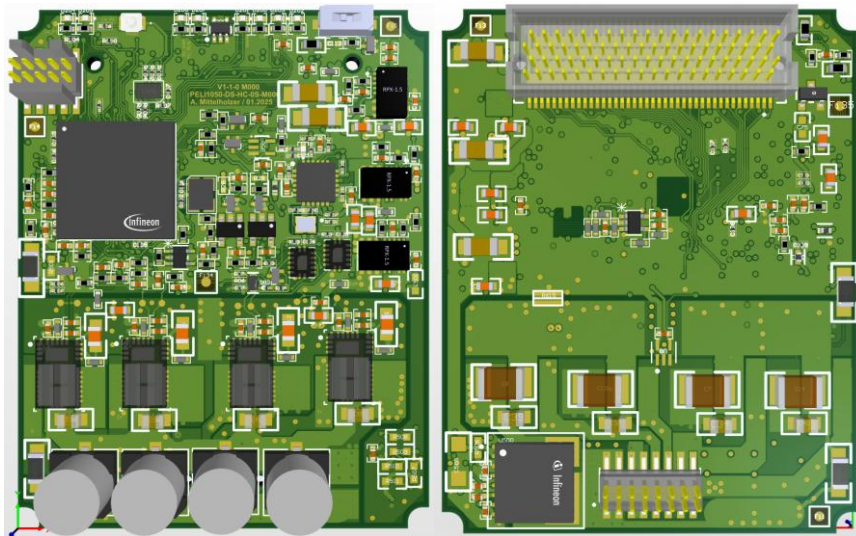


Installation Guide Servo Drive

ENG

I1050-DS/preliminary



Important Notice:

Please note that we use machine translation to provide documents in your local language. It is possible that not all texts will be translated correctly. If you have any questions or discrepancies regarding the accuracy of the information in the translated version, please read the original English version (0185-1179-E).

Please visit <http://www.linmot.com> to check for the latest version of this document!

Content

1	General Information	3
1.1	Introduction	3
1.2	Explanation of Symbols	3
1.3	Qualified Personnel	3
1.4	Liability	3
1.5	Copyright	3
2	Safety Instructions	4
3	System Overview	6
4	Interfaces	7
5	Functionality	8
6	Software	8
7	Power Supply and Grounding	9
8	Description of the connectors / Interfaces	10
8.1	X72	10
8.2	X73	11
8.2.1	CAN Bus (non isolated)	12
8.2.2	CAN Bus (isolated)	12
8.2.3	Config Ethernet	13
8.2.4	Digital Output	13
8.2.5	Digital Inputs	14
8.2.6	Brake	14
8.2.7	Bus Address	15
8.2.8	24VDC Supply	15
8.2.9	Motor Supply	16
8.2.10	Motor Connector	17
8.2.11	External Encoder X13	18
8.2.12	EtherCAT	19
8.2.13	EtherCAT MAC2MAC connection	21
8.3	LEDs	22
9	System LED Blink Codes	23
10	Physical Dimension	24
11	Power Supply Requirements	25
11.1	Motor-Power Supply	25
11.2	Signal-Power Supply	25
12	Regeneration	25
13	Ordering Information	27
13.1	Drives	27
13.2	Accessories	27
14	International Certifications	28
14.1	EU Declaration of Conformity CE Marking	29

1 General Information

1.1 Introduction

This manual includes instructions for the assembly, installation, maintenance, transport, and storage of the servo drives. The document is intended for electricians, mechanics, service technicians, and warehouse staff. Read this manual before using the product and always observe the general safety instructions and those in the relevant section. Keep these operating instructions in an accessible place and make them available to the personnel assigned.

1.2 Explanation of Symbols



Triangular warning signs warn of danger.



Round command symbols tell what to do.

1.3 Qualified Personnel

All work such as installation, commissioning, operation, and service of the product may only be carried out by qualified personnel. The personnel must have the necessary qualifications for the corresponding activity and be familiar with the installation, commissioning, operation, and service of the product. The manual and in particular the safety instructions must be carefully read, understood, and observed.

1.4 Liability

NTI AG (as manufacturer of LinMot and MagSpring products) excludes all liability for damages and expenses caused by incorrect use of the products. This also applies to false applications, which are caused by NTI AG's own data and notes, for example during sales, support or application activities. It is the responsibility of the user to check the data and information provided by NTI AG for correct applicability in terms of safety. In addition, the entire responsibility for safety-related product functionality lies exclusively with the user. Product warranties are void if products are used with stators, sliders, servo drives, or cables not manufactured by NTI AG unless such use was specifically approved by NTI AG.

NTI AG's warranty is limited to repair or replacement as stated in our standard warranty policy as described in our "terms and conditions" previously supplied to the purchaser of our equipment (please request copy of same if not otherwise available). Further reference is made to our general terms and conditions.

1.5 Copyright

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2 Safety Instructions



For your personal safety

Disregarding the following safety measures can lead to severe injury to persons and damage to material:

- Only use the product as directed.
- Never commission the product in the event of visible damage.
- Never commission the product before assembly has been completed.
- Do not carry out any technical changes on the product.
- Only use the accessories approved for the product.
- Only use original spare parts from LinMot.
- Observe all regulations for the prevention of accidents, directives and laws applicable on site.
- Transport, installation, commissioning, and maintenance work must only be carried out by qualified personnel.
- Observe IEC 364 and CENELEC HD 384 or DIN VDE 0100 and IEC report 664 or DIN VDE 0110 and all national regulations for the prevention of accidents.
- According to the basic safety information, qualified, skilled personnel are persons who are familiar with the assembly, installation, commissioning, and operation of the product and who have the qualifications necessary for their occupation.
- Observe all specifications in this documentation.
- This is the condition for safe and trouble-free operation and the achievement of the specified product features.
- The procedural notes and circuit details described in this documentation are only proposals. It is up to the user to check whether they can be transferred to the applications. NTI AG / LinMot does not accept any liability for the suitability of the procedures and circuit proposals described.
- LinMot servo drives, and the accessory components can include live and moving parts (depending on their type of protection) during operation. Surfaces can be hot.
- Non-authorized removal of the required cover, inappropriate use, incorrect installation, or operation create the risk of severe injury to persons or damage to material assets.
- For more information, please see the documentation.
- High amounts of energy are produced in the drive. Therefore, it is required to wear personal protective equipment (body protection, headgear, eye protection, hand guard).



Application as directed.

- Drives are components, which are designed for installation in electrical systems or machines. They are not to be used as domestic appliances, but only for industrial purposes according to EN 61000-3-2.
- When drives are installed into machines, commissioning (i.e., starting of the operation as directed) is prohibited until it is proven that the machine complies with the regulations of the EC Directive 2006/42/EG (Machinery Directive); EN 60204 must be observed.
- Commissioning (i.e., starting of the operation as directed) is only allowed when there is compliance with the EMC Directive (2014/30/EU).
- The technical data and supply conditions can be obtained from the nameplate and the documentation. They must be strictly observed.



Transport, storage

- Please observe the notes on transport, storage, and appropriate handling.
- Observe the climatic conditions according to the technical data.

**Installation**

- The drives must be installed and cooled according to the instructions given in the corresponding documentation.
- The ambient air must not exceed the degree of pollution 2 according to EN 61800-5-1.
- Ensure proper handling and avoid excessive mechanical stress. Do not bend any components and do not change any insulation distances during transport or handling. Do not touch any electronic components and contacts.
- Drives contain electrostatic sensitive devices, which can easily be damaged by inappropriate handling. Do not damage or destroy any electrical components since this might endanger your health!

**Electrical connection**

- When working on live drives, observe the applicable national regulations for the prevention of accidents.
- The electrical installation must be carried out according to the appropriate regulations (e.g. cable cross-sections, circuit breakers, fuses, PE connection). Additional information can be obtained from the documentation.
- This product can cause high-frequency interferences in non-industrial environments, which require measures for interference suppression.

**Operation**

- If necessary, systems including drives must be equipped with additional monitoring and protection devices according to the valid safety regulations (e.g. law on technical equipment, regulations for the prevention of accidents). The drives can be adapted to your application. Please observe the corresponding information given in the documentation.
- After the drive has been disconnected from the supply voltage, all live components and power connections must not be touched immediately because capacitors can still be charged. Please observe the corresponding stickers on the drive. All protection covers and doors must be shut during operation.

**Burn Hazard**

The heat sink (housing) of the drive can have an operating temperature of $> 80\text{ }^{\circ}\text{C}$: Contact with the heat sink results in burns.

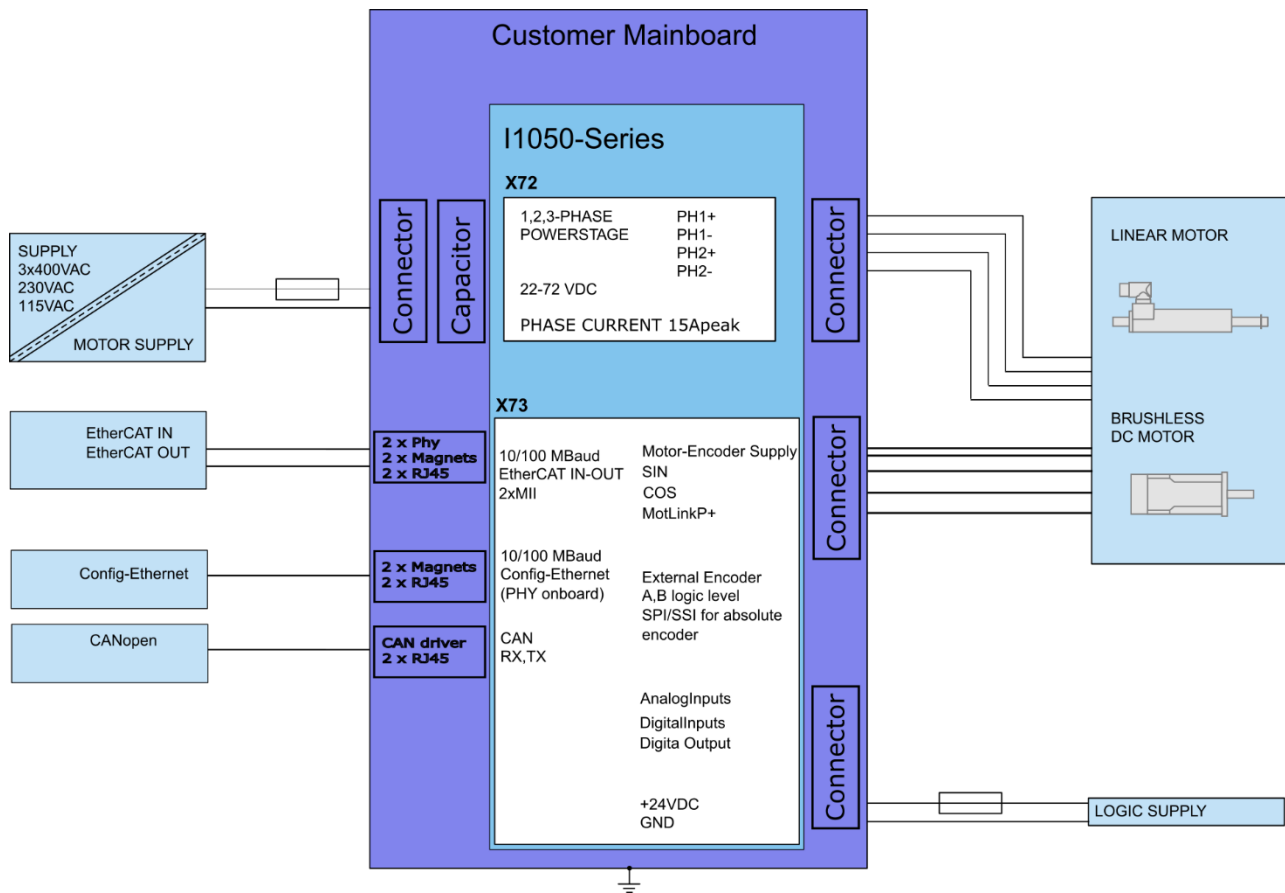
**Caution - Risk of Electric Shock!**

- Before servicing, disconnect supply, wait 5 minutes and measure between PWR+ and PGND to be sure that the capacitors have discharged below 42 VDC.
- The power terminals Ph1+, Ph1-, Ph2+, Ph2- and PWR+ remain live for at least 5 minutes after disconnecting from the power supplies.

**Grounding**

All metal parts that are exposed to contact during any user operation or servicing and likely to become energized shall be reliably connected to the means for grounding.

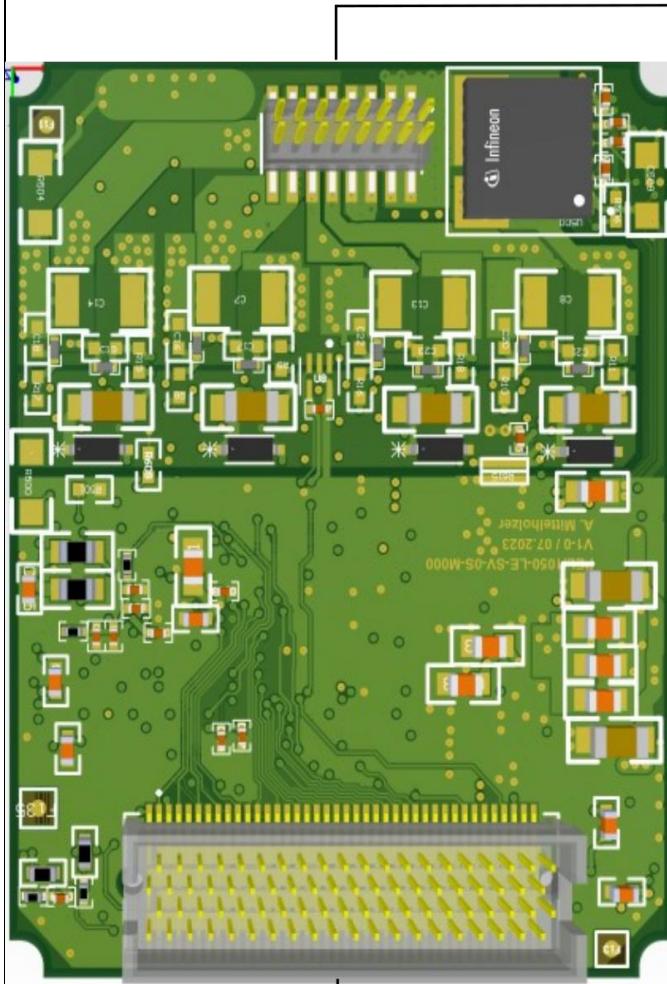
3 System Overview



Typical servo system I1050: Servo drive, Mainboard, motor, and power supply:

The I1050 needs to be installed on a baseboard, which must be designed by the customer!

4 Interfaces



X72:
Motor Supply
Motor Phases

X73:
Logic Supply
Motor Encoder
Ethernet-Config
CANopen
EtherCAT
Analog Input
Digital IO
External Encoder

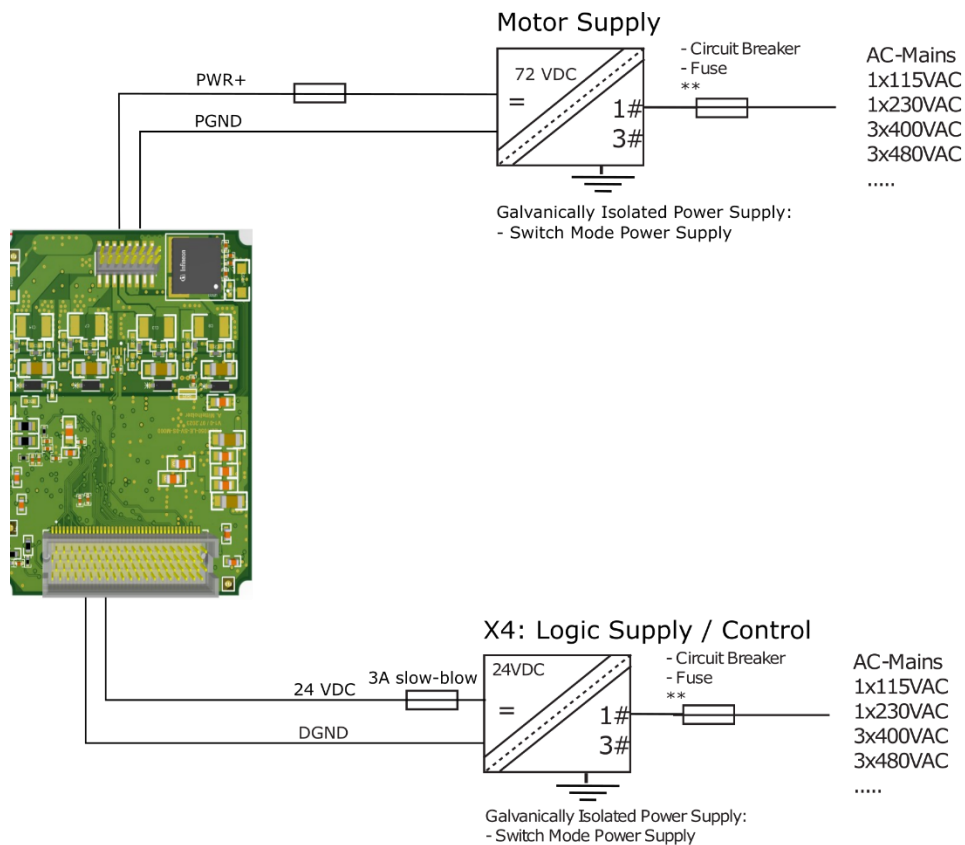
5 Functionality

		I1050-DS-HC-0S
Supply Voltage		
Motor Supply 72 VDC (24...85 VDC)		•
Logic Supply 24 VDC (22...26 VDC)		•
Motor Phase Current		
15 A peak (0-599 Hz)		•
Controllable Motors		
LinMot P0x- and PR0x- Motors		•
Selected motors (contact support)		•
Plug and Play (PnP) Auto Configuration		•
Command Interface		
CANopen DS402 (external CAN driver required)		•
EtherCAT CiA402 (<i>external PHY required – MII</i>)		•
1 digital Output, 2 digital Inputs (logic level)		•
1 analog input (logic level)		
External Position Sensor		
Incremental (RS422 up to 25 Mcounts/s) with external transceivers		•
Absolute (SSI, BiSS-B, BiSS-C, EnDat2.1, EnDat 2.2) with external transceivers		•
Configuration Interface		
Ethernet (external connector with magnets required)		•

6 Software

The configuration software LinMot-Talk is free of charge and can be downloaded from the LinMot homepage.

7 Power Supply and Grounding



To assure a safe and error free operation, and to avoid severe damage to system components, **all system components must be well grounded to protective earth PE**. This includes both LinMot and all other control system components on the same ground bus.



Each system component¹ should be tied directly to the ground bus (**star pattern**). Daisy chaining from component to component is forbidden. (LinMot motors are properly grounded through their power cables when connected to LinMot drives.)



Power supply connectors must not be connected or disconnected while DC voltage is present. Do not disconnect system components until all LinMot drive LEDs have turned off. (Capacitors in the power supply may not fully discharge for several minutes after input voltage has been disconnected). Failure to observe these precautions may result in severe damage to electronic components in LinMot motors and/or drives.

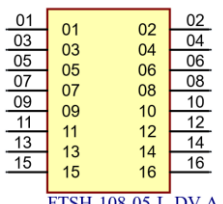


Do not switch Power Supply DC Voltage. All power supply switching, and E-Stop breaks should be done to the AC supply voltage of the power supply. Failure to observe these precautions may result in severe damage to the drive.

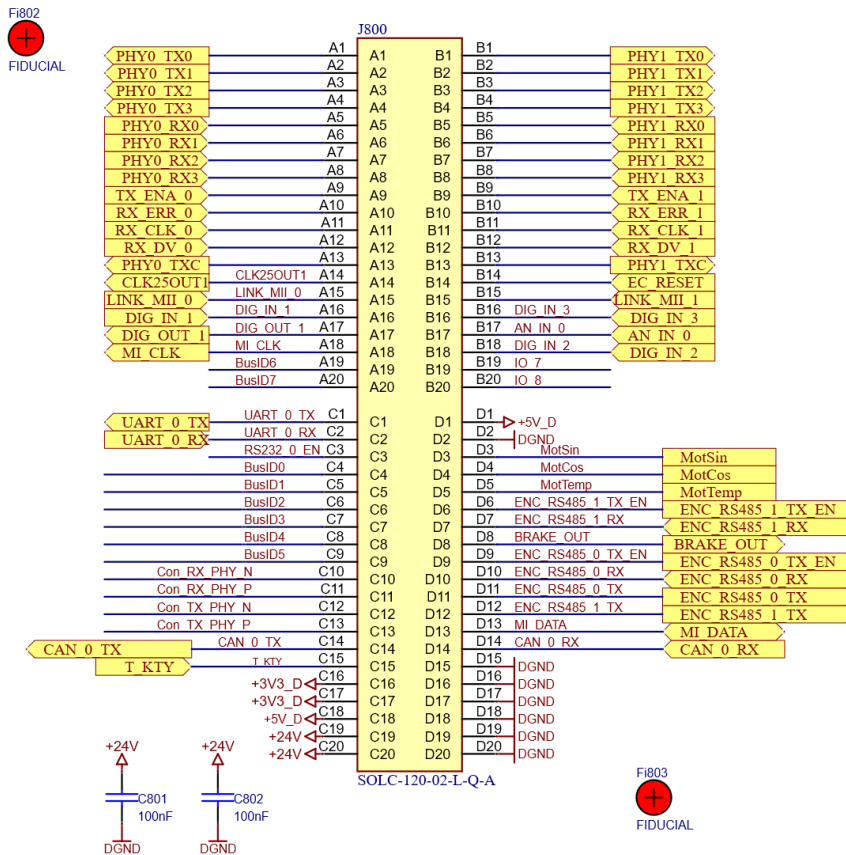
¹ Inside of the I1050 drive the PWR motor GND and PWR signal GND are connected and to the GND of the drive housing. It is recommended that the PWR motor GND is NOT grounded at another place than inside of the drive to reduce circular currents.

8 Description of the connectors / Interfaces

8.1 X72

X72	Motor Supply	
 FTSH-108-05-L-DV-A	1..4	PWR+ (24 – 85 VDC)
	5..8	PGND
	9..10	Motor Phase 1+
	11..12	Motor Phase 1-
	13..14	Motor Phase 2+
	15..16	Motor Phase 2-
On the mainboard, use Samtec SFMC-108-01-S-D	Motor Supply: 72 VDC nominal (22...85 VDC) Absolute max. Rating: 85 VDC External Circuit Breaker: 10 A / min. 100 VDC	

8.2 X73



X73	Logic			
 TOLC-120-X-X-Q-A	A1-A15, A18, D13	EC in	MII	Media Independent Interface EtherCAT in
	A16	DIG_IN_1	Digital Input 1	Digital Input logic level (3.3V)
	A17	DIG_OUT_1	Digital Output 1	Digital Output logic level (3.3V)
	C4-C9, A19, A20	Busaddress	Busaddress	Busaddress (BusID0-BusID7)
	B1-B15	EC out	MII	Media Independent Interface EtherCAT out
	B17	AN_IN_0	Analog input	Analog input logic level (3.3V)
	B18	DIG_IN_2	Digital Input 2	Digital Input logic level (3.3V)
	B19, B20	IO7, IO8	Do not connect	Do not connect
	C10-C13	Ethernet	RX+, RX-, TX+, TX-	Config Ethernet (must be connected to an RJ45 with magnets)
	C1-C3	UART0	TX, RX, EN	UART0 (do not connect) / only used for bootstrap
	C14, D14	CAN	TX, RX	CAN logic level
	C15	T_KTY	Temperature	Analog input for temperature sensor (KTY, PT1000)
	D1-D5	Motor Enc	Motor Encoder	Encoder for LinMot P01 motors (supply, sin, cos and MotLink P)
	D6, D7, D9-D12	Encoder X13	External Encoder	External Encoder signals (logic level), EnDAT, BISS, AB
	C16, C17	3.3 VDC	3.3VDC Output	Internal supply (generated from I1050)
	C18	5 VDC	5 VDC	Internal supply (generated from I1050)
	C19, C20	24VDC in	Logic Supply	24 VDC logic supply
	D15-D20	DGND	Ground	Logic Ground

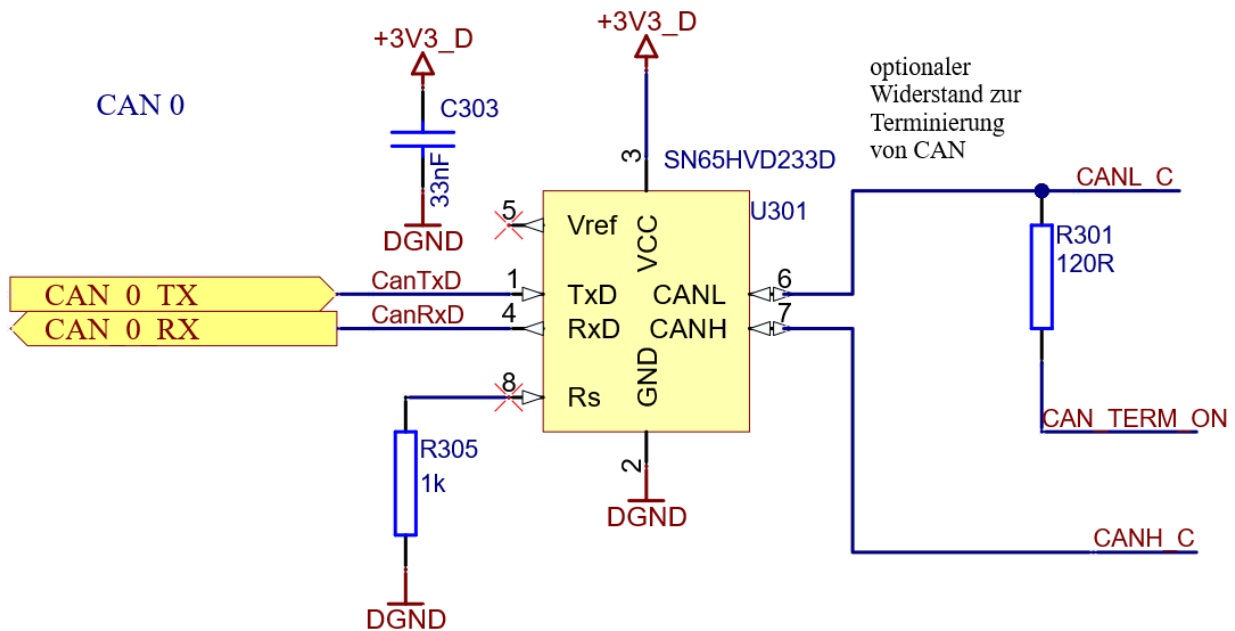
On the mainboard,
use Samtec SOLC-
120-02-L-Q-A

Important notes:
The 24 VDC logic supply for the control circuit must be protected with an external fuse (3 A slow blow)

8.2.1 CAN-Bus (non isolated)

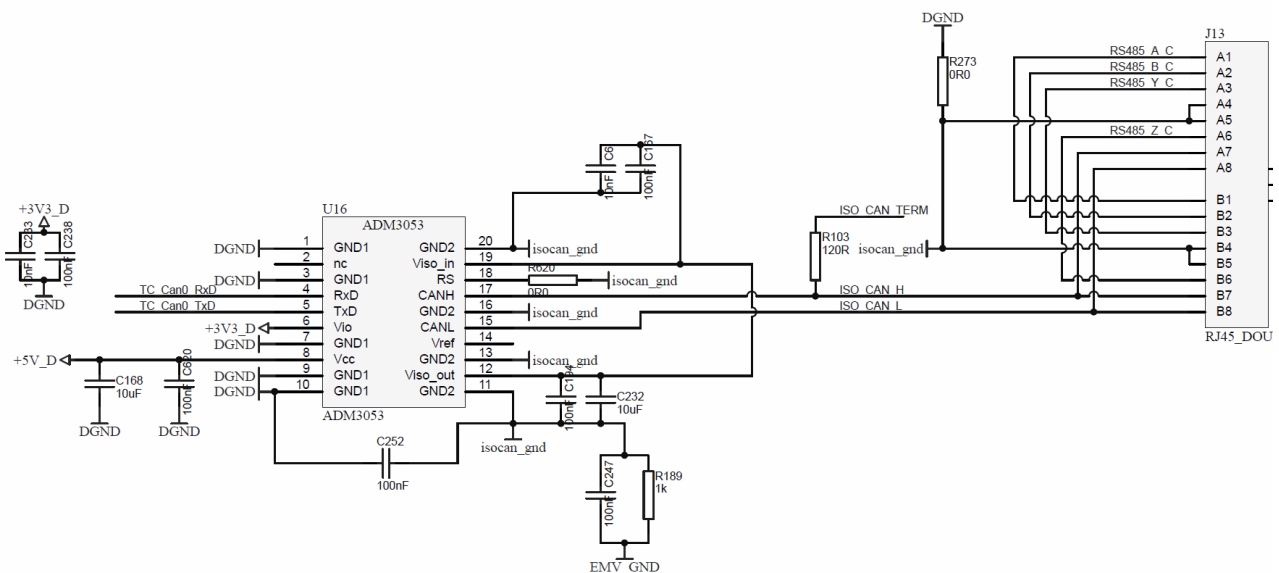
The CAN signals are one X73 pin C14 and D14. On the mainboard a CAN-driver is required.

This is an example



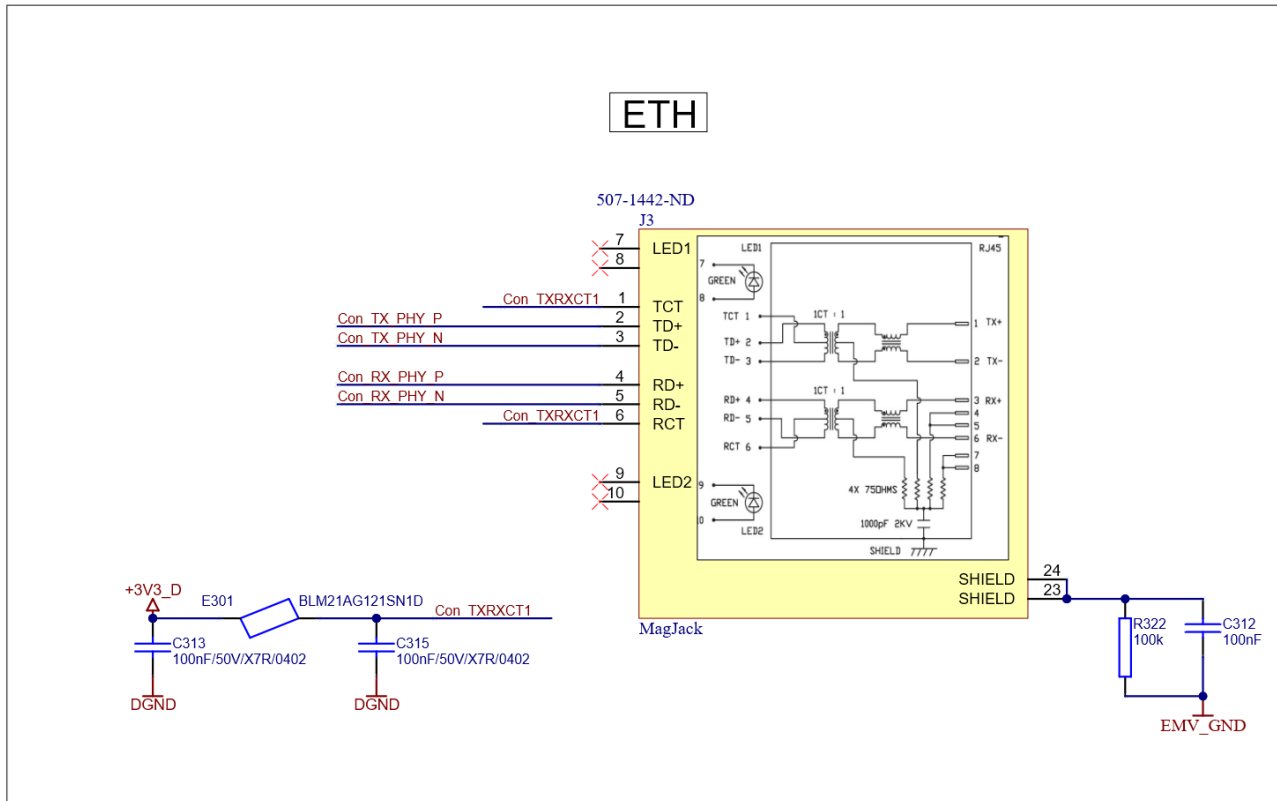
8.2.2 CAN-Bus (isolated)

This is an example of an isolated CAN Bus:

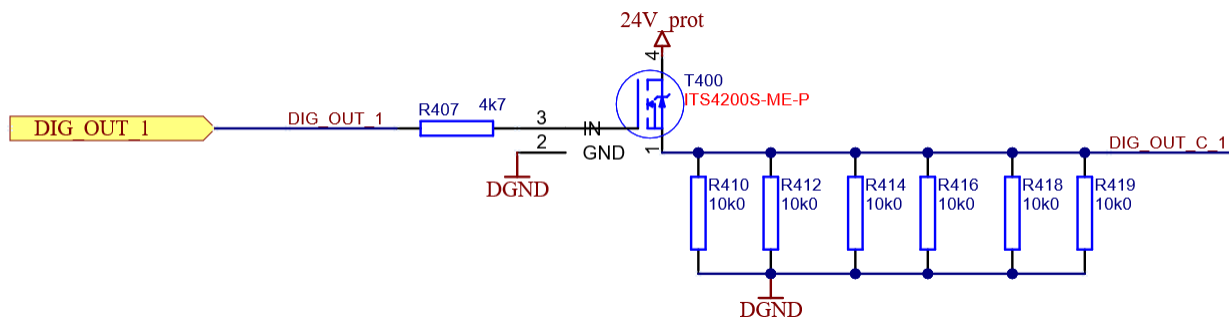


8.2.3 Config Ethernet

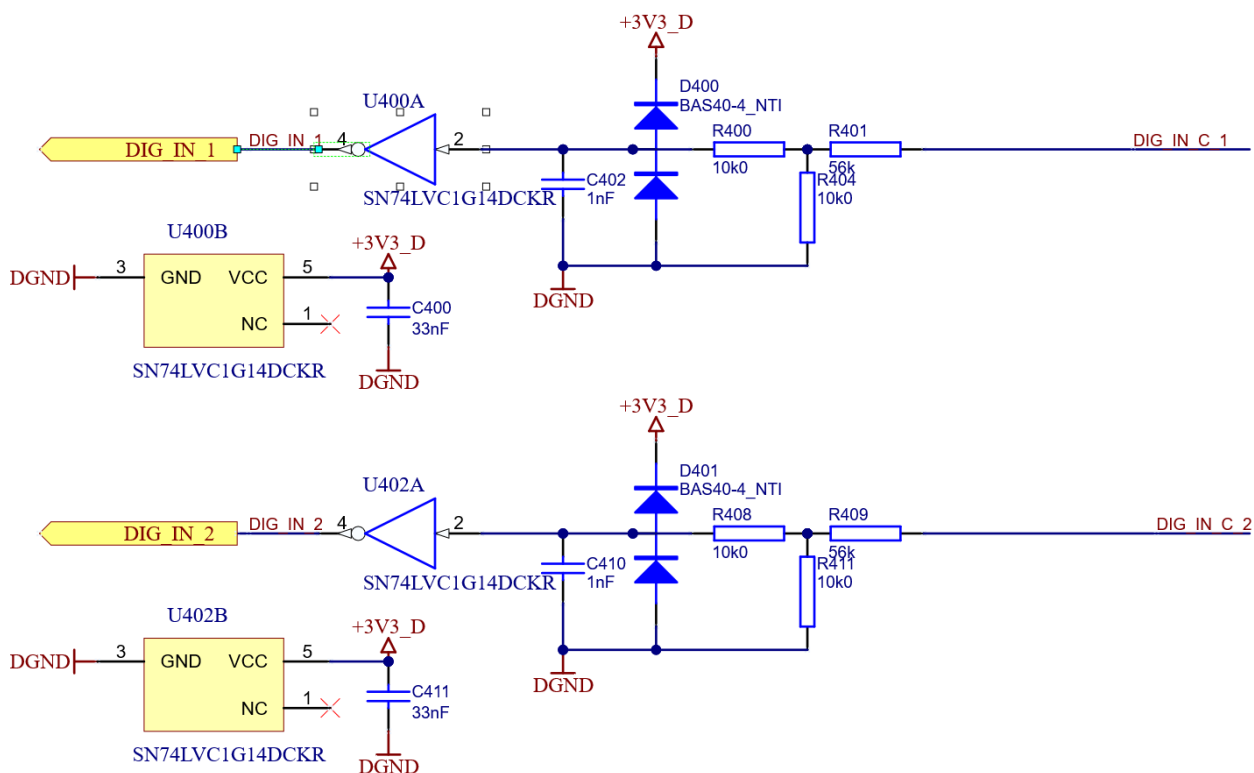
For implementing the config Ethernet, there is PHY on the I1050. This can be connected to an RJ45 connector with integrated magnets. This is an example of how it is implemented on the Eval-Board:



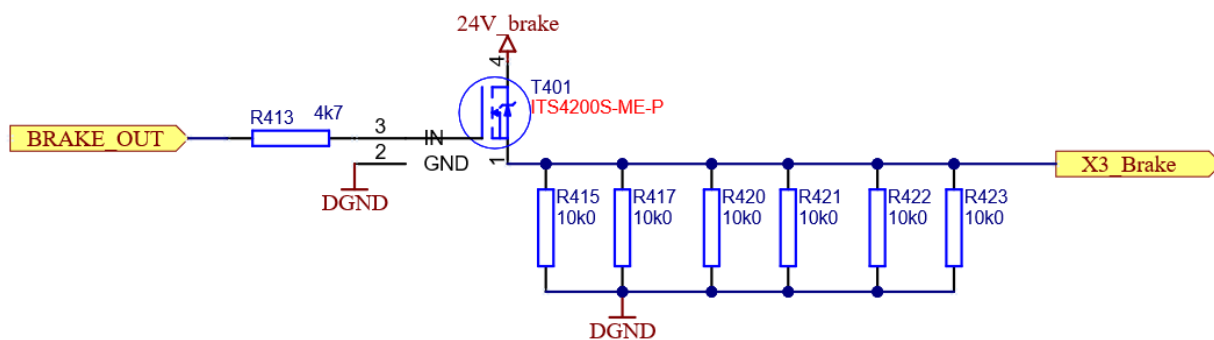
8.2.4 Digital Output



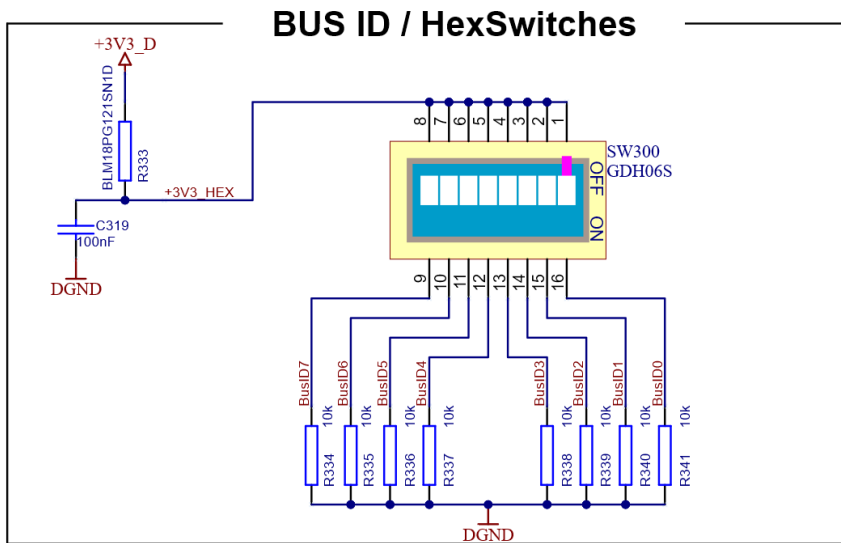
8.2.5 Digital Inputs



8.2.6 Brake

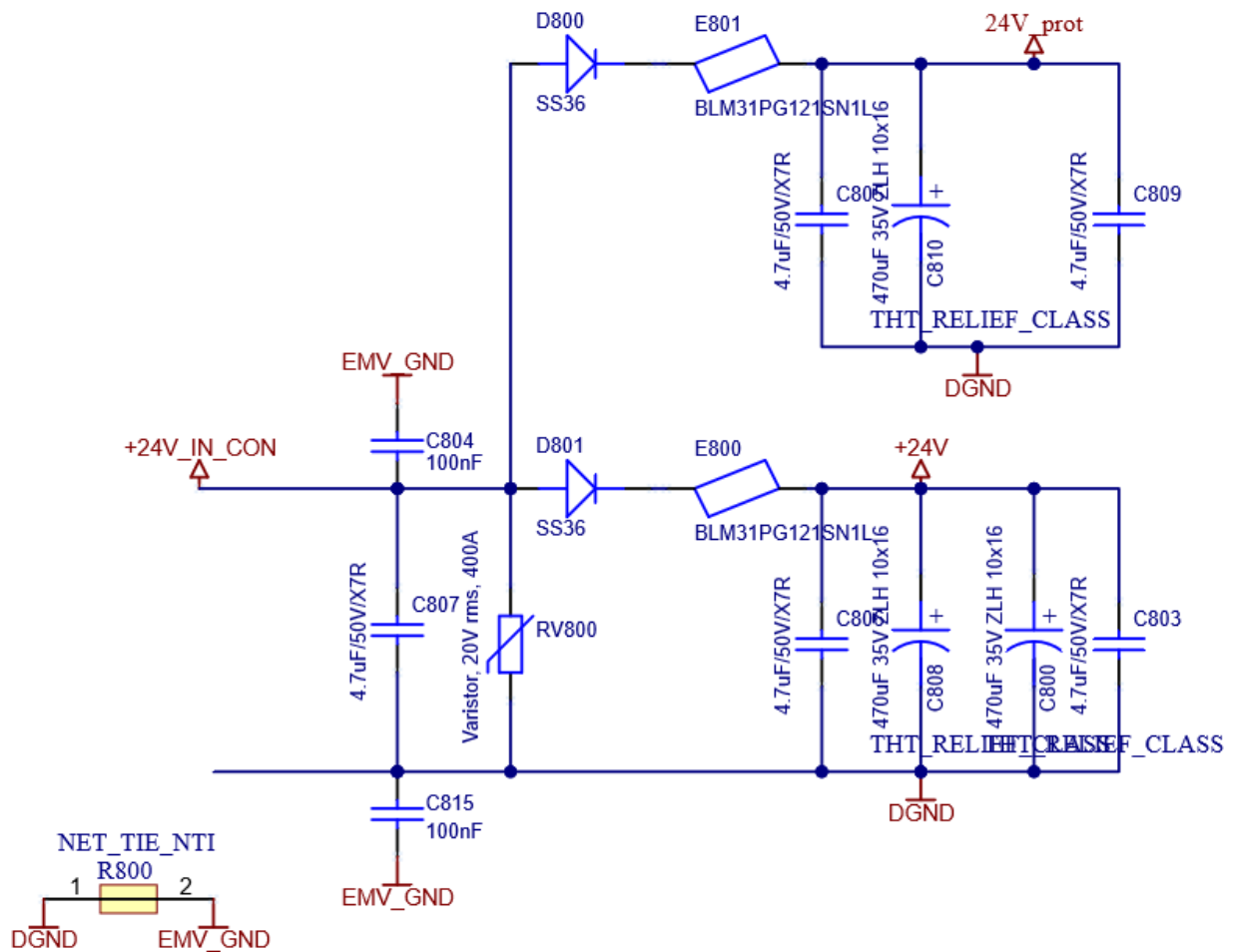


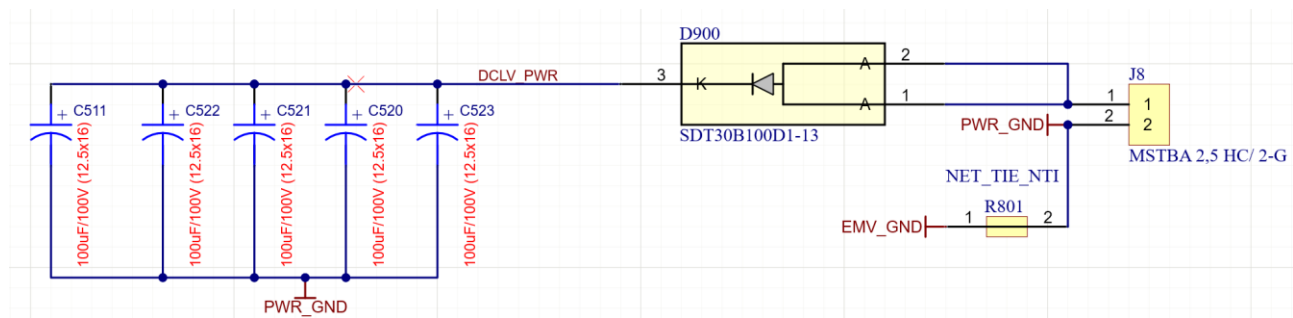
8.2.7 Bus Address



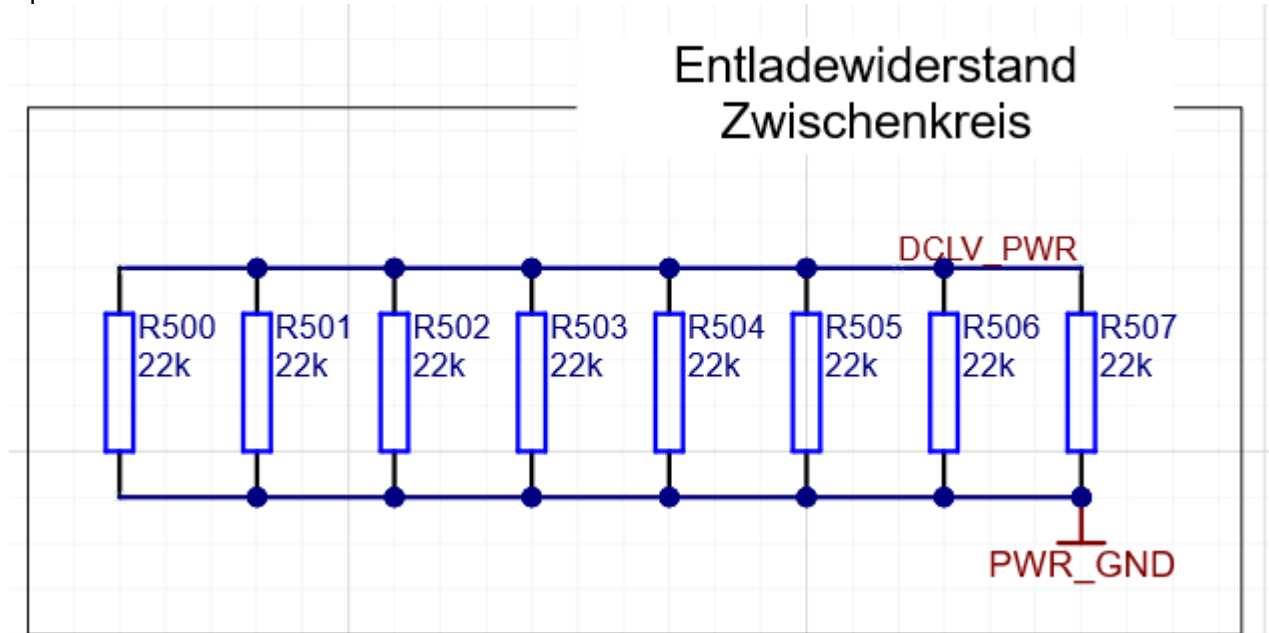
8.2.8 24VDC Supply

24V Supply



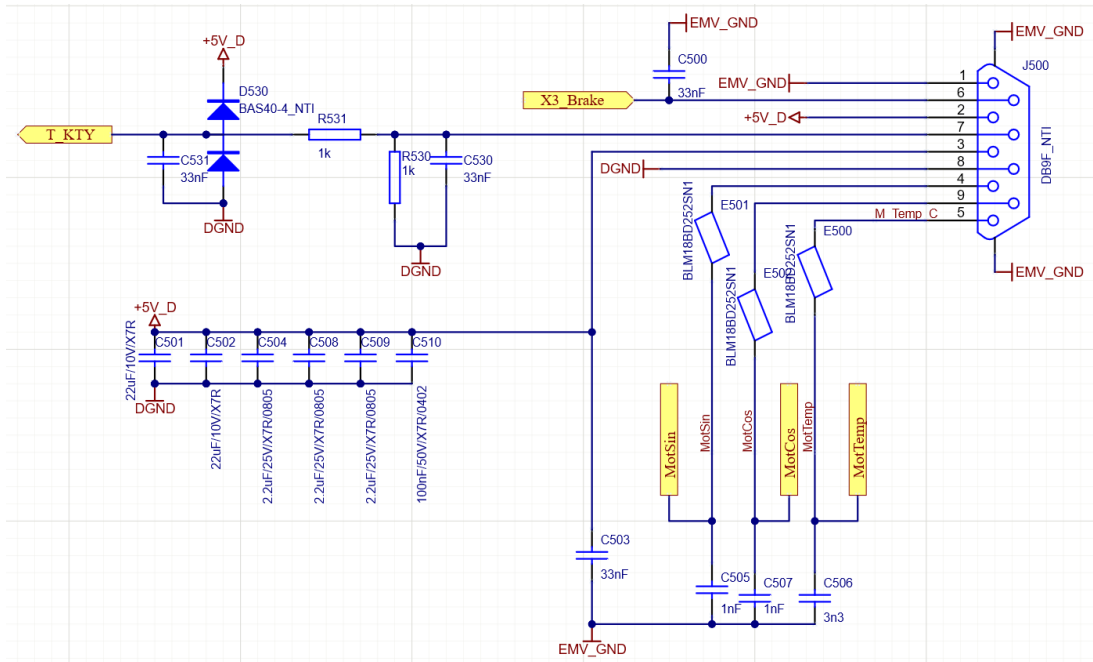
8.2.9 Motor Supply

Optional resistors:

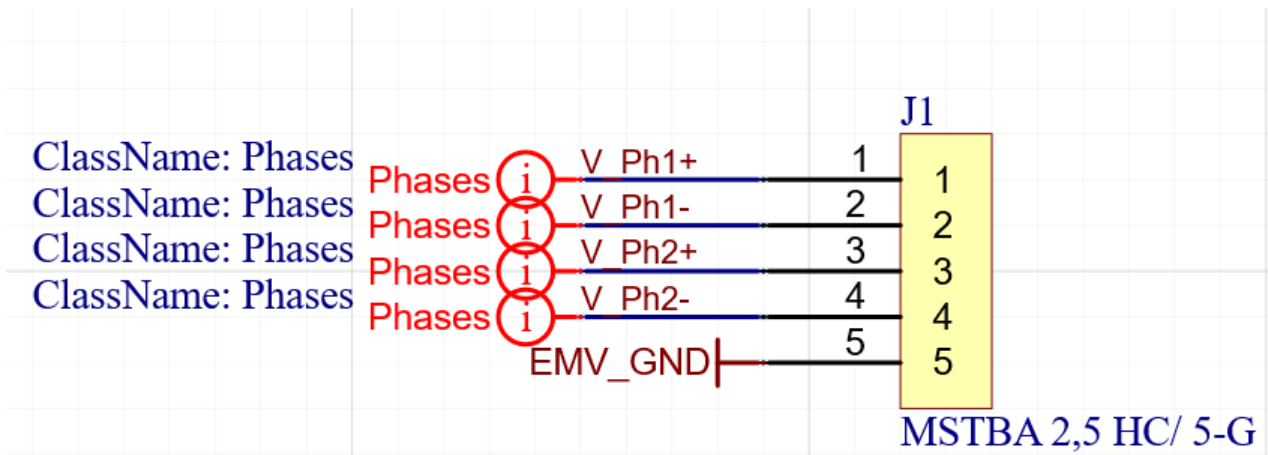


8.2.10 Motor Connector

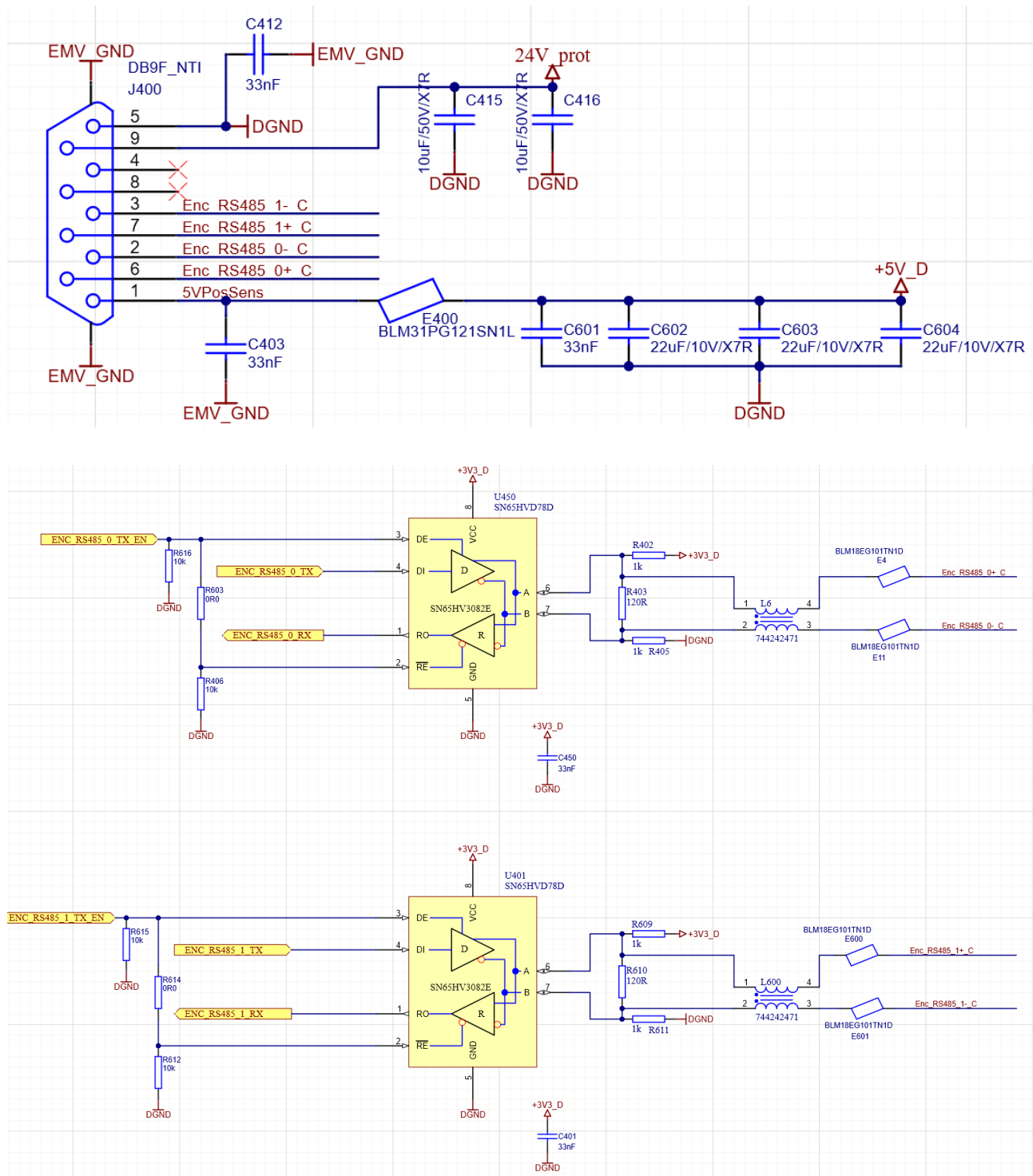
X3:



X2:



8.2.11 External Encoder X13

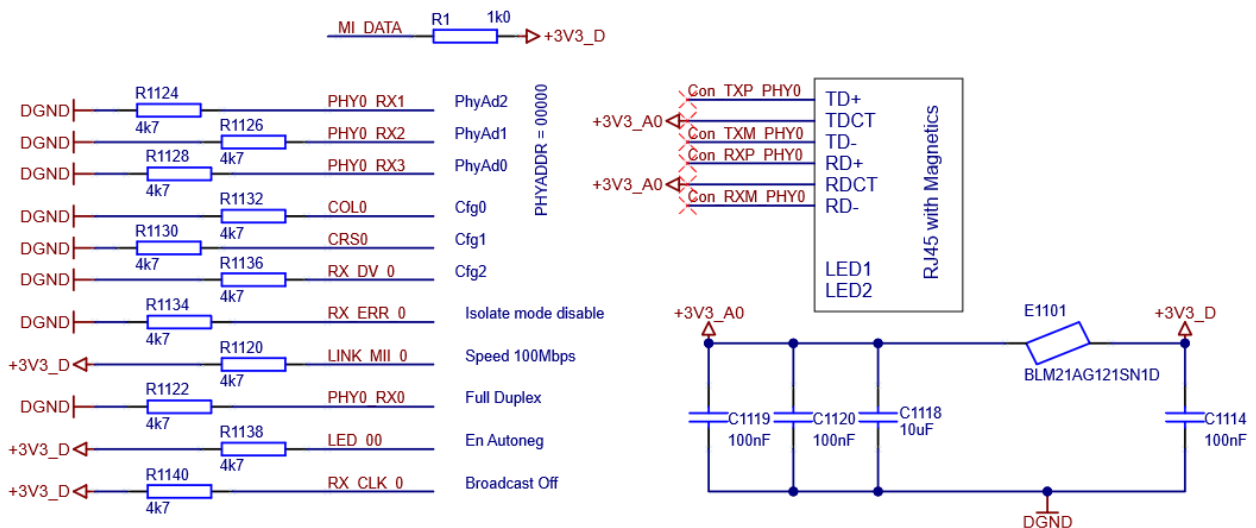
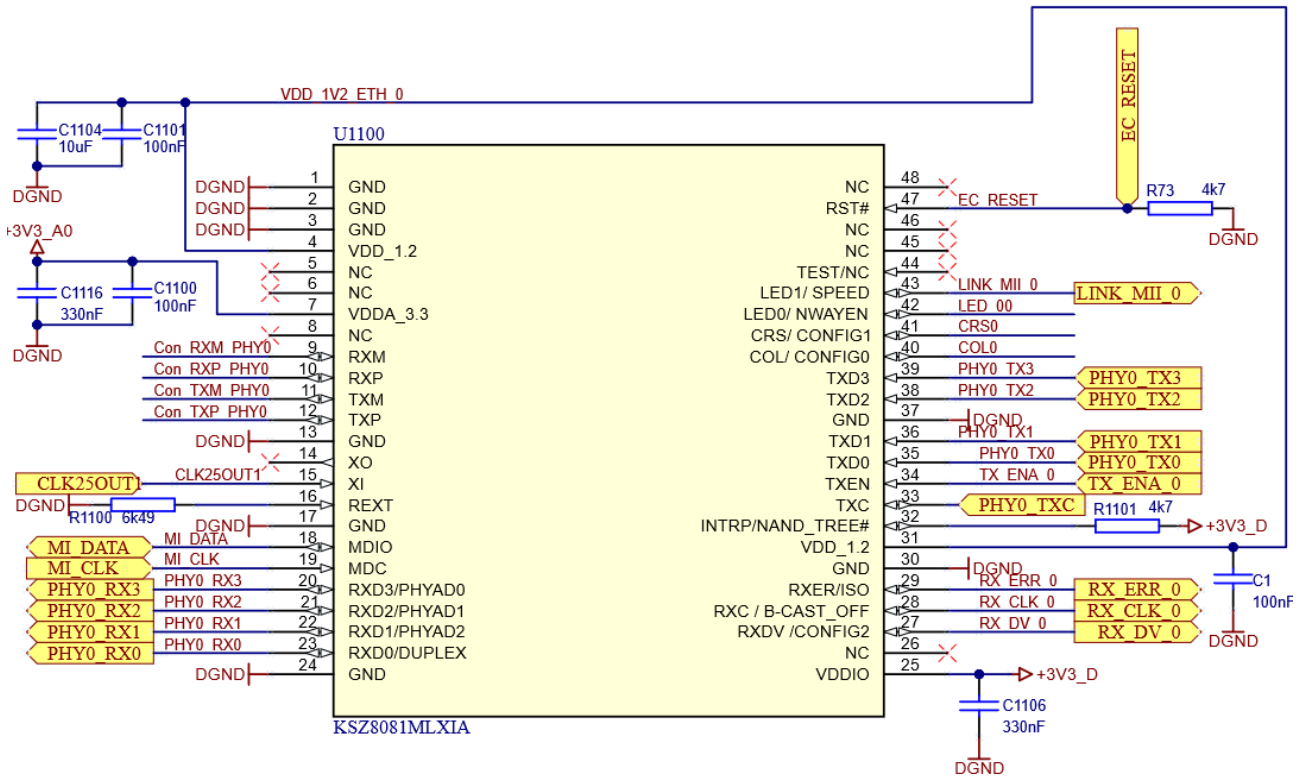


8.2.12 EtherCAT

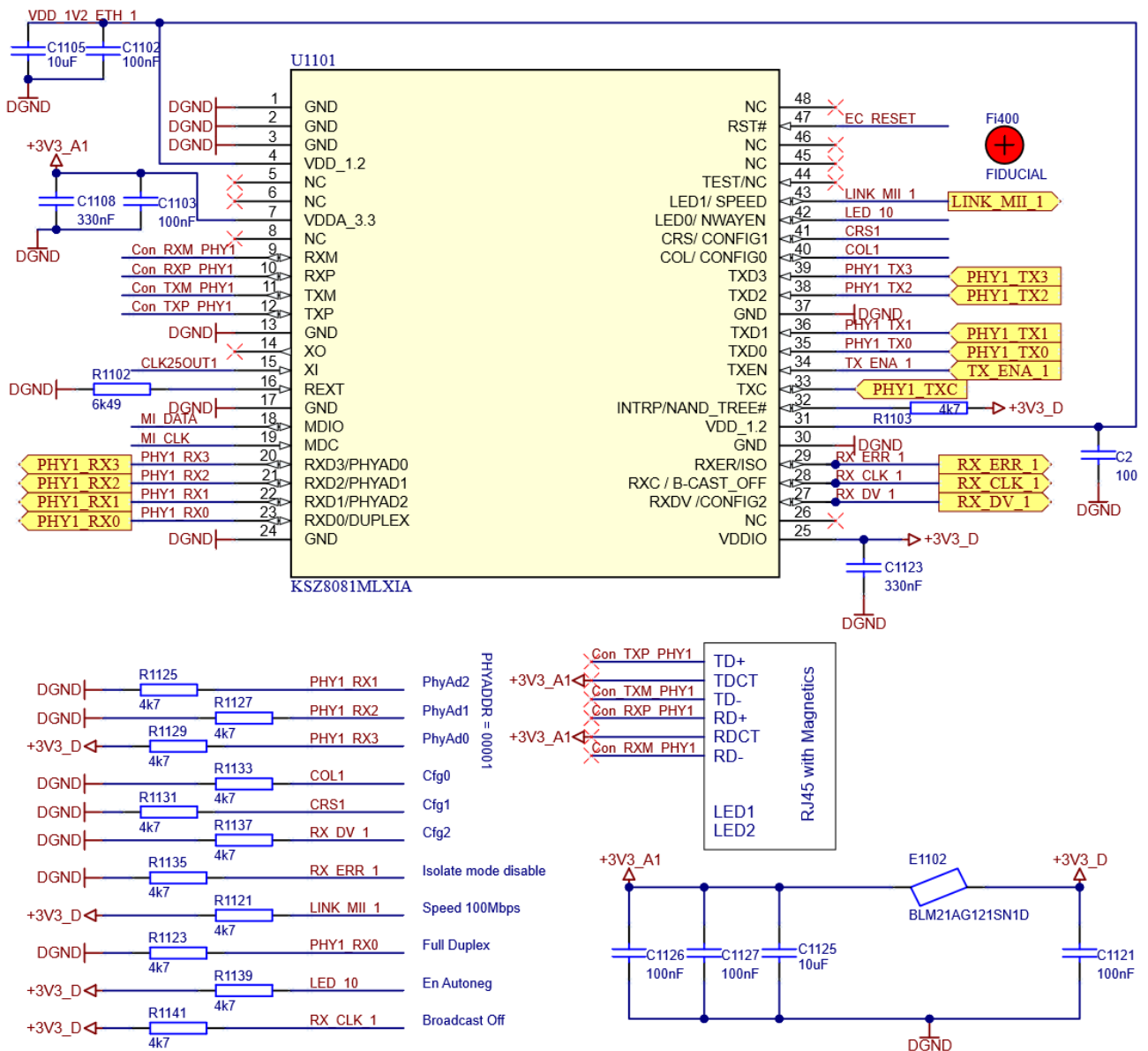
For the EtherCAT interface, two MII interfaces are on X73.

This is an example schematic for the EtherCAT in / out:

8.2.12.1 PHY 0 / EC-IN:

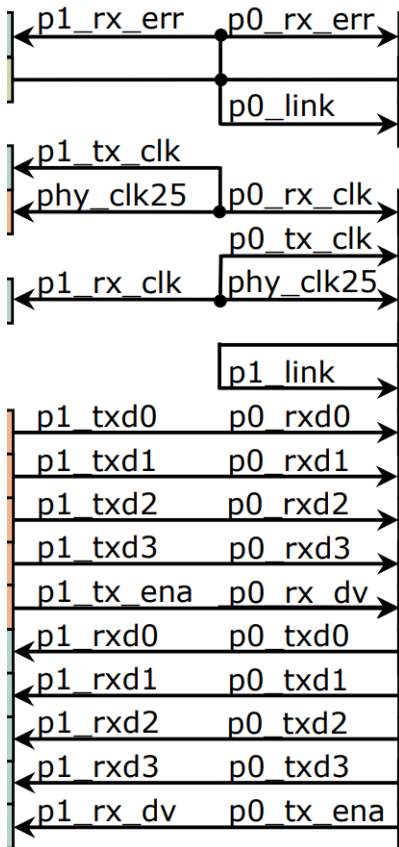


8.2.12.2 PHY 1 / EC-OUT:



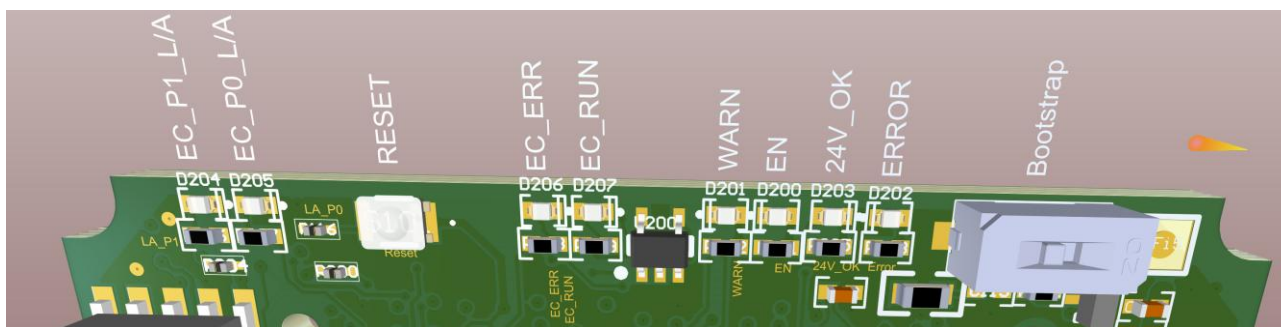
8.2.13 EtherCAT MAC2MAC connection

If multiple drives are on the same mainboard and have all the same grounds and supplies, the EtherCAT connection between the drives can be done without PHY's and magnets. The connection can be done directly by a MAC2MAC connection:



The last node inside the chain, must have p1_link connected to 3.3V for closing port1. All other nodes must have p1_link connected to GND for keeping port1 open.

8.3 LEDs



LEDs	State Displays		
System LEDs	Signal:	Color:	Description:
	24VOK	Green	D203: 24 VDC Logic Supply OK
	EN (enable)	Yellow	D200: Motor Enabled / Error Code Low Nibble
	WARN	Yellow	D201: Warning / Error Code High Nibble
	ERROR	Red	D202: Error
EtherCAT	LA 0	Yellow	D205: EtherCAT in Link Activity
	LA 1	Yellow	D204: EtherCAT out Link Activity
	RUN	Green	D2072: EtherCAT RUN
	ERROR	RED	D206: EtherCAT ERROR

9 System LED Blink Codes

System LED Blink Codes			
ERROR	WARN	EN (enable)	Description
OFF	Warning	Operation Enabled	Normal Operation: Warnings and operation enabled are displayed.
ON	<ul style="list-style-type: none"> • ~2 Hz 0..15 x Error Code High Nibble 	<ul style="list-style-type: none"> • ~2 Hz 0..15 x Error Code Low Nibble 	Error: The error code is shown by a blink code with "WARN" and "EN". The error byte is divided into low and high nibble (= 4 bit). "WARN" and "EN" are blinking together. The error can be acknowledged. (e.g.: WARN blinks 3x, EN blinks 2x; Error Code = 32h)
<ul style="list-style-type: none"> • ~2 Hz 	<ul style="list-style-type: none"> • ~2 Hz 0..15 x Error Code High Nibble 	<ul style="list-style-type: none"> • ~2 Hz 0..15 x Error Code Low Nibble 	Fatal Error: The error code is shown by a blink code with "WARN" and "EN". The error byte is divided into low and high nibble. "WARN" and "EN" are blinking together. Fatal errors can only be acknowledged by a reset or power cycle. (e.g.: WARN blinks 3x, EN blinks 2x; Error Code = 32h)
<ul style="list-style-type: none"> • ~4 Hz 	<ul style="list-style-type: none"> • ~2 Hz 0..15 x Error Code High Nibble 	<ul style="list-style-type: none"> • ~2 Hz 0..15 x Error Code Low Nibble 	System Error: Please reinstall firmware or contact support.
<ul style="list-style-type: none"> • ~0.5 Hz 	<ul style="list-style-type: none"> • ~0.5 Hz 	On	Signal Supply 24V too low: The error and warn LEDs blink alternating if the signal supply +24 VDC (X4.2) is less than 18 VDC.
Off	○●●●	●○●●	Plug&Play Communication Active: This sequence (Warn on, then En on, then both off, complete sequence of the 4 states ca. 1 s) signalizes the state when the plug and play parameters are being read from the motor.
<ul style="list-style-type: none"> ○● ~4 Hz 	<ul style="list-style-type: none"> ●○ ~4 Hz 	Off	Waiting for Defaulting Parameters: When ID (S1, S2) is set to 0xFF, the drive starts up in a special mode and the Error and Warn LED blink alternating ~4 Hz. When the ID is set to 0x00, all parameters will be set to their default value. To leave this state, power down the drive and change the ID. Also see in the Usermanual_LinMot-Talk under chapter trouble shooting.
Off	<ul style="list-style-type: none"> ○● ~2 Hz 	<ul style="list-style-type: none"> ○● ~2 Hz 	Defaulting Parameters Done: When the parameters have set to their default values (initiated via S1/S2 on power up) the Warn and EN LEDs blink together at 2 Hz. To leave this state, power down the drive. Also see in the Usermanual_LinMot-Talk under chapter trouble shooting.

The meaning of the error codes can be found in the *Usermanual_MotionCtrl_Software_SG5-SG7* and the user manual of the installed interface software. These documents are provided together with LinMot-Talk configuration software and can be downloaded from www.linmot.com.

10 Physical Dimension



I1050 Series single axis drive		I1050
Width	mm	42.8
Height	mm	53.98
Depth	mm	17
Hight above mainboard (mated)	mm	8
Case, Degree of Protection	IP	00
Storage Temperature	°C	-25...40
Transport Temperature	°C	-25...70
Operating Temperature	°C	0...40 at rated data (40...50 with power derating *)
Relative humidity		< 95% (non-condensing)
Pollution	IEC/EN 60664-1	Pollution degree 2
Mounting place		In the control cabinet (at least IP54)

11 Power Supply Requirements

11.1 Motor-Power Supply

The calculation of the needed power for the Motor supply is depending on the application and the used motor.

The nominal supply voltage is 72 VDC.

The possible range is from 22 to 72 VDC.



The motor supply can rise to 85 VDC when braking. This means that everything connected to that power supply needs a dielectric withstand voltage of at least 100 VDC. (Additional capacitors, etc...). Due to high braking voltage and sudden load variations of linear motor applications, **only compatible power supplies can be used (see chapter 15 Ordering Information).**

11.2 Signal-Power Supply

The logic supply needs a regulated power supply of a nominal voltage of 24 VDC. The voltage must be between 22 and 26 VDC.

Current provided from the logic-supply:

- min. 0.5 A (no load on the outputs)



The 24 VDC supply for the control circuit must be protected with an external fuse (3 A slow blow)

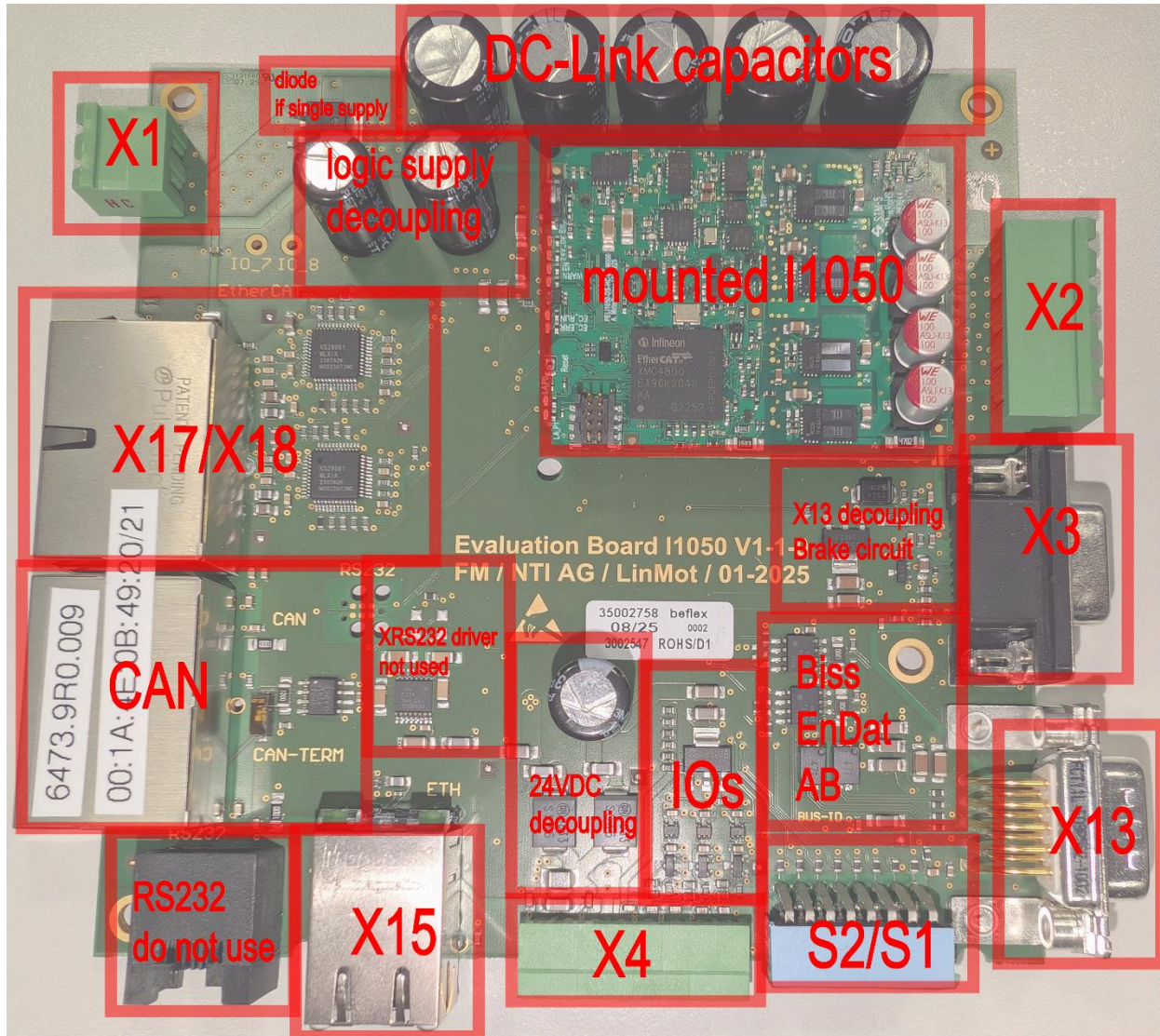
12 Regeneration

If the power supply rises too high during braking, connect an additional capacitor to the motor power supply.

It is recommended to use a capacitor $\geq 10'000 \mu\text{F}$ (install capacitor close to the drive supply!).

13 Evaluation Board

As the I1050 needs some circuits and connectors on the baseboard, there is an evaluation board available, which shows the possible functionality of the system. If the complete functionality will be used, all the circuits on the evaluation board should be implemented on the customer baseboard. Normally only a subset of the functionality is used in the application and therefore some circuits can be removed (for example the EtherCAT physicals and connector, if only CAN is used). The functionality of the evaluation board implements the functionality of the F1150, but without 3S safety and limited current.



The detailed description of the connectors can be found in the installation guide of the F1150 drive.

15 Ordering Information

15.1 Drives

Drives	Description	Art. No.
I1050-DS-HC-0S-M0000	Micro-Drive I1050-DS-HC-0S (72V/15A)	0150-6763

15.2 Accessories

Accessories	Description	Art. No.
I1050 Evaluation Board	Evaluation Board for I1050-DS-HC-0S	0150-6362
Compatible Power Supplies		Art. No.
S02-72/1000	Power Supply 72 V/1000 W, 3x400-480 VAC	<u>0150-4535</u>
S01-72/500	Power Supply 72 V/500 W, 1x120/230 VAC	<u>0150-1874</u>
S01-24/500	Power Supply 24 V/500 W, 1x120/230 VAC	<u>0150-2480</u>

Bold items are strongly recommended accessories!

16 International Certifications

Certifications

Europe



See chapter 16.1 EU Declaration of Conformity CE Marking

16.1 EU Declaration of Conformity CE Marking

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declares under sole responsibility the compliance of the products:

- Drives of the Series **I1050-DS-HC-OS-xxxx**

with the EMC Directive 2014/30/EU.

Applied harmonized standards:

- **EN 61800-3:2004 + A1:2012**
- **EN 61800-3:2018**

According to the EMC directive, the listed devices are not independently operable products.

Compliance of the directive requires the correct installation of the product, the observance of specific installation guides and product documentation. This was tested on specific system configurations.

The safety instructions of the manuals are to be considered.

The product must be mounted and used in strict accordance with the installation instructions contained within the installation guide, a copy of which may be obtained from NTI AG.

Company: NTI AG

Spreitenbach, 14.08.2023



Dr. Ronald Rohner / CEO NTI AG

ALL LINEAR MOTION FROM A SINGLE SOURCE

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