metronix
servo drives

Decentral Intelligent Servo DIS-2 48/10 DIS-2 48/10 IC DIS-2 48/10 FB

Mounting Instructions

Version 3.0

1 General

1.1 Documentation

This installation information serves the purpose of a safe use of the DIS-2 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:

- **User Manual "DIS-2 48/10, DIS-2 48/10 IC, DIS-2 48/10 FB":** Description of the device functionality as well as notes of the operation of the DIS-2.
  Further on the description of the software functions of the firmware including RS232 communication. Description of the parameterisation program DIS-2 ServoCommander with instructions on the commissioning of an DIS-2 series servo positioning controller
- **CANopen Manual " Decentral Intelligent Servo DIS-2 48/10"**: Description of the implemented CANopen protocol as per DSP402.

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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 load currents may cause high electrical voltage (even if supply is ≤ 48 V_{DC})!

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).

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	Regulations for the installation of high voltage (up to 1000 V) devices
EN 60204	Electrical equipment of machines
EN 50178	Electronic equipment for use in power installations

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 any kind of dangerous movements 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 the whole time 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.

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 EN60617!

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 50178/1998, section 5.2.8.1.

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 to be 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 48/10**
Ambient conditions and qualification:	
Admissible temperature ranges	Storage temperature: -25°C to +70°C
	Operating temperature: 0°C to +50°C up to 70°C with a de-rating of 2%/°C
Admissible installation height	Up to 1000 m above msl, 1000 to 4000 m above msl at reduced power
Humidity	Relative humidity up to 90%, not bedewing
Protection class	IP54, dependent on mounting IP67 may be achieved
Pollution degree	1
CE conformity Low-voltage directive: EMC regulation::	 Not applicable EN 61 800 – 3

Dimensions and weight:	
Dimensions: H*W*D	65*90*110 mm
Weight	approx. 500 g

Performance data Power Supply [X1]:	
DC supply Power Stage	0 V... 60 V DC (48 V DC nominal / 10 A nominal) external Fuse 10 A / short circuit protection needed !
24 V logic supply	24 V DC [± 20%] / 0,20 A [1)] internal protected with poly-switch, triggered at approx. 1 A [1)] plus supply current of the optional holding brake and driven I/Os
Brake Chopper (only DIS-2 48/10 FB)	Brake Chopper is integrated; $U_{Chop} \approx 60$ V external braking resistor with 4.7 Ω / 100 W recommended

Motor connection specifications [X301 to X303]:	
Specifications for operation with 48 V DC / $T_{Housing,max}$ = 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

Resolver evaluation [X2]:	
Suitable Resolver	Industry standard, single speed, exciting frequency 10 kHz, transfer ration ü = 1 : 0.5
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}

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 Optical Encoders [X2]:	**supported only by DIS-2 48/10 FB !**
Suitable encoder pulse counts	Programmable 32 to 1024 periods per 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)

Motor temperature monitoring:	
Digital Sensor	Normally closed contact: $R_{cold} < 500\ \Omega$ $R_{hot} > 100\ k\Omega$
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 $R_{100} \approx 1000\ \Omega$

Digital inputs and outputs [X1]:		
Logic inputs general	24V (8V...30V) active high, conforming with EN 1131-2	
DIN0 DIN1 DIN2 DIN3	Bit 0 \ Bit 1, \ Target selection for positioning Bit 2, / 16 targets selectable from target table Bit 3 /	
DIN4 DIN5	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	
DIN6	Control signal Start positioning	
DIN7	End switch input 0	
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 (Pin shared with DIN2 and AIN1)	24 V, max. 20 mA
DOUT2	Freely configurable, usable as Encoder output B-Signal (Pin shared with DIN2 and AIN1)	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

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 / DOUT1 and DIN4 / DOUT3
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 was originally designed for direct mounting on one side of the motor.
- Optionally it is possible to use the DIS-2 separated from the motor. In this case additional connectors between DIS-2 and motor will be needed. The traces between DIS-2 and motor should be as short as possible, maximum length is l = 1 m.
- Optimum cooling will be achieved, if the DIS-2 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 is 70 °C to ensure 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 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.

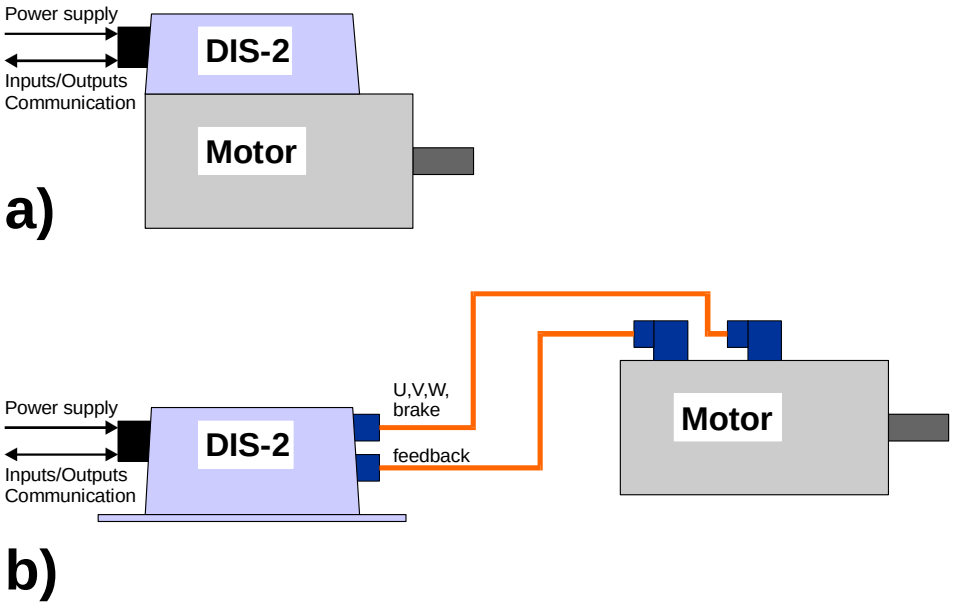


Figure 1: DIS-2 mounting options
a) mounted directly to the motor – standard
b) separated from the motor – please contact your dealer for availability

4.2 Position and alignment of the connectors

The DIS-2 contains the following connections:

X1 is the only external IO interface, it contains digital and analogue inputs and outputs as well as the power supply connections, the CANopen interface and some debug signals.

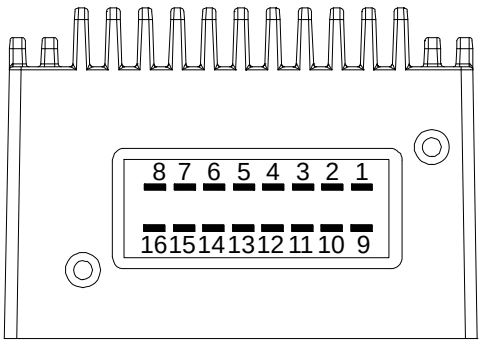
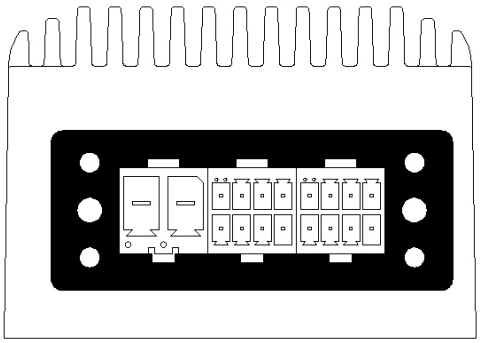


Figure 2: DIS-2 48/10 front view with pin assignment of X1



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

Figure 3: DIS-2 48/10 IC and DIS-2 48/10 FB front view with pin assignment of X1

X2 is the connector for the angle sensor. It is a multifunctional interface with support for the following angle sensors:

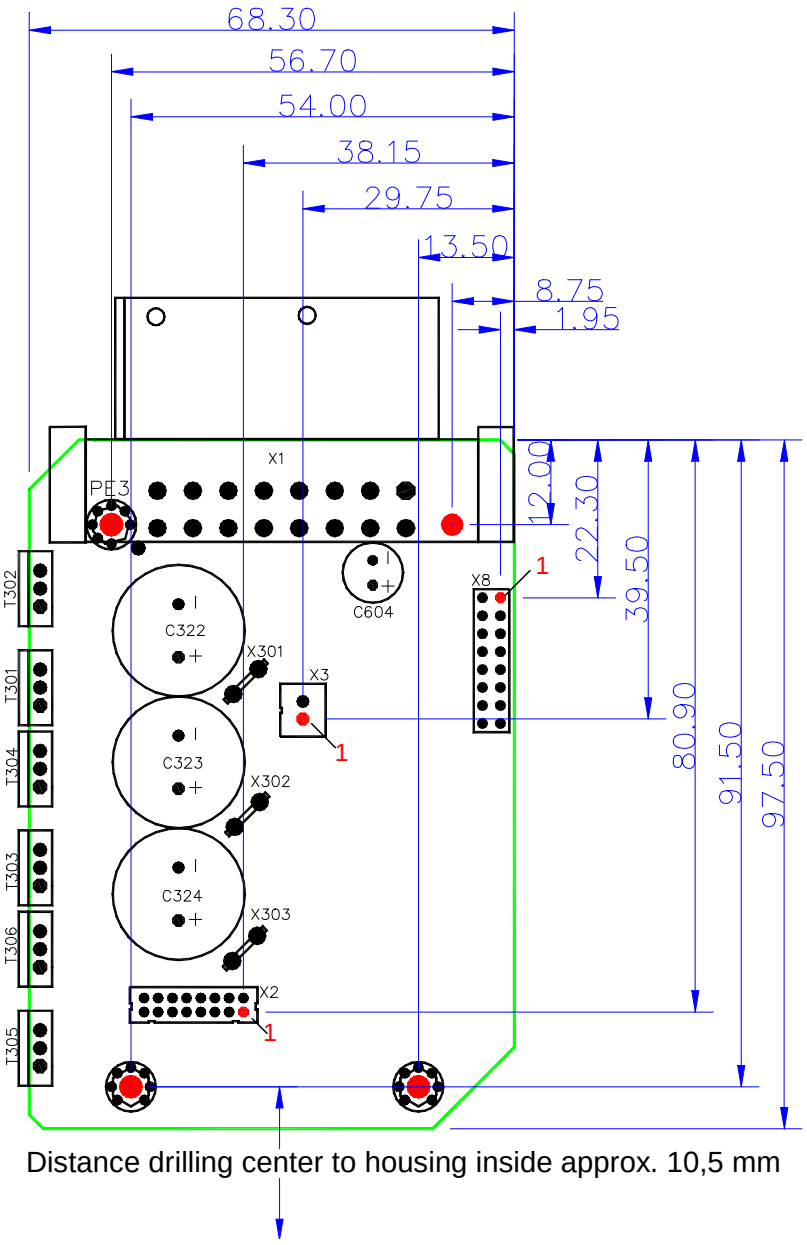
- ❖ resolver (industry standard - 10kHz exciting frequency, transfer ration 1 : 0,5)
- ❖ analogue hall sensors (SIN- and COS signals)
- ❖ Stegmann HIPERFACE
- ❖ Incremental encoders (with differential signals, 128 to 4096 lines/turn)
- ❖ Digital Hall sensors (six-step-encoder)

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

X301, X302, X303 are the connections for the three motor phases U, V and W.

X8 is an expansion interface for future technology modules

Figure 4: DIS-2 view into the housing – location and pin assignment of the internal connections, pin 1 red highlighted



4.3 Dimensions of the housing

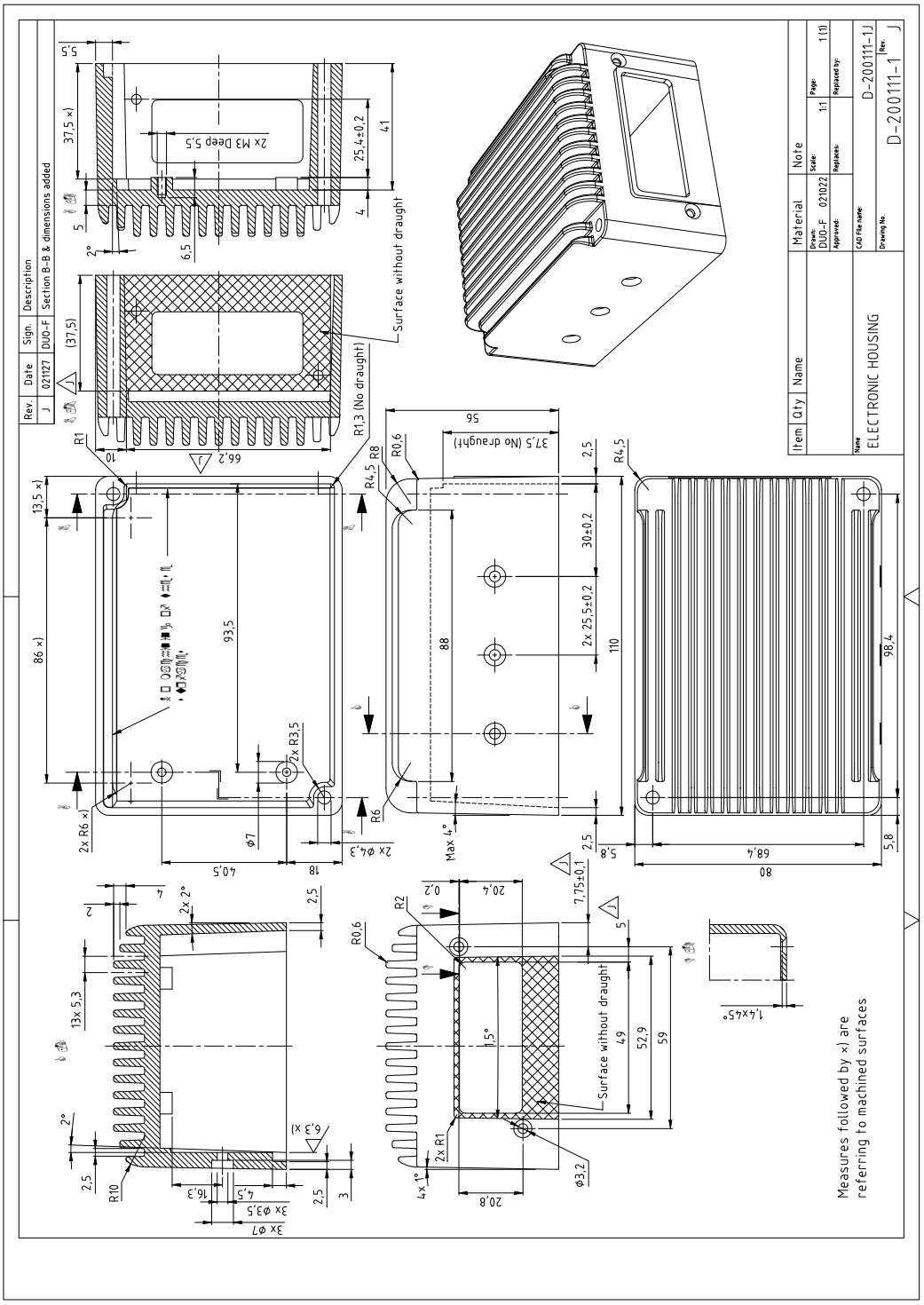


Figure 5: DIS-2 dimensions of the housing

4.4 Mounting

The electronic 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 protective class of IP67 is possible by using a good mechanical construction.

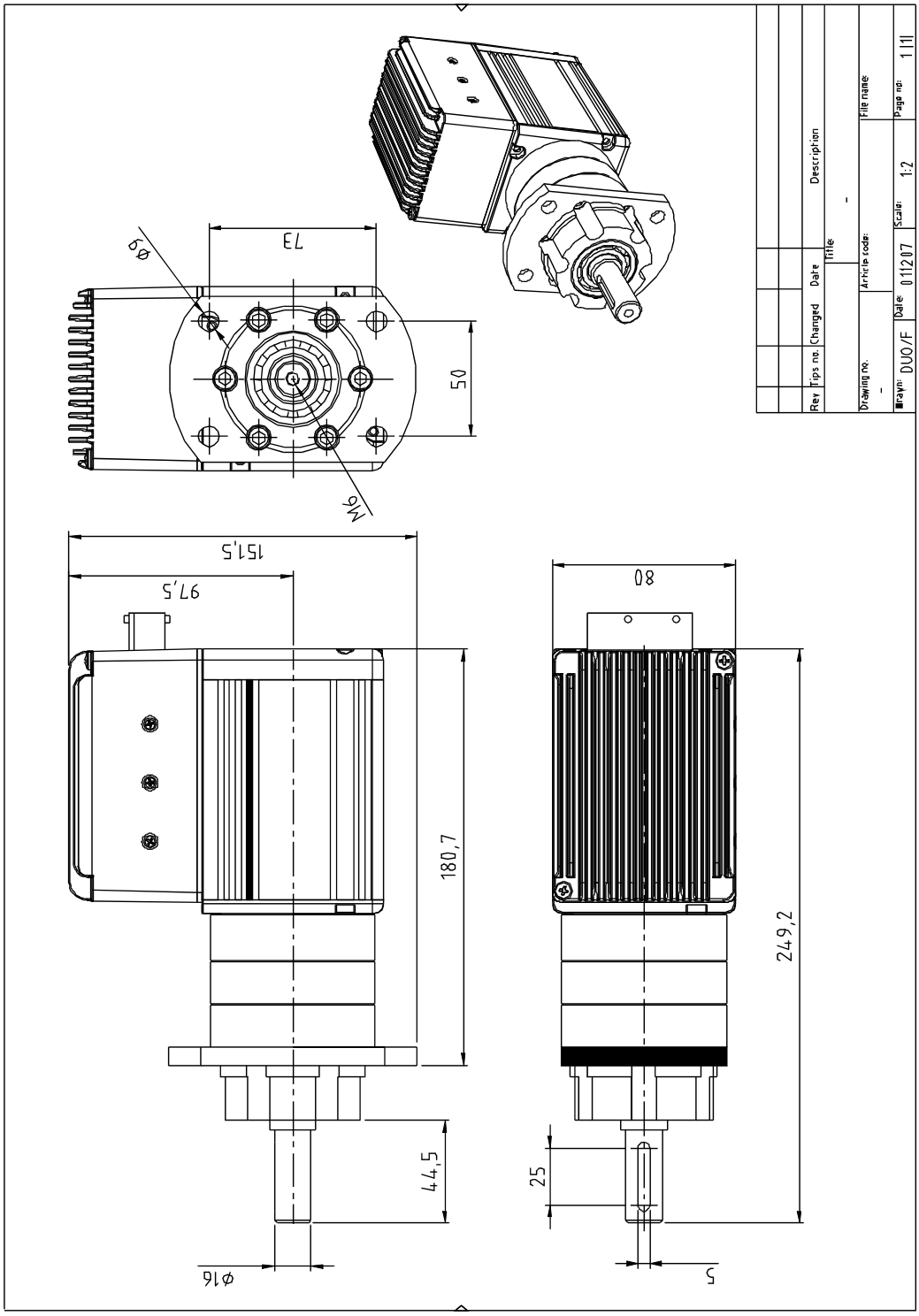


Figure 6: DIS-2 application example – synchronous servo motor in the power range of 500 W with DIS-2 electronic and gearbox for steering application

5 Electrical installation

5.1 Pin configuration Power supply and I/O [X1] for DIS-2 48/10

Connector type at DIS-2: AMP Junior Timer **1-963215-1**

Counter Plug: AMP 1-963217-1
and with 18 contacts 929938-1

Interface Description:

Pin No.	Denomination	Value	Specification
1	DIN9	0 V...24 V	Input Power stage enable
2	DIN7	0 V...24 V	Input end switch 0 (locks n > 0)
3	CANHI (DIN4)	0 V...24 V	Signal line for CAN high (Input Target selection positioning group Bit 0)
4	AIN1 (DIN2) ((DOUT1))	-10 V...10 V (0 V...24 V) ((0 V...24 V))	Setpoint input 1, differential with #AIN1 (Input Target selection positioning Bit 2) ((Output freely programmable / Encoder output A-Line))
5	AIN0 (DIN0)	-10 V...10 V	Setpoint input 0, differential with #AIN0 (Input Target selection positioning Bit 0)
6	RxD	+/-10 V	Receive line, RS232 specification
7	**GND**	**0 V**	**Common Ground Potential for both Intermediate circuit voltage (DC-bus) and 24 V logic supply**
8	ZK+	+48 V / 10 $A_{nom.}$	Intermediate circuit voltage (DC-bus)
9	DOUT0 / READY	0 V / 24 V	Output operational / no error
10	DIN8	0 V...24 V	Input end switch 1 (locks n < 0)
11	CANLO (DIN5)	0 V...24 V	Signal line for CAN low (Input Target selection positioning group Bit 1)
12	#AIN1 (DIN3) ((DOUT2))	-10 V...10 V (0 V...24 V) ((0 V...24 V))	Inverse setpoint input 1, differential with AIN1 (Input Target selection positioning Bit 3) ((Output freely programmable / Encoder output B-Line))
13	#AIN0 (DIN1)	-10 V...10 V	Inverse setpoint input 0, differential with AIN0 (Input Target selection positioning Bit 1)
14	TxD	+/-10 V	Transmitting line, RS232 specification
15	AMON0 (DIN6)	0 V...10 V; 2 mA (0 V...24 V)	Analogue monitor output 0 (only one available !) (Input for positioning start)
16	+24V Logik	+24 V	24 V power supply for internal logic and IOs, one common GND with DC bus voltage !

5.2 Pin configuration Power supply and I/O [X1] for DIS-2 48/10 IC

Connector type at DIS-2: Phoenix PLUSCON – VARIOCON

Counter Plug: Phoenix PLUSCON – VARIOCON Set, with:

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

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	CANLO (DIN5)	0 V...24 V	Signal line for CAN low (Input Target selection positioning group Bit 1)
A4	#AIN1 (DIN3) ((DOUT2))	-10 V...10 V (0 V...24 V) ((0 V...24 V))	Inverse setpoint input 1, differential with AIN1 (Input Target selection positioning Bit 3) ((Output freely programmable / Encoder output B-Line))
A5	DIN9	0 V...24 V	Input Power stage enable
A6	DIN7	0 V...24 V	Input limit switch 0 (locks n > 0)
A7	CANHI (DIN4)	0 V...24 V	Signal line for CAN high (Input Target selection positioning group Bit 0)
A8	AIN1 (DIN2) ((DOUT1))	-10 V...10 V (0 V...24 V) ((0 V...24 V))	Setpoint input 1, differential with #AIN1 (Input Target selection positioning Bit 2) ((Output freely programmable / Encoder output A-Line))
B1	#AIN0 (DIN1)	-10 V...10 V	Inverse setpoint input 0, differential with AIN0 (Input Target selection positioning Bit 1)
B2	TxD	+/-10 V	Transmitting line, RS232 specification
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)
B6	RxD	+/-10 V	Receive line, RS232 specification
B7	DIN6	0 V...24 V	Input for positioning start
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	**GND**	**0 V**	**Common Ground Potential for both Intermediate circuit voltage (DC-bus) and 24 V logic supply**
C2	ZK+	+48 V / 15 $A_{nom.}$	Intermediate circuit voltage (DC-bus)

5.3 Pin configuration Power supply and I/O [X1] for DIS-2 48/10 FB

Connector type at DIS-2: Phoenix PLUSCON – VARIOCON

Counter Plug: Phoenix PLUSCON – VARIOCON Set, with:

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

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
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
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 / 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)
B6	DOUT1	0 V...24 V	Output freely programmable / Encoder output A-Line
B7	DIN6	0 V...24 V	Input for positioning start
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	**GND**	**0 V**	**Common Ground Potential for both Intermediate circuit voltage (DC-bus) and 24 V logic supply**
C2	ZK+	+48 V / 15 $A_{nom.}$	Intermediate circuit voltage (DC-bus)

Note: The DIS-2 48/10 FB has separate connectors for the CAN-Bus (X401, X402) and for the serial interface (X5) – for details about these connections please refer to the user manual

5.4 Pin configuration Encoder Interface [X2]

Connector type at DIS-2: JST No. B16B-PHDSS
Counter Plug: JST No. PHDR-16VS
with up to 16 contacts JST No. SPHD-002T-P0.5

Interface Description:

Pin No.		**Denomination**		**Value**	**Specification**
1st row	**2nd row**	**Resolver**	**Others**	**(Resolver Version)**	
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
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.		-	-

5.5 Pin configuration holding brake [X3]

Connector type at DIS-2: JST No. B02B-XASK-1
Counter Plug: JST No. XAP-02V-1
with 3 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

5.6 Pin configuration motor phases [X301]...[X303]

Connector type at DIS-2: 6.3 mm FAST-ON male
Counter Plug: 6.3 mm FAST-ON female (outside isolated)

Interface Description:

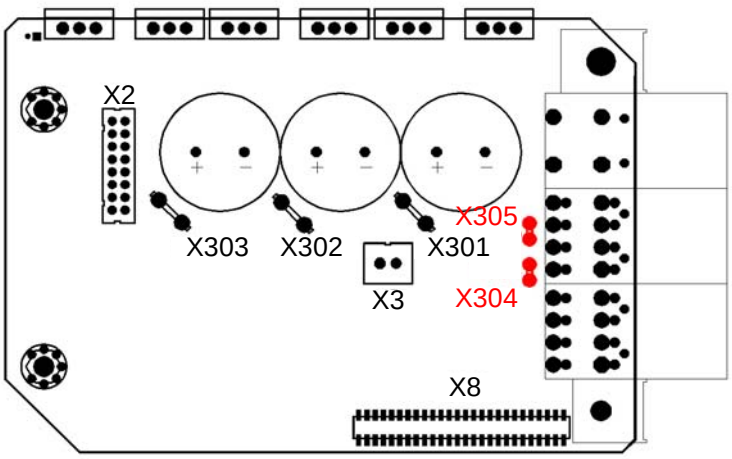
X30x	Denomination	Value	Specification
X301	PHASE_U	3 x 0 V...48 V 10 $A_{RMS,nom}$ 32 $A_{RMS,max}$ 0 Hz...200 Hz	Connection to the 3phase synchronous motor
X302	PHASE_V		
X303	PHASE_W		

5.7 Pin configuration brake resistor [X304]...[X305] (only DIS-2 48/10 FB)

Connector type at DIS-2: 2.8 mm FAST-ON male
Counter Plug: 2.8 mm FAST-ON female (outside isolated)

Interface Description:

X30x	Denomination	Value	Specification
X304	ZK+	+48 V / 10 $A_{nom.}$	Connection for brake resistor to intermediate voltage
X305	BR-CHOP	0 V / 48 V	Connection for brake resistor to brake chopper



5.8 Wiring Example – Connections to [X1]

Figure 6 shows a typical application with two or more DIS-2 48/10 connected to the 48V power supply, to the 24V logic supply and to a controller or a PLC. The main supply, EMC filters in the main and a emergency stop circuit are not shown, but will be necessary in practice !

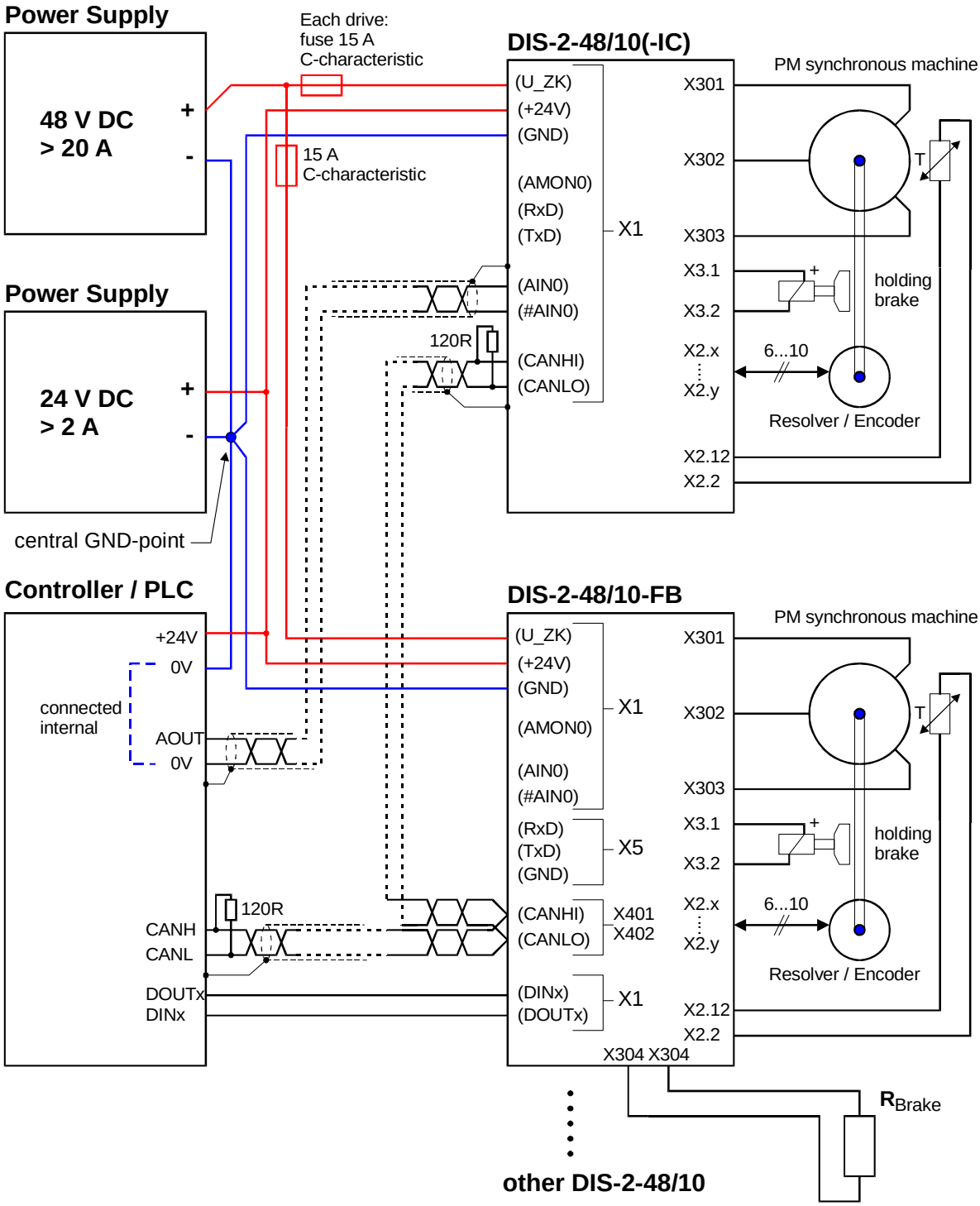


Figure 7: Connection to power supply, PLC [X1] and motor [X2], [X3], [X301] – [X303]

The servo positioning controller DIS-2 48/10 is connected to the DC bus supply voltage (48 V) and to the logic supply voltage (24 V) using the same reference potential, nominated GND in the wiring diagram. Use a central star point for all GND connections close to the power supply to reduce “ground bouncing” effects between the drives.

To control the DIS-2 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 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 and to the PLC housing.

The wiring of the CAN bus signals should be done in the same way as the wiring for the analogue inputs. At both ends of the CAN bus network a termination resistor of 120 Ω / 1% is needed. Because the CAN bus requires a in-line topology of all nodes, it is necessary to connect two wires of the cable to one pin of the connector X1 (as shown in the lower DIS-2 in **Figure 7**).

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 and PLC will improve the EMC emmission of the whole system.

The DIS-2 must be completely wired first. Only then may the operating voltages for the DC bus and the electronics supply be switched on. In the case of inversed wiring of the operating voltage connections, excessive operating voltage or in the case of confusing the connections for operating voltage and motor the servo positioning controller will be damaged

6 EMC-compliant wiring

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

6.1 Connection between DIS-2 and motor

The motor is connected to terminals Phase_U [X301], Phase_V [X302] and Phase_W [X303].
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 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.

If the DIS-2 is separated from the motor, please regard the following wiring guidelines:

- Only use shielded cables, the encoder cable should have an inner and an outer shield.
- Use separate cables for the motor phases and angle encoder
- Alternative: Use one combined cable for motor and angle encoder with separated shields inside
- Connect all (outer) shields to the housing of the DIS-2
- Connect the shield of the motor cable to the motor housing
- Connect the inner shields of the encoder cable to PIN 1 at X2
- Take care of a "good" PE connection between motor and DIS-2

A "good" PE connection is a low impedance connection even at high noise frequency. Mounting the DIS-2 directly to the motor will give the optimal PE connection, If the DIS-2 and the Motor are separated, they should be mounted on the same metal machine part. In this case the surface of the machine part should be Aluminium or tinned sheet metal and not coated with paint !

6.2 Connection between DIS-2 and power supply

- Use cables with sufficient cross section to reduce “ground bouncing” on the DC bus supply: 2.5 mm² (AWG13) cables should be sufficient for line length up to 5 m between power supply and DIS-2
- To connect multiple DIS-2 to one power supply use a star wiring technique as shown in **Figure 7**. The star point of the reference GND potential should be located as close to the power supply as possible.
- The power supply should contain Y-capacitors of at least 100 nF between DC bus voltage and PE as well as between GND and PE.
- Take care of a “good” PE connection between DIS-2 and power 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 in combination with the winding capacity between phase and PE inside the motor.

A “good” PE connection is a low impedance connection even at high noise frequency. Mounting the DIS-2 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.

DANGER!

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

The EN 50178 regulations for protective earthing must be complied with during installation, especially for the installation of the power supply !