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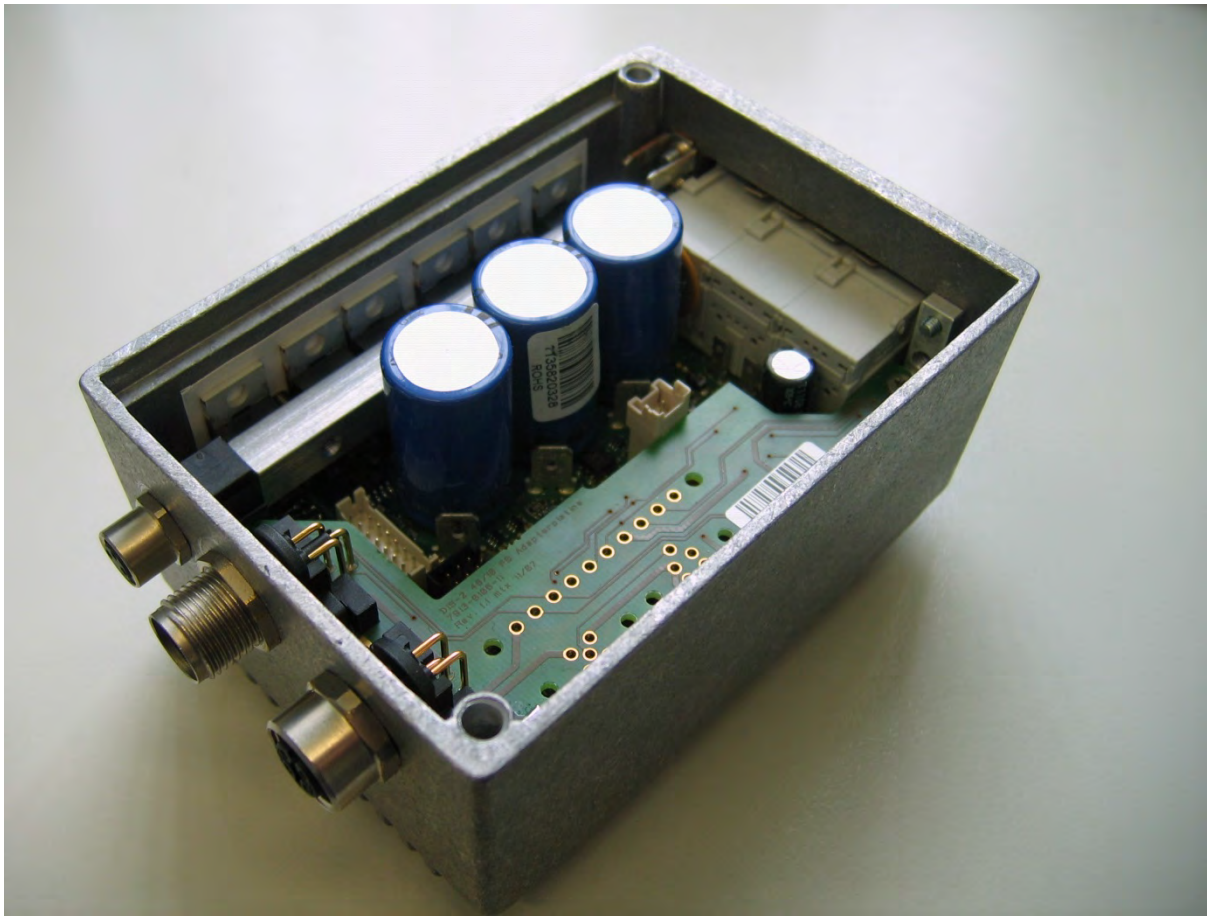
servo drives

Mounting Instructions



Servo drive
DIS-2 48/10 FB FS STO

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Original instructions

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Revision Information	
Author:	Metronix Meßgeräte und Elektronik GmbH
Manual title:	Mounting Instructions "Servo drive DIS-2 48/10 FB FS STO"
File name:	MI_DIS-2_48_10_FB-FS-STO_1p0_EN.docx
Version 1.0	July 2013

CONTENTS

1 General

1.1 Documentation

This installation information serves the purpose of a safe use of the DIS-2 48/10 FB FS STO servo drive. It contains safety notes, which must be complied with.

Further information can be found in the following manuals of the DIS-2 product range:

- **Product Manual "Servo drive DIS-2 48/10 FB FS STO":** Description of the technical data and the device functionality plus notes concerning the installation and operation of the DIS-2 48/10 FB FS STO servo drive (German version).
- **CANopen Manual "Servo drive DIS-2":** Description of the implemented CANopen protocol as per DSP402.
- **PROFIBUS Manual "Servo drive DIS-2 48/10 FB":** Description of the implemented PROFIBUS-DP protocol.
- **EtherCAT Manual "Servo drive DIS-2 48/10 FB":** Description of the implemented EtherCAT protocol (Geman version).
- **User Manual "DIS-2 48/10, DIS-2 48/10 IC, DIS-2 48/10 FB":** Description of the device functionality and the software functionalities of the firmware including the RS232 communication. Description of the parameterisation program DIS-2 ServoCommander™ with instructions for the commissioning of a DIS-2 series servo drive.

You can find all these documents on our homepage at the download area (http://www.metronix.de).

Furthermore, the manuals are part of the CD-ROM DIS-2 ServoCommander™.

Certificates and declarations of conformity for the products described in this manual can be found at http://www.metronix.de.

The functions described in this installation information refer to the firmware version 3.4.

1.2 Scope of supply

The DIS-2 48/10 FB FS STO servo drive is available in the following three versions. The corresponding technology modules (CAN, PROFIBUS, EtherCAT) are factory-integrated and are not designed for an exchange by the user.

Table 1: Scope of supply DIS-2 48/10 FB FS STO CANopen

1x	Servo drive DIS-2 48/10 FB FS STO CANopen	Metronix part number: 9019-0248-13
1x	STO connection cable pre-fabricated on both sides with the device interface M12 (circular connector) for rear panel installation.	
1x	Counterplug for the STO interface	

Table 2: Scope of supply DIS-2 48/10 FB FS STO PROFIBUS

1x	Servo drive DIS-2 48/10 FB FS STO PROFIBUS	Metronix part number: 9019-0248-14
1x	STO connection cable pre-fabricated on both sides with the device interface M12 (circular connector) for rear panel installation.	
1x	Counterplug for the STO interface	

Table 3: Scope of supply DIS-2 48/10 FB FS STO EtherCAT

1x	Servo drive DIS-2 48/10 FB FS STO EtherCAT	Metronix part number: 9019-0248-15
1x	STO connection cable pre-fabricated on both sides with the device interface M12 (circular connector) for rear panel installation.	
1x	Counterplug for the STO interface	

Information

In the delivery status [X40] is not connected!

The scope of supply includes an STO connection cable pre-fabricated on both sides with the device interface M12 (circular connector) for wiring the STO function.

For the case that the function “STO” is not needed, a counterplug for [X40] is included alternatively. This counterplug allows bypassing pins 1, 3 and 5 to deactivate the STO function.

Counterplugs, control panel, mains filter, communication cables, brake resistor and parameterisation program are not part of the standard scope of supply. They can be ordered as accessories:

Table 4: Accessories DIS-2 48/10 FB FS STO

<table>
<tr><td rowspan="4">1x</td><td colspan="3">Connector set for motor, encoder, holding brake:</td><td rowspan="4">Metronix part number:
9019-0210-01</td></tr>
<tr><td rowspan="3">Content:</td><td>1x</td><td>3 pcs insulated blade receptacles 6,3 mm for motor connection</td></tr>
<tr><td>1x</td><td>16-pole counterplug für angle encoder, incl. crimp contacts</td></tr>
<tr><td>1x</td><td>2-pole counterplug for holding brake, incl. crimp contacts</td></tr>
<tr><td>1x</td><td colspan="3">Connector set for power supply and I/Os
1x 2-pole VARICON counterplug
(for DIS-2 48/10 FB FS STO)
1x 6-pole VARICON counterplug
(for DIS-2 310/2 FB FS STO)
2x 8-pole VARICON counterplug incl. sleeve frame, sleeve housing and EMC cable gland</td><td>Metronix part number:
9019-3120-01</td></tr>
<tr><td>1x</td><td colspan="3">Control panel DIS-2 FB with Phoenix connector</td><td>Metronix part number:
9019-0320-00</td></tr>
<tr><td>1x</td><td colspan="3">RS232 connection cable for DIS-2 48/10 FB
Pre-fabricated connection cable for the servo drive parameterisation, length approximately 150 cm, M8 circular connector for the connection to the servo drive, DSUB9 connector for the connection to the COM-Port of the PC</td><td>Metronix part number:
9019-0221-00</td></tr>
<tr><td>1x</td><td colspan="3">Brake resistor for DIS-2 48/10 FB
Plate resistor, Metallux PLR100.55.43, 5 Ω ±10%, 30 W continuous power output, dimensions 55 mm x 43 mm, height: 1,5 mm, in the area of the connecting cables height 4 mm, with strands l = 100 mm</td><td>Metronix part number:
9519-0001-00</td></tr>
<tr><td>1x</td><td colspan="3">Parameterisation program
DIS-2 ServoCommander™</td><td>Metronix part number:
9019-0900-00</td></tr>
</table>

2 Safety notes for electrical drives and controllers

2.1 Used symbols

Information

Important information and notes.

Caution!

Nonobservance may result in severe property damages.

DANGER!

Nonobservance may result in **property damages** and in **personal injuries**.

Caution! Dangerous voltages.

The safety note indicates a possible perilous voltage.

2.2 General notes

In case of damage resulting from non-compliance with the safety notes in this manual, Metronix Meßgeräte und Elektronik GmbH will not assume any liability.

Prior to the initial use you must read *chapter* 2 *Safety notes for electrical drives and controllers*, starting on *page 8* and *chapter* 7 *EMC-compliant cabling*, starting on *page 47*.

If the documentation in the language at hand is not understood accurately, please contact and inform your supplier.

Sound and safe operation of the servo drive requires proper and professional transportation, storage, assembly and installation as well as proper operation and maintenance.

Only trained and qualified personnel is authorised to handle electrical devices and systems:

TRAINED AND QUALIFIED PERSONNEL

in the sense of this product manual or the safety notes on the product itself are persons who are sufficiently familiar with the project, the setup, assembly, commissioning and operation of the product as well as all warnings and precautions as per the instructions in this manual and who are sufficiently qualified in their field of expertise:

- Education and instruction or authorisation to switch devices/systems on and off and to ground them as per the standards of safety engineering and to efficiently label them as per the job demands.
- Education and instruction as per the standards of safety engineering regarding the maintenance and use of adequate safety equipment.
- First aid training.

The following notes must be read prior to the initial operation of the system to prevent personal injuries and/or property damages:

These safety notes must be complied with at all times.

Do not try to install or commission the servo drive before carefully reading all safety notes for electrical drives and controllers contained in this document. These safety instructions and all other user notes must be read prior to any work with the servo drive.

In case you do not have any user notes for the servo drive, please contact your sales representative. Immediately demand these documents to be sent to the person responsible for the safe operation of the servo drive.

If you sell, rent and/or otherwise make this device available to others, these safety notes must also be included.

The user must not open the servo drive for safety and warranty reasons.

Professional control process design is a prerequisite for sound functioning of the servo drive!

DANGER!

Inappropriate handling of the servo drive and non-compliance with the warnings as well as inappropriate intervention in the safety features may result in property damage, personal injuries, electric shock or in extreme cases even death.

2.3 Danger resulting from misuse

DANGER!

High electrical voltages and high load currents!

Danger to life or serious personal injury from electrical shock!

DANGER!

High electrical voltage caused by wrong connections!

Danger to life or serious personal injury from electrical shock!

DANGER!

Surfaces of device housing may be hot!

Risk of injury! Risk of burning!

DANGER!

Dangerous movements!

Danger to life, serious personal injury or property damage due to unintentional movements of the motors!

2.4 Safety notes

2.4.1 General safety notes

The servo drive corresponds to IP54 degree of protection as well as pollution degree 2. Make sure that the environment corresponds to this degree of protection and pollution degree.

Only use replacement parts and accessories approved by the manufacturer.

The devices must be connected to the mains supply as per EN regulations and VDE regulations, so that they can be cut off the mains supply by means of corresponding separation devices (for example main switch, contactor, power switch).

Gold contacts or contacts with a high contact pressure should be used to switch the control contacts.

Preventive interference rejection measures should be taken for control panels, such as connecting contactors and relays using RC elements or diodes.

The safety rules and regulations of the country in which the device will be operated must be complied with.

The environment conditions defined in the product documentation must be kept. Safety-critical applications are not allowed, unless specifically approved by the manufacturer.

For notes on installation corresponding to EMC, please refer to *chapter* 7 *EMC-compliant cabling*, starting on *page 47*. The compliance with the limits required by national regulations is the responsibility of the manufacturer of the machine or system.

The technical data and the connection and installation conditions for the servo drive are to be found in this product manual and must be met.

DANGER!

The general setup and safety regulations for work on power installations (for example DIN, VDE, EN, IEC or other national and international regulations) must be complied with.

Non-compliance may result in death, personal injury or serious property damages.

Without claiming completeness, the following regulations and others apply:

VDE 0100	Erection of power installations with nominal voltages up to 1000 V
EN 1037	Safety of maschinery - Prevention of unexpected start-up
EN 60204-1	Safety of machinery - Electrical equipment of machines Part 1: General requirements
EN 61800-3	Adjustable speed electrical power drive systems Part 3: EMC requirements and specific test methods
EN 61800-5-1	Adjustable speed electrical power drive systems Part 5-1: Safety requirements - Electrical, thermal and energy
EN 61800-5-2	Adjustable speed electrical power drive systems Part 5-2: Safety requirements - Functional
EN ISO 12100	Safety of machinery - General principles for design - Risk assessment and risk reduction
EN ISO 13849-1	Safety of machinery - Safety-related parts of control systems Part 1: General principles for design
EN ISO 13849-2	Safety of machinery - Safety-related parts of control systems Part 2: Validation

2.4.2 Safety notes for assembly and maintenance

The appropriate DIN, VDE, EN and IEC regulations as well as all national and local safety regulations and rules for the prevention of accidents apply for the assembly and maintenance of the system. The plant engineer or the operator is responsible for compliance with these regulations:

The servo drive must only be operated, maintained and/or repaired by personnel trained and qualified for working on or with electrical devices.

Prevention of accidents, injuries and/or damages:

Additionally secure vertical axes against falling down or lowering after the motor has been switched off, for example by means of:

- Mechanical locking of the vertical axle,
- External braking, catching or clamping devices or
- Sufficient balancing of the axle

The motor holding brake supplied by default or an external motor holding brake driven by the servo drive alone is not suitable for personal protection!

Keep the electrical equipment voltage-free using the main switch and protect it from being switched on again until the DC bus circuit is discharged, in the case of:

- Maintenance and repair work
- Cleaning
- long machine shutdowns

Prior to carrying out maintenance work make sure that the power supply has been turned off, locked and the DC bus circuit is discharged.

Be careful during the assembly. During the assembly and also later during operation of the drive, make sure to prevent drill chips, metal dust or assembly parts (screws, nuts, cable sections) from falling into the servo drive.

Also make sure that the external power supply of the servo drive (24 V) is switched off.

The DC bus circuit or the mains supply must always be switched off prior to switching off the 24 V servo drive supply.

Carry out work in the machine area only, if AC and/or DC supplies are switched off. Switched off output stages or servo drive enablings are no suitable means of locking. In the case of a malfunction the drive may accidentally be put into action.

This does not apply to drives with the “Safe Torque Off” (STO) feature (see *chapter 6*).

Initial operation must be carried out with idle motors, to prevent mechanical damages for example due to the wrong direction of rotation.

Electronic devices are never fail-safe. It is the user’s responsibility, in the case an electrical device fails, to make sure the system is transferred into a secure state.

The servo drive and in particular the brake resistor, externally or internally, can assume high temperatures, which may cause serious burns.

2.4.3 Protection against electrical shock by means of protective extra-low voltage (PELV)

All connections and terminals with voltages of up to 50 Volts at the servo drive are protective extra-low voltage, which are designed safe from contact in correspondence with the following standards:

- International: IEC 60364-4-41
- European countries within the EU: EN 61800-5-1

DANGER!

High electrical voltages due to wrong connections!

Danger to life, risk of injury due to electrical shock!

Only devices and electrical components and wires with a protective extra low voltage (PELV) may be connected to connectors and terminals with voltages between 0 to 50 Volts.

Only connect voltages and circuits with protection against dangerous voltages. Such protection may be achieved by means of isolation transformers, safe optocouplers or battery operation.

2.4.4 Protection against dangerous movements

Dangerous movements can be caused by faulty control of connected motors, for different reasons:

- Improper or faulty wiring or cabling
- Error in handling of components
- Error in sensor or transducer
- Defective or non-EMC-compliant components
- Software error in superordinated control system

These errors can occur directly after switching on the device or after an indeterminate time of operation.

The monitors in the drive components for the most part rule out malfunctions in the connected drives. In view of personal protection, particularly the danger of personal injury and/or property damage, this may not be relied on exclusively.

Until the built-in monitors come into effect, faulty drive movements must be taken into account; their magnitude depends on the type of control and on the operating state.

DANGER!

Dangerous movements!

Danger to life, risk of injury, serious personal injuries or property damage!

For the reasons mentioned above, personal protection must be ensured by means of monitoring or superordinated measures on the device. These are installed in accordance with the specific data of the system and a danger and error analysis by the manufacturer. The safety regulations applying to the system are also taken into consideration. Random movements or other malfunctions may be caused by switching the safety installations off, by bypassing them or by not activating them.

2.4.5 Protection against contact with hot parts

DANGER!

Housing surfaces may be hot!

Risk of injury! Risk of burning!

Do not touch housing surfaces in the vicinity of heat sources! Danger of burning!

Before accessing devices let them cool down for 10 minutes after switching them off.

Touching hot parts of the equipment such as the housing, which contain heat sinks and resistors, may cause burns!

2.4.6 Protection during handling and assembly

Handling and assembly of certain parts and components in an unsuitable manner may under adverse conditions cause injuries.

DANGER!

Risk of injury due to improper handling!

Personal injury due to pinching, shearing, cutting, crushing!

The following general safety notes apply:

Comply with the general setup and safety regulations on handling and assembly.

Use suitable assembly and transportation devices.

Prevent incarcerations and contusions by means of suitable protective measures.

Use suitable tools only. If specified, use special tools.

Use lifting devices and tools appropriately.

If necessary, use suitable protective equipment (for example goggles, protective footwear, protective gloves).

Do not stand underneath hanging loads.

Remove leaking liquids on the floor immediately to prevent slipping.

3 Technical data

3.1 Ambient conditions and qualification

Table 5: Technical data: Ambient conditions and qualification

Range	Values
Admissible temperature ranges	Storage temperature: -25°C to +70°C
	Operating temperature: 0°C to +50°C +50°C to +70°C at reduced power 2%/K Temperature switch-off at approx. 80°C
Admissible installation height	Mounting height maximum 2000 m above msl, above 1000 m above msl with power reduction 1% per 100 m
Humidity	Relative humidity up to 90%, no bedewing
Protection degree	IP54, dependent on mounting IP67 may be achieved
Protection class	III
Pollution degree	2
EC type-examination for integrated safety function „Safe Torque Off (STO)“	See *chapter 6 Functional safety technology*.
CE conformity: Low-voltage directive: EMC directive: Interference emission: Interference immunity:	 not applicable Directive 2004/108/EG (Standard DIN EN 61800–3) First environment category C2 Second environment

Table 6: Technical data: Dimensions and weight

Parameter	Values
Dimensions basic device (H*W*D) (without counterplug und mounting plate)	56 x 80 x 112 mm
Weight	approx. 0,5 kg

3.2 Supply [X1]

Table 7: Technical data: Performance data power supply [X1]

Parameter	Values
DC bus voltage	0 V... 60 V DC (48 V DC nominal / 15 A nominal) [1]
24 V logic supply	24 V DC [± 20%] / approx. 200 mA [2] + 700 mA [3] + 100 mA [4] internally protected with poly-switch, triggered at approx. 1 A
Brake chopper switching threshold ON: switching threshold OFF:	 U_{CHOP_ON} = 60 V [± 5%] U_{CHOP_OFF} = 55 V [± 5%]
External brake resistor	possible mounting on mounting plate (Type: PLR of Metallux, Metronix order no: 9519-0001-00)
Resistance	5 Ω
Continuous power / pulse power	30 W / 750 W

[1] An external fuse 15A is recommended.

[2] Current consumption of the DIS-2 48/10 without additional wiring

[3] Maximum admissible current consumption of an optional holding brake

[4] Maximum current consumption when DOUT0 to DOUT2 and the CAN bus are active

3.3 Motor connection [X301-X303]

Table 8: Technical data: Motor connection specifications [X301-X303]

Parameter	Values
Specifications for operation with 48 V / $T_{Housing\ max.}$ = 50°C	
Output power	500 VA
Max. output power for 2 s	1500 VA
Output current	15 A_{rms} @ $T_{PowerStage} \leq 50°C$ 10 A_{rms} @ $T_{PowerStage} \leq 70°C$
Max. output current for 2 s	40 A_{rms} @ $T_{PowerStage} \leq 50°C$ 32 A_{rms} @ $T_{PowerStage} \leq 70°C$
PWM frequency	10 kHz / 20 kHz

Table 9: Technical data: Motor temperature monitoring [X2]

Parameter	Values
Digital sensor	Normally closed contact: R_{cold} < 500 Ω R_{hot} > 100 kΩ
Analogue sensor	Silicon temperature sensors, KTY series KTY81-2x0; KTY82-2x0 $R_{25} \approx 2000\ \Omega$ KTY81-1x0; KTY81-2x0 $R_{25} \approx 1000\ \Omega$ KTY83-1xx $R_{25} \approx 1000\ \Omega$ KTY84-1xx $R_{100} \approx 1000\ \Omega$

3.4 Angle encoder connector [X2]

Table 10: Technical data: Resolver evaluation [X2]

Parameter	Values
Suitable resolvers	Industry standard
Transformation ratio	0.5
Carrier frequency	10 kHz
Resolution	> 12 Bit (typ. 15 Bit)
Delay time signal detection	< 200 µs
Speed resolution	ca. 4 min^{-1}
Absolute accuracy of angle detection	< 10´
Max. rotational speed	16.000 min^{-1}

Table 11: Technical data: Evaluation of analogue Hall sensor signals [X2]

Parameter	Values
Suitable Hall sensors	HAL400 (Micronas), SS495A (Honeywell) and others Type: differential analogue output, V_{CM} = 2.0 V...3.0 V Signal amplitude: max. 4,8 V_{ss} differential [1)]
Resolution	> 12 Bit (typ. 15 Bit)
Delay time signal detection	< 200 µs
Speed resolution	approx. 10 min^{-1}
Absolute accuracy of angle detection	< 30´
Max. rotational speed	16.000 min^{-1}

[1)] Other Signal levels on request as customer specific version, please contact your local supplier.

Table 12: Evaluation of Six-Step-Sensors (Hall) and block commutation mode [X2]

Parameter	Values
Suitable Hall sensors	Hall sensors with +5V supply, 120° phase shift between phases, open collector or push-pull output; i_{out} > 5 mA
Resolution	6 steps per electric turn
Delay time signal detection	< 200 µs
Speed resolution	Depends on number of poles of the motor
Max. rotational speed	3.000 min^{-1} on motors with two pole pairs

Table 13: Technical data: Evaluation of Incremental encoder [X2]

Parameter	Values
Pulse counts	Programmable 32 to 1024 lines per revolution, equivalent to 128 to 4096 increments / revolution
Input signal level	5 V differential inputs / RS422 standard
Power supply for encoder	+5 V / 100 mA max.
Input impedance	$R_i \approx 1600\ \Omega$
Max. input frequency	f_{max} > 100 kHz (pulses/s)

Table 14: Technical data: Evaluation of HIPERFACE® Encoders [X2]

Parameter	Values
Suitable encoders	Stegmann HIPERFACE®; SCS60/70, SCM60/70; SRS50/60, SRM50/60; SNS50/60; SKS36 / SKM36; SEK 34/37/52, SEL 34/37/52; for other types, please contact your supplier.
Resolution	Up to 16 Bit (depends on number of increments)
Delay time signal detection	< 200 µs
Speed resolution	approx. 4 min^{-1}
Absolute accuracy of angle detection	< 5´
Max. rotational speed	6.000 min^{-1} / 3.000 min^{-1} at 1024 increments / revolution

3.5 Communication interfaces

Table 15: Technical data: RS232 [X5]

Parameter	Values
RS232	as per RS232 specification, 9600 Baud to 115,2 kBaud

Table 16: Technical data: Analogue inputs and outputs [X1]

Parameter	Values
High resolution analogue inputs	±10V input range, 12 Bit resolution, differential, < 250µs delay time, Input protection up to 30V
Analogue input: AIN0 / #AIN0	Analogue input, usable as input for current or speed setpoint. (Pins shared with DIN0 and DIN1)
Analogue input: AIN1 / #AIN1	Analogue input, usable as input for current or speed setpoint. (Pins shared with DIN2 / DIN3)
Analogue output: AMON0	0... 10V output range, 8 Bit resolution, $f_{Limit} \approx$ 1kHz

Table 17: Technical data: Digital inputs and outputs [X1]

Parameter	Values
Signal level	24V (14V … 30V) active high
DIN0 DIN1 DIN2 DIN3	Bit 0 \ Bit 1, \ Target selection for positioning Bit 2, / 16 targets selectable from target table Bit 3 /
DIN4 (usable as incremental input A-signal)	Bit 4 \ \ Target selection for positioning / 4 target groups with separate positioning parameter Bit 5 / selectable (e.g. speed, acceleration)
DIN5 (usable as incremental input B-signal)	
DIN6 (usable as incremental input N-signal)	Control signal start positioning
DIN7	End switch input 0
DIN8	End switch input 1
DIN9	Servo drive enable at high signal, acknowledge error with falling edge
Logic outputs general	24V (8V... 30V) active high, short circuit rated to GND
DOUT0	Operational state / Ready 24 V, max. 20 mA
DOUT1	Freely configurable, usable as Encoder output A-signal 24 V, max. 20 mA
DOUT2	Freely configurable, usable as Encoder output B-Signal 24 V, max. 20 mA
DOUT3 (**on [X3]**)	Holding brake 24 V, max. 700 mA

Table 18: Technical data: Incremental encoder input [X1] (DIN4, DIN5, DIN6):

Parameter	Values
Number of lines	Programmable to 32 / 64 / 128 / 256 / 512 / 1024 lines per revolution
Connection level	24 V single ended / 24V (8V...30V) active high, following DIN EN 61131-2
Max. input frequency	F_{Limit} = 50 kHz (lines/s); f_{Limit} depending on input filter, data measured with R_{Input} = 13,3 kΩ and C_{Input} = 470 pF

Table 19: Technical data: Incremental encoder output [X1] (DOUT1, DOUT2):

Parameter	Values
Number of lines	Programmable to 32 / 64 / 128 / 256 / 512 / 1024 lines per revolution
Connection level	24V / max. 20 mA
Output impedance	$R_a \approx 300\ \Omega$
Limit frequency	F_{Limit} > 100 kHz (lines/s); f_{Limit} depending on cable length, data measured with R_{Load} = 1 kΩ and C_{Load} = 1 nF (which corresponds to a cable length of 5m)

3.6 STO interface

Table 20: Technical data: Control ports [X40] (STO1, STO2):

Parameter	Values		
Nominal voltage	24 V (related to GND)		
Voltage range	19,2 ... 28,8V		
Permissible residual ripple	2 % (related to nominal voltage 24 V)		
Input current STO1	0,5 mA (typical; maximum 1 mA)		
Input current STO2	25 mA (typical; maximum 30 mA)		
Input voltage threshold Switching on Switching off	 approx. 17 V approx. 15,5 V		
Switch-on time STO1 from Low to High ($t_{STO1-ON}$)	5 ms (typical; maximum 10 ms)		
Switch-on time STO2 from Low to High ($t_{STO1-ON}$)	10 ms (typical; maximum 15 ms)		
Switch-off time STO1 from High to Low ($t_{STO1-OFF}$)	5 ms (typical; maximum 10 ms)		
Switch-off time STO2 from High to Low ($t_{STO2-OFF}$)	70 ms (typical; maximum 75 ms)		
Maximum test impulse length STO1/2 for OSSD signals	19,2 V	24 V	28,8 V
	max. 2,5 ms	max. 4 ms	max. 4 ms

Table 21: Technical data: Feedback contact [X40] (REL1, REL2):

Parameter	Values
Version	Floating relay contact, normally open
Voltage range contacts	< 30 V (overvoltage-proof up to 60 V DC)
Nominal current	< 200 mA (not short circuit proof)
Voltage drop	< 200 mV
Residual current (contact opened)	< 1µA
Switching time closing	< 1ms
Switching time opening	< 0,5 ms

3.7 Fieldbus interfaces

Table 22: Technical data: CAN-Bus [X401] / [X402]

Communication interface	Values
CAN controller	TJA 1050, Full-CAN-Controller, 1MBit/s; adjustable max. 500kBit/s
CANopen protocol	as per DS301 and DSP402
Current consumption of the activated CAN technology module	5 mA

Table 23: Technical data: PROFIBUS [X401] / [X402]

Communication interface	Values
Controller	PROFIBUS-controller VPC3+C, max. 12 MBaud
Protocol	PROFIBUS DP, 32 byte telegrams with mode-dependent structure
Current consumption of the activated PROFIBUS technology module	20 mA

Table 24: Technical data: EtherCAT [X401] / [X402]

Communication interface	Values
Controller	ESC10, slave
EtherCAT protocol	CoE, CANopen over EtherCAT
Signal level	0 ... 2,5 VDC
Differential voltage	1,9 ... 2,1 VDC
Current consumption of the activated EtherCAT technology module	35 mA

4 Mechanical installation

4.1 Important notes

- The DIS-2 48/10 FB FS STO servo drive was designed for direct installation on the motor.
- Optionally, it is possible to use it separately from the motor. In this case, additional connecting cables between the motor and the DIS-2 servo drive are required. These cables should be as short as possible. The maximum length is 1 m.
- Optimum cooling can be ensured when the DIS-2 48/10 FB FS STO servo drive is mounted in a vertical position. This means that connector [X1] is located on top or at the bottom.
- The maximum permissible temperature of the housing is 70°C to guarantee the specified service life of the electronic system.
- Connect the connecting cable for [X1] as closely as possible to the DIS-2 48/10 FB FS STO servo drive to increase the reliability of the cabling.
- Installation spaces:
  Keep a minimum distance of 100 mm to other components each underneath and above the device to ensure sufficient venting.

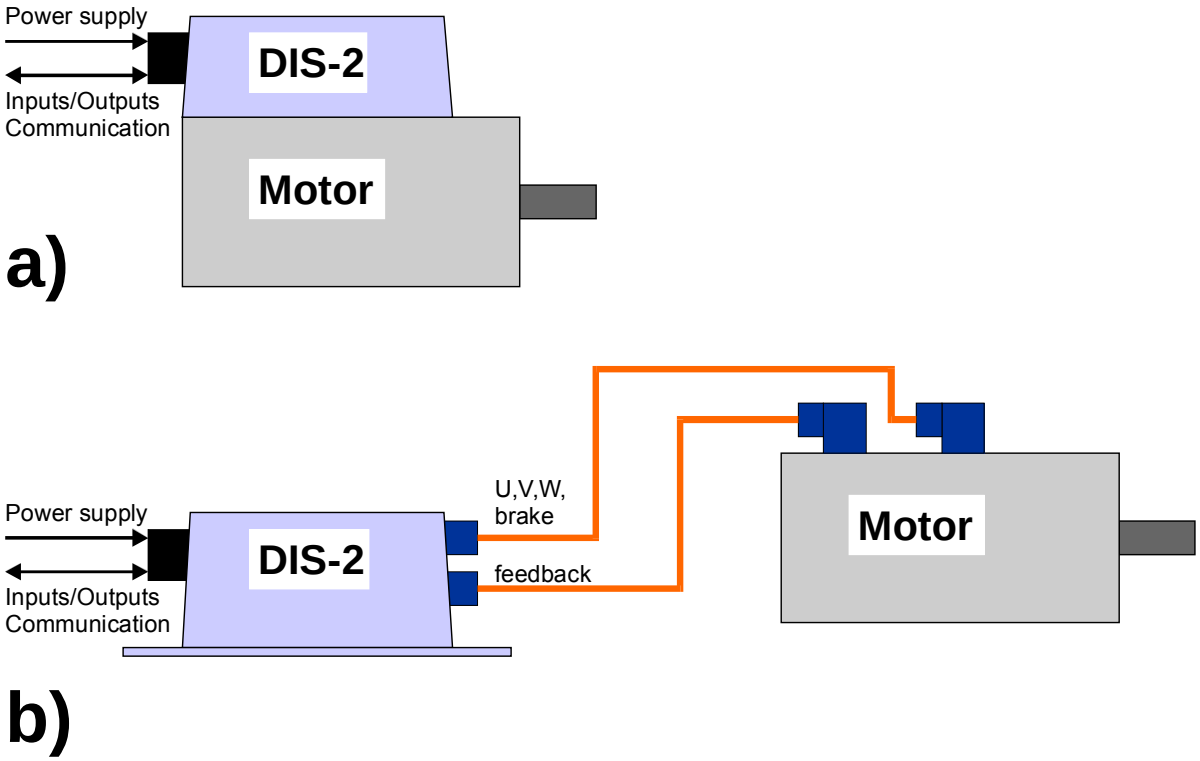


Figure 1: **a) Mounted directly on the motor – standard,**
b) Separated from the motor – Please contact your local distributor to check whether this option is available.

4.2 Position and alignment of the connectors

The DIS-2 48/10 FB FS STO has the following connections:

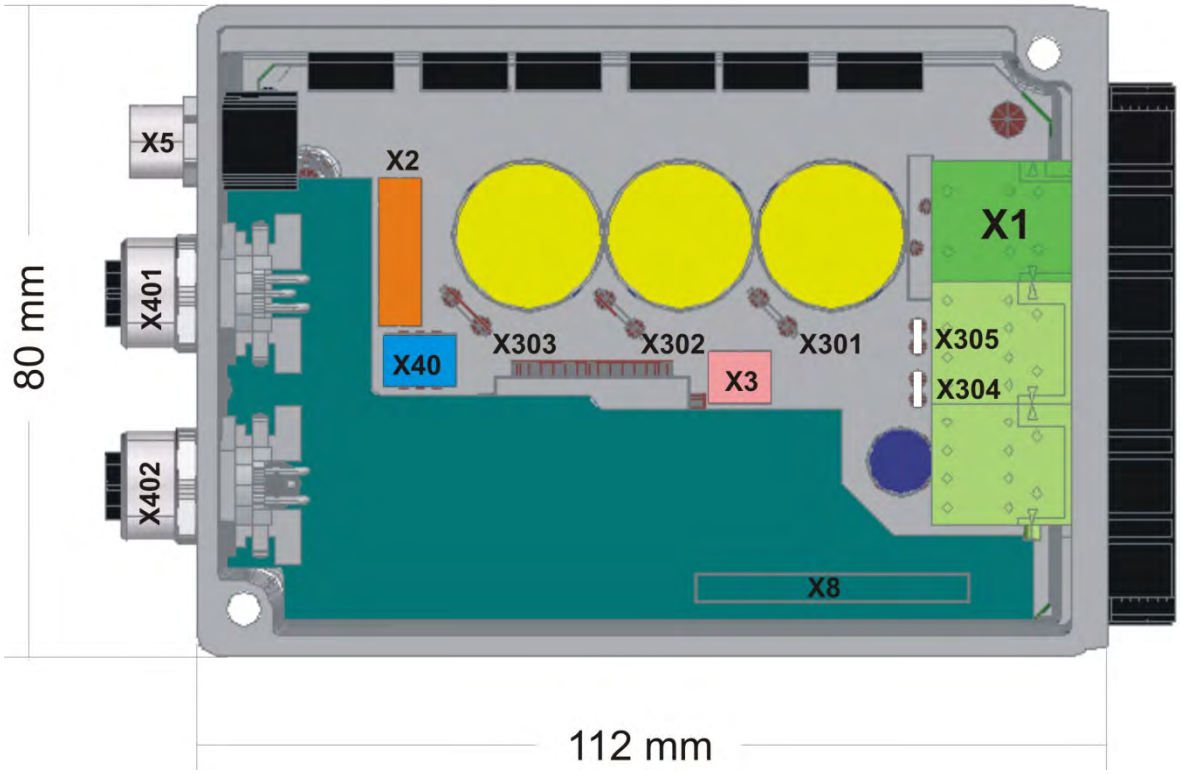


Figure 2: Arrangement of the connectors DIS-2 48/10 FB FS STO – Top view of the device

4.2.1 Connectors on the main board

- **[X1]:** The only connector on the main board that is led to the outside. It includes digital and analogue inputs and outputs and the power supply.
- **[X2]:** Connector of the angle encoder.
- **[X3]:** Connector of the holding brake.
- **[X304, X305]:** Connector for the brake resistor that is mounted on the mounting plate.
- **[X301, X302, X303]:** Connectors for the three motor phases U, V and W.
- **[X8]:** Expansion interface for technology modules (fieldbuses).
- **[X40]:** Connector of the STO interface. This interface is led to the outside via a 5-pole M12 circular connector. The circular connector normally is fixed on the mounting plate.

4.2.2 Connectors for the fieldbus interfaces and RS232 interface (CANopen, PROFIBUS or EtherCAT)

- **[X5]:** Connector for the RS232 communication, for example to parameterise the DIS-2 48/10 FB FS STO
- **[X401]:** Fieldbus connector for bus IN or bus OUT
- **[X402]:** Second fieldbus connector for bus IN or bus OUT

4.3 Dimensions of the housing

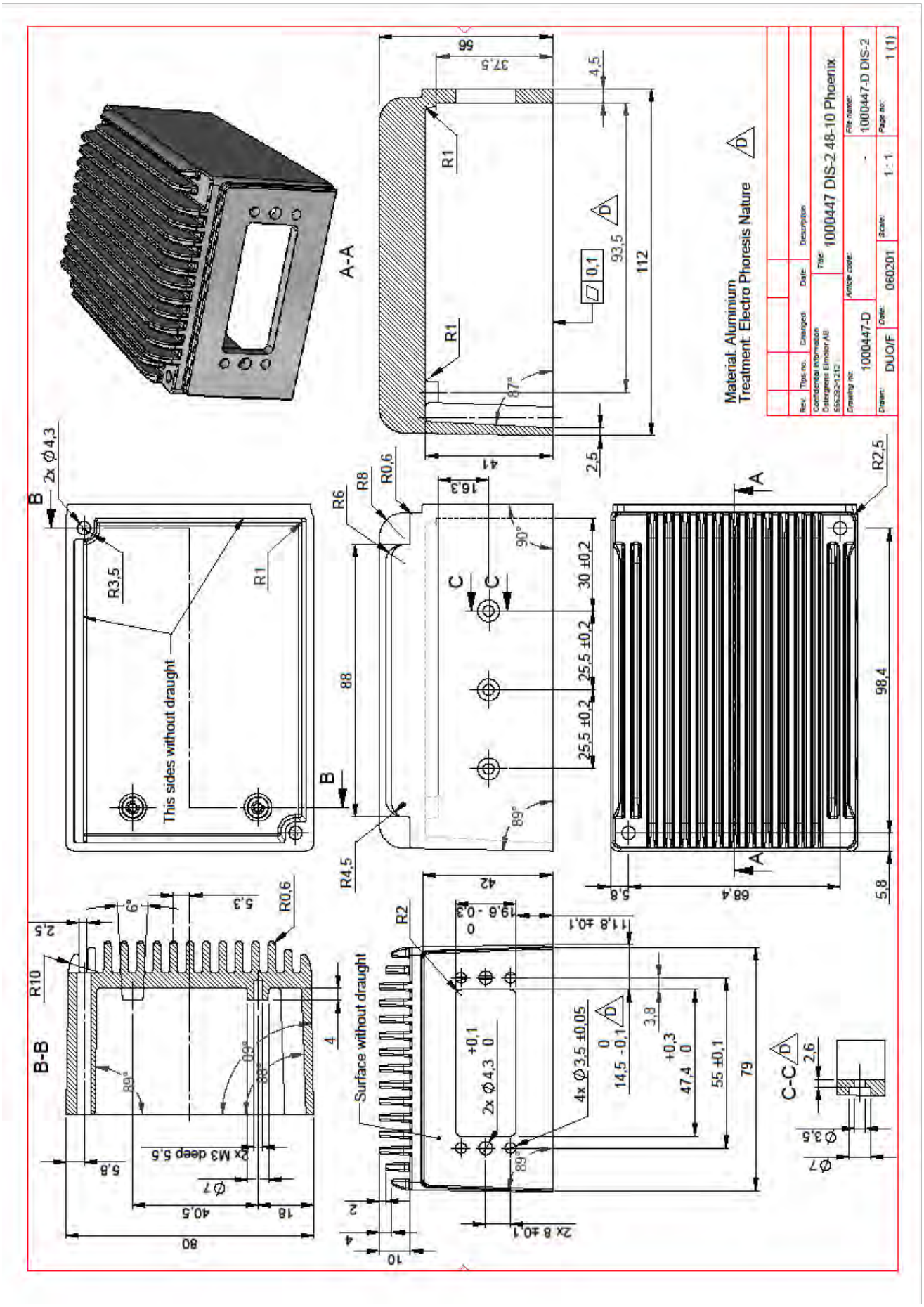


Figure 3: Dimensions of the housing - 1

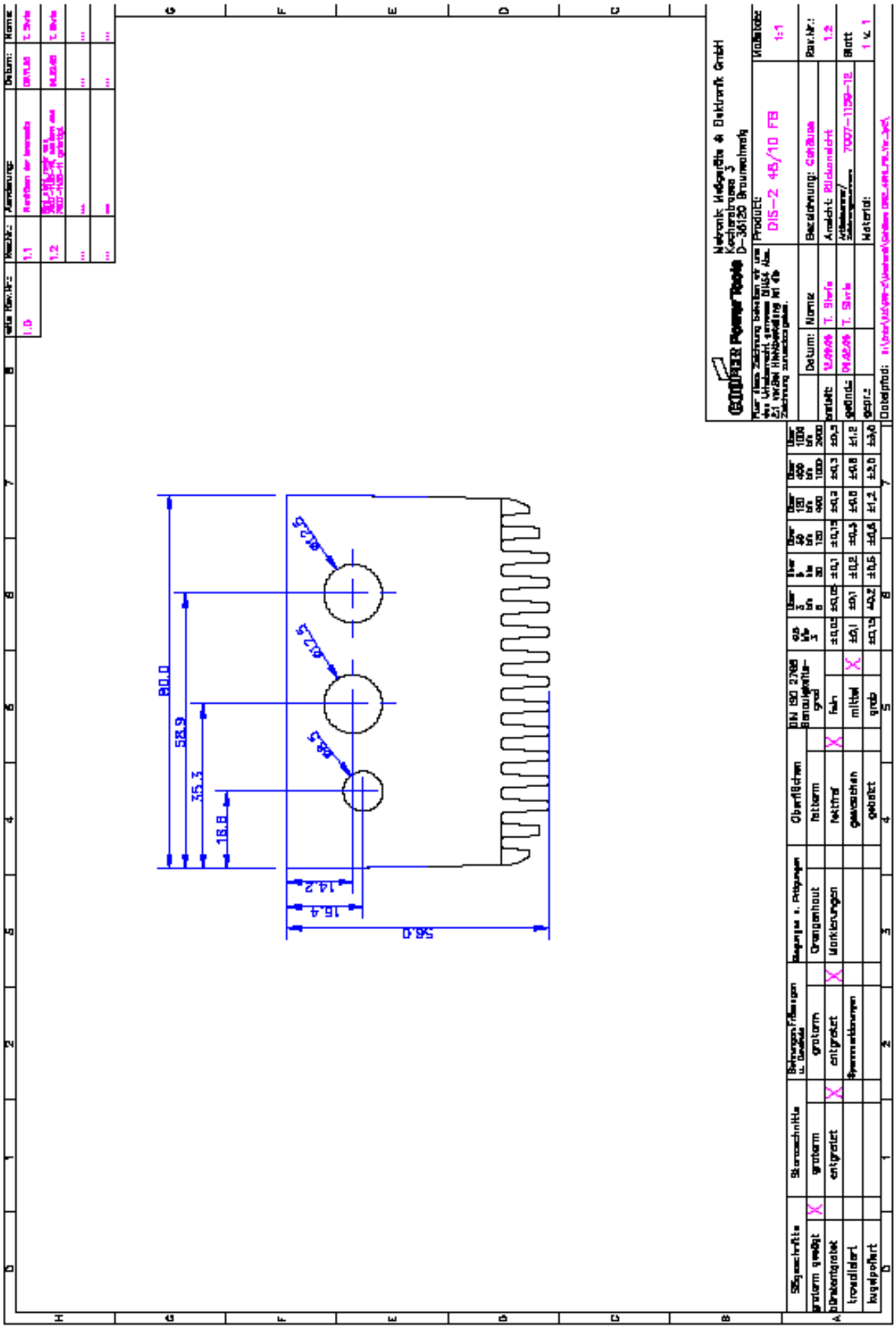


Figure 4: Dimensions of the housing - 2

4.4 Mounting

The servo drive DIS-2 48/10 FB FS STO will be mounted directly to the motor using a seal. The mounting flange at the motor should have a smooth surface with a circular slot to achieve the highest protection against water. Achieving the protection degree of IP67 is possible by using a good mechanical construction.

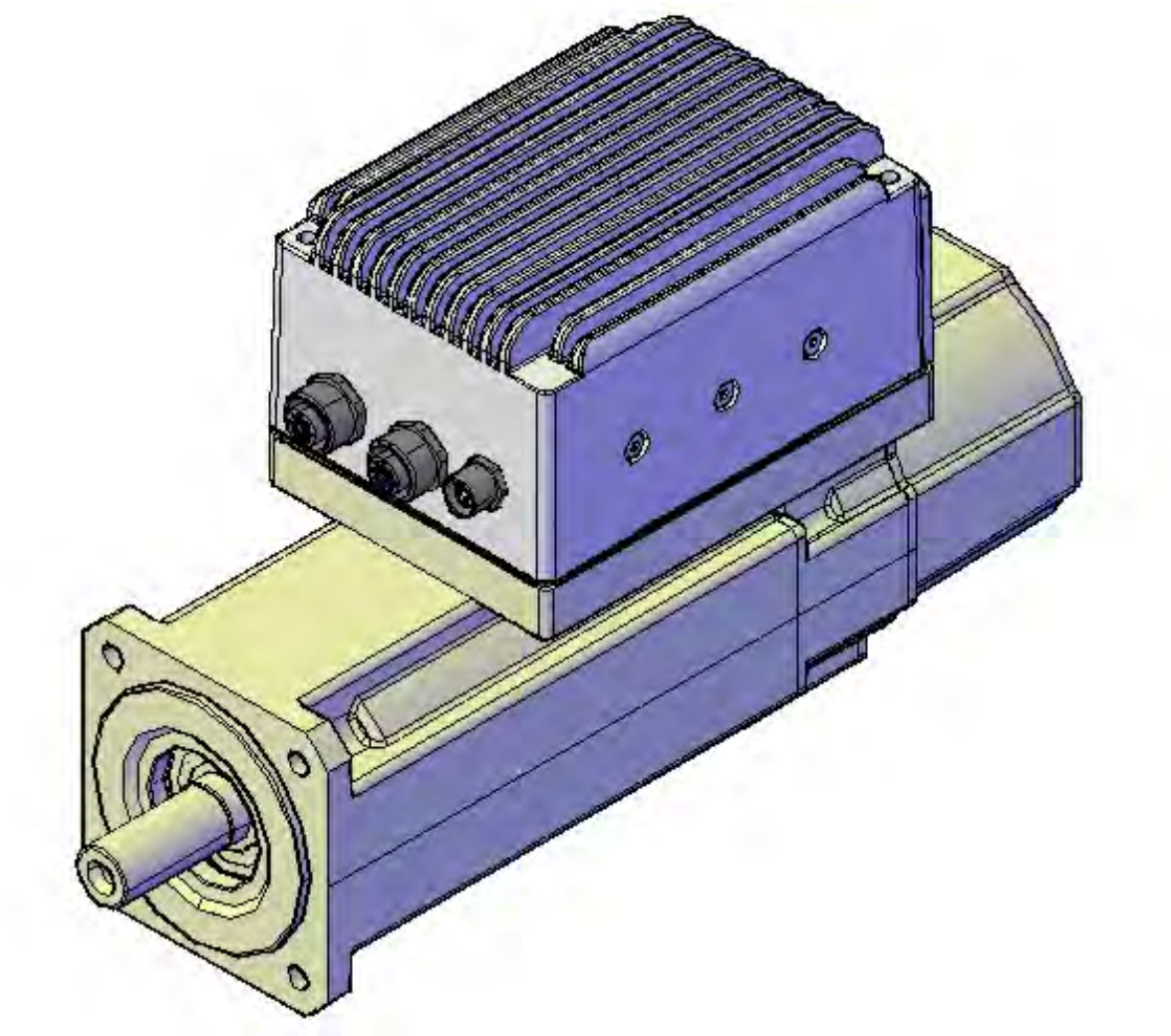


Figure 5: DIS-2 mounting example without STO

The following two figures show a mounting example of an STO application. In this case, the mounting plate must be milled deeper so that the M12 circular connector [X40A] can be integrated.

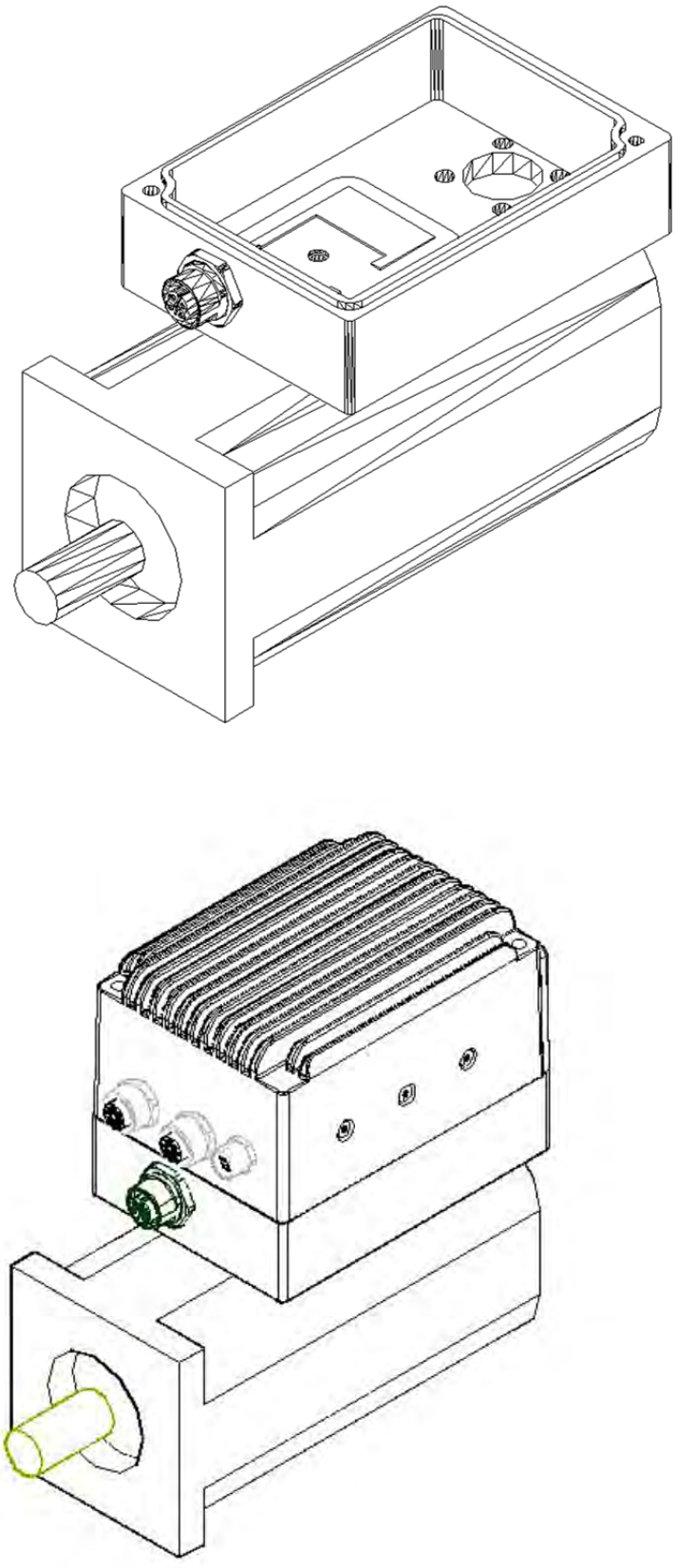


Figure 6: DIS-2 48/10 FB FS STO mounting example with STO – synchronous servo motor, mounting plate with brake resistor and servo drive

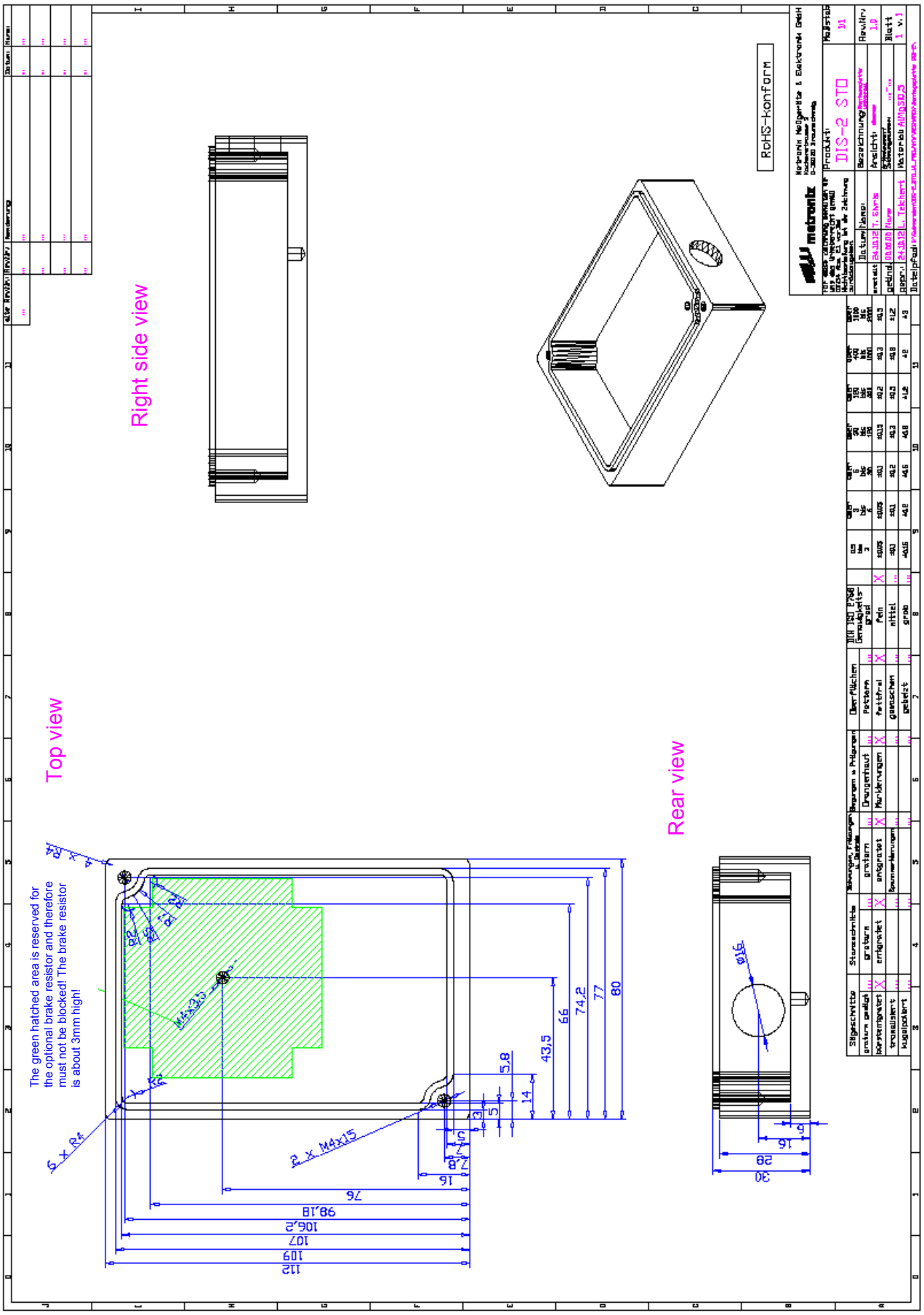


Figure 7: DIS-2-FB FS STO Example of a mounting plate universal

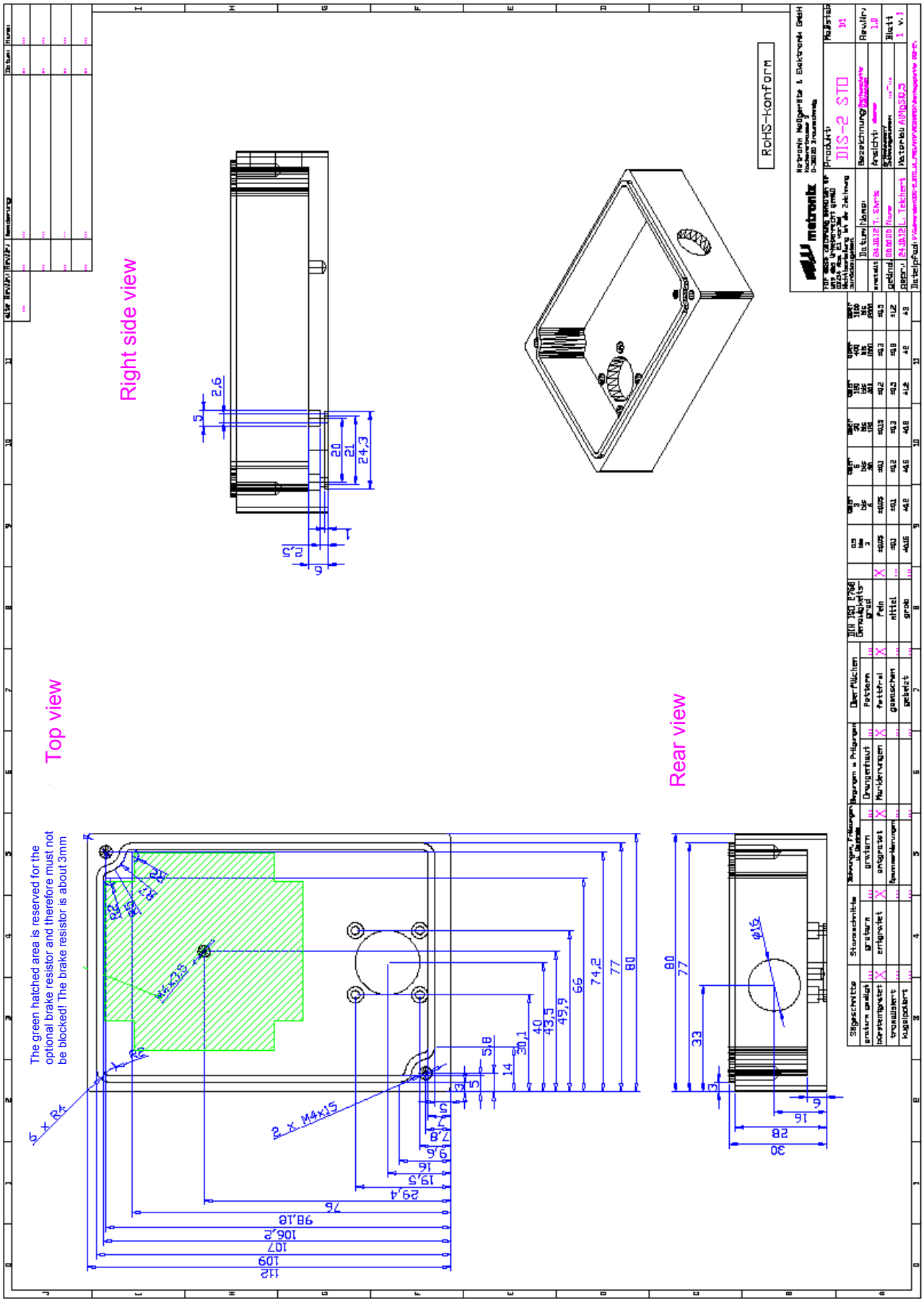


Figure 8: DIS-2-FB FS STO Example of a realised mounting plate

5 Electrical installation

5.1 Connection to power supply, control and motor

The following figure shows a typical application with two or more DIS-2 servo drives with a connection to an 48V intermediate circuit supply, to a 24 V DC logic supply and to a control or to a PLC without STO functionality.

The connector [X40] for the integrated safety function “Safe Torque Off (STO)” is not shown in this figure. For further information concerning the safety function please refer to *chapter 6 Functional safety technology* and the Product Manual “Servo drive DIS-2 48/10 FB FS STO”, chapter 6.

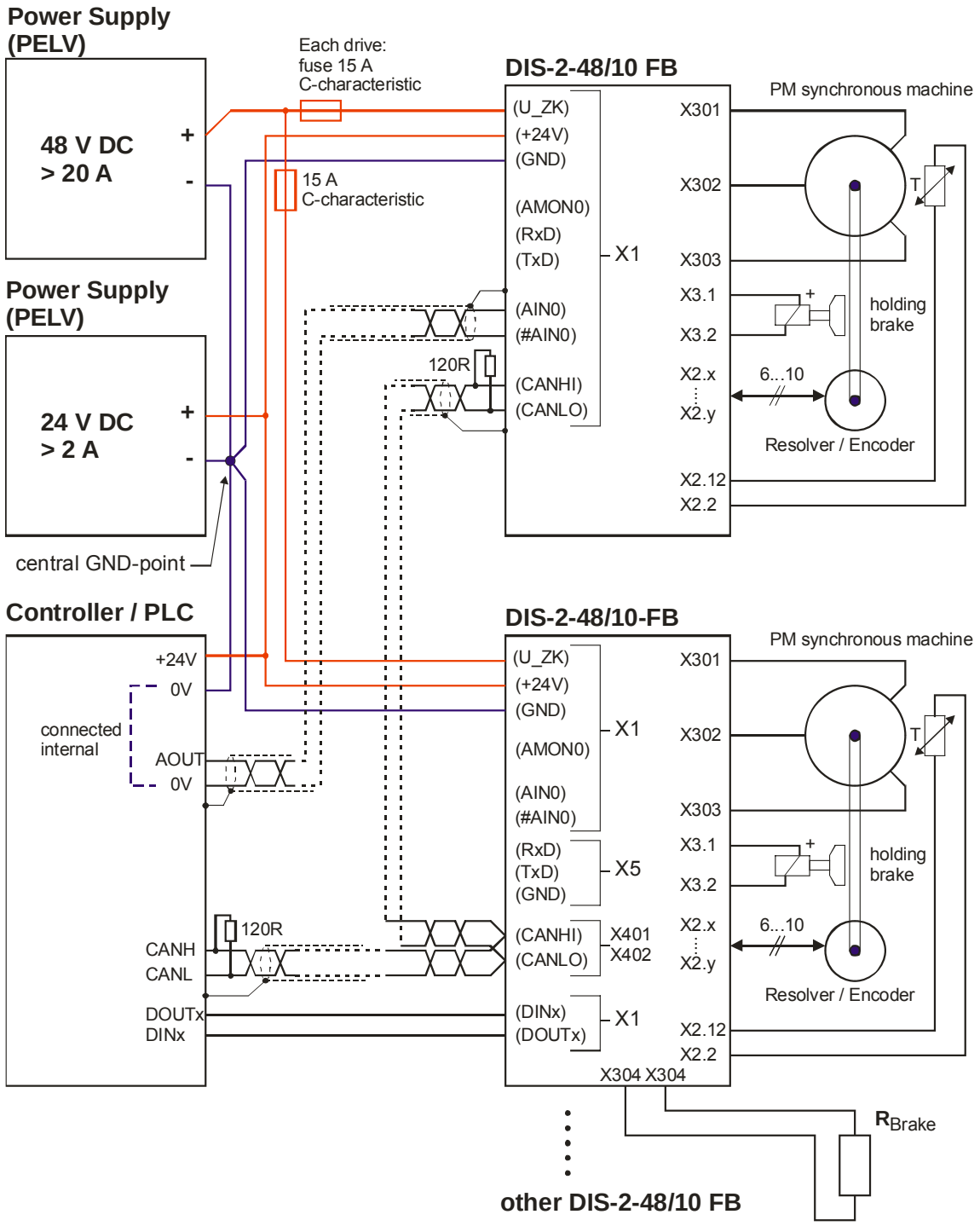


Figure 9: Connection to power supply, control and motor

The servo drive is connected to the 48 V intermediate circuit supply and to the 24 V logic supply. A shared reference potential (GND) is used. A central star point near the power supply units for all GND connections reduces the "ground bouncing" effects between the servo drives.

The motor has to be connected through the FASTONs [X301] to [X303] on the circuit board of the DIS-2. The DIS-2 controls an optional holding brake through connector [X3]. The encoder and the temperature sensor have to be connected through the recessed connector [X2] on the circuit board.

The DIS-2-48/10 FB has an additional integrated brake chopper. It is therefore possible to connect the braking resistor through the FASTONs [X304] and [X305] on the circuit board as shown in *Figure 9* on the bottom right. Normally, the braking resistor is installed on the mounting plate for the electronics housing.

DANGER!

Only use the brake resistor that is approved by the manufacturer. The used brake resistor must have a high pulse loading capacity to be able to permanently withstand the short peak loads. Unsuitable brake resistors will fail prematurely; they can cause fires and even electrical hazards! Consecutively, the user is at risk of being harmed, too.

If the analogue inputs are used to assign setpoints, we recommend using shielded and twisted cables for AINx / #AINx, even if the control does not provide any differential signal. Connection of #AINx to the 0V reference potential at the control system prevents common-mode interferences which are caused by high currents flowing through the power stage and the external cables. The shield prevents the penetration of interferences and should be connected on both ends (to the housing of the DIS-2 48/10 FB FS STO servo drive and to the housing of the control system).

The wiring of the fieldbus should be done in the same way as the wiring of the analogue inputs. At both ends of the network, for example for the CAN bus (120 Ω / 1%), a termination resistor is needed.
The fieldbus is looped through the DIS-2 48/10 FB FS STO via the fieldbus connectors [X401] und [X402].

The DIS-2 48/10 FB FS STO has a separate connector, [X5], for the serial service interface to be connected to a PC. This enables the parameterisation and analysis using the DIS-2 ServoCommander™ or the control of the servo drive. [X5] is part of the fieldbus module and is looped through to the basic device.

The signals for the digital IOs, DINx and DOUTx, do not need a shield to protect them against interferences, but a shielded cable between the DIS-2 servo drive and the control system improves the EMC behaviour throughout the entire system, particularly in view of radiated interferences. At least the control signals DIN9 (servo drive enable) and DOUT0 (ready for operation) have to be connected between the PLC and the servo drive.

For synchronization, DIN4, 5 and 6 are used as incremental encoder inputs and DOUT1 and DOUT2 are used as incremental encoder outputs.

Make sure that the servo drive is completely wired prior to switching on the power supply for the intermediate circuit (DC bus) and the logic system. If the 24 V DC power supply connections are reversed, if the power supply is too high or if the connections of the intermediate supply and the logic supply are mixed up, the DIS-2 48/10 FB FS STO servo drive may be permanently damaged.

Verify that the power supply used for the power and for the logic part fulfil the specifications for the DIS-2 48/10 FB FS STO and are correspondingly resistant:

see *Table 7: Technical data: Performance data power supply [X1]*

All power supply units must have PELV (Protective Extra Low Voltage).

Intermediate supply: 48 V DC (PELV)

Logic supply: : 24 V DC (PELV)

DANGER!

Wrong connections around the power supply can destroy the servo drive DIS-2 48/10 FB FS STO when the power is switched on. This is particularly true for the connection of the mains, the protection earth, the motor phases and the brake resistor.

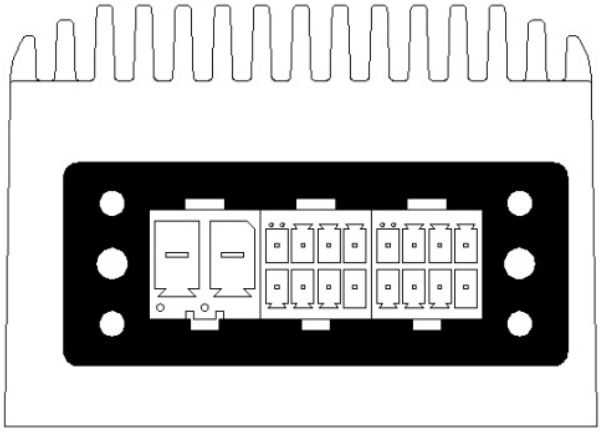
Also high voltages lead to the destruction of the device. A high power can occur if the neutral conductor is not loadable, or a neutral conductor interruption occurs in the wiring cabinet or externally!

5.2 Connectors on the basic device DIS-2 48/10 FB FS STO

5.2.1 Connection: Power supply and I/O [X1]

Configuration on the device [X1]: Phoenix PLUSCON – VARIOCON with a total of 18 contacts

Counterplug [X1]: Phoenix PLUSCON – VARIOCON kit,
consisting of: 1x VC-TFS2
2x VC-TFS8
1x VC-TR2/3M
1x VC-MEMV-T2-Z
1x VC-EMV-KV-PG21-(11,5-15,5/13,5)
Dimensions approximately
H x W x DH = 86 mm x 80 mm x 32 mm



C		B				A			
2	1	8	7	6	5	8	7	6	5
		4	3	2	1	4	3	2	1

Figure 10: Connection and pin numbering [X1]

Table 25: Pin assignment [X1]

Pin No.	Denomination	Values	Specification
A1	DOUT0 / READY	0 V / 24 V	Ready for operation
A2	DIN8	0 V...24 V	Digital input: Limit switch 1 (blocks n > 0)
A3	DIN5	0 V...24 V	Digital input: Positioning group selector Bit 1 / Incremental encoder input track B
A4	#AIN1(DIN3)	-10 V...10 V (0 V...24 V)	Inverted analogue input 1: Differential analogue input with AIN1 or (Digital input: Positioning destination selector Bit 3)
A5	DIN9	0 V...24 V	Digital input: Power stage activation
A6	DIN7	0 V...24 V	Digital input: Limit switch 0 (blocks n < 0)
A7	DIN4	0 V...24 V	Digital input: Positioning group selector Bit 0 / Incremental encoder input track A
A8	AIN1 (DIN2)	-10 V...10 V (0 V...24 V)	Analogue input 1: Differential analogue input with #AIN1 or (Digital input: Positioning destination selector Bit 2)
B1	#AIN0 (DIN1)	-10 V...10 V	Inverted analogue input 0: Differential analogue input with AIN0 or (Digital input: Positioning destination selector Bit 1)
B2	DOUT2	0 V...24 V	Digital output programmable / encoder output track B
B3	AMON0	0 V...10 V; 2 mA	Analogue output 0
B4	GND	0 V	Reference potential for the control signals
B5	AIN0 (DIN0)	-10 V...10 V	Analogue input 0: Differential analogue input with #AIN0 or (Digital input: Positioning destination selector Bit 0)
B6	DOUT1	0 V...24 V	Digital output programmable / encoder output track A#
B7	DIN6	0 V...24 V	Digital input: Positioning start / Incremental encoder track N
B8	+24V Logik	+24 V / I_{Logik} = 200 mA...1000 mA	24 V power supply for the internal logic and the IOs.
C1	**GND**	**0 V**	**Shared ground potential for the intermediate circuit voltage (DC bus voltage) and the 24V logic supply.**
C2	ZK+	+48 V / 15 $A_{nom.}$	Intermediate circuit supply (DC bus)

5.2.2 Connection: Motor [X301-X303]

Configuration on the device [X301 – X303]: 6.3 mm FAST-ON male

Counterplug [X301 – X303]: 6.3 mm FAST-ON female (insulated externally)

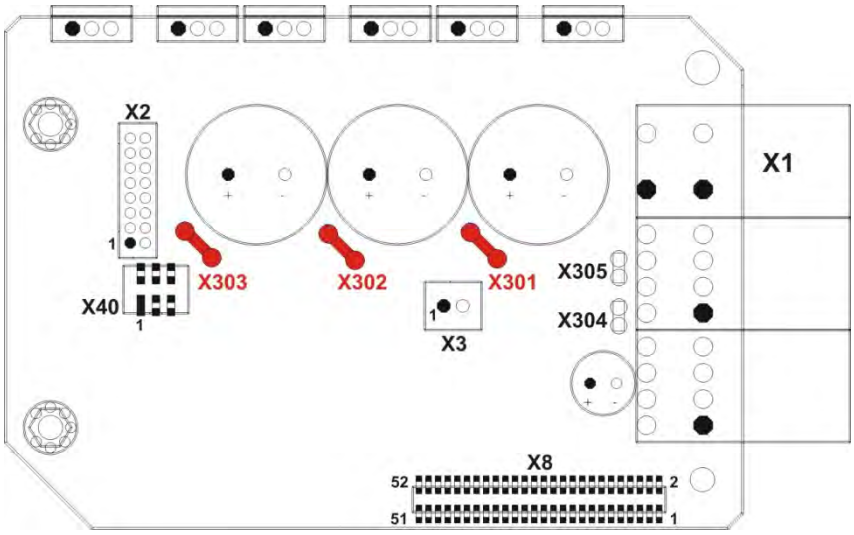


Figure 11: Position and connection motor cable

Table 26: Pin assignment [X301 – X303]

[X30x]	Denomination	Values	Specification
[X301]	PHASE_U	3 x 0 V...48 V 15 $A_{RMS,nom}$ 40 $A_{RMS,max}$ 0 Hz...200 Hz	Connection of the three motor phases
[X302]	PHASE_V		
[X303]	PHASE_W		

5.2.3 Connection: Angle encoder [X2]

Configuration on the device [X2]: JST No. B16B-PHDSS

Counterplug [X2]: JST No. PHDR-16VS / contacts: JST No. SPHD-002T-P0.5

X2

15	16
13	14
11	12
9	10
7	8
5	6
3	4
1	2

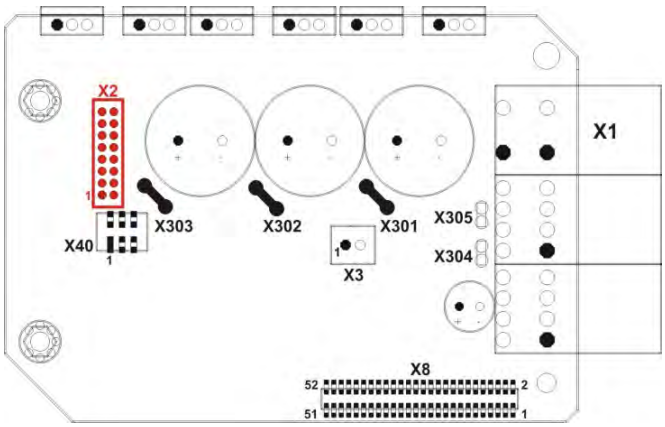


Figure 12: Position and connection angle encoder

Table 27: Pin assignment [X2]

Pin No.		Denomination		Values	Specification
1		GND		0 V	Reference potential for incremental encoder / analogue Hall sensors / Stegmann HIPERFACE® encoder
	2	GND		0 V	Reference potential for Hall sensors and / or motor temperature sensor
3		+5V		+5 V / 100 mA	+5 V supply for linear Hall sensors or incremental encoder
	4	+5V		+5 V / 100 mA	+5 V supply for Hall sensors
5		COS	A	1.5 $V_{RMS,diff}$ / R_i > 10 kΩ	Connection to resolver signal S1 or connection to incremental encoder track A
	6	HALL_U		0 V / 5 V R_i = 5 kΩ	Phase U Hall sensor for commutation Input with 4,7 kΩ pull-up at +5 V
7		#COS	#A	1.5 $V_{RMS,diff}$ / R_i > 10 kΩ	Connection to resolver signal S3 or connection to incremental encoder track #A
	8	HALL_V		0 V / 5 V R_i = 5 kΩ	Phase V Hall sensor for commutation Input with 4,7 kΩ pull-up at +5 V
9		SIN	B	1.5 $V_{RMS,diff}$ / R_i > 10 kΩ	Connection to resolver signal S2 or connection to incremental encoder track B
	10	HALL_W		0 V / 5 V R_i = 5 kΩ	Phase W Hall sensor for the commutation Input with 4,7 kΩ pull-up at +5 V
11		#SIN	#B	1.5 $V_{RMS,diff}$ / R_i > 10 kΩ	Connection to resolver signal S4 or connection to incremental encoder track #B
	12	MTEMP		0 V / 3.3 V R_i = 2 kΩ	Motor temperature sensor, normally-closed contact, PTC, or analogue sensor of KTY series; connected to GND
13		REF	N	3 $V_{RMS,diff.}$ max. 50 mA_{RMS}	Connection to resolver signal R1 or connection to incremental encoder track N / DATA
	14	+12V		+12 V / 100 mA	+12 V power supply for Stegmann HIPERFACE® encoder
15		#REF	#N	3 $V_{RMS,diff.}$ max. 50 mA_{RMS}	Connection to resolver signal R2 or connection to incremental encoder track #N / #DATA
	16	n.c.		-	-

5.2.4 Connection: Holding brake [X3]

Configuration on the device [X3]: JST No. BH02B-XASK-BN (High Box Type)

Counterplug [X3]: JST No. XAP-02V-1 with 2 contacts
JST No. SXA-001T-P0.6

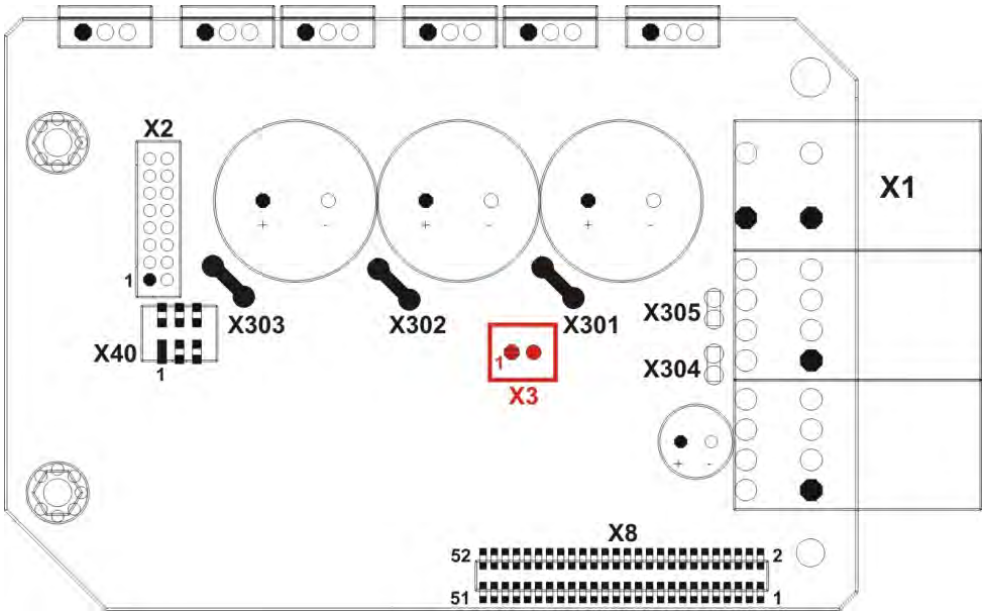


Figure 13: Position and connection holding brake

Table 28: Pin assignment [X3]

Pin No.	Denomination	Values	Specification
1	DOUT3	0 V / 24 V max. 500 mA	Digital output: (high active) for the holding brake, internal supply via the 24 V logic supply.
2	GND	0 V	Reference potential for the holding brake

5.2.5 Connection: Brake resistor [X304, X305]

Configuration on the device [X304, X305]: 2.8 mm FAST-ON male

Counterplug [X304, X305]: 2.8 mm FAST-ON female (insulated externally)

Configuration brake resistor: see *chapter 1.2, Table 4: Accessories DIS-2 48/10 FB FS STO*.

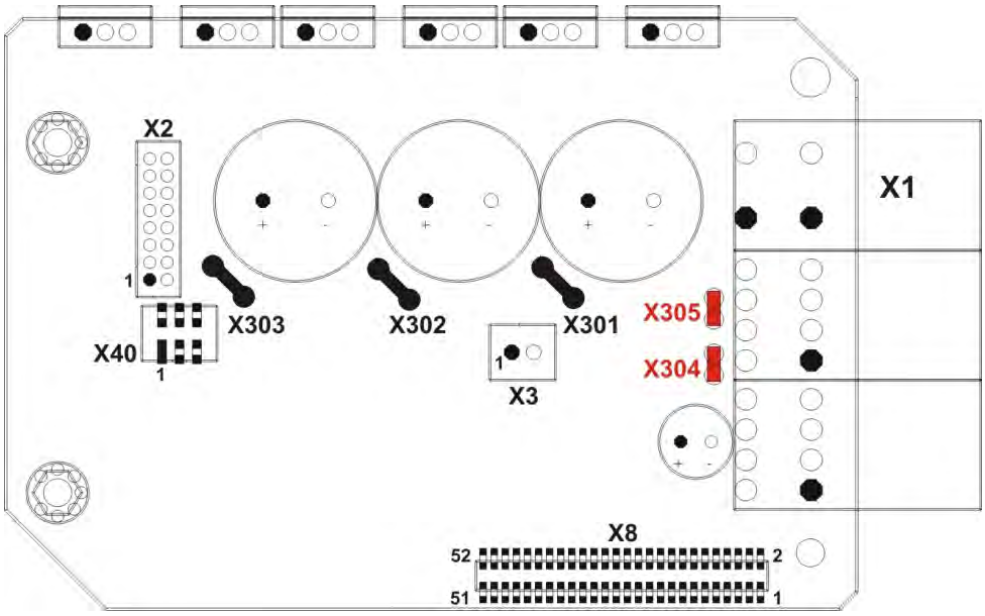


Figure 14: Position and connection brake resistor

Table 29: Pin assignment [X304, X305]

[X30x[	Denomination	Values	Specification
[X304[	ZK+	+48 V / 10 $A_{nom.}$	Intermediate circuit supply (DC bus)
[X305]	BR-CHOP	0 V / 48 V	Connection to brake resistance transistor

5.2.6 Connection: Extension port [X8]

Configuration on the device [X8]: 2 x 26 RM 1.27 mm pin row with protective collar

Counterplug [X8]: 2 x 26 RM 1.27 mm socket row

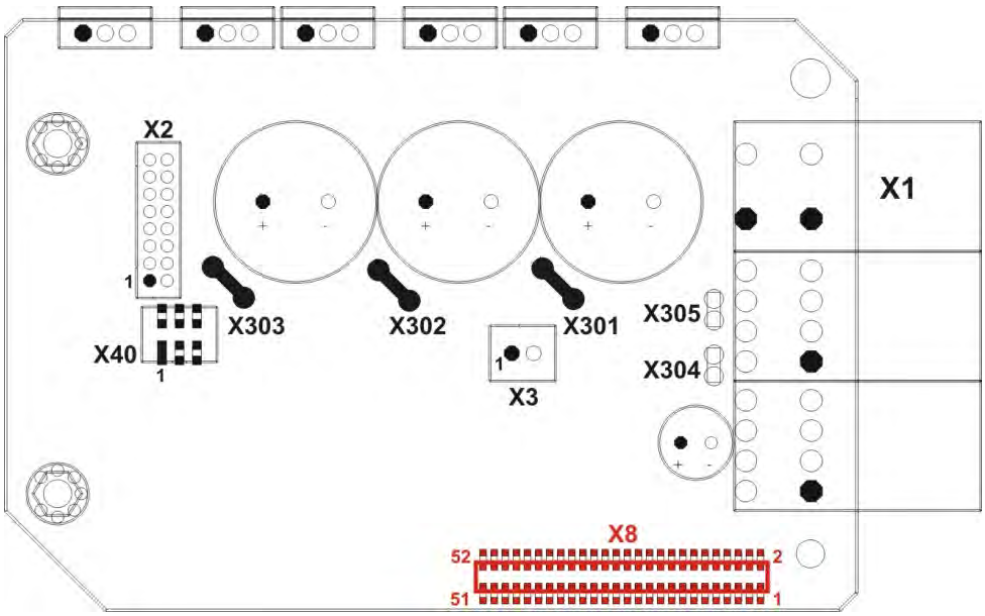


Figure 15: Position and connection technology module interface

Table 30: Pin assignment [X8]

Pin No.		Denomination	Values	Specification
1		n.b.	All signals with 3,3 V CMOS logic level	Not used
	2	+24 V	+ 24 V / max. 100 mA	Withdrawal of the protected logic supply of + 24 V for future applications / device variants
3		DIN8	0 V / 24 V	Digital 24 V input for limit switches, parallel to [X1]
	4	DIN7	0 V / 24 V	Digital 24 V input for limit switches, parallel to [X1]
5		GND	0 V	Reference potential
	6	GND	0 V	Reference potential
7		RxD	+/- 10 V	Serial interface signal RxD
	8	TxD	+/- 10 V	Serial interface signal TxD
9		CANHI_NDR	0 V / 5 V	Field bus signal CAN_H before „filter“
	10	CANLO_NDR	0 V / 5 V	Field bus signal CAN_L before „filter“
11		+3.3 V	3,3 V +/- 2%	Technology module power supply 100 mA max. (together with 5 V)
	12	+5 V	5,0 V +/- 5%	Technology module power supply 100 mA max. (together with mit 3.3 V)

Continuation of the table: Pin assignment [X8]

Pin No.		Denomination	Values	Specification
13		D14	All signals with 3,3 V CMOS logic level	16-bit parallel interface data bus
	14	D15		
15		D12		
	16	D13		
17		D10		
	18	D11		
19		D8		
	20	D9		
21		D6		
	22	D7		
23		D4		
	24	D5		
25		D2		
	26	D3		
27		D0		
	28	D1		
29		A11	All signals with 3,3 V CMOS logic level	16-bit parallel interface – address bus
	30	A12		
31		A9		
	32	A10		
33		A7		
	34	A8		
35		A5		
	36	A6		
37		A3		
	38	A4		
39		A1		
	40	A2		
41		#DS	All signals with 3,3 V CMOS logic level	Bus control signals for access to technology modules via the data and address bus, and synchronous-serial interface for access to technology modules with an SSIO interface
	42	A0		
43		#RD		
	44	#WR		
45		#IRQB (SYNC)		
	46	#IRQA		
47		MOSI		
	48	SCLK		
49		MISO		
	50	#SS		
51		GND	0 V	Reference potential
	52	GND	0 V	Reference potential

5.2.7 Connection: Safe Torque Off (STO) [X40] and [X40A]

For further information concerning the safety function please refer to *chapter 6 Functional safety technology* and the Product Manual “Servo drive DIS-2 48/10 FB FS STO”, chapter 6.

Configuration on the device [X40]:	Molex No. 87832-0614
Counterplug [X40]:	Molex No. 51110-0660 with up to 6 contacts Molex No. 50394-8051
Configuration on the mounting plate [X40A]:	for example: PhoenixContact M12 socket (SACC-DSI-FS-5P-PG 9/0,5 SCO 0,25), rear panel 5-pin-type A-coded
Counterplug [X40A]:	for example: M12 plug with xx m cable length: SAC-5P-MS/xx-PUR SAC

Length in metres	Order number
1,5	1518960
5,0	1518986
10.0	1518999

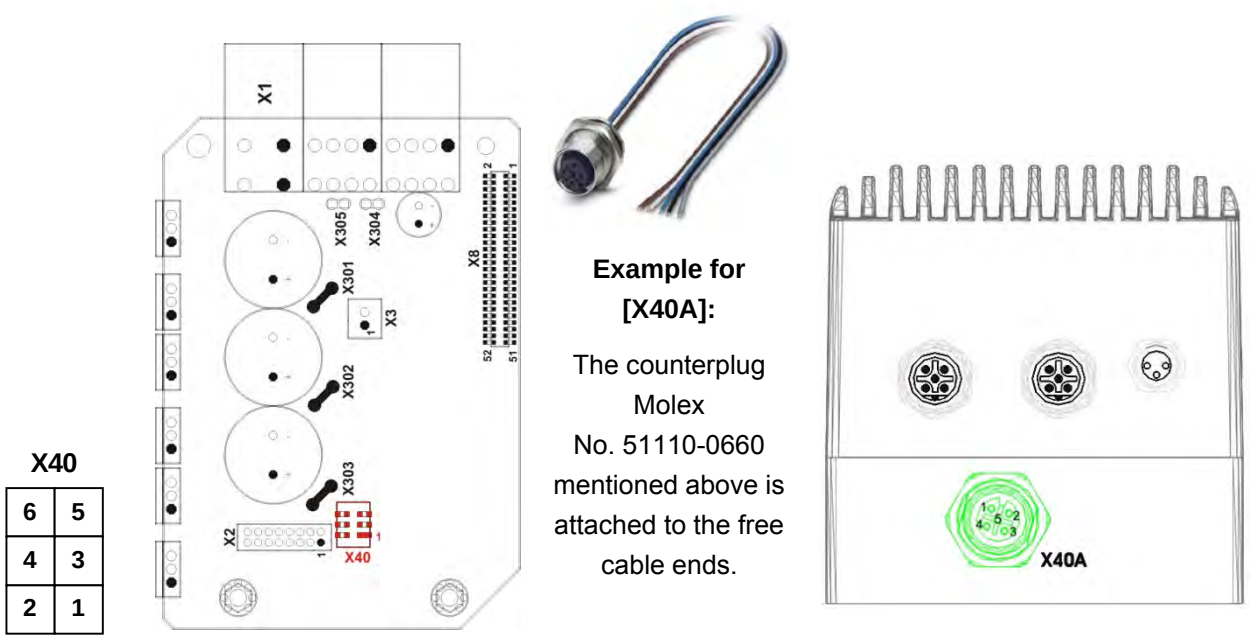


Figure 16: Position and connection STO signals [X40] and [X40A]

Table 31: Pin assignment [X40]

Pin No.		Denomination	Values	Specification
1		STO1	0 V / 24 V	Control input 1 for STO function
	2	GND		Corresponding GND for STO1 and STO2
3		+24V	+24 V / +/-20%	Internal logic supply +24V
	4	REL1		Normally open contact for feedback STO to an external control system
5		STO2	0 V / 24 V	Control input 2 for STO function
	6	REL2		Normally open contact for feedback STO to an external control system

Table 32: Pin assignment [X40A]

Pin No.		Denomination	Values	Specification
1		STO1	0 V / 24 V	Control input 1 for STO function
	2	STO2	0 V / 24 V	Control input 2 for STO function
3		REL1		Normally open contact for feedback STO
	4	REL2		Normally open contact for feedback STO
5		GND		Corresponding GND for STO1 and STO2

5.3 Connectors field bus modules DIS-2 48/10 FB FS STO

The following types of technology modules can be integrated into the basic device DIS-2 48/10 FB FS STO. The modules are factory assembled according to the order. The RS232 interface is integrated in each technology module.

5.3.1 Connection: Serial interface [X5]

Configuration on the device: M8 flush-type socket, 3-pin type

Counterplug [X5]: M8 counterplug for free configuration, for example Phoenix, order number 1506901 or see *chapter 1.2, Table 4: Accessories DIS-2 48/10 FB FS STO*

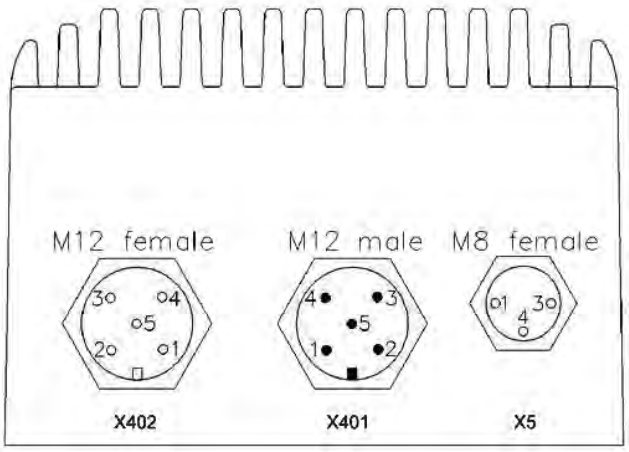


Figure 17: Position and connection RS232 interface

Table 33: Pin assignment [X5]

Pin No.	Denomination	Values	Specification
1	RxD	+/-10 V	Receive signal, RS232 specification
3	TxD	+/-10 V	Transmit signal, RS232 specification
4	GND	0 V	Reference potential for the serial interface, internally connected with the common reference potential for the logic system

Table 34: Pin assignment to set up an RS232 adapter cable for connection to a PC/notebook

[X5] pin assignment at DIS-2 48/10-FB		D-SUB 9 connector (pin) for connection to a PC		Specification
Pin No.	Denomination	Pin No.	Denomination	Specification
1	RxD	3	TxD_PC	Transmit signal, RS232 specification
3	TxD	2	RxD_PC	Receive signal, RS232 specification
4	GND	5	GND	Reference potential for the serial interface, internally connected with the common reference potential for the logic system
-	Shield		Shield	Connect the cable shield on both sides of the connector housing

5.3.2 Connection: CANopen [X401] and [X402]

Configuration on the device: [X401] M12 flush-type plug, 5-pin type, A-coded
[X402] M12 flush-type socket, 5-pin type, A-coded

Counterplug: Assembled M12 bus cable, for example made by Phoenix, one end male connector, one end female connector, pre-fabricated lengths, order name: SAC-5P-MS/xxx-920/FS SCO
xxx defines the length in [m]. The following lengths are available:
xxx = 0,3 / 0,5 / 1,0 / 2,0 / 5,0 / 10,0 / 15,0

Length in metres	Order number
0,3	1518258
0,5	1518261
1,0	1518274
2,0	1518287

Length in metres	Order number
5	1518290
10	1518300
15	1518813

Terminating resistor CANopen M12: Order number: 1507816

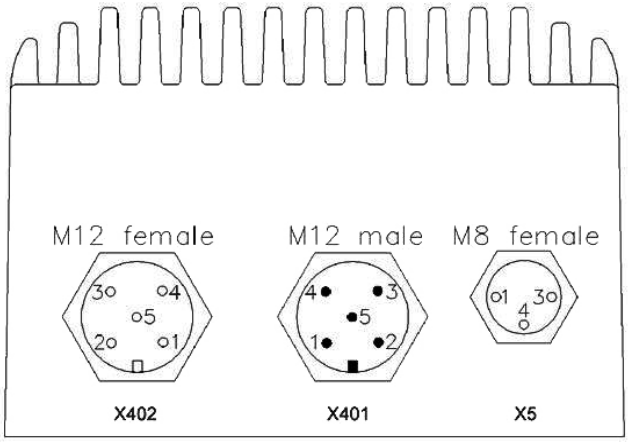


Figure 18: Position and connection CAN interface

Table 35: Pin assignment [X401] and [X402]

Pin No.	Denomination	Values	Specification
1	Shield	PE	Contact for cable shield, in the DIS-2 48/10 FB FS STO connected with the housing
2	--	-	Not used
3	CAN_GND	0 V	Reference potential for the CAN bus, internally connected with the common reference potential for the logic system
4	CANHI	0 V 5 V	Signal CAN_H according to CAN-Bus specification
5	CANLO	0 V 5 V	Signal CAN_L according to CAN-Bus specification

5.3.3 Connection: PROFIBUS [X401] and [X402]

The PROFIBUS interface at the servo drive DIS-2 48/10 FB FS STO is configured according to EN 50170 as a 5-pole M12 plug, B-coded at the technology module as plug and socket.

Configuration on the device:
[X401] M12 flush-type plug, 5-pin type, B-coded
[X402] M12 flush-type plug, 5-pin type, B-coded

Counterplug:
Assembled M12 bus cable, for example made by Phoenix, one end female connector straight, shielded M12-B-coded, 2-pin type, other end male connector straight, shielded M12-B-coded, 2-pin type, pre-fabricated lengths, order name:
SAC-5P-MS/xxx-920/FS SCO
xxx defines the length in [m]. The following lengths are available:
xxx = 0.3 / 0.5 / 1.0 / 2.0 / 5.0 / 10.0 / 15.0

Length in metres	Order number
0,3	1518106
0,5	1518119
1,0	1518122
2,0	1518135

Length in metres	Order number
5	1518148
10	1518151
15	1518164

Terminating resistor PROFIBUS M12: 1507803

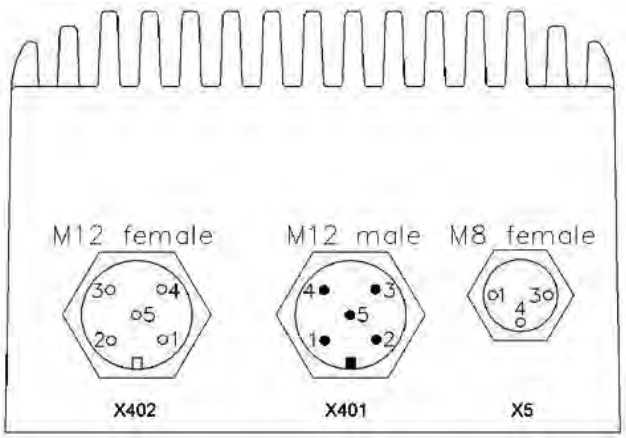


Figure 19: Position and connection PROFIBUS interface

Table 36: Pin assignment [X401] and [X402]

Pin No.	Denomination	Values	Specification
1	+5V	+5V	
2	A-line	green	Signal A according to the PROFIBUS specification
3	0V	0 V	Internally connected with the common reference potential for the logic system
4	B-line	red	Signal B according to the PROFIBUS specification
5	Shield	PE	Contact for cable shield, in the DIS-2 48/10 FB FS STO connected with the housing

5.3.4 Connection: EtherCAT [X401] and [X402]

The EtherCAT interface at the servo drive DIS-2 48/10 FB FS STO is configured according to IEC 61076-2-101 as a 4-pole M12 socket, shielded and D-coded at the technology module.

Configuration on the device: [X401] M12 flush-type plug, 4-pin type, D-coded
[X402] M12 flush-type plug, 4-pin type, D-coded

Position: [X401] front – middle
[X402] front – left

Counterplug: Assembled M12 Bus cable for example made by Phoenix Contact, shielded M12, D-coded, 4-pin type cable

pre-fabricated lengths, order number:

Length in metres	Order number
0,3	1523065
0,5	1523078
1,0	1523081
2,0	1521533

Length in metres	Order number
5	1524051
10	1524064
15	1524077

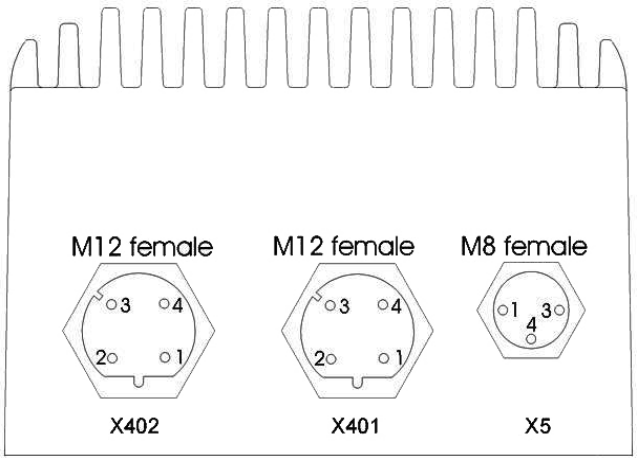


Figure 20: Position and connection EtherCAT interface

Table 37: Pin assignment [X401] and [X402]

Pin No.	Denomination	Values	Specification
1	TX+	0 ... 2,5 VDC	Transmission Data +
2	RX+	0 ... 2,5 VDC	Receive Data +
3	TX-	0 ... 2,5 VDC	Transmission Data -
4	RX-	0 ... 2,5 VDC	Receive Data -

6 Functional safety technology

6.1 General, intended use

The DIS-2 48/10 FB FS STO servo drives support the integrated safety function “Safe Torque Off” (STO) according to the requirements of the standard EN ISO 13849-1.

Furthermore, the principles for testing “Additional requirements for electrical power drive systems according to EN 61800-5-2” have been considered.

6.2 Safety indices

- Category / Performance level: Category 3, Performance level e
- PFH value (probability of dangerous failure per hour): PFH = $4{,}29 \cdot 10^{-8}$ /h

Information

The indicated values are only reached under the following condition:
Regular testing of the STO function by a superordinated control system (at least once a week), if such process-related testing is not provided anyway, and test at every switch-on of the machine / system.

For further information concerning the safety function please refer to the Product Manual “Servo drive DIS-2 48/10 FB FS STO”, chapter 6.

7 EMC-compliant cabling

The following must be considered for an EMC-compliant setup of the drive system:

7.1 Connection between the DIS-2 and the motor

If the DIS-2 servo drive is mounted directly on the motor, the cables are located inside the housing. They are only a few cm long. In this case, shielding is not necessary.

If you want to mount the motor and the DIS-2 separately, please observe the following wiring instructions:

- Use shielded cables only. The encoder cables should have an internal and an external shield.
- Use separate cables for the motor phases and the angle encoder.
  Alternative: Use a combined cable for the motor and the angle encoder, but with separate shields.
- Connect all (external) shields with the housing of the DIS-2 servo drive.
- Connect the shield of the motor cable with the motor housing.
- Connect the internal shield of the encoder cable to PIN 1 of [X2].
- Make sure to set up a "good" PE connection between the motor and the DIS-2 servo drive.

A "good" PE connection only has a low impedance even in the case of very high interference frequencies. An optimum PE connection can be obtained by mounting the DIS-2 servo drive directly on the motor. If you want to mount the DIS-2 servo drive and the motor separately, make sure to mount them on the same (metal) part of the machine. In this case, the surface of the machine part should be made of uncoated aluminium or galvanized sheet metal!

7.2 Connection between DIS-2 and power supply

- Use cable with a sufficient cross-section to reduce "ground bouncing" effects on the DC bus supply (intermediate circuit supply):
  2.5 mm² (AWG13) should be sufficient for a cable length of up to 5 m between the power supply unit and the DIS-2 servo drive.
- Use a star-shaped cable layout (see *chapter 5.1 Connection to power supply, control and motor)* if you want to connect several DIS-2 servo drives to one power supply unit. The star point of the reference potential should be as close as possible to the power supply unit.
- The power supply unit should have Y-capacitors of at least 100 nF between the DC bus voltage (intermediate circuit voltage) and PE as well as between GND and PE.
- Make sure to set up a "good" PE connection between the DIS-2 servo drive and the power supply unit. It is important to ensure a good feedback of the high-frequency leakage currents generated by the clocked power stage in the DIS-2 servo drive combined with the winding capacity between the motor phase and PE in the motor.
- To make sure that the radiation limits are complied with, use a shielded cable.

The device variants DIS-2 48/10 FB use Pluscon Variocon connectors made by Phoenix for [X1]. If the recommended metal connector housings (see also *chapter 5.2.1*) are used, a good PE connection is ensured by the design of the housing. It is sufficient to connect the shield to the connector housing of the counterplug.

A "good" PE connection only has a low impedance even in the case of very high interference frequencies. Mounting the DIS-2 servo drive and the power supply unit to the same (metal) part of the machine is sufficient for most cases. If not, use a flexible copper strip (width approx. 10 mm) or a connecting cable with a Cu cross-section of at least 6 mm^2 to set up a PE connection.

DANGER!

For safety reasons, all PE ground conductors must be connected prior to initial operation.

The regulations of EN 61800-5-1 concerning protective grounding must be complied with during installation!