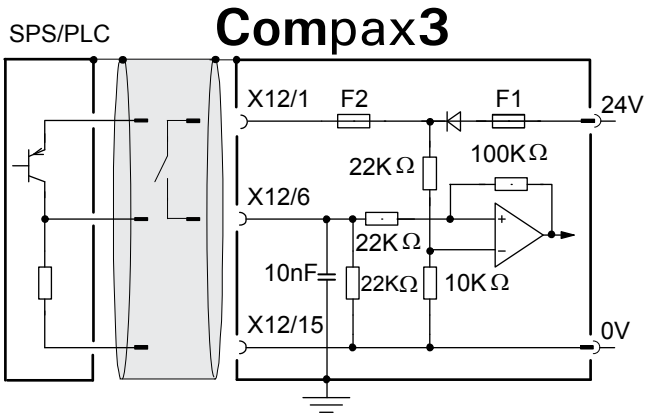
Wiring of digital outputs



The circuit example is valid for all digital outputs!

The outputs are short circuit proof; a short circuit generates an error.

Status of digital inputs



The circuit example is valid for all digital inputs!

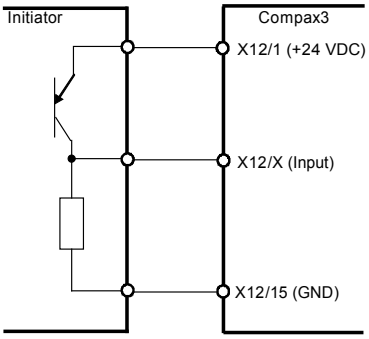
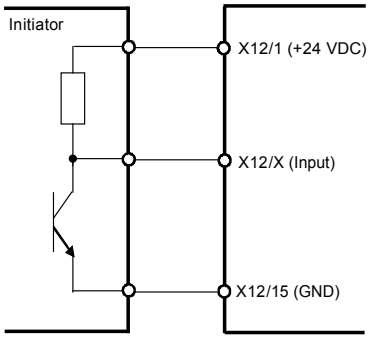
Signal level:

- > 9.15V = "1" (38.2% of the control voltage applied)
- < 8.05V = "0" (33.5% of the control voltage applied)

F1: Delayed action fuse

F2: Quick action electronic fuse; can be reset by switching the 24 VDC supply off and on again.

3.8.3.2 Logic proximity switch types

Type	1	2	3	4
Transistor switch	PNP	PNP	NPN	NPN
Logic	(N.O.) “active high"	(N.C) “active low"	(N.O.) “active low"	(N.C) “active high"
Description of logic	Compax3 sees a logical “1” upon activation	Compax3 sees a logical “0” upon activation"	Compax3 sees a logical “0” upon activation"	Compax3 sees a logical “1” upon activation
Fail safe logic	no	yes	Only conditional [1]	no
Instruction for pull up resistor in the initiator	-	-	Rmin=3k3 Rmax=10k [2]	Rmin=3k3 Rmax=10k [2]
Connections				

[1] When the connection between transistor emitter of the initiator and X12/15 (GND24V of the Compax3)is lost, it can not be guaranteed, that the Compax3 detects a logical „0".

[2] The INSOR NPN types INHE5212 and INHE5213 manufactured by Schönbuch Electronic do correspond to this specification.

3.8.3.3 Energize motor X12/6="24VDC"

This input effects the state of the power stage and therefore that of the motor:

X12/6="0V":

De-energize motor

With a rotating motor, this will be decelerated to a speed of 0 via a settable deceleration ramp.

Thereafter current switch-off and **activation of the motor holding brake** (see on page 143).

X12/6="24 V DC":

Energize motor

Motor holding brake is deactivated (see on page 143), current is applied to the motor and the motor is accelerated to the commanded speed setpoint via an adjustable accelerating ramp.

Prerequisite: X12/7 "Enable setpoint" = 24VDC

In response to X12/7 "Enable setpoint" = 0VDC the control loop adjusts to setpoint = 0.

Setting values for "Energize motor"

See also **Setpoint control** (see on page 107).

3.8.3.4 Command value release X12/7="24VDC"

This input effects the state of the power stage and therefore that of the motor:

X12/7="0V":	**Set motor to command value=0** With a rotating motor, this will be decelerated to a speed of 0 via a settable deceleration ramp.
X12/7="24 V DC":	**Current setpoint value active** The motor will be accelerated via a settable acceleration ramp to the predefined setpoint value. Prerequisite: X12/6 "Energize the motor" = 24VDC

Setting values for "Setpoint value release":

See also **Setpoint control** (see on page 107).

3.9 Installation and dimensions Compax3

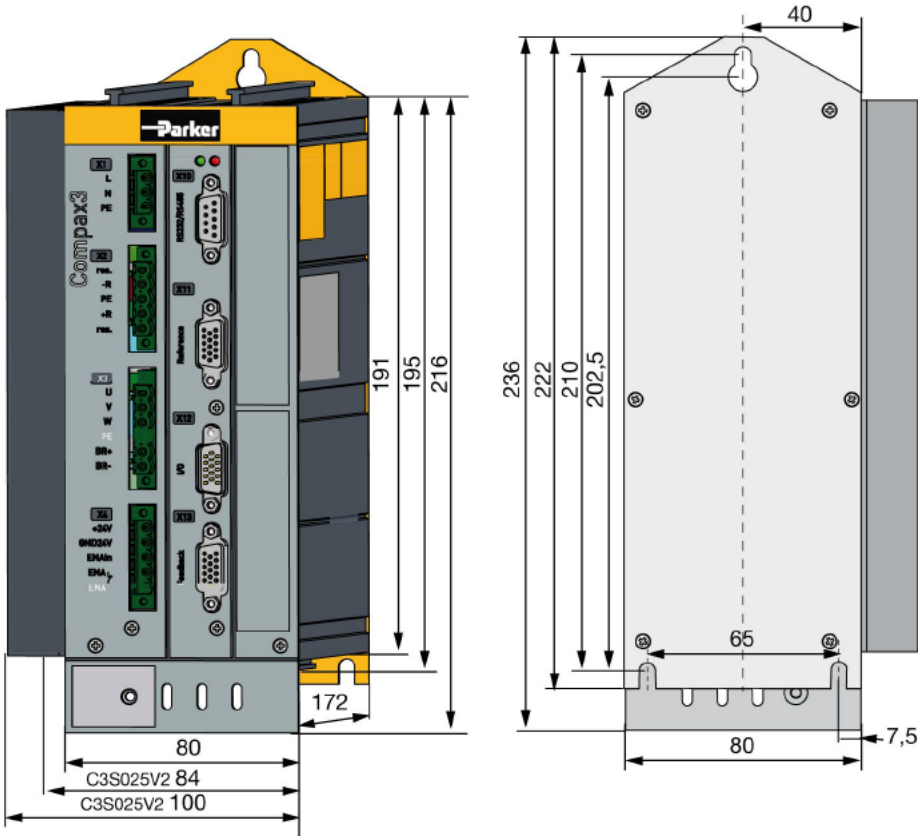
In this chapter you can read about:

3.9.1. Mounting and dimensions Compax3S

3.9.1.1 Mounting and dimensions Compax3S0xxV2

Mounting:

3 socket head screws M5



Stated in mm

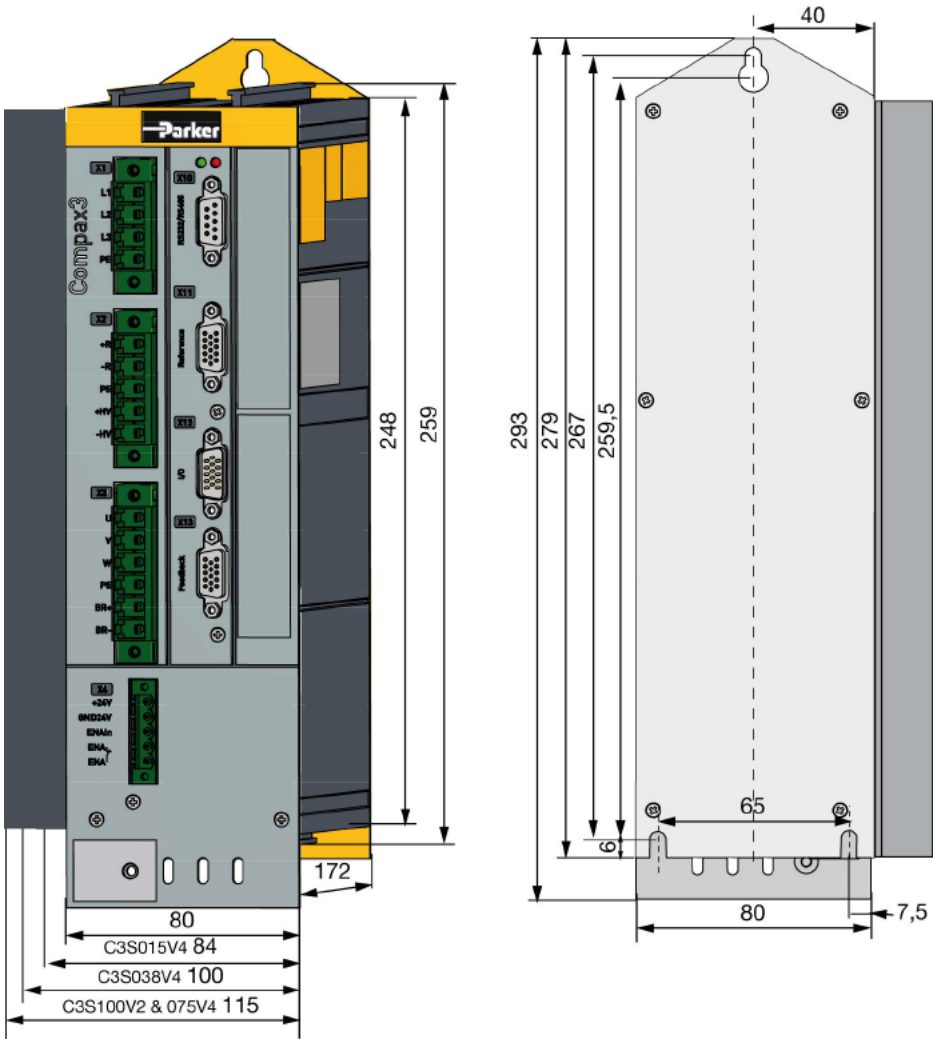
Please respect an appropriate mounting gap in order to ensure sufficient convection:

- At the side: 15mm
- At the top and below: at least 100mm

3.9.1.2 Mounting and dimensions Compax3S100V2 and S0xxV4

Mounting:

3 socket head screws M5



Stated in mm

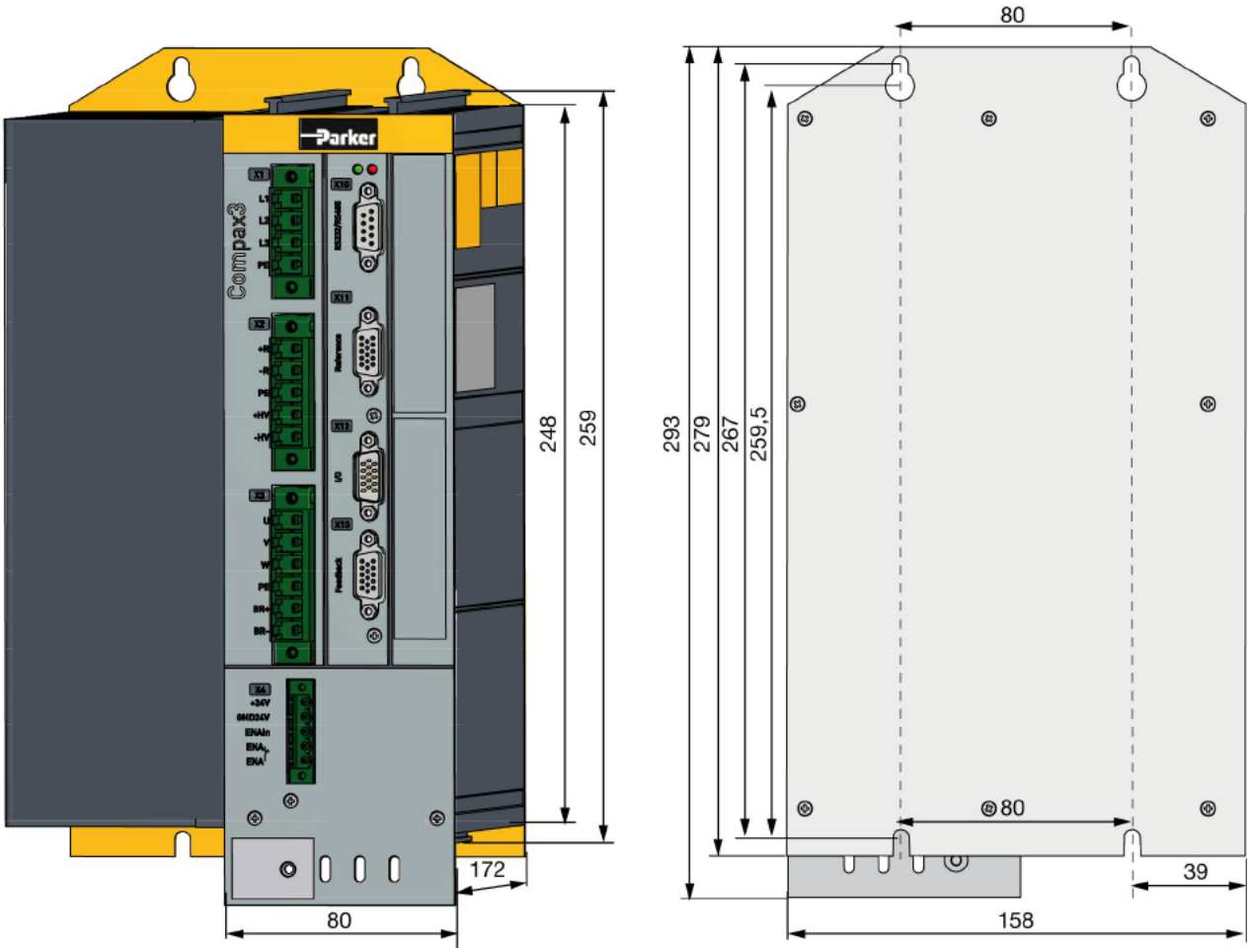
Please respect an appropriate mounting gap in order to ensure sufficient convection:

- At the side: 15mm
- At the top and below: at least 100mm

3.9.1.3 Mounting and dimensions Compax3S150V2 and S150V4

Mounting:

4 socket head screws M5



Stated in mm

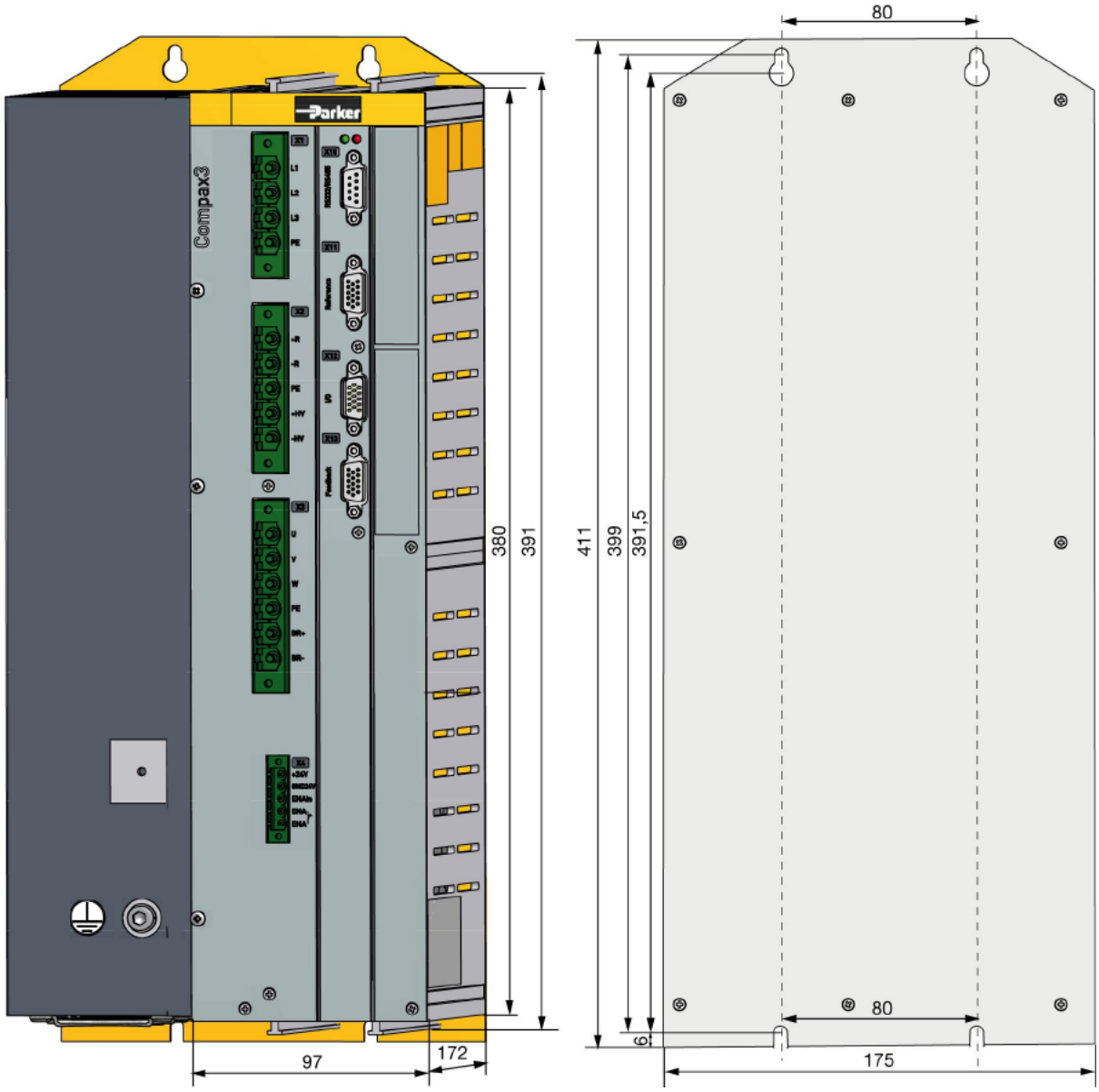
Please respect an appropriate mounting gap in order to ensure sufficient convection:

- At the side: 15mm
- At the top and below: at least 100mm

3.9.1.4 Mounting and dimensions Compax3S300V4

Mounting:

4 socket head screws M5



Stated in mm

Please respect an appropriate mounting gap in order to ensure sufficient convection:

- At the side: 15mm
- At the top and below: at least 100mm

Compax3S300V4 is force-ventilated via a fan integrated into the heat dissipator!

3.9.2. Mounting and dimensions PSUP/C3M

Ventilation: During operation, the device radiates heat (power loss). Please provide for a sufficient mounting distance below and above the device in order to ensure free circulation of the cooling air. Please do also respect the recommended distances of other devices. Make sure that the mounting plate is not exhibited to other temperature influences than that of the devices mounted on this very plate. The devices must be mounted vertically on a level surface. Make sure that all devices are sufficiently fixed.

3.9.2.1 Mounting and dimensions PSUP10/C3M050D6, C3M100D6, C3M150D6

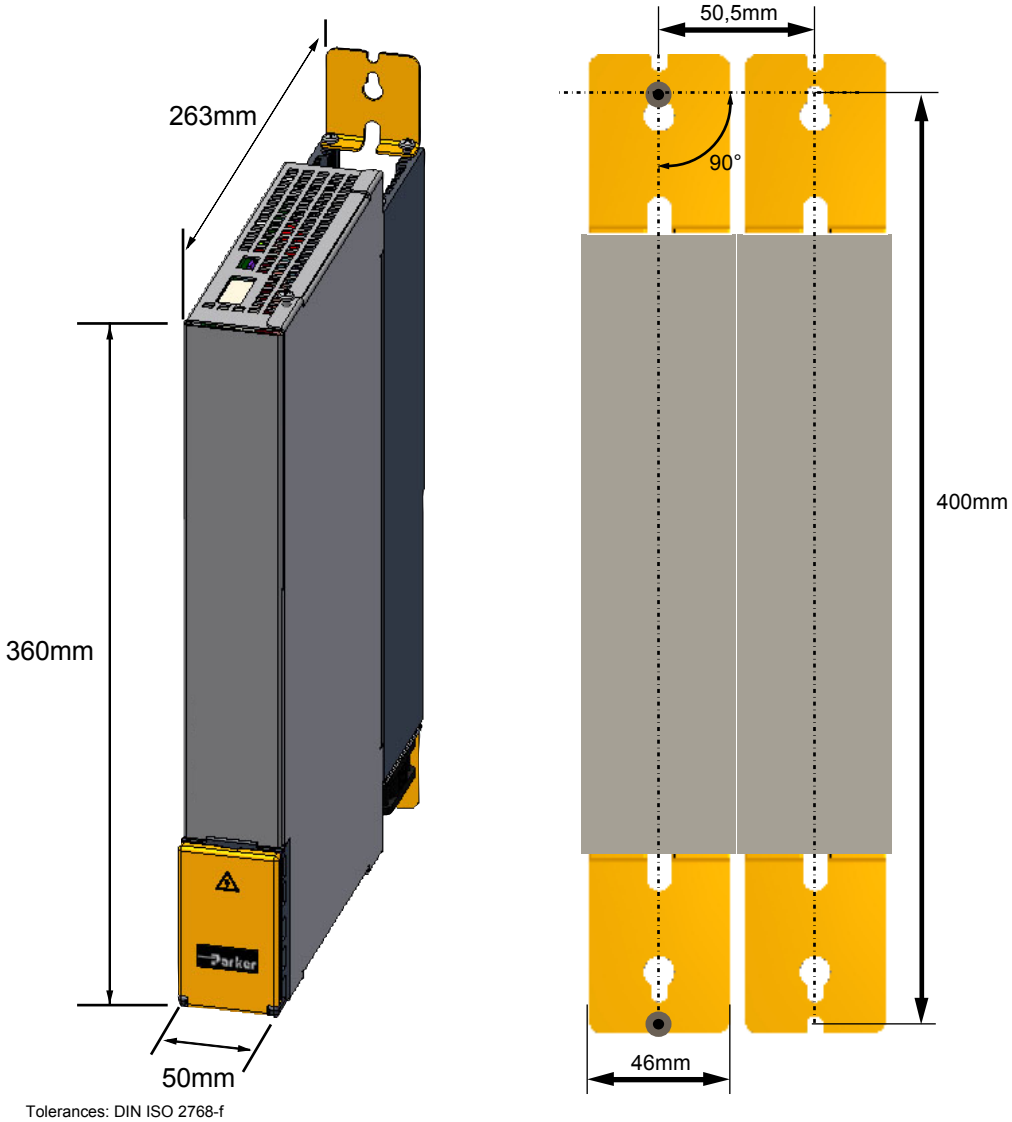
The devices are force-ventilated via a ventilator fan fixed to the lower part of the heat dissipator!

Mounting spacing: At the top and below: at least 100mm

Information on PSUP10D6/C3M050D6, C3M100D6, C3M150D6

Mounting:

2 socket head screws M5



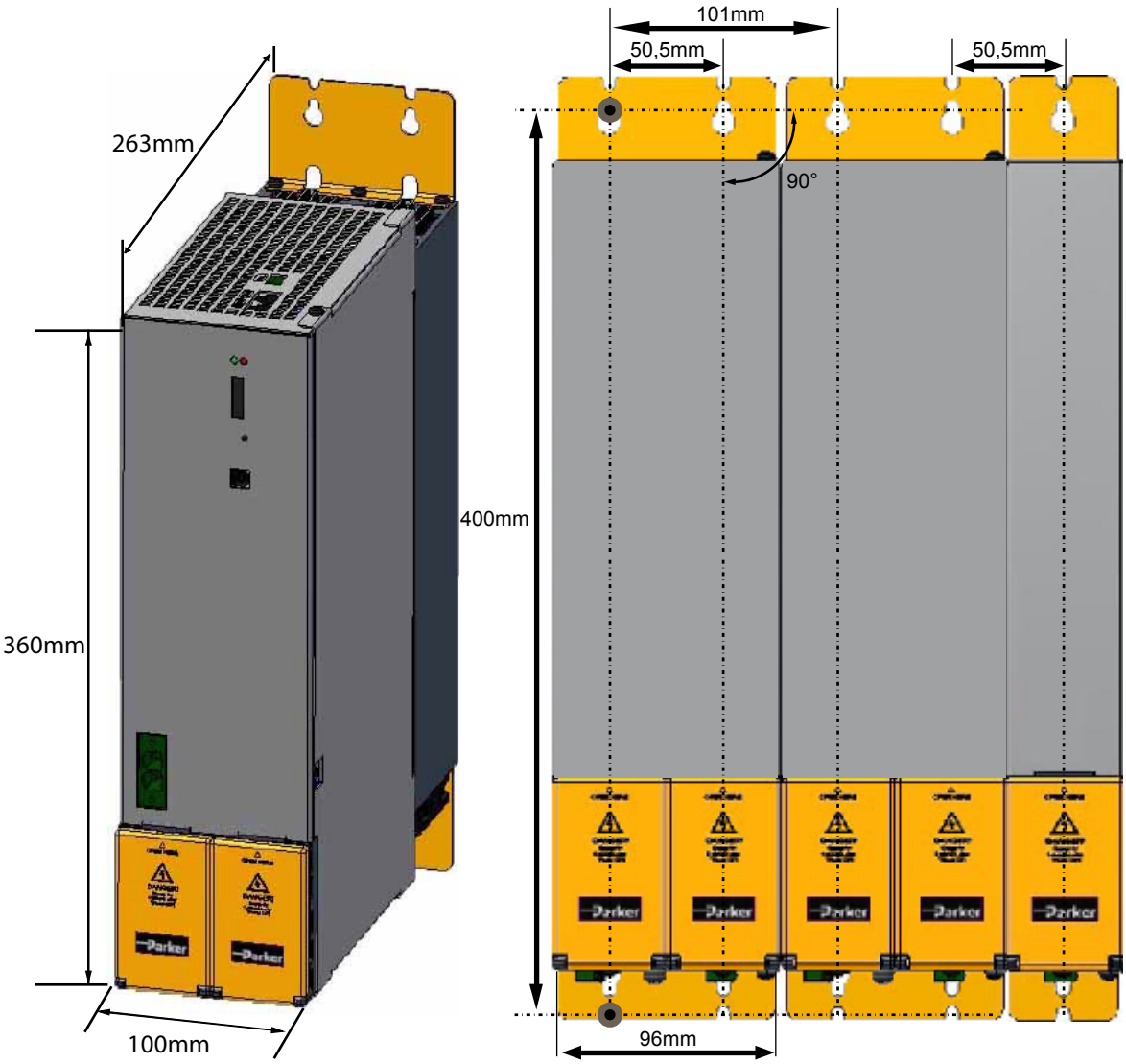
Tolerances: DIN ISO 2768-f

3.9.2.2 Mounting and dimensions PSUP20/PSUP30/C3M300D6

Information on PSUP20/PSUP30/C3M300D6

Mounting:

4 socket head screws M5

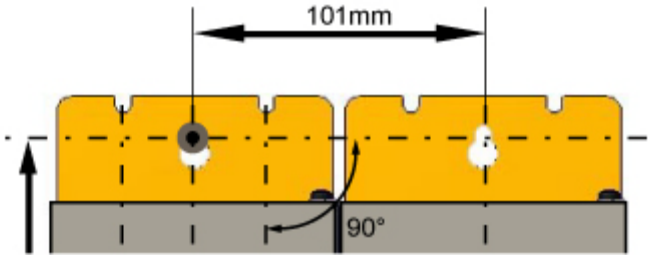


Tolerances: DIN ISO 2768-f

3.9.2.3 With upper mounting, the housing design may be different

Mounting:

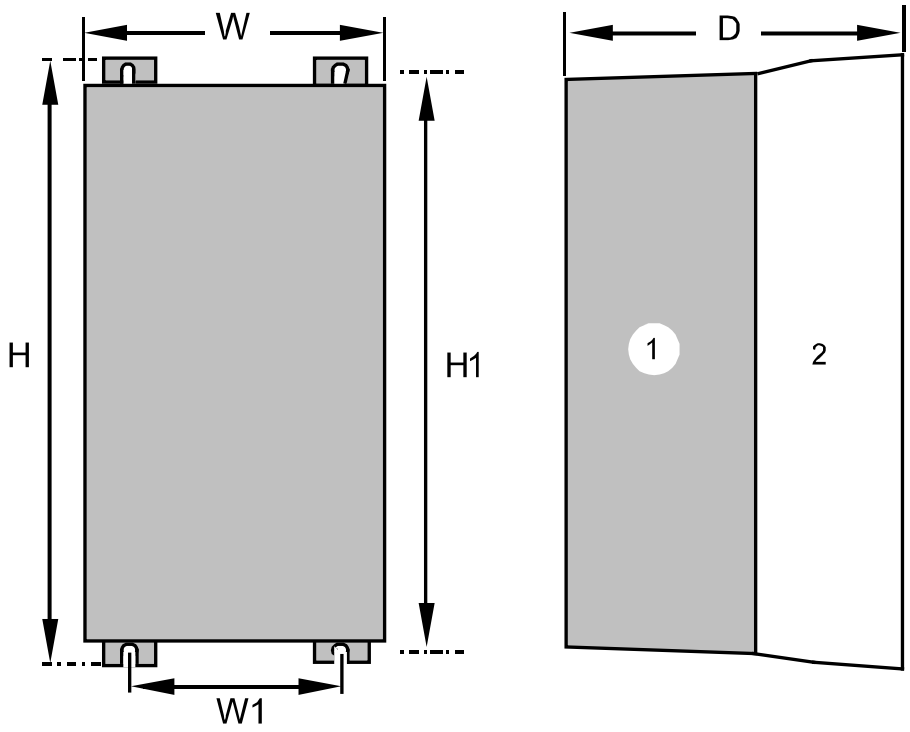
3 socket head screws M5



3.9.3. Mounting and dimensions C3H

The devices must be mounted vertically on a level surface in the control cabinet.

Dimensions:



(1): Electronics
(2): Head dissipator

	H	H1	D	W	W1
C3H050V4	453mm	440mm	245mm	252mm	150mm
C3H090V4	668.6mm	630mm	312mm	257mm	150mm
C3H1xxV4	720mm	700mm	355mm	257mm	150mm

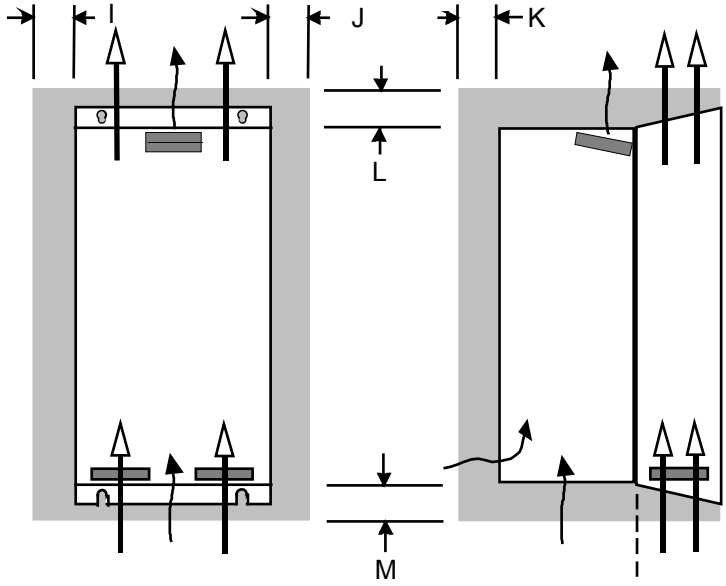
Mounting:4 screws M6

Ventilation:

During operation, the device radiates heat (power loss). Please provide for a sufficient mounting distance below and above the device in order to ensure free circulation of the cooling air. Please do also respect the recommended distances of other devices. Make sure that the mounting plate is not exhibited to other temperature influences than that of the devices mounted on this very plate.

If two or more devices are combined, the mounting distances are added.

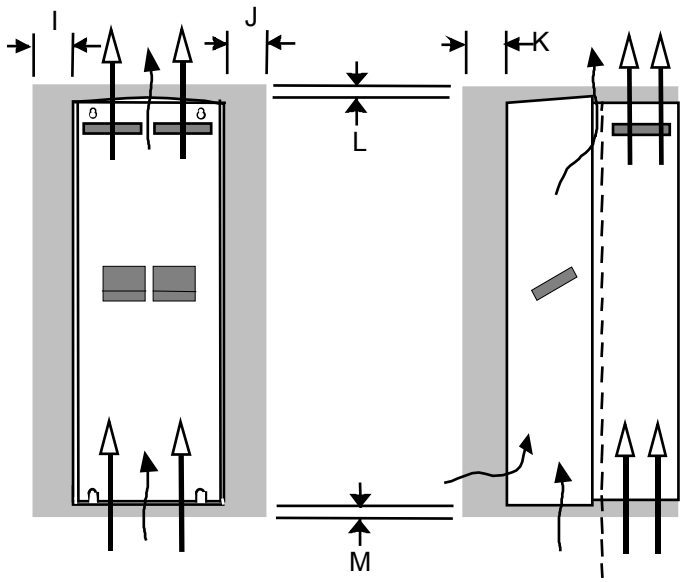
3.9.3.1 Mounting distances, air currents Compax3H050V4



in mm

	I	J	K	L	M
C3H050V4	15	5	25	70	70

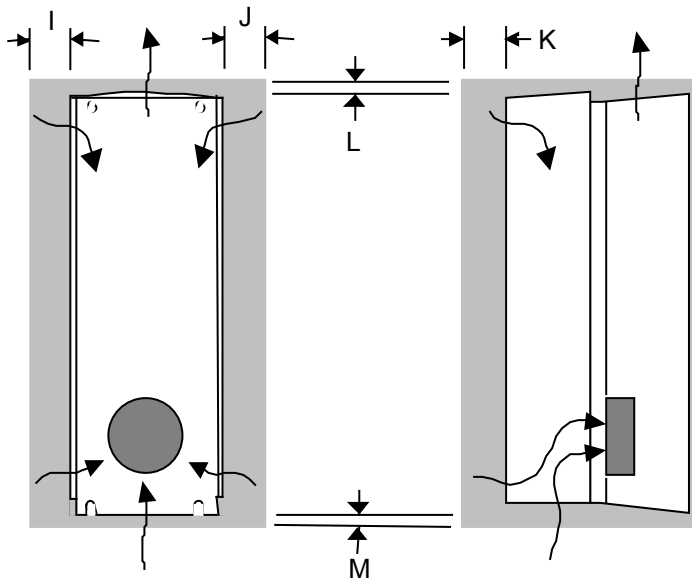
3.9.3.2 Mounting distances, air currents Compax3H090V4



in mm

	I	J	K	L	M
C3H090V4	0	0	25	70	70

3.9.3.3 Mounting distances, air currents Compax3H1xxV4



in mm

	I	J	K	L	M
C3H1xxV4	0	0	25	70	70

3.10 Safety function - STO (=safe torque off)

In this chapter you can read about:

3.10.1. General Description

In this chapter you can read about:

The present documentation assumes a basic knowledge of our drive controllers as well as an understanding of safety-oriented machine design. References to standards and other regulations are only rudimentarily expressed.

For complementary information, we recommend the respective technical literature.

3.10.1.1 Important terms and explanations

Term	Explanation
Safety category 3 in accordance with EN ISO 13849-1	Definition according to standard: Circuit with safety function against individual errors. Some, but not all errors are detected. An accumulation of errors may lead to a loss of the safety function. The remaining risk is accepted. The determination of the safety category required for an application (risk analysis) lies within the responsibility of the machine manufacturer. It can take place according to the method described in EN ISO 13849-1, appendix A.
"Safe torque off" **or abbreviated:** **STO=Safe torque off**	With the "safe torque off", the energy supply of the drive is safely interrupted according to EN 1037, paragraph 4.1. The drive is not to be able to produce a torque and thus dangerous movements (see EN 1037, paragraph 5.3.1.3). The standstill position must not be monitored. If an external force effect, e.g. a drop of hanging loads, is possible with the "safe torque off", additional measures to safely prevent those must be provided (e.g. additional mechanical brakes). The following measures are appropriate for a "safe torque off": Contactor between mains and drive system (mains contactor) Contactor between power section and motor (motor contactor) Safe blocking of the power semiconductor control (start inhibitor)
Start inhibitor	Safe blocking of the power semiconductor control. With the aid of this function, you can obtain a "safe torque off".

Stop categories according to EN60204-1 (9.2.2)

Stop category	Safety function	Requirement	System behavior	Remark
0	Safe torque off (STO)	Stopping by immediately switching off the energy supply of the machine drive elements	Uncontrolled stop	Uncontrolled stop is the stopping of a machine movement by switching off the energy of the machine drive elements. Available brakes and/or other mechanical stopping components are applied.
1	Safe stop 1 (SS1)	Stop where the energy of the machine drive elements is maintained in order to reach a stop. The energy supply is only interrupted, if the standstill is attained.	Controlled stop	Controlled stop is the stopping of a machine movement by for instance resetting the electrical command signal to zero, as soon as the stop signal has been detected by the controller, the electrical energy for the machine drive elements remains however during the stopping procedure.
2	Safe stop 2 (SS2)	Stop where the energy to the machine drive elements is maintained.	Controlled stop	This category is not covered.

3.10.1.2 Intended use

The Compax3 drive controller supports the "safe torque off" (STO) safety function, with protection against unexpected startup according to the requirements of EN ISO 13849-1, category 3 to PLe and EN 1037.

Together with the external safety control device, the "safe stop 1" (SS1) safety function according to the requirements of EN ISO 13849-1 category 3 can be used. As the function is however realized with the aid of an individually settable time delay on the safety switching device, you must take into account that, due to an error in the drive system during the active braking phase, the axis trundles to a stop unguided or may even accelerate actively in the worst case until the expiry of the preset switch-off time.

According to a risk evaluation which must be carried out according to the machine standard 98/37/EG and 2006/42/EG or EN ISO 12100, EN ISO 13849-1 and EN ISO 14121-1, the machine manufacturer must project the safety system for the entire machine including all integrated components. This does also include the electrical drives.

Qualified personnel

Projecting, installation and setup require a detailed understanding of this description.

Standards and accident prevention regulation associated with the application must be known and respected as well as risks, protective and emergency measures.

3.10.1.3 Advantages of using the "safe torque off" safety function.

Safety category 3 in accordance with EN ISO 13849-1

Requirements performance feature	Use of the safe torque off function	Conventional solution: Use of external switching elements
Reduced switching overhead	Simple wiring, certified application examples Grouping of drive controllers on a mains contactor is possible.	Two safety-oriented power contactors in series connection are required.
Use in the production process High operating cycles, high reliability, low wear	Extremely high operating cycles thanks to almost wear-free technology (low-voltage relay and electronic switch). The "safe torque off" status is attained due to the use of wear-free electronic switches (IGBTs).	This performance feature cannot be reached with conventional technology.
Use in the production process High reaction speed, fast restart	Drive controller remains performance- and control-oriented in connected state. No significant waiting times due to restart.	When using power contactors in the supply, a long waiting time for the energy discharge of the DC link circuit is required. When using two power contactors on the motor side, the reaction times may increase, you must however take into consideration other disadvantages: a) Securing that switching takes only place in powerless state (Direct current! Constant electric arcs must be prevented). b) Increased overhead for EMC conform wiring.
Emergency-stop function	According to the German version of the standard: Permitted without control of mechanical power switching elements 1)	Switch-off via mechanical switching elements is required

1) According to the preface of the German version of the EN 60204-1/11.98, electronic equipment for emergency-stop devices are also permitted, if they comply with the safety categories as described in EN ISO 13849-1.

3.10.1.4 Devices with the STO (=safe torque off) safety function

Safety function - STO (=safe torque off:

Compax3 technology function

- I10T10, I11T11, I12T11
- I11T30, I20T30, I21T30, I22T30, I30T30, I31T30, I32T30, I11T40, I20T40, I21T40, I22T40, I30T40, I31T40, I32T40
- I20T11, I21T11, I22T11, I30T11, I31T11, I32T11
- C10T11, C10T30, C10T40, C13T11, C13T30, C13T40, C20T11, C20T30, C20T40

with the device power / series

S025V2, S063V2, S100V2, S150V2, S015V4, S038V4, S075V4, S150V4, S300V4

M050D6, M100D6, M150D6, M300D6,

and is only valid with the stated conditions of utilization.

3.10.2. STO (= safe torque off) with Compax3S

In this chapter you can read about:

3.10.2.1 STO Principle (= Safe Torque Off) with Compax3S

To ensure safe protection against a motor starting up unexpectedly, the flow of current to the motor and thus to the power output stage must be prevented.

This is accomplished for Compax3S with two measures independent of each other (Channel 1 and 2), without disconnecting the drive from the power supply:

Channel 1:

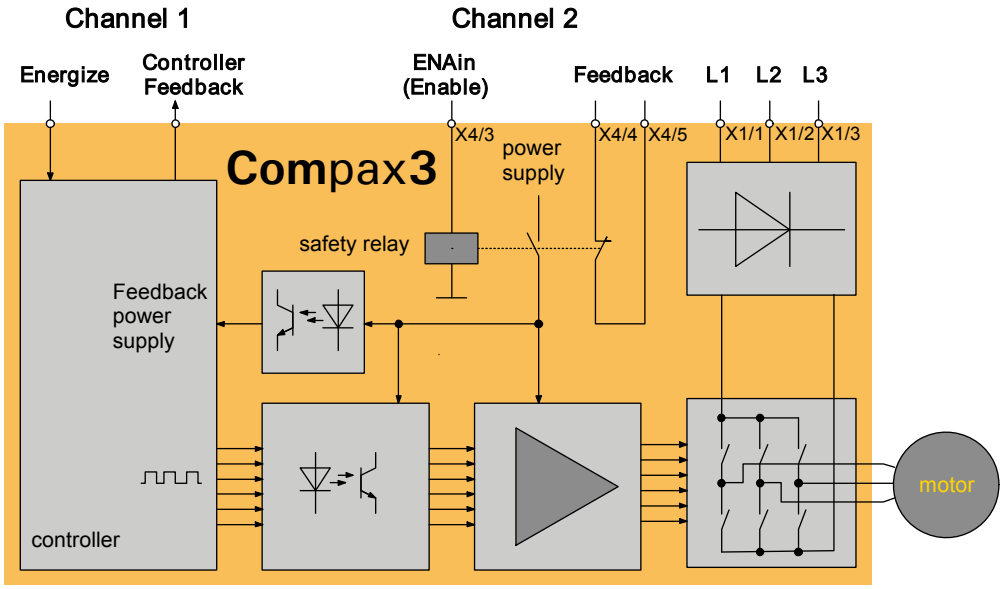
Activation of the power output stage can be disabled in the Compax3 controller by means of a digital input or with a fieldbus interface (depending on the Compax3 device type) (deactivation of the energize input).

Channel 2:

The power supply for optocouplers and drivers of power output stage signals is disconnected by a safety relay activated by the enable input "ENAin"(X4/3) and equipped with force-directed contacts. This prevents control signals from being transferred to the power output stage.

The STO (= Safe Torque Off) safety function in accordance with EN ISO 13849-1: 2008 PLd or PLe, Kat.3 is only possible when using both channels via an external safety switching device
Please note the application examples!

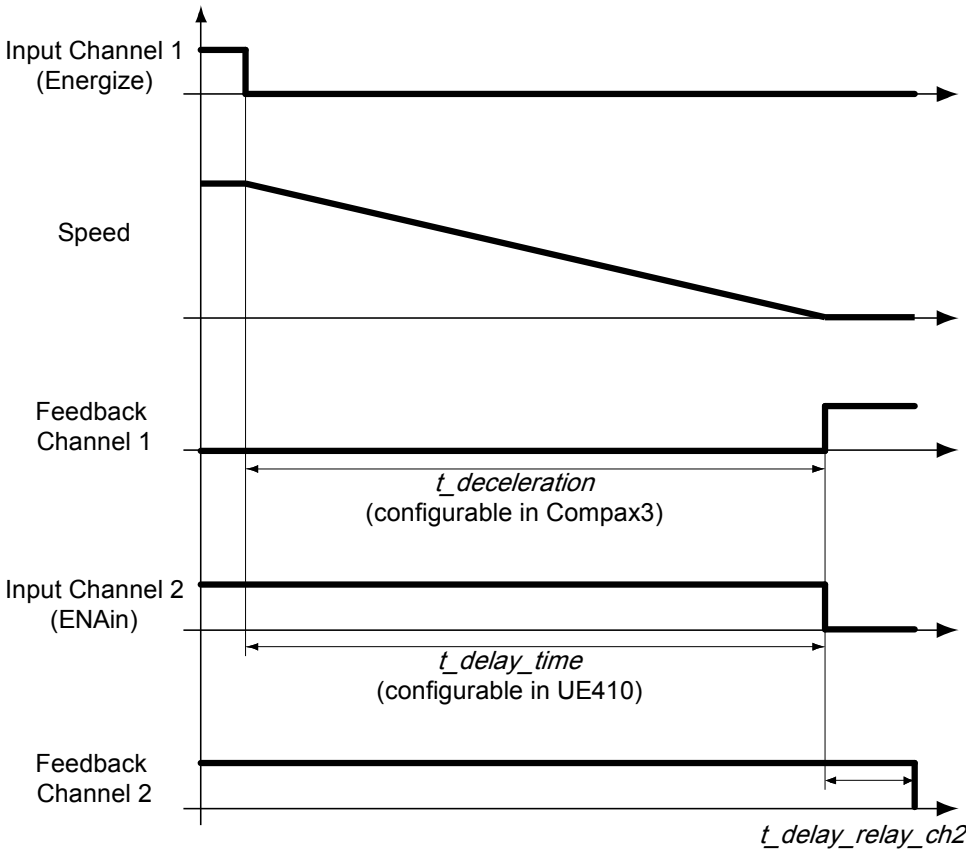
Circuit diagram illustrating working principle:



Notes

- In normal operation of Compax3, 24VDC of power is supplied to the "Enable" input (X4/3). The control of the drive takes then place via the digital inputs/outputs or via the fieldbus.

STO delay times



The deceleration time *t_deceleration* depends on the configuration of the Compax3. It must be configured so that oscillation free bringing to standstill is possible, depending on the mechanical load. The delay time *t_delay_time* must be set in the safety control device UE410 so that *t_delay_time* > *t_deceleration*.

Only after the elapsing of the relay delay *t_delay_relay_ch2*, the STO function is completely activated. The relay delay time *t_deay_relay_ch2* is 15 ms.

3.10.2.2 Conditions of utilization STO (=safe torque off) Safety function

- STO can only be implemented in Compax3 with a corresponding safety switching device considering the application examples.
- Safety functions must be tested 100%.
- The Compax3S and the safety switching device used must be mounted in a protected way (IP54 mounting cabinet).
- Only qualified staff members are permitted to install the STO (=safe torque off) function and place it in service.
- For all applications in which the first channel of the “Safe torque off” is implemented by means of a PLC, care must be taken that the part of the program that is responsible for current flowing to or not flowing to the drive is programmed with the greatest possible care. The Safe Torque off application example of Compax3 with fieldbus should be considered.
  The designer and operator responsible for the system and machine must refer programmers who are involved to these safety-related points.
- Terminal X4/2 (GND 24 V and at the same time the reference point for the safety relay bobbin) must be connected with the PE protective lead. This is the only way to ensure protection against incorrect operation through earth faults (EN60204-1 Section 9.4.3)!
- All conditions necessary for CE-conform operation must be observed.
- When using an external safety switching device with adjustable delay time, (as illustrated in the STO application example), it must be ensured that the delay time cannot be adjusted by persons not authorized to do so (for example by applying a lead seal). With the UE410-MU3T5 safety switching device, this is not necessary, if the anti manipulation measures are respected.
- The adjustable delay time on the safety switching device must be set to a value greater than the duration of the braking ramp controlled by the Compax3 with maximum load and maximum speed.
  If the setting range for the specified Emergency power-off module is not sufficient, the Emergency power-off module must be replaced by another equivalent module.
- All safety-related external leads (for example the control lead for the safety relay and feedback contact) must absolutely be laid so they are protected, for example in a cable duct. Short circuits and crossed wires must be reliably excluded!
- If there are external forces operating on the drive axes, additional measures are required (for example additional brakes). Please note in particular the effects of gravity on suspended loads!

3.10.2.3 Notes on the STO function

- It should be noted in connection with the STO (= safe torque off) application example illustrated here that after the Emergency stop switch has been activated, no galvanic isolation in accordance with EN 60204-1 Section 5.5 is guaranteed. This means that the entire system must be disconnected from the mains power supply with an additional main switch or mains power contactor for repair jobs. Please note in this regard that even after the power is disconnected, dangerous electrical voltages may still be present in the Compax3 drive for about 10 minutes.
- During the active braking phase of Stop category 1 (controlled bringing to a stop with safely monitored delay time according to EN60204-1) or safe stop 1, faulty function must be expected. If an error in the drive system or mains failure occurs during the active braking phase, the axis may trundle to a stop unguided or might even actively accelerate until the expiry of the defined switch-off time.
- Please note that the control of the drive via Energize (Energize input or fieldbus interface) is not executed in all operating conditions. The following restrictions apply when the set-up window of the C3 ServoManager is used:
  - If the setup mode is switched on, the fieldbus interface and the energize input are blocked.
  - the energize input can be ignored if the input simulator is activated (depending on the settings).

Note on error switch-off

	**If the "safe torque off" function of Compax3 is required or used for a machine or system, the two errors:** ◆ “Motor_Stalled” (Motor stalled) and ◆ “Tracking” (following error) **are** not to be switched off **(see on page 109).**

3.10.2.4 STO application example (= safe torque off)

In this chapter you can read about:

The application example described here corresponds to Stop Category 1 as defined by EN60204-1.

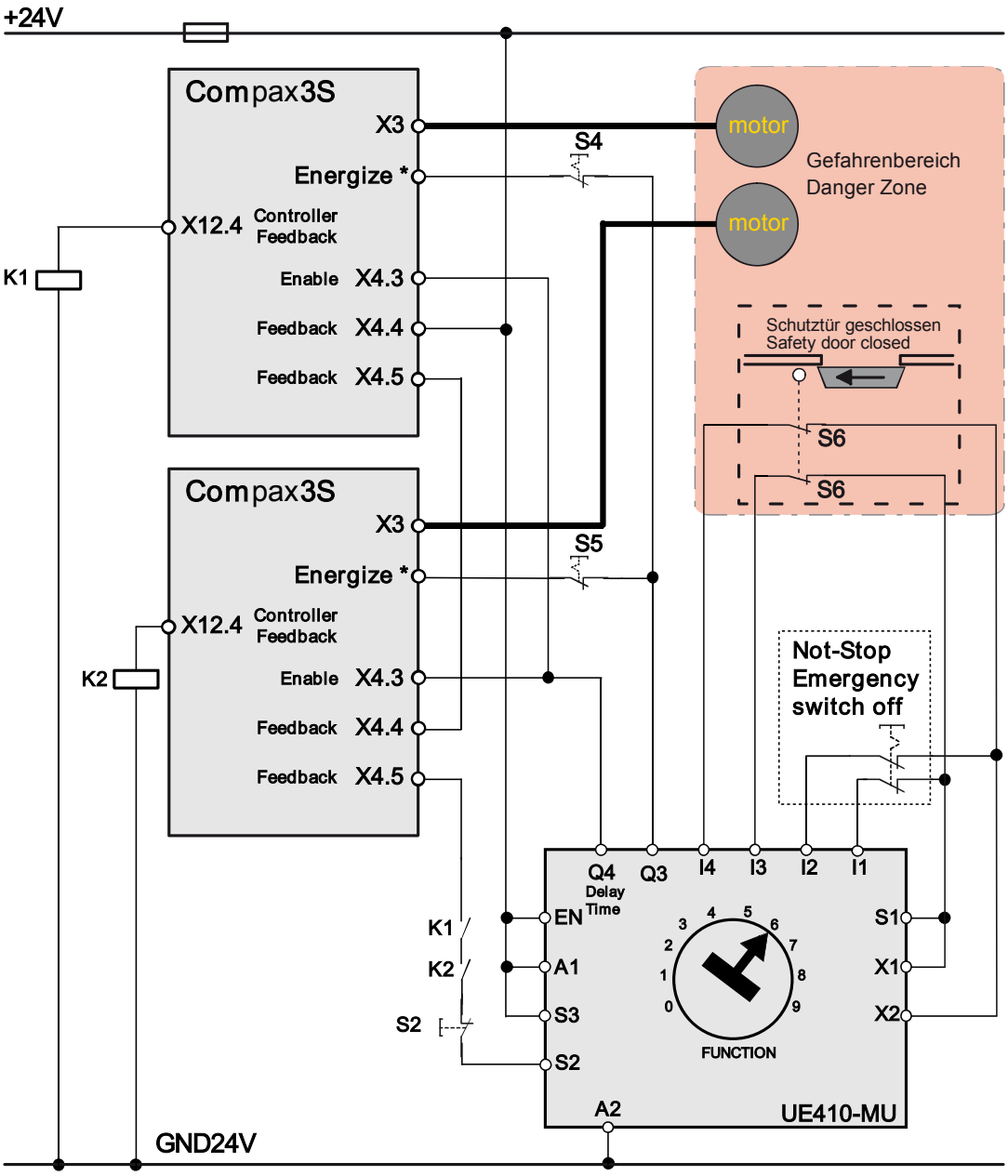
Together with the external safety switching device, the "Safe Stop 1”(SS1) safety function can also be implemented.

A Stop Category 0 in accordance with EN 60204-1 can be implemented, for example by setting the delay time on the Emergency power-off module as well as on the Compax3 (delay time for “switch to currentless”) to 0. The Compax3M will then be turned off immediately in 2 channels and will therefore not be able to generate any more torque. Please take into consideration that the motor will not brake and a coasting down of the motor may result in hazards. If this is the case, the STO function in stop category 0 is not permitted.

Circuit layout overview

- 2 Compax3 devices (the circuit example is also valid for one or multiple devices, if it is adapted accordingly)
- 1 Emergency Power-off module (UE410-MU3T5 manufactured by Sick)
  With adjustable delayed deactivation of the Compax3 enable input ENAin.
  The time must be set so that all axes are at a standstill before the Compax3 controllers are deactivated.
- The operating instructions of the UE410-MU3T5 safety switching device must be observed.
- 1 emergency power-off switch
- Hazardous area accessible via a safety door with safety door switch S6.
- 1 pushbutton per Compax3
- For the Energize input on Compax3, a debouncing time > 3 ms must be configured
- 1 relay per Compax3
  The relay must be dimensioned so that it has a lifetime of at least 20 years, taking the cycle time into consideration. If this is not the case, the relays must be exchanged for new relays after expiration of the lifetime.

Circuit:



Energize = I0 (X12/6) Ackn = I2 (X12/8)

Instead of the safety switching device manufactured by Sick mentioned above, you may use other safety switching devices.

The safety switching device must however provide the following features:

- 1 normally open contact is required for switching off channel 1 (as an alternative, a safe semiconductor output is possible)
- 1 off-delayed normally open safety contact is required for switching off channel 2 (as an alternative, a safe semiconductor output with adjustable delay time for the high_to_low_edge is possible).
- 1 one-channel monitoring circuit where the feedback contacts of channels 1 and 2 can be integrated for simultaneous monitoring, is required.
  At the same time it must be possible to integrate a one-channel start button for activation of the safety switching device into the circuit.
  A new start may only be successful, if it is ensured, that channels 1 and 2 are switched off.
- 1 two-channel connection for emergency power off and/or safety door contacts with cross fault monitoring is required.
- The safety switching device must feature performance PL e. The I/Os must at least correspond to category 3.

Switches and buttons:

1 N/C (S4, S5) per device:	Guide Device to a currentless state
S6:	closed when the safety door is closed
S2:	Activate safety switching device

Caution! Module UET410-MU3T5 modulates regularly test switching signals (OSSD) on outputs Q3 and Q4.
We recommend to use a filter > 3 ms for signal Q3 in the PLC.

Safe torque off description

In this chapter you can read about:

Safe torque off basic function

Compax3 devices disabled by:

Channel 1: Energize input to “0” by safety switching device output Q3

Channel 2: Enable input ENAin to “0” by safety switching device output Q4

Activate safety switching device

Before the Compax3 can be placed into operation, the safety switching device must be activated by a pulse to Input S2.

Prerequisite:

- S2 closed
- Safety door closed
- K1 and K2 energized
  - K1: receives current if Compax3 Device 1 is currentless (output = "1" in currentless state) = Channel 1 feedback
  - K2: receives current if Compax3 device 2 is currentless (output = “1” in the currentless state) = channel 1 feedback
- The feedback contact of all Compax3 devices must be closed (channel 2).

Energize Compax3 (Motor and power output stage)

- With the safety switching device, the Compax3 devices are enabled via the energize input and the Enable input ENAin. (If an error is still present in the Compax3, it must be acknowledged - the ackn function depends on the Compax3 device type)
- The motors are energized with current.

Summary: Compax3 is only energized if the feedback functions are capable of functioning via two channels.

Access to the hazardous area

Actuate emergency power-off switch

Due to the interruption on two channels at the emergency power-off switch, the safety switching device is deactivated - output Q3 is immediately “0”.

Channel 1: Via the Energize input, the Compax3 devices receive the command to guide the drive to a currentless state (using the ramp configured in the C3 ServoManager for "drive disable").

Channel 1 feedback 1: The "Controller Feedback" Compax3 outputs supply current to Relays K1 and K2.

Channel 2: After the delay time set in the safety switching device, (this time must be set so that all drives are stopped after it has elapsed) the output Q4 = “0”, which in turn deactivates the Enable inputs ENAin of the Compax3 devices.

Channel 2 feedback: Via the series circuit of all feedback contacts, the “Safe Torque-off” status (all Compax3 devices without current) is reported.

Only if the drives are all at a standstill, the safety door may be opened and the hazardous area may be accessed.

If the safety door is opened during operation and the emergency-power-off switch was not triggered before, the Compax3 drives will also trigger the stop ramp.

Caution! The drives may still move.

If danger to life and limb of a person entering cannot be excluded, the machine must be protected by additional measures (e.g. a safety door locking).

3.10.2.5 Technical Characteristics STO Compax3S

Safety technology Compax3S

Safe torque-off in accordance with EN ISO 13849: 2008, Category 3, PL d/e Certified. **Test mark IFA 1003004**	◆ For implementation of the “protection against unexpected start-up” function described in EN1037. ◆ Please note the **circuitry examples** (see on page 76).

Compax3S STO (=safe torque off)

Nominal voltage of the inputs	24 V
Required isolation of the 24V control voltage	Grounded protective extra low voltage, PELV
Protection of the STO control voltage	1 A
Grouping of safety level	**STO switch-off via internal safety relay & digital input:** PL e, PFHd=2.98E-8 **STO switch-off via internal safety relay & fieldbus:** PL d, PFHd=1.51E-7 A MTTFd=15 of the external PLC and STO cycles/year < 500 000 are assumed.

3.10.3. STO (= safe torque off) with Compax3m (Option S1)

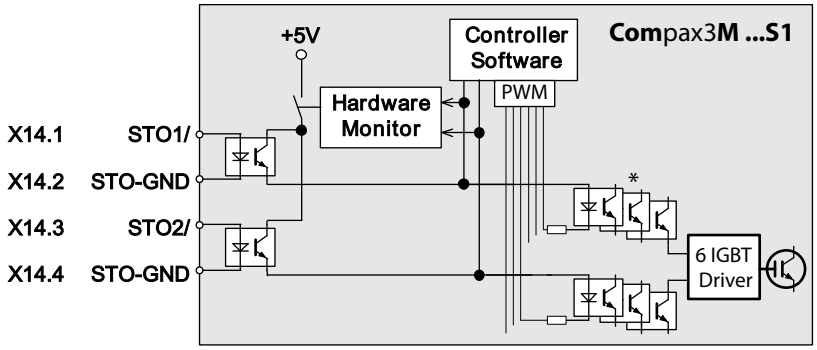
In this chapter you can read about:

3.10.3.1 Safety switching circuits

The current flow in the motor windings is controlled by a power semiconductor bridge (6-fold IGBT). A processor circuit and PWM circuit will switch the IGBT with rotary field orientation. Between control logic and power module, optocouplers are used for potential separation.

On the Compax3M drive controller with S1 option, the X14 (STO) connector can be found on the front plate. 2 optocouplers are controlled on two channels via the STO1/ and STO2/ terminals of this connector. When requesting the STO via an external safety switching device, the two auxiliary voltage supply channels of the power stage control circuits are switched off on two channels. Therefore the power transistors (IGBTs) for the motor current can not longer be switched on.

The hardware monitor detects the failure of the optocoupler circuit of a channel by always checking both channels for similarity. If the hardware monitor detects a discrepancy for a defined time (ax. 20s), the error will be stored in the hardware memory. The processor signals this error externally via the 0x5493 error code. An activation of the coupler supply can then only take place via a hardware reset (switching off and on again) of the device.



* Potential separation with optocoupler.

3.10.3.2 Safety notes for the STO function in the Compax3M

- It should be noted in connection with the STO application examples illustrated here that after the Emergency stop switch has been activated, no galvanic isolation in accordance with EN 60204-1 Section 5.5 is guaranteed. This means that the entire system must be disconnected from the mains power supply with an additional main switch or mains power contactor for repair jobs. Please note in this regard that even after the power is disconnected, dangerous electrical voltages may still be present in the Compax3 drive for about 10 minutes.
- During the active braking phase of Stop category 1 (controlled bringing to a stop with safely monitored delay time according to EN60204-1) or safe stop 1, faulty function must be expected. If an error in the drive system occurs during the active braking phase, the axis may trundle to an unguided stop or might even actively accelerate until the expiry of the defined switch-off time.
- For synchronous motors operated in the field weakening range, the operation of the STO function may lead to over speed and destructive, life-threatening over voltages as well as explosions in the servo drive. Therefore, NEVER use the STO function with synchronous drives in the field-weakening range.
- It is important to note that if the drive is being activated (Energize) by the USB / RS485 interface, it may not be possible to execute switch-off by a controlled braking ramp. For example, this is true when the set-up window of the C3 ServoManager is used. If set-up mode is turned on or with the input simulator, the digital I/O interface and fieldbus interface are automatically disabled.

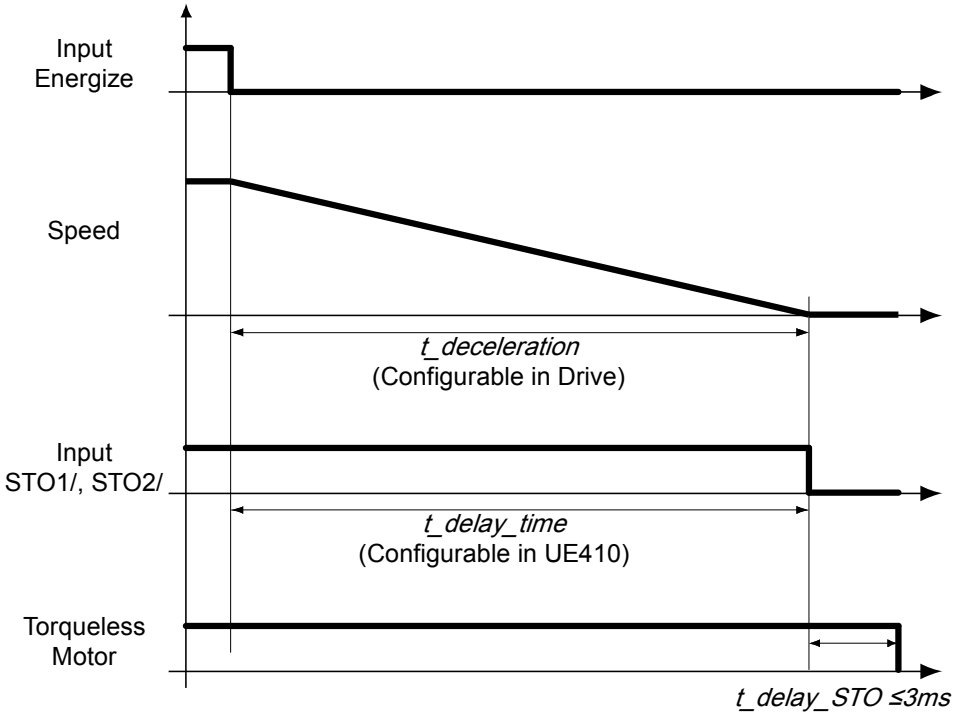
Maintenance

When using the S1 option, a protocol describing the orderly working of the safety function must be made upon the setup and in defined maintenance intervals (see protocol proposal).

3.10.3.3 Conditions of utilization for the STO function with Compax3M

- The STO safety function must be tested and protocoled **as described** (see on page 93). The safety function must be requested at least once a week. In safety door applications, the weekly testing interval must not be observed, as you can assume that the safety doors will be opened several times during the operation of the machine.
- The Compax3M with integrated STO safety function as well as the utilized safety switching devices must be mounted protected (IP54 control cabinet).
- Only qualified staff members are permitted to install the STO function and place it in service.
- The X9/2 (GND24V) terminal on the PSUPxx mains module must be connected to the PE protective lead. This is the only way to ensure protection against incorrect operation through earth faults (EN60204-1 Section 9.4.3)!
- When using an external safety switching device with adjustable delay time, (as illustrated in the STO application example), it must be ensured that the delay time cannot be adjusted by persons not authorized to do so (for example by applying a lead seal). With the UE410-MU3T5 safety switching device, this is not necessary, if the anti manipulation measures are respected.
- The adjustable delay time on the safety switching device must be set to a value greater than the duration of the braking ramp controlled by the Compax3 with maximum load and maximum speed.
- All conditions necessary for CE-conform operation must be observed.
- If there are external forces operating on the drive axes, additional measures are required (for example additional brakes). Please note in particular the effects of gravity on suspended loads! This must be respected above all for vertical axes without self-locking mechanical devices or weight balance.
- When using synchronous motors, a short movement over a small angle is possible, if two errors occur simultaneously in the power section. This depends on the number of pole pairs of the motor (rotary types: 2 poles = 180°, 4 poles = 90°, 6 poles = 60°, 8 poles = 45 °, Linear motors: 180° electrically).

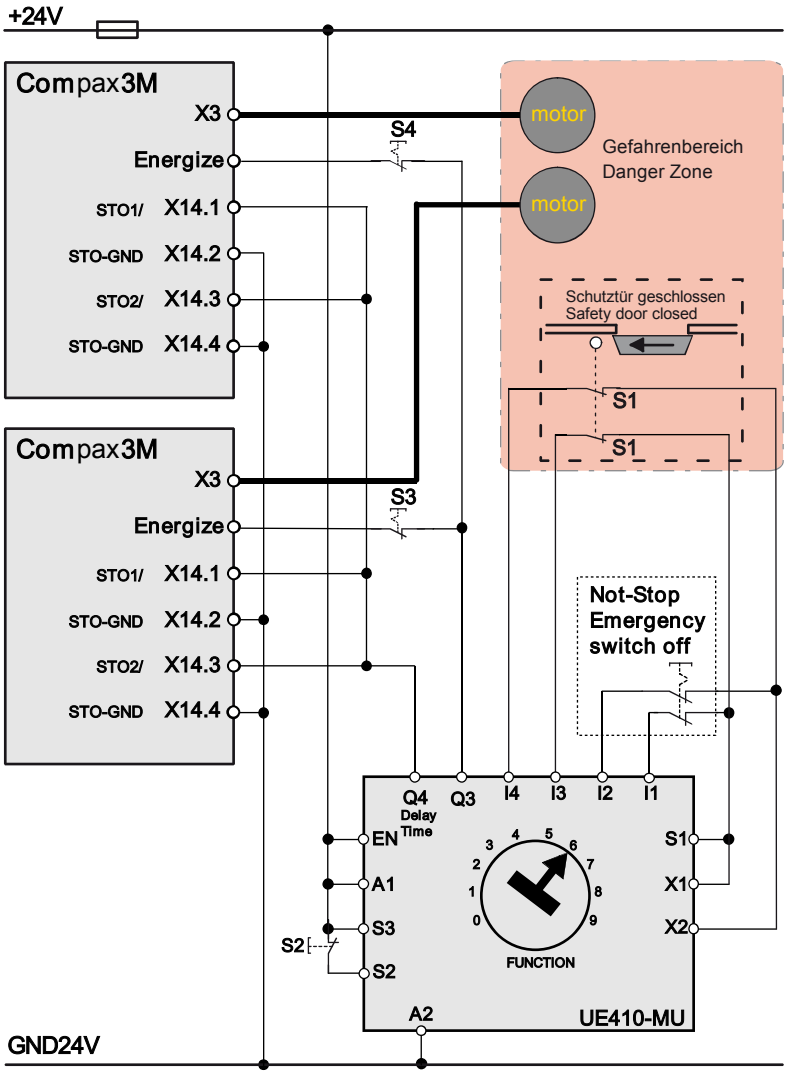
3.10.3.4 STO delay times



3.10.3.5 Compax3M STO application description

In this chapter you can read about:

STO function with safety switching device via Compax3M inputs



Recommendation Energize = I0 (X12/6) (debounceable digital input)

The acknowledgement S2 via the safety control UE410-MU3T5 is only necessary, if after the disabling of the STO function, a danger to any person or to the machine could arise by automatic starting. During the **Configuration des Compax3M** (see on page 109)you must see to a debouncing time >3ms being configured for the Energize input.

The operating instructions of the UE410-MU3T5 safety control must be observed.

The Compax3M devices and the UE410-MU3T5 safety control must be mounted in the same control cabinet.

1 N.C. (S3, S4) per device	Guide Device to a currentless state
S1	closed when the safety door is closed
S2	Activate safety switching device

STO function description

When opening the protective door or after actuating the emergency stop switch, the signal of the "energize" input of the Compax3M drive modules is interrupted via the Q3 output on the UE410-MU3T5 safety control. This triggers an immediate braking ramp on the drives. Then after the delay time set on the UE410-MU4T5 safety control, the STO function in the drives is triggered via the Q4 output. The servo drives are then in safe torqueless state. The delay time must be set on the safety control so that the braking ramp in the drives has run off and the drives are at standstill when the delay time has elapsed.

The described application example corresponds to the stop category 1 according to EN 60204-1. Together with the external safety switching device, the "Safe Stop 1" safety function can also be implemented.

A Stop Category 0 in accordance with EN 60204-1 can be implemented, for example by setting the delay time on the safety switching device to 0. The Compax3M will then be turned off immediately in 2 channels and will not be able to generate any more torque. Please take into consideration that the motor will not brake and a coasting down of the motor may result in hazards. If this is the case, the STO function in stop category 0 is not permitted.

Depending on the interface Ixx or technology function Txx of the Compax3M, the "energize" input can be a digital input or for instance a defined bit of a fieldbus control word (see the overview table below).

In the I10T10, I11T11, I12T11, I2xT11 and I3xT11 devices, the ackn input is assigned fixed.

Interface/Technology	"Energize"	Ackn
I10T10	Digital input I0 (X12/6)	I2 (X12/8)
I11T11	Digital input I2 (X12/8) (Energize & Ackn identical)	
I12T11	Digital input I0 (X12/6) (Energize & Ackn identical)	
I2xT11, I3xT11		
I2xT11, I3xT11	Applications with fieldbusses	
I11T30 and I11T40	Debounced digital input defined in the IEC program, which leads to the enable input of the MCpower function module	
I2xT30, I2xT40, I3xT30 and I3xT40	Bit defined in the IEC program (debounced digital input or via fieldbus) which is linked to the enable input of the MCpower function module	
C1xT30 and C1xT40 C20T30 and C20T40	Debounced digital input defined in the IEC program, which leads to the enable inputs of several MCpower function modules for different axes. The information is passed on to the individual axes via the CANbus.	

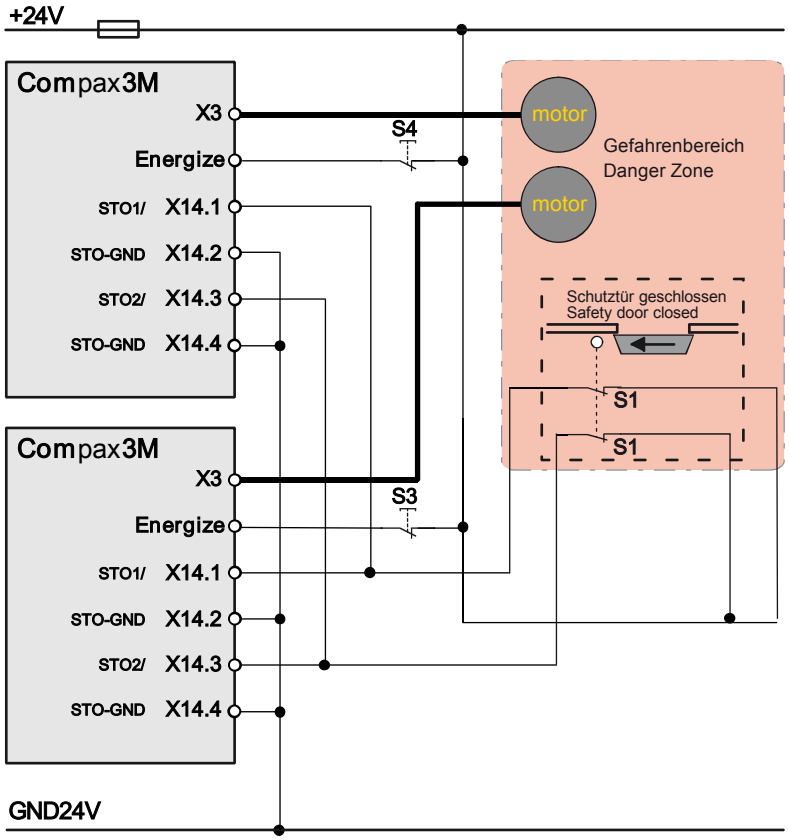
The acknowledement via the safety control UE410-MU3T5 is only necessary, if after the disabling of the STO function, a danger to any person or to the machine could arise due to automatic startup..

Emergency stop and protective door monitoring without external safety switching device.

With Compax3M, a 2-channel protective door monitoring switch or a 2 channel emergency power-off switch can be directly connected. The figure below visualizes an application with 2 channel protective door monitoring switch.

The Compax3M drive modules with PSUPxx mains rectifier must be located in a protected area (IP54 control cabinet). Outside this protected area, the line guiding to the external switches must be separated channelwise or must be especially protected (blinded).

It is also permitted to use one acknowledgement switch for both servo drives at a time. In both cases the acknowledgement does only correspond to category B, therefore this acknowledgement should not be used if there is any possibility of stepping in the dangerous area. In this case, an external acknowledgement device must be used.



3.10.3.6 STO function test

The STO function must be checked in the event of:

- Commissioning
- After each exchange of any equipment within the system
- After each intervention into the system wiring
- In defined maintenance intervals (at least once per week) and after a longer standstill of the machine
  If the STO function was triggered by opening a protective door and if this door is opened several times a week, the weekly testing interval is not required.

The check must be made by qualified personnel adhering to all necessary safety precautions.

The following testing steps must be performed:

STO Test	Action, activity	Expected reaction and effect
1	24V DC voltage on terminal X14.1 and X14.3	
2	Switch on power and 24V supply voltage	No error must be present
3	Configuring the device	No error must be present
4	Testing active STO on terminal X14.1 and X14.3: Remove 24V DC on terminal X14.1 and X14.3 at the same time	Error message 0x5492 must be present 1)
5	Re-apply 24V DC voltage on terminals X14.1 and X14.3 and then acknowledge error	No error must be present
6	Then switch off and on again 24V voltage supply	No error must be present

1) In order to automate the test, it is sufficient here to monitor the general error output with an external logic.

A manual check of the torqueless drive is here also sufficient.

The triggering of the STO can also be made by actuating the emergency stop switch. During the automated test, the STO can also be triggered via the contacts of an external relay

Following the test steps

The performance of the individual test steps of the STO function must be logged. A protocol specimen can be found in the following section.

Depending on the machine version, additional or other test steps may be required.

STO test protocol specimen

General information:

Project/machine:

Servo axis:

Name of the tester:

STO function test:

Test specification according to the Compax3 release:

STO function test steps 1-6: o successfully tested

Acknowledgement safety switching device: o successfully tested
o is not used

Safe stop 1: o successfully tested
o is not used

Initial acceptance on:

Repeat check on:

Signature of the tester

Signature of the tester

3.10.3.7 Technical details of the Compax3M S1 option

Safety technology Compax3M

Safe torque-off in accordance with EN ISO 13849-1: 2007, Category 3, PL=e Certified. Test mark MFS 09029	◆ Please respect the stated safety technology on the **type designation plate** (see on page 11) and the **circuitry examples** (see on page 87)

Compax3M S1 Option: Signal inputs for connector X14

Nominal voltage of the inputs	24V
Required isolation of the 24V control voltage	Grounded protective extra low voltage, PELV
Protection of the STO control voltage	1A
Number of inputs Signal inputs via optocoupler	2 Low = 0...7V DC or open High = 15...30V DC I_{in} at 24V DC: 8mA
STO1/	Low = STO activated High = STO deactivated Reaction time max. 3ms
STO2/	Low = STO activated High = STO deactivated Reaction time max. 3ms
Switch-off time with unequal input statuses (max. reaction time)	20 seconds
Grouping of safety level	Category 3 PL=e (according to table 4 in EN ISO 13849-1 this corresponds to SIL 3) PFHd=4.29E-8

4. Setting up Compax3

In this chapter you can read about:

4.1 Configuration

In this chapter you can read about:

The general proceeding in order to operate an empty-running motor is described **here** (see on page 98).

Configurations sequence:

Installation of the C3 ServoManager

The Compax3 ServoManager can be installed directly from the Compax3 DVD. Click on the corresponding hyperlink resp. start the installation program "C3Mgr_Setup_V.....exe" and follow the instructions.

PC requirements

Recommendation:

Operating system:	MS Windows XP SP2 / MS Windows 2000 as from SP4 / (MS Vista)
Browser:	MS Internet Explorer 6.x
Processor:	Intel Pentium 4 / Intel Core 2 Duo / AMD Athlon class as from >=2GHz
RAM memory:	>= 1024MB
Hard disk:	>= 20GB available memory
Drive:	DVD drive
Monitor:	Resolution 1024x768 or higher
Graphics card:	on onboard graphics (for performance reasons)
Interface:	USB

Minimum requirements:

Operating system:	MS Windows XP SP2 / MS Windows 2000 as from SP4
Browser:	MS Internet Explorer 6.x
Processor:	>=1.5GHz
RAM memory:	512MB
Hard disk:	10GB available memory
Drive:	DVD drive
Monitor:	Resolution 1024x768 or higher
Graphics card:	on onboard graphics (for performance reasons)
Interface:	USB

Note:

- For the installation of the software you need administrator authorization on the target computer.
- Several applications running in parallel, reduce the performance and operability.
- Especially customer applications, exchanging standard system components (drivers) in order to improve their own performance, may have a strong influence on the communication performance or even render normal use impossible.
- Operation under virtual machines such as Vware Workstation 6/ MS Virtual PC is not possible.
- Onboard graphics card solutions reduce the system performance by up to 20% and cannot be recommended.
- Operation with notebooks in current-saving mode may lead, in individual cases, to communication problems.

Connection between PC and Compax3

Your PC is connected with Compax3 via a RS232 cable (**SSK1** (see on page 205)).

Cable **SSK1** (see on page 205) (COM 1/2-interface on the PC to X10 on the Compax3 or via adapter SSK32/20 on programming interface of Compax3H).

Start the Compax3 ServoManager and make the setting for the selected interface in the "**Options Communication settings RS232/RS485...**" menu.

Device Selection

In the menu tree under device selection you can read the device type of the connected device (Online Device Identification) or select a device type (Device Selection Wizard).

Configuration

Then you can double click on "Configuration" to start the configuration wizard. The wizard will lead you through all input windows of the configuration.

Input quantities will be described in the following chapters, in the same order in which you are queried about them by the configuration wizard.

4.1.1. Test commissioning of a Compax3 axis

In the device online help, we show you at this place an animation of a test setup with the aim to move an unloaded motor.

- Simple and independent of the Compax3 device variant*
- Without overhead for configuration
- Without special knowledge in programming

* for device specific functions, please refer to the corresponding device description.

Due to continuous optimization, individual monitor displays may have changed.

This does however hardly influence the general proceeding.

4.1.2. Selection of the supply voltage used

Please select the mains voltage for the operation of Compax3.

This influences the choice of motors available.

4.1.3. Motor selection

The selection of motors can be broken down into:

- Motors that were purchased in Europe and
- Motors that were purchased in the USA.
- You will find non-standard motors under "Additional motors" and
- under "User-defined motors" you can select motors set up with the C3 MotorManager.

For motors with holding brake SMH**A** or MH**A** brake delay times can be entered. For this see **Brake delay times** (see on page 143).

Pleas note the following equivalence that applies regarding terms concerning linear motors**:**

- **Rotary motors / linear motors**
- **Revolutions** ≡ **Pitch**
- **Rotation speed (velocity)**≡ **Speed**
- **Torque** ≡ **Power**
- **Moment of inertia** ≡ **Load**

Notes on direct drives **(see on page 170) (Linear and Torque - Motors)**

4.1.4. Optimize motor reference point and switching frequency of the motor current

Optimization of the motor reference point

The motor reference point is defined by the reference current and the reference (rotational) speed.

Standard settings are:

- Reference current = nominal current
- Reference (rotational) speed = nominal (rotational) speed

These settings are suitable for most cases.

The motors can, however, be operated with different reference points for special applications.

- By reducing the reference (rotational) speed, the reference current can be increased. This results in more torque with a reduced speed.
- For applications where the reference current is only required cyclically with long enough breaks in between, you may use a reference current higher than I_0. The limit value is however reference current = max. 1.33*I_0. The reference (rotational) speed must also be reduced.

The possible settings or limits result from the respective motor characteristics.

Caution!

Wrong reference values (too high) can cause the motor to switch off during operation (because of too high temperature) or even cause damage to the motor.

Optimization of the switching frequency

The switching frequency of the power output stage is preset to optimize the operation of most motors.

It may, however, be useful to increase the switching frequency especially with direct drives in order to reduce the noise of the motors. Please note that the power output stage must be operated with reduced nominal currents in the case of increased switching frequencies.
The switching frequency may only be increased.

Caution!

By increasing the motor current switching frequency, the nominal current and the peak current are reduced.
This must already be observed in the planning stage of the plant!

The preset motor current switching frequency depends on the performance variant of the Compax3 device.

The respective Compax3 devices can be set as follows:

Resulting nominal and peak currents depending on the switching frequency

Compax3S0xxV2 at 1*230VAC/240VAC

Switching frequency*		S025V2	S063V2
16kHz	I_{nom}	**2.5A$_{rms}$**	**6,3A$_{rms}$**
	I_{peak} (<5s)	**5.5A$_{rms}$**	**12,6A$_{rms}$**
32kHz	I_{nom}	2.5A$_{rms}$	5.5A$_{rms}$
	I_{peak} (<5s)	5.5A$_{rms}$	12,6A$_{rms}$

Compax3S1xxV2 at 3*230VAC/240VAC

Switching frequency*		S100V2	S150V2
8kHz	I_{nom}	**-**	**15A$_{rms}$**
	I_{peak} (<5s)	**-**	**30A$_{rms}$**
16kHz	I_{nom}	**10A$_{rms}$**	12.5A$_{rms}$
	I_{peak} (<5s)	**20A$_{rms}$**	25A$_{rms}$
32kHz	I_{nom}	8A$_{rms}$	10A$_{rms}$
	I_{peak} (<5s)	16A$_{rms}$	20A$_{rms}$

Compax3S0xxV4 at 3*400VAC

Switching frequency*		S015V4	S038V4	S075V4	S150V4	S300V4
8kHz	I_{nom}	-	-	-	**15A$_{rms}$**	**30A$_{rms}$**
	I_{peak} (<5s)	-	-	-	**30A$_{rms}$**	**60A$_{rms}$**
16kHz	I_{nom}	**1.5A$_{rms}$**	**3.8A$_{rms}$**	**7.5A$_{rms}$**	10.0A$_{rms}$	26A$_{rms}$
	I_{peak} (<5s)	**4.5A$_{rms}$**	**9.0A$_{rms}$**	**15.0A$_{rms}$**	20.0A$_{rms}$	52A$_{rms}$
32kHz	I_{nom}	1.5A$_{rms}$	2.5A$_{rms}$	3.7A$_{rms}$	5.0A$_{rms}$	14A$_{rms}$
	I_{peak} (<5s)	3.0A$_{rms}$	5.0A$_{rms}$	10.0A$_{rms}$	10.0A$_{rms}$	28A$_{rms}$

Compax3S0xxV4 at 3*480VAC

Switching frequency*		S015V4	S038V4	S075V4	S150V4	S300V4
8kHz	I_{nom}	-	-	-	**13.9A$_{rms}$**	**30A$_{rms}$**
	I_{peak} (<5s)	-	-	-	**30A$_{rms}$**	**60A$_{rms}$**
16kHz	I_{nom}	**1.5A$_{rms}$**	**3.8A$_{rms}$**	**6.5A$_{rms}$**	8.0A$_{rms}$	21.5A$_{rms}$
	I_{peak} (<5s)	**4.5A$_{rms}$**	**7.5A$_{rms}$**	**15.0A$_{rms}$**	16.0A$_{rms}$	43A$_{rms}$
32kHz	I_{nom}	1.0A$_{rms}$	2.0A$_{rms}$	2.7A$_{rms}$	3.5A$_{rms}$	10A$_{rms}$
	I_{peak} (<5s)	2.0A$_{rms}$	4.0A$_{rms}$	8.0A$_{rms}$	7.0A$_{rms}$	20A$_{rms}$

The values marked with grey are the pre-set values (standard values)!

*corresponds to the frequency of the motor current

Resulting nominal and peak currents depending on the switching frequency

Compax3HxxxV4 at 3*400VAC

Switching frequency*		H050V4	H090V4	H125V4	H155V4
8kHz	I_{nom}	$50A_{rms}$	$90A_{rms}$	$125A_{rms}$	$155A_{rms}$
	I_{peak} (<5s)	$75A_{rms}$	$135A_{rms}$	$187.5A_{rms}$	$232.5A_{rms}$
16kHz	I_{nom}	$33A_{rms}$	$75A_{rms}$	$82A_{rms}$	$100A_{rms}$
	I_{peak} (<5s)	$49.5A_{rms}$	$112.5A_{rms}$	$123A_{rms}$	$150A_{rms}$
32kHz	I_{nom}	$19A_{rms}$	$45A_{rms}$	$49A_{rms}$	$59A_{rms}$
	I_{peak} (<5s)	$28.5A_{rms}$	$67.5A_{rms}$	$73.5A_{rms}$	$88.5A_{rms}$

Compax3HxxxV4 at 3*480VAC

Switching frequency*		H050V4	H090V4	H125V4	H155V4
8kHz	I_{nom}	$43A_{rms}$	$85A_{rms}$	$110A_{rms}$	$132A_{rms}$
	I_{peak} (<5s)	$64.5A_{rms}$	$127.5A_{rms}$	$165A_{rms}$	$198A_{rms}$
16kHz	I_{nom}	$27A_{rms}$	$70A_{rms}$	$70A_{rms}$	$84A_{rms}$
	I_{peak} (<5s)	$40.5A_{rms}$	$105A_{rms}$	$105A_{rms}$	$126A_{rms}$
32kHz	I_{nom}	$16A_{rms}$	$40A_{rms}$	$40A_{rms}$	$48A_{rms}$
	I_{peak} (<5s)	$24A_{rms}$	$60A_{rms}$	$60A_{rms}$	$72A_{rms}$

The values marked with grey are the pre-set values (standard values)!

*corresponds to the frequency of the motor current

Resulting nominal and peak currents depending on the switching frequency

Compax3MxxxD6 at 3*400VAC

Switching frequency*		M050D6	M100D6	M150D6	M300D6
8kHz	I_{nom}	$5A_{rms}$	$10A_{rms}$	$15A_{rms}$	$30A_{rms}$
	I_{peak} (<5s)	$10A_{rms}$	$20A_{rms}$	$30A_{rms}$	$60A_{rms}$
16kHz	I_{nom}	$3.8A_{rms}$	$7.5A_{rms}$	$10A_{rms}$	$20A_{rms}$
	I_{peak} (<5s)	$7.5A_{rms}$	$15A_{rms}$	$20A_{rms}$	$40A_{rms}$
32kHz	I_{nom}	$2.5A_{rms}$	$3.8A_{rms}$	$5A_{rms}$	$11A_{rms}$
	I_{peak} (<5s)	$5A_{rms}$	$7.5A_{rms}$	$10A_{rms}$	$22A_{rms}$

Compax3MxxxD6 at 3*480VAC

Switching frequency*		M050D6	M100D6	M150D6	M300D6
8kHz	I_{nom}	$4A_{rms}$	$8A_{rms}$	$12.5A_{rms}$	$25A_{rms}$
	I_{peak} (<5s)	$8A_{rms}$	$16A_{rms}$	$25A_{rms}$	$50A_{rms}$
16kHz	I_{nom}	$3A_{rms}$	$5.5A_{rms}$	$8A_{rms}$	$15A_{rms}$
	I_{peak} (<5s)	$6A_{rms}$	$11A_{rms}$	$16A_{rms}$	$30A_{rms}$
32kHz	I_{nom}	$2A_{rms}$	$2.5A_{rms}$	$4A_{rms}$	$8.5A_{rms}$
	I_{peak} (<5s)	$4A_{rms}$	$5A_{rms}$	$8A_{rms}$	$17A_{rms}$

The values marked with grey are the pre-set values (standard values)!

*corresponds to the frequency of the motor current

4.1.5. Ballast resistor

If the regenerative brake output exceeds the **amount of energy that can be stored by the servo controller** (see on page 220), then an error will be generated. To ensure safe operation, it is then necessary to either

- reduce the accelerations resp. the decelerations,
- or to use an **external ballast resistor** (see on page 187).

Please select the connected ballast resistor or enter the characteristic values of your ballast resistor directly.

Please note that with resistance values greater than specified, the power output from the servo drive can no longer be dissipated in the braking resistor.

4.1.6. General drive

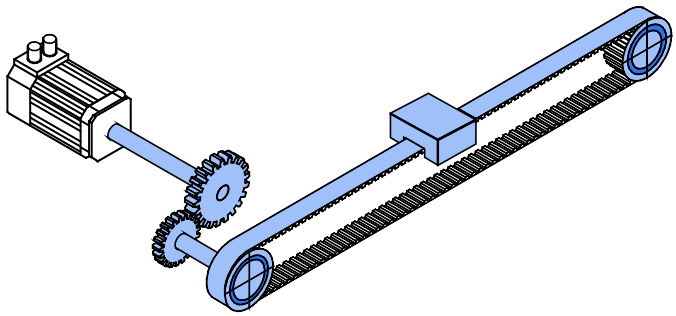
External moment of inertia / load

The external moment of inertia is required for adjusting the servo controller. The more accurately the moment of inertia of the system is known, the better is the stability and the shorter is the settle-down time of the control loop.

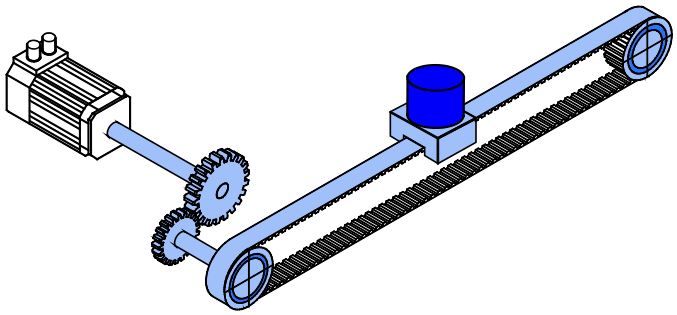
It is important to specify the minimum and maximum moment of inertia for best possible behavior under varying load.

If you do not know the moment of inertia, click on "Unknown: using default values". You have then the possibility to determine the moment of inertia by means of automatic **load identification** (see on page 126).

Minimum moment of inertia / minimum load



Maximum moment of inertia / maximum load



Enter minimum = maximum moment of inertia when the load does not vary.

4.1.7. Command interface

Make you selection from the following command interfaces:

- ±10V analog setpoint commanding and encoder emulation (rotation speed control mode)
- Step/direction input RS422 (5V push-pull signal)
- Step/direction input 24V level
- Encoder input RS422 (5V push-pull signal)
- Encoder input 24V level
- ±10V analog current setpoint commanding and encoder emulation (rotation speed control mode) with different holding functions.

Please observe:

Encoder simulation exists with an

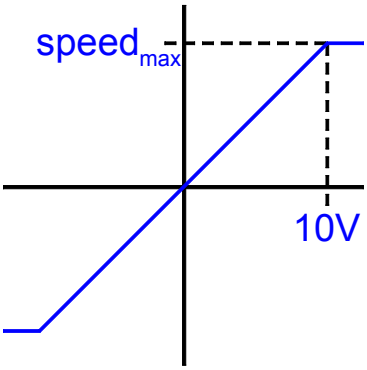
- analog input command interface of ±10V
- Step/direction input 24V level and
- Encoder input 24V level

!

4.1.7.1 ±10V analogue speed setpoint commanding and encoder emulation

Input:

- ±10V analogue;
- 14Bit resolution;
- 125µs scanning rate



Keep position via I4

With I4 = “1” position setpoint = 0 is predefined.

External forces can be compensated via corresponding motor moments.

If the motor is shifted from its position by too high external forces (current limit is reached), the drive moves to its original position (after the reduction of the external forces).

Setting values:

Rotational speed/velocity at a setpoint of +10V

Unit: rpm or m/s	Range: +/-0... 1.2 * reference value	Standard value: Reference value
Defining the reference system. Reference value = Nominal speed/velocity of the motor.		

Simulated Encoder Output Resolution

Unit: Increments per revolution / pitch	Range: 4 - 16384	Standard value: 1024
Any resolution can be set **Limit frequency: 620kHz** (track A or B) i.e. , with:		
Increments per revolution	max. Velocity	
1024	36000 rpm	
4096	9000 rpm	
16384	2250 rpm	

Invert Motor Rotation/Direction Polarity

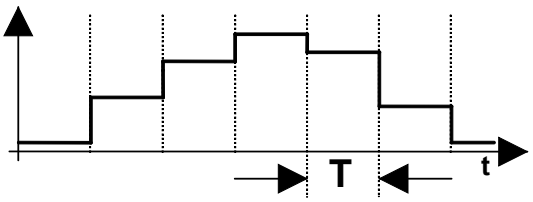
Unit: -	Range: no / yes	Standard value: no
Reverse direction inverts the sense of rotation, i.e. the direction of movement of the motor is reversed in the case of equal setpoint.		

Time frame predefined setpoint value

Averaging and a following filter (interpolation) can help to avoid steps caused by discrete signals.

If the external signal is analog, there is no need to enter a value here (Value = 0).

For discrete signals e.g. from a PLC, the scanning time (or cycle time) of the signal source is entered.



This function is only available if the analog interface +/-10V is used!

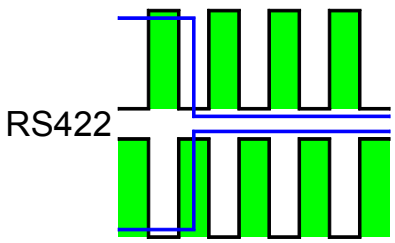
4.1.7.2 Step/Direction Input 24V

Required wiring:

Plug/Pin	Assignment
X12/13	Step
X12/14	Direction
X12/15	0V

4.1.7.3 Step/Direction Input RS422

Input:



Setting values:

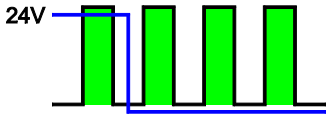
Increments per motor revolution / pitch

Unit: Increments	Range:	Standard value: 1024
Number of steps per motor revolution / pitch		

Invert Motor Rotation/Direction Polarity

Unit: -	Range: no / yes	Standard value: no
Reverse direction inverts the sense of rotation, i.e. the direction of movement of the motor is reversed in the case of equal setpoint.		

4.1.7.4 Step/Direction Input 24V



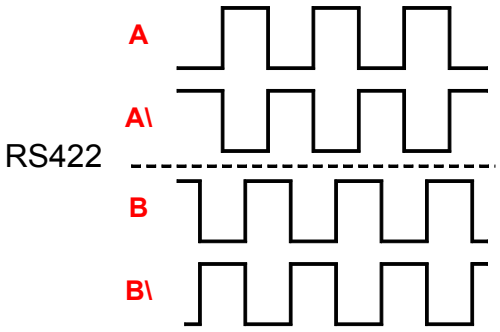
Increments per motor revolution / pitch

Unit: Increments	Range:	Standard value: 1024
Number of steps per motor revolution / pitch		

Invert Motor Rotation/Direction Polarity

Unit: -	Range: no / yes	Standard value: no
Reverse direction inverts the sense of rotation, i.e. the direction of movement of the motor is reversed in the case of equal setpoint.		

4.1.7.5 Encoder input RS422



The zero pulse is not evaluated!

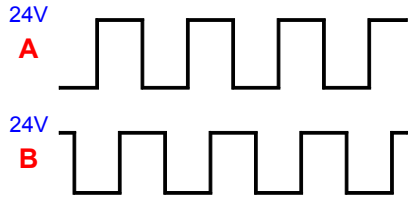
Increments per motor revolution / pitch

Unit: Increments	Range:	Standard value: 1024
Number of steps per motor revolution / pitch		

Invert Motor Rotation/Direction Polarity

Unit: -	Range: no / yes	Standard value: no
Reverse direction inverts the sense of rotation, i.e. the direction of movement of the motor is reversed in the case of equal setpoint.		

4.1.7.6 Encoder input 24V



The zero pulse is not evaluated!

Increments per motor revolution / pitch

Unit: Increments	Range:	Standard value: 1024
Number of steps per motor revolution / pitch		

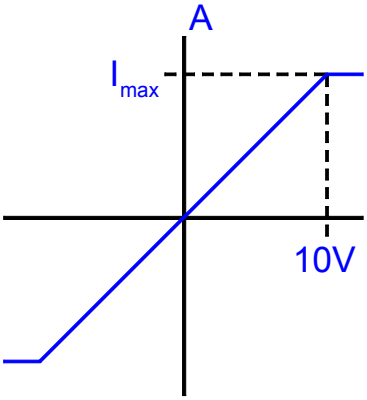
Invert Motor Rotation/Direction Polarity

Unit: -	Range: no / yes	Standard value: no
Reverse direction inverts the sense of rotation, i.e. the direction of movement of the motor is reversed in the case of equal setpoint.		

4.1.7.7 ±10V analog current setpoint commanding and encoder emulation

Input:

- ±10V analogue;
- 14Bit resolution;
- 62.5µs scanning rate



Holding function “keep Position / speed 0” via I4

The input I4 can be assigned with an additional function. You may choose between:

without holding function I4

Keep rotational speed / velocity 0 via I4

Predefine speed setpoint value = 0 via I4 = “1”.

External forces can be compensated via corresponding motor moments.

The state “internal current setpoint” reflects the external forces.

Keep position via I4

With I4 = “1” position setpoint = 0 is predefined.

External forces can be compensated via corresponding motor moments.

If the motor is shifted from its position by too high external forces (current limit is reached), the drive moves to its original position (after the reduction of the external forces).

Setting values:

Current at setpoint +10V

Unit: mA	Range: +/-0... I(max)	Standard value: I(nom)
Define reference system 10V = current; I(nom)= Nominal current of the motor. I(max): is the smaller value from motor peak current and device peak current		

Simulated Encoder Output Resolution

Unit: Increments per revolution / pitch	Range: 4 - 16384	Standard value: 1024
Any resolution can be set **Limit frequency: 620kHz** (track A or B) i.e. , with:		
Increments per revolution	max. Velocity	
1024	36000 rpm	
4096	9000 rpm	
16384	2250 rpm	

Invert Motor Rotation/Direction Polarity

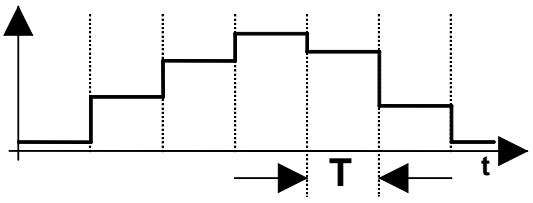
Unit: -	Range: no / yes	Standard value: no
Reverse direction inverts the sense of rotation, i.e. the direction of movement of the motor is reversed in the case of equal setpoint.		

Time frame predefined setpoint value

Averaging and a following filter (interpolation) can help to avoid steps caused by discrete signals.

If the external signal is analog, there is no need to enter a value here (Value = 0).

For discrete signals e.g. from a PLC, the scanning time (or cycle time) of the signal source is entered.



This function is only available if the analog interface +/-10V is used!

4.1.8. Setpoint control

Servo-drive behavior after activating or deactivating the X12/6 "energize motor" and X12/7 "setpoint value release" inputs can be set using ramps.

Ramps are not supported in the operating mode "±10V analogue current setpoint value

Acceleration ramp: "setpoint value release"

Unit: U/(s*s)	Range: 10 ... 10000	Standard value: 50
The entered value specifies the number of revolutions per second (rp/s) by which the rotation speed / velocity changes in 1second		

Deceleration ramp "Enable setpoint"

Unit: U/(s*s)	Range: 10 ... 10000	Standard value: 50
The entered value specifies the number of revolutions per second (rp/s) by which the rotation speed changes in 1second.		

Please observe:

The configured ramp is limited. The ramp will not be smaller than the deceleration set in the last motion set.

Acceleration ramp: "energize motor"

Unit: U/(s*s)	Range: 10 ... 10000	Standard value: 100
The entered value specifies the number of revolutions per second (rp/s) by which the rotation speed / velocity changes in 1second		

Deceleration ramp: "energize motor"

Unit: U/(s*s)	Range: 10 ... 10000	Standard value: 100
The entered value specifies the number of revolutions per second (rp/s) by which the rotation speed changes in 1second.		

Please observe:

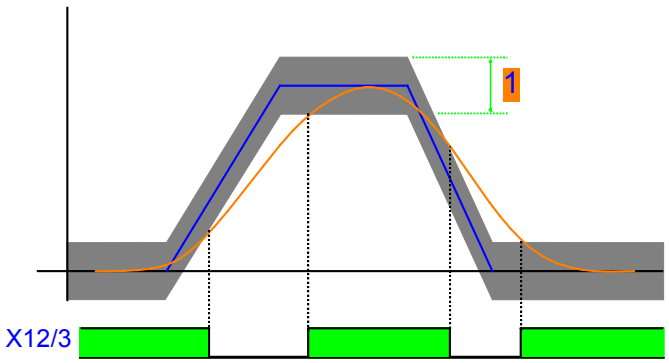
The configured ramp is limited. The ramp will not be smaller than the deceleration set in the last motion set.

4.1.9. Limit and monitoring settings

In this chapter you can read about:

4.1.9.1 Nominal value window

The setpoint window is not supported in the operating mode "±10V analog current setpoint value"!



X12/3 = 24VDC indicates that the current rotation speed or position lies in the setpoint window (1).

Nominal value window

Unit: rpm or increments	Range: +/-0... 10000	Standard value: +/-10
Control deviation (setpoint value/actual value) < setpoint value window: Output "setpoint value in window" =24V Control deviation (setpoint value/actual value) < setpoint value window: Output "setpoint value in window" =0V		

4.1.9.2 Current (Torque) Limit

The current required by the speed controller is limited to the current limit.

Torque limit

Unit: % of M(nominal)	Range: 0 ... 400	Standard value: 200
The torque limit is specified as a percentage of the rated motor torque and is the maximum permitted continuous output torque of the servo drive. If the value is greater than 100% the motor may become overloaded and signal too high temperature so that the servo drive switches off.		

4.1.9.3 Maximum operating speed

The speed limitation is deduced from the maximum operating speed. In order to ensure control margins, the speed is limited to a higher value.

The speed setpoint value is actively limited to 1.1 times the given value.

If the speed actual value exceeds the preset maximum speed by 21% (=”switching off limit speed”), error 0x7310 is triggered.

“Switching off limit of speed” with predefined analog current command value

In the operating mode "±10V analogue current command value and encoder simulation” the speed setpoint is not limited actively.

If the speed actual value exceeds the preset “switching off limit speed” error 0x7310 is triggered.

4.1.9.4 Debouncing input I0

A majority gate is used for debouncing.

The signal is sampled every 0.5ms
The debounce time determines the number of scans the majority gate will perform. If the level of more than half of the signals was changed, the internal status will change.

The debounce time can be set in the configuration wizard within the range of 0 ... 20ms.

The value 0 deactivates the debouncing.

4.1.9.5 Error response

Under "configuring: Error reaction" you can change the error reaction for individual **errors** (see on page 164) (the error no. which can be influenced is displayed).

Possible settings for the error reaction are:

- No response
- Downramp / stop
- Downramp / stromlos schalten (standard settings)

Note on Compax3H:

The error reaction upon the "low voltage DC" error (0x3222) is fixed to "downramp/deenergize" for Compax3H.

4.1.10. Configuration name / comments

Here you can name the current configuration as well as write a comment.

Then you can download the configuration settings or, in T30 or T40 devices, perform a complete Download (with IEC program and curve).

	**Caution!** Deactivate the drive before downloading the configuration software! **Please note!** Incorrect configuration settings entail danger when activating the drive. Therefore take special safety precautions to protect the travel range of the system.

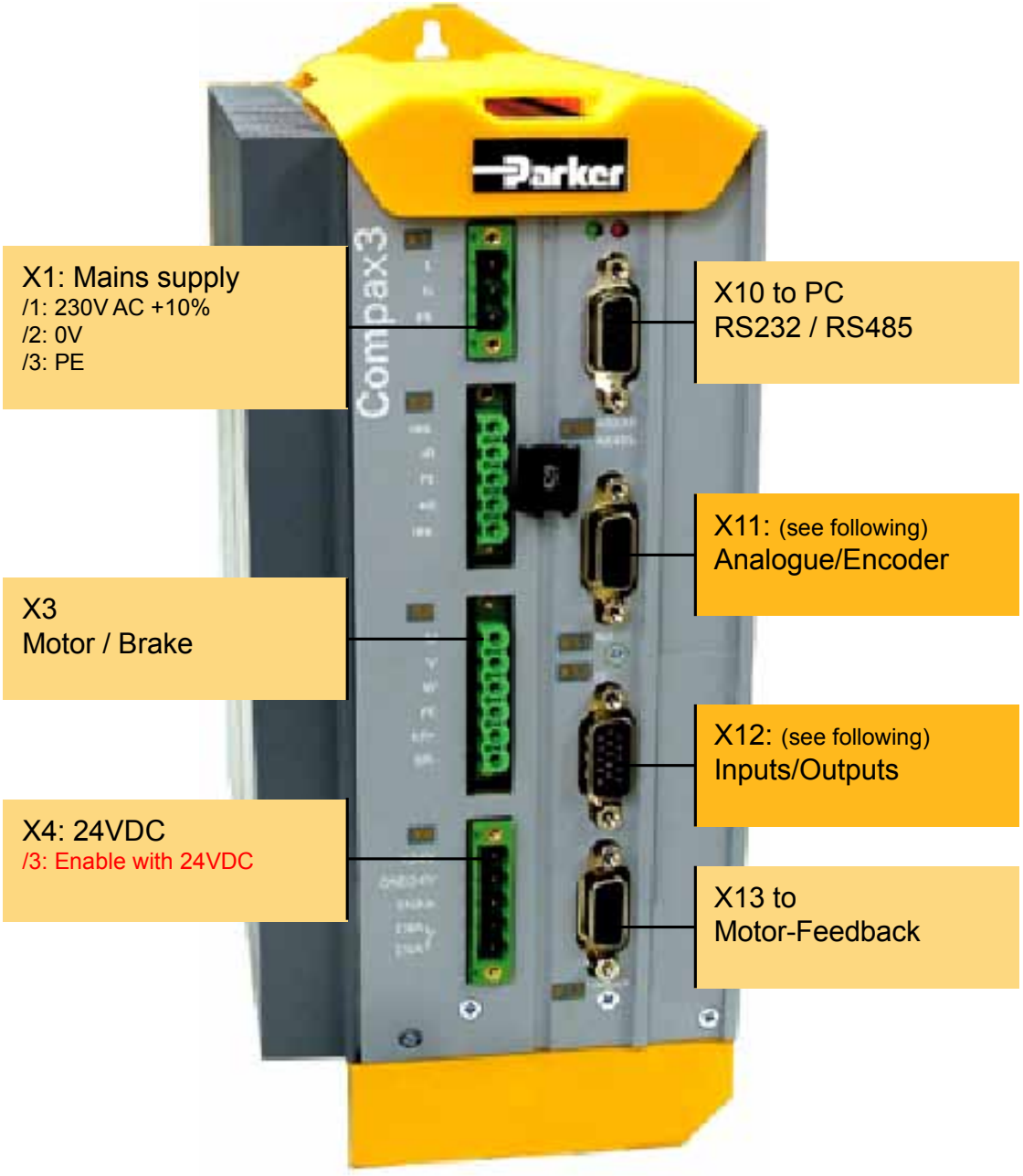
	**Mechanical limit values!** Observe the limit values of the mechanical components! Ignoring the limit values can lead to destruction of the mechanical components.

4.2 Test commissioning: Compax3 S0xx V2 I10

In this chapter you can read about:

For testing and understanding the function of the device, the required input connections are specified below for making simple movements.

Required wiring:



Operational enable of the servo controller:

Plug/Pin	Assignment
X12/6 (Energize the motor)	= 24V DC (jumper to X12/1)
X12/7 (setpoint value release)	= 24V DC (jumper to X12/1)
X4/3 (Enable power output stage)	= 24V DC (jumper to X4/1)

The further assignment of plug X11: "Analog/encoder" and X12: "Digital inputs/outputs" is dependent on the selected mode of operation.

4.2.1. Analog command interface +/-10V with encoder simulation

Required wiring:

Plug/Pin	Assignment
X11/9	Analog setpoint input; positive terminal
X11/11	Analog setpoint input; negative terminal

Encoder simulation

Plug/Pin	Assignment
X11/6	A/
X11/7	A
X11/8	B
X11/12	B/
X11/13	N/
X11/14	N

4.2.2. Step/Direction Input RS422

Required wiring:

Plug/Pin	Assignment
X11/6	Steps -
X11/7	Steps +
X11/12	Direction -
X11/8	Direction +

4.2.3. Encoder input RS422

Required wiring:

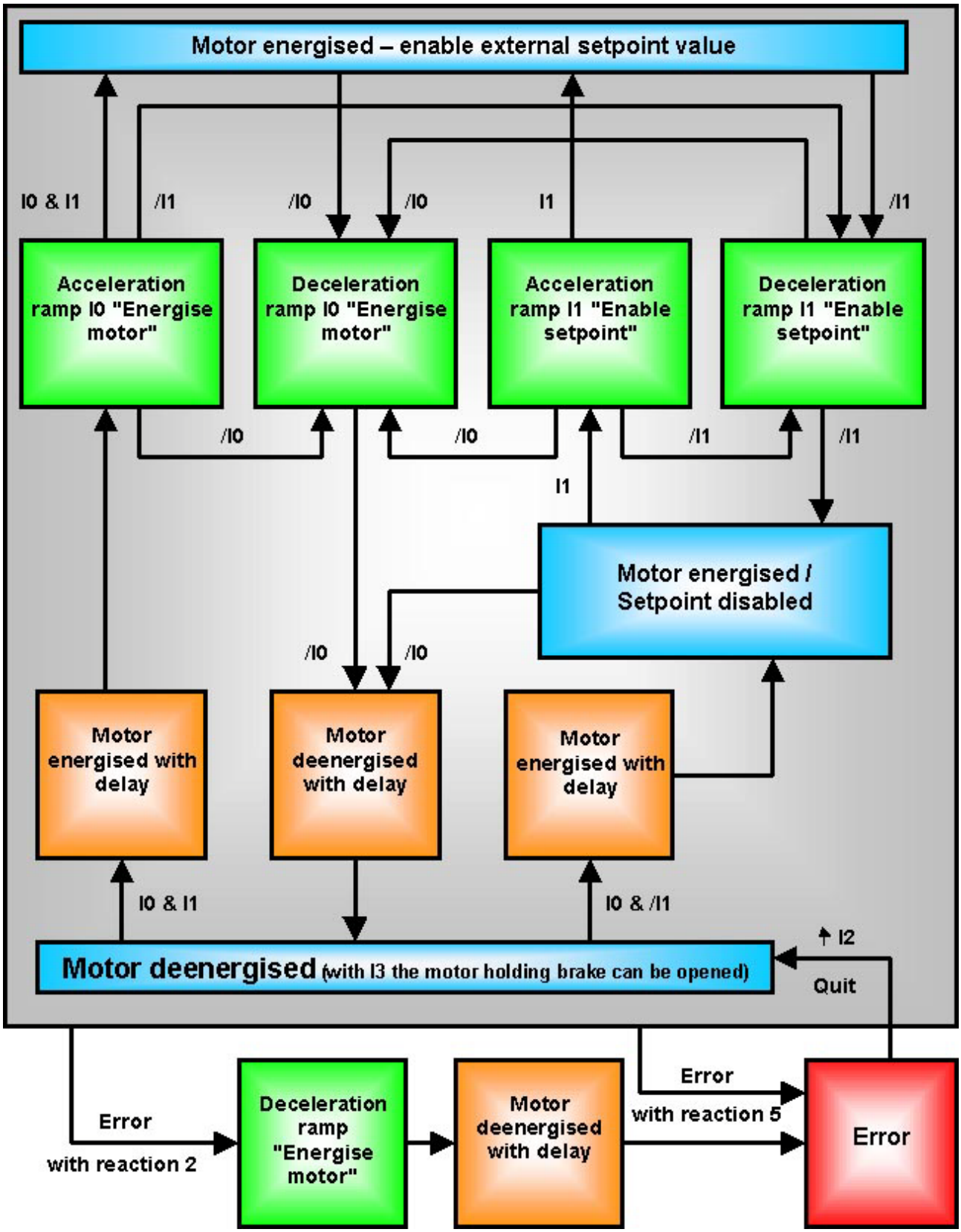
Plug/Pin	Assignment
X11/6	A/
X11/7	A
X11/12	B/
X11/8	B
X11/13	N/ (is not evaluated)
X11/14	N (is not evaluated)

4.2.4. Encoder input 24V

Required wiring:

Plug/Pin	Assignment
X12/12	N (is not evaluated)
X12/13	A
X12/14	B
X12/15	0V

4.3 Device status



Key:

- I0, I1, I3: Input = 24VDC
- /I0, /I1: Input = 0V
- ↑I2: positive edge on I2

The device can be brought into various states via the inputs:

- **I0: Energize motor,**
- **I1: Enable Setpoint value** and
- **I2: Ackn**
- **I3: Open brake**

the device is brought into various device states.

The transitions are implemented via **ramps** (see on page 107) and the controlled switching of **motor brake** (see on page 143).

The ramps are not used in the "±10V analog current setpoint" operating mode!

An error can occur in any device state. For reactions to the different error causes please see the **Error list** (see on page 164).

4.4 Optimization

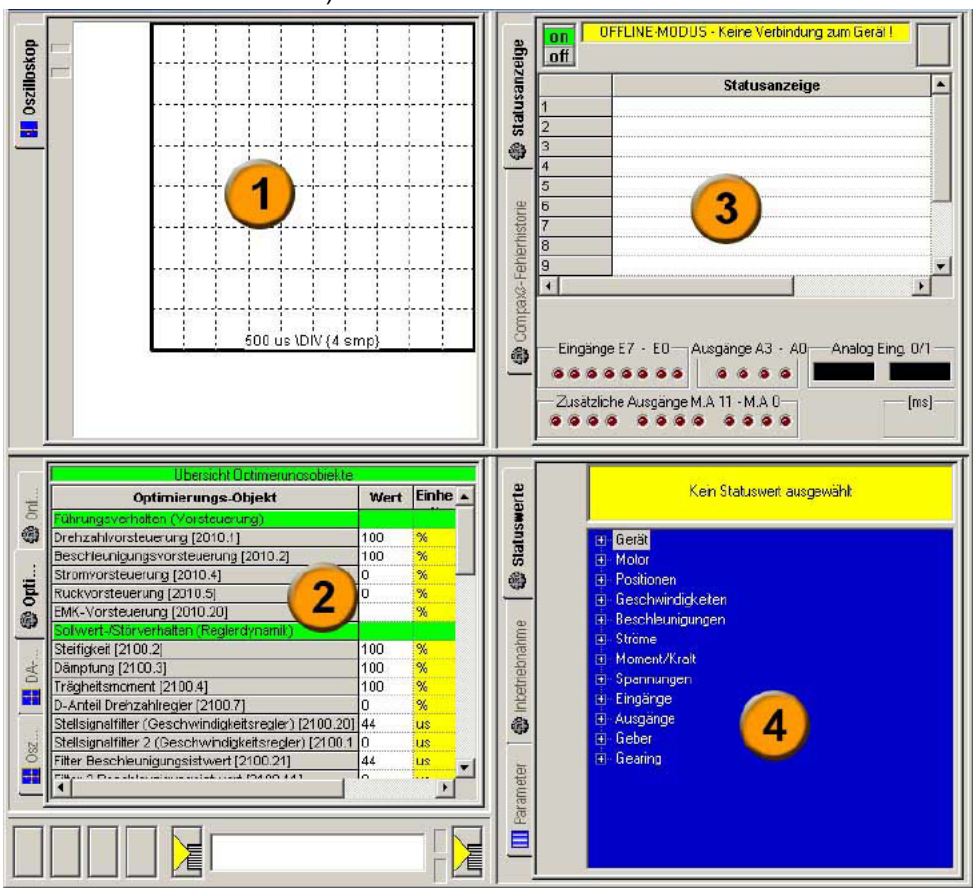
In this chapter you can read about:

- Select the entry **"Optimization"** in the tree.
- Open the optimization window by clicking on the **"Optimization Tool"** button.

4.4.1. Optimization window

Layout and functions of the optimization window

Segmentation	Functions (TABs)
Window1:	◆ **Oscilloscope** (see on page 118)
Window 2:	◆ **Optimization: Controller optimization** (see on page 129) ◆ **D/A Monitor** (see on page 163): Output of status values via 2 analog outputs ◆ Scope Settings
Window 3:	◆ Status Display ◆ Compax3 Error History
Window 4:	◆ Status values ◆ Commissioning: **Setup mode** (see on page 141) with **load identification** (see on page 126) ◆ Parameters for commissioning, test movements (relative & absolute) and for load identification.



4.4.2. Scope

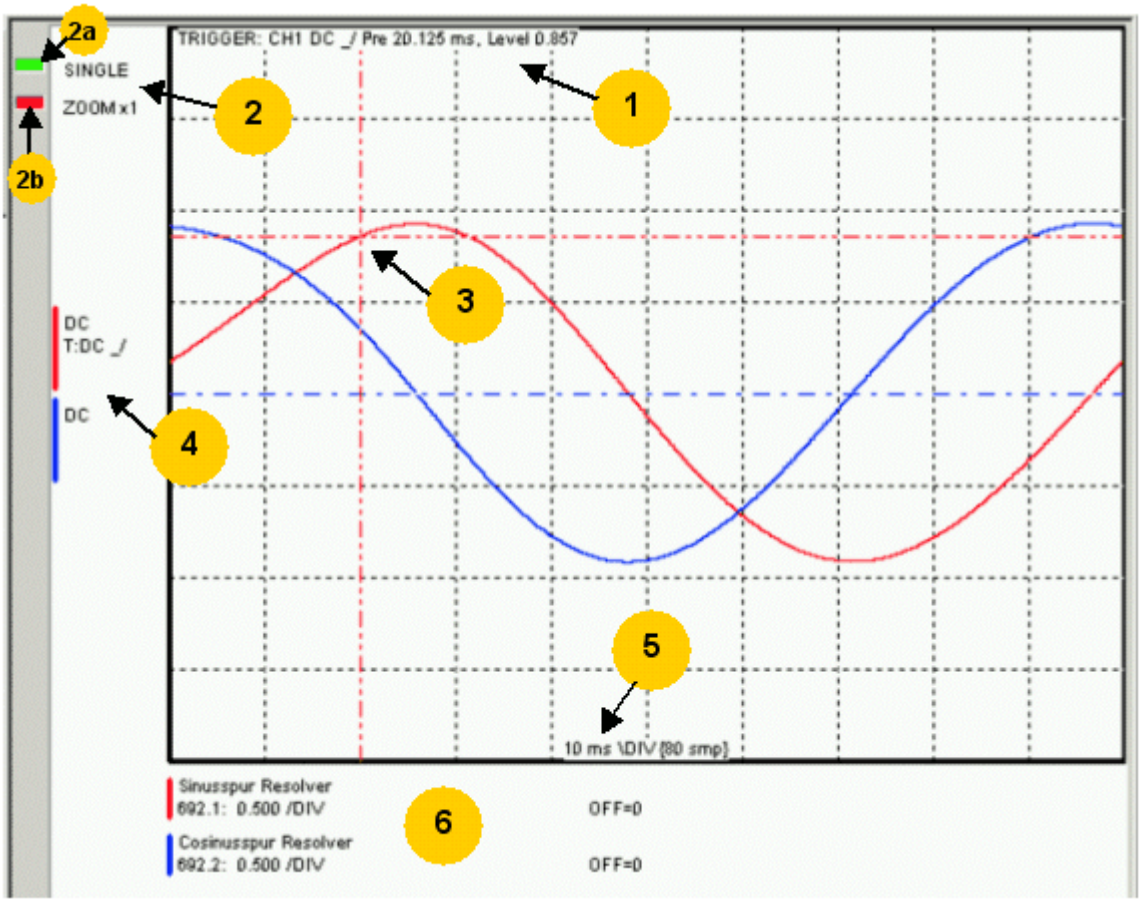
In this chapter you can read about:

The integrated oscilloscope function features a 4-channel oscilloscope for the display and measurement of signal images (digital and analog) consisting of a graphic display and a user interface.

Special feature:

In the single mode you can close the ServoManager after the activation of the measurement and disconnect the PC from Compax3 and upload the measurement into the ServoManager later.

4.4.2.1 Monitor information



1: Display of the trigger information

2: Display of the operating mode and the zoom setting

- **2a:** Green indicates, that a measurement is active (a measurement can be started or stopped by clicking here).
- **2b:** Active channel: The active channel can be changed sequentially by clicking here (only with valid signal source).

3: Trigger point for Single and Normal operating mode

4: Channel information: Type of display and trigger setting

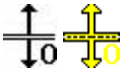
5: X-DIV: X deviation set

6: Single channel sources

Cursor modes -functions

Depending on the operating mode, different cursor functions are available within the osci monitor.

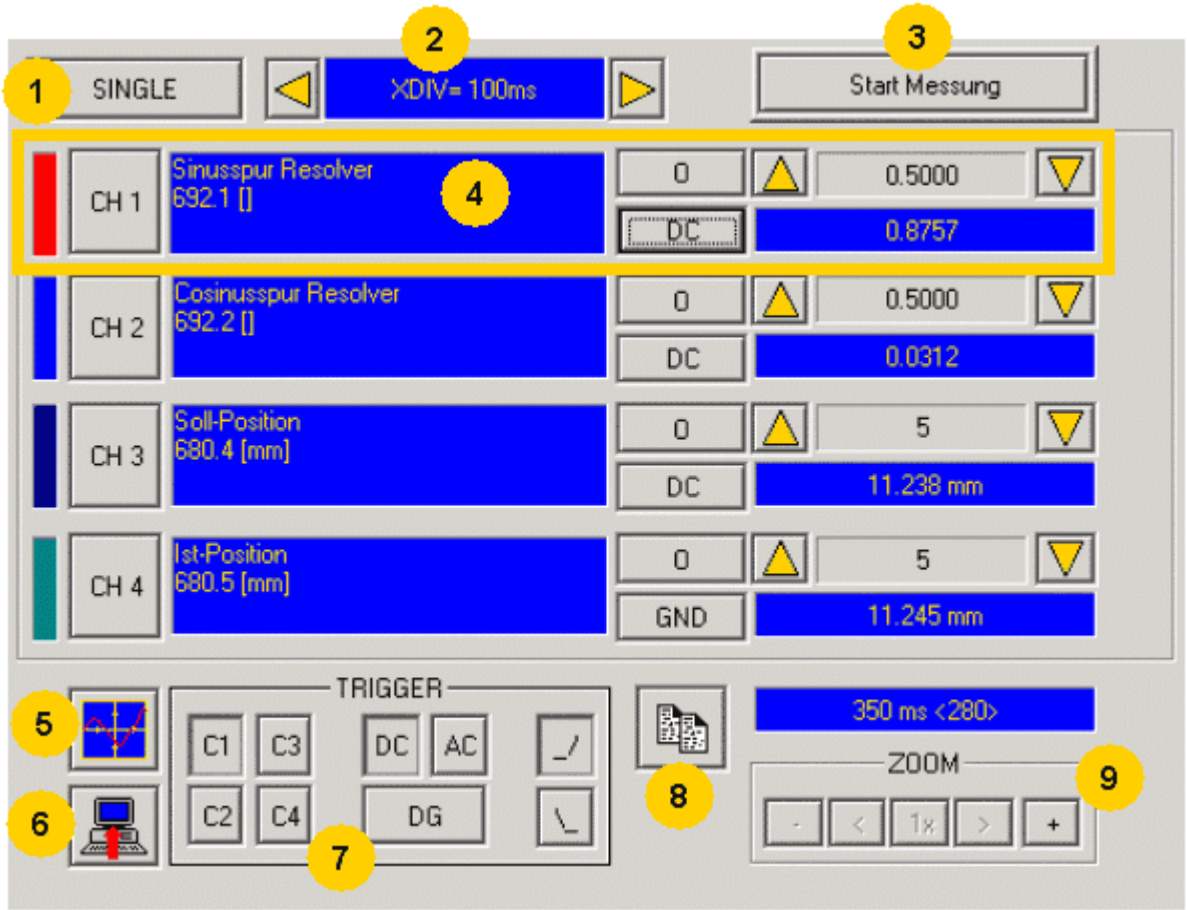
The functions can be changed sequentially by pressing on the right mouse button.

Cursor Symbol	Function
	Set Marker 1 the measurement values of the active channel as well as the Y difference to marker 2 are displayed
	Set Marker 2
	Delete and hide marker
	Move offset of the active channel. The yellow symbol indicates that the scrolling is active.
	Set trigger level and pretrigger

In the ROLL operating mode, marker functions and set trigger level positions are not available.

4.4.2.2 User interface

In this chapter you can read about:



1: **Operating mode switch** (see on page 120) (Single / Normal / Auto / Roll)

2: **Setting the time basis** (see on page 120)

3: Starting / Stopping the measurement (prerequisites are valid channel sources and if necessary valid trigger settings.)

4: **Setting channel** (see on page 121) (Channels 1 ...4)

5: **Special functions** (see on page 122) (Color settings; memorizing settings and measurement values)

6: Loading a measurement from Compax3: in the single mode you can close the ServoManager after the activation of the measurement and disconnect the PC from Compax3 and upload the measurement later.

7: **Setting triggering** (see on page 122)

8: Copy osci display to clipboard

9: Zoom of the osci display (1, 2, 4, 8, 16 fold) with the possibility to shift the zoom window (<,>)

Oscilloscope operating mode switch:

Oscilloscope operating mode switch:

Selection of the desired operating mode: SINGLE, NORMAL; AUTO and ROLL by clicking on this button.

Changing the operating mode is also permitted during a measurement. The current measurement is interrupted and started again with the changed settings.

The following operating modes are possible:

Operating mode	Short description
SINGLE	Single measurements of 1-4 channels with trigger on a freely selectable channel
NORMAL	Like Single, but after each trigger event, the measurement is started again.
AUTO	No Trigger. Continuous measuring value recording with the selected scanning time or XDIV setting
ROLL	Continuous measuring value recording of 1 .. 4 channels with selectable scanning time and a memory depth of 2000 measuring values per channel.

With SINGLE / NORMAL / AUTO, the measurement is made in Compax3 and is then loaded into the PC and displayed.

With ROLL, the measuring values are loaded into the PC and displayed continuously.

Setting the time basis XDIV

Setting the time basis XDIV

Depending on the selected operating mode, the time basis can be changed via the arrow keys.

For the operating modes SINGLE, NORMAL and AUTO, the following XDIV time settings are possible:

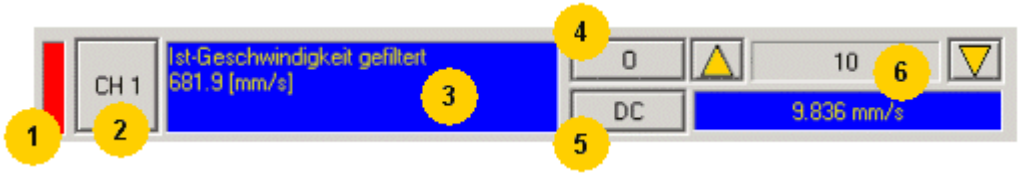
XDIV	Mode	Scanning time	Samples DIV/TOTAL	Measuring time
0.5ms	1	125us	4/40	5ms
1.0ms	2	125µs	8/80	10ms
2.0ms	3	125µs	16/160	20ms
5.0ms	4	125µs	40/400	50ms
10.0ms	5	125µs	80/800	100ms
20.0ms	6	250µs	80/800	200ms
50.0ms	7	625µs	80/800	500ms
100.0ms	8	1.25ms	80/800	1s
200.0ms	9	2.50ms	80/800	2s
500.0ms	10	6.25ms	80/800	5s
1s	11	12.50s	80/800	10s
2s	12	25.00ms	80/800	20s
5s	13	62.50ms	80/800	50s
10s	14	125.00ms	80/800	100s

For the operating ROLL, the following XDIV time settings are possible:

XDIV	Mode	Scanning time	Samples DIV/TOTAL
2 ms	54	125us	200/2000
2ms	54	125µs	200/2000
4ms	55	125µs	200/2000
10ms	56	125µs	200/2000
20ms	57	125µs	200/2000
40ms	58	125µs	200/2000
100ms	59	250µs	200/2000
200ms	60	625µs	200/2000

Changing the time basis is also permitted during an OSCI measuring sequence. This means, however, that the current measurement is interrupted and started again with the changed settings.

Settings for channels 1..4



1: Select channel color

2: Open menu for channel-specific settings

- **Resetting channel CH 1..4:** All channel settings are deleted.
  Please note: Channels can only be filled with sources one after the other. It is, for example, not possible to start a measurement which has only a signal source for channel 2!
- **Select channel color:**Here you can change the color of the channel.
- **Show/hide channel:**Hide/show display of the channel.
- **Change logic display mask:**Mask bits in logic display.
- **Autoscale:**Calculating YDIV and offset: The program calculates the best settings for YDIV and channel offset in order to display the complete signal values optimally.

3: Set signal source with object name, number and if necessary unit

- Define source: Draw the desired status object with the mouse (drag & drop) from the "Status value" window (right at the bottom) into this area.
  Multiple oscilloscope in Compax3M: select device in addition to the object.

4: Set Channel offset to 0

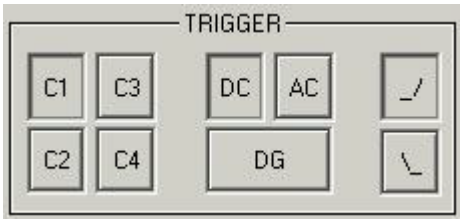
5: Select channel display (GND, DC, AC, DIG)

- **DC:**Display of the measurement values with constant component
- **AC:**Display of the measurement values without constant component
- **DIG:**Display of the individual bits of an INT signal source.
  The displayed bits can be defined via the logic display mask.
- **GND:**A straight line is drawn on the zero line.

6: Set Y-amplification (YDIV)

Change of the Y amplification YDIV in the stages 1, 2, 5 over all decades.
Arrow upwards increases YDIV, arrow downwards diminishes YDIV.
The standard value is 1 per DIV.
The measurement value of the channel at the cursor cross is displayed.

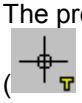
Trigger settings



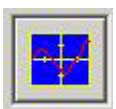
Select trigger channel: Buttons C1, C2, C3, C4

Select trigger mode: DC, AC, DG

Selecting the trigger edge: Rising_/ or falling _.

The pretrigger as well as the trigger level are set by clicking on the trigger cursor () directly in the OSCI display.

Special functions



Menu with special oscilloscope functions such as memorizing or loading settings.

Functions:

- **Select background color:**Adapt background color to personal requirements.
- **Select grid color:**Adapt grid color to personal requirements.
- **Memorize OSCI settings in file:** The settings can be memorized in a file on any drive. The file ending is *.OSC.
- The format corresponds to an INI file and is presented in the appendix.
- **Open OSCI settings from file:**Loading a memorized set of settings. The file ending is *.OSC.
- **Memorizing OSCI settings in the project:**Up to four sets of OSCI settings can be memorized in the current C3 ServoManager project. .
- **Open OSCI settings from project:**If settings were memorized in the project, they can be read in again.
- **Memorize OSCI measurement in file:**Corresponds to memorizing the setting; the measurement values of the measurement are stored in addition. Thus it is possible to memorize and read measurements completely with settings. The file ending is *.OSM.
- **Export measure samples to csv file:**e.g. for reading into Excel.

4.4.2.3 Example: Setting the Oscilloscope

SINGLE measurement with 2 channels and logic trigger on digital inputs

The order of the steps is not mandatory, but provides a help for better understanding.

As a rule, all settings can be changed during a measurement. This will lead to an automatic interruption of the current measurement and to a re-start of the measurement with the new settings:

Assumption: A test movement in the commissioning mode is active.

1.) Select OSCI operating mode

2.) Select Time basis XDIV

3.) Select channel 1 signal source digital inputs 120.2 from status tree with the aid of Drag & Drop

4.) Select channel 2 (filtered actual speed) via "Drag and drop" from the status tree

5.) Set trigger to channel 1 and DG.

Input of the mask in HEX

Triggering a rising edge to input I1.

BIT 0 (value 1) = I0

BIT 1 (value 2) = I1

BIT 2 (value 4) = I2 etc.

Trigger to input	I0	I1	I2	I3	I4	I5	I6	I7
Trigger mask in hex	1	2	4	8	10	20	40	80

The masks can also be combined so that the trigger is only active, if several inputs are active. Example: Triggering to I2 and I5 and I6 -> 4h + 20h + 40h = 64h

The mask for input I1 is in this case 2.

Select rising edge.

NOTE: If the trigger mask DG (digital) is selected for a channel, the display mode of the trigger channel is automatically set to DIG display.

6.) Start measurement

7.) Set pretrigger in the OSCI window

Note: There is no level for the DIG trigger. The the event limit determines the mask

If a trigger event occurs, the measurement values are captured until the measurement is completed.

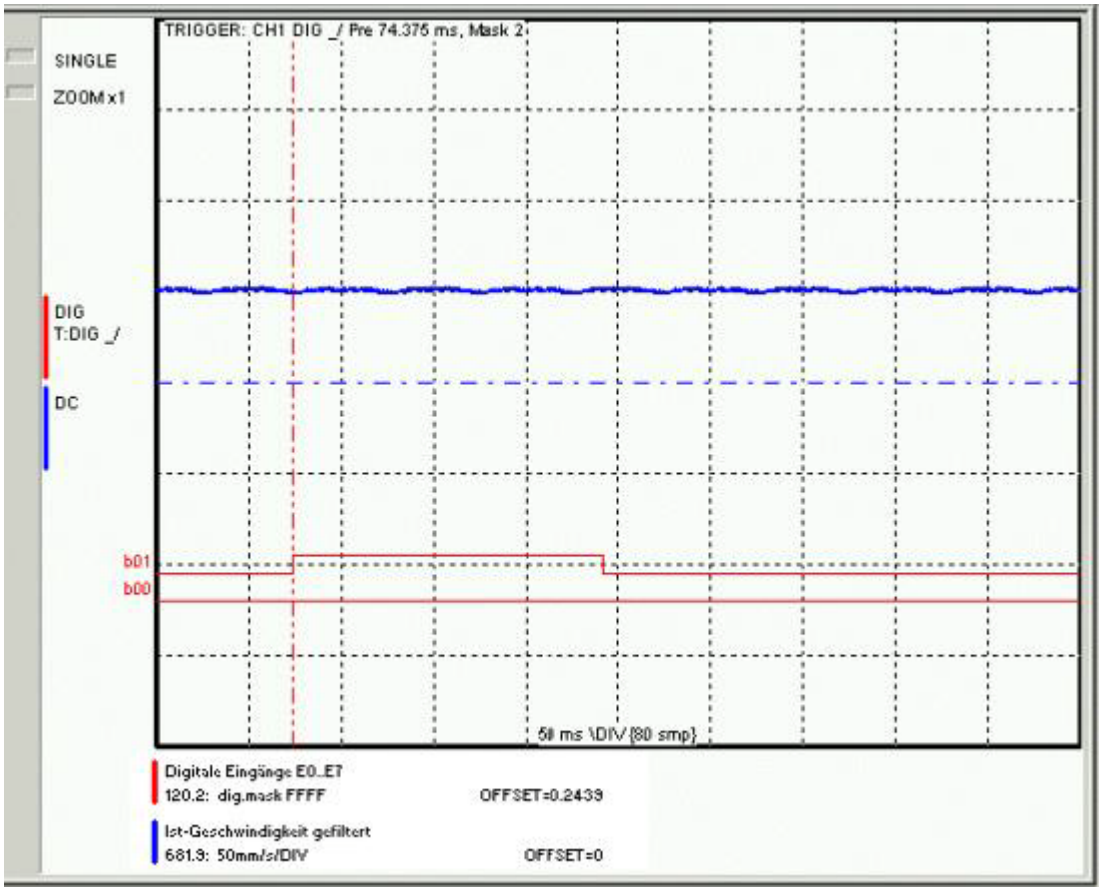
Afterwards, the measurement values are read from the Compax3 and displayed.

The display mask of trigger channel 1 was not yet limited, therefore it shows all 16 bit tracks (b0...b15). In order to limit it to 8 bit tracks, you must call up the menu for channel 1 via [CH1] and select "change logic of display mask [H].

Limit the display mask to 8 bit tracks with Mask FFh.

In the display the bit tracks b0 to b7 are now shown:

Example: Only b0 and b1 are to be displayed: Set display mask to 03



4.4.3. Load identification

In this chapter you can read about:

Automatic determination of the load characteristic value:

- of the mass moment of inertia with rotary systems
- of the mass with linear systems

4.4.3.1 Principle

The load characteristic value is automatically determined.

For this it is necessary to excite the system additionally with a signal (excitation signal = noise).

The excitation signal is fed into the control loop. The control loop dampens the excitation signal. Therefore, the superimposed control loop is set so slowly by reducing the stiffness, that the measurement is not influenced.

A superimposed test movement is additionally possible. This helps to eliminate possible mechanical effects such as rubbing caused by friction.

4.4.3.2 Boundary conditions

If the control is instable before the beginning of the measurement, please reduce the stiffness (in the optimization window at the left bottom)

The following factors can disturb a measurement:

- Systems with high friction (e.g. linear actuators with sliding guide)
  Here, the systems where the static friction is considerably higher than the kinetic friction (slip-stick effect) are especially problematic.
- Systems with significant slack points (play)
- Systems with "too light" or susceptible to oscillation bearing of the total drive (rack).
  Formation of rack resonances. (e.g. with gantries,...)
- Non constant disturbance forces which influence the speed development. (e.g. extremely strong slot moments)

The effects of the factors one to three on the measurement can be reduced by using a test movement.

Caveat emptor (exclusion of warranty)

Due to multiple possibilities for disturbing influences of a real control path, we cannot accept any liability for secondary damages caused by faultily determined values. Therefore it is essential to verify all values automatically determined before loading them into the control loop.

4.4.3.3 Process of the automatic determination of the load characteristic value (load identification)

- Please click on "unknown: default values are used" in the configuration wizard in the "External moment of inertia" window.
- After the configuration download, you can enter directly, that the optimization window is to be opened.
- In the Commissioning window (left at the bottom) change to commissioning mode.
- Finally enter the values of the excitation signal and of the test movement in the parameter window.
  Parameters of the excitation signal:
  - Amplitude of the excitation signal in % of the motor reference current
    Only an amplitude value causing a distinct disturbance can give a usable result.
  - permissible following error
    In order to avoid a following error caused by the excitation signal, the permissible following error must be increased for the measurement if necessary.
  - Selection of the test movement: inactive, reverse, continuous
  - Parameterizing of the test movement if necessary
- Now energize drive and open load identification window in the commissioning window.

Caution! Safeguard the travel range before energizing!

- Starting the load identification.

Caution! The drive will perform a jerky movement during load identification!

- After the measurement, the values can be accepted. Depending on the application, 2 measurements for minimum external load and maximum external load are recommended.

4.4.3.4 Tips

Tip	Problem	Measures
1	Speed too low (with reverse operation)	Increase maximum speed and adapt travel range*
2	Speed too low (with continuous operation)	Increase maximum speed
3	Test movement missing	A test movement is important for drives with high friction or with mechanical slack points (play).
4	No error detected	Please note the **boundary conditions** (see on page 126).
5	Speed too low and amplitude of the excitation signal too small (with reverse operation)	Increase amplitude of the excitation signal; increase maximum speed and adapt travel range*
6	◆ Speed too low and ◆ amplitude of the excitation signal too small (with continuous operation)	Increase amplitude of the excitation signal; increase maximum speed.
7	◆ Test movement missing ◆ amplitude of the excitation signal too small	◆ Increase amplitude of the excitation signal or / and ◆ activate an appropriate test movement
8	amplitude of the excitation signal too small	Increase the amplitude of the excitation signal.
9	Following error occurred	Increase the parameter "permissible following error" or decrease the amplitude of the excitation signal.

*if the travel range is too short, the speed is not increased, as the drive does not reach the maximum speed.

4.4.4. Control Loop Dynamics

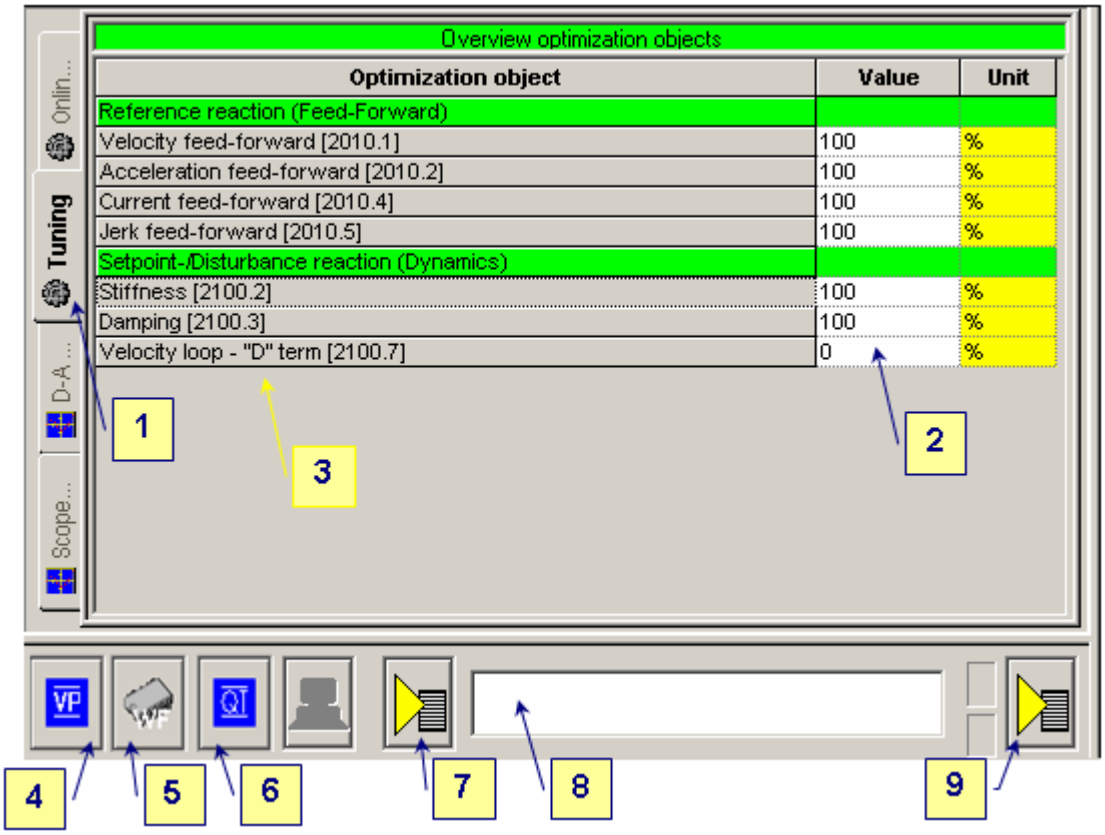
In this chapter you can read about:

The controller optimization of the Compax3 is carried out by setting the optimization objects in 2 steps:

- Via the standard settings, with the help of which many applications can be optimized in a simple manner.
- With advanced settings for users familiar with control loops.

Editing the optimization objects

The settings are made in the controller optimization window:



1: Selection of the optimization tab

2: Selection of the optimization value

3: List of the optimization objects, with object name and object number

4: Command VP for accepting a changed optimization object.
Yellow background indicates that an object was changed, however not yet set to valid with VP.

5: Command WF for permanently saving the changed objects (also after mains off/on)

6: Acknowledging a Compax3 error.

7: Setting options:

- Standard / Advanced mode
- Load protocol to clipboard, load into notepad or delete

8: Editing window: The value of an object selected with the aid of the mouse (in 3) can here be edited and confirmed with return.

9: Additional functions, depending on the Compax3 technology function.

4.4.4.1 Velocity loop stiffness

The stiffness is proportional to the control loop speed.

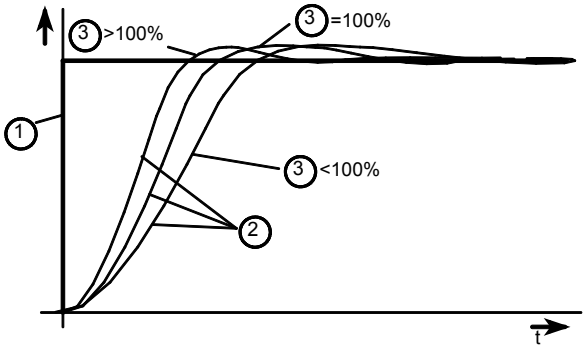
Nominal value: 100%

On increasing stiffness:

Control action becomes faster. The control loop oscillates above a critical threshold value. Set the stiffness with an adequate safety margin with respect to the oscillation threshold value.

On decreasing stiffness:

Control action becomes slower. This increases the tracking error. Current limiting will be reached later.



1: Setpoint value

2: Actual value

3: Rigidity

2100.2: Velocity loop stiffness

Unit: %	Range: 10 ... 100 000	Standard value: 100%
The stiffness is proportional to the control loop speed.		

4.4.4.2 Velocity loop damping

The damping influences the Setpoint value overshoot magnitude and the decay time constant of control loop oscillation.

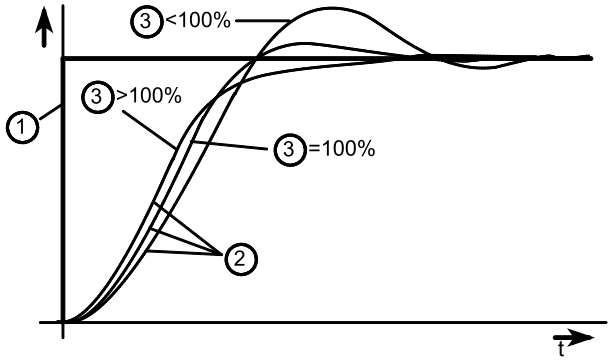
Nominal value: 100%

On increasing the damping:

Overshoot decreases. High frequency oscillation of the servo drive takes place as from a certain threshold value.

On decreasing the attenuation

The Setpoint value overshoot of the actual value increases, and the actual value oscillates for a longer time above and below the Setpoint value. As from a certain threshold value the servo drive oscillates continuously.



1: Setpoint value

2: Actual value

3: Damping

2100.3: Velocity loop damping

Unit: %	Range: 0 ... 500	Standard value: 100%
The damping influences the Setpoint value overshoot magnitude and the decay time constant of control loop oscillation.		

4.4.4.3 Filter - Actual velocity

Can be used to improve (filter) the rotation speed signal. The greater the value, the stronger becomes the filter effect. However, the rotation speed delay increases with this value, so that the maximum possible control loop dynamic range becomes smaller with values which are too large.

- If you use motors with high-quality feedback systems (SinCos© / EnDat / SineCosine feedback) and low vibration mechanics, set the value to 0.
- In the case of large load inertia in relation to the moment of inertia of the motor, a large value can achieve further improvement in the attainable stiffness.

2100.5: Filter - Actual velocity

Unit: %	Range: 0 ... 550	Standard value: 100%
This is used to improve signals (filtering) of the speed control signal		

4.4.4.4 Advanced control parameters

The Statuswerte are divided into 2 groups (user levels):

standard: here you can find all important Statuswerte

advanced: Advanced Statuswerte requiring a better knowledge

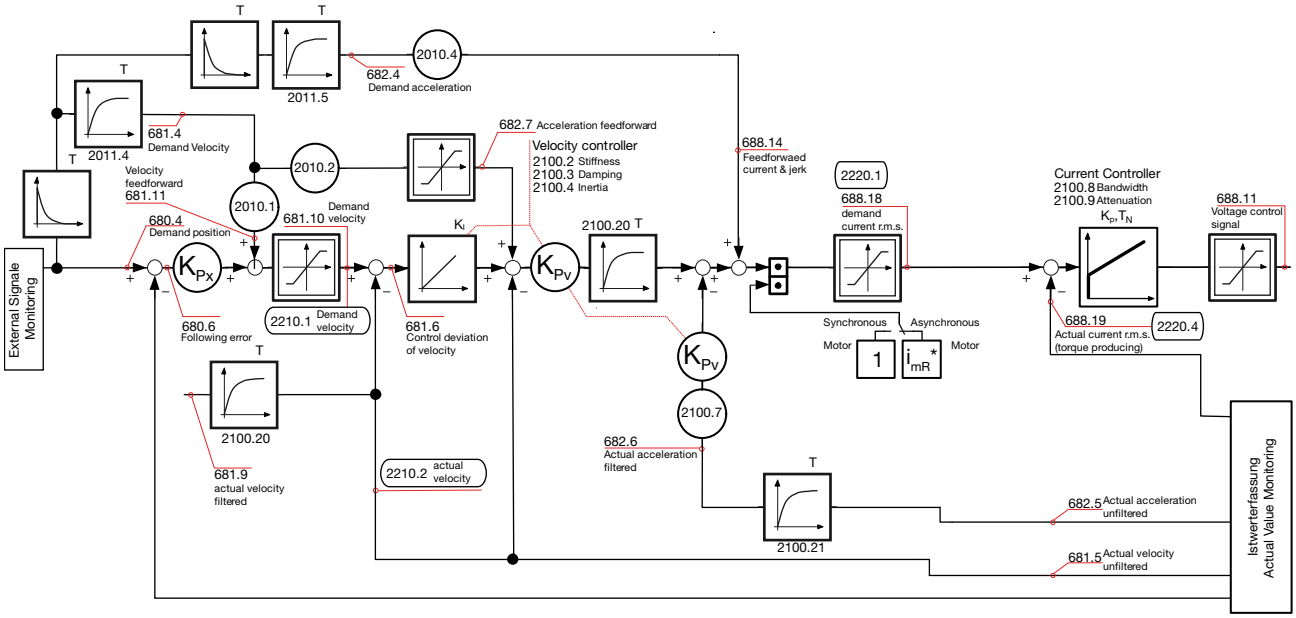
Switching of the user level

The user level can be changed in the optimization window (left hand side lower part under selection (TAB) "optimization") with the following button.

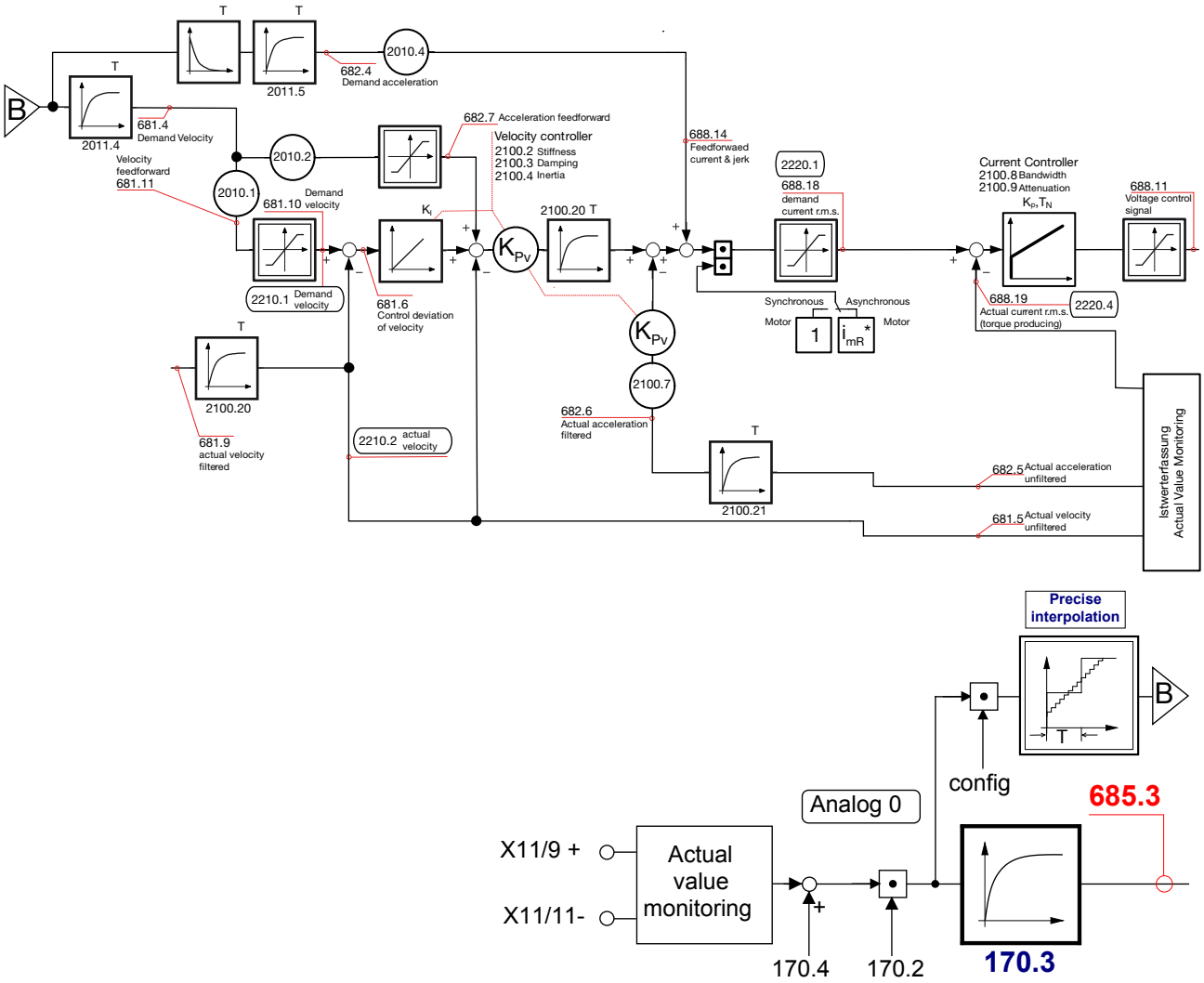
Controller structures

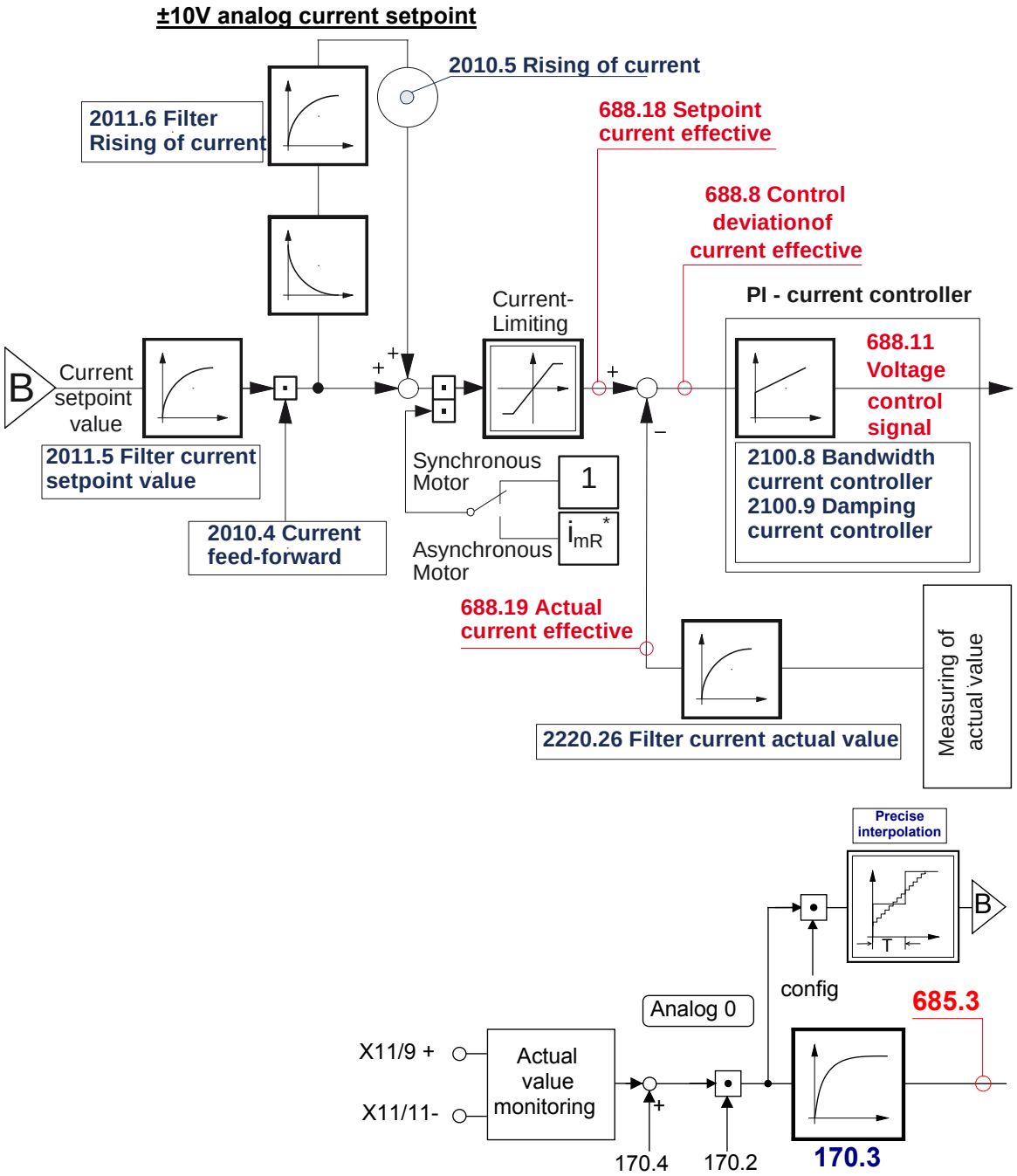
In this chapter you can read about:

Controller structure step/direction or encoder input



±10V analog speed setpoint





Controller settings

2100.8: Current regulator bandwidth

Unit: %	Range: 10 ... 200	Standard value: 50%

2100.9: Current loop - Damping

Unit: %	Range: 0 ... 500	Standard value: 100%

2100.7: D-component of speed controller

Unit: %	Range: 0 ... 4 000 000	Standard value: 0

2100.6: Filter - Actual acceleration

Unit: %	Range: 0 ... 550	Standard value: 100

2100.4: Moment of Inertia

Unit: %	Range: 10 ... 500	Standard value: 100%

Position controller

For motors with distinct transition from static friction to kinetic friction in connection with a noisy feedback signal, where a control oscillation is generated at standstill, 3 optimization objects are available:

- Deadband (Object 2200.20)
- Following error filter (object 2200.11) and
- Friction compensation (Object 2200.21)

Application:

The control oscillation at standstill is eliminated by the deadband.

Please note, however, that the possible exactitude is reduced by the deadband.

The use of the following error filter and the friction compensation can reduce the deadband.

Noisy feedback signal:

A noisy feedback signal necessitates to set an unnecessarily large deadband.

To avoid this, the time constant of the following error filter can be increased.

Friction compensation

The following error can be reduced faster with the aid of friction compensation, which will reduce the deadband.

Note:

The objects (deadband, following error filter, friction compensation) are stored in the motor library. Therefore these objects are overwritten when configuring another motor.

PowerRod

When configuring a PowerRod, the deadband (+/-25µm) and the following error are preassigned, the friction compensation is switched off.

Remaining motors of the motor library

For all other motors (not PowerRod), the objects are preassigned with "0".

Forward control measures

Forward control of rotation speed, acceleration and current

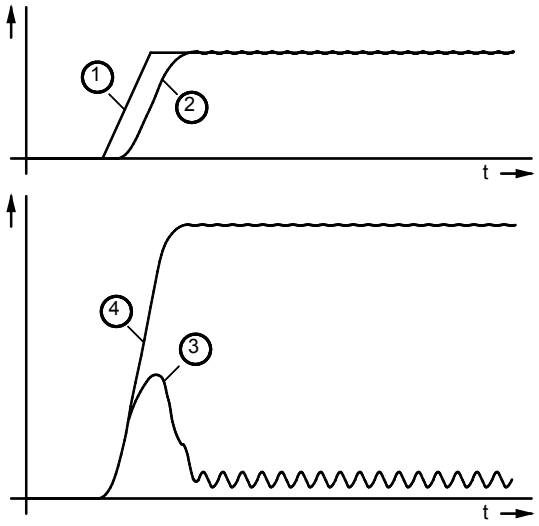
Advantages:

- Minimal following error
- Improves the transient response
- Gives greater dynamic range with lower maximum current

Principle: A positioning is calculated in the Setpoint value plate and specified as the Setpoint value for the position controller. This provides the Setpoint value plate with the preliminary information on changes in speed, acceleration and current required for positioning. Switching this information to the controller then makes it possible to reduce tracking errors to a minimum. The transient response of the controller is also improved and the drive dynamics are increased.

The stability of the control loop is unaffected by the forward control.

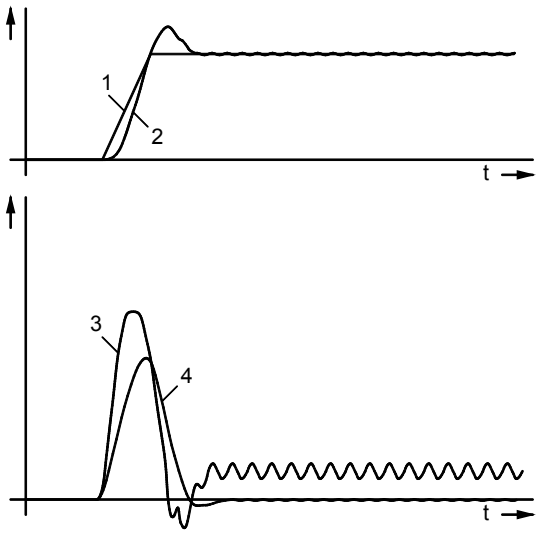
Positioning without forward control:



2010.1: Speed feedforward

Unit: %	Range: 0 ... 500	Standard value: 100%

Effect of the speed feedforward



1: Speed setpoint value

2: Actual speed value

3: Motor current

4: Following error

2011.1: Filter external rotation speed feedforward

Unit: %	Range: 0 ... 550	Standard value: 500*

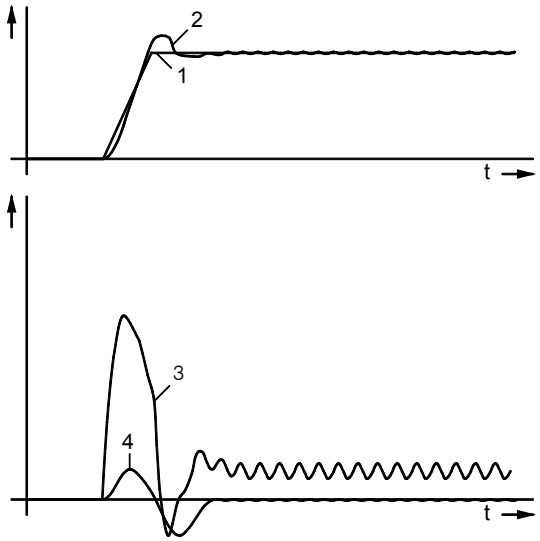
* Depending on the operating mode

With ±10V analog setpoint control the standard value = 0; otherwise 500.

2010.2: Acceleration feed-forward

Unit: %	Range: 0 ... 500	Standard value: 100%

Additional effect of forward acceleration control



1: Speed setpoint value

2: Actual speed value

3: Motor current

4: Following error

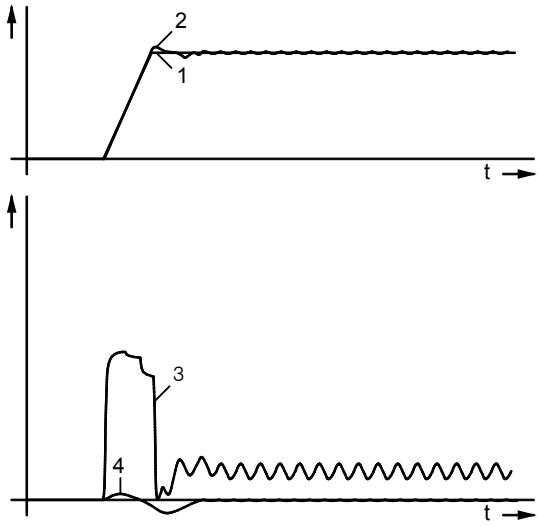
2011.2: Filter external acceleration feedforward

Unit: %	Range: 0 ... 550	Standard value: 500%

2010.4: Current feed-forward

Unit: %	Range: 0 ... 500	Standard value: 0%

Additional effect of current feedforward



1: Speed setpoint value

2: Actual speed value

3: Motor current

4: Following error

Rising of current (Para)

2010.5: Current rise

Unit: %	Range: 0 ... 500	Standard value: 0%
Influences the rising of current		

Filter rising of current (Para)

2011.3: Filter current rise

Unit: %	Range: 0 ... 550	Standard value: 500%

4.4.5. Input simulation

In this chapter you can read about:

Function

The input simulation is used for the performance of tests without the complete input/output hardware being necessary.

The digital inputs (standard and inputs of M10/M12 option) as well as the analog inputs are supported.

The following operating modes are available for digital inputs:

- The physical inputs are deactivated, the digital inputs are only influenced via the input simulation.
- The digital inputs and the physical inputs are logically or-linked.
  This necessitates very careful action, as the required function is, above all with low-active signals, no longer available.

The pre-setting of an analog input value is always made in addition to the physical analog input.

The function of the inputs depends on the Compax3 device type; please refer to the respective online help or the manual.

The input simulation is only possible if the connection with Compax3 is active and if the commissioning mode is deactivated!

4.4.5.1 Calling up the input simulation

Open the optimization window (double click in the C3 ServoManager tree entry: Optimization).

Activate the Tab “Setup” in the right lower window.

Clicking on the following button will open a menu; please select the input simulation.

4.4.5.2 Operating Principle

Window Compax3 InputSimulator:

1. Row: Standard Inputs E7 ... E0 = “0” button not pressed; = “1” switch pressed

2. Row: Optional digital inputs (M10 / M12)

Green field: port 4 is defined as input

Red field: port 4 is defined as output

the least significant input is always on the right side

3. Row: If the button “deactivating physical inputs” is pressed, all physical, digital inputs are deactivated; only the input simulation is active.

If both sources (physical and simulated inputs) are active, they are or-linked!

Caution!

Please consider the effects of the or-linking; above all on low-active functions.

4. Row: Simulation of the analog inputs 0 and 1 in steps of 100mV.

The set value is added to the value on the physical input.

After the input simulation has been called up, all simulated inputs are on “0”.

When the input simulation is left, the physical inputs become valid.

4.4.6. Setup mode

The setup mode is used for moving an axis independent of the system control

The following functions are possible:

- Homing run
- Manual+ / Manual-
- Activation / deactivation of the motor holding brake.
- Acknowledging errors
- Defining and activating a test movement
- Activating the digital outputs.
- **Automatic determination of the load characteristic value** (see on page 126)
- Setup of the load control

Activating the commissioning mode

By activating the setup mode, das Steuerungsprogramm (IEC-Programm) is deactivated; the system function of the device is no longer available.

Access via an interface (RS232/RS485, Profibus, CANopen,...) and via digital inputs is deactivated. (if necessary, acyclic communication ways are nevertheless possible (e.g. Profibus PKW channel)

Caution!
The safety functions are not always guaranteed during the setup mode! This will for instance lead to the fact that the axis may trundle to a stop if the Emergency stop button is pressed (interruption of the 24 V on C3S X4.3), which requires special caution with z axes!

- In the Commissioning window (left at the bottom) the commissioning mode is activated.
- Then parameterize the desired test movement in the Parameter window. You can accept changed configuration settings into the current project.
- Now energize drive in the commissioning window and start the test movement.

Caution! Safeguard the travel range before energizing!

Deactivating the commissioning mode

If the setup mode is left, the drive is deactivated and the das Steuerungsprogramm (IEC-Programm) is re-activated.

Note:

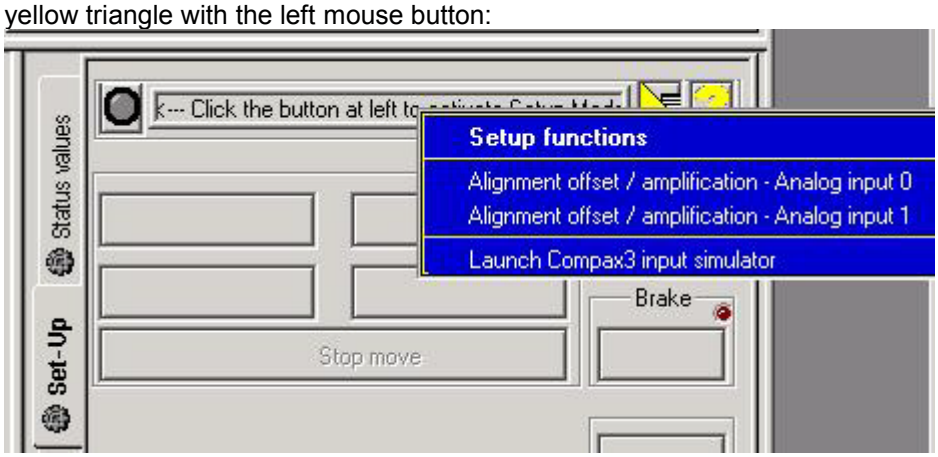
- The parameters of the commissioning window are saved with the project and are loaded into Compax3 if the commissioning mode is activated (see explanation below).

4.4.7. Alignment of the analog inputs

In this chapter you can read about:

There are two possibilities to align the analog inputs in the optimization window:

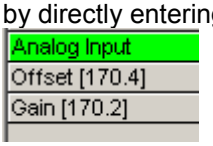
- Wizard-guided under commissioning: Commissioning functions (click on the yellow triangle with the left mouse button:



Caution!
This wizard guided automatic alignment does not work if you bridge Ain+ with Ground for the alignment!
In this case, please make a manual alignment as described below.

or

- by directly entering under optimization: Analog input



4.4.7.1 Offset alignment

Performing an offset alignment when working with the ±10V analog interface in the optimization window under optimization: Analog input Offset [170.4].

Enter the offset value for 0V input voltage.

The currently entered value is shown in the status value "analog input" (optimizing window at the top right) (unit: 1 ≡ 10V). Enter this value directly with the same sign as offset value.

The status value "analogue input" shows the corrected value.

4.4.7.2 Gain alignment

Performing an offset alignment when working with the ±10V analog interface in the optimization window under optimization: Analog input: Gain [170.2].

A gain factor of 1 has been entered as default value.

The currently entered value is shown in the status value “analog input” (optimizing window at the top right).

The status value "analogue input" shows the corrected value.

4.4.8. Turning the motor holding brake on and off

Compax3 controls the holding brake of the motor and the power output stage. The time behavior can be set.

Application:

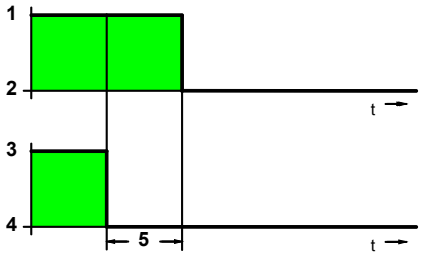
With an axis that is subject to momentum when it is halted (e. g. for a z-axis) the drive can be switched on and off such that no movement of the load takes place. The drive thereby remains energized during the holding brake response time. This is adjustable.

The power output stage current is de-energized by:

- Error or
- I0=X12/6="0"

Thereafter the motor is braked to zero rotation speed on the set ramp.

When zero speed is reached, the motor is de-energized with the delay "brake closing delay time".



1: Motor powered

2: Motor de-energized

3: Open brake

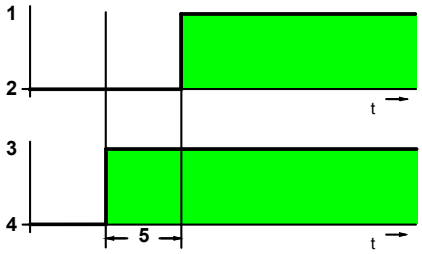
4: Engage the brake

5: Brake closing delay time

The power output stage is enabled by:

- Quit (after error; precondition X12/6 = 24V)
- I0=X12/6 = 24V
- after power on (only when device is already configured)

The motor is energized with the delay "delay time for brake release".



1: Motor powered

2: Motor de-energized

3: Open brake

4: Engage the brake

5: Delay time for brake release

5. Communication

In this chapter you can read about:

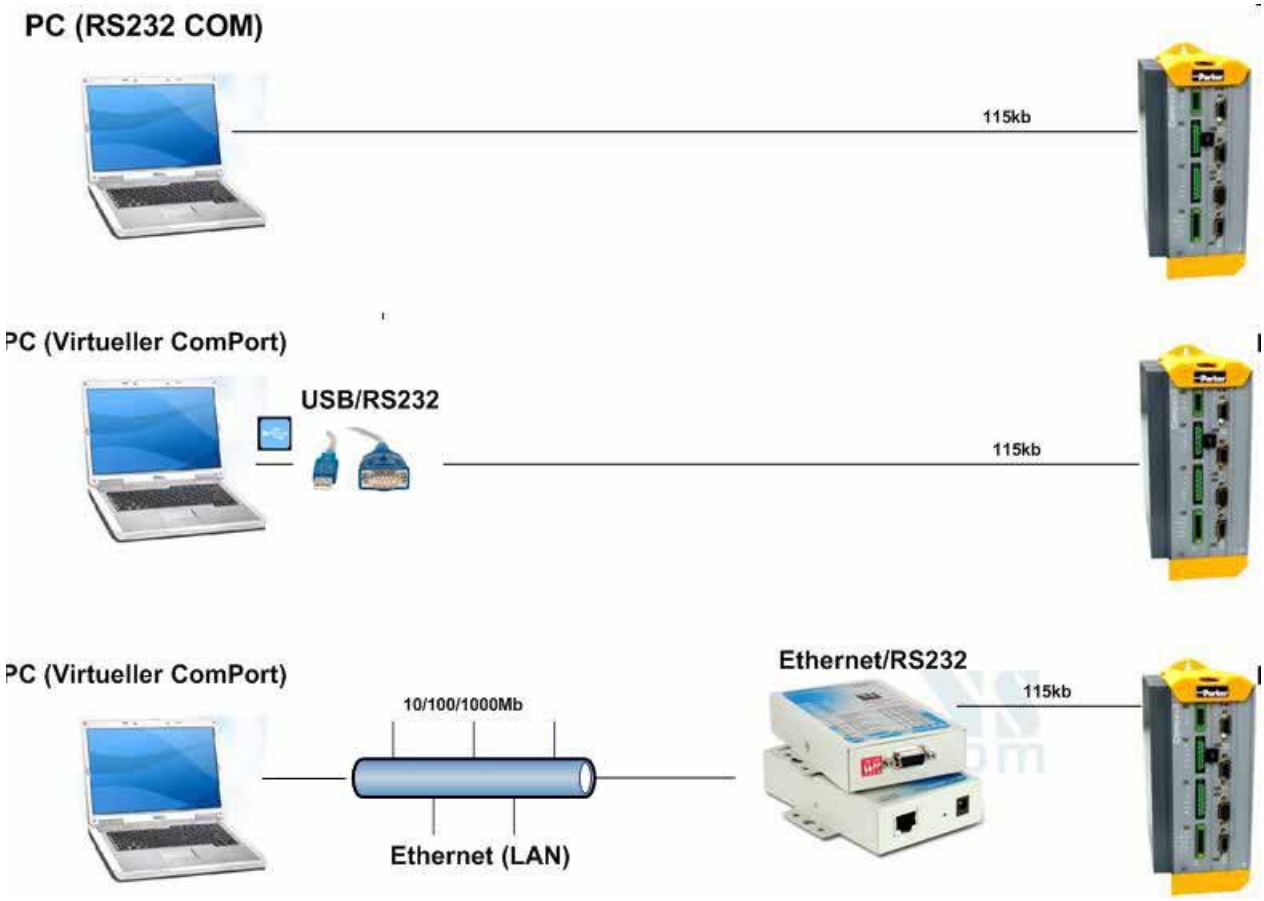
5.1 Compax3 communication variants

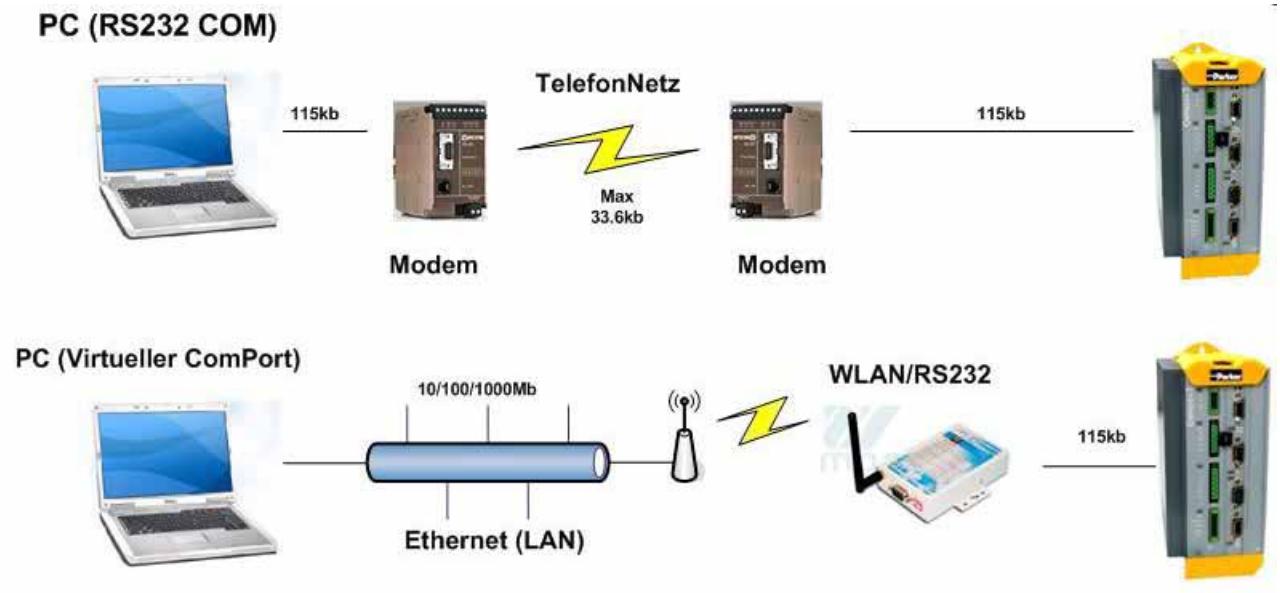
In this chapter you can read about:

Overview of all possible communication modes between Compax3 devices and a PC.

5.1.1. PC <-> Compax3 (RS232)

PC <-> Compax3 (RS232): Connections to a device

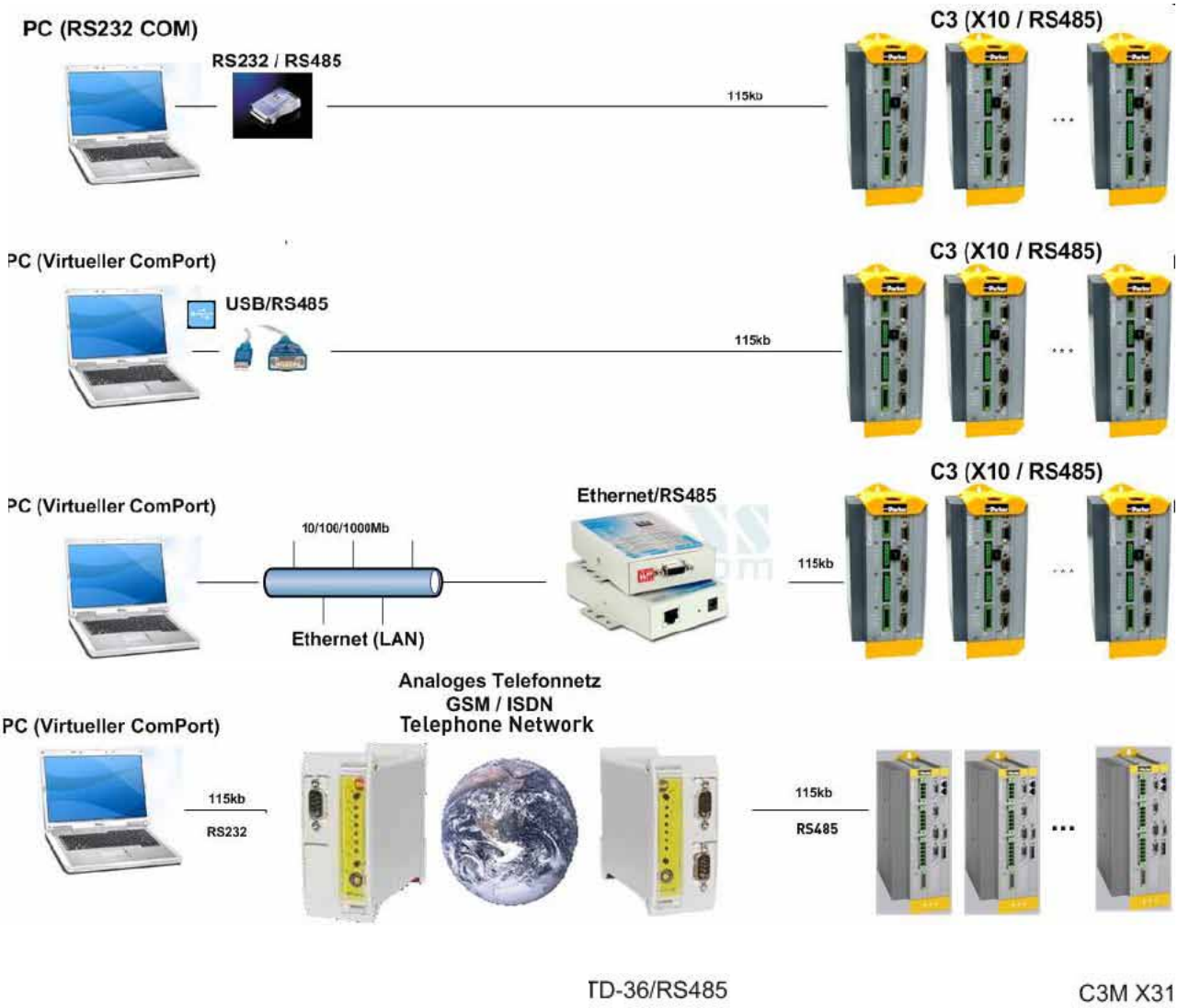


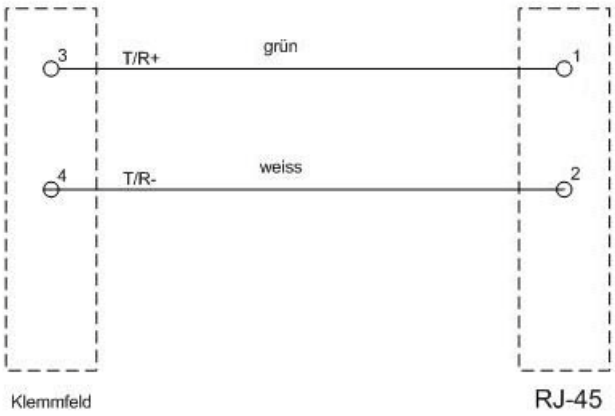

PC (RS232 COM)
115kb
TelefonNetz
Max
33.6kb
115kb
Modem
Modem
PC (Virtueller ComPort)
10/100/1000Mb
WLAN/RS232
115kb
Ethernet (LAN)


Analoges Telefonnetz
GSM / ISDN
Telephone Network
PC (Virtueller ComPort)
115kb
RS232
115kb
RS232

5.1.2. PC <-> Compax3 (RS485)

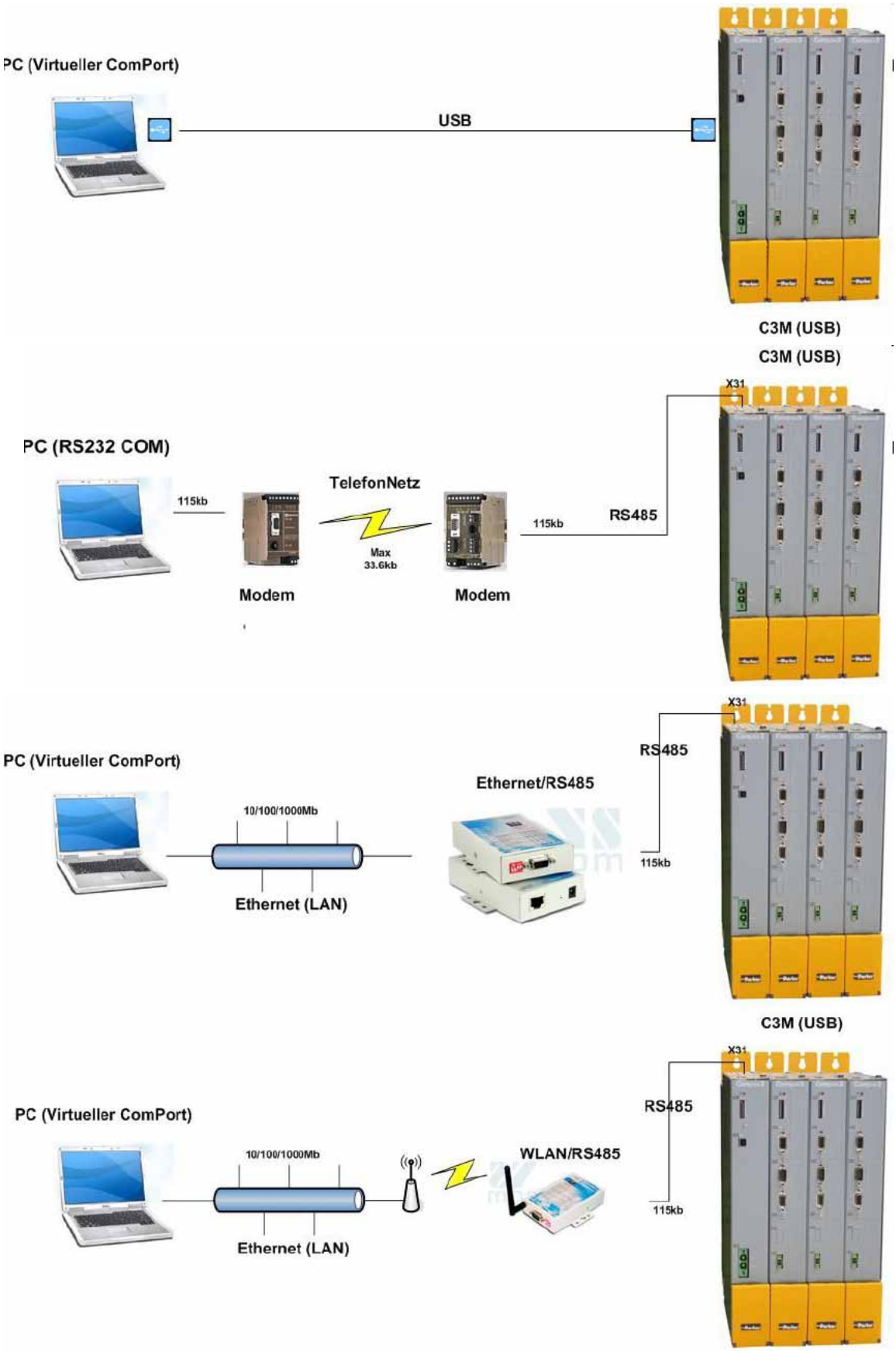
PC <-> Compax3 (RS485)





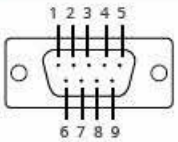
5.1.3. PC <-> C3M device combination (USB)

PC <-> C3M device combination



5.1.4. USB-RS485 Moxa Uport 1130 adapter

Male DB9



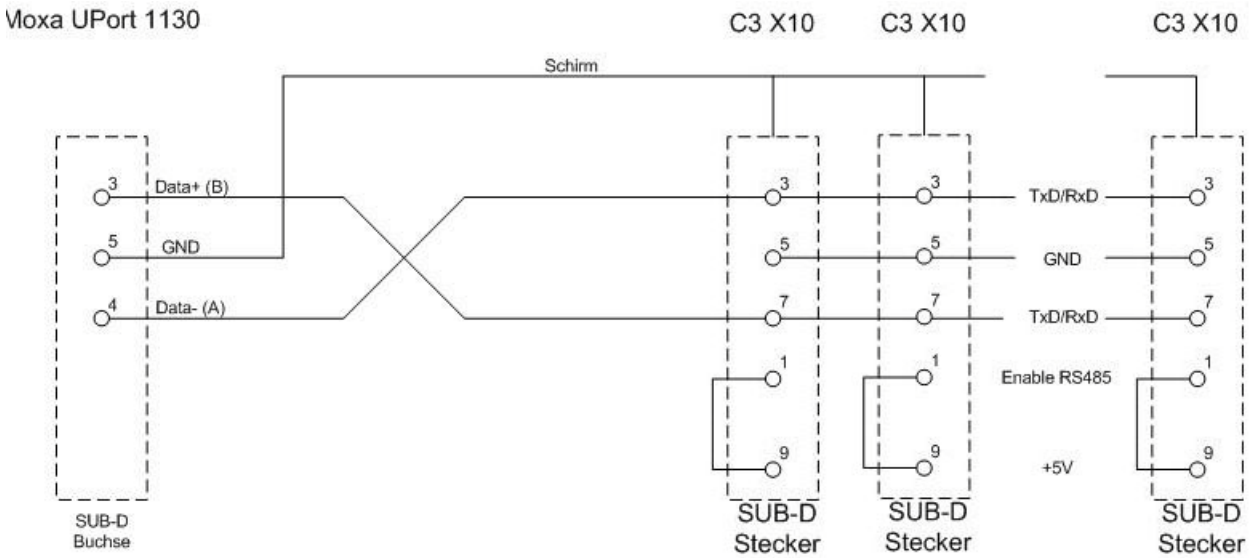
PIN	RS-422/4-wire RS-485	2-wire RS-485
1	TxD-(A)	–
2	TxD+(B)	–
3	RxD+(B)	Data+(B)
4	RxD-(A)	Data-(A)

PIN	RS-422/4-wire RS-485	2-wire RS-485
5	GND	GND
6	–	–
7	–	–
8	–	–

The serial UPort 1130 USB adapter offers a simple and comfortable method of connecting an RS-422 or RS-485 device to your laptop or PC. The UPort 1130 is connected to the USB port of your computer and complements your workstation with a DB9 RS-422/485 serial interface. For simple installation and configuration, Windows drivers are already integrated. The UPort 1130 can be used with new or legacy serial devices and supports both 2- and 4-wire RS-485. It is especially suited for mobile, instrumentation and point-of-sale (POS) applications.

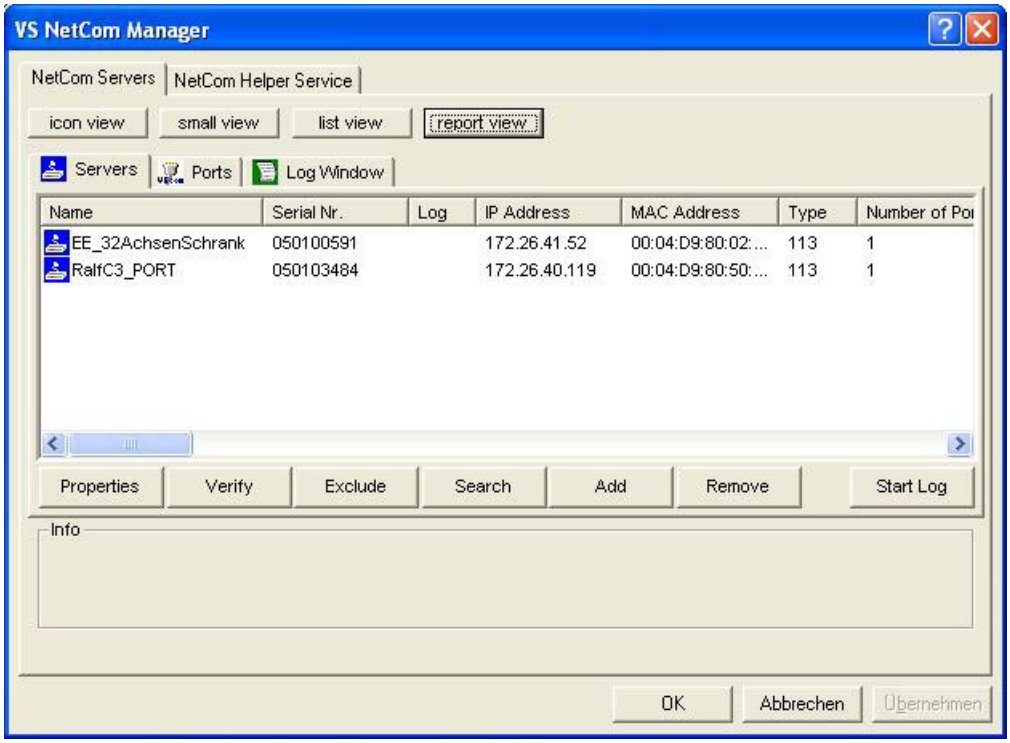
Manufacturer link: **http://www.moxa.com/product/UPort_1130.htm**
http://www.moxa.com/product/UPort_1130.htm

Connection plan for Compax3S:



5.1.5. ETHERNET-RS485 NetCOM 113 adapter

Manufacturer link: **http://www.vscom.de/666.htm**
(**http://www.vscom.de/666.htm**)



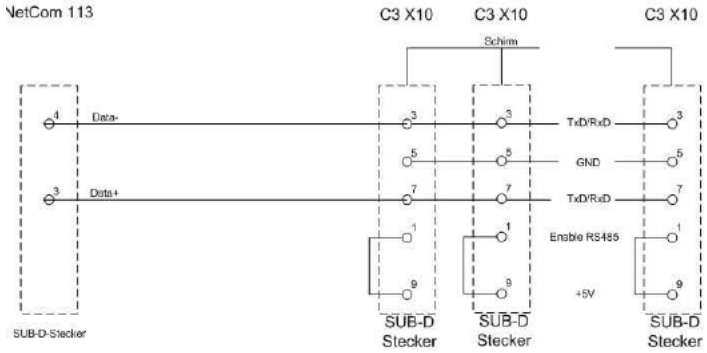
DIP Switch settings NetCom 113 for two-wire operation:

1ON 2ON 3off 4off (Mode: RS485 by ART (2 wire without Echo)

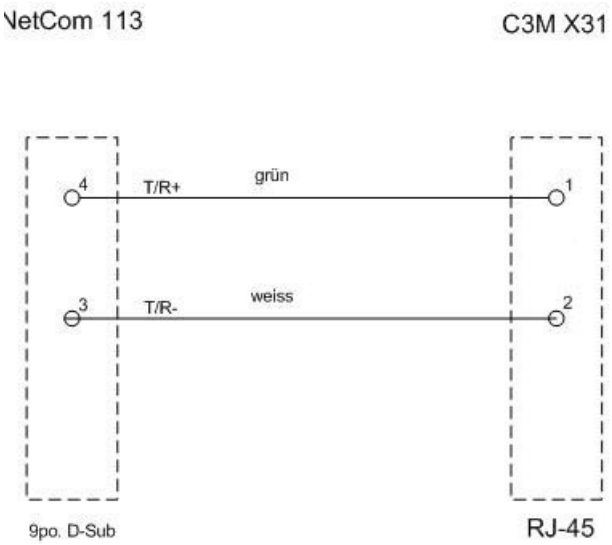
Communication settings C3S/C3M:

Object	Function	Value
810.1	Protocol	16 (two wire)
810.2	Baud rate	115200
810.3	NodeAddress	1..254
810.4	Multicast Address	

Connection plan NetCom113 <-> C3S :



Connection plan NetCom113 <-> C3M X31:



5.1.6. Modem MB-Connectline MDH 500 / MDH 504

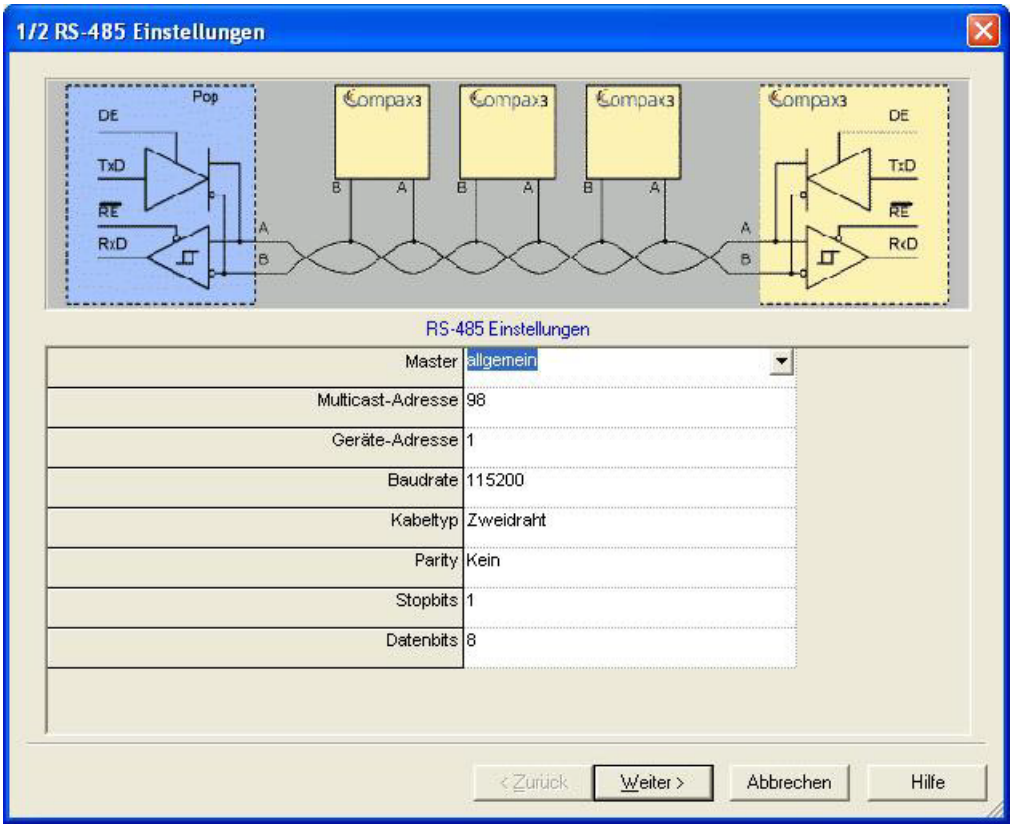
With the modems MDH500 and MDH504 manufactured by MB-Connectline, you can establish an independent connection. A virtual COM port is generated and the communication with the PC as well as the Compax3 takes place via RS232 or RS485.

It is not necessary to make any modem settings on the Compax3.

5.1.7. C3 settings for RS485 two wire operation

C3 ServoManager RS485 wizard settings:

download with configuration in RS232 mode°!



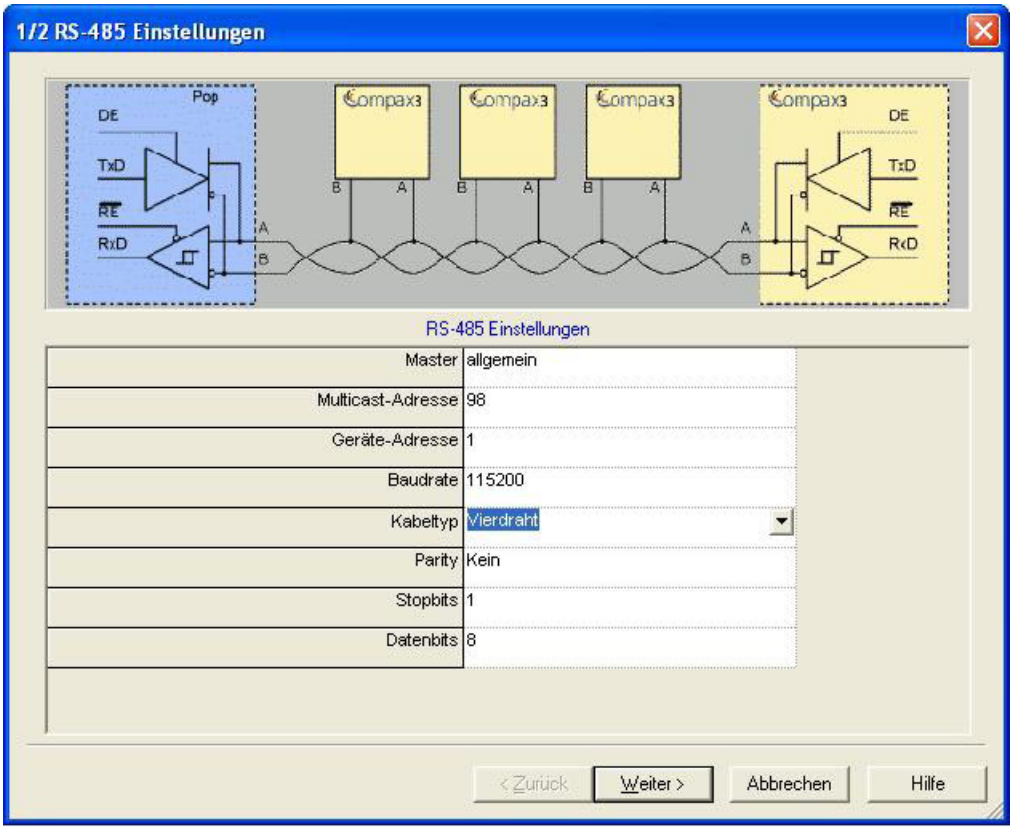
Communication settings C3S/C3M:

Object	Function	Value
810.1	Protocol	16 (two wire)
810.2	Baud rate	115200
810.3	NodeAddress	1..254
810.4	Multicast Address	

5.1.8. C3 settings for RS485 four wire operation

C3 ServoManager RS485 wizard settings:

download with configuration in RS232 mode



Communication settings C3S/C3M:

Object	Function	Value
810.1	Protocol	0 (4 wire)
810.2	Baud rate	115200
810.3	NodeAddress	1..254
810.4	Multicast Address	

5.2 COM port protocol

In this chapter you can read about:

You can communicate with Compax3 in order to read or write objects via plug X10 (or X3 on the mains module of Compax3M) on the front via a COM port (max. 32 nodes).

As a rule 2 records are possible:

- ASCII record: simple communication with Compax3
- Binary record: fast and secure communication with Compax3 by the aid of block securing.

Switching between the ASCII and the binary record via automatic record detection.

Interface settings **(see on page 226)**

Wiring

RS232: **SSK1** (see on page 205)

RS485: as **SSK27** (see on page 206) / RS485 is activated by +5V on X10/1.

USB: SSK33/03 (only for Compax3M)

5.2.1. RS485 settings values

If “Master=Pop” is selected, only the settings compatible with the Pops (Parker Operator Panels) made by Parker are possible.

Please note that the connected Pop has the same RS485 setting values.

You can test this with the "PopDesigner" software.

"Master=General" makes all Compax3 settings possible.

Multicast Address

You can use this address to allow the master to access multiple devices simultaneously.

Device Address

The device address of the connected Compax3 can be set here.

Baud rate

Adjust the transfer speed (baud rate) to the master.

Cable type

Please choose between **two-wire and four-wire RS485** (see on page 59).

Protocol

Adjust the protocol settings to the settings of your master.

5.2.2. ASCII - record

The general layout of a command string for Compax3 is as follows:

[Adr] command CR

Adr	RS232: no address RS485: Compax3 address in the range 0 ... 99 Address settings can be made in the C3 ServoManager under "RS485 settings"
Command	valid Compax3 command
CR	End sign (carriage return)

Command

A command consists of the representable ASCII characters (0x21 .. 0x7E). Small letters are converted automatically into capitals and blanks (0x20) are deleted, if they are not placed between two quotation marks.

Separator between places before and after the decimal is the decimal point (0x2E).

A numeric value can be given in the Hex-format if it is preceded by the “$” sign. Values can be requested in the Hex-format if the CR is preceded additionally by the “$” sign.

Answer strings

All commands requesting a numeric value from Compax3 are acknowledged with the respective numeric value in the ASCII format followed by a CR without preceding command repetition and following statement of unit. The length of these answer strings differs depending on the value.

Commands requesting an Info-string (e.g. software version), are only acknowledged with the respective ASCII character sequence followed by a CR, without preceding command repetition. The length of these answer strings is here constant.

Commands transferring a value to Compax3 or triggering a function in Compax3 are acknowledged by:

>CR

if the value can be accepted resp. if the function can be executed at that point in time.

If this is not the case or if the command syntax was invalid, the command is acknowledged with

!xxxxCR

.

The 4 digit error number **xxxx** is given in the HEX format; you will find the meaning in the **appendix** (see on page 164).

RS485 answer string

When using RS485, each answer string is preceded by a “*“" (ASCII - character: 0x2A).

Compax3 commands

Read object

RS232: O [$] Index , [$] Subindex [$]

RS485: Address O [$] Index , [$] Subindex [$]

The optional "$" after the subindex stands for "hex-output" which means that an object value can also be requested in hex;

For example "**O 0192.2**": (Object 402.2)

Write object

RS232: O [$] Index , [$] Subindex = [$] Value [; Value2 ; Value3 ; ...]

RS485: Address O [$] Index , [$] Subindex = [$] Value [; Value2 ; Value3 ; ...]

The optional "$" preceding Index, Subindex and value stands for "Hex-input" which means that Index, Subindex and the value to be transferred can also be entered in hex (e.g. **O $0192.2=$C8**).

5.2.3. Binary record

The binary record with block securing is based on 5 different telegrams:

- 2 request telegrams which the control sends to Compax3 and
- 3 response telegrams which Compax3 returns to the control.

Telegram layout

Basic structure:

Start code	Address	Number of data bytes - 1	Data				Block securing	
SZ	A	L	D0	D1	...	Dn	Crc(Hi)	Crc(Lo)

The start code defines the frame type and is composed as follows:

Bit		7	6	5	4	3	2	1	0
Frame type		Frame identification				PLC		Gateway	Address
RdObj	read object	1	0	1	0	x	1	x	x
WrObj	write object	1	1	0	0	x	1	x	x
Rsp	response	0	0	0	0	0	1	0	1
Ack	positive command acknowledgement	0	0	0	0	0	1	1	0
Nak	Negative command acknowledgement	0	0	0	0	0	1	1	1

Bits 7, 6, 5 and 4 of the start code form the telegram identification; Bit 2 is always "1".

Bits 3, 1 and 0 have different meanings for the request and response telegrams.

The address is only necessary for RS484.

Request telegrams

<u>-> Compax3</u>

- the address bit (Bit 0 = 1) shows if the start code is followed by an address (only for RS485; for RS232 Bit 0 = 0)
- the gateway bit (Bit 1 = 1) shows if the message is to be passed on. (Please set Bit 1 = 0, as this function is not yet available)
- the PLC bit (Bit 3 = 1) allows access to objects in the PLC/Pop format
  U16, U32: for integer formats (see bus formats: Ix, Ux, V2)
  IEEE 32Bit Floating Point: for non integer formats (bus formats: E2_6, C4_3, Y2, Y4; without scaling)
  With Bit 3 = 0 the objects are transmitted in the DSP format.
  DSP formats:
  24 Bit = 3 Bytes: Integer INT24 or Fractional FRACT24
  48 Bit = 6 Bytes: Real REAL48 (3 Byte Int, 3 Byte Fract) / Double Integer DINT48 / Double Fractional DFRACT48

Response telegram

<u>Compax3 -></u>

- Bits 0 and 1 are used to identify the response
- Bit 3 is always 0

The maximum number of data bytes in the request telegram is 256, in the response telegram 253.

The block securing (CRC16) is made via the CCITT table algorithm for all characters.

After receiving the start code, the timeout monitoring is activated in order to avoid that Compax3 waits in vain for further codes (e.g. connection interrupted) The

timeout period between 2 codes received is fixed to 5ms (5 times the code time at 9600Baud)

Write object - WrObj telegram

SZ	Adr	L	D0	D1	D2	D3 ... Dn	Crc(Hi)	Crc(Lo)
0xCX		n	Index(Hi)	Index(Lo)	Subindex	Value	0x..	0x..

Describing an object by a value.

Positive acknowledgement - Ack-telegram

SZ	L	D0	D1	Crc(Hi)	Crc(Lo)
0x06	1	0	0	0x..	0x..

Answer from Compax3 if a writing process was successful, i.e. the function could be executed and is completed in itself.

Negative acknowledgement - Nak - telegram

SZ	L	D0	D1	Crc(Hi)	Crc(Lo)
0x07	1	F-No.(Hi)	F-No.(Lo)	0x..	0x..

Answer from Compax3 if access to the object was denied (e.g. function cannot be executed at that point in time or object has no reading access). The error no. is coded according to the DriveCom profile resp. the CiA Device Profile DSP 402.

Read object - RdObj - telegram

SZ	Adr	L	D0	D1	D2	D3	D4	D5	...	Dn	Crc(Hi)	Crc(Lo)
0xAX		n	Index1(Hi)	Index1(Lo)	Subindex1	Index2(Hi)	Index2(Lo)	Subindex2	...	...	0x..	0x..

Reading one or several objects

Answer - Rsp - telegram

SZ	L	D0 ... Dx-1	Dx ... Dy-1	Dy-D..	D ... D..	D ... Dn	Crc(Hi)	Crc(Lo)
0x05	n	Value1	Value 2	Value 3	Value ..	Value n	0x..	0x..

Answer from Compax3 if the object can be read.

If the object has no reading access, Compax3 answers with the Nak - telegram.

Example:

Reading object "StatusPositionActual" (o680.5):

Request: A5 03 02 02 A8 05 E1 46

Response: 05 05 FF FF FF FF FE 2D 07 B4

Writing into an Array (o1901.1 = 2350)

Request: C5 02 08 07 6D 01 00 09 2E 00 00 00 95 D5

Response: 06 01 00 00 BA 87

Block securing:

Checksum calculation for the CCITT table algorithm

The block securing for all codes is performed via the following function and the corresponding table:

The “CRC16” variable is set to “0” before sending a telegram.

Function call:

```
CRC16 = UpdateCRC16(CRC16, Character);
```

This function is called up for each Byte (Character) of the telegram.

The result forms the last two bytes of the telegram

Compax3 checks the CRC value on receipt and reports CRC error in the case of a deviation.

Function

```
const unsigned int _P CRC16_table[256] = {
   0x0000, 0x1021, 0x2042, 0x3063, 0x4084, 0x50a5, 0x60c6, 0x70e7,
   0x8108, 0x9129, 0xa14a, 0xb16b, 0xc18c, 0xd1ad, 0xe1ce, 0xf1ef,
   0x1231, 0x0210, 0x3273, 0x2252, 0x52b5, 0x4294, 0x72f7, 0x62d6,
   0x9339, 0x8318, 0xb37b, 0xa35a, 0xd3bd, 0xc39c, 0xf3ff, 0xe3de,
   0x2462, 0x3443, 0x0420, 0x1401, 0x64e6, 0x74c7, 0x44a4, 0x5485,
   0xa56a, 0xb54b, 0x8528, 0x9509, 0xe5ee, 0xf5cf, 0xc5ac, 0xd58d,
   0x3653, 0x2672, 0x1611, 0x0630, 0x76d7, 0x66f6, 0x5695, 0x46b4,
   0xb75b, 0xa77a, 0x9719, 0x8738, 0xf7df, 0xe7fe, 0xd79d, 0xc7bc,
   0x48c4, 0x58e5, 0x6886, 0x78a7, 0x0840, 0x1861, 0x2802, 0x3823,
   0xc9cc, 0xd9ed, 0xe98e, 0xf9af, 0x8948, 0x9969, 0xa90a, 0xb92b,
   0x5af5, 0x4ad4, 0x7ab7, 0x6a96, 0x1a71, 0x0a50, 0x3a33, 0x2a12,
   0xdbfd, 0xcbdc, 0xfbbf, 0xeb9e, 0x9b79, 0x8b58, 0xbb3b, 0xab1a,
   0x6ca6, 0x7c87, 0x4ce4, 0x5cc5, 0x2c22, 0x3c03, 0x0c60, 0x1c41,
   0xedae, 0xfd8f, 0xcdec, 0xddcd, 0xad2a, 0xbd0b, 0x8d68, 0x9d49,
   0x7e97, 0x6eb6, 0x5ed5, 0x4ef4, 0x3e13, 0x2e32, 0x1e51, 0x0e70,
   0xff9f, 0xefbe, 0xdfdd, 0xcffc, 0xbf1b, 0xaf3a, 0x9f59, 0x8f78,
   0x9188, 0x81a9, 0xb1ca, 0xa1eb, 0xd10c, 0xc12d, 0xf14e, 0xe16f,
   0x1080, 0x00a1, 0x30c2, 0x20e3, 0x5004, 0x4025, 0x7046, 0x6067,
   0x83b9, 0x9398, 0xa3fb, 0xb3da, 0xc33d, 0xd31c, 0xe37f, 0xf35e,
   0x02b1, 0x1290, 0x22f3, 0x32d2, 0x4235, 0x5214, 0x6277, 0x7256,
   0xb5ea, 0xa5cb, 0x95a8, 0x8589, 0xf56e, 0xe54f, 0xd52c, 0xc50d,
   0x34e2, 0x24c3, 0x14a0, 0x0481, 0x7466, 0x6447, 0x5424, 0x4405,
   0xa7db, 0xb7fa, 0x8799, 0x97b8, 0xe75f, 0xf77e, 0xc71d, 0xd73c,
   0x26d3, 0x36f2, 0x0691, 0x16b0, 0x6657, 0x7676, 0x4615, 0x5634,
   0xd94c, 0xc96d, 0xf90e, 0xe92f, 0x99c8, 0x89e9, 0xb98a, 0xa9ab,
   0x5844, 0x4865, 0x7806, 0x6827, 0x18c0, 0x08e1, 0x3882, 0x28a3,
   0xcb7d, 0xdb5c, 0xeb3f, 0xfb1e, 0x8bf9, 0x9bd8, 0xabbb, 0xbb9a,
   0x4a75, 0x5a54, 0x6a37, 0x7a16, 0x0af1, 0x1ad0, 0x2ab3, 0x3a92,
   0xfd2e, 0xed0f, 0xdd6c, 0xcd4d, 0xbdaa, 0xad8b, 0x9de8, 0x8dc9,
   0x7c26, 0x6c07, 0x5c64, 0x4c45, 0x3ca2, 0x2c83, 0x1ce0, 0x0cc1,
   0xef1f, 0xff3e, 0xcf5d, 0xdf7c, 0xaf9b, 0xbfba, 0x8fd9, 0x9ff8,
   0x6e17, 0x7e36, 0x4e55, 0x5e74, 0x2e93, 0x3eb2, 0x0ed1, 0x1ef0
};

unsigned int UpdateCRC16(unsigned int crc,unsigned char wert) {

unsigned int crc16;

crc16 = (CRC16_table[(crc >> 8) & 0x00FF] ^ (crc << 8)
  ^ (unsigned int)(value));

return crc16;

}
```

You will find this function on the Compax3 DVD under RS232_485\\Function UpdateCRC16.txt!

5.3 Remote diagnosis via Modem

In this chapter you can read about:

Caution!

As the transmission via modem may be very slow and interference-prone, the operation of the Compax3 ServoManager via modem connection is on your own risk!

The function setup mode as well as the ROLL mode of the oscilloscope are not available for remote diagnosis!

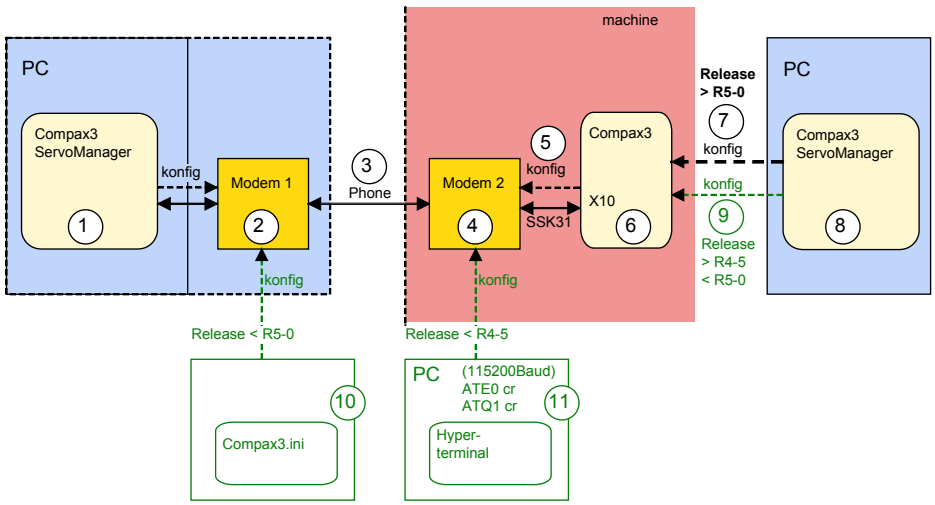
It is not recommended to use the logic analyzer in the Compax3 IEC61131-3 debugger due to the limited bandwidth.

Requirements:

For modem operation, a direct and stable telephone connection is required. Operation via a company-internal telephone system is not recommended.

5.3.1. Structure

Layout and configuration of a modem connection ServoManager - Compax3:



The green part of the drawing shows the proceeding for Compax3 release versions < R5-0!

The proceeding for Compax3 release versions < R5-0 is described in an application example (.../modem/C3_Appl_A1016_*language*.pdf on the Compax3 CD).

Connection Compax3 ServoManager <=> Compax3

The Compax3 ServoManager (1) establishes a RS232 connection with modem 1 (PC internal or external).

Modem 1 dials modem 2 via a telephone connection (3).

Modem 2 communicates with Compax3 (6) via RS232.

Configuration

Modem 1 is configured via the Compax3 ServoManager (1)

Modem 2 can be configured via Compax3 (on place), triggered by putting **SSK31** (see on page 209) on X10. For this, the device must be configured before. This can be made locally before the system / machine is delivered with the aid of the Compax3 ServoManager (8).

5.3.2. Configuration of local modem 1

- Menu "Options: Communication settings RS232/RS485..." must be opened
- Select "Connection via Modem"
- Under "name" you can enter a name for the connection
- Enter the target telephone number.
  Note: If an ISDN telephone system is operated within a company network, an additional "0" may be required in order to get out of the local system into the company network before reaching the outside line with an additional "0".
- The timeout periods are set to reasonable standard values according to our experience.
- Select the modem type.
  - For "user-defined modem", additional settings are only required, if the modem does not support standard AT commands.
    Then you can enter special AT commands.
  - **Hint**:When operating the local modem on a telephone system, it may be necessary to make a blind dialing. Here, the modem does not wait for the dialing tone.
- Select the COM interface where the modem is connected.
- Close the window and establish the connection with button  (open/close COM port).
- The connection is interrupted when the COM port is closed.
- Select the modem type.
  - For "user-defined modem", additional settings are only required, if the modem does not support standard AT commands.
    Then you can enter special AT commands.
  - **Hint**:When operating the local modem on a telephone system, it may be necessary to make a blind dialing. Here, the modem does not wait for the dialing tone.

5.3.3. Configuration of remote modem 2

Settings in Compax3 under "configure communication: Modem settings":

- Modem initialization = "ON": After the SSK31 modem cable has been connected, Compax3 initializes the modem
- Modem initialization after Power On = "ON": After Power on of Compax3, the device initializes the modem
- Modem check = "ON": a modem check is performed
- The timeout periods are set to reasonable standard values according to our experience.
- Select the modem type.
  - For "user-defined modem", additional settings are only required, if the modem does not support standard AT commands.
    Then you can enter special AT commands.
  - **Hint**:When operating the local modem on a telephone system, it may be necessary to make a blind dialing. Here, the modem does not wait for the dialing tone.
- In the following wizard window, a specific download of the modem configuration can be made.

Note:

If a configuration download is interrupted, the original settings in the non volatile memory of the Compax3 are still available.
You have to finish the communication on the PC side and to reset the Compax3 via the 24V supply before you can start a new trial.

Reinitialization of the remote modem 2

Remove cable on Compax3 X10 and connect again!

5.3.4. Recommendations for preparing the modem operation

Preparations:

- Settings in Compax3 under "configure communication: Modem settings":
  - Modem initialization: "ON"
  - Modem initialization after Power On: "ON"
  - Modem check: "ON"
- Deposit SSK31 cable in the control cabinet.
- Install modem in the control cabinet and connect to telephone line.

Remote diagnosis required:

- On site:
  - Connect modem to Compax3 X10 via SSK31
  - Modem is automatically initialized
- Local:
  - Connect modem to telephone line
  - Establish cable connection to modem (COM interface)
  - Select "connection via modem" under "options: communication settings RS232/RS485...".
  - Select modem under "selection"
  - Enter telephone number
  - Select COM interface (PC - modem)
  - Establish connection with button  (open/close COM port).

Access to Compax3 objects

Via RS232 and RS485 you can access the status objects.

6. Status values

In this chapter you can read about:

A list of the status values supports you in optimization and commissioning.

Open the optimization function in the C3 ServoManager (double-click on optimization in the tree)

You will find the available status values in the lower right part of the window under selection (TAB) “Status values”.

You can pull them into the oscilloscope (upper part of the left side) or into the status display (upper part of the right side) by the aid of the mouse (drag and drop).

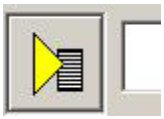
The status values are divided into 2 groups (user levels):

standard: here you can find all important status values

advanced: Advanced status values, require a better knowledge

Switching of the user level

The user level can be changed in the optimization window (left hand side lower part under selection (TAB) "optimization") with the following button.



6.1 D/A-Monitor

A part of the status values can be output via the D/A monitor channel 0 (X11/4) and channel 1 (X11/3).In the following status list under D/A monitor output: possible / not possible).

The reference for the output voltage can be entered individually in the reference unit of the status value.

Example: Output Object 2210.2: (actual speed unfiltered)

In order to get an output voltage of 10V at 3000prm , please enter rev/s (=3000rpm) as "value of the signal at 10V".

Hint

The unit of measurement of the D/A monitor values differs from the unit of measurement of the status values.

6.2 Status values

Additional information on the topic of "status values" can be found in the online help of the device.

7. Error

Standard error reactions:

Reaction 2: Downramp with "de-energize" **then apply brake** (see on page 143) and finally de-energize.

For errors with standard reaction 2 the **error reaction can be changed** (see on page 109).

Reaction 5: deenergize immediately (without ramps), apply brake.

Caution! A Z-axis may drop down due to the brake delay times

Most pending errors can be acknowledged with Quit!

The following errors must be acknowledged with Power on:

0x7381, 0x7382, 0x7391, 0x7392, 0x73A0

Object 550.1 displays error:
value 1 means "no error".

The errors as well as the error history can be viewed in the C3 ServoManager under optimization (at the top right of the optimization window).

7.1 Error list

Detailed information on the topic of the "error list" can be found in the online help of the device.

8. Order code

8.1 Order code device: Compax3

Example: C3S025V2F10I10T10M00	C3								
Device type: Compax3									
Single axis	S								--
Highpower	H								--
Multi-axis device	M								
Device currents static/dynamic; supply voltage									
2.5A / 5A ; 230VAC (single phase)	S	025	V2						--
6.3 A / 12.6 A ; 230VAC (1 phase)	S	063	V2						--
10A / 20A ; 230VAC (three phase)	S	100	V2						--
15A / 30A ; 230VAC (three phase)	S	150	V2						--
1.5A / 4.5A ; 400VAC (three phase)	S	015	V4						--
3.8 A / 7.5 A ; 400VAC (3 phase)	S	038	V4						--
7.5 A / 15.0 A ; 400VAC (3 phase)	S	075	V4						--
15.0 A / 30.0 A ; 400VAC (3 phase)	S	150	V4						--
30.0 A / 60.0 A ; 400VAC (3 phase)	S	300	V4						--
50A / 75A ; 400VAC (three phase)	H	050	V4						--
90A / 135A ; 400VAC (three phase)	H	090	V4						--
125A / 187.5A ; 400VAC (three phase)*	H	125	V4						--
155A / 232.5A ; 400VAC (three phase)*	H	155	V4						--
5.0A / 10,0A ; 400VAC (three phase)	M	050	D6						
10A / 20A ; 400VAC (three phase)	M	100	D6						
15A / 30A ; 400VAC (three phase)	M	150	D6						
60A 30A / ; 400VAC (three phase)	M	300	D6						
Feedback:									
Resolver				F10					
SinCos© (Hiperface)				F11					
Encoder, Sine-cosine with/without hall				F12					
Interface:									
Step/direction / analogue input					I10	T10	M00		
Positioning with inputs/outputs					I11	T11	M00		
Positioning via I/Os or RS232 / RS485/USB					I12				
Profibus DP V0/V1/V2 (12Mbaud)					I20				
CANopen					I21				
DeviceNet					I22				
Ethernet Powerlink					I30				
EtherCAT					I31				
Profinet					I32				
C3 powerPLmC (Multi-axis control)					C20		M00		
Technology functions:									
Positioning						T11			
Motion control programmable according to IEC61131-3						T30			
Motion control programmable according to IEC61131-3 & electronic cam extension						T40			
Options:									
no additional supplement							M00		
Expansion 12 digital I/Os & HEDA (Motionbus)							M10		
HEDA (Motionbus)							M11		
Expansion, 12 digital I/Os							M12		
Safety technology only C3M:									
Safe torque off	M		D6						S1
Extended safety technology	M		D6						S3

*external voltage supply for ventilator fan required. Available in two versions for single phase feed:
Standard: 220/240VAC: 140W, on request: 110/120VAC: 130W

8.2 Order code for mains module: PSUP

Example: PSUP10D6USBM00	PSU	P		D6	USB	M00
Power module		P				
Nominal power; supply voltage						
10kW; 400 VAC (3-phase)			10	D6		
20kW; 400 VAC (3-phase)			20	D6		
30kW; 400 VAC (3-phase)			30	D6		
Interface:						
USB connection					USB	
Options:						
no additional supplement						M00

8.3 Order code for accessories

Order Code connection set for Compax3S

The corresponding connection sets are furnished with the device.					
for C3S0xxV2	ZBH 02/01		ZBH	02/	01
for C3S0xxV4 / S150V4 / S1xxV2	ZBH 02/02		ZBH	02/	02
for C3S300V4	ZBH 02/03		ZBH	02/	03

Order code for PSUP/Compax3M connection set

The corresponding connection sets are furnished with the device.					
for C3M050D6, C3M100D6, C3M150D6	ZBH 04/01		ZBH	04/	01
for C3M300D6	ZBH 04/02		ZBH	04/	02
for PSUP10	ZBH 04/03		ZBH	04/	03
PSUP20, PSUP30	ZBH 04/04		ZBH	04/	04

Order code for feedback cables

for resolver [2	for MH / SMH motors		REK	42/	...[1
for resolver [2	for MH / SMH motors	(cable chain compatible)	REK	41/	...[1
for SinCos© – feedback [2	for MH / SMH motors	(cable chain compatible)	GBK	24/	..[1
for EnDat 2.1 [2	for MH / SMH motors	(cable chain compatible)	GBK	38/	..[1
Encoder – Compax3			GBK	23/	...[1
for LXR linear motors		(cable chain compatible)	GBK	33/	...[1
for BLMA linear motors		(cable chain compatible)	GBK	32/	...[1

[x **Note on cable** (see on page 169)

Motor cable order code [2

for SMH / MH56 / MH70 / MH105[3	(1.5mm^2; up to 13.8A)		MOK	55/	...[1
for SMH / MH56 / MH70 / MH105[3	(1.5mm^2; up to 13.8A)	(cable chain compatible)	MOK	54/	...[1
for SMH / MH56 / MH70 / MH105[3	(2.5mm^2; up to 18.9A)		MOK	56/	...[1
for SMH / MH56 / MH70 / MH105[3	(2.5mm^2; up to 18.9A)	(cable chain compatible)	MOK	57/	...[1
for MH145 / MH205[4	(1.5mm^2; up to 13.8A)		MOK	60/	...[1
for MH145 / MH205[4	(1.5mm^2; up to 13.8A)	(cable chain compatible)	MOK	63/	...[1
for MH145 / MH205[4	(2.5mm^2; up to 18.9A)		MOK	59/	...[1
for MH145 / MH205[4	(2.5mm^2; up to 18.9A)	(cable chain compatible)	MOK	64/	...[1
for MH145 / MH205[4	(6mm^2; up to 32.3A)	(cable chain compatible)	MOK	61/	...[1
for MH145 / MH205[4	(10mm^2; up to 47.3A)	(cable chain compatible)	MOK	62/	...[1

[x **Note on cable** (see on page 169)

Order Code braking resistors

						/		
for C3S063V2 or C3S075V4	56Ω / 0.18kW$_{cont.}$	BRM	0	5	/	0	1
for C3S075V4	56Ω / 0.57kW$_{cont.}$	BRM	0	5	/	0	2
for C3S025V2 or C3S038V4	100Ω / 60W$_{cont.}$	BRM	0	8	/	0	1
for C3S150V4	47Ω / 0.57kW$_{cont.}$	BRM	1	0	/	0	1
for C3S150V2, C3S300V4 and PSUP20D6	4/01:15Ω / 0.57kW$_{cont.}$ 4/02:15Ω / 0.74kW$_{cont.}$	BRM	0	4	/	0	...
for C3S300V4 and PSUP20D6	4/03:15Ω / 1.5kW$_{cont.}$						
for C3S100V2	22Ω / 0.45kW$_{cont.}$	BRM	0	9	/	0	1
for C3H0xxV4	27Ω / 3.5kW$_{cont.}$	BRM	1	1	/	0	1
**for PSUP10D6 and PSUP20D6 2x30Ω parallel)	30Ω / 0.5kW$_{cont.}$	BRM	1	3	/	0	1
for PSUP10D6 (2x15Ω in series), PSUP20D6, PSUP30D6	15Ω / 0.5kW$_{cont.}$	BRM	1	4	/	0	1
for C3H1xxV4, PSUP30D6	18Ω / 4.5kW$_{cont.}$	BRM	1	2	/	0	1

Order code mains filter Compax3S

					/		
for C3S025V2 or S063V2		NFI	0	1	/	0	1
for C3S0xxV4, S150V4 or S1xxV2		NFI	0	1	/	0	2
for C3S300V4		NFI	0	1	/	0	3

Order code mains filter Compax3H

					/		
for C3H050V4		NFI	0	2	/	0	1
for C3H090V4		NFI	0	2	/	0	2
for C3H1xxV4		NFI	0	2	/	0	3

Order Code mains filter PSUP

					/		
for PSUP10	Reference axis combination 3x480V 25A 6x10m motor cable length	NFI	0	3	/	0	1
for PSUP10	Reference axis combination 3x480V 25A 6x50m motor cable length	NFI	0	3	/	0	2
for PSUP20 & PSUP30	Reference axis combination 3x480V 50A 6x50m motor cable length	NFI	0	3	/	0	3

Order code for mains filters

for PSUP30	Mains filter	LCG-0055-0.45 mH
for PSUP30	Mains filter with UL approval	LCG-0055-0.45 mH-UL

Order code for motor output filter (for Compax3S, Compx3M >20m motor cable)

					/		
up to 6,3 A rated motor current		MDR	0	1	/	0	4
Up to 16 A rated motor current		MDR	0	1	/	0	1
Up to 30A A rated motor current		MDR	0	1	/	0	2

Order code condenser module

for C3S300V4	1100µF	Modules	C4

Order code for interface cables and plugs

PC – Compax3 (RS232)		SSK	0	1	/	...	...(1
PC – PSUP (USB)		SSK	3	3	/	...	...
on X11 (Ref/Analog) and X13 at C3F001D2	with flying leads	SSK	2	1	/	...	...(1
on X12 / X22 (digital I/Os)	with flying leads	SSK	2	2	/	...	...(1
on X11 (Ref /Analog)	for I/O terminal block	SSK	2	3	/	...	...(1
on X12 / X22 (digital I/Os)	for I/O terminal block	SSK	2	4	/	...	...(1
PC ⇔ POP (RS232)		SSK	2	5	/	...	...(1
Compax3 ⇔ POP (RS485) for several C3H on request		SSK	2	7	/	../	...(6
Compax3 HEDA ⇔ Compax3 HEDA or PC ⇔ C3powerPLmC Compax3 I30 ⇔ Compax3 I30 or C3M-multi-axis communication Profinet, EtherCAT, Ethernet Powerlink		SSK	2	8	/	../	...(5
Compax3 X11 ⇔ Compax3 X11 (encoder coupling of 2 axes)		SSK	2	9	/	...	...(1
Compax3 X10 ⇔ Modem		SSK	3	1	/	...	
Compax3H adapter cable ⇔ SSK01 (length 15cm, delivered with the device)		SSK	3	2	/	2	0
Compax3H X10 RS232 connection control ⇔ Programming interface (delivered with the device)		VBK	1	7	/	0	1
Bus terminal connector (for the 1st and last Compax3 in the HEDA Bus/or multi-axis system)		BUS	0	7	/	0	1
Profibus cable (2	non prefabricated	SSL	0	1	/	...	...(1
Profibus plug		BUS	0	8	/	0	1
CAN bus cable (2	non prefabricated	SSL	0	2	/	...	...(1
CANbus connector		BUS	1	0	/	0	1

(x **Note on cable** (see on page 169)

Order Code operating module

Operating module (for Compax3S and Compax3F)	BDM	0	1	/	0	1

Order Code terminal block

for I/Os without luminous indicator	for X11, X12, X22	EAM	0	6	/	0	1
for I/Os with luminous indicator	for X12, X22	EAM	0	6	/	0	2

Order Code decentralized input terminals

PIO 2DI 24VDC 3.0ms	2-channel digital input terminal	PIO	4	0	0		
PIO 4DI 24VDC 3.0ms	4-channel digital input terminal	PIO	4	0	2		
PIO 8DI 24VDC 3.0ms	8-channel digital input terminal	PIO	4	3	0		
PIO 2AI DC ±10V differential input	2-channel analog - Input terminal (±10V differential input)	PIO	4	5	6		
PIO 4AI 0-10VDC S.E.	4 channel analog input terminal (0-10V signal voltage)	PIO	4	6	8		
PIO 2AI 0-20mA differential input	2-channel analog - Input terminal (0-20mA differential input)	PIO	4	8	0		

Order Code decentralized output terminals

PIO 2DO 24VDC 0.5A	2 channel digital output terminal (output voltage 0.5A)	PIO	5	0	1		
PIO 4DO 24VDC 0.5A	4 channel digital output terminal (output voltage 0.5A)	PIO	5	0	4		
PIO 8DO 24VDC 0.5A	8 channel digital output terminal (output voltage 0.5A)	PIO	5	3	0		
PIO 2AO 0-10VDC	2 channel analog output terminal (0-10V signal voltage)	PIO	5	5	0		
PIO 2AO 0-20mA	2-channel analog output terminal (0-20mA signal voltage)	PIO	5	5	2		
PIO 2AO DC ±10V	2-channel analog output terminal (±10V signal voltage)	PIO	5	5	6		

Order Code CANopen Fieldbus Coupler

CANopen Standard	max. Vectorial sum current for bus terminals 1650mA at 5V	PIO	3	3	7		
CANopen ECO	max. Vectorial sum current for bus terminals 650mA at 5V	PIO	3	4	7		

(1 Length code 1

Length [m]	1.0	2.5	5.0	7.5	10.0	12.5	15.0	20.0	25.0	30.0	35.0	40.0	45.0	50.0
Order code	01	02	03	04	05	06	07	08	09	10	11	12	13	14

Example:

SSK01/09: Length 25m

(2 Colors according to DESINA

(3 with motor connector

(4 with cable eye for motor terminal box

5 length code 2 for SSK28

Length [m]	0.17	0.25	0.5	1.0	3.0	5.0	10.0
Order code	23	20	21	01	22	03	05

(6 Order code: SSK27/nn/..

Length A (Pop - 1. Compax3) variable (the last two numbers according to the length code for cable, for example SSK27/nn/01)

Length B (1. Compax3 - 2. Compax3 - ... - n. Compax3) fixed 50 cm (only if there is more than 1 Compax3, i.e. nn greater than 01)

Number n (the last two digits)

Examples include:

SSK27/05/.. for connecting from Pop to 5 Compax3.

SSK27/01/.. for connecting from Pop to one Compax3

MOK55 and MOK54 can also be used for linear motors LXR406, LXR412 and BLMA.

(x **Note on cable** (see on page 169)

9. Compax3 Accessories

In this chapter you can read about:

9.1 Parker servo motors

In this chapter you can read about:

9.1.1. Direct drives

In this chapter you can read about:

9.1.1.1 Transmitter systems for direct drives

The Feedback option F12 makes it possible to operate linear motors as well as torque motors. Compax3 supports the following transmitter systems:

Special encoder systems for direct drives	Option F12
Analog hall sensors	◆ Sine-Cosine signal (max. 5Vss*; typical 1Vss) 90° offset ◆ U-V signal (max. 5Vss*; typical 1Vss) 120° offset.
Encoder (linear or rotatory)	◆ Sine-Cosine (max. 5Vss*; typical 1Vss) (max. 400kHz) or ◆ TTL (RS422) (max. 5MHz; track A o. B) with the following modes of commutation: ◆ **Automatic commutation** (see on page 171) or ◆ U, V, W or R, S, T commutation signals (NPN open collector) e.g. digital hall sensors, incremental encoders made by Hengstler (F series with electrical ordering variant 6)
Digital, bidirectional interface	◆ All EnDat 2.1 or EnDat 2.2 (Endat01, Endat02) feedback systems with incremental track (sine-cosine track) ◆ linear or rotary ◆ max. 400kHz Sine-Cosine
Distance coded feedback systems	◆ Distance coding with 1VSS - Interface ◆ Distance coding with RS422 - Interface (Encoder)

*Max. differential input between SIN- (X13/7) and SIN+ (X13/8).

The motor performs automatic commutation after:

- Power on,
- A configuration download or
- An IEC program download

The time duration (typically 5-10 sec) of automatic commutation can be optimized with the start current (see in the optimization display of the C3 ServoManager; given as a percentage of the reference current). Note that values that are too high will cause Error 0x73A6 to be triggered.

Typically the motor moves by 4% of the pitch length or, with rotary direct drives 4% of 360°/number of pole pairs - maximum 50%.

Note the following conditions for automatic commutation

- During automatic commutation the end limits are not monitored.
- Actively working load torques are not permitted during automatic commutation.
- Static friction deteriorates the effect of automatic commutation.
- With the exception of missing commutation information, the controller/motor combination is configured and ready for operation (parameters correctly assigned for the linear motor/drive). The transmitter and the direction of the field of rotation in effect must match.
- The auto-commutating function must be adapted to fit the mechanics if necessary during commissioning.

9.1.1.2 Linear motors

Parker offers you a number of systems of linear motor drives:

Linear motors	**Feed force (continuous/dynamic)**	**Stroke length:**
LMDT ironless linear servo motors:	26 ... 1463N	almost any
LMI iron-cored linear servo motors:	52 ... 6000N	64 ... 999mm
LXR Series Linear Motors	315N / 1000N	up to 3m
Linear motor module BLMA:	605N / 1720N	up to 6m

9.1.1.3 Torque motors

Parker offers you an extensive range of torque motors that can be adapted to your application. Please contact us for information.

Additional information can be found on the **Internet http://www.parker-eme.com** in the direct drives section.

9.1.2. Rotary servo motors

Parker offers you an extensive range of servo motors that can be adapted to your application. Please contact us for information.

Additional information can be found on the **Internet http://www.parker-eme.com/sm**

or on the DVD supplied in the documentations file.

Suitable servo motors for Compax3H are available on request!

9.2 EMC measures

In this chapter you can read about:

9.2.1. Mains filter

For radio disturbance suppression and for complying with the emission limit values for CE conform operationwe offer mains filters:

Observe the maximum permitted length of the connection between the mains filter and the device:

- unshielded <0.5m;
- shielded: <5m (fully shielded on ground e.g. ground of control cabinet)

Order code mains filter Compax3S

					/		
for C3S025V2 or S063V2		NFI	0	1	/	0	1
for C3S0xxV4, S150V4 or S1xxV2		NFI	0	1	/	0	2
for C3S300V4		NFI	0	1	/	0	3

Order Code mains filter PSUP

					/		
for PSUP10	Reference axis combination 3x480V 25A 6x10m motor cable length	NFI	0	3	/	0	1
for PSUP10	Reference axis combination 3x480V 25A 6x50m motor cable length	NFI	0	3	/	0	2
for PSUP20 & PSUP30	Reference axis combination 3x480V 50A 6x50m motor cable length	NFI	0	3	/	0	3

Order code for mains filters

for PSUP30	Mains filter	LCG-0055-0.45 mH
for PSUP30	Mains filter with UL approval	LCG-0055-0.45 mH-UL

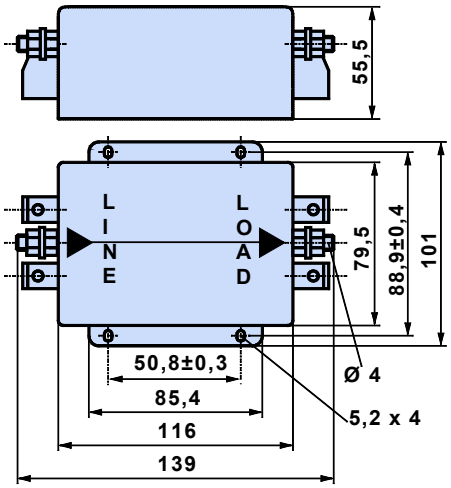
Order code mains filter Compax3H

					/		
for C3H050V4		NFI	0	2	/	0	1
for C3H090V4		NFI	0	2	/	0	2
for C3H1xxV4		NFI	0	2	/	0	3

9.2.1.1 Mains filter NFI01/01

for Compax3 S025 V2 and Compax3 S063 V2

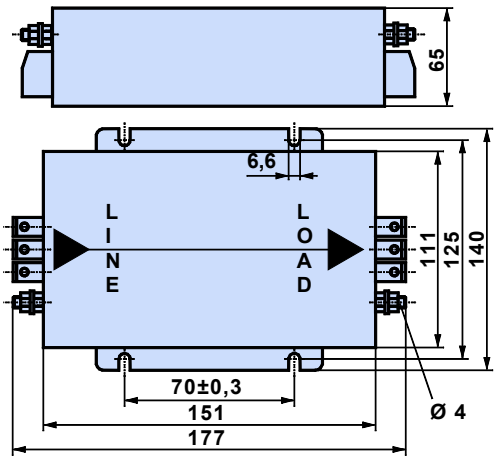
Dimensional drawing:



9.2.1.2 Mains filter NFI01/02

for Compax3 S0xx V4, Compax3 S150 V4 and Compax3 S1xx V2

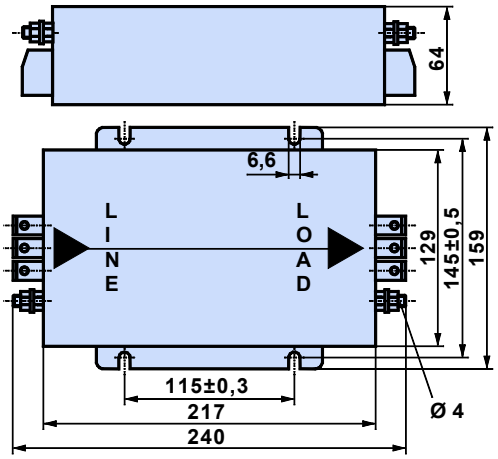
Dimensional drawing:



9.2.1.3 Mains filter for NFI01/03

for Compax3 S300

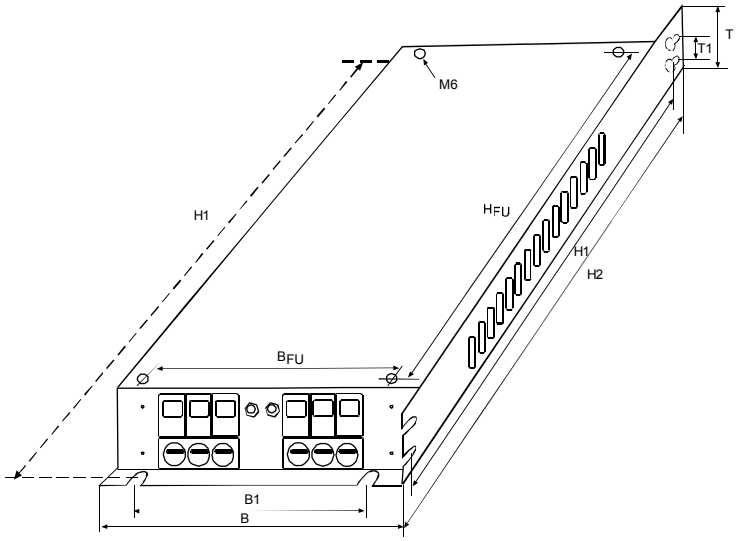
Dimensional drawing:



9.2.1.4 Mains filter NFI02/0x

Filter for mounting below theCompax3 Hxxx V4 housing

Dimensional drawing:

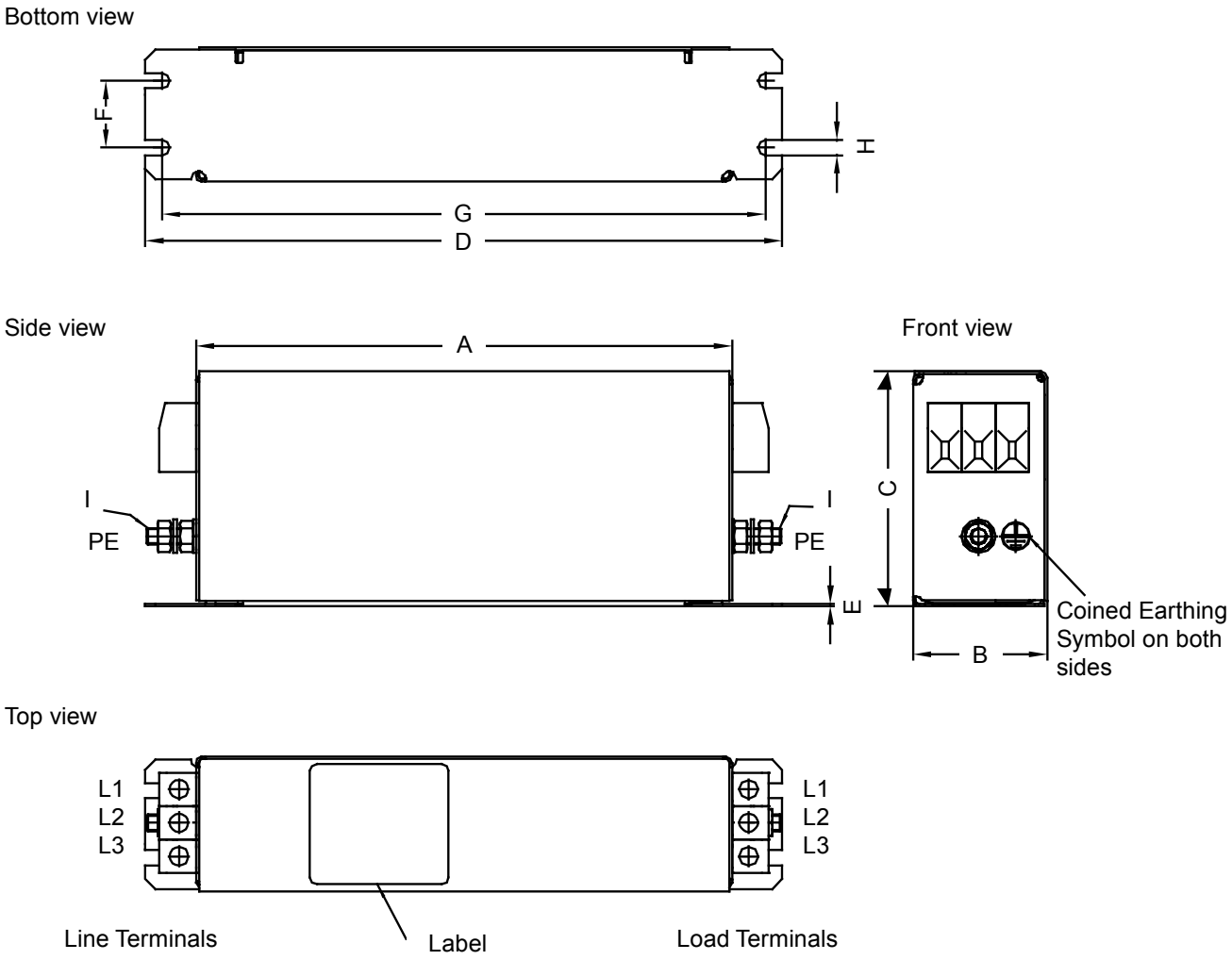


Stated in mm	Filter type	Dimensions				Hole distances			Distances		Weight	Grounding clamp	Connection clamp
		B	H	H2	T	B1	H1	T1	BFU	HFU	kg		
C3H050V4	NFI02/01	233	515	456	70	186	495	40	150	440	4.3	M6	16mm^2
C3H090V4	NFI02/02	249	715	649	95	210	695	40	150	630	8.5	M8	50mm^2
C3H1xxV4	NFI02/03	249	830	719	110				150	700	15.0	M10	95mm^2

9.2.1.5 Mains filter NFI03/01& NFI03/03

for PSUP10D6 and PSUP20D6

Dimensional drawing:



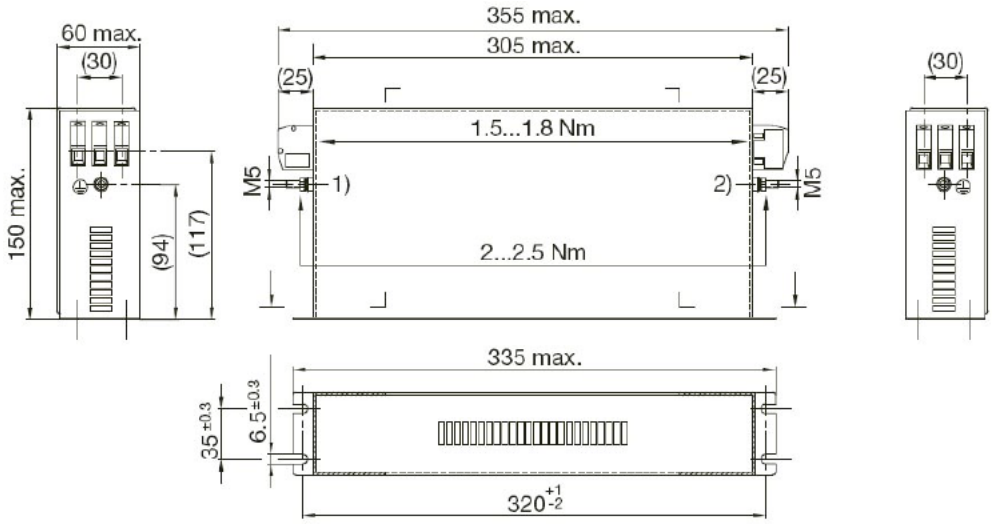
Filter type										Weight	GND(I)	Connection clamp
	A	B	C	D	I	F	G	H		kg		
NFI03/01	240	50	85	270	0.8	30	255	5.4		1.5	M5	$10mm^2$
NFI03/03	220	85	90	250	1.0	60	235	5.4		2.4	M6	$16mm^2$

Stated in mm

9.2.1.6 Mains filter NFI03/02

for PSUP10D6

Dimensional drawing:



9.2.2. Motor output filter

In this chapter you can read about:

We offer motor output filters for disturbance suppression when the motor connecting cables are long (>20m):

Order code for motor output filter (for Compax3S, Compx3M >20m motor cable)

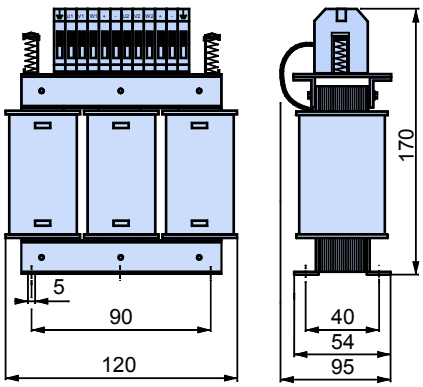
				/		
up to 6,3 A rated motor current	MDR	0	1	/	0	4
Up to 16 A rated motor current	MDR	0	1	/	0	1
Up to 30A A rated motor current	MDR	0	1	/	0	2

Larger motor output filters are available on request!

9.2.2.1 Motor output filter MDR01/04

up to 6.3A nominal motor current (3.6mH)

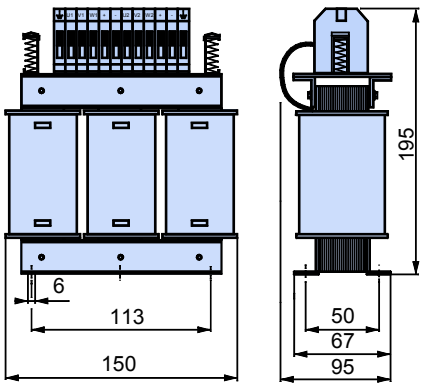
Dimensional drawing:



9.2.2.2 Motor output filter MDR01/01

Up to 16 A nominal motor current (2mH)

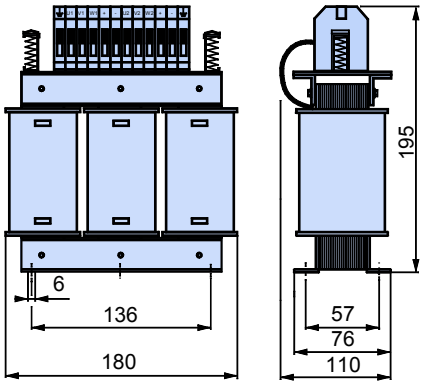
Dimensional drawing:



9.2.2.3 Motor output filter MDR01/02

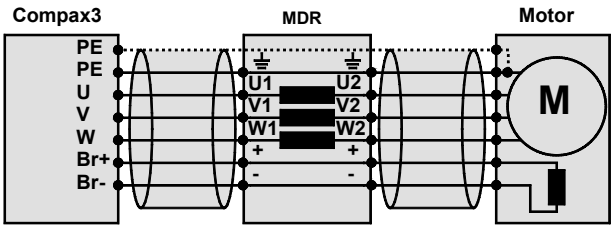
up to 30A nominal motor current (1.1mH)

Dimensional drawing:



Weight: 5.8kg

9.2.2.4 Wiring of the motor output filter



9.2.3. Mains filters

In this chapter you can read about:

Mains filters serve for reducing the low-frequency interferences on the mains side.

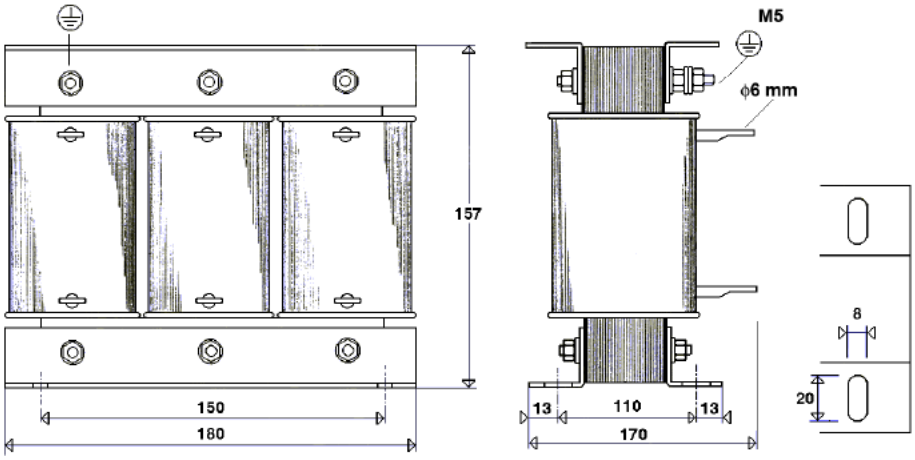
9.2.3.1 Mains filter for PSUP30

Required mains filter for the PSUP30: 0.45 mH / 55 A

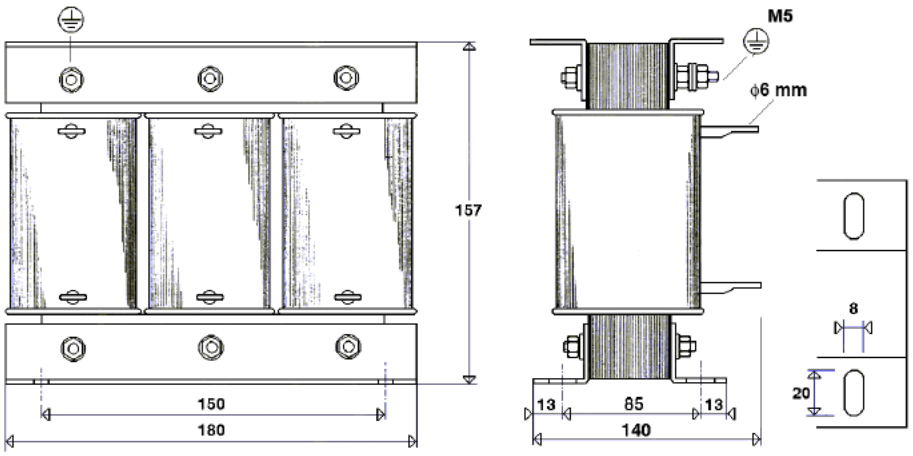
We offer the following mains filters:

- LCG-0055-0.45 mH (WxDxH: 180 mm x 140 mm x 157 mm; 10 kg)
- LCG-0055-0.45 mH-UL (with UL approval) (WxDxH: 180 mm x 170 mm x 157 mm; 15 kg)

Dimensional drawing: LCG-0055-0.45 mH



Dimensional drawing: LCG-0055-0.45 mH-UL



9.3 Connections to the motor

In this chapter you can read about:

Under the designation "REK.." (resolver cables) and "MOK.."(motor cables) we can deliver motor connecting cables in various lengths to order. If you wish to make up your own cables, please consult the cable plans shown below:

Motor cable order code [2]

							/	
for SMH / MH56 / MH70 / MH105[3]	(1.5mm^2; up to 13.8A)		MOK	5	5	/	...	...[1]
for SMH / MH56 / MH70 / MH105[3]	(1.5mm^2; up to 13.8A)	(cable chain compatible)	MOK	5	4	/	...	...[1]
for SMH / MH56 / MH70 / MH105[3]	(2.5mm^2; up to 18.9A)		MOK	5	6	/	...	...[1]
for SMH / MH56 / MH70 / MH105[3]	(2.5mm^2; up to 18.9A)	(cable chain compatible)	MOK	5	7	/	...	...[1]
for MH145 / MH205[4]	(1.5mm^2; up to 13.8A)		MOK	6	0	/	...	...[1]
for MH145 / MH205[4]	(1.5mm^2; up to 13.8A)	(cable chain compatible)	MOK	6	3	/	...	...[1]
for MH145 / MH205[4]	(2.5mm^2; up to 18.9A)		MOK	5	9	/	...	...[1]
for MH145 / MH205[4]	(2.5mm^2; up to 18.9A)	(cable chain compatible)	MOK	6	4	/	...	...[1]
for MH145 / MH205[4]	(6mm^2; up to 32.3A)	(cable chain compatible)	MOK	6	1	/	...	...[1]
for MH145 / MH205[4]	(10mm^2; up to 47.3A)	(cable chain compatible)	MOK	6	2	/	...	...[1]

[x] **Note on cable** (see on page 169)

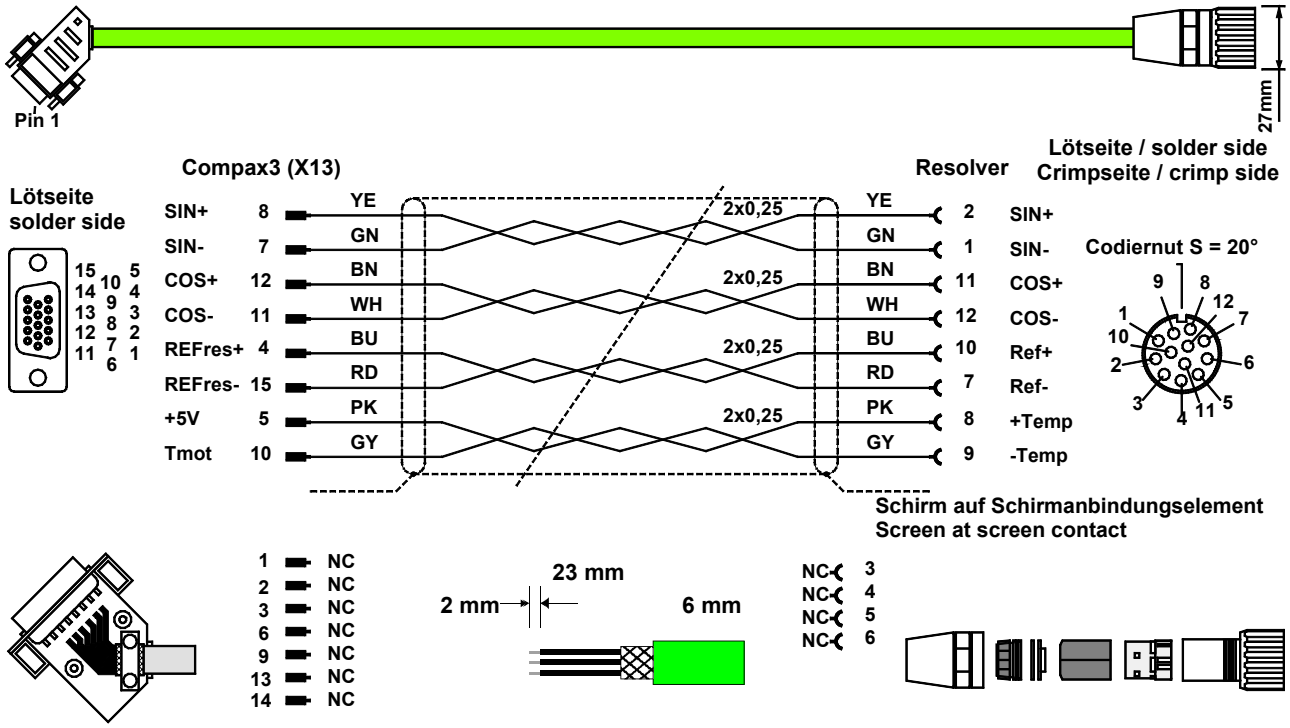
Order code for feedback cables

							/	
for resolver [2]	for MH / SMH motors		REK	4	2	/	...	...[1]
for resolver [2]	for MH / SMH motors	(cable chain compatible)	REK	4	1	/	...	...[1]
for SinCos© – feedback [2]	for MH / SMH motors	(cable chain compatible)	GBK	2	4	/	..	...[1]
for EnDat 2.1 [2]	for MH / SMH motors	(cable chain compatible)	GBK	3	8	/	..	...[1]
Encoder – Compax3			GBK	2	3	/	...	...[1]
for LXR linear motors		(cable chain compatible)	GBK	3	3	/	...	...[1]
for BLMA linear motors		(cable chain compatible)	GBK	3	2	/	...	...[1]

[x] **Note on cable** (see on page 169)

9.3.1. Resolver cable

REK42/..

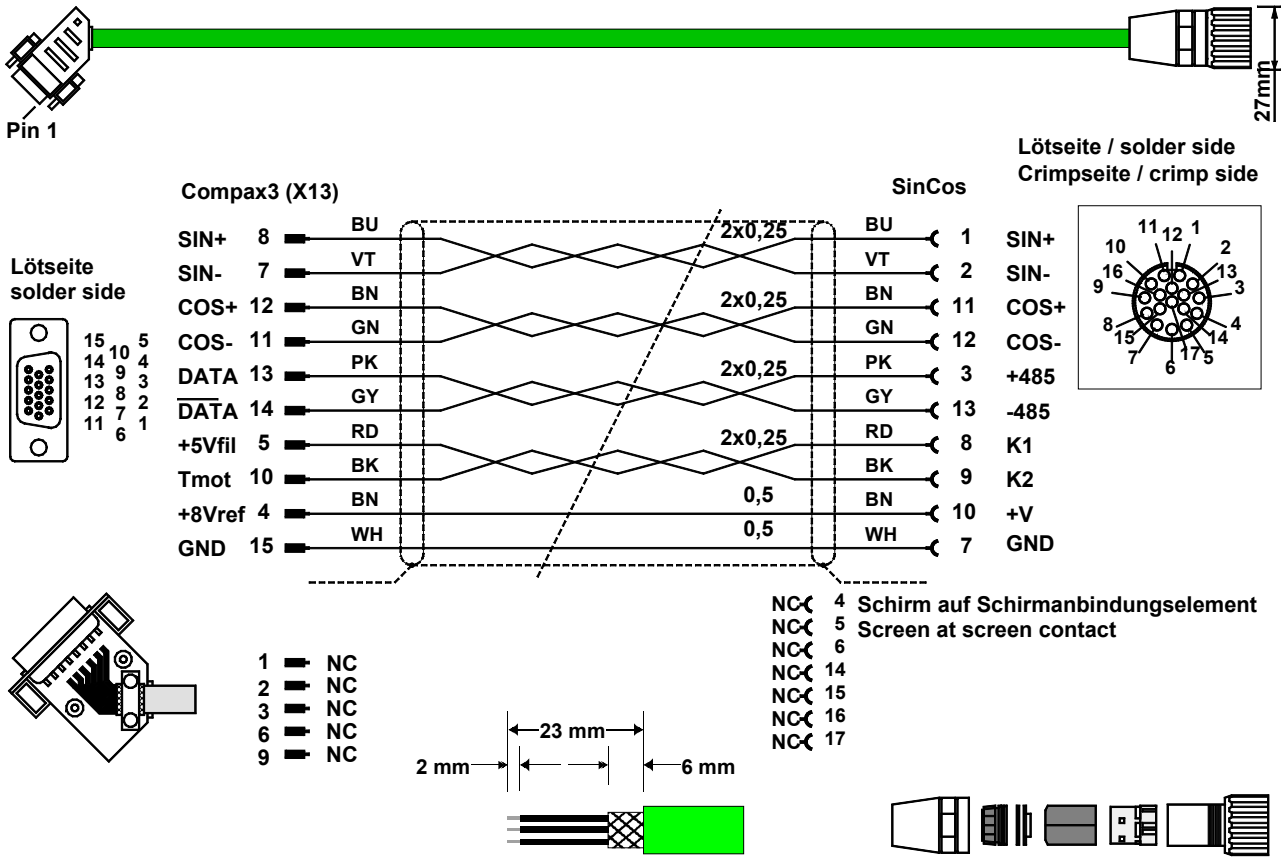


The same cable (with changed conductor coloring) is available under the designation REK41/.. in a version which is suitable for cable chain systems.

You can find the length code in the Chapter **Order Code Accessories** (see on page 166).

9.3.2. SinCos© cable

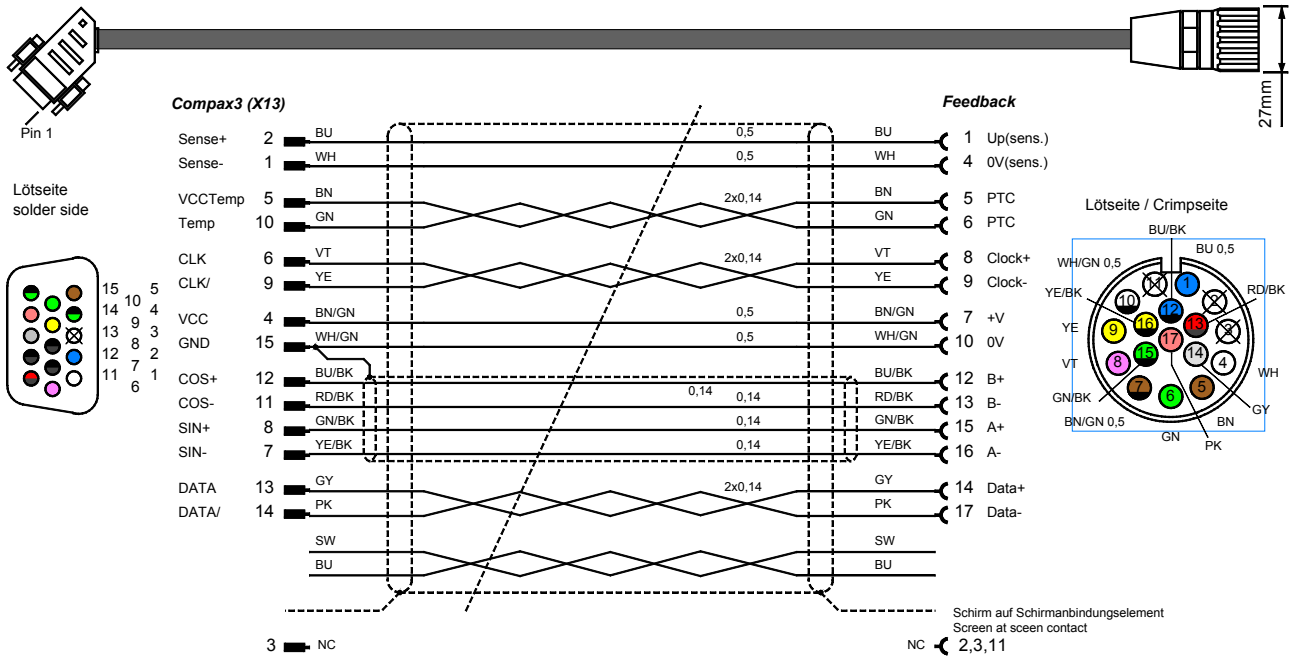
GBK24/..: Cable chain compatible



You can find the length code in the Chapter **Order Code Accessories** (see on page 166).

9.3.3. EnDat cable

GBK38/..: (cable chain compatible)

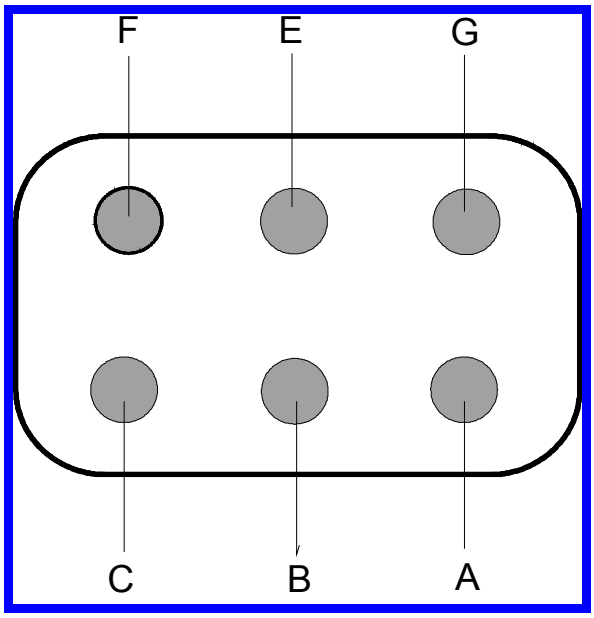


You can find the length code in the Chapter **Order Code Accessories** (see on page 166).

9.3.4. Motor cable

Cross-section / max. permanent load	Motor connector SMH motors MH56, MH70, MH105		Motor terminal box MH145, MH205	
	standard	cable chain compatible	standard	cable chain compatible
1.5 mm^2 / up to 13.8 A	MOK55	MOK54	MOK60	MOK63
2.5 mm^2 / up to 18.9 A	MOK56	MOK57	MOK59	MOK64
6 mm^2 / up to 32.3 A	-	-	-	MOK61
10 mm^2 / up to 47.3 A		--	-	MOK62

9.3.4.1 Connection of terminal box MH145 & MH205

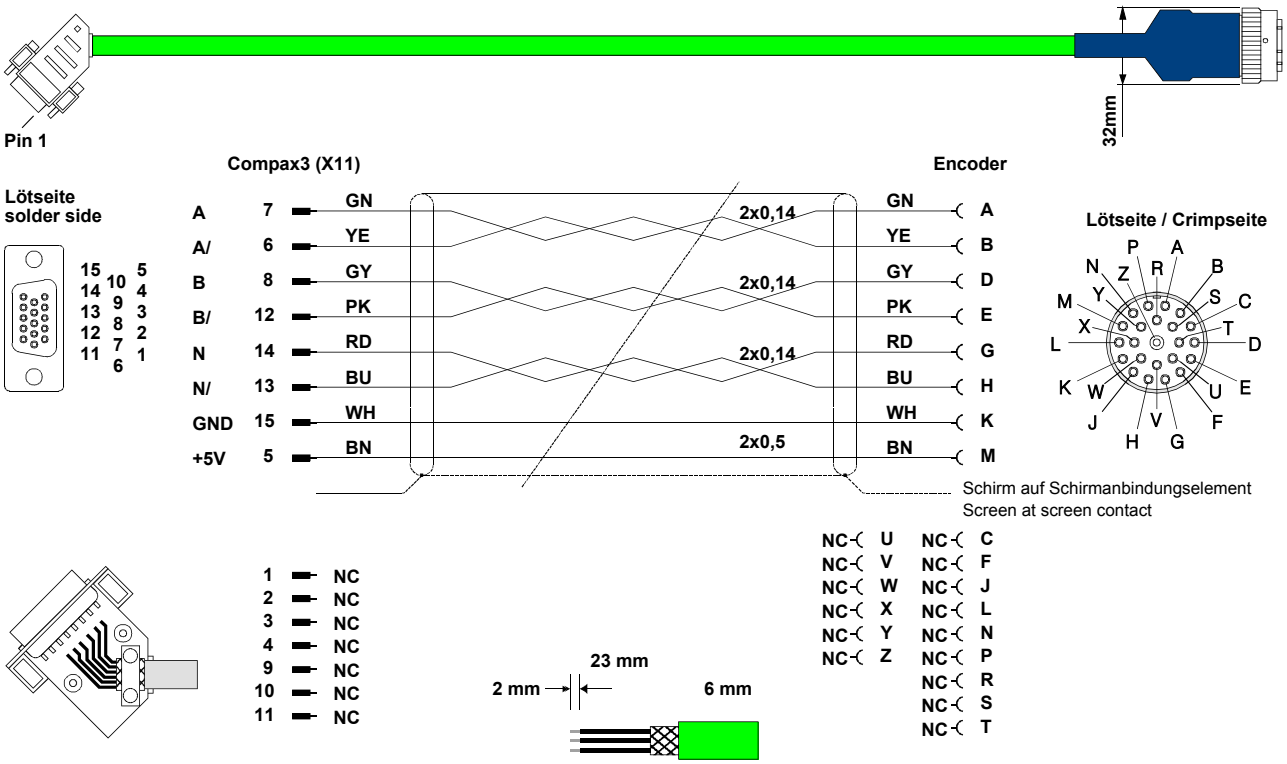


Terminal	Assignment
A	Phase U
B	Phase V
C	Phase W
E	Protective earth terminal
F	Brake (+ red for MH205)
G	Brake (- blue for MH205)

Additional designations can be found on the connection cable clamping board - motor (internal).

9.3.5. Encoder cable

GBK23/..: Connection Compax3 - Encoder



You can find the length code in the **Order Code Accessories** (see on page 166)

9.4 External braking resistors

In this chapter you can read about:

Danger!

Hazards when handling ballast resistors!

Housing temperature up to 200°C!

Dangerous voltage!

The device may be operated only in the mounted state!

The external braking resistors must be installed such that protection against contact is ensured (IP20).

Install the connecting leads at the bottom.

The braking resistors must be grounded.
We recommend to use a thrust washer for the BRM13 and BRM14.

Observe the instructions on the resistors (warning plate).

Please note that the length of the supply cable must not exceed 2m!

Ballast resistors for Compax3

Ballast resistor **(see on page 187)**	**Device**	**Rated output**
BRM08/01 (100Ω)	Compax3S025V2 Compax3S015V4 Compax3S038V4	60 W
BRM05/01 (56Ω)	Compax3S063V2 Compax3S075V4	180 W
BRM05/02 (56Ω)	Compax3S075V4	570 W
BRM10/01 (47Ω)	Compax3S150V4	570 W
BRM10/02 (470Ω)	Compax3S150V4	1500 kW
BRM04/01 (15Ω)	Compax3S150V2 Compax3S300V4 PSUP20D6	570 W
BRM04/02 (15Ω)	Compax3S150V2 Compax3S300V4 PSUP20D6	740 W
BRM04/03 (15Ω)	Compax3S300V4 PSUP20D6	1500 W
BRM09/01 (22Ω)	Compax3S100V2	570 W
BRM11/01 (27Ω)	Compax3H0xxV4	3500 W
BRM13/01 (30Ω)	PSUP10D6 PSUP20D6**	500 W
BRM14/01 (15Ω)	PSUP10D6* PSUP20D6	500 W
BRM12/01 (18Ω)	Compax3H1xxV4	4500 W

*for PSUP10D6 2x15Ω in series

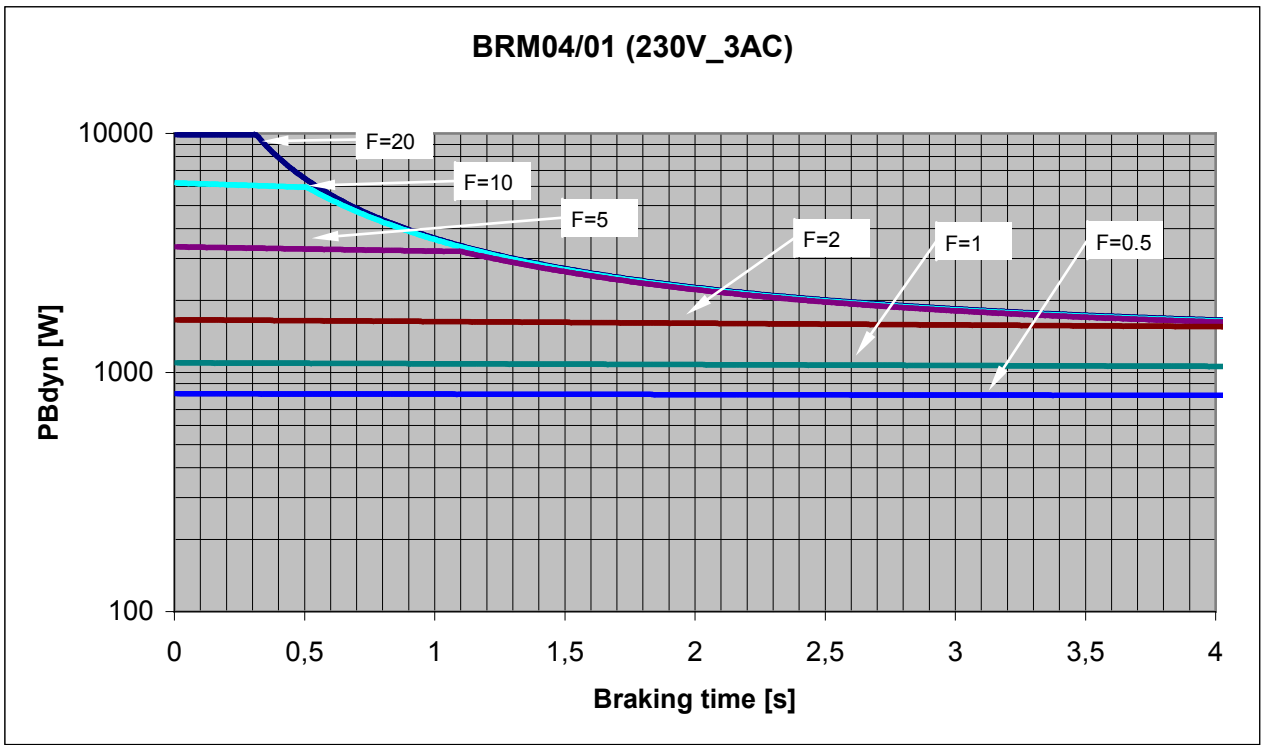
**for PSUP20D6 2x30Ω parallel

9.4.1. Permissible braking pulse powers of the braking resistors

In this chapter you can read about:

The diagrams show the permissible braking pulse powers of the braking resistors in operation with the assigned Compax3.

9.4.1.1 Calculation of the BRM cooling time



F = Factor

Cooling time = F * braking time

Example 1: For a braking time of 1s, a braking power of 1kW is required. The Diagram shows the following:

The required values can be found in the range between characteristic F = 0.5 and F = 1. In order to achieve operating safety, please select the higher factor, this means that the required cooling time is 1s.

F * Braking time = cooling time

1 * 1s = 1s

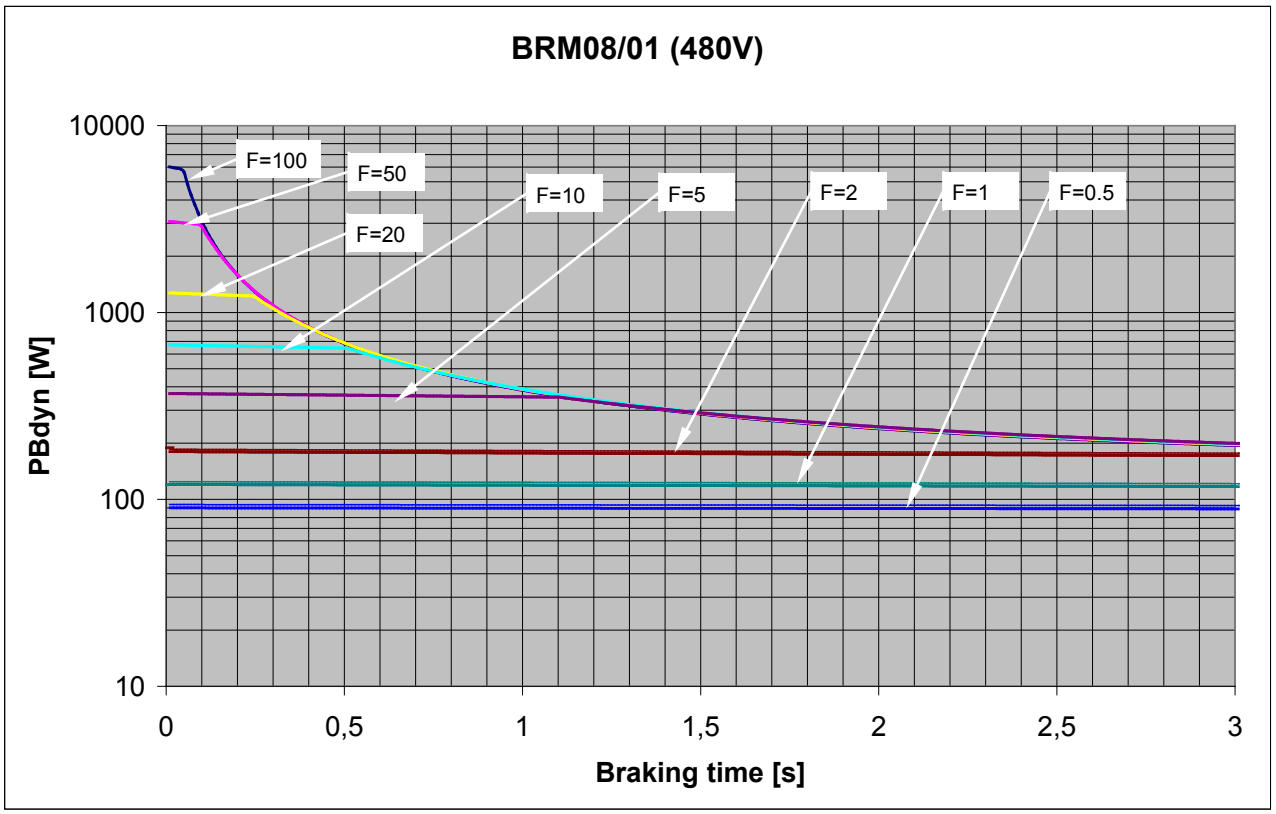
Example 2: For a braking time of 0.5s, a braking power of 3kW is required. The Diagram shows the following:

The required values can be found in the range between characteristic F = 2 and F = 5. In order to achieve operating safety, please select the higher factor, this means that the required cooling time is 2.5s.

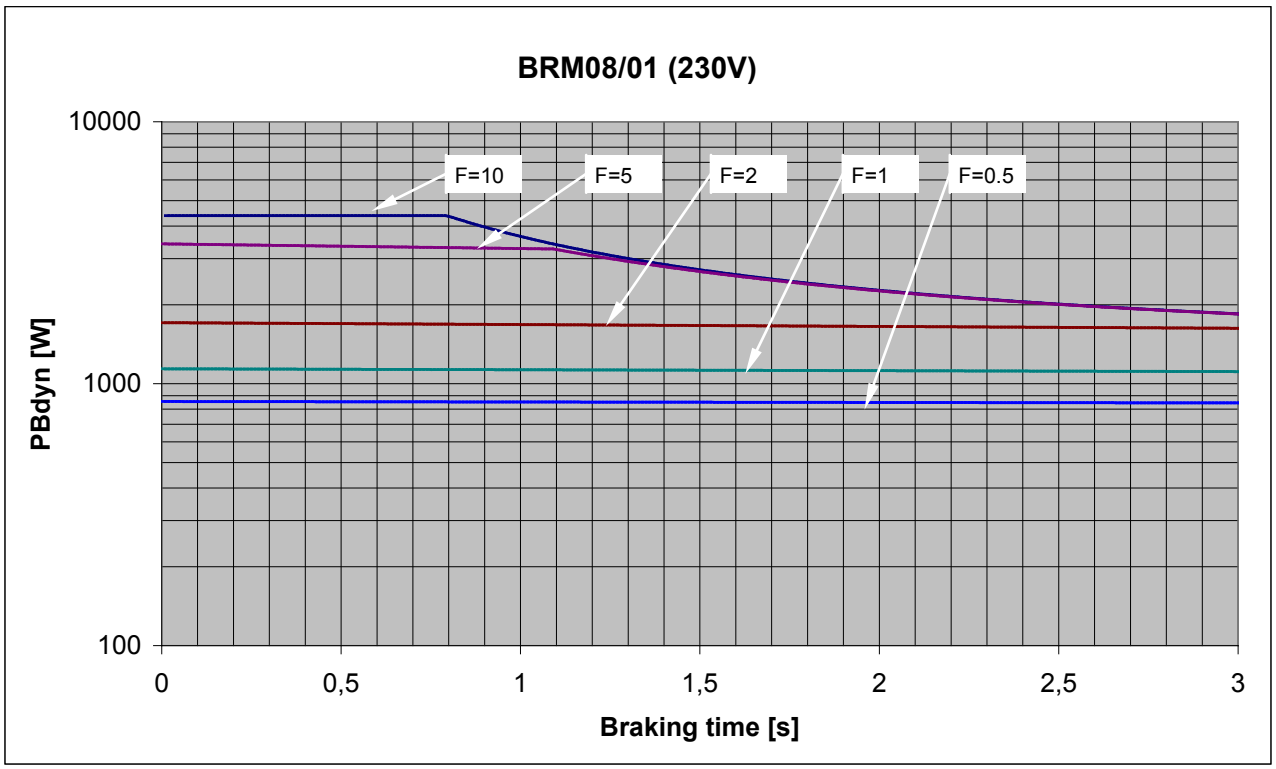
F * Braking time = cooling time

5 * 0.5s = 2.5s

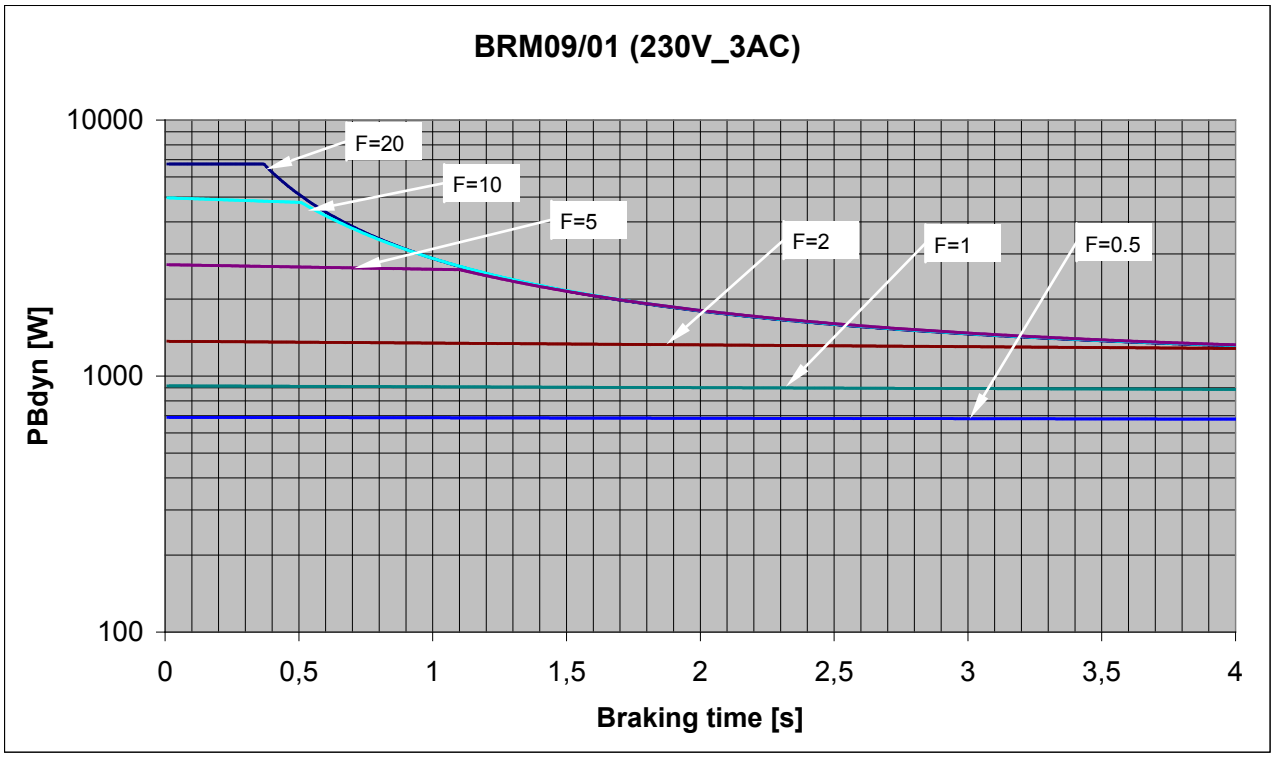
9.4.1.2 Permissible braking pulse power: BRM08/01 with C3S015V4 / C3S038V4



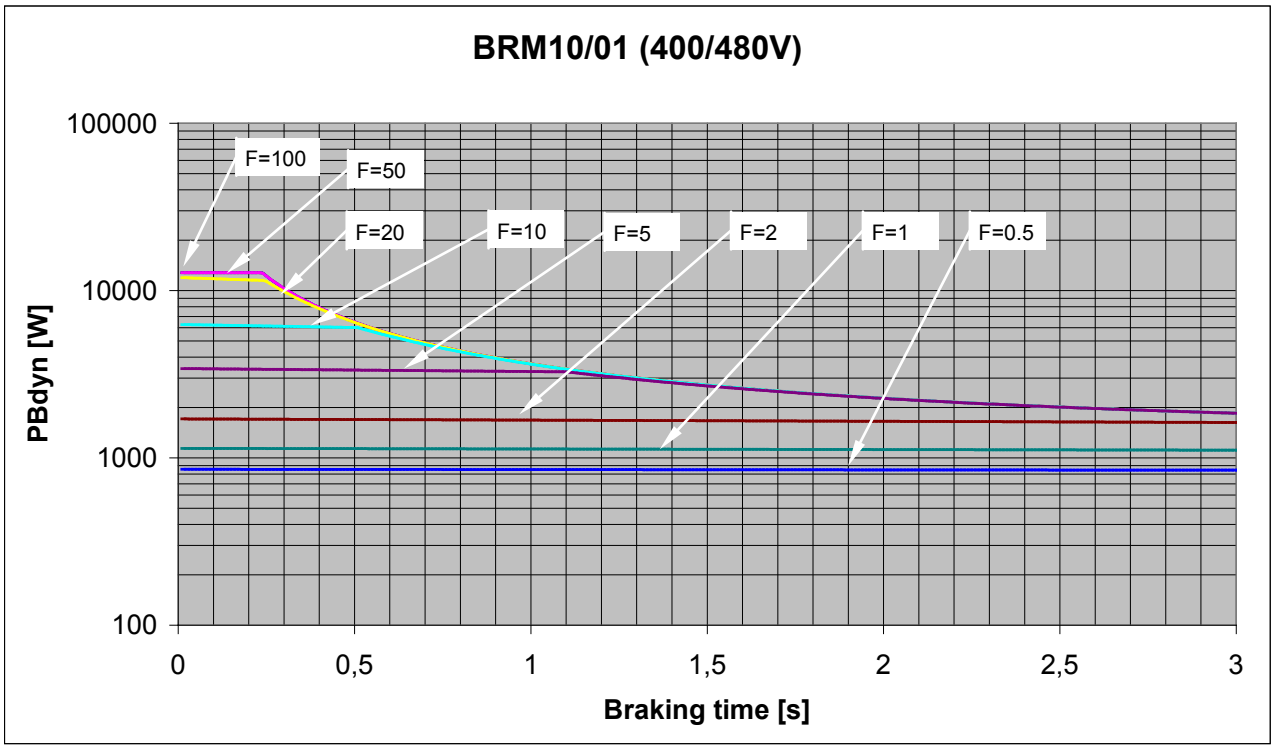
9.4.1.3 Permissible braking pulse power: BRM08/01 with C3S025V2



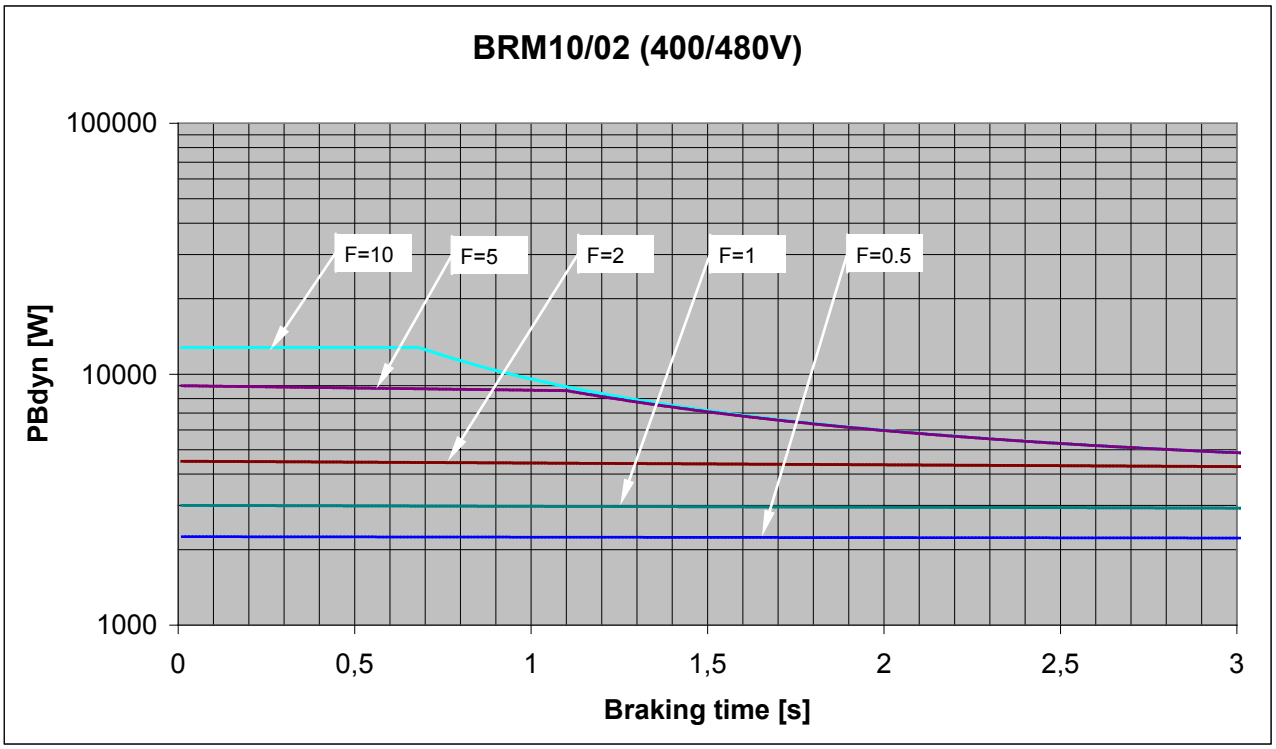
9.4.1.4 Permissible braking pulse power: BRM09/01 with C3S100V2



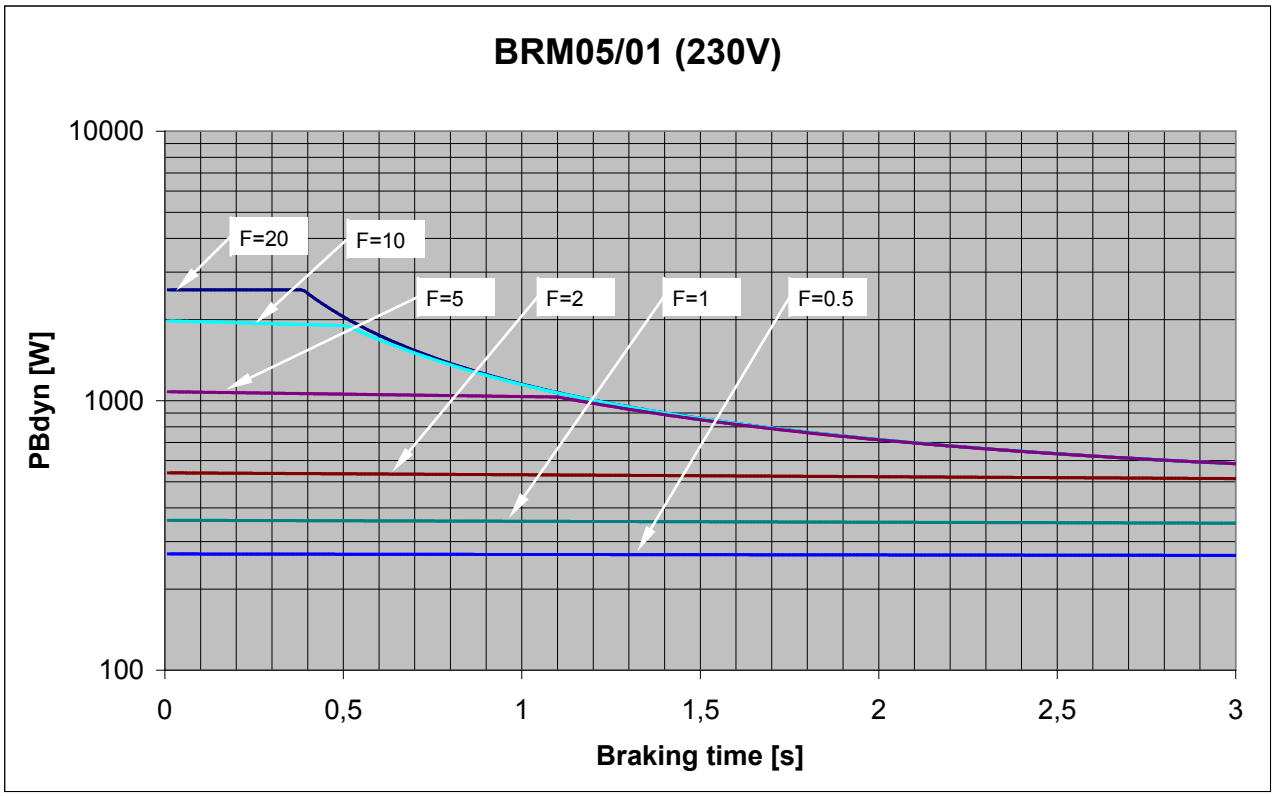
9.4.1.5 Permissible braking pulse power: BRM10/01 with C3S150V4



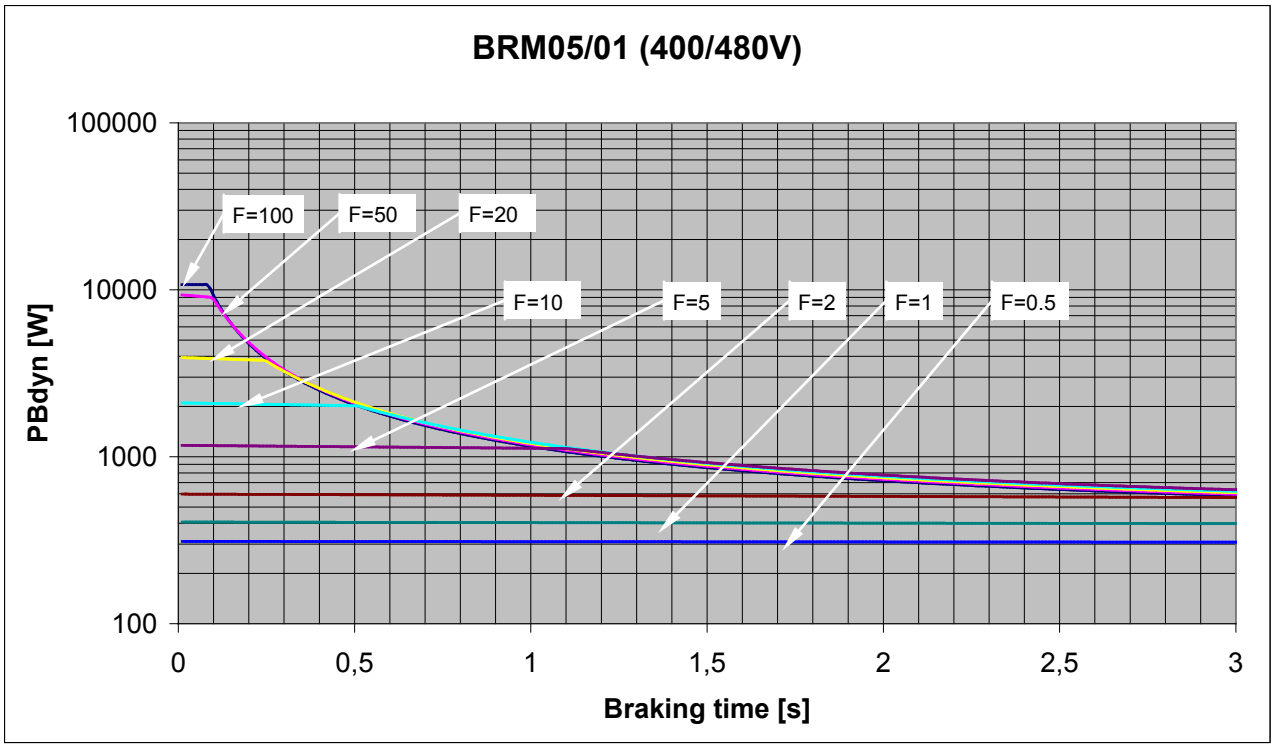
9.4.1.6 Permissible braking pulse power: BRM10/02 with C3S150V4



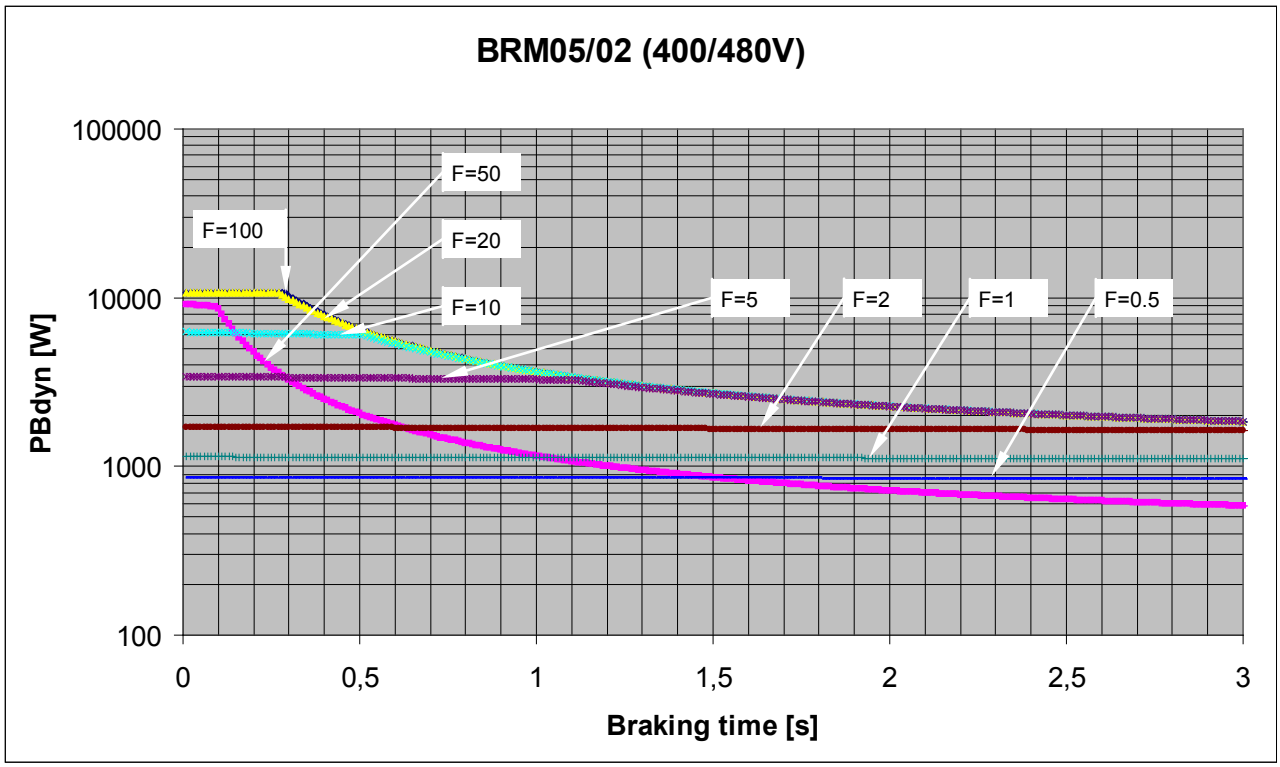
9.4.1.7 Permissible braking pulse power: BRM05/01 with C3S063V2



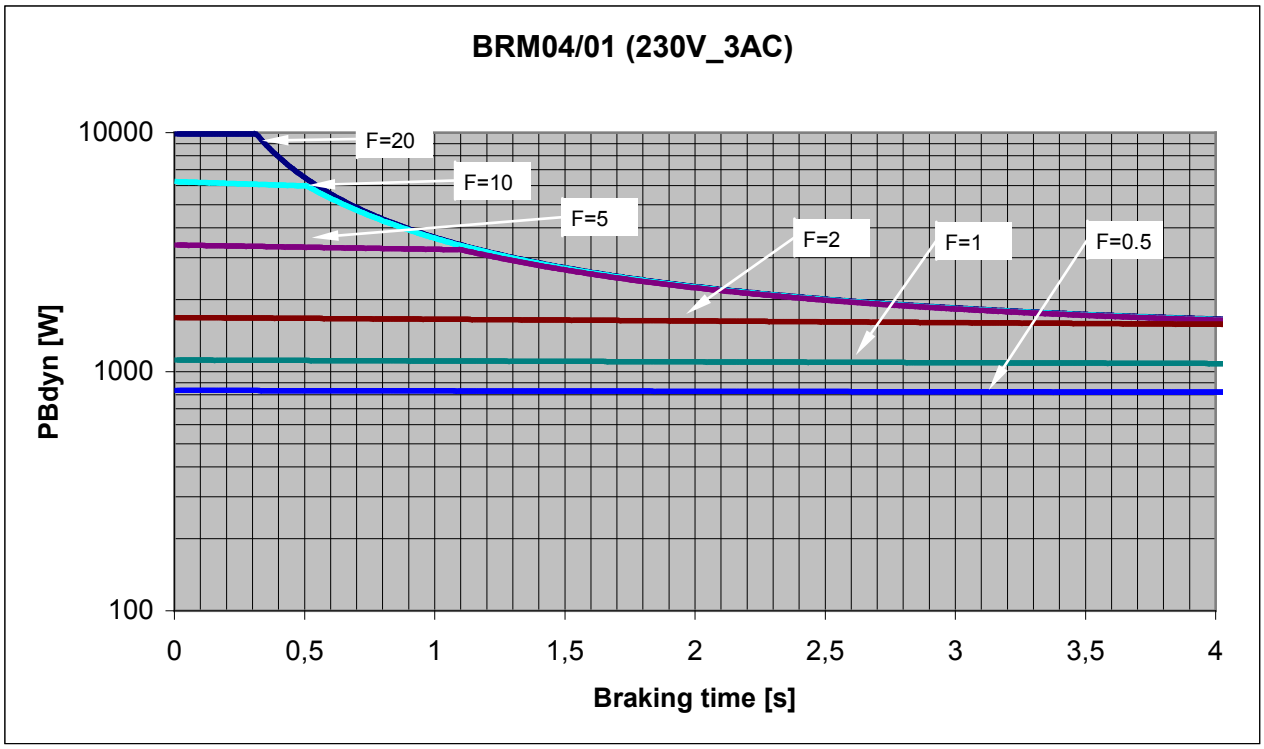
9.4.1.8 Permissible braking pulse power: BRM05/01 with C3S075V4



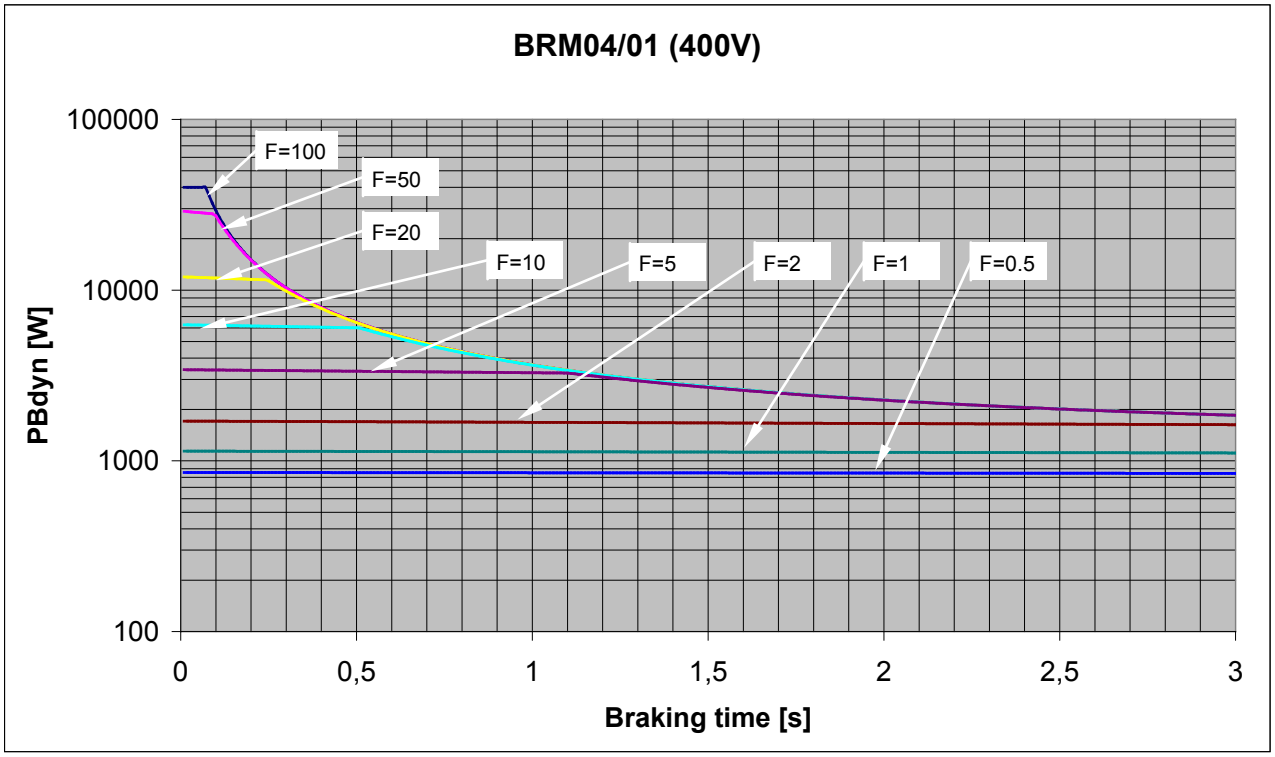
9.4.1.9 Permissible braking pulse power: BRM05/02 with C3S075V4



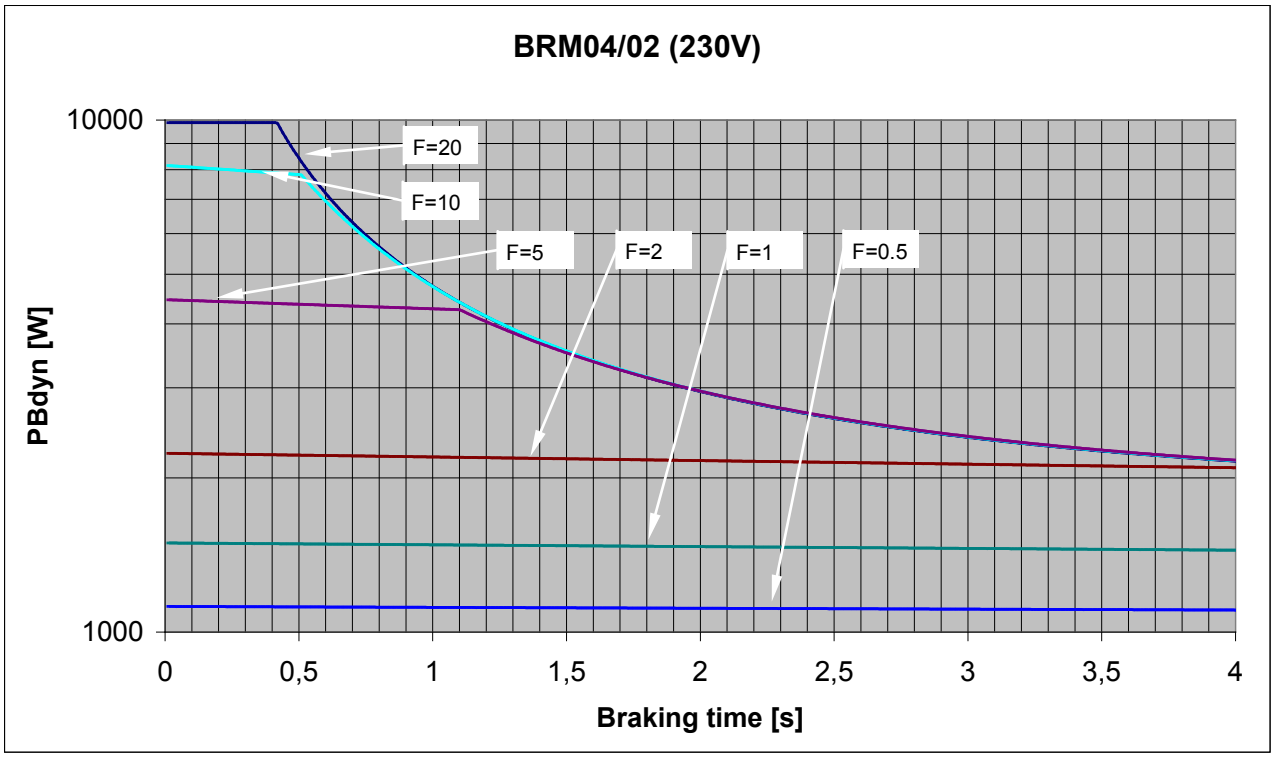
9.4.1.10 Permissible braking pulse power: BRM04/01 with C3S150V2



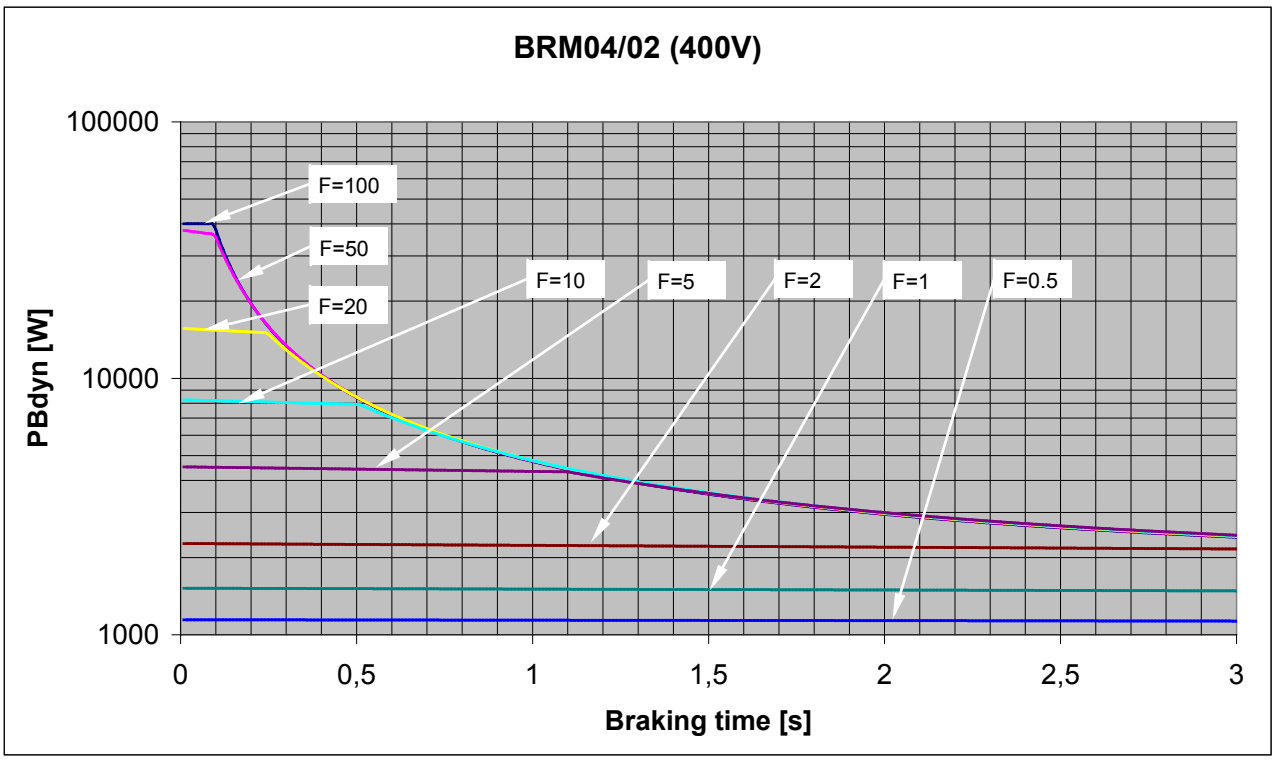
9.4.1.11 Permissible braking pulse power: BRM04/01 with C3S300V4



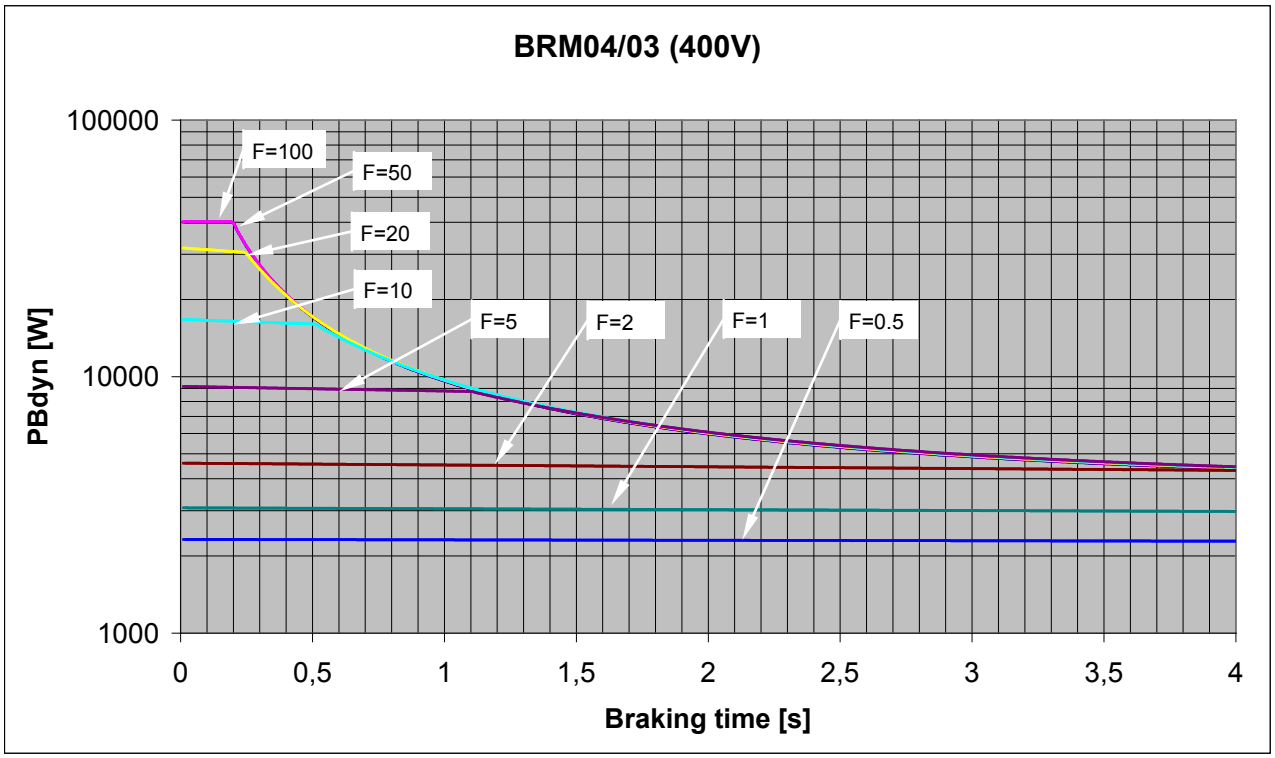
9.4.1.12 Permissible braking pulse power: BRM04/02 with C3S150V2



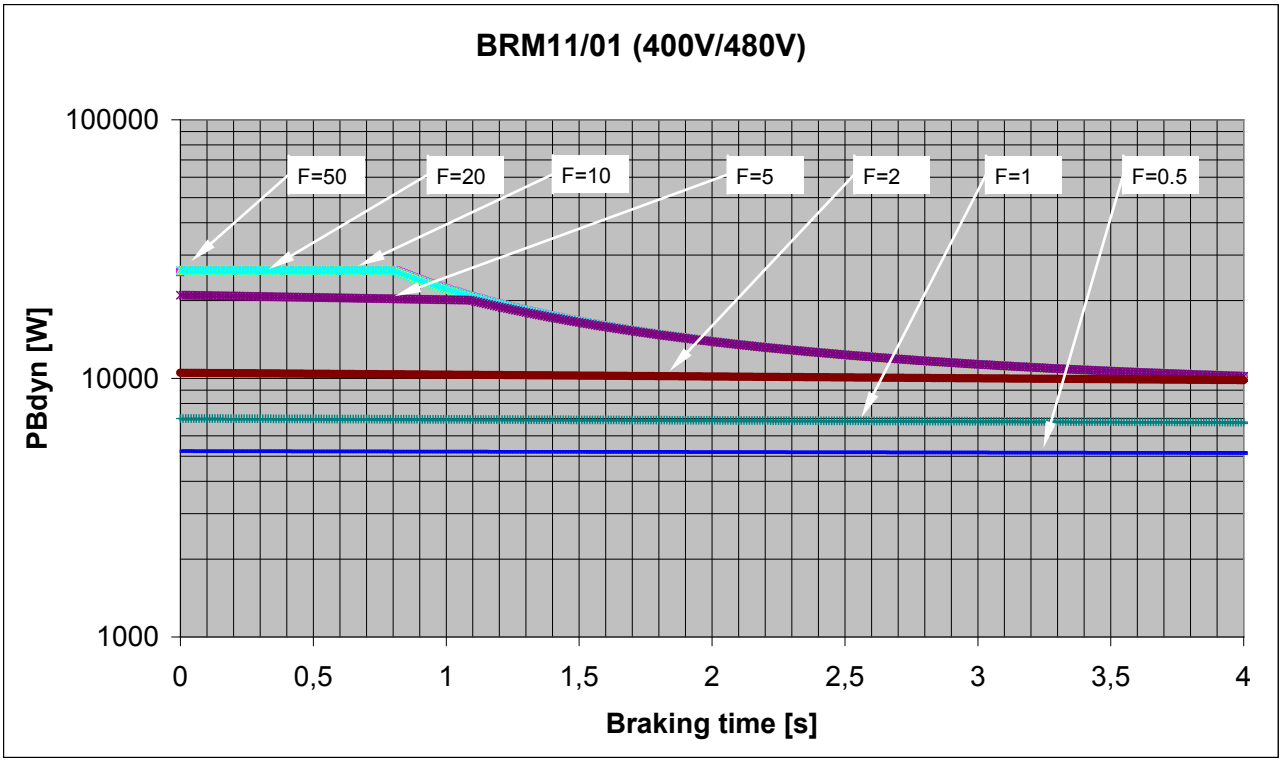
9.4.1.13 Permissible braking pulse power: BRM04/02 with C3S300V4



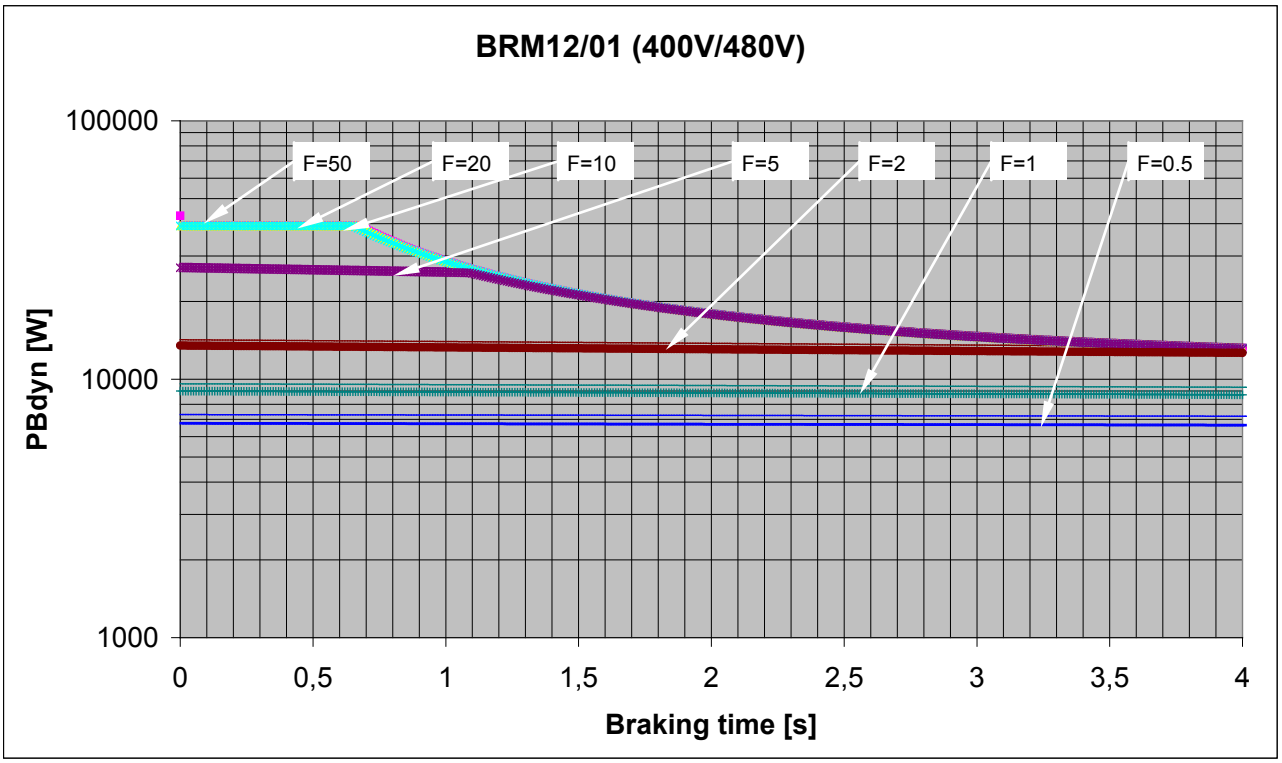
9.4.1.14 Permissible braking pulse power: BRM04/03 with C3S300V4



9.4.1.15 Permissible braking pulse power: BRM11/01 with C3H0xxV4



9.4.1.16 Permissible braking pulse power: BRM12/01 with C3H1xxV4



9.4.1.17 Permissible braking pulse power: BRM13/01 with PSUP10D6

on request

9.4.1.18 Permissible braking pulse power: BRM14/01 with PSUP10D6

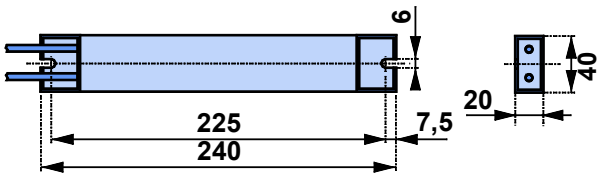
on request

9.4.2. Dimensions of the braking resistors

In this chapter you can read about:

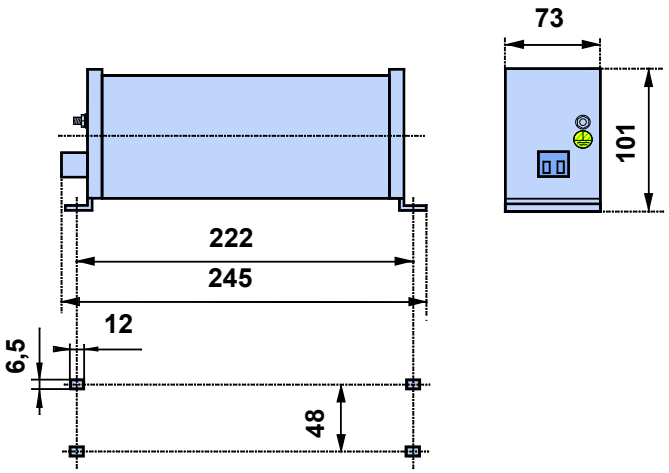
9.4.2.1 BRM8/01braking resistors

Dimensional drawing:



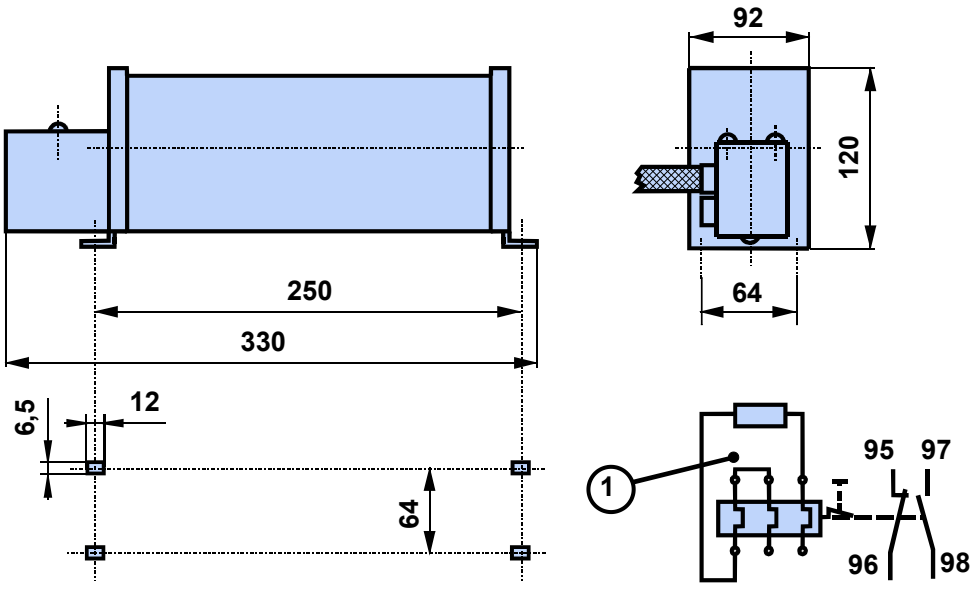
9.4.2.2 BRM5/01 braking resistor

Dimensional drawing:



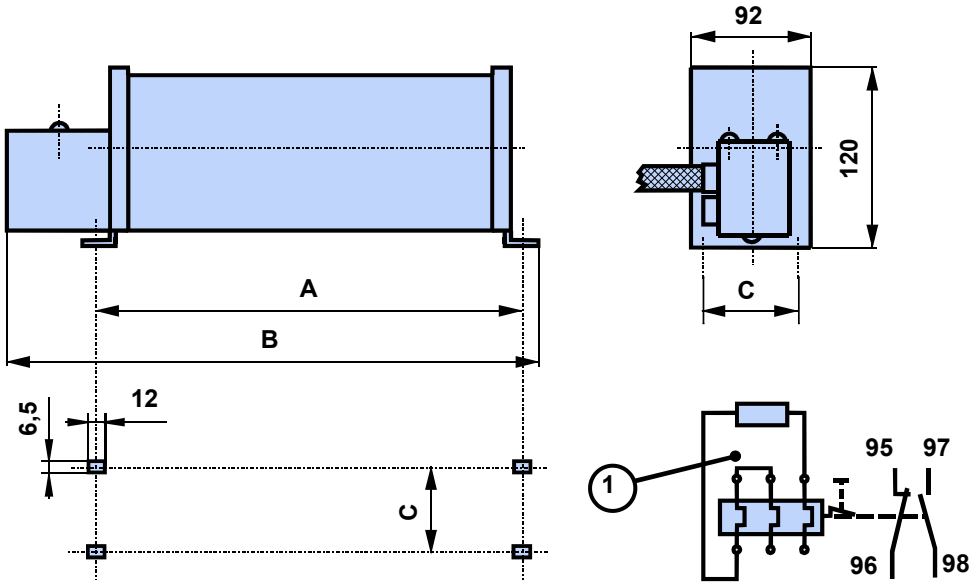
9.4.2.3 Braking resistor BRM5/02, BRM9/01 & BRM10/01

Dimensional drawing:



9.4.2.4 Ballast resistor BRM4/0x and BRM10/02

Dimensional drawing:



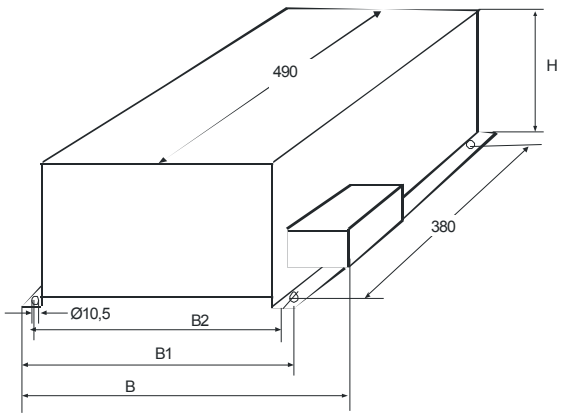
1: thermal overcurrent relay

Dimensions in mm:

Size:	BRM4/01	BRM4/02	BRM4/03 & BRM10/02
A	250	300	540
B	330	380	620
C	64	64	64

9.4.2.5 Braking resistor BRM11/01 & BRM12/01

Dimensional drawing:

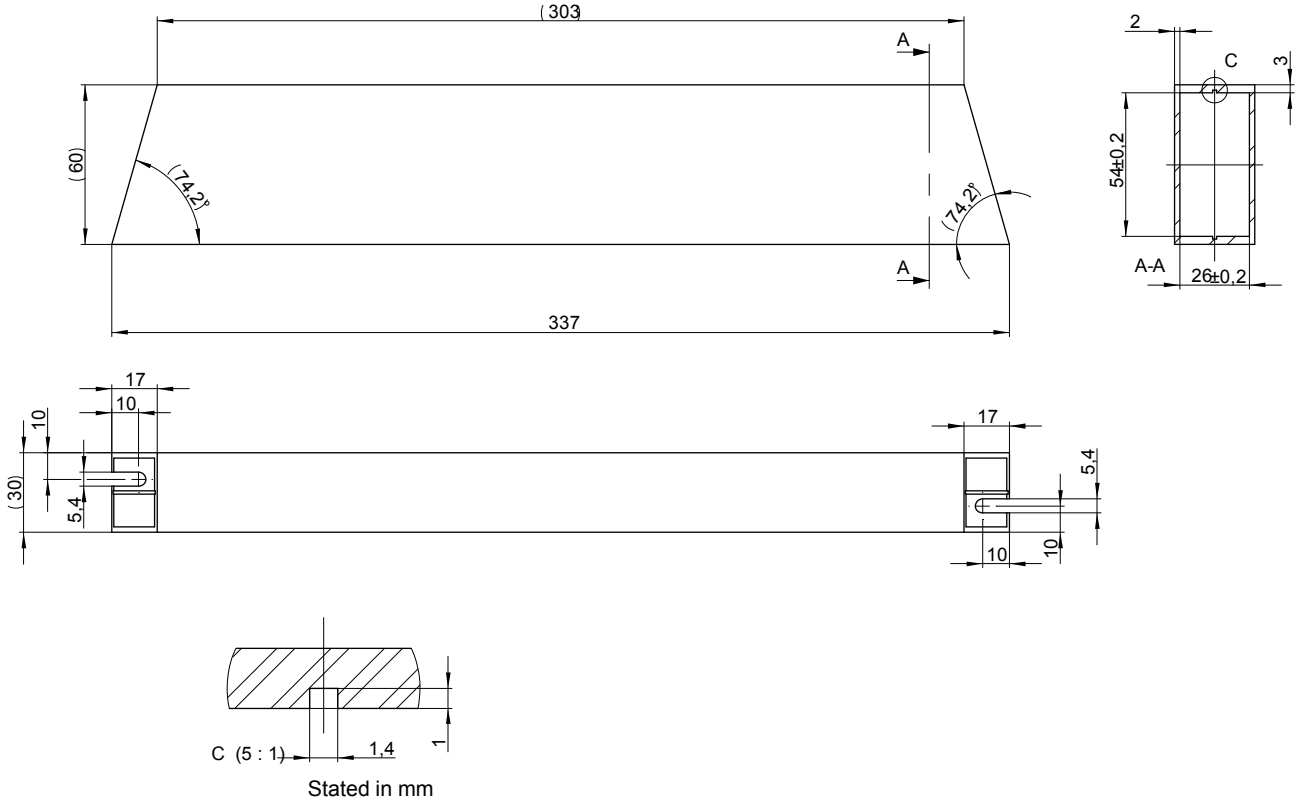


Dimensions in mm:

	BRM11/01	BRM12/02
B	330	
B1	295	
B2	270	
H	260	
Weight	6.0	7.0

9.4.2.6 Ballast resistor BRM13/01 & BRM14/01

Dimensional drawing:



Stated in mm

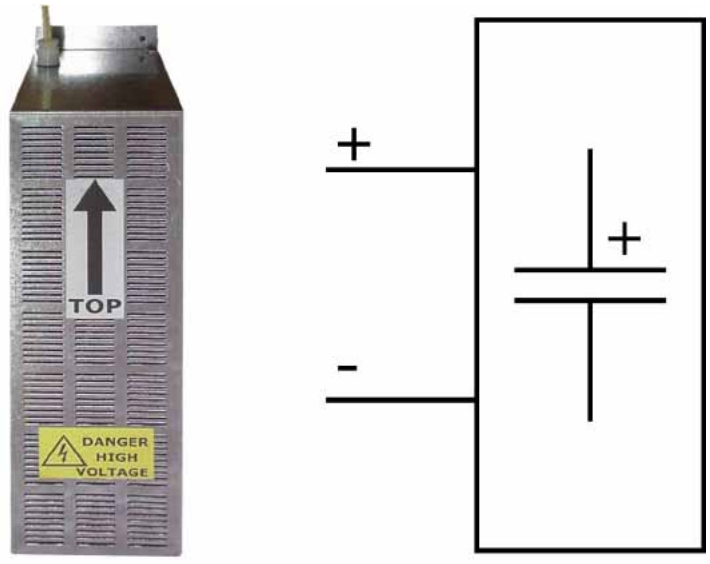
9.5 Condenser module C4

Order code condenser module

for C3S300V4	1100µF	Modules	C4

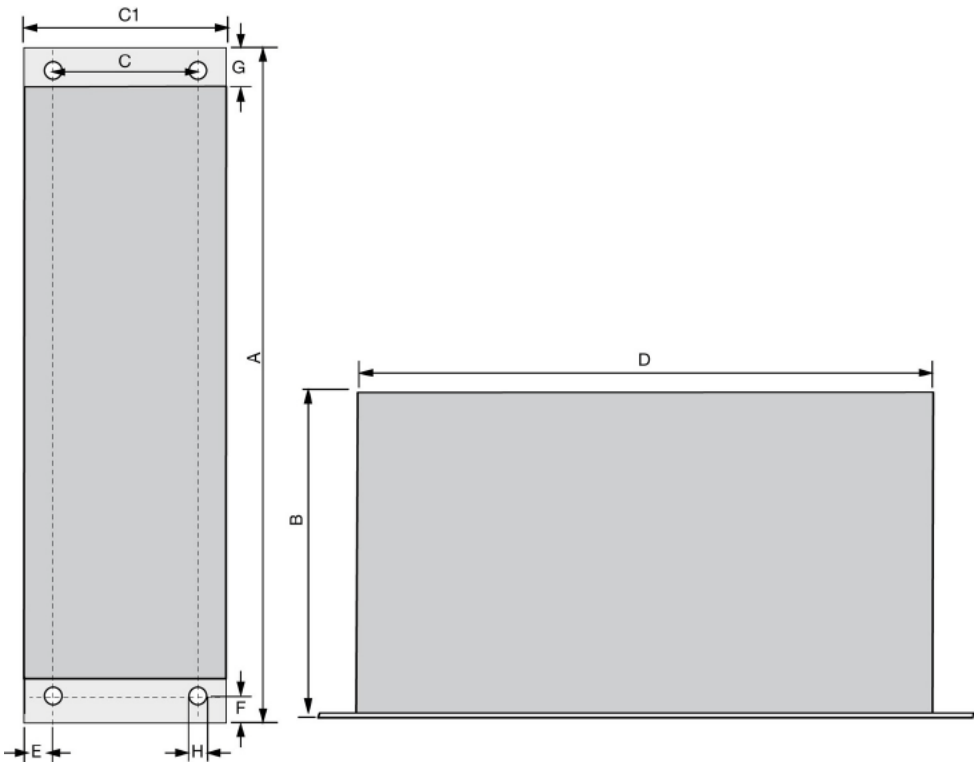
Technical Characteristics

Type	Capacity	Cable length
Module C4	1100µF	~30 cm



Dimensions in mm

Module C4	A	B	C	C1	D	E	F	G	H
	430	190	90	120	370	15	18	30	∅ 6



9.6 Operator control module BDM

Order Code operating module

							/	
Operating module (for Compax3S and Compax3F)	BDM	0	1	/	0	1		

Flexible service and maintenance

Functions:

- Mobile or stationary handling: can remain on the unit for display and diagnostic purposes, or can be plugged into any unit.
- Can be plugged in while in operation
- Power supply via Compax3 servo control
- Display with 2 times 16 places.
- Menu-driven operation using 4 keys.
- Displays and changing of values.
- Display of Compax3 messages.
- Duplication of device properties and IEC61131-3 program to another Compax3 with identical hardware.
- Additional information can be found int he BDM manual This can be found on the Compax3 CD or on our Homepage: **BDM-manual** (**http://divapps.parker.com/divapps/EME/EME/Literature_List/dokumentationen/BDM.pdf**).

9.7 EAM06: Terminal block for inputs and outputs

Order Code terminal block

						/		
for I/Os without luminous indicator	for X11, X12, X22	EAM	0	6	/	0	1
for I/Os with luminous indicator	for X12, X22	EAM	0	6	/	0	2

The terminal block EAM06/.. can be used to route the Compax3 plug connector X11 or X12 for further wiring to a terminal strip and to a Sub-D plug connector.

Via a supporting rail (Design: ⌙ or ⌙) the terminal unit can be attached to a mounting rail in the switch cabinet.

EAM06/ is available in 2 variants:

- EAM06/01: Terminal block for X11, X12, X22 without luminous indicator
- EAM06/02: Terminal block for X12, X22 with luminous indicator

Corresponding connecting cables EAM06 - Compax3 are available:

- from X11 - EAM06/01: SSK23/..
- from X12, X22 - EAM06/xx: SSK24/..

EAM6/01: Terminal block without luminous indicator for X11, X12 or X22

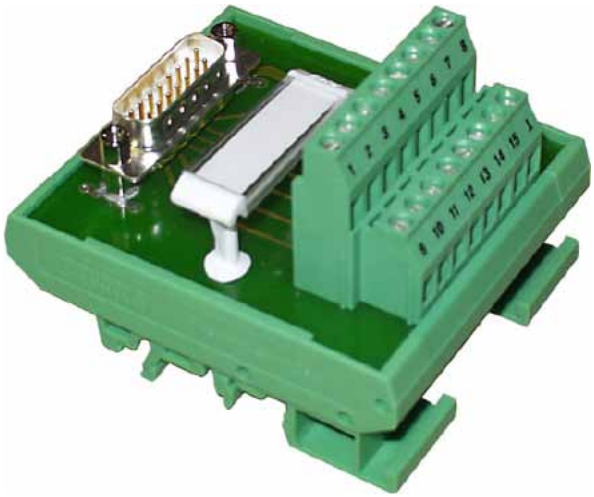


Figure similar

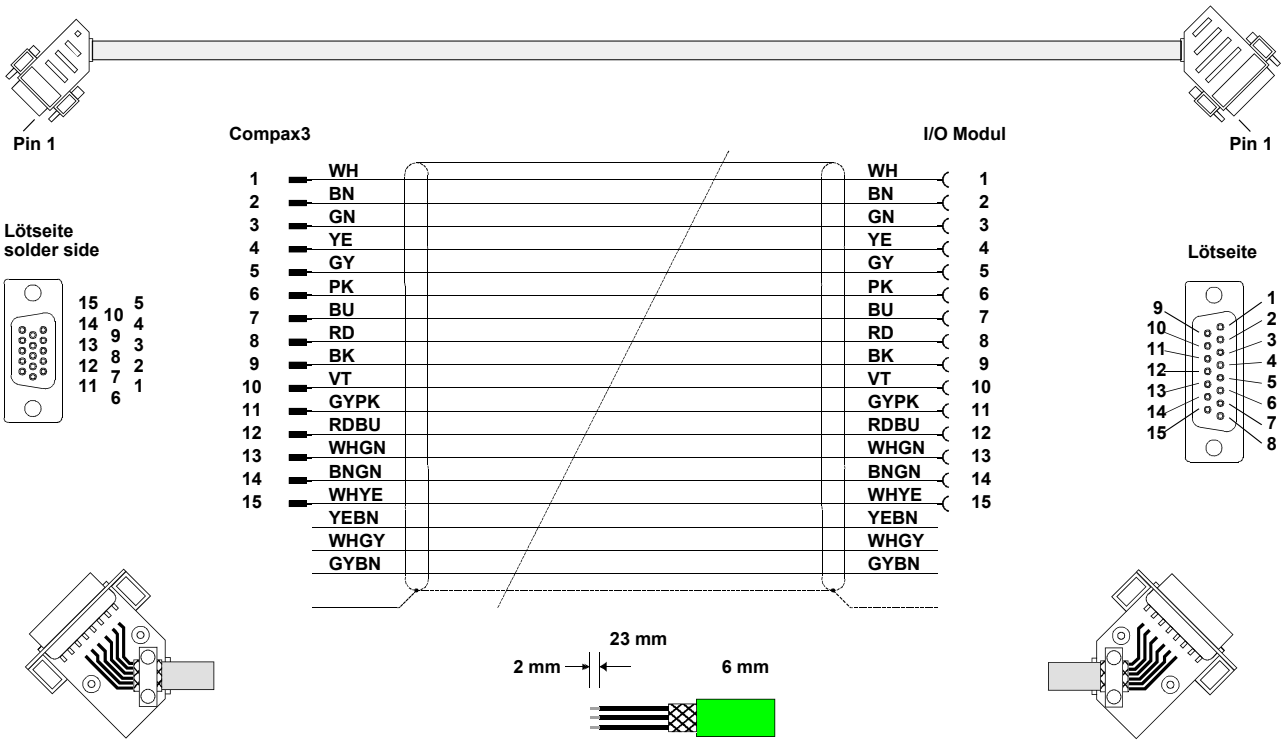
Width: 67.5 mm

EAM6/02: Terminal block with luminous indicator for X12, X22

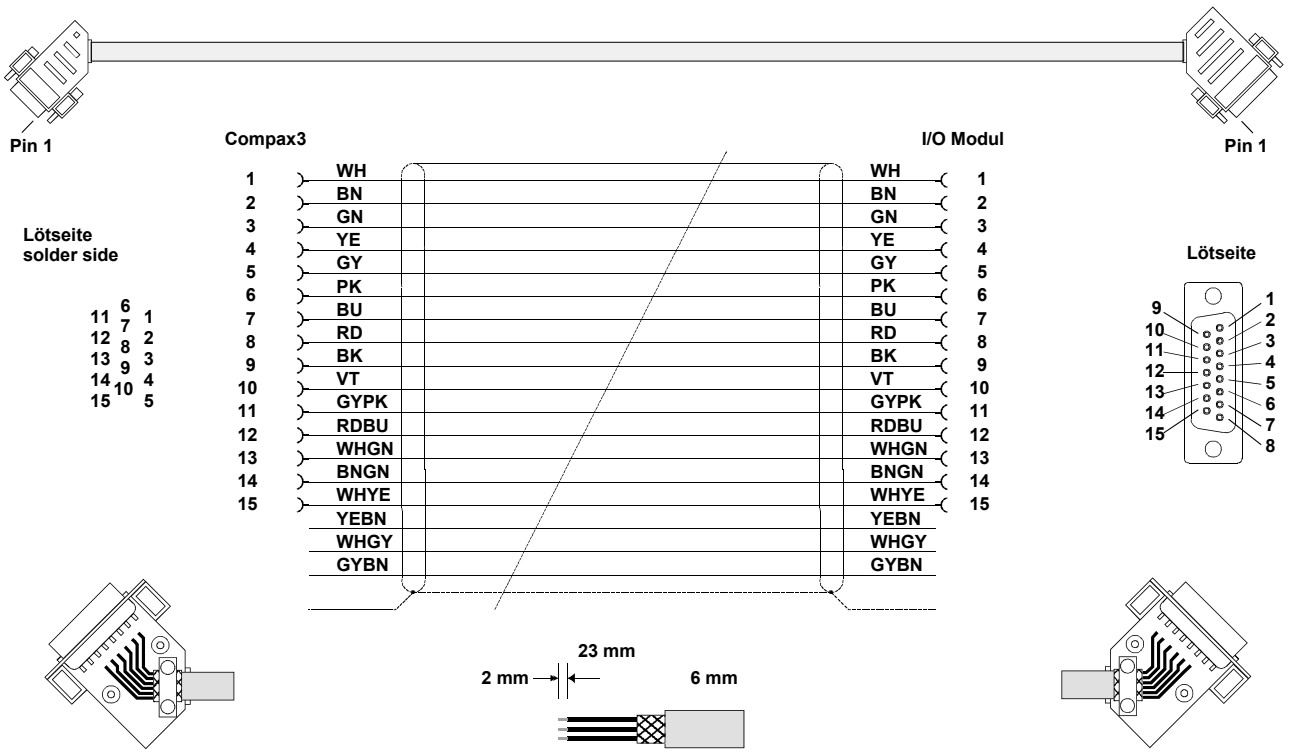
Figure similar

Width: 67.5 mm

Cable plan SSK23/..: X11 to EAM 06/01



Cable plan SSK24/..: X12 to EAM 06/xx



9.8 Interface cable

In this chapter you can read about:

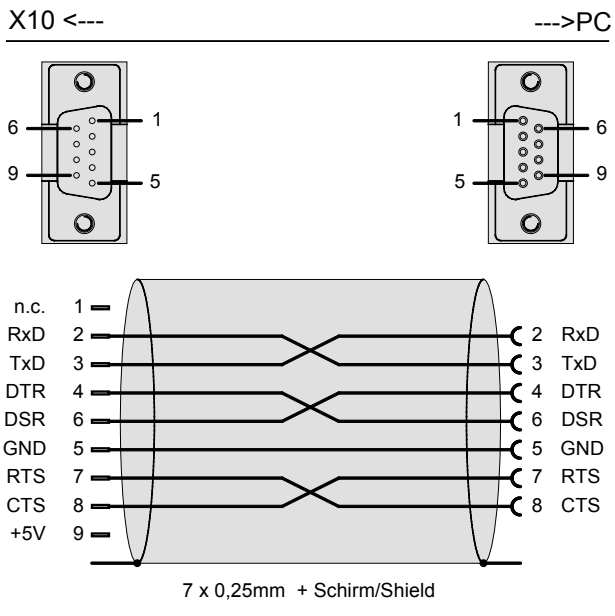
Order code for interface cables and plugs

PC – Compax3 (RS232)		SSK	0	1	/	...	...(1
PC – PSUP (USB)		SSK	3	3	/	...	...
on X11 (Ref/Analog) and X13 at C3F001D2	with flying leads	SSK	2	1	/	...	...(1
on X12 / X22 (digital I/Os)	with flying leads	SSK	2	2	/	...	...(1
on X11 (Ref /Analog)	for I/O terminal block	SSK	2	3	/	...	...(1
on X12 / X22 (digital I/Os)	for I/O terminal block	SSK	2	4	/	...	...(1
PC ⇔ POP (RS232)		SSK	2	5	/	...	...(1
Compax3 ⇔ POP (RS485) for several C3H on request		SSK	2	7	/	../	...(6
Compax3 HEDA ⇔ Compax3 HEDA or PC ⇔ C3powerPLmC Compax3 I30 ⇔ Compax3 I30 or C3M-multi-axis communication Profinet, EtherCAT, Ethernet Powerlink		SSK	2	8	/	../	...(5
Compax3 X11 ⇔ Compax3 X11 (encoder coupling of 2 axes)		SSK	2	9	/	...	...(1
Compax3 X10 ⇔ Modem		SSK	3	1	/	...	
Compax3H adapter cable ⇔ SSK01 (length 15cm, delivered with the device)		SSK	3	2	/	2	0
Compax3H X10 RS232 connection control ⇔ Programming interface (delivered with the device)		VBK	1	7	/	0	1
Bus terminal connector (for the 1st and last Compax3 in the HEDA Bus/or multi-axis system)		BUS	0	7	/	0	1
Profibus cable (2	non prefabricated	SSL	0	1	/	...	...(1
Profibus plug		BUS	0	8	/	0	1
CAN bus cable (2	non prefabricated	SSL	0	2	/	...	...(1
CANbus connector		BUS	1	0	/	0	1

(x **Note on cable** (see on page 169)

9.8.1. RS232 cable

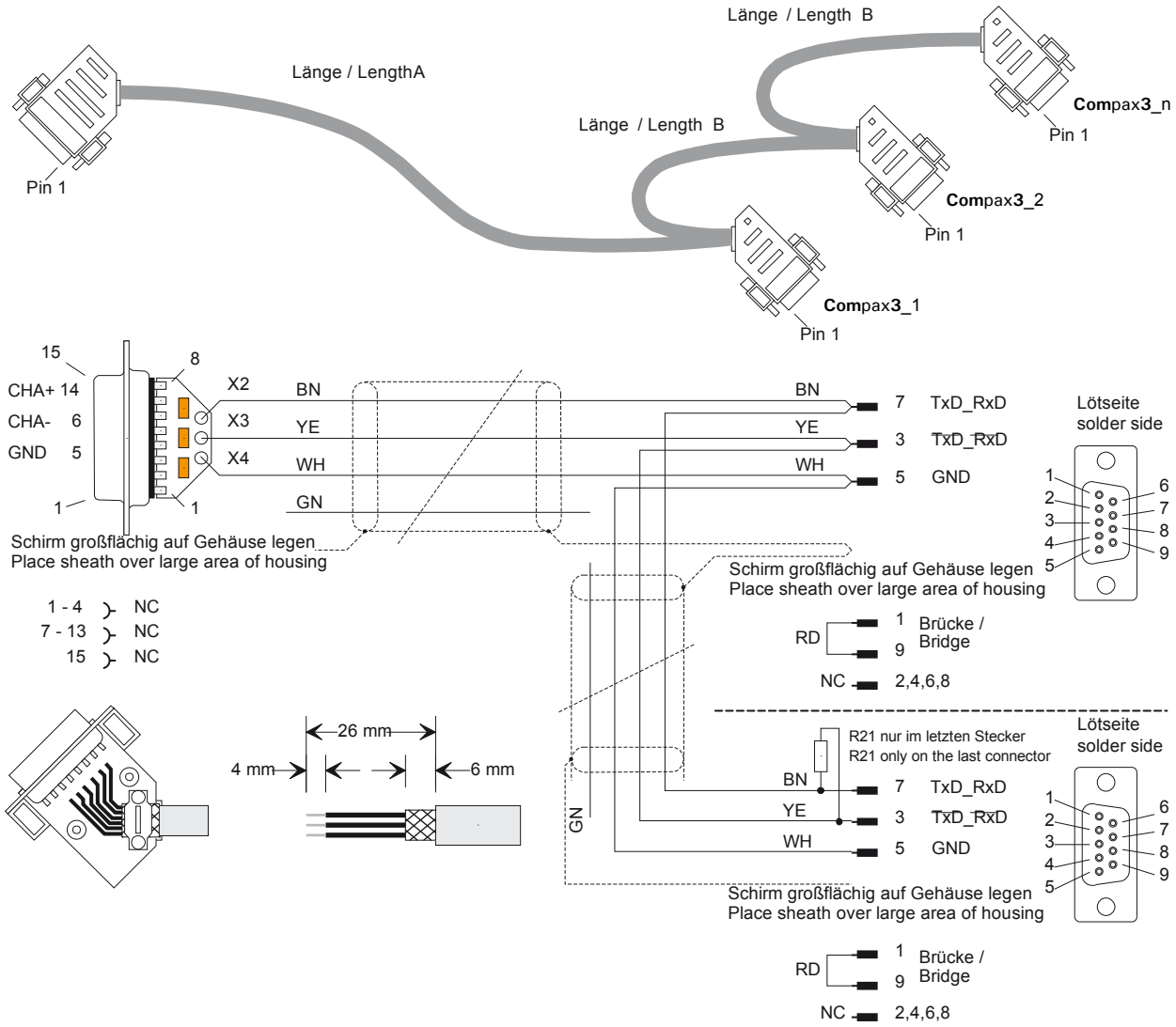
SSK1/..



You can find the length code in the **Order Code Accessories** (see on page 166)

9.8.2. RS485 cable to Pop

SSK27: Connection Pop - Compax3 - Compax3 - ...



R21 = 220 Ohm

(6 Order code: SSK27/nn/..

Length A (Pop - 1. Compax3) variable (the last two numbers according to the length code for cable, for example SSK27/nn/01)

Length B (1. Compax3 - 2. Compax3 - ... - n. Compax3) fixed 50 cm (only if there is more than 1 Compax3, i.e. nn greater than 01)

Number n (the last two digits)

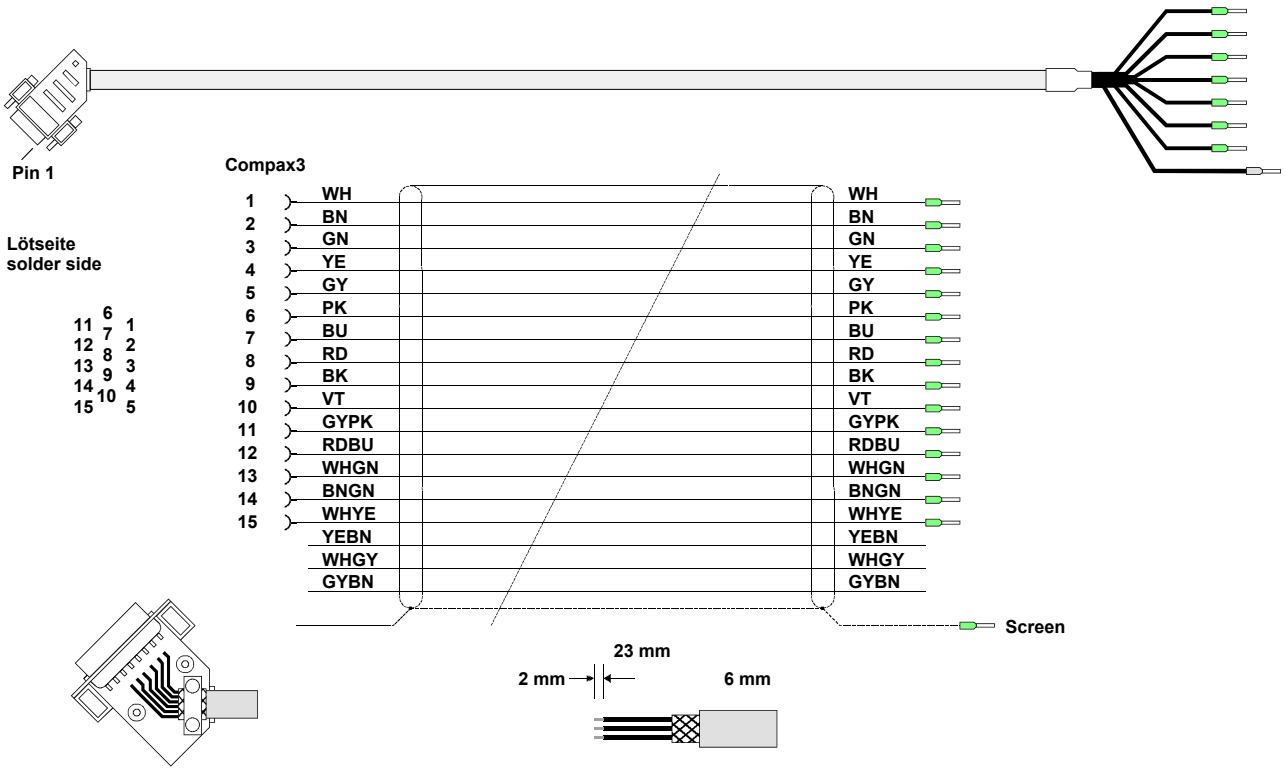
Examples include:

SSK27/05/.. for connecting from Pop to 5 Compax3.

SSK27/01/.. for connecting from Pop to one Compax3

9.8.3. I/O interface X12 / X22

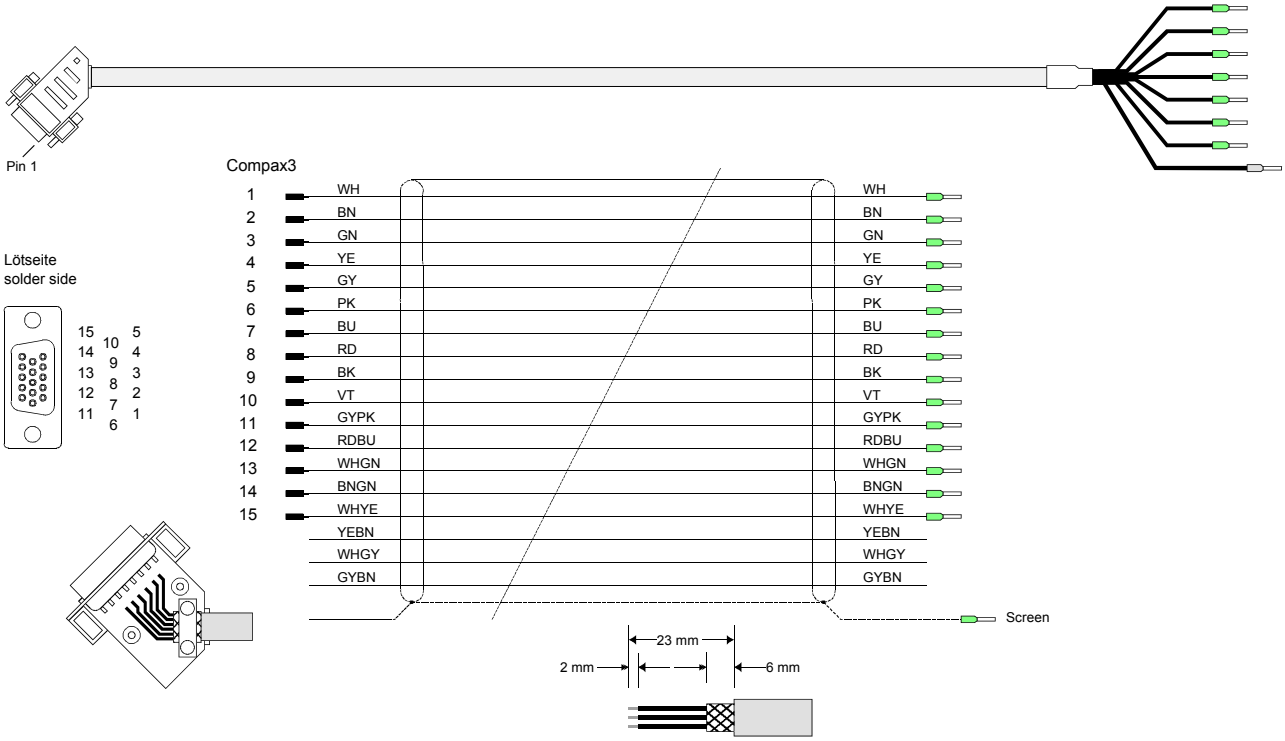
SSK22/..: Cable for X12 / X22 with flying leads



You can find the length code in the **Order Code Accessories** (see on page 166)

9.8.4. Ref X11

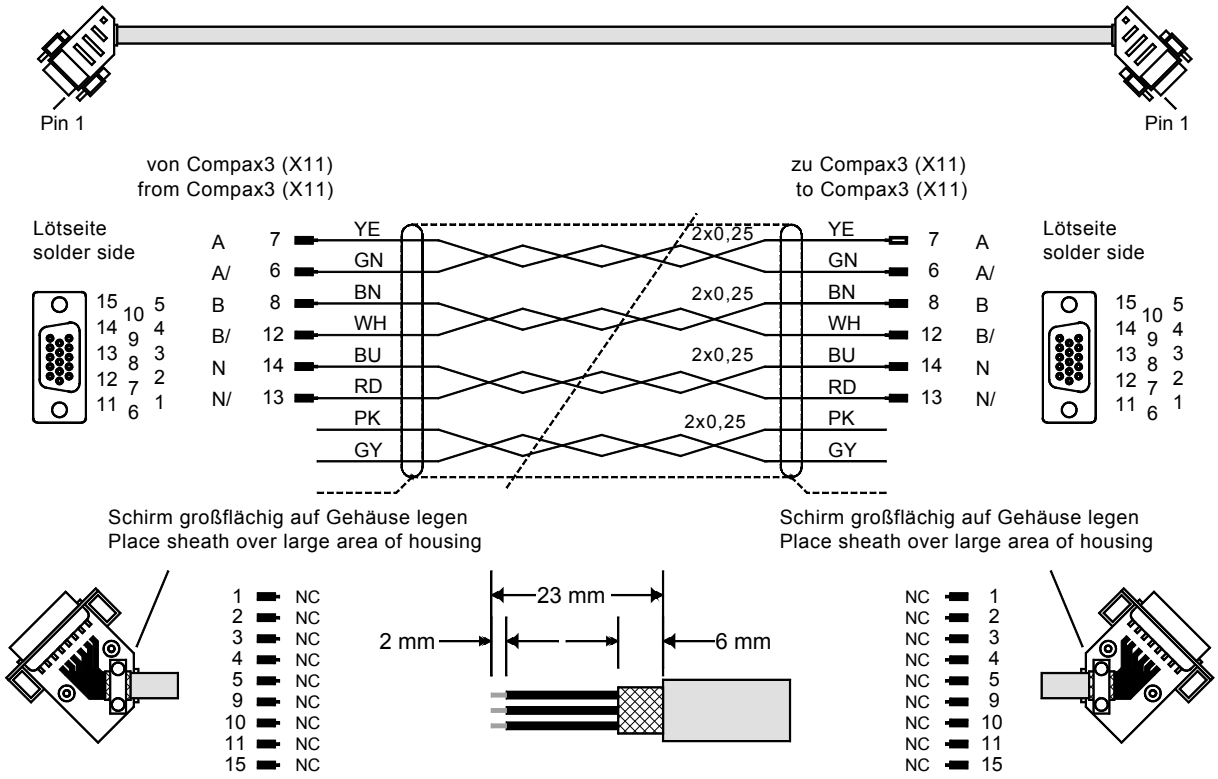
SSK21/..: Cable for X11 with open ends



You can find the length code in the **Order Code Accessories** (see on page 166)

9.8.5. Encoder coupling of 2 Compax3 axes

SSK29/..: Cable from Compax3 X11 to Compax3 X11

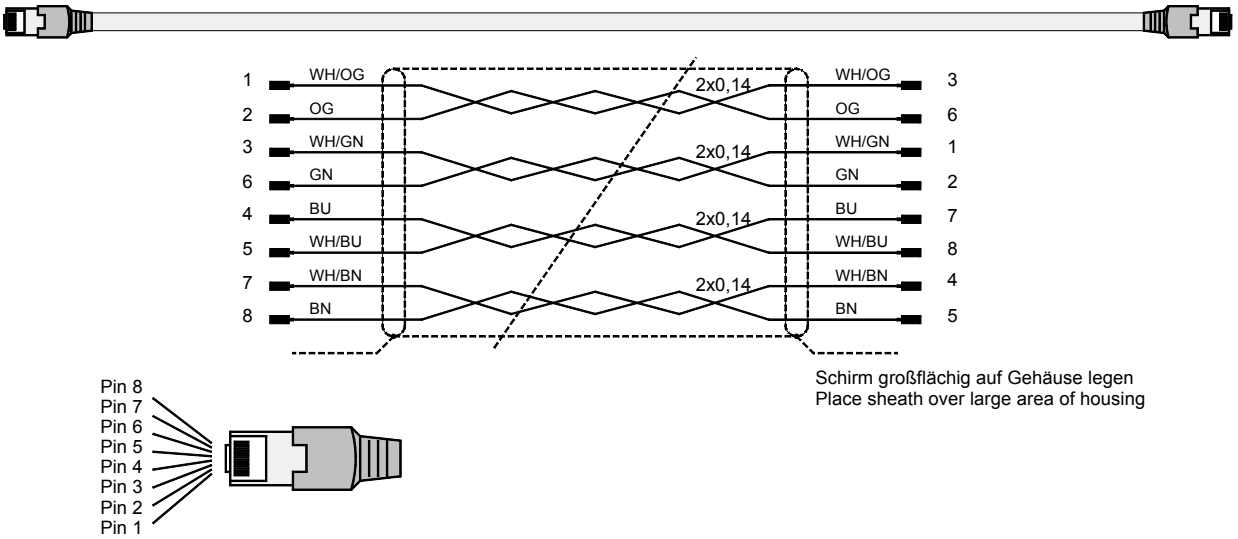


You can find the length code in the **Order Code Accessories** (see on page 166)

Compax3 HEDA ⇔ Compax3 HEDA or PC ⇔ C3powerPLmC
Compax3 I30 ⇔ Compax3 I30 or C3M-multi axis communication

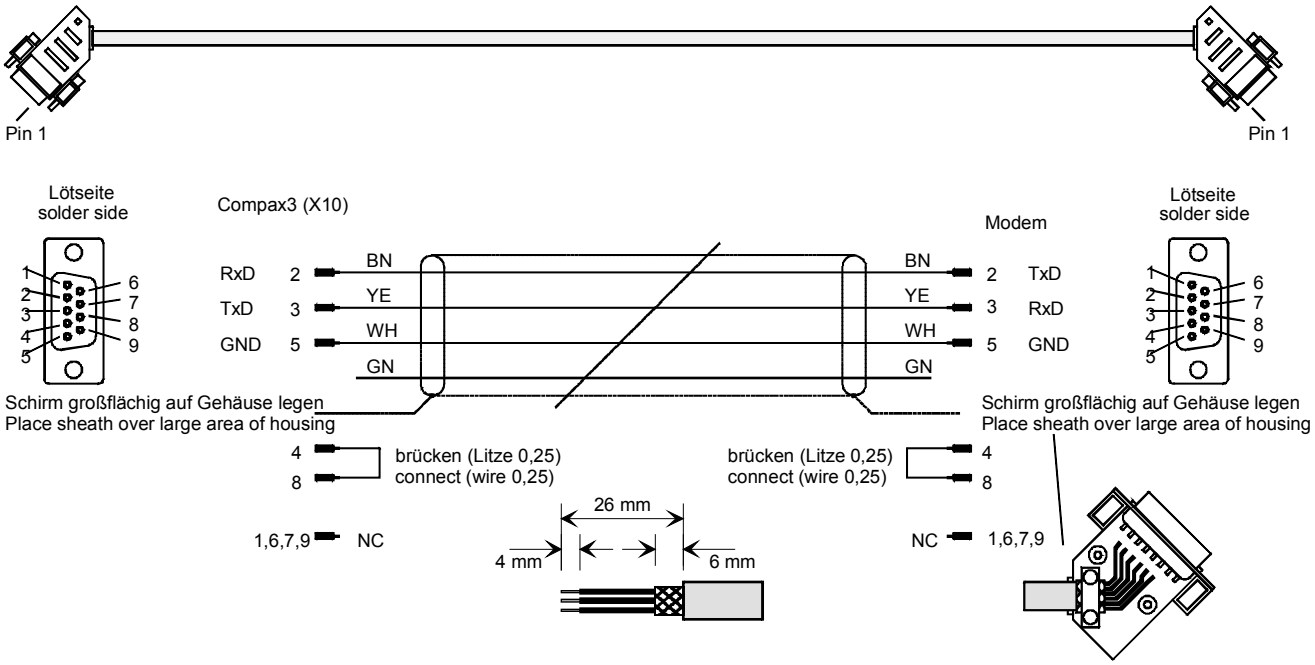
Profinet, EtherCAT, Ethernet Powerlink

Layout of SSK28:



9.8.6. Modem cable SSK31

SSK31/..



You can find the length code in the **Order Code Accessories** (see on page 166)

10. Technical Characteristics

Mains connection Compax3S0xxV2 1AC

Controller type	S025V2	S063V2
Supply voltage	Single phase 230VAC/240VAC 80-253VAC / 50-60Hz	
Input current	6Arms	13Arms
Maximum fuse rating per device (=short circuit rating)	10 A (MCB miniature circuit breaker, K characteristic)	16A (automatic circuit breaker K)

Mains connection Compax3S1xxV2 3AC

Controller type	S100V2	S150V2
Supply voltage	Three phase 3* 230VAC/240VAC 80-253VAC / 50-60Hz	
Input current	10Arms	13Arms
Maximum fuse rating per device (=short circuit rating)	16A	20A
	MCB miniature circuit breaker, K characteristic	

Mains connection Compax3SxxxV4 3AC

Controller type	S015V4	S038V4	S075V4	S150V4	S300V4
Supply voltage	Three phase 3*400VAC/480VAC 80-528VAC / 50-60Hz				
Input current	3Aeff	6Arms	10Arms	16Arms	22Arms
Maximum fuse rating per device(=short circuit rating)	6A	10A	16A	20A	25A
	MCB miniature circuit breaker, K characteristic				D*

Mains connection PSUP10D6

Device type PSUP10	230V	400V	480V
Supply voltage	230VAC ±10% 50-60Hz	400VAC ±10% 50-60Hz	480VAC ±10% 50-60Hz
Rated voltage	3AC 230V	3AC 400V	3AC 480V
Input current	22Arms	22Arms	18Arms
Output voltage	325VDC ±10%	565VDC ±10%	680VDC ±10%
Output power	6kW	10 kW	10 kW
Pulse power (<5s)	12kW	20kW	20kW
Power dissipation	60W	60W	60W
Maximum fuse rating per device (=short circuit rating)	Measure for line and device protection: MCB miniature circuit breaker (K characteristic) 25A in accordance with UL category DIVQ Recommendation: (ABB) S203UP-K 25(480VAC)		

Mains connection PSUP20D6

Device type PSUP20	230V	400V	480V
Supply voltage	230VAC ±10% 50-60Hz	400VAC ±10% 50-60Hz	480VAC ±10% 50-60Hz
Rated voltage	3AC 230V	3AC 400V	3AC 480V
Input current	44Arms	44Arms	35Arms
Output voltage	325VDC ±10%	565VDC ±10%	680VDC ±10%
Output power	12kW	20kW	20kW
Pulse power (<5s)	24kW	40kW	40kW
Power dissipation	120W	120W	120W
Maximum fuse rating per device (=short circuit rating) 2 circuit breakers in line are required	**Cable protection measure:** MCB (K characteristic) with a rating of 50A / 4xxVAC (depending on the input voltage) Recommendation: (ABB) S203U-K50 (440VAC) **Device protection measure:** Circuit breakers 80A / 700VAC per supply leg in accordance with UL category JFHR2 Requirement: Bussmann 170M1366 or 170M1566D		

Mains connection Compax3HxxxV4 3*400VAC

Device type Compax3	H050V4	H090V4	H125V4	H155V4
Supply voltage	Three-phase 3*400VAC 350-528VAC / 50-60Hz			
Input current	66Arms	95Arms	143Arms	164Arms
Output current	50Arms	90Arms	125Arms	155Arms
Maximum fuse rating per device(=short circuit rating)	80A	100A	160A	200A
Branch circuit protection according to UL	JDDZ Class K5 or H JDRX Class H			

Mains connection Compax3HxxxV4 3*480VAC

Device type Compax3	H050V4	H090V4	H125V4	H155V4
Supply voltage	Three-phase 3*480VAC 350-528VAC / 50-60Hz			
Input current	54Arms	82Arms	118Arms	140Arms
Output current	43Arms	85Arms	110Arms	132Arms
Maximum fuse rating per device(=short circuit rating)	80A	100A	160A	200A
Branch circuit protection according to UL	JDDZ Class K5 or H JDRX Class H			

Control voltage 24VDC Compax3S and Compax3H

Controller type	Compax3
Voltage range	21 - 27VDC
Current drain of the device	0.8 A
Total current drain	0.8 A + Total load of the digital outputs + current for the motor holding brake
Ripple	0.5Vpp
Requirement according to safe extra low voltage (SELV)	yes
Short-circuit proof	conditional (internally protected with 3.15AT)

Control voltage 24 VDC PSUP

Device type	PSUP
Voltage range	21 - 27VDC
Ripple	0.5Vpp
Requirement according to safe extra low voltage (SELV)	yes (class 2 mains module)
Current drain PSUP	PSUP10: 0.2A PSUP20 / PSUP30: 0.3A
Electric current drain Compax3M	C3M050D6: 0.85 3M100D6: 0.85A C3M150D6: 0.85A C3M300D6: 1.0 A + Total load of the digital outputs + current for the motor holding brake

Output data Compax3S0xx at 1*230VAC/240VAC

Controller type	S025V2	S063V2
Output voltage	3x 0-240V	3x 0-240V
Nominal output current	2.5Arms	6.3Arms
Pulse current for 5s	5.5Arms	12.6Arms
Power	1kVA	2.5kVA
Switching frequency	16kHz	16kHz
Power loss for In	30W	60W

Output data Compax3S1xx at 3*230VAC/240VAC

Controller type	S100V2	S150V2
Output voltage	3x 0-240V	3x 0-240V
Nominal output current	10Arms	15Arms
Pulse current for 5s	20Arms	30Arms
Power	4kVA	6kVA
Switching frequency	16kHz	8kHz
Power loss for In	80W	130W

Output data Compax3Sxxx at 3*400VAC

Controller type	S015V4	S038V4	S075V4	S150V4	S300V4
Output voltage	3x 0-400V				
Nominal output current	1.5Arms	3.8Arms	7.5Arms	15Arms	30Arms
Pulse current for 5s	4.5Arms	9.0Arms	15Arms	30Arms	60Arms*
Power	1kVA	2.5kVA	5kVA	10kVA	20kVA
Switching frequency	16kHz	16kHz	16kHz	8kHz	8kHz
Power loss for In	60W	80W	120W	160W	350W

* With cyclic peak currents (S8 or S9 operation), the device utilization (683.2) may not be > 70%; otherwise it is necessary to use a condenser module “**C4Module** (see on page 201)”.

Output data Compax3Sxxx at 3*480VAC

Controller type	S015V4	S038V4	S075V4	S150V4	S300V4
Output voltage	3x 0-480V				
Nominal output current	1.5Arms	3.8Arms	6.5Arms	13.9Arms	30Arms
Pulse current for 5s	4.5Arms	7.5Arms	15Arms	30Arms	60Arms*
Power	1.25kVA	3.1kVA	6.2kVA	11.5kVA	25kVA
Switching frequency	16kHz	16kHz	16kHz	8kHz	8kHz
Power loss for In	60W	80W	120W	160W	350W

* With cyclic peak currents (S8 or S9 operation), the device utilization (683.2) may not be > 70%; otherwise it is necessary to use a condenser module “**C4Module** (see on page 201)”.

Output data Compax3Mxxx at 3*230VAC

Device type Compax3	M050D6	M100D6	M150D6	M300D6
Input voltage	325VDC ±10%			
Output voltage	3x 0-230V (0...500Hz)			
Nominal output current	5Arms	10Arms	15Arms	30Arms
Pulse current for 5s*	10Arms	20Arms	30Arms	60Arms
Power	2kVA	4kVA	6kVA	12kVA
Switching frequency	8kHz	8kHz	8kHz	8kHz
Power loss for In	70W+**	90W+**	120W+**	270W+**

*Electrical turning frequency for pulse current: f>5 Hz; with an electrical turning frequency of f<5 Hz, the maximum pulse current time is 100ms

** Maximum additional losses with option card 5 W.

Output data Compax3Mxxx at 3*400VAC

Device type Compax3	M050D6	M100D6	M150D6	M300D6
Input voltage	565VDC ±10%			
Output voltage	3x 0-400V (0...500Hz)			
Nominal output current	5Arms	10Arms	15Arms	30Arms
Pulse current for 5s*	10Arms	20Arms	30Arms	60Arms
Power	3.33kVA	6.66kVA	10kVA	20kVA
Switching frequency	8kHz	8kHz	8kHz	8kHz
Power loss for In	70W+**	90W+**	120W+**	270W+**

*Electrical turning frequency for pulse current: f>5 Hz; with an electrical turning frequency of f<5 Hz, the maximum pulse current time is 100ms

** Maximum additional losses with option card 5 W.

Output data Compax3Mxxx at 3*480VAC

Device type Compax3	M050D6	M100D6	M150D6	M300D6
Input voltage	680VDC ±10%			
Output voltage	3x 0-480V (0...500Hz)			
Nominal output current	4Arms	8Arms	12.5Arms	25Arms
Pulse current for 5s*	8Arms	16Arms	25Arms	50Arms
Power	3.33kVA	6.66kVA	10kVA	20kVA
Switching frequency	8kHz	8kHz	8kHz	8kHz
Power loss for In	70W+**	90W+**	120W+**	270W+**

*Electrical turning frequency for pulse current: f>5 Hz; with an electrical turning frequency of f<5 Hz, the maximum pulse current time is 100ms

** Maximum additional losses with option card 5 W.

Output data Compax3Hxxx at 3*400VAC

Controller type	H050V4	H090V4	H125V4	H155V4
Output voltage	3x 0-400V			
Nominal output current	50Arms	90Arms	125Arms	155Arms
Pulse current for 5s *	75Arms	135Arms	187.5Arms	232.5Arms
Power	35kVA	62kVA	86kVA	107kVA
Switching frequency	8kHz	8kHz	8kHz	8kHz
Power loss for In	880W	900W	1690W	1970W

* during low speeds, the overload time is reduced to 1s. Limit:
< 2.5 electric rev/s (= actual revolutions/s * number of pole pairs) resp. >2.5 pitch/s

Output data Compax3Hxxx at 3*480VAC

Controller type	H050V4	H090V4	H125V4	H155V4
Output voltage	3x 0-480V			
Nominal output current	43Arms	85Arms	110Arms	132Arms
Pulse current for 5s*	64.5Arms	127.5Arms	165Arms	198Arms
Power	35kVA	70kVA	91kVA	109kVA
Switching frequency	8kHz	8kHz	8kHz	8kHz
Power loss for In	850W	1103W	1520W	1800W

* during low speeds, the overload time is reduced to 1s. Limit:
< 2.5 electric rev/s (= actual revolutions/s * number of pole pairs) resp. >2.5 pitch/s

Resulting nominal and peak currents depending on the switching frequency

Compax3S0xxV2 at 1*230VAC/240VAC

Switching frequency*		S025V2	S063V2
16kHz	I_{nom}	**2.5A$_{rms}$**	**6,3A$_{rms}$**
	I_{peak} (<5s)	**5.5A$_{rms}$**	**12,6A$_{rms}$**
32kHz	I_{nom}	2.5A$_{rms}$	5.5A$_{rms}$
	I_{peak} (<5s)	5.5A$_{rms}$	12,6A$_{rms}$

Compax3S1xxV2 at 3*230VAC/240VAC

Switching frequency*		S100V2	S150V2
8kHz	I_{nom}	**-**	**15A$_{rms}$**
	I_{peak} (<5s)	**-**	**30A$_{rms}$**
16kHz	I_{nom}	**10A$_{rms}$**	12.5A$_{rms}$
	I_{peak} (<5s)	**20A$_{rms}$**	25A$_{rms}$
32kHz	I_{nom}	8A$_{rms}$	10A$_{rms}$
	I_{peak} (<5s)	16A$_{rms}$	20A$_{rms}$

Compax3S0xxV4 at 3*400VAC

Switching frequency*		S015V4	S038V4	S075V4	S150V4	S300V4
8kHz	I_{nom}	-	-	-	**15A$_{rms}$**	**30A$_{rms}$**
	I_{peak} (<5s)	-	-	-	**30A$_{rms}$**	**60A$_{rms}$**
16kHz	I_{nom}	**1.5A$_{rms}$**	**3.8A$_{rms}$**	**7.5A$_{rms}$**	10.0A$_{rms}$	26A$_{rms}$
	I_{peak} (<5s)	**4.5A$_{rms}$**	**9.0A$_{rms}$**	**15.0A$_{rms}$**	20.0A$_{rms}$	52A$_{rms}$
32kHz	I_{nom}	1.5A$_{rms}$	2.5A$_{rms}$	3.7A$_{rms}$	5.0A$_{rms}$	14A$_{rms}$
	I_{peak} (<5s)	3.0A$_{rms}$	5.0A$_{rms}$	10.0A$_{rms}$	10.0A$_{rms}$	28A$_{rms}$

Compax3S0xxV4 at 3*480VAC

Switching frequency*		S015V4	S038V4	S075V4	S150V4	S300V4
8kHz	I_{nom}	-	-	-	**13.9A$_{rms}$**	**30A$_{rms}$**
	I_{peak} (<5s)	-	-	-	**30A$_{rms}$**	**60A$_{rms}$**
16kHz	I_{nom}	**1.5A$_{rms}$**	**3.8A$_{rms}$**	**6.5A$_{rms}$**	8.0A$_{rms}$	21.5A$_{rms}$
	I_{peak} (<5s)	**4.5A$_{rms}$**	**7.5A$_{rms}$**	**15.0A$_{rms}$**	16.0A$_{rms}$	43A$_{rms}$
32kHz	I_{nom}	1.0A$_{rms}$	2.0A$_{rms}$	2.7A$_{rms}$	3.5A$_{rms}$	10A$_{rms}$
	I_{peak} (<5s)	2.0A$_{rms}$	4.0A$_{rms}$	8.0A$_{rms}$	7.0A$_{rms}$	20A$_{rms}$

The values marked with grey are the pre-set values (standard values)!

*corresponds to the frequency of the motor current

Resulting nominal and peak currents depending on the switching frequency

Compax3MxxxD6 at 3*400VAC

Switching frequency*		M050D6	M100D6	M150D6	M300D6
8kHz	I_{nom}	$5A_{rms}$	$10A_{rms}$	$15A_{rms}$	$30A_{rms}$
	I_{peak} (<5s)	$10A_{rms}$	$20A_{rms}$	$30A_{rms}$	$60A_{rms}$
16kHz	I_{nom}	$3.8A_{rms}$	$7.5A_{rms}$	$10A_{rms}$	$20A_{rms}$
	I_{peak} (<5s)	$7.5A_{rms}$	$15A_{rms}$	$20A_{rms}$	$40A_{rms}$
32kHz	I_{nom}	$2.5A_{rms}$	$3.8A_{rms}$	$5A_{rms}$	$11A_{rms}$
	I_{peak} (<5s)	$5A_{rms}$	$7.5A_{rms}$	$10A_{rms}$	$22A_{rms}$

Compax3MxxxD6 at 3*480VAC

Switching frequency*		M050D6	M100D6	M150D6	M300D6
8kHz	I_{nom}	$4A_{rms}$	$8A_{rms}$	$12.5A_{rms}$	$25A_{rms}$
	I_{peak} (<5s)	$8A_{rms}$	$16A_{rms}$	$25A_{rms}$	$50A_{rms}$
16kHz	I_{nom}	$3A_{rms}$	$5.5A_{rms}$	$8A_{rms}$	$15A_{rms}$
	I_{peak} (<5s)	$6A_{rms}$	$11A_{rms}$	$16A_{rms}$	$30A_{rms}$
32kHz	I_{nom}	$2A_{rms}$	$2.5A_{rms}$	$4A_{rms}$	$8.5A_{rms}$
	I_{peak} (<5s)	$4A_{rms}$	$5A_{rms}$	$8A_{rms}$	$17A_{rms}$

The values marked with grey are the pre-set values (standard values)!

*corresponds to the frequency of the motor current

Resulting nominal and peak currents depending on the switching frequency

Compax3HxxxV4 at 3*400VAC

Switching frequency*		H050V4	H090V4	H125V4	H155V4
8kHz	I_{nom}	$50A_{rms}$	$90A_{rms}$	$125A_{rms}$	$155A_{rms}$
	I_{peak} (<5s)	$75A_{rms}$	$135A_{rms}$	$187.5A_{rms}$	$232.5A_{rms}$
16kHz	I_{nom}	$33A_{rms}$	$75A_{rms}$	$82A_{rms}$	$100A_{rms}$
	I_{peak} (<5s)	$49.5A_{rms}$	$112.5A_{rms}$	$123A_{rms}$	$150A_{rms}$
32kHz	I_{nom}	$19A_{rms}$	$45A_{rms}$	$49A_{rms}$	$59A_{rms}$
	I_{peak} (<5s)	$28.5A_{rms}$	$67.5A_{rms}$	$73.5A_{rms}$	$88.5A_{rms}$

Compax3HxxxV4 at 3*480VAC

Switching frequency*		H050V4	H090V4	H125V4	H155V4
8kHz	I_{nom}	$43A_{rms}$	$85A_{rms}$	$110A_{rms}$	$132A_{rms}$
	I_{peak} (<5s)	$64.5A_{rms}$	$127.5A_{rms}$	$165A_{rms}$	$198A_{rms}$
16kHz	I_{nom}	$27A_{rms}$	$70A_{rms}$	$70A_{rms}$	$84A_{rms}$
	I_{peak} (<5s)	$40.5A_{rms}$	$105A_{rms}$	$105A_{rms}$	$126A_{rms}$
32kHz	I_{nom}	$16A_{rms}$	$40A_{rms}$	$40A_{rms}$	$48A_{rms}$
	I_{peak} (<5s)	$24A_{rms}$	$60A_{rms}$	$60A_{rms}$	$72A_{rms}$

The values marked with grey are the pre-set values (standard values)!

*corresponds to the frequency of the motor current

Resolution of the motor position

For option F10: Resolver	◆ Position resolution: 16 Bits (= 0.005°) ◆ Absolute accuracy: ±0.167°
For option F11: SinCos©	◆ Position resolution: 13.5 Bits / Encoder sine period => 0.03107°/encoder resolution
For option F12:	◆ Maximum position resolution ◆ Linear: 24 Bits per motor magnet spacing ◆ Rotary: 24 Bits per motor revolution ◆ Resolution for Sine-Cosine encoders (e.g. EnDat) with 1Vss signal): 13.5 bits / graduation of the scale of the encoder ◆ For RS 422 encoders: 4x encoder resolution ◆ Accuracy of the feedback zero pulse acquisition = accuracy of the feedback resolution. ◆ Resolution for analog hall sensors with 1Vss signal: 13.5 Bits / motor magnet spacing

Accuracy

The exactitude of the position signal is above all determined by the exactitude of the feedback system used.

Motors and feedback systems supported

Motors **Direct drives** ◆ Linear motors ◆ Torque motors	◆ Sinusoidally commutated synchronous motors ◆ Maximum electrical turning frequency: 1000Hz* ◆ Max. velocity at 8 pole motors: 15000 rpm. ◆ General max. Velocity: 60*1000/number of pole pairs in [rpm] ◆ Max. number of poles = 600 ◆ Sinusoidal commutated asynchronous motors ◆ Maximum electrical turning frequency: 1000Hz ◆ Max. velocity: 60*1000/number of pole pairs - slip in [rpm]. ◆ Field weakening: typically up to triple (higher on request). ◆ Temperature sensor: KTY84-130 (insulated in accordance with EN60664-1 or IEC60664-1) ◆ 3 phase synchronous direct drives
Position encoder (Feedback)	**Option F10: Resolver**
LTN:	◆ RE-21-1-A05, RE-15-1-B04
Tamagawa:	◆ TS2610N171E64, TS2620N21E11, TS2640N321E64, TS2660N31E64
Tyco (AMP)	◆ V23401-T2009-B202
	Option F11: SinCos©
	◆ Singleturn (SICK|Stegmann) ◆ Multiturn (SICK|Stegmann) Absolute position up to 4096 motor revolutions. ◆ SEK52, SEL52, SEK37, SEL37, SEK160, SEK90 ◆ Rotary feedback with HIPERFACE® interface: e.g.: SRS50, SRM50, SKS36, SKM36, SEK52

* higher values on request

Special encoder systems for direct drives	Option F12
Analog hall sensors	◆ Sine-Cosine signal (max. 5Vss*; typical 1Vss) 90° offset ◆ U-V signal (max. 5Vss*; typical 1Vss) 120° offset.
Encoder (linear or rotatory)	◆ Sine-Cosine (max. 5Vss*; typical 1Vss) (max. 400kHz) or ◆ TTL (RS422) (max. 5MHz; track A o. B) with the following modes of commutation: ◆ **Automatic commutation** (see on page 171) or ◆ U, V, W or R, S, T commutation signals (NPN open collector) e.g. digital hall sensors, incremental encoders made by Hengstler (F series with electrical ordering variant 6)
Digital, bidirectional interface	◆ All EnDat 2.1 or EnDat 2.2 (Endat01, Endat02) feedback systems with incremental track (sine-cosine track) ◆ linear or rotary ◆ max. 400kHz Sine-Cosine
Distance coded feedback systems	◆ Distance coding with 1VSS - Interface ◆ Distance coding with RS422 - Interface (Encoder)

*Max. differential input between SIN- (X13/7) and SIN+ (X13/8).

Feedback error compensation

Feedback error compensation	◆ Automatic feedback error compensation (offset & amplification) for analog hall sensors and sine-cosine encoder can be activated in the MotorManager.

Motor holding brake output

Motor holding brake output	Compax3
Voltage range	21 – 27VDC
Maximum output current (short circuit proof)	1.6A
Securing of brake Compax3M	3.15A

Braking operation Compax3S0xxV2 1AC

Controller type	S025V2	S063V2
Capacitance / storable energy	560µF / 15Ws	1120µF / 30Ws
Minimum braking- resistance	100Ω	56Ω
Recommended nominal power rating	20 ... 60W	60 ... 180W
Maximum continuous current	8A	15A

Braking operation Compax3S1xxV2 3AC

Controller type	S100V2	S150V2
Capacitance / storable energy	780µF / 21Ws	1170µF / 31Ws
Minimum braking- resistance	22Ω	15Ω
Recommended nominal power rating	60 ... 450W	60 ... 600W
Maximum continuous current	20A	20A

Braking operation Compax3SxxxV4 3AC

Controller type	S015V4	S038V4	S075V4	S150V4	S300V4
Capacitance / storable energy 400V / 480V	235µF 37 / 21 Ws	235µF 37 / 21 Ws	470µF 75 / 42 Ws	690µF 110 / 61 Ws	1230µF 176 / 98 Ws
Minimum braking- resistance	100Ω	100Ω	56Ω	33Ω	15Ω
Recommended nominal power rating	60 ... 100W	60 ... 250W	60 ... 500 W	60 ... 1000 W	60 ... 1000 W
Maximum continuous current	10A	10A	15A	20A	30A

Braking operation Compax3MxxxD6 (axis controller)

Device type Compax3	M050	M100	M150	M300
Capacity/ storable energy	110µF/ 18Ws at 400V 10Ws at 480V	220µF/ 37Ws at 400V 21Ws at 480V	220µF/ 37Ws at 400V 21Ws at 480V	440µF/ 74Ws at 400V 42Ws at 480V

Braking operation of Compax3HxxxV4

Controller type	H050V4	H090V4	H125V4	H155V4
Capacitance / storable energy 400V / 480V	2600 µF 602 / 419 Ws	3150 µF 729 / 507 Ws	5000 µF 1158 / 806 Ws	5000 µF 1158 / 806 Ws
Minimum braking- resistance	24 Ω	15 Ω	8 Ω	8 Ω
Maximum continuous current	11 A	17 A	31 A	31 A

Ballast resistors for Compax3

Ballast resistor **(see on page 187)**	**Device**	**Rated output**
BRM08/01 (100Ω)	Compax3S025V2 Compax3S015V4 Compax3S038V4	60 W
BRM05/01 (56Ω)	Compax3S063V2 Compax3S075V4	180 W
BRM05/02 (56Ω)	Compax3S075V4	570 W
BRM10/01 (47Ω)	Compax3S150V4	570 W
BRM10/02 (470Ω)	Compax3S150V4	1500 kW
BRM04/01 (15Ω)	Compax3S150V2 Compax3S300V4 PSUP20D6	570 W
BRM04/02 (15Ω)	Compax3S150V2 Compax3S300V4 PSUP20D6	740 W
BRM04/03 (15Ω)	Compax3S300V4 PSUP20D6	1500 W
BRM09/01 (22Ω)	Compax3S100V2	570 W
BRM11/01 (27Ω)	Compax3H0xxV4	3500 W
BRM13/01 (30Ω)	PSUP10D6 PSUP20D6**	500 W
BRM14/01 (15Ω)	PSUP10D6* PSUP20D6	500 W
BRM12/01 (18Ω)	Compax3H1xxV4	4500 W

*for PSUP10D6 2x15Ω in series

**for PSUP20D6 2x30Ω parallel

Size / weight Compax3S

Controller type	Dimensions HxWxD [mm]	Weight [kg]
Compax3S025V2	191 x 84 x 172	2.0
Compax3S063V2	191 x 100 x 172	2.5
Compax3S015V4	248 x 84 x 172	3.1
Compax3S100V2	248 x 115 x 172	4.3
Compax3S150V2	248 x 158 x 172	6.8
Compax3S038V4	248 x 100 x 172	3.5
Compax3S075V4	248 x 115 x 172	4.3
Compax3S150V4	248 x 158 x 172	6.8
Compax3S300V4	380 x 175 x 172	10.9

Minimum mounting distance: 15mm at the sides, above & below 100mm

Protection type IP20

Drawings, Mounting **(see on page 67, see on page 73)**

Size / weight PSUP/Compax3M

Device type	Dimensions HxWxD [mm]	Weight [kg]
PSUP10D6	360 x 50 x 263	3.95
PSUP20D6 & PSUP30D6	360 x 100 x 263	6.3
Compax3M050D6	360 x 50 x 263	3.5
Compax3M100D6	360 x 50 x 263	3.6
Compax3M150D6	360 x 50 x 263	3.6
Compax3M300D6	360 x 100 x 263	5.25

Protection type IP20

Size / weight Compax3H

Mounting (see on page 67, see on page 73)

Controller type	Dimensions HxWxD [mm]	Weight [kg]
Compax3H050V4	453 x 252 x 245	17.4
Compax3H090V4	668.6 x 257 x 312	32.5
Compax3H125V4	720 x 257 x 355	41
Compax3H155V4	720 x 257 x 355	41

Protection class IP20 when mounted in a control cabinet (not for Compax3H1xxxV4)

Safety technology Compax3S

Safe torque-off in accordance with EN ISO 13849: 2008, Category 3, PL d/e Certified. **Test mark IFA 1003004**	◆ For implementation of the “protection against unexpected start-up” function described in EN1037. ◆ Please note the **circuitry examples** (see on page 76).

Compax3S STO (=safe torque off)

Nominal voltage of the inputs	24 V
Required isolation of the 24V control voltage	Grounded protective extra low voltage, PELV
Protection of the STO control voltage	1 A
Grouping of safety level	**STO switch-off via internal safety relay & digital input:** PL e, PFHd=2.98E-8 **STO switch-off via internal safety relay & fieldbus:** PL d, PFHd=1.51E-7 A MTTFd=15 of the external PLC and STO cycles/year < 500 000 are assumed.

Safety technology Compax3M

Safe torque-off in accordance with EN ISO 13849-1: 2007, Category 3, PL=e Certified. **Test mark MFS 09029**	◆ Please respect the stated safety technology on the **type designation plate** (see on page 11) and the **circuitry examples** (see on page 87)

Compax3M S1 Option: Signal inputs for connector X14

Nominal voltage of the inputs	24V
Required isolation of the 24V control voltage	Grounded protective extra low voltage, PELV
Protection of the STO control voltage	1A
Number of inputs **Signal inputs via optocoupler**	2 Low = 0...7V DC or open High = 15...30V DC I_{in} at 24V DC: 8mA
STO1/	Low = STO activated High = STO deactivated Reaction time max. 3ms
STO2/	Low = STO activated High = STO deactivated Reaction time max. 3ms
Switch-off time with unequal input statuses (max. reaction time)	20 seconds
Grouping of safety level	Category 3 PL=e (according to table 4 in EN ISO 13849-1 this corresponds to SIL 3) PFHd=4.29E-8

UL certification for Compax3S

conform to UL:	◆ according to UL508C
Certified	◆ E-File_No.: E235342

The UL certification is documented by a "UL" logo on the device (type specification plate).

"UL" logo:

UL-approval for PSUP/Compax3M

conform to UL:	◆ according to UL508C
Certified	◆ E-File_No.: E235342

The UL certification is documented by a "UL" logo on the device (type specification plate).

Insulation requirements

Enclosure rating	Protection class in accordance with EN 60664-1
Protection against human contact with dangerous voltages	In accordance with EN 61800-5-1
Overvoltage category	Voltage category III in accordance with EN 60664-1
Degree of contamination	Degree of contamination 2 in accordance with EN 60664-1 and EN 61800-5-1

Environmental conditions Compax3S and Compax3H

General ambient conditions	In accordance with **EN 60 721-3-1 to 3-3** Climate (temperature/humidity/barometric pressure): Class 3K3	
Permissible ambient temperature:		
Operation storage transport	0 to +45 °C class 3K3 –25 to +70 °C class 2K3 –25 to +70 °C class 2K3	
Tolerated humidity:	no condensation	
Operation storage transport	<= 85% class 3K3 <= 95% class 2K3 <= 95% class 2K3	(Relative humidity)
Elevation of operating site	<=1000m above sea level for 100% load ratings <=2000m above sea level for 1% / 100m power reduction please inquire for greater elevations	
Mechanic resonances:	EN 60068-2-6 (sinusoidal excitation)	
Sealing	Protection type IP20 in accordance with EN 60 529	

Cooling Compax3S and Compax3H

Cooling mode:	C3S025V2 ... S150V4: Convection C3S300V4 & C3H: Forced air ventilation with fan in the heat dissipator **Air flow rate:**459m³/h (C3H)
Supply:	C3S300V4, C3H050, C3H090 internal C3H125, C3H155 external 220/240VAC: 140W, 2.5µF, Stator - 62Ω Optionally on request: 110/120VAC: 130W, 10µF, Stator - 16Ω **Circuit breaker:**3A

EMC limit values Compax3S and Compax3H

EMC interference emission	Limit values in accordance with EN 61 800-3, Limit value class C3/C4 without additional mains filter: **Information on C2 limit value classes** (see on page 17)
EMC disturbance immunity	Industrial area limit values in accordance with EN 61 800-3

Ambient conditions PSUP/Compax3M

General ambient conditions	In accordance with **EN 60 721-3-1 to 3-3** Climate (temperature/humidity/barometric pressure): Class 3K3	
Permissible ambient temperature:		
Operation storage transport	0 to +40 °C Class 3K3 -25 to +70 °C -25 to +70 °C	
Tolerated humidity:	no condensation	
Operation storage transport	<= 85% class 3K3 <= 95% <= 95%	(Relative humidity)
Elevation of operating site	<=1000m above sea level for 100% load ratings <=2000m above sea level for 1% / 100m power reduction please inquire for greater elevations	
Sealing	Protection type IP20 in accordance with EN 60 529	
Mechanic resonances:	Class 2M3, 20m/s²;8-200Hz	

Cooling PSUP/Compax3M

Cooling mode:	Forced air ventilation with fan in the heat dissipator

EMV limit values PSUP/Compax3M

EMC interference emission	Limit values in accordance with EN 61 800-3, Limit value class C3 with mains filter.
EMC disturbance immunity	Industrial area limit values in accordance with EN 61 800-3

EC directives and applied harmonized EC norms

EC low voltage directive 2006/95/EG	**EN 61800-5-1,** Standard for electric power drives with settable speed; requirements to electric safety **EN 60664-1,** isolation coordinates for electrical equipment in low-voltage systems **EN 60204-1, machinery norm** partly applied
EC-EMC-directive 2004/108/EC	**EN 61800-3, EMC standard** Product standard for variable speed drives

COM ports

RS232	◆ 115200 baud ◆ Word length: 8 bits, 1 start bit, 1 stop bit ◆ Hardware handshake XON, XOFF
RS485 (2 or 4-wire)	◆ 9600, 19200, 38400, 57600 or 115200 baud ◆ Word length 7/8 bit, 1 start bit, 1 stop bit ◆ Parity (can be switched off) even/odd ◆ 2 or 4-wire
USB (Compax3M)	◆ USB 2.0 Full Speed compatible

Inputs / Outputs

Command interface (optional)	◆ ±10V analog speed or current setpoint; 14Bits; 62.5µs sampling rate ◆ Step/Direction RS422 (5V level) ◆ Encoder A/B RS422 ◆ Step/Direction (24V level) ◆ Encoder A/B 24V ◆ Maximum input frequency ◆ 24V inputs: Maximum input frequency 300kHz at ≥50Ω source impedance and minimum pulse width of 1.6µs ◆ RS422 inputs: up to 5MHz
Actual position at ±10V defined analog setpoint	◆ Encoder simulation ◆ Resolution: 512 or 1024 Increments/revolutions
Signal monitor	◆ 2 channels ±10 V analog ◆ Resolution: 8 Bit
4/5 digital inputs (24V level)	◆ Energize motor, setpoint value release, quit, brake open. ◆ Keep position / speed 0 (configurable) (only in the "±10V analog current setpoint" operating mode")
4 digital outputs	◆ Error, setpoint value in window, power output stage de-energized, holding ◆ Load max. 100mA

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