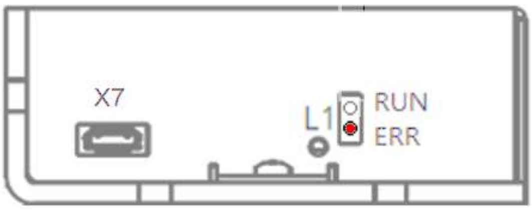
LED behavior	Status	Prerequisite
Permanently off	INIT	The *slave* is in the initialisation state.
Flashing	PRE-OPERATIONAL	The *slave* is in the *PRE-OPERATIONAL* state.
Single flash	SAFE-OPERATIONAL	The *slave* is in the *SAFE-OPERATIONAL* state.
Flickering	INITIALISATION or BOOTSTRAP	The *slave* is in the initialisation phase and has not yet achieved the *INIT* status or the *slave* is in *boot loader mode* and firmware is being loaded.
continuously green	OPERATIONAL	The *slave* is in the *OPERATIONAL* state.

ERR

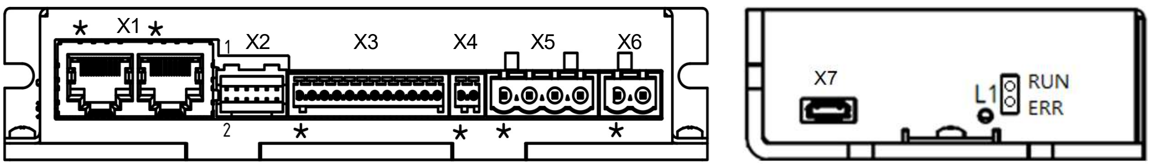


The red *ERR* LED indicates one of the following controller states (*EtherCAT slave*):

LED behavior	Status	Prerequisite
Permanently off	No error	Not an error
Flashing	Invalid Configuration	General configuration error
Single flash	Local Error	The *slave* automatically changed its *EtherCAT status* due to a local error.
Double flash	Process Data Watchdog Timeout/ EtherCAT Watchdog Timeout	*Watchdog* timeout
Triple flash	Application Error	Error in the *power state machine* of the *slave*
Flickering	Booting Error	Error when loading the firmware
continuously red	Application controller failure	The *slave* no longer responds.

3.6 Pin assignment

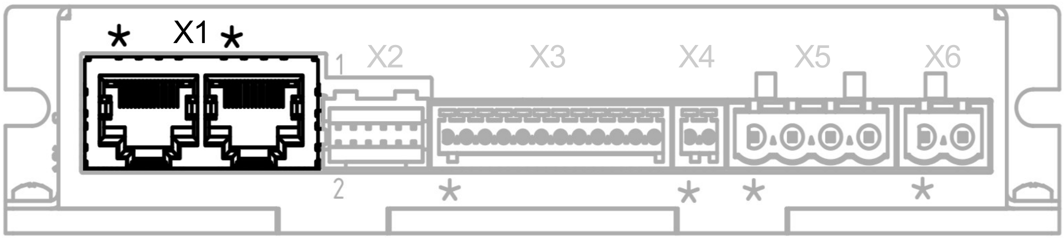
3.6.1 Overview



Connector	Function
X1	EtherCAT IN and OUT
X2	Encoder and Hall sensor connection
X3	Digital/analog inputs and outputs
X4	Brake connection
X5	Motor connection
X6	Voltage supply
X7	Micro USB connection
L1	Power LED

3.6.2 Connector X1 – EtherCAT IN and OUT

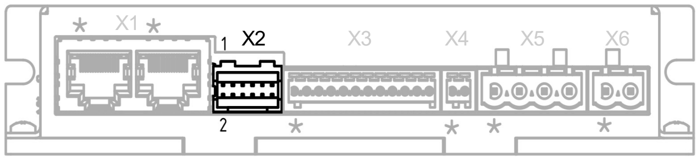
Pin 1 is marked with an asterisk "*". Both connectors are configured identically according to the following table.



PIN	Function	Note
1	TD+	
2	TD-	
3	RD+	
4	n.c.	
5	n.c.	
6	RD-	
7	n.c.	
8	n.c.	

3.6.3 Connector X2 – encoder/Hall sensor

Pin 1 and pin 2 are marked in the figure.



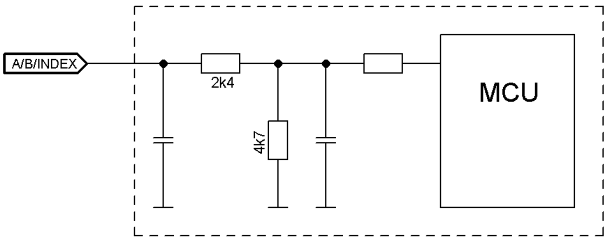
PIN	Function	Note
1	GND	

PIN	Function	Note
2	Vcc	5 V DC, output and supply voltage for encoder / Hall sensor; max. 200 mA
3	A	5 V signal, max. 1 MHz
4	B	5 V signal, max. 1 MHz
5	A\	5 V signal, max. 1 MHz
6	B\	5 V signal, max. 1 MHz
7	I	5 V signal, max. 1 MHz
8	I\	5 V signal, max. 1 MHz
9	Hall 1	5 V signal
10	Hall 2	5 V signal
11	Hall 3	5 V signal
12	Shielding	Shielding

The following switching thresholds apply for the encoder inputs:

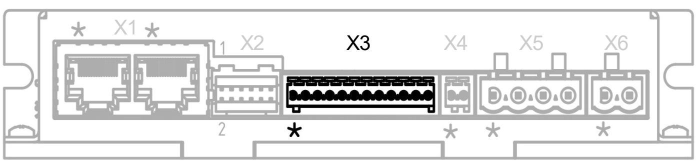
Type	Switching thresholds	
	On	Off
Single	> 3.8 V	< 0.26 V
Difference	> 3.8 V	< 0.26 V

The internal wiring of the encoder inputs is shown in the following.



3.6.4 Connector X3 – inputs and outputs

Pin 1 is marked with an asterisk "*".



PIN	Function	Note
1	+10 V DC	Output voltage, max. 200 mA
2	Digital input 1	5 V / 24 V signal, switchable by means of software with object **3240**$_h$, max. 1 MHz; clock input in clock-direction mode
3	Digital input 2	5 V / 24 V signal, switchable by means of software with object **3240**$_h$, max. 1 MHz; direction input in clock-direction mode
4	Digital input 3	5 V / 24 V signal, switchable by means of software with object **3240**$_h$

PIN	Function	Note
5	Digital input 4	5 V / 24 V signal, switchable by means of software with object **3240**$_h$
6	Digital input 5	5 V / 24 V signal, switchable by means of software with object **3240**$_h$
7	Analog input 1	10 bit, 0-10 V or 0-20 mA, switchable by means of software with object **3221**$_h$
8	Analog input 2	10 bit, 0-10 V, not switchable by means of software
9	Digital output 1	Open drain, maximum 24 V / 100 mA
10	Digital output 2	Open drain, maximum 24 V / 100 mA
11	Digital output 3	Open drain, maximum 24 V / 100 mA
12	GND	

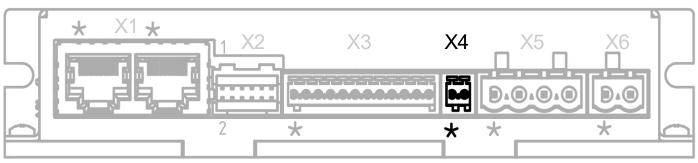
The following switching thresholds apply for inputs 1 to 5:

Max. Voltage	Switching thresholds	
	On	Off
5 V	> 3.8 V	< 0.26 V
24 V	> 14.42 V	< 4.16 V

Connection data	min	max
Conductor cross section, rigid, min.	0.14 mm^2	0.5 mm^2
Conductor cross section, flexible, min.	0.14 mm^2	0.5 mm^2
Conductor cross section, flexible, min. Wire-end sleeve without plastic sleeve, min.	0.25 mm^2	0.5 mm^2
Conductor cross section, min. AWG	26	20
Min. AWG acc. to UL/CUL	28	20

3.6.5 Connector X4 – brake connection

Pin 1 is marked with an asterisk "*".



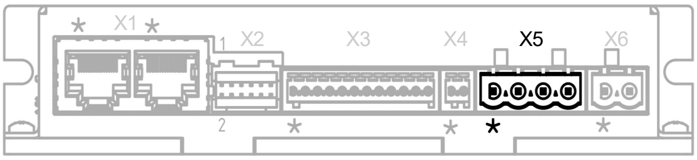
PIN	Function	Note
1	Brake +	Internally connected to +UB
2	Brake -	PWM-controlled open-drain output, max. 1.5 A

Connection data	min	max
Conductor cross section, rigid, min.	0.14 mm^2	0.5 mm^2
Conductor cross section, flexible, min.	0.14 mm^2	0.5 mm^2
Conductor cross section, flexible, min. Wire-end sleeve without plastic sleeve, min.	0.25 mm^2	0.5 mm^2

Connection data	min	max
Conductor cross section, min. AWG	26	20
Min. AWG acc. to UL/CUL	28	20

3.6.6 Connector X5 – motor connection

Pin 1 is marked with an asterisk "*".



PIN	Function (Stepper)	Function (BLDC)
1	A	U
2	A\	V
3	B	W
4	B\	Not used

Connection data	min	max
Conductor cross section, rigid, min.	0.2 mm^2	1.5 mm^2
Conductor cross section, flexible, min.	0.2 mm^2	1.5 mm^2
Conductor cross section, flexible, min. Wire-end sleeve without plastic sleeve, min.	0.25 mm^2	1.5 mm^2
Conductor cross section, flexible, min. Wire-end sleeve min. Plastic sleeve min.	0.25 mm^2	0.75 mm^2
Conductor cross section, min. AWG	24	16
Min. AWG acc. to UL/CUL	24	16

3.6.7 Connector X6 – voltage supply

Voltage source

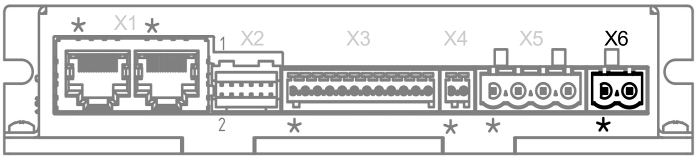
The operating or supply voltage supplies a battery, a transformer with rectification and filtering, or a switching power supply.

Note

- EMC: For a DC power supply line longer than 30 m or when using the motor on a DC bus, additional interference-suppression and protection measures are necessary.
- An EMI filter is to be inserted in the DC supply line as close as possible to the controller/motor.
- Long data or supply lines are to be routed through ferrites.

Connections

Pin 1 is marked with an asterisk "*".



PIN	Function	Note
1	+UB	12-48 V DC, ±5%
2	GND	

Connection data	min	max
Conductor cross section, rigid, min.	0.2 mm^2	1.5 mm^2
Conductor cross section, flexible, min.	0.2 mm^2	1.5 mm^2
Conductor cross section, flexible, min. Wire-end sleeve without plastic sleeve, min.	0.25 mm^2	1.5 mm^2
Conductor cross section, flexible, min. Wire-end sleeve min. Plastic sleeve min.	0.25 mm^2	0.75 mm^2
Conductor cross section, min. AWG	24	16
Min. AWG acc. to UL/CUL	24	16

Permissible operating voltage

The maximum operating voltage is 51.5 V DC. If the input voltage of the controller exceeds this threshold value, the motor is switched off and an error triggered. Above 50.5 V, the integrated ballast circuit (5 W power) is activated.

The minimum operating voltage is 10 V DC. If the input voltage of the controller falls below this threshold value, the motor is switched off and an error triggered.

A charging capacitor of at least 4700 µF / 50 V (approx. 1000 µF per ampere rated current) must be connected to the supply voltage to avoid exceeding the permissible operating voltage (e.g., during braking).

3.6.8 Micro USB (connector X7)

A cable of type "micro USB" is needed for this USB connection.