Decentral Intelligent Servo DIS-2 310/2 FB

Mounting Instructions

Version 5.0

1 General

1.1 Documentation

This installation information serves the purpose of a safe use of the DIS-2 310/2 FB series servo positioning controller. 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 "DIS-2 310/2 FB":** Description of the device functionality as well as notes of the operation of the servo positioning controller DIS-2 310/2 FB.
- **CANopen Manual "DIS-2"**: Description of the implemented CANopen protocol as per DSP 402.
- **Profibus Manual "DIS-2"**: Description of the implemented PROFIBUS-DP protocol.
- **EtherCAT Manual "DIS-2"**: Description of the implemented EtherCAT protocol.
- **Software Manual**: Description of the device functionality and the software functions of the firmware including RS232 communication. Description of the parameterisation program DIS-2 ServoCommander™ with instructions of the commissioning of an DIS-2 series servo positioning controller

These documents are available for download on our homepage (http://www.metronix.de/).

1.2 Order numbers DIS-2 310/2 FB

DIS-2 310/2 FB CANopen:	9019-3103-00
DIS-2 310/2 FB PROFIBUS:	9019-3103-04
DIS-2 310/2 FB EtherCAT:	9019-3103-05

Auxiliary equipment

Brake resistor:	9519-0002-00	Power connector set:	9019-3120-01
Input line filter:	9504-0005	Signal and motor connector set:	9019-3120-02
Control panel:	9019-0330-00	RS232-cable:	9019-0221-00

Metronix Meßgeräte und Elektronik GmbH
Kocherstraße 3
D-38120 Braunschweig
Germany

Telefon: +49-(0)531-8668-0
Telefax: +49-(0)531-8668-555
E-mail: vertrieb@metronix.de

2 Safety notes for electrical drives and controllers

2.1 Used symbols

Information
Important information and notes.

Caution!
Non observance may result in severe property damages.

DANGER!
Non observance 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.

Sound and safe operation of the servo drive controller requires proper and professional transportation, storage, assembly and installation as well as proper operation and maintenance. Only trained and qualified personnel may handle electrical devices:

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 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 controller 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 controller.

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

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 controller for safety and warranty reasons.

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

DANGER!

Inappropriate handling of the servo drive controller and non-compliance of 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 controller corresponds to **IP54** class of protection as well as pollution level 1. Make sure that the environment corresponds to this class of protection and pollution level.

Only use replacements parts and accessories approved by the manufacturer.

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

The servo drive controller may be protected using an AC/DC sensitive 300mA fault current protection switch (RCD = Residual Current protective Device).

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.

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 controller are to be found in this product manual and must be met.

DANGER!

The general setup and safety regulations for work on power installations (e.g. 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 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 controller 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, e.g. 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 drive controller alone is not suitable for personal protection!

Render 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.

High DC-Bus voltage.
Minimum discharge time after switching power off: 5 minutes.
Caution: Do not touch electrical connectors / components for 5 mintutes after switching power off!

The internal (or external) brake resistor carries dangerous DC bus voltages during operation of the servo positioning controller.

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 device.

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

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

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

Initial operation must be carried out with idle motors, to prevent mechanical damages e.g. 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 controller and in particular the brake resistor, externally or internally, can assume high temperatures, which may cause serious burns.

2.4.3 Protection against contact with electrical parts

This section only concerns devices and drive components carrying voltages exceeding 50 V. Contact with parts carrying voltages of more than 50 V can be dangerous for people and may cause electrical shock. During operation of electrical devices some parts of these devices will inevitably carry dangerous voltages.

DANGER!

High electrical voltage!

Danger to life, danger due to electrical shock or serious personal injury!

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:

Before switching on the device, install the appropriate covers and protections against accidental contact. Rack-mounted devices must be protected against accidental contact by means of a housing, e.g. a switch cabinet. The regulations VGB4 must be complied with!

Always connect the ground conductor of the electrical equipment and devices securely to the mains supply. Due to the integrated line filter the leakage current exceeds 3.5 mA!

Comply with the minimum copper cross-section for the ground conductor over its entire length as per EN 60617!

Prior to the initial operation, even for short measuring or testing purposes, always connect the ground conductor of all electrical devices as per the terminal diagram or connect it to the ground wire. Otherwise the housing may carry high voltages which can cause electrical shock.

Do not touch electrical connections of the components when switched on.

Prior to accessing electrical parts carrying voltages exceeding 50 Volts, disconnect the device from the mains or power supply. Protect it from being switched on again.

For the installation the amount of DC bus voltage must be considered, particularly regarding insulation and protective measures. Ensure proper grounding, wire dimensioning and corresponding short-circuit protection.

The device comprises a rapid discharge circuit for the DC bus as per EN60204 section 6.2.4. In certain device constellations, however, mostly in the case of parallel connection of several servo drive controllers in the DC bus or in the case of an unconnected brake resistor, this rapid discharge may be rendered ineffective. The servo drive controllers can carry voltage until up to 5 minutes after being switched off (residual capacitor charge).

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

All connections and terminals with voltages between 5 and 50 Volts at the servo drive controller 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.

2.4.5 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
- Error in software 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.

2.4.6 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!

2.4.7 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 (e.g. goggles, protective footwear, protective gloves).

Do not stand underneath hanging loads.

Remove leaking liquids on the floor immediately to prevent slipping.

3 Technical data

Range	**DIS-2 310/2 FB**	
Ambient conditions and qualification:		
Admissible temperature ranges	Storage temperature:	-25°C to +70°C
	Housing temperature:	0°C to +80°C Temperature switch-off at approx. 85°C
	Ambient temperature at nominal power:	0°C to +30°C With power derating respectively output current derating of 3% / K from 30°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	I	
Pollution degree	2	
CE conformity: Low-voltage directive: EMC directive: Interference emission: Interference immunity:	 Directive 2006/95/EG (Standard EN 61800–5-1) Directive 2004/108/EG (Standard EN 61800–3) (with external line filter, for example Epcos B84111-A-B110) First environment category C2 Second environment	

Dimensions and weight:	
Dimensions: H*W*D	56*80*112 mm (without mounting plate and mating plugs)
Weight	approx. 550 g

Performance data power supply [X1]:	
Supply voltage	1x 230 V AC [± 10%], approx. 2 A [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	Brake chopper is integrated; UChop ≈ 390 V
External brake resistor	possible mounting on mounting plate (Type: PLR of Metallux, Metronix order no: 9519-0002-00)
Resistance	100 Ω
Continuous power / pulse power	30 W / 1450 W

[1)] An external fuse B10 is recommended, see *section 5.3*

[2)] Current consumption of the DIS-2 310/2 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

Motor connection specifications [X6]:	
Specifications for operation with 230 V_{eff} / $T_{Housing}$ = 80°C	
Output nominal power	300 W
Output nominal current	2 A_{eff}
Max. output current for 1 s	6 A_{eff}
PWM frequency	10 kHz

Motor temperature monitoring [X2]:	
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} ≈ 2000 Ω KTY81-1x0; KTY81-2x0 R_{25} ≈ 1000 Ω KTY83-1xx R_{25} ≈ 1000 Ω KTY84-1xx R_{100} ≈ 1000 Ω

Resolver evaluation [X2]:	
Suitable resolver	Industry standard, single speed
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}

Evaluation of analogue Hall sensor signals [X2]:	
Suitable Hall sensors	HAL400 (Micronas), SS495A (Honeywell) and others Output 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	ca. 10 min^{-1}
Absolute accuracy of angle detection	< 30´
Max. rotational speed	16.000 min^{-1}

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

Evaluation of Hiperface Encoders [X2]:	
Suitable Encoder	Stegmann Hiperface SCS / SCM60 ; SRS / SRM50 ; SKS36 other types – please contact supplier
Resolution	Up to 16 Bit (depends on number of increments)
Delay time signal detection	< 200 µs
Speed resolution	ca. 4 min^{-1}
Absolute accuracy of angle detection	< 5´
Max. rotational speed	6.000 min^{-1}, 3.000 min^{-1} with lines / turn at 1024

Evaluation of Six-Step-Sensors (Hall) and block commutation mode [X2]:	
Suitable Six-Step-Sensors	HALL-Sensors with +5 V 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} with a 4 pole motor

Evaluation of Incremental encoder [X2]:	
Suitable encoder pulse counts	Programmable 32 to 1024 periods per turn, is equivalent to 128 to 4096 lines/turn
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)

Digital inputs and outputs [X1]:	
Logic inputs general	24V (14V...30V) active high, in accordance with EN 61131-2
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 encoder input A-signal)	Bit 4 \ Target Group selection \ Target selection for positioning / 4 target groups with separate positioning parameters Bit 5 / (speed, acceleration, positioning mode e.g.) selectable
DIN5 (usable as encoder input B-signal)	
DIN6 (usable as encoder input N-signal)	Control signal Start positioning
DIN7	End switch input 0

Digital inputs and outputs [X1]:		
DIN8	End switch input 1	
DIN9	Controller enable at High, clear error high-low transition at Low	
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

Incremental encoder output [X1] (DOUT1, DOUT2):	
Number of lines	Programmable 32 / 64 / 128 / 256 / 512 / 1024 lines / turn
Connection level	24 V single ended / maximum 20 mA output current
Output impedance	$R_a \approx 300\ \Omega$
Limit frequency	$f_{Limit} > 100$ kHz (lines/s); f_{limit} depends on line length, data measured with $R_{Load} = 1\ k\Omega$ and $C_{Load} = 1$ nF , which equals 5 m cable length

Incremental encoder input [X1] (DIN4, DIN5, DIN6):	
Number of lines	Programmable 32 / 64 / 128 / 256 / 512 / 1024 lines / turn
Connection level	24 V single ended / 24V (14V...30V) active high, in accordance with EN 61131-2
Max. input frequency	$f_{Limit} = 50$ kHz (lines/s); f_{limit} depends on input filter, data measured with $R_{Input} = 13{,}3\ k\Omega$ and $C_{Input} = 470$ pF

Analogue inputs and outputs [X1]:	
Analogue Inputs general	±10V input range, 12 Bit resolution , differential input stage < 250µs delay time, Input protection up to 30 V
AIN0 / #AIN0	Analogue input, used as an input for the current or speed setpoint; Pins shared with DIN0 and DIN1
AIN1 / #AIN1	Analogue input, used as an input for the current or speed setpoint; Pins shared with DIN2 and DIN4
Analogue monitor output: AMON0	0 V...10 V output range, 8 bit resolution, $f_{Limit} \approx 1$kHz

4 Mechanical installation

4.1 Important notes

- The DIS-2 310/2 FB was originally designed for direct mounting on one side of the motor.
- Optimum cooling will be achieved, if the DIS-2 310/2 FB is mounted vertical, this means that connector X1 is directed to the floor or to the sky.
- Maximum allowable housing temperature of the DIS-2 310/2 FB is 80 °C to achieve the specified lifetime of the electronic!
- The connection cable to X1 should be fixed (to some machine parts e.g.) close to the DIS-2 310/2 FB to achieve the maximum reliability of the wiring.
- Installation spaces: Keep a minimum distance of 100 mm to other components / motors each above and underneath the device to ensure sufficient venting.

4.2 Position and alignment of the connectors

The DIS-2 310/2 FB contains the following connectors:

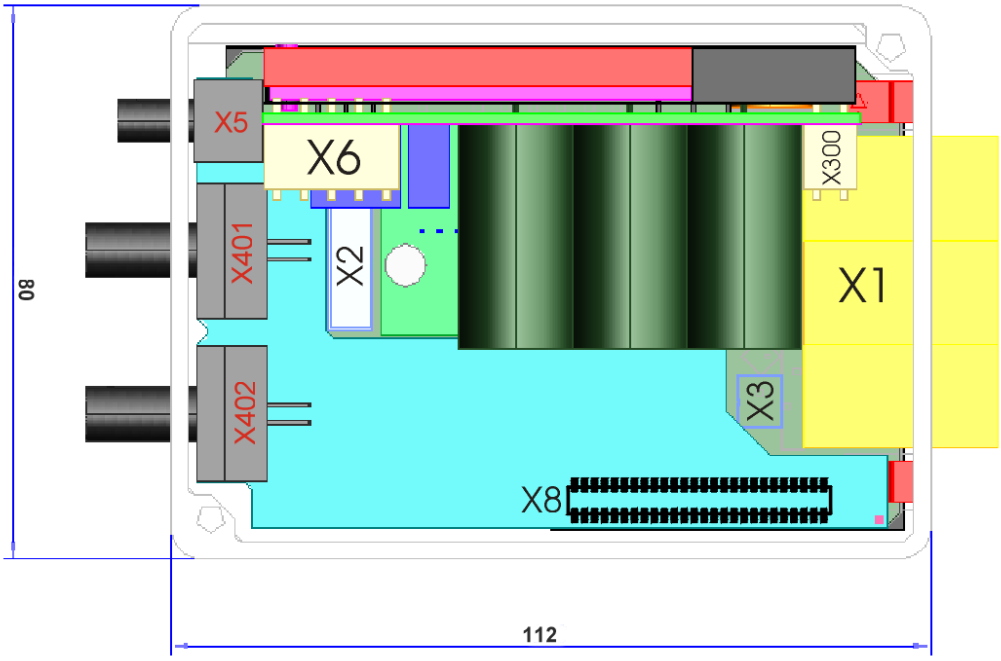


Figure 1: DIS-2 view into the housing – location of the connectors

Connectors on the main board:

X1: The only IO connector led to the outside. It includes digital and analogue inputs and outputs, as well as the power supply and some debug signals.

X2: Is used to connect the angle encoders. It is a multifunction interface which support the following angle sensors:

- resolver (industry standard - 10kHz exciting frequency, transfer ration 1 : 0,5)
- analogue hall sensors (SIN- and COS signals)
- Stegmann HIPERFACE

- Incremental encoders (with differential signals, programmable from 32 to 1024 periods / turn, which is equivalent to 128 to 4096 lines/turn)
- Digital Hall sensors (six-step-encoder)

X3: Connector for the holding brake at the motor (24 V, max. 500 mA)

X300: Connector for the brake resistor which has to be screwed on the mounting plate

X6: Connector for the three motor phases U, V ,W and PE

X8: Is an expansion interface for the fieldbus-modules

Connectors on the fieldbus-modules (CANopen, PROFIBUS, EtherCAT):

X5: Connector for the RS232 communication to parameterise or control the DIS-2 310/2 FB

X401: Fieldbus connector which can be used for bus IN or bus OUT

X402: Second fieldbus connector for bus IN or bus OUT

4.3 Dimensions of the housing

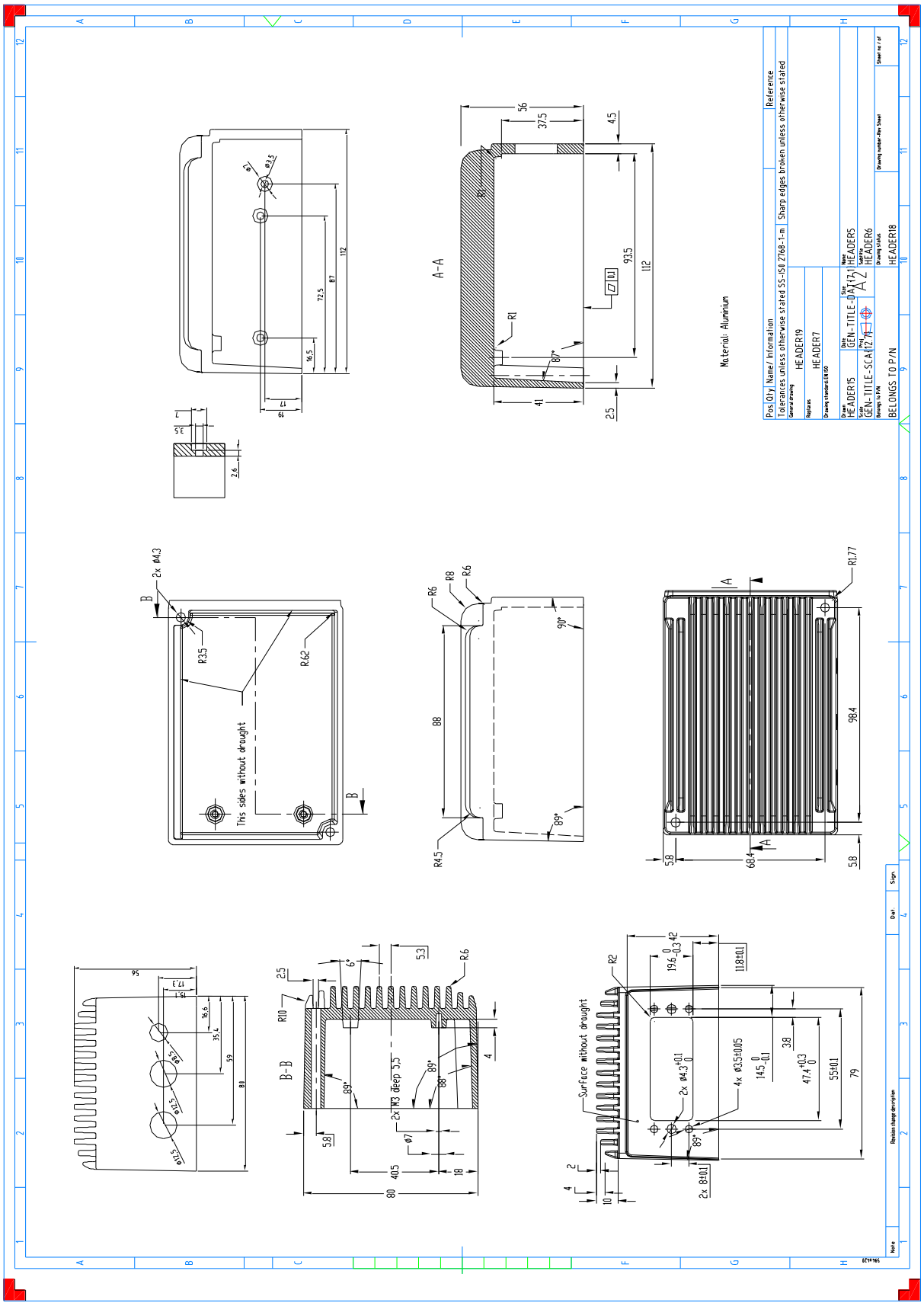


Figure 2: DIS-2 dimensions of housing

4.4 Mounting

The electronic will be mounted directly to the motor using a seal. The mounting flange at the motor should have smooth surface with a circular slot to achieve the highest protection against water. With a good construction the protective class of IP67 will be achieved.It is recommended that the brake resistor is screwed on the mounting plate.

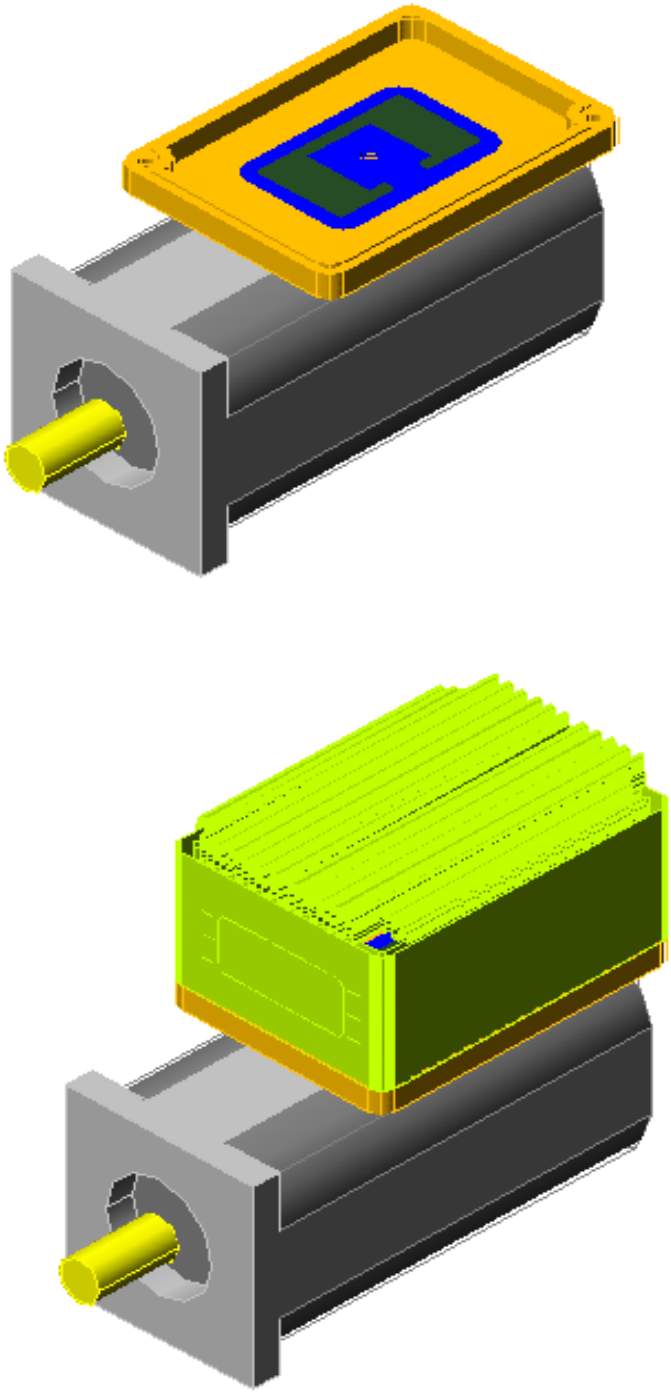


Figure 3: **DIS-2 310/2 FB mounting example – synchronous servo motor, mounting plate with brake resistor and servo positioning controller DIS-2 310/2 FB**

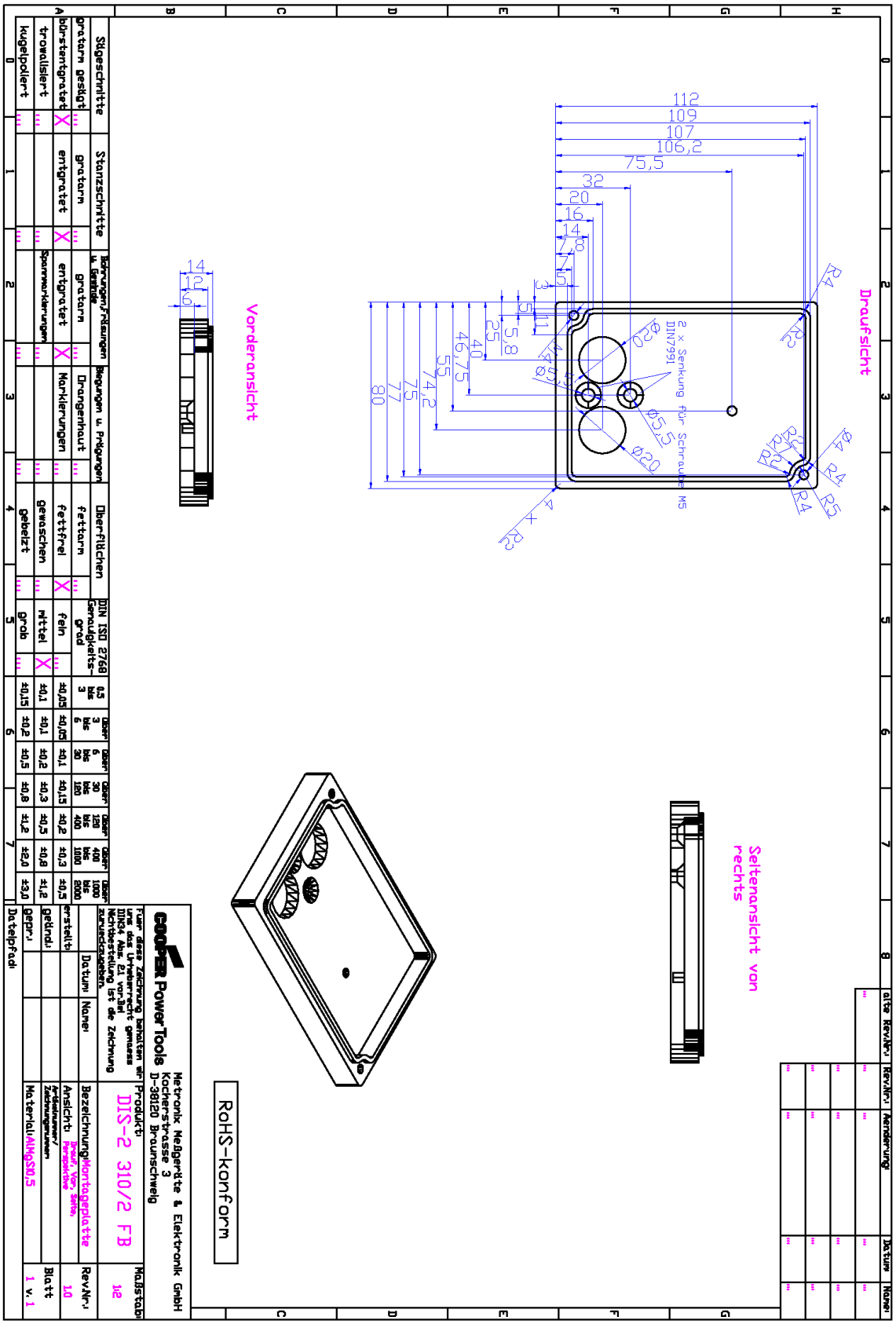


Figure 4: Example of a mounting plate for a motor from supplier *DRIVETEC*

5 Electrical installation

5.1 Pin configuration main board DIS-2 310/2 FB

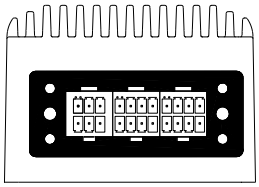
5.1.1 Pin configuration Power supply and I/O [X1]

Connector type at DIS-2 310/2 FB: Phoenix PLUSCON – VARIOCON

Counter Plug: Phoenix PLUSCON – VARIOCON Set, with:

1x VC-TFS6
2x VC-TFS8
1x VC-TR2/3M-PEA (with PE-connection)
1x VC-MEMV-T2-Z
1x VC-EMV-KV-PG21-(11,5-15,5/13,5)

Dimensions approx. L x B x H = 86 mm x 80 mm x 32 mm



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

Interface Description:

Pin No.	Denomination	Value	Specification
A1	DOUT0 / READY	0 V / 24 V	Output operational / no error
A2	DIN8	0 V...24 V	Input limit switch 1 (locks n < 0)
A3	DIN5	0 V...24 V	Input Target selection positioning group Bit 1 / Incremental encoder input B-Line
A4	#AIN1 (DIN3)	-10 V...10 V (0 V...24 V)	Inverse setpoint input 1, differential with AIN1/ (Input Target selection positioning Bit 3)
A5	DIN9	0 V...24 V	Input Power stage enable
A6	DIN7	0 V...24 V	Input limit switch 0 (locks n > 0)
A7	DIN4	0 V...24 V	Input Target selection positioning group Bit 0 / Incremental encoder Input A-Line
A8	AIN1 (DIN2)	-10 V...10 V (0 V...24 V)	Setpoint input 1, differential with #AIN1/ (Input Target selection positioning Bit 2)
B1	#AIN0 (DIN1)	-10 V...10 V	Inverse setpoint input 0, differential with AIN0/ (Input Target selection positioning Bit 1)
B2	DOUT2	0 V...24 V	Output freely programmable / Incremental encoder output B-Line
B3	AMON0	0 V...10 V; 2 mA	Analogue monitor output 0
B4	GND	0 V	Common Ground Potential for IO signals
B5	AIN0 (DIN0)	-10 V...10 V	Setpoint input 0, differential with #AIN0 / (Input Target selection positioning Bit 0)

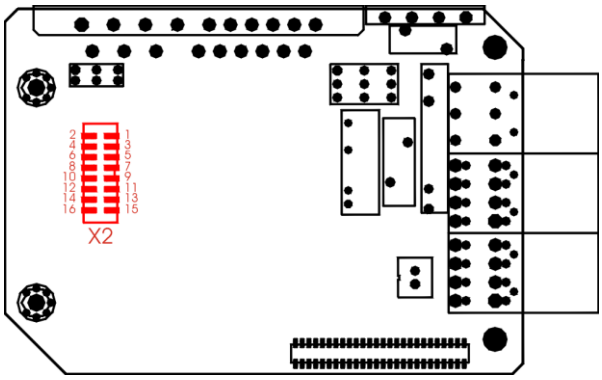
Pin No.	Denomination	Value	Specification
B6	DOUT1	0 V...24 V	Output freely programmable / Incremental encoder output A-Line
B7	DIN6	0 V...24 V	Input for positioning start / Incremental encoder Input N-Line
B8	+24V Logik	+24 V / I_{Logik} = 200 mA...1000 mA	24 V power supply for internal logic and IOs, one common GND with DC bus voltage !
C1	PE	PE	Protective earth
C2	ZK+	+310 V	Intermediate circuit voltage plus
C3	ZK-	Bench mark for ZK+	Intermediate circuit voltage minus
C4	PE	PE	Protective earth
C5	N	230V AC ± 10%	Input power supply N
C6	L	230V AC ± 10%	Input power supply L

5.1.2 Pin configuration Encoder Interface [X2]

Connector type at DIS-2 310/2 FB: Molex No. 87832-1614
Counter Plug: Molex No. 51110-1651 with up to 16 contacts Molex No. 50394-8051

X2

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



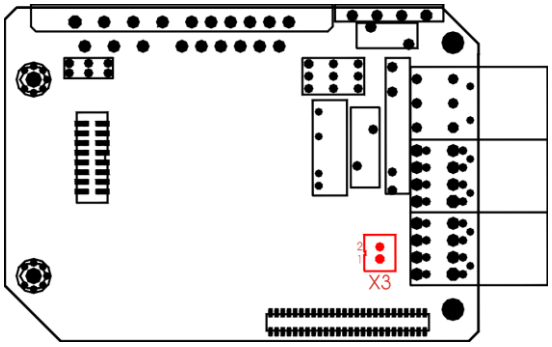
Interface Description:

Pin No. 1st row	Pin No. 2nd row	Denomination Resolver	Denomination Others	Value (Resolver Version)	Specification
1		GND		0 V	Reference GND for incremental encoder / analogue hall sensor / Stegmann Hiperface encoder
	2	GND		0 V	Reference GND for hall sensors and / or motor temperature sensor
3		+5V		+5 V / 100 mA	+5 V power supply for linear hall sensors or incremental encoders
	4	+5V		+5 V / 100 mA	+5 V power supply for hall sensors for commutation

Pin No.		Denomination		Value	Specification
1st row	2nd row	Resolver	Others	(Resolver Version)	
5		COS	A	1.5 $V_{RMS,diff}$ / R_i > 10 kΩ	Resolver: connect to resolver line S1 Others: connect to incremental line A
	6	HALL_U		0 V / 5 V R_i = 5 kΩ	Phase U hall sensor for commutation; input with pull-up 4,7 kΩ to +5 V
7		#COS	#A	1.5 $V_{RMS,diff}$ / R_i > 10 kΩ	Resolver: connect to resolver line S3 Others: connect to incremental line #A
	8	HALL_V		0 V / 5 V R_i = 5 kΩ	Phase V hall sensor for commutation; input with pull-up 4,7 kΩ to +5 V
9		SIN	B	1.5 $V_{RMS,diff}$ / R_i > 10 kΩ	Resolver: connect to resolver line S2 Others: connect to incremental line B
	10	HALL_W		0 V / 5 V R_i = 5 kΩ	Phase W hall sensor for commutation; input with pull-up 4,7 kΩ to +5 V
11		#SIN	#B	1.5 $V_{RMS,diff}$ / R_i > 10 kΩ	Resolver: connect to resolver line S4 Others: connect to incremental line #B
	12	MTEMP		0 V / 3.3 V R_i = 2 kΩ	Motor temperature sensor of type closed contact, PTC, or analogue sensor KTY82; connected to GND
13		REF	N	3 $V_{RMS,diff.}$ max. 50 mA_{RMS}	Resolver: connect to resolver line R1 Others: connect to incremental line 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}	Resolver: connect to resolver line R2 Others: connect to incremental line #N /#DATA
	16	n.c.		-	-

5.1.3 Pin configuration holding brake [X3]

Connector type at DIS-2 310/2 FB: JST No. B02B-XASK-1
Counter Plug: JST No. XAP-02V-1
with 2 contacts JST No. SXA-001T-P0.6

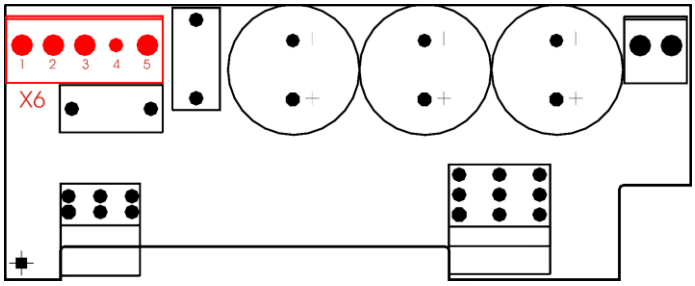


Interface Description:

Pin No.	Denomination	Value	Specification
1	DOUT3	0 V / 24 V max. 500 mA	Output (high active) for holding brake on motor shaft
2	GND	0 V	Reference potential for holding brake

5.1.4 Pin configuration motor phases [X6]

Connector type at DIS-2 310/2 FB: JST No. B5P-VH-B
Counter Plug: JST No. VHR-5N with 4 contacts JST No. SVH-41T-P1.1

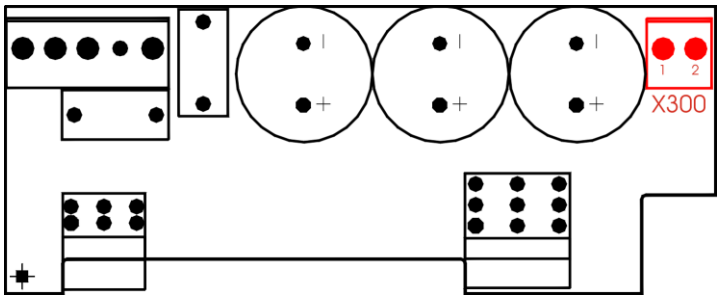


Interface Description:

Pin No.	Denomination	Value	Specification
1	PHASE_W	3 x 0 V...300 V 2 $A_{RMS,nom}$ 6 $A_{RMS,max}$ 0 Hz...300 Hz	Connection to the 3phase synchronous motor
2	PHASE_V		
3	PHASE_U		
4	n.c		Saftey clearance between PE an motor phase
5	PE		Protective earth

5.1.5 Pin configuration brake resistor [X300]

Connector type at DIS-2 310/2 FB: JST No. B2P-VH-B
Counter Plug: JST No. VHR-2N with 2 contacts JST No. SVH-41T-P1.1



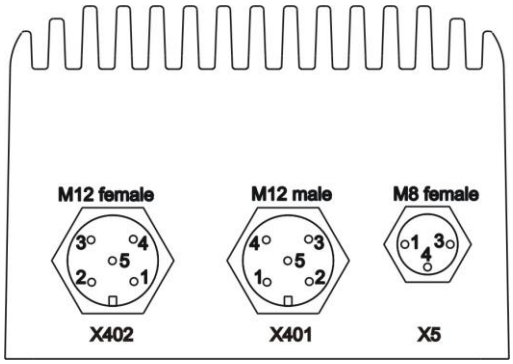
Interface Description:

Pin No.	Denomination	Value	Specification
1	ZK+	390 V / 4 $A_{nom.}$	Connection for brake resistor to intermediate voltage
2	BR-CH	0 V / 390V	Connection for brake resistor to brake chopper

5.2 Pin configuration fieldbus-modules

5.2.1 Pin configuration RS232 interface [X5]

Connector type at DIS-2 310/2 FB: M8 flush-type socket, 3-pin type
Counter Plug: M8 mating connector for free configuration, e.g.
Phoenix No. 1506901 respectively
RS232-cable: 9019-0221-00



5.2.2

Interface Description:

Pin no.	Denomination	Value	Specification
1	RxD	+/-10 V	Receive line, RS232 specification
3	TxD	+/-10 V	Transmitting line, RS232 specification
4	GND	0 V	Interface GND, Reference potential for the serial interface, internally connected with the common reference potential for the logic system

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

[X5] pin assignment at DIS-2 310/2 FB		9-pole D-SUB connector for connection by PC		Specification
Pin no.	**Denomination**	**Pin no.**	**Denomination**	**Specification**
1	RxD	3	TxD_PC	Receive line, RS232 specification
3	TxD	2	RxD_PC	Transmitting line, RS232 specification
4	GND	5	GND	Interface GND, Reference potential for the serial interface, galvanically connected with the common reference potential for the intermediate circuit and the logic system
-	Shield	-	Shield	Connect the cable shield on both sides of the connector housing

5.2.3 Pin configuration CANopen [X401, X402]

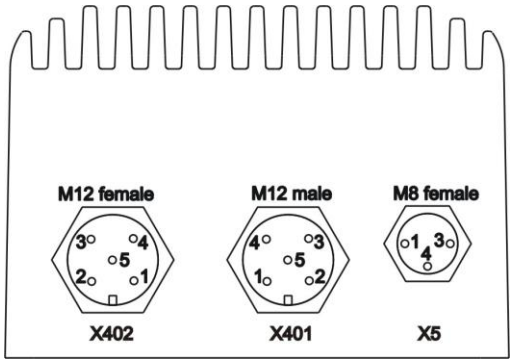
Connector type at DIS-2 310/2 FB: [X401] M12 flush-type plug, 5-pin type, A-coded
[X402] M12 flush-type socket, 5-pin type, A-coded

Counter Plug: Assembled M12 bus cable, e.g. made by Phoenix,
one end socket straight, shielded M12-A-coded, 5-pole,
other end pin straight, shielded M12-A-coded, 5-pole,
prefabricated 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

Terminating resistor CANopen M12: Order number: 1507816

length in meter	order number
0,3	1518258
0,5	1518261
1,0	1518274
2,0	1518287

length in meter	order number
5	1518290
10	1518300
15	1518813



Interface Description:

Pin no.	Denomination	Value	Specification
1	Shield	PE	Contact for cable shield, in the DIS-2 connected with the housing
2	--	--	Not used
3	CAN_GND	0 V	Reference potential for the CAN bus, internally connected to the common reference potential of the logic system
4	CAN_HI	0 V 5 V	Signal CAN_HI according to CAN bus specification
5	CAN_LO	0 V 5 V	Signal CAN_LO according to CAN bus specification

5.2.4 Pin configuration PROFIBUS [X401, X402]

The PROFIBUS interface at the servo positioning controller DIS-2 310/2 FB is in accordance with EN 61800-5-1 as 5-pin M12 plug (B-coded, at the technology plug-in module, as socket and as plug)

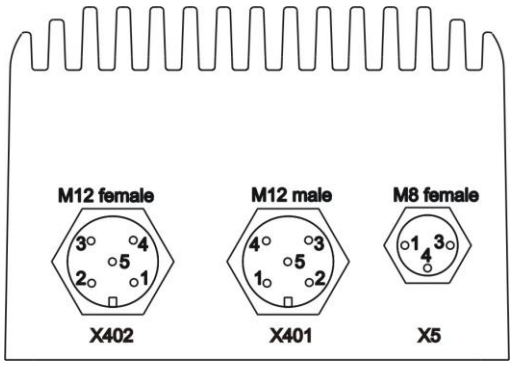
Connector type at DIS-2 310/2 FB: [X401] M12 flush-type plug, 5-pin type, B-coded
[X402] M12 flush-type socket, 5-pin type, B-coded

Counter Plug: Assembled M12 bus cable, e.g. made by Phoenix Contact, one end socket straight, shielded M12-B-coded, 2-pole, other end pin straight, shielded M12-B-coded, 2-pole, prefabricated lengths, order name:
SAC-2P-MSB/xxx-910/FSB 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

Terminating resistor PROFIBUS M12: 1507803

length in meter	order number
0,3	1518106
0,5	1518119
1,0	1518122
2,0	1518135

length in meter	order number
5	1518148
10	1518151
15	1518164



Interface Description:

Pin no.	Denomination	Value / color	Specification
1	+5V	+5V	
2	A-line	green	Signal A according to PROFIBUS specification
3	0V	0 V	Internally connected with the common reference potential the logic system
4	B-line	red	Signal B according to PROFIBUS specification
5	Shield	PE	Contact for cable shield, in the DIS-2 310/2 FB connected with the housing

5.2.5 Pin configuration EtherCAT [X401, X402]

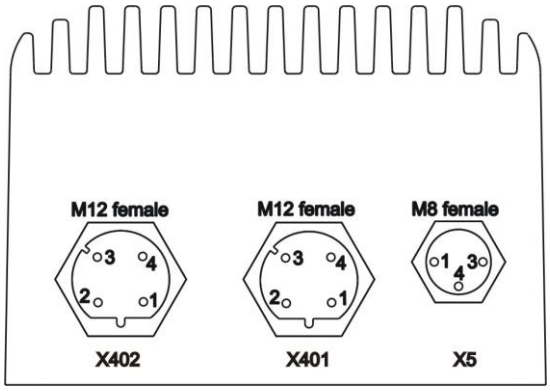
The EtherCAT-Interface at the servo positioning controller DIS-2 310/2 FB is in accordance with IEC 61076-2-101 as 4-pole M12 socket (shielded und D-coded)

Connector type at DIS-2 310/2 FB: [X401] M12 flush-type socket, 4-pin type, D-coded
[X402] M12 flush-type socket, 4-pin type, D-coded

Counter Plug: Assembled M12 bus cable, e.g. made by Phoenix Contact, shielded M12-D-coded, 4-pole, prefabricated lengths and part numbers:

length in meter	order number
0,3	1523065
0,5	1523078
1,0	1523081
2,0	1521533

length in meter	order number
5	1524051
10	1524064
15	1524077



Interface Description:

Pin no.	Denomination	Value	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 -

5.3 Wiring Example

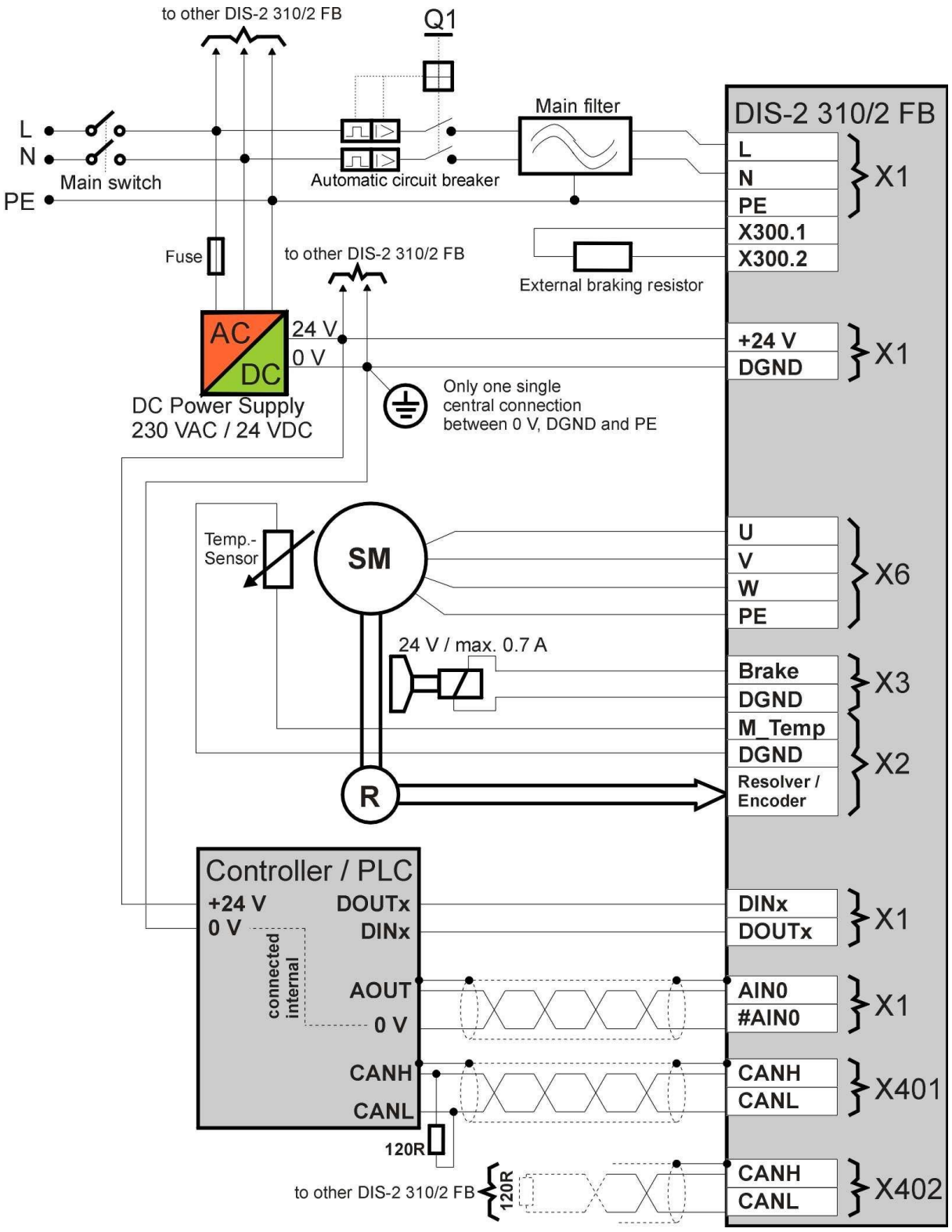


Figure 5: Connection to power supply, PLC and motor

Figure 5 shows a typical application with one or more DIS-2 310/2 FB connected to the 230 VAC power supply, to the 24V logic supply (1 A per device is used) to the holding brake and to the controller or a PLC. An emergency stop circuit is not shown, but will be necessary in practice!

A slow-blow two-pole automatic circuit breaker of 10 A (B10) is recommended and has to be installed in the mains supply line.

The motor is connected to terminals U, V, W, PE at [X6]. The motor temperature switch (PTC or normally closed contact or analog temperature sensor e.g. KTY82) is connected to terminals M_temp and DGND at [X2]

Make sure that the temperature sensor signals and the encoder signals are suitable for the use in PELV – (protective extra-low voltage) applications, because inside the DIS-2 310/2 FB they are connected to digital ground, which is a PELV.

Verify that the power supply used for the power and for the logic part fulfil the specifications for the DIS-2 310/2 FB and are correspondingly resistant.

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

Intermediate supply: 230 VAC

Logic supply: : 24 VDC

DANGER!

Wrong connections around the power supply can destroy the servo drive DIS-2 310/2 FB 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!

The counter plug for the power supply [X1] must be screwed and must not be plugged or pulled under voltage!

To control the DIS-2 310/2 FB via analogue input, it is strongly recommended to use a shielded and twisted pair for AINx / #AINx. Even if the PLC provides a single ended analogue output only, this technique should be used. By connecting #AINx to the reference 0V at the PLC, common mode voltages between the PLC and the DIS-2 310/2 FB due to the high currents flowing through the power stage and the external wiring will be eliminated. The shield of the cable will protect the analogue input from noise. The shield should be connected on both sides - to the housing of the DIS-2 310/2 FB and to the PLC housing.

To control the DIS-2 310/2 FB via CAN bus it recommended to use the cables that are named in *5.2.3 Pin configuration CANopen [X401, X402]*. Because the CAN bus requires a in-line topology of all nodes, [X401] respectively [X402] can be used as input or output. At both ends of the CAN bus network a termination resistor of 120 Ω / 1% is needed.

To control the DIS-2 310/2 FB via PROFIBUS it recommended to use the cables that are named in *5.2.4 Pin configuration PROFIBUS [X401, X402]*. Because the PROFIBUS requires a in-line topology of all nodes, [X401] respectively [X402] can be used as input or output. At both ends of the PROFIBUS network a termination resistor is needed.

The digital IO signals DINx and DOUTx do not need a shield to protect them from incoming noise, but a shielded cable between DIS-2 310/2 FB and PLC will improve the EMC emmission of the whole system. For synchronisation mode use the DIN4, 5, 6 as incremental encoder input signals and DOUT1, 2 as incremental encoder output signals.

6 EMC-compliant wiring

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

6.1 Connection between DIS-2 310/2 FB and motor

The motor is connected to [X6]. The motor temperature switch (normally closed contact, PTC or KTY82) is connected to terminals MTEMP and GND at [X2]. The Resolver or Encoder is connected to the appropriate pins of [X2]. The holding brake is connected to [X3], take care of the right polarity, when connecting!

If the DIS-2 310/2 FB is mounted directly to the motor, the cables are only some cm long and covered by the electronic housing, so the cables don't need to be shielded.

6.2 Connection between DIS-2 310/2 FB and power supply

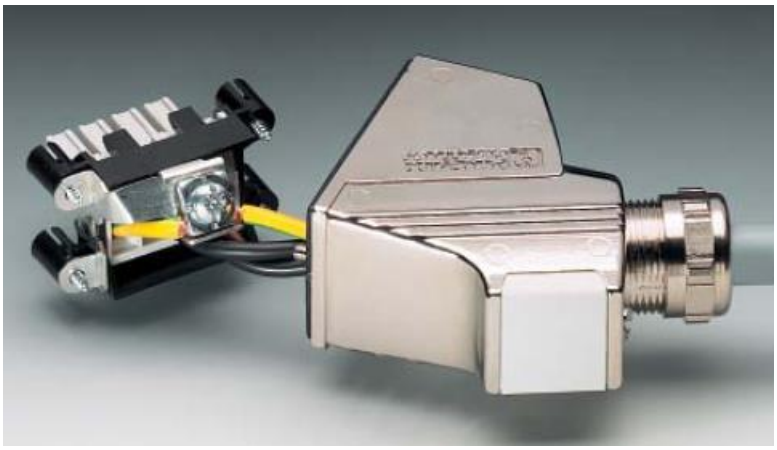
Connection to the 24 VDC power supply:

- Use cables with sufficient cross section to reduce "ground bouncing" on the 24 VDC power supply: 0.75 mm² cables should be sufficient for line length up to 5 m between 24 VDC power supply and DIS-2 310/2 FB
- To connect multiple DIS-2 310/2 FB to one 24 VDC power supply use a star wiring technique as shown in **Figure 5**. The star point of the reference GND potential should be located as close to the power supply as possible.
- The 24 VDC power supply should contain a Y-capacitor of at least 100 nF between DGND and PE.

Connection to the 230 VAC mains supply:

- Take care of a “good” PE connection between DIS-2 310/2 FB and 230 VAC mains supply. It is necessary to have a good return path for the high frequency leakage currents produced from the switched power stage inside the DIS-2 310/2 FB in combination with the winding capacity between phase and PE inside the motor.

  Installation note: The frame has a PE sheet with a PE connection. Strip the PE conductor by 20 mm and cut the insulation at 50 mm. Push the cut insulation forward by 15 mm. Connect the PE contact of the module and clamp the PE sheet under the PE screw.



A “good” PE connection is a low impedance connection even at high noise frequency. Mounting the DIS-2 310/2 FB and the power supply directly to the same metal machine parts should be sufficient in most cases. If not, use a flexible approx. 10 mm wide Copper strap to connect the different devices.

- To comply with the limit values for the interference emission it is recommended to use a shielded 230 VAC supply cable between input line filter and DIS-2 310/2 FB. The max. length is 10 m.

DANGER!

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

The EN 61800-5-1 regulations for protective earthing must be complied with during installation, especially for the installation of the power supply!

The counter plug for the power supply [X1] must be screwed and must not be plugged or pulled under voltage!