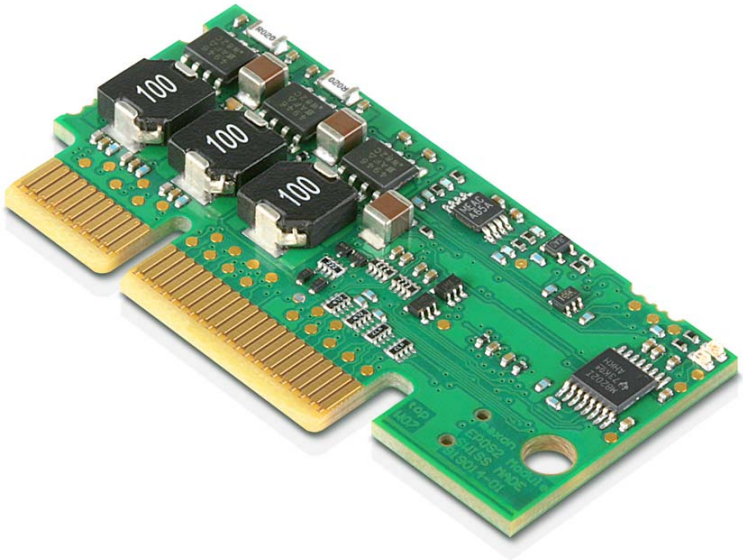
EPOS2 Module 36/2

Positioning Controller

Hardware Reference



epos.maxonmotor.com

Document ID: rel7050

PLEASE READ THIS FIRST

These instructions are intended for qualified technical personnel. Prior commencing with any activities …

- *you must carefully read and understand this manual and*
- *you must follow the instructions given therein.*

We have tried to provide you with all information necessary to install and commission the equipment in a **secure**, **safe** and **time-saving** manner. Our main focus is …

- to familiarize you with all relevant technical aspects,
- to let you know the easiest way of doing,
- to alert you of any possibly dangerous situation you might encounter or that you might cause if you do not follow the description,
- to **write as little** and to **say as much** as possible and
- not to bore you with things you already know.

Likewise, we tried to skip repetitive information! Thus, you will find things **mentioned just once**. If, for example, an earlier mentioned action fits other occasions you then will be directed to that text passage with a respective reference.

Follow any stated reference – observe respective information – then go back and continue with the task!

PREREQUISITES FOR PERMISSION TO COMMENCE INSTALLATION

The EPOS2 Module 36/2 is considered as partly completed machinery according to EU directive 2006/42/EC, Article 2, Clause (g) and therefore **is intended to be incorporated into or assembled with other machinery or other partly completed machinery or equipment**.

You must not put the device into service, …

- *unless you have made completely sure that the other machinery – the surrounding system the device is intended to be incorporated to – fully complies with the requirements stated in EU directive 2006/42/EC!*
- *unless the surrounding system fulfills all relevant health and safety aspects!*
- *unless all respective interfaces have been established and fulfill the stated requirements!*

TABLE OF CONTENTS

1 About this Document

1.1 Intended Purpose

The purpose of the present document is to familiarize you with the described equipment and the tasks on safe and adequate installation and/or commissioning.

Observing the described instructions in this document will help you …

- to avoid dangerous situations,
- to keep installation and/or commissioning time at a minimum and
- to increase reliability and service life of the described equipment.

Use for other and/or additional purposes is not permitted. maxon motor, the manufacturer of the equipment described, does not assume any liability for loss or damage that may arise from any other and/or additional use than the intended purpose.

1.2 Target Audience

This document is meant for trained and skilled personnel working with the equipment described. It conveys information on how to understand and fulfill the respective work and duties.

This document is a reference book. It does require particular knowledge and expertise specific to the equipment described.

1.3 How to use

Take note of the following notations and codes which will be used throughout the document.

Notation	Explanation
(n)	referring to an item (such as order number, list item, etc.)
➔	denotes “see”, “see also”, “take note of” or “go to”

Table 1-1 Notations used in this Document

1.4 Symbols and Signs

In the course of the present document, the following symbols and sings will be used.

Type	Symbol	Meaning	
Safety Alert	 (typical)	DANGER	Indicates an **imminent hazardous situation**. If not avoided, it **will result in death or serious injury**.
		WARNING	Indicates a **potential hazardous situation**. If not avoided, it **can result in death or serious injury**.
		CAUTION	Indicates a **probable hazardous situation** or calls the attention to unsafe practices. If not avoided, it **may result in injury**.
Prohibited Action	 (typical)	Indicates a dangerous action. Hence, **you must not**!	
Mandatory Action	 (typical)	Indicates a mandatory action. Hence, **you must**!	
Information		Requirement / Note / Remark	Indicates an activity you must perform prior continuing, or gives information on a particular item you need to observe.
		Best Practice	Indicates an advice or recommendation on the easiest and best way to further proceed.
		Material Damage	Indicates information particular to possible damage of the equipment.

Table 1-2 Symbols & Signs

1.5 Trademarks and Brand Names

For easier legibility, registered brand names are listed below and will not be further tagged with their respective trademark. It must be understood that the brands (the below list is not necessarily concluding) are protected by copyright and/or other intellectual property rights even if their legal trademarks are omitted in the later course of this document.

The brand name(s) …	… is/are a registered trademark(s) of …
Adobe® Reader®	© Adobe Systems Incorporated, USA-San Jose, CA
OMNI-BLOK® SMD NANO2®	© Littelfuse, USA-Chicago, IL
Pentium®	© Intel Corporation, USA-Santa Clara, CA
Windows®	© Microsoft Corporation, USA-Redmond, WA

Table 1-3 Brand Names and Trademark Owners

1.6 Copyright

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www.maxonmotor.com

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2 Introduction

The present document provides you with information on the EPOS2 Module 36/2 Positioning Controller's hardware. It contains…

- performance data and specifications,
- information on connections and pin assignment and
- wiring examples.

maxon motor control's EPOS2 Module 36/2 is a small-sized, full digital, smart motion controller. It is designated for the use as plug-in module in customer-specific motherboards for single axis or multi axes motion control systems. Due to its flexible and high efficient power stage, the EPOS2 Module 36/2 drives brushed DC motors with digital encoder as well as brushless EC motors with digital Hall sensors and encoder.

The sinusoidal current commutation by space vector control offers the possibility to drive brushless EC motors with minimal torque ripple and low noise. The integrated position, velocity and current control functionality allows sophisticated positioning applications. The EPOS2 Module 36/2 is especially designed being commanded and controlled as a slave node in a CANopen network. In addition, the unit can be operated via any USB (external transceiver necessary) or RS232 interface.

Find the latest edition of the present document, as well as additional documentation and software to the EPOS2 Module 36/2 Positioning Controller also on the Internet: ➔www.maxonmotor.com

2.1 Documentation Structure

The present document is part of a documentation set. Please find below an overview on the documentation hierarchy and the interrelationship of its individual parts:

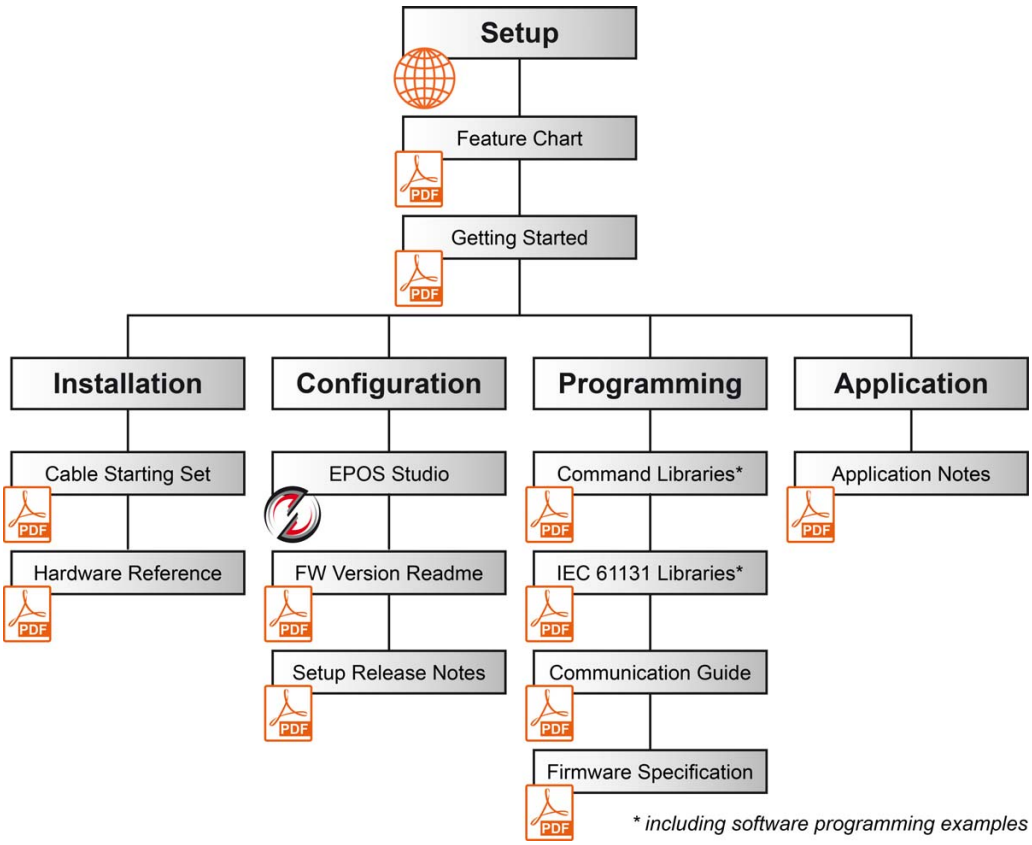

Figure 2-1 Documentation Structure

2.2 Safety Precautions

Prior continuing …

- make sure you have read and understood chapter " PLEASE READ THIS FIRST" on page A-2,
- do not engage with any work unless you possess the stated skills (➔chapter "1.2 Target Audience" on page 1-5),
- refer to chapter "1.4 Symbols and Signs" on page 1-6 to understand the subsequently used indicators,
- you must observe any regulation applicable in the country and/or at the site of implementation with regard to health and safety/accident prevention and/or environmental protection,
- take note of the subsequently used indicators and follow them at all times.

DANGER

High Voltage and/or Electrical Shock
Touching live wires causes death or serious injuries!
- *Consider any power cable as connected to live power, unless having proven the opposite!*
- *Make sure that neither end of cable is connected to live power!*
- *Make sure that power source cannot be engaged while work is in process!*
- *Obey lock-out/tag-out procedures!*
- *Make sure to securely lock any power engaging equipment against unintentional engagement and tag with your name!*

Requirements
- *Make sure that all associated devices and components are installed according to local regulations.*
- *Be aware that, by principle, an electronic apparatus can not be considered fail-safe. Therefore, you must make sure that any machine/apparatus has been fitted with independent monitoring and safety equipment. If the machine/apparatus should break down, if it is operated incorrectly, if the control unit breaks down or if the cables break or get disconnected, etc., the complete drive system must return – and be kept – in a safe operating mode.*
- *Be aware that you are not entitled to perform any repair on components supplied by maxon motor.*

Best Practice
- *For initial operation, make sure that the motor is free running. If not the case, mechanically disconnect the motor from the load.*

Maximal permitted Supply Voltage
- *Make sure that supply power is between 11…36 VDC.*
- *Supply voltages above 40 VDC will destroy the unit.*
- *Wrong polarity will destroy the unit.*

Electrostatic Sensitive Device (ESD)
- *Make sure to wear working cloth in compliance with ESD.*
- *Handle device with extra care.*

Hot plugging the USB interface may cause hardware damage
If the USB interface is being hot-plugged (connecting while the power supply is on), the possibly high potential differences of the two power supplies of controller and PC/Notebook can lead to damaged hardware.
- *Avoid potential differences between the power supply of controller and PC/Notebook or, if possible, balance them.*
- *Insert the USB connector first, then switch on the power supply of the controller.*

3 Technical Data

3.1 Electrical Data

Rating	
Nominal power supply voltage V_{CC}	11…36 VDC
Nominal logic supply voltage V_C (optional)	11…36 VDC
Absolute minimum supply voltage	10 VDC
Absolute max. supply voltage	40 VDC
Max. output voltage	0.9 • V_{CC}
Max. output current I_{max} (<1sec)	4 A
Continuous output current I_{cont}	2 A
Switching frequency	50 kHz
Max. efficiency	93%
Sample rate PI – current controller	10 kHz
Sample rate PI – speed controller	1 kHz
Sample rate PID – positioning controller	1 kHz
Max. speed @ sinusoidal commutation (motors with 1 pole pair)	25 000 rpm
Max. speed @ block commutation (motors with 1 pole pair)	100 000 rpm
Built-in motor choke per phase	10 µH / 2 A

Table 3-4 Electrical Data – Rating

Inputs	
Hall sensor signals	Hall sensor 1, Hall sensor 2 and Hall sensor 3 for Hall effect sensor ICs (Schmitt trigger with open collector output)
Encoder signals	A, A\, B, B\, I, I\ (max. 5 MHz) internal line receiver EIA RS422 Standard
Digital Input 1 (“General Purpose”)	+3…+36 VDC (Ri = 12 kΩ)
Digital Input 2 (“General Purpose”)	+3…+36 VDC (Ri = 12 kΩ)
Digital Input 3 (“General Purpose”)	+3…+36 VDC (Ri = 12 kΩ)
Digital Input 4 (“General Purpose”)	+3…+36 VDC (Ri = 12 kΩ)
Digital Input 7 (“High Speed Command”)	internal line receiver EIA RS422 Standard
Digital Input 8 (“High Speed Command”)	internal line receiver EIA RS422 Standard
Analog Input 1	resolution 11-bit 0…+5 V (Ri = 34 kΩ)
Analog Input 2	resolution 11-bit 0…+5 V (Ri = 34 kΩ)
CAN ID (CAN identification)	ID 1…127 configurable by external wiring

Table 3-5 Electrical Data – Inputs

Outputs	
Digital Output 1 (“General Purpose”), open collector	max. 36 VDC (I_L <50 mA)
Digital Output 2 (“General Purpose”), open collector	max. 36 VDC (I_L <50 mA)
Digital Output 5 (“High Speed Command”), push-pull	max. 3.3 VDC (I_L <10 mA)

Table 3-6 Electrical Data – Outputs

Voltage Outputs	
Encoder supply voltage	+5 VDC (I_L <100 mA)
Hall sensors supply voltage	+5 VDC (I_L <30 mA)

Table 3-7 Electrical Data – Voltage Outputs

Motor Connections	
maxon EC motor	**maxon DC motor**
Motor winding 1	+ Motor
Motor winding 2	− Motor
Motor winding 3	

Table 3-8 Electrical Data – Motor Connections

Interfaces		
RS232	RxD; TxD	max. 115 200 bit/s
USB 2.0 / USB 3.0	external transceiver necessary	
CAN	CAN_H (high); CAN_L (low)	max.1 Mbit/s

Table 3-9 Electrical Data – Interfaces

Status Indicators	
Operation	green LED
Error	red LED

Table 3-10 Electrical Data – LEDs

Connections	
On board: Suitable plug: Suitable retainer:	Card edge connector PCI Express (PCIe) Connector 2x32 Pin vertical or horizontal, 1 mm pitch Tyco 2-1775801-1 (vertical) / Tyco 1761465-2 (horizontal) FCI 10018783-11111TLF (vertical) Meritec 983172-064-2MMF (horizontal) FCI PCI express retainer, blue, 10042618-002LF

Table 3-11 Electrical Data – Connections

3.2 Mechanical Data

Mechanical Data	
Weight	approx. 10 g
Dimensions (L x W x H)	54.5 x 28.2 x 9 mm
Mounting	pluggable card edge connector with optional PCB support brackets

Table 3-12 Mechanical Data

3.3 Dimensional Drawings

VERTICAL CONNECTOR

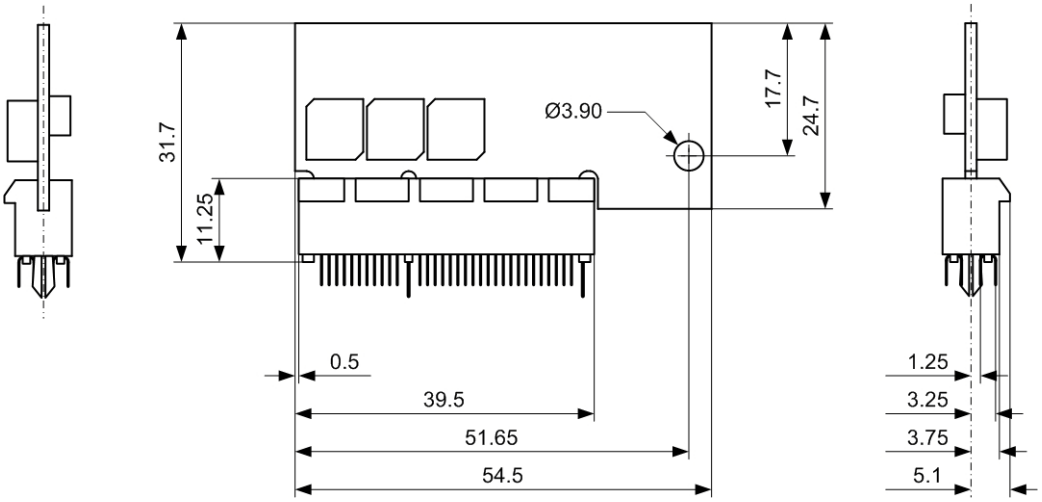

Figure 3-2 Dimensional Drawing (with vertical Connector) [mm]

HORIZONTAL CONNECTOR

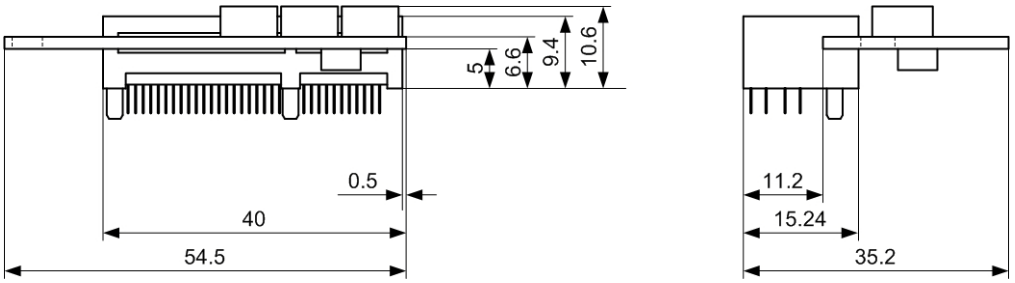

Figure 3-3 Dimensional Drawing (with horizontal connector Meritec 983172-064-2MMF) [mm]

RETAINER

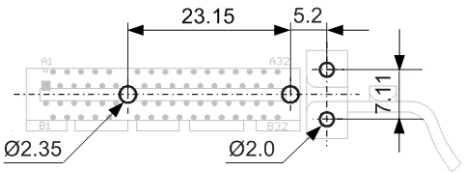

Figure 3-4 Footprint of Retainer (Meritec 983172-064-2MMF connector) [mm]

3.4 Environmental Conditions

Environmental Condition		
Temperature	Operation	−10…+45 °C
	Extended Range *1)	+45…+75 °C / Derating: ➔Figure 3-5
	Storage	−40…+85 °C
Altitude *2)	Operation	0…6'000 m MSL
	Extended Range *1)	6'000…10'000 m MSL / Derating: ➔Figure 3-5
Humidity		5…90% (condensation not permitted)

*1) Operation within the extended range (temperature and altitude) is permitted. However, a respective derating (declination of output current I_{cont}) as to the stated values will apply.
*2) Operating altitude in meters above Mean Sea Level, MSL.

Table 3-13 Environmental Conditions

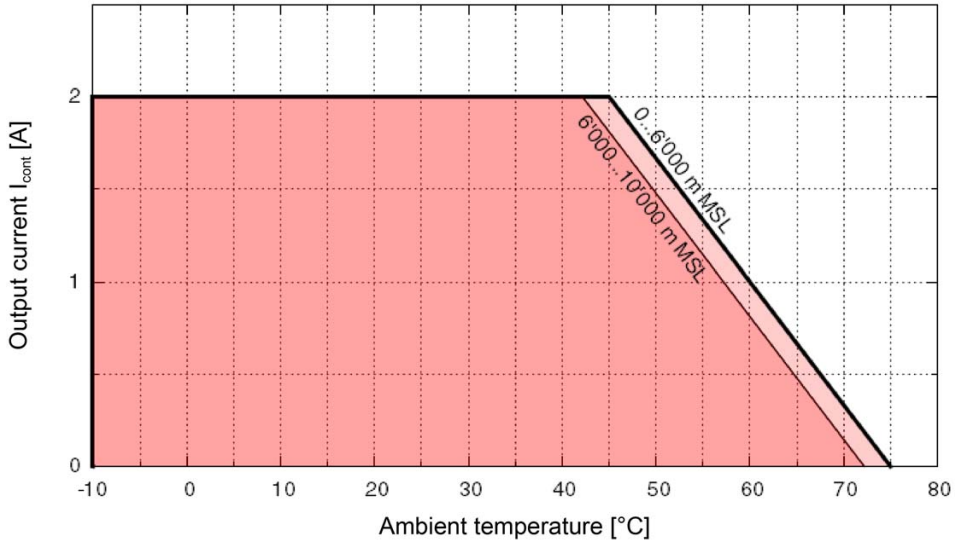

Figure 3-5 Derating Output Current

3.5 Order Details

Order Details	
EPOS2 Module 36/2	Order number 360665

Table 3-14 Order Details

Accessories	
EPOS2 Module Evaluation Board	Order number 361435
EPOS2 Module Starter Kit (including EPOS2 Module 36/2, EPOS2 Module Evaluation Board and necessary cables)	Order number 363407

Table 3-15 Accessories

Note
Accessories are not part of the delivery. You will need to order them separately.

3.6 Standards

The described device has been successfully tested for compliance with the below listed standards. In practical terms, only the complete system (the fully operational equipment comprising all individual components, such as motor, servo controller, power supply unit, EMC filter, cabling etc.) can undergo an EMC test to ensure interference-free operation.

Important Notice

The device's compliance with the mentioned standards does not imply its compliance within the final, ready to operate setup. In order to achieve compliance of your operational system, you must perform EMC testing of the involved equipment as a whole.

Electromagnetic Compatibility		
Generic Standards	IEC/EN 61000-6-2	Immunity for industrial environments
	IEC/EN 61000-6-3	Emission standard for residential, commercial and light-industrial environments
Applied Standards	IEC/EN 61000-6-3 IEC/EN 55022 (CISPR22)	Radio disturbance characteristics / radio interference
	IEC/EN 61000-4-3	Radiated, radio-frequency, electromagnetic field immunity test >10 V/m
	IEC/EN 61000-4-4	Electrical fast transient/burst immunity test ±1 kV/±2 kV
	IEC/EN 61000-4-6	Immunity to conducted disturbances, induced by radio-frequency fields 10 Vrms
	IEC/EN 61000-4-8	Power frequency magnetic field 30 A/m

Others		
Environmental Standards	IEC/EN 60068-2-6	Environmental testing – Test Fc: Vibration (sinusoidal, 10…500 Hz, 20 m/s^2)
	MIL-STD-810F	Random transport (10…500 Hz up to 1.05 g_{rms})
Safety Standards	UL File Number E172472 or E92481; unassembled printed circuit board	
Reliability	MIL-HDBK-217F	Reliability prediction of electronic equipment Environment: Ground, benign Ambient temperature: 298 K (25 °C) Component stress: In accordance with circuit diagram and nominal power Mean Time Between Failures (MTBF): 610'435 hours

Table 3-16 Standards

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4 Connections

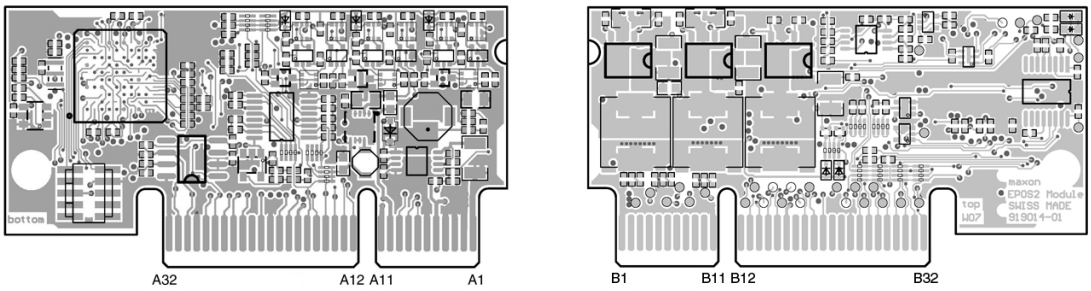

Figure 4-6 EPOS2 Module 36/2 – PCB with Connector Array

4.1 Pin Assignment

ARRAY A

Pin	Signal	Description
A1	Power_GND	Ground of supply voltage
A2	V_{CC}	Power supply voltage +0…+36 VDC
A3	V_{CC}	
A4	V_{CC}	
A5	V_C	Logic supply voltage 11…36 VDC (optional)
A6	Power_GND	Ground of supply voltage
A7	Hall sensor 1	Hall sensor 1 input
A8	Hall sensor 2	Hall sensor 2 input
A9	Hall sensor 3	Hall sensor 3 input
A10	$+V_{aux}$	Auxiliary voltage output +5 VDC
	$+V_{DDin}$	Auxiliary supply voltage input +5 VDC (optional)
A11	GND	Ground of Hall sensor supply and Ground of encoder supply
A12	Channel A	Encoder channel A
A13	Channel A\	Encoder channel A complement
A14	Channel B	Encoder channel B
A15	Channel B\	Encoder channel B complement
A16	Channel I	Encoder index
A17	Channel I\	Encoder index complement
A18	GND	Ground of analog inputs
A19	AnIN1	Analog Input 1
A20	AnIN2	Analog Input 2
A21	GND	Ground of digital output
A22	DigOUT5	Digital Output 5
A23	not connected	
A24	EPOS SCI RTS	Serial communication interface handshake *1)
A25	EPOS SCI RxD	Serial communication interface receive *1)
A26	EPOS SCI TxD	Serial communication interface transmit *1)
A27	EPOS RxD	EPOS RS232 receive *2)
A28	EPOS TxD	EPOS RS232 transmit *2)
A29	GND	Ground of SCI and RS232

Pin	Signal	Description
A30	CAN low	CAN low bus line
A31	CAN high	CAN high bus line
A32	GND	Ground of CAN bus

Note
**1) Voltage level "low" = 0V, "high" = 3.3V, connected directly to the DSP*
**2) EIA RS232 Standard*

Table 4-17 EPOS2 Module 36/2 – Pin Assignment Array A

ARRAY B

Pin	Signal	Description
B1	Power_GND	Ground of supply voltage
B2	**EC:** Motor winding 1 **DC:** Motor +	**EC motor:** Motor winding 1 **DC motor:** Motor +
B3	**EC:** Motor winding 1 **DC:** Motor +	
B4	**EC:** Motor winding 1 **DC:** Motor +	
B5	**EC:** Motor winding 2 **DC:** Motor −	**EC motor:** Motor winding 2 **DC motor:** Motor −
B6	**EC:** Motor winding 2 **DC:** Motor −	
B7	**EC:** Motor winding 2 **DC:** Motor −	
B8	**EC:** Motor winding 3 **DC:** not connected	**EC motor:** Motor winding 3 **DC motor:** not connected
B9	**EC:** Motor winding 3 **DC:** not connected	
B10	**EC:** Motor winding 3 **DC:** not connected	
B11	Power_GND	Ground of supply voltage
B12	GND	Ground of digital input
B13	DigIN1	Digital Input 1
B14	DigIN2	Digital Input 2
B15	DigIN3	Digital Input 3
B16	DigIN4	Digital Input 4
B17	GND	Ground of digital input
B18	DigIN7	Digital Input 7 "High Speed Command"
B19	DigIN7\	Digital Input 7 "High Speed Command" complement
B20	DigIN8	Digital Input 8 "High Speed Command"
B21	DigIN8\	Digital Input 8 "High Speed Command" complement
B22	DigOUT1	Digital Output 1
B23	DigOUT2	Digital Output 2
B24	GND	Ground of CAN ID setting
B25	CAN ID 1	CAN ID 1 (valence = 1)
B26	CAN ID 2	CAN ID 2 (valence = 2)

Pin	Signal	Description
B27	CAN ID 3	CAN ID 3 (valence = 4)
B28	CAN ID 4	CAN ID 4 (valence = 8)
B29	CAN ID 5	CAN ID 5 (valence = 16)
B30	CAN ID 6	CAN ID 6 (valence = 32)
B31	CAN ID 7	CAN ID 7 (valence = 64)
B32	Auto bit rate	Automatic bit rate detection of CAN bus

Table 4-18 EPOS2 Module 36/2 – Pin Assignment Array B

4.2 Minimum external Wiring

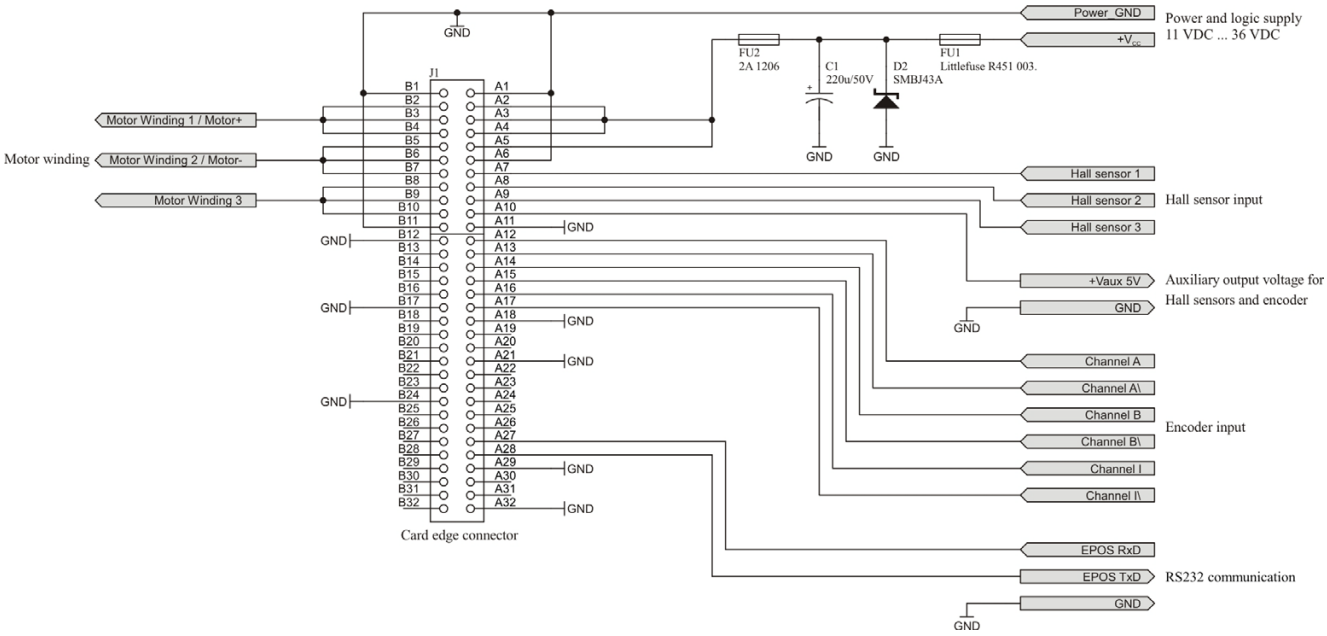

Figure 4-7 Minimum external Wiring

4.3 Power Supply

Best Practice
Keep the motor mechanically disconnected during setup and adjustment phase.

External Protection
Supply voltages above 40 VDC will destroy the unit.

To prevent damage to the EPOS2 Module 36/2, we recommend to install two upstream fuses – a transient voltage suppressor diode (TVS diode) and a capacitor in the power supply voltage line (for details ➔chapter "5.1.2 Power Supply Voltage" on page 5-37).

4.3.1 Determination of Power Supply

Basically, any power supply may be used, provided it meets below stated minimal requirements.

Power Supply Requirements	
Output voltage	V_{CC} min. 11 VDC; V_{CC} max. 36 VDC
Absolute output voltage	min. 0 V (V_{CC} below 11 V is only possible with separate logic supply voltage!) / max. 40 VDC
Output current	Depending on load (continuous max. 2 A / acceleration, short-time max. 4 A <1 s)

1) Calculate required voltage under load using following scheme (the formula takes a max. PWM cycle of 90% and a max. voltage drop of −1 V at EPOS2 Module 36/2 into account):

KNOWN VALUES:

- Operating torque M_B [mNm]
- Operating speed n_B [min⁻¹]
- Nominal motor voltage U_N [Volt]
- Motor no-load speed at U_N, n_0 [min⁻¹]
- Speed/torque gradient of the motor $\Delta n/\Delta M$ [min⁻¹ mNm⁻¹]

SOUGHT VALUE:

- Supply voltage V_{CC} [Volt]

SOLUTION:

$$V_{CC} = \frac{U_N}{n_O} \cdot \left(n_B + \frac{\Delta n}{\Delta M} \cdot M_B \right) \cdot \frac{1}{0.9} + 1[V]$$

2) Choose power supply capable as to above calculation. Thereby consider:
   a) During braking of the load, the power supply must be capable of buffering the fed back energy, e.g. in a capacitor or shunt regulator (309687).
   b) When using an electronically stabilized power supply, observe that the overcurrent protection must not be activated in any operating state.

Pin	Signal	Description
A1/6 B1/11	Power_Gnd	Ground of supply voltage
A2/3/4	V_{CC}	Power supply voltage +11…+36 VDC

Limited Current Rating per Pin
Due to the limited current rating per pin (1.1 A), you must connect all pins!

4.3.2 Use of separate Logic Supply (optional)

By default, the logic must be powered by (connected to) the regular supply voltage. Optionally, you may wish to feed the logic supply voltage separately, permitting a safe and economical power backup feature. For connection ➔chapter “4.2 Minimum external Wiring” on page 4-19).

External Protection

Supply voltages above 40 VDC will destroy the unit.

To prevent damage to the EPOS2 Module 36/2, we recommend to install two upstream fuses – a transient voltage suppressor diode (TVS diode) and a capacitor in the power supply voltage line (for details ➔chapter “5.1.2 Power Supply Voltage” on page 5-37).

Basically, any power supply may be used, provided it meets below stated minimal requirements.

Logic Power Supply Requirements	
Output voltage	V_C min. 11 VDC; V_C max. 36 VDC
Absolute output voltage	min. 9 VDC; max. 40 VDC
Min. output power	P_C min. 3 W

Pin	Signal	Description
A1/6 B1/11	Power_Gnd	Ground of supply voltage
A5	V_C	Logic supply voltage +11…+36 VDC

4.3.3 Low Supply Voltage Operation (optional)

For low voltage applications, you may supply the power stage separately with voltages lower than +11V.

APPLICATION EXAMPLE:

Operation with a Li-Ion battery 3.6 V:

- Power supply voltage direct via accumulator.
- An external step-up converter produces 5 V for logic supply voltage.

The low supply voltage operation for logic and power supply is possible, as long as the following conditions are met (for further details ➔chapter “5.3.4 Wiring Example: Low Supply Voltage Operation” on page 5-44):

- Supply the logic part via $+V_{DDin}$ (pin A10). The voltage range must be 4.75…5.25 V.
- Supply the power part via V_{CC} (pins A2, A3 and A4). The voltage range must be 0…40 V.
- Deactivate undervoltage control using «EPOS Studio». Do so by opening the Object Dictionary and set the object with Index 0x2008 (Miscellaneous Configuration) to 32 (decimal format).

Best Practice

We strongly recommend to use separate voltage supplies for logic part and power part.

- *Using a common supply, it will be very difficult to maintain the logic voltage range condition (4.75…5.25 V).*
- *Voltage drops during acceleration, as well as the fed back energy during breaking may cause significant voltage variations on the power supply voltage.*

Following requirements must be met:

Supply Voltage Requirements	
Output voltage	V_{DD} +5 VDC
Absolute output voltage	min. 4.75 VDC; max. 5.25 VDC

Power Supply Requirements	
Output voltage	V_{CC} min. 0 VDC; max. 36 VDC
Absolute output voltage	min. 0 V / max. 40 VDC

Pin	Signal	Description
A1/6 B1/11	Power_Gnd	Ground of supply voltage
A2/3/4	V_{CC}	Power supply voltage 0…+36 VDC
A10	$+V_{DD}$	+5 V voltage supply

Limited Current Rating per Pin
Due to the limited current rating per pin (1.1 A), you must connect all pins!

4.4 Motor Connection

Limited Current Rating per Pin
Due to the limited current rating per pin (1.1 A), you must connect all pins!

4.4.1 maxon EC motor (brushless)

Pin	Signal	Description
B2/3/4	Motor winding 1	EC motor: Winding 1
B5/6/7	Motor winding 2	EC motor: Winding 2
B8/9/10	Motor winding 3	EC motor: Winding 3

4.4.2 maxon DC motor (brushed)

Pin	Signal	Description
B2/3/4	Motor (+M)	DC motor: Motor +
B5/6/7	Motor (−M)	DC motor: Motor −

4.5 Hall Sensor Connection

Hall sensors are required to detect the rotor position of maxon EC motors (brushless).

Suitable Hall effect sensors IC use «Schmitt trigger» with open collector output.

Hall sensor supply voltage	+5 VDC
Max. Hall sensor supply current	30 mA
Input voltage	0…+24 VDC
Logic 0	typical <0.8 VDC
Logic 1	typical >2.4 VDC
Internal pull-up resistor	2.7 kΩ (against +5 VDC)

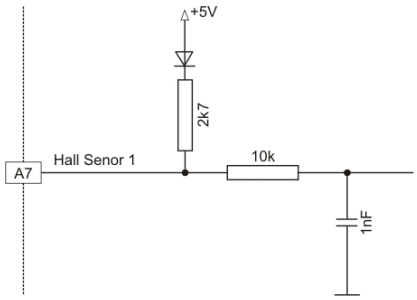

Figure 4-8 Hall Sensor Input Circuit

Pin	Signal	Description
A7	Hall sensor 1	Hall sensor 1 Input
A8	Hall sensor 2	Hall sensor 2 Input
A9	Hall sensor 3	Hall sensor 3 Input
A10	$+V_{aux}$	Auxiliary output voltage for Hall sensors and encoder +5 VDC
A11	GND	Ground of Hall sensor/encoder supply

4.6 Encoder Connection

Best Practice
The use of encoder with built-in line driver is mandatory.
Even though 2-channel will do, we strongly recommend to use only 3-channel versions!

By default, the controller is set for a 500 count per turn encoder. For other encoders, you will need to adjust respective settings via software.

Encoder supply voltage	+5 VDC
Max. encoder supply current	100 mA
Min. differential Input voltage	± 200 mV
Line receiver (internal)	EIA RS422 Standard
Max. encoder input frequency	5 MHz

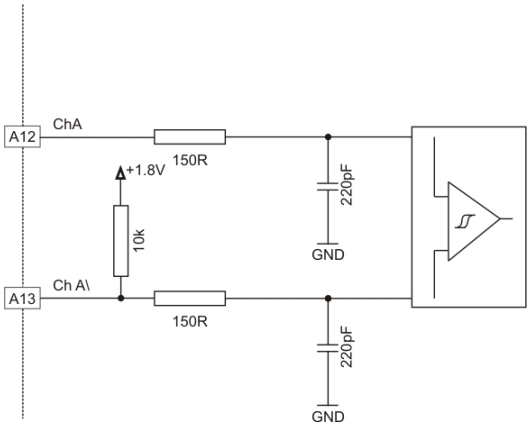

Figure 4-9 Encoder Input Circuit

Pin	Signal	Description
A10	$+V_{aux}$	Auxiliary output voltage for Hall sensors and encoder +5 VDC
A11	GND	Ground of Hall sensor/encoder supply
A12	Channel A	Channel A
A13	Channel A\	Channel A complement
A14	Channel B	Channel B
A15	Channel B\	Channel B complement
A16	Channel I	Index
A17	Channel I\	Index complement

4.7 Digital Input Connection

Contains four smart multi-purpose digital inputs configurable as “Positive Limit Switch”, “Negative Limit Switch”, “Home Switch” and “General Purpose”.

Additionally offered are two “High Speed Command” inputs.

4.7.1 Digital Inputs 1, 2, 3 and 4

By default, the digital input is defined as “General Purpose” and may be configured via software.

DigIN1 “General Purpose” DigIN2 “Home Switch” DigIN3 “Positive Limit Switch” DigIN4 “Negative Limit Switch” GND	Pin [B13] Pin [B14] Pin [B15] Pin [B16] Pin [B12]
Type of input	single-ended
Input voltage	0…36 VDC
Max. input voltage	±36 VDC
Logic 0	U_{in} <0.8 VDC
Logic 1	U_{in} >2.0 VDC
Input resistance	typical 22 kΩ (<3.3 V) typical 18 kΩ (@ 5 V) typical 12 kΩ (@ 24 V)
Input current at logic 1	typical 270 µA @ 5 VDC
Switching delay	<300 µs

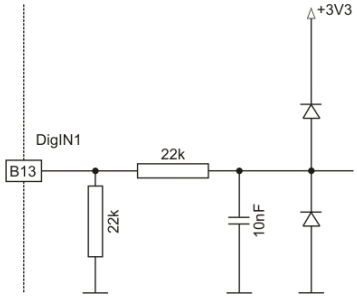

Figure 4-10 DigIN1 Circuit (analogously valid also for DigIN2…4)

For wiring examples ➔page 4-26.

Wiring Example: "Proximity Switch Type PNP 3-wire Model"

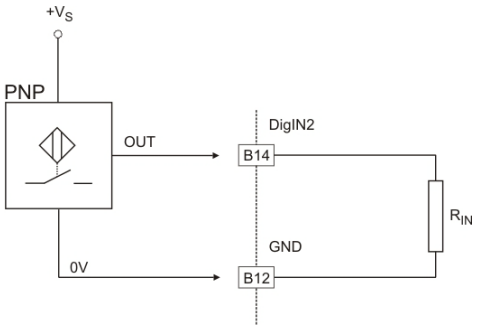

Figure 4-11 DigIN2 – Wiring Example for Type PNP Proximity Switch

Wiring Example: "Slotted optical Sensor"

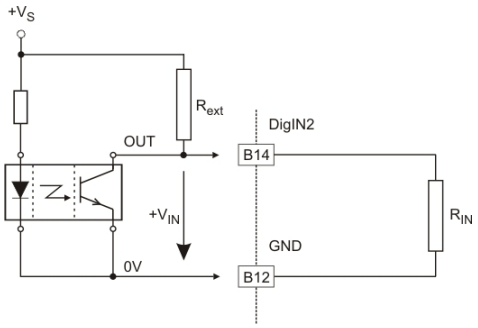

Figure 4-12 DigIN2 – Wiring Example for slotted optical Sensor

$$R_{ext} = \frac{R_{IN} \cdot (V_S - V_{IN})}{V_{IN}}$$

Note
Logic level threshold V_{IN} assumed to be 5 V.

4.7.2 Digital Inputs 7 and 8

The “High Speed Command” differential inputs are set by default and may be configured via software.

Differential	
DigIN7 “High Speed Command” DigIN8 “High Speed Command”	Pins [B18] / [B19] Pins [B20] / [B21]
Min. differential input voltage	±200 mV
Line receiver (internal)	EIA RS422 Standard
Max. input frequency	5 MHz

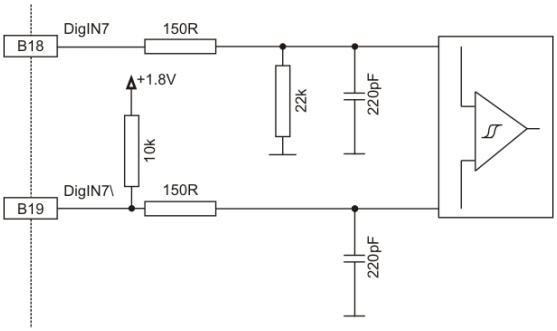

Figure 4-13 DigIN7 “Differential” Circuit (analogously valid also for DigIN8)

Single-ended	
DigIN7 “High Speed Command” DigIN8 “High Speed Command”	Pins [B18] Pins [B20]
Input voltage	0…5 VDC
Max. input voltage	−7.5…+12.5 VDC
Logic 0	<0.8 V
Logic 1	>2.0 V
Input resistance	typical 20 kΩ (referenced to D_GND)
Max. input frequency	2.5 MHz

Note

Do not *connect DigIN’s complements!*

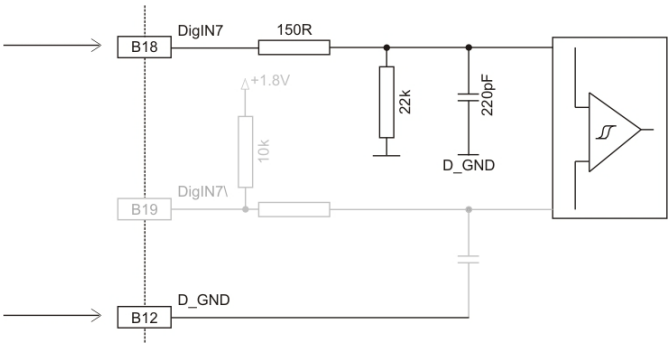

Figure 4-14 DigIN7 “Single-ended” Circuit (analogously valid also for DigIN8)

4.8 Analog Input Connection

4.8.1 Analog Inputs 1 and 2

By default, the analog inputs are defined as “General Purpose” and may be configured via software.

AnIN1 “General Purpose” AnIN2 “General Purpose” GND	Pin [A19] Pin [A20] Pin [A18]
Input voltage	0…5 VDC
Max. input voltage	0…10 VDC
Input resistance	typical 34 kΩ (referenced to GND)
Resolution	2.49 mV
Bandwidth	250 Hz

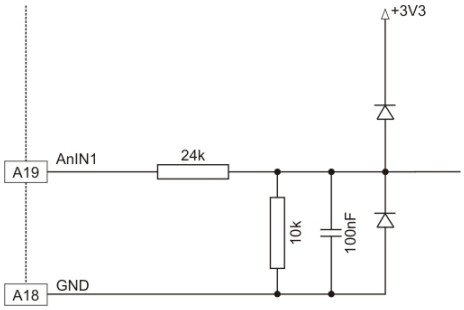

Figure 4-15 AnIN1 Circuit (analogously valid also for AnIN2)

4.9 Digital Output Connection

Contains two “General Purpose” open collector (5 V) and one “High speed” push-pull (3.3 V) digital outputs.

4.9.1 Digital Outputs 1 and 2

By default, the digital outputs are defined as “General Purpose” and may be configured via software.

DigOUT1 DigOUT2 GND	Pin [B22] Pin [B23] Pin [A21]
Circuit	Open collector (internal pull-up resistor 2k2 and diode to +5 VDC
Switching delay	<3 µs

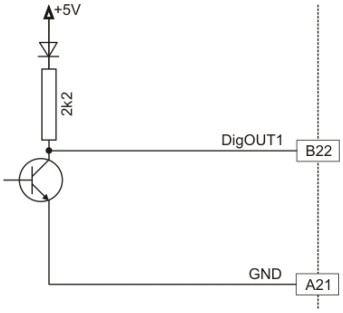

Figure 4-16 DigOUT1 Circuit (analogously valid also for DigOUT2)

DigOUT “Sinks”	
Max. input voltage	+36 VDC
Max. load current	50 mA
Max. voltage drop	<1.0 V @ 50 mA

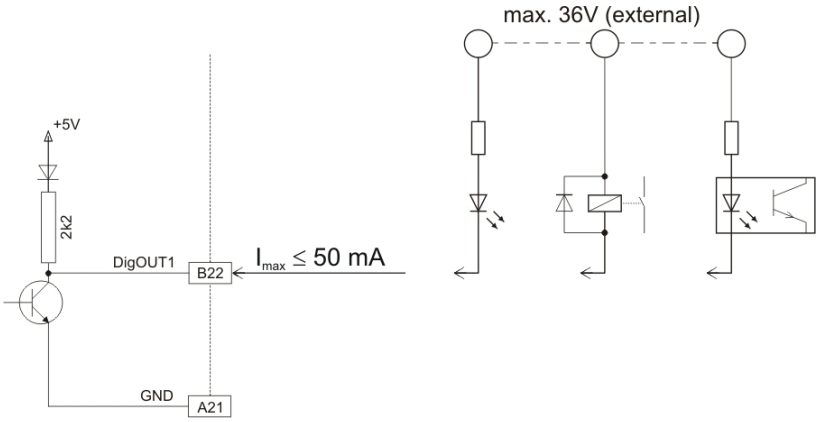

Figure 4-17 DigOUT1 “Sinks” Circuit (analogously valid also for DigOUT2)

DigOUT "Source"	
Output voltage	$U_{out} \approx 5\ V - 0.75\ V - (I_{load} \times 2200\ \Omega)$
Max. load current	$I_{load} \leq 2\ mA$

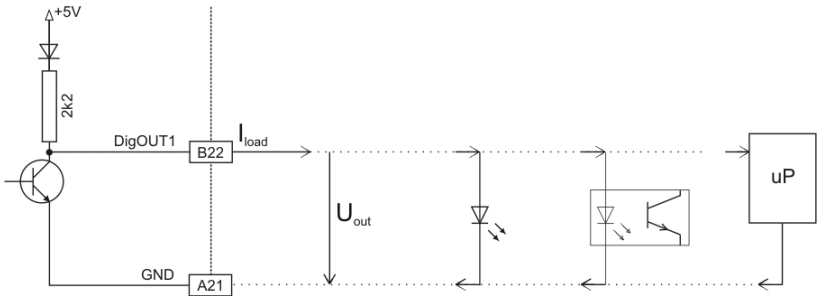

Figure 4-18 DigOUT1 "Source" Circuit (analogously valid also for DigOUT2)

4.9.2 Digital Output 5

The digital output is defined as “High Speed” and may be configured via software.

DigOUT5 GND	Pin [A22] Pin [A21]
Circuit	Push-pull stage
Switching delay	<10 ns

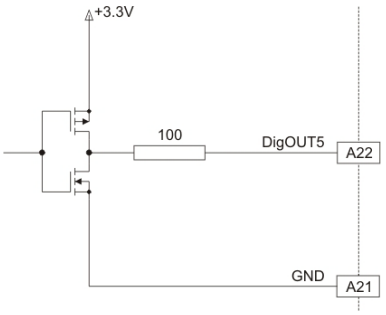

Figure 4-19 DigOUT5 Circuit

DigOUT “Sinks”	
Max. input voltage	U_{in} ≤3.3 VDC
Max. load current	I_{max} ≤24 mA
Max. voltage drop	U_{drop} <0.55 V + (I_{max} x 100 Ω)

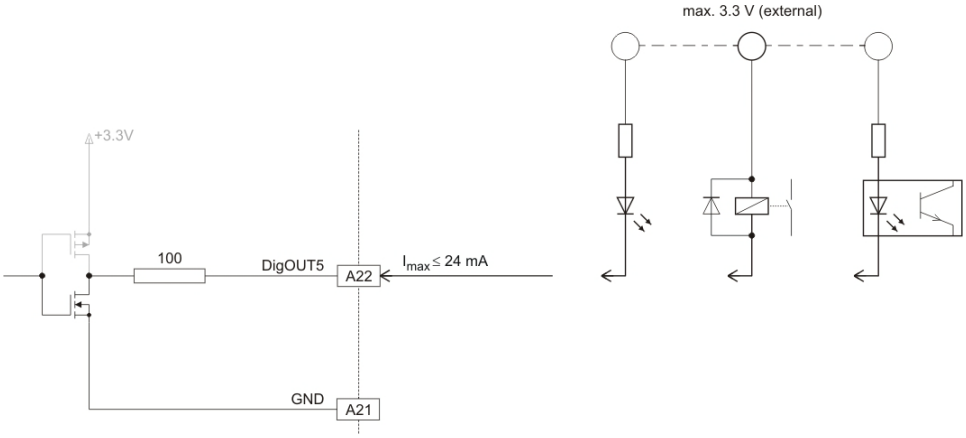

Figure 4-20 DigOUT5 “Sinks” Circuit

DigOUT “Source”	
Output voltage	$U_{out} \approx 3.3\ V - 0.75\ V - (I_{load} \times 100\ \Omega)$
Max. load current	$I_{load} \leq 24\ mA$

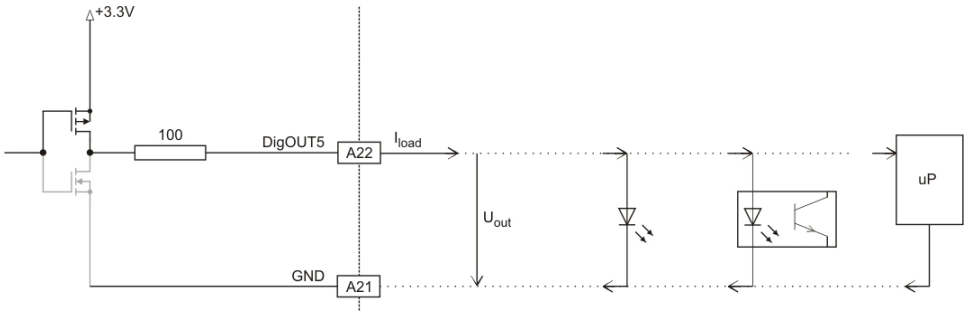

Figure 4-21 DigOUT5 “Source” Circuit

4.10 RS232 Connection

The EPOS2 Module 36/2 can be configured via RS232 communication port. The software «EPOS Studio» provides a graphical user interface to setup all features via the PC’s serial port.

Max. input voltage	±30 V
Output voltage	typical ±9 V @ 3 kΩ to Ground
Max. bit rate	115 200 bit/s
Internal RS232 driver/receiver	EIA RS232 Standard

Note

- *Consider your PC's serial port maximal baud rate.*
- *The standard baud rate setting (factory setting) is 115'200 bauds.*

Connection of Positioning Controller to PC

EPOS2 Module 36/2	PC Interface (RS232), DIN41652
Pin [A27] “EPOS RxD”	Pin 3 “PC TxD”
Pin [A28] “EPOS TxD”	Pin 2 “PC RxD”
Pin [A29] “GND”	Pin 5 “GND”

4.11 SCI Interface Connection

The serial communications interface (SCI) is a two-wire asynchronous serial port, commonly known as a UART. The SCI modules support digital communication between the CPU and other asynchronous peripherals that use the standard non-return-to-zero (NRZ) format.

As a common application for EPOS2 Module 36/2's SCI interface, it can be wired to an USB-to-UART converter to built an USB interface. For further details ➔chapter "5.1.6 USB" on page 5-40.

Max. input voltage	3.3 VDC
High-level input voltage	>2.0 VDC
Low-level input voltage	<0.8 VDC
High-level output voltage	>2.4 VDC
Low-level output voltage	<0.4 VDC
Bit rate	1 Mbit/s
Data format	NRZ (non-return-to-zero)

Pin	Signal	Description
A24	DSP_RTS2	Serial communication interface handshake
A25	DSP_RxD2	Serial communication interface receive
A26	DSP_TxD2	Serial communication interface transmit
A29	GND	Ground

4.12 CAN Connection

The EPOS2 Module 36/2 is specially designed being commanded and controlled via a Controller Area Network (CAN), an highly efficient data bus, very common in all fields of automation and motion control.

The EPOS2 Module 36/2 is preferably used as a slave node in the CANopen network.

Standard	ISO 11898-2:2003
Max. bit rate	1 Mbit/s
Max. number of CAN nodes	127
Protocol	CANopen DS-301 V4.02
Identifier setting	by external wiring or software

Pin	Signal	Description
A30	CAN_L	CAN low bus line
A31	CAN_H	CAN high bus line
A32	GND	Ground

Note

- *Consider CAN Master's maximal baud rate.*
- *The standard baud rate setting (factory setting) is "Auto Bit Rate".*
- *Use 120 Ω termination resistor at both ends of the CAN bus.*
- *For detailed CAN information ➔separate document «EPOS2 Communication Guide».*

4.13 CAN Configuration

4.13.1 CAN ID (Node Address)

The CAN ID is set with input lines CAN ID1…CAN ID7. Addresses (1…127) may be coded using binary code.

Logic 1	typical <0.8 VDC
Logic 0	typical >2.4 VDC
Internal pull-up resistor	4.7 kΩ (against +3.3 VDC)

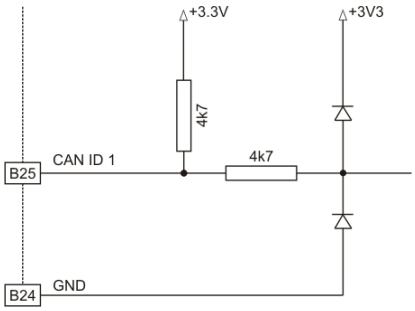

Figure 4-22 CAN ID Input Circuit

Pin	Signal	Description	Binary Code	Valence
B24	GND	Ground for CAN ID settings	–	–
B25	CANID1	CAN ID 1	2^0	1
B26	CANID2	CAN ID 2	2^1	2
B27	CANID3	CAN ID 3	2^2	4
B28	CANID4	CAN ID 4	2^3	8
B29	CANID5	CAN ID 5	2^4	16
B30	CANID6	CAN ID 6	2^5	32
B31	CANID7	CAN ID 7	2^6	64

Table 4-19 CAN ID – Binary Code Values

The set CAN ID (node address) can be observed by adding the valences of all inputs connected externally to GND.

EXAMPLES:

Use following table as a (non-concluding) guide:

CAN ID/Switch	1	2	3	4	5	6	7	
Valence	1	2	4	8	16	32	64	
CAN ID								**Calculation**
1	1*	0**	0	0	0	0	0	1
2	0	1	0	0	0	0	0	2
32	0	0	0	0	0	1	0	32
35	1	1	0	0	0	1	0	1 + 2 + 32
127	1	1	1	1	1	1	1	1 + 2 + 4 + 8 + 16 + 32 + 64

Legend:
* 1 = CAN ID input line externally connected to GND
** 0 = CAN ID input line open or externally connected to +3.3 VDC

Table 4-20 CAN ID – Examples

Note

The Node ID set by software is valid, if CAN ID is set “0” (all CAN ID input lines open or externally connected to +3.3 VDC).

4.13.2 CAN automatic Bit Rate Detection

By using this function, the CANopen interface can be put in a “listen only” mode. For further details ➔separate document «EPOS2 Firmware Specification».

The automatic bit rate detection is activated when the input line is connected externally to GND.

Auto Bit Rate GND	Pin [B32] Pin [B24]
Logic 0	typical <0.8 VDC
Logic 1	typical >2.4 VDC
Internal pull-up resistor	4.7 kΩ (against +3.3 VDC)

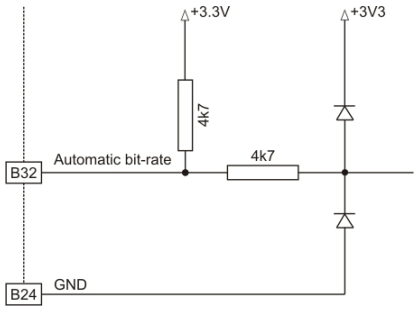

Figure 4-23 CAN automatic Bit Rate Detection Circuit

4.14 Status LEDs

The LEDs display the current status of the EPOS2 Module 36/2, as well as possible errors:

- Green LED shows the operating status
- Red LED indicates errors

For detailed information ➔separate document «EPOS2 Firmware Specification».

LED		Status / Error
Red	Green	
OFF	Slow	Power stage is disabled. Device is in status… • "Switch ON Disabled" • "Ready to Switch ON" • "Switched ON"
OFF	ON	Power stage is enabled. Device is in status… • "Operation Enable" • "Quick Stop Active"
ON	OFF	FAULT state. Device is in status… • "Fault"
ON	ON	Power stage is enabled. Device is in temporary status… • "Fault Reaction Active"
ON	Flash	No valid firmware or firmware download in progress.
Flash = Flashing (≈0.9 s OFF/≈0.1 s ON) Slow = Slow blinking (≈1 Hz)		

Table 4-21 LEDs – Interpretation of Condition

5 Motherboard Design Guide

The «Motherboard Design Guide» provides helpful information on the implementation of the EPOS2 Module 36/2 into an electronics board. It contains external component requirements, routing instructions, pin assignment, mechanical dimensions and wiring examples.

CAUTION

Hazardous
Incorrect Design can lead to serious injuries!

- *Do not further proceed if you are not familiar with electronic design!*
- *Designing an electronic board requires specific skills and must only be performed by experienced electronic engineers!*
- *This short guide must only be considered as a help and does not by itself lead to a working design!*

Get assistance:
If you are not familiar with electronic design, you might wish to seek assistance.
maxon motor ag's specialists will be glad to offer you a customized motherboard design that suits your particular application.

5.1 Requirements for external Components

For correct and save function of the EPOS2 Module 36/2, the following external components will be required. Function and key data of each component is noted and completed with examples.

5.1.1 Card Edge Connector

The EPOS2 Module 36/2 is designed to plug into a card edge connector that is mounted on an application-specific PCB. This connector must be a 2x32 way vertical or horizontal type with at rated current per pin of at least 1 A. In case of high vibration in your application, the EPOS2 Module 36/2 must be locked with an additional PCB retainer (for details and references ➔"Connections" on page 3-12.

5.1.2 Power Supply Voltage

Due to limited current rating of 1.1 A per pin, all pins of the power supply voltage V_{CC} must be connected. To protect the module from damage, two fuses – a transient voltage suppressor diode (TVS diode) and a capacitor in the power supply voltage line – are recommended.

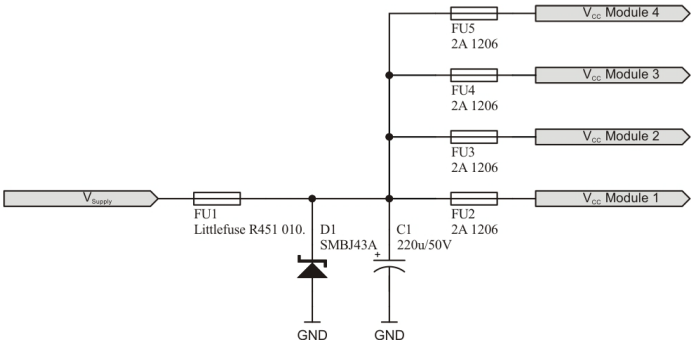

Figure 5-24 Recommended Protection for Power Supply

5.1.2.1 Capacitor C1

An external capacitor is not mandatory for the function of the module, but – during braking of the load – the power supply must be capable to buffer the fed back energy. Hence, connect an electrolytic capacitor to the power supply voltage. The capacity needed depends on the following items:

- Power supply voltage
- Speed at the beginning of the braking
- Total mass inertia
- Deceleration rate
- Number of modules

For recommended types (supplying one EPOS2 Module 36/2) ➔"Supplier Reference" on page 5-39.

5.1.2.2 Fuse FU1

Place a fuse at the power supply's entry to protect against reverse polarity. Together with the TVS diode, the fuse breaks an occurring reverse current. The continuous current of the fuse depends on the number of modules supplied and how much current each module needs. For recommended types ➔"Supplier Reference" on page 5-39.

5.1.2.3 Fuse FU2

For protection against short circuit of the motor winding connections, it is recommended to place additionally one fuse per module. The fuse must withstand 2 A continuously and 4 A during 5 seconds with a typical melt I^2t smaller than 0.05 A^2s. For recommended types ➔"Supplier Reference" on page 5-39.

5.1.2.4 TVS Diode D1

To protect against overvoltage due to supply transients or the braking energy, connect a transient voltage suppressor diode to the power supply voltage. For recommended types ➔"Supplier Reference" on page 5-39.

5.1.3 Logic Supply Voltage

The EPOS2 Module 36/2 features a logic supply voltage input and a $+V_{aux}$ output. The logic supply voltage input has a voltage range of 9…40 V and can be sourced separately or by the power supply voltage (➔chapter "4.2 Minimum external Wiring" on page 4-19).

- If the logic supply voltage is sourced, the $+V_{aux}$ can be used as +5 VDC supply output for Hall sensors and encoder.
- If the logic supply voltage is sourced separately, a transient voltage suppressor diode at the logic supply voltage input can be connected to protect the module against overvoltage. For references on the TVS diode ➔"Supplier Reference" on page 5-39.

5.1.4 Motor Phase

The EPOS2 Module 36/2 features a built-in choke of 10 µH per phase. For most motors and applications this will be sufficient. In case of high power supply voltage and for motors with very low inductance, the current ripple will become too high thus, requiring additional chokes on the motherboard.

The minimum inductance of each choke can be calculated as to below formula.

- If the result is negative, no additional chokes will be needed.
- If the result is positive, additional chokes will be required.
  The chokes must have an electromagnetic shield, high saturation current, low losses and a rated current higher than the continuous motor current. For recommended types ➔"Supplier Reference" on page 5-39.

$$L_{ext} = \frac{V_{cc}}{6 \cdot I_N \cdot f_{pwm}} - (L_{int} - (0.3 \cdot L_{mot}))$$

L_{ext} [H]	External inductance per phase
V_{cc} [V]	Power supply voltage
I_N [A]	Nominal motor current (consult maxon catalog for applicable data)
f_{pwm} [Hz]	PWM frequency = 50000 Hz
L_{int} [H]	EPOS2 Module 36/2's built-in inductance per phase = 10^{-5} H
L_{mot} [H]	Terminal inductance phase to phases of the motor

$L_{ext} \leq 0$	No additional motor choke necessary
$L_{ext} > 0$	Additional motor choke recommended

5.1.5 Supplier Reference

Recommended Components	
Capacitor C1	**Panasonic** (EEUFC1H221) C=220 uF / U_{DC}=50 V / I_{AC}=1030 mA @ 100kHz, low impedance / T=−55…105 °C **Rubicon** (50ZL220M10X16) C=220 uF / U_{DC}=50 V / I_{AC}=1370 mA @ 100kHz, low impedance / T=−55…105 °C
Fuse FU1	**Littelfuse**, 154 Series OMNI-BLOK fuse holder with SMD NANO2 fuse installed. – 3 A very fast-acting (154003) when employing 1 EPOS2 Module 36/2 – 5 A very fast-acting (154005) when employing 2 EPOS2 Module 36/2 – 10 A very fast-acting (154010) when employing 4 EPOS2 Module 36/2
Fuse FU2	**Bussmann**, 3216FF Series (3216FF-2A), fast-acting, 2 A **Wickmann**, SMD 0805 Series (FCD081200), quick-acting, 2 A
TVS diode D1	**Vishay** (SMBJ43A) **Diotec**(P6KE51A) U_R=43 V / U_{BR}=47.8…52.8 V @ 1 m A / U_C=69.4 V @ 8.6 A
Motor choke	**Würth Elektronik**, WE-PD-XXL (7447709101) L_N=100 µH / R_{DC}=100 mΩ / I_{DC}=2.5 A / I_{sat} = 3.1A, shielded

Table 5-22 Recommended Components

5.1.6 USB

5.1.6.1 General Requirements

USB offers an easy way to configure and command the EPOS2 Module 36/2. The module itself does not possess an USB interface, but an USB to UART converter placed on the motherboard can be wired to the module's SCI interface pins. It will be sufficient to place only one USB converter on the motherboard. The modules among themselves communicate via the CAN bus. For a schematic example of the USB to UART converter ➔ chapter "5.3.3 USB Interface" on page 5-43.

5.1.6.2 USB to UART Converter Configuration

1) Connect the USB cable to an USB port of a PC.
2) Install and start the «EPOS Studio» software.
   The provided USB driver supports only the USB to UART converter "FT232RQ" by FTDI. It must be configured with FTDI's utility software «MProg» before communication between «EPOS Studio» and the EPOS2 Module 36/2 will be available.
3) Download and install «D2XX drivers» from www.ftdichip.com – category «Drivers» / category «D2XX» / column «Comments» / link «setup executable».
4) Download and install «MProg» from www.ftdichip.com – category «Resources» / category «Utilities» / heading «MProg - EEPROM Programming Utility».
5) Connect FT232RQ with an USB cable to your computer. The FT232RQ will be powered via USB.
6) Start the software utility «MProg» and click in menu "Tools" / "Read and Parse". The default configuration will be read-out and displayed.
7) Change values as follows:

Name	Change from…	…to
USB VID/PID	FTDI Default	FTDI Supplied PID
Product ID	6001	A8B0
Manufacturer	FTDI	maxon motor ag
Description	FT232R USB UART	maxon motor EPOS2
Check box "Load D2XX driver"		ticked

Table 5-23 USB to UART Converter Configuration – Settings

8) Select menu "File" / "Save As…" and assign a name.
9) Select menu "Device" / "Program".
10) The "Programmed Serial Number: …" will now be displayed in the text box at the bottom. Leave this number unchanged.
11) Close «MProg» utility and disconnect the USB cable.

Now, the converter is configured and the communication between «EPOS Studio» and the EPOS2 Module 36/2 via USB is established.

5.2 Design Rules

Follow below rules to design your application-specific motherboard and to provide correct and save function of the EPOS2 Module 36/2.

Before continuing, make sure to consult the following sections:

- For **Pin Description** ➔chapter “4.1 Pin Assignment” on page 4-17.
- For **Performance Data** ➔chapter “3 Technical Data” on page 3-11 and ➔chapter “4.3.3 Low Supply Voltage Operation (optional)” on page 4-21.
- For **Dimensional Drawings** ➔chapter “3.3 Dimensional Drawings” on page 3-13.

5.2.1 Ground

The ground pins (GND) are internally connected, but each ground pin is assigned to a functional block. It is common practice to place a ground plane on the motherboard and will be required to connect pins A1, A6, B1 and B11 with thick tracks to the power supply voltage ground.The ground pins of each functional block are as follows:

Use Pin(s)…	…to connect this Functional Block to Ground:
A1/6 B1/11	Power supply voltage
A11	Encoder
A18	Analog inputs
A21 B12/17	Digital inputs and outputs
A29	USB and RS232
A32	CAN bus
B24	CAN ID settings

Table 5-24 Functional Blocks – Ground Connections

If ground safety earth is available, connect the ground plane over some parallel capacitors to the ground safety earth. We recommend the use of capacitors with 47 nF and 100 V.

5.2.2 Communication Interfaces

- For **RS232** ➔chapter “4.10 RS232 Connection” on page 4-32.
- For **CAN** ➔chapter “4.12 CAN Connection” on page 4-33.

5.2.3 I/Os

- For **Digital inputs** ➔chapter “4.7 Digital Input Connection” on page 4-25.
- For **Analog Inputs** ➔chapter “4.8 Analog Input Connection” on page 4-28.
- For **Digital Outputs** ➔chapter “4.9 Digital Output Connection” on page 4-29.

5.2.4 Layout

Follow these rules:

- Connect pins A2, A3 and A4 (power supply voltage V_{CC}) with a thick track to the fuse.
- Connect pins A1, A6, B1 and B11 (Power_GND) with thick tracks to the ground of supply voltage.
- Copper plating's width and thickness of traces for power supply voltage and motor winding depend on the maximum current expected in the application. We recommend a minimum width of 50 mil at a thickness of 35 µm.
- Route fast signal wire pairs (encoder, differential inputs, CAN, USB) close to the return wire in order to minimize the area of the loop enclosed by the corresponding current.

5.3 Schematic Examples

5.3.1 Minimum External Wiring

Logic supply is sourced by the power supply voltage. The EPOS2 Module 36/2 is configured by RS232. For details ➔chapter "4.2 Minimum external Wiring" on page 4-19.

5.3.2 Separate Logic Supply Voltage and CAN Communication

Power and logic supply voltage are sourced separately. The EPOS2 Module 36/2 is configured and commanded by CAN.

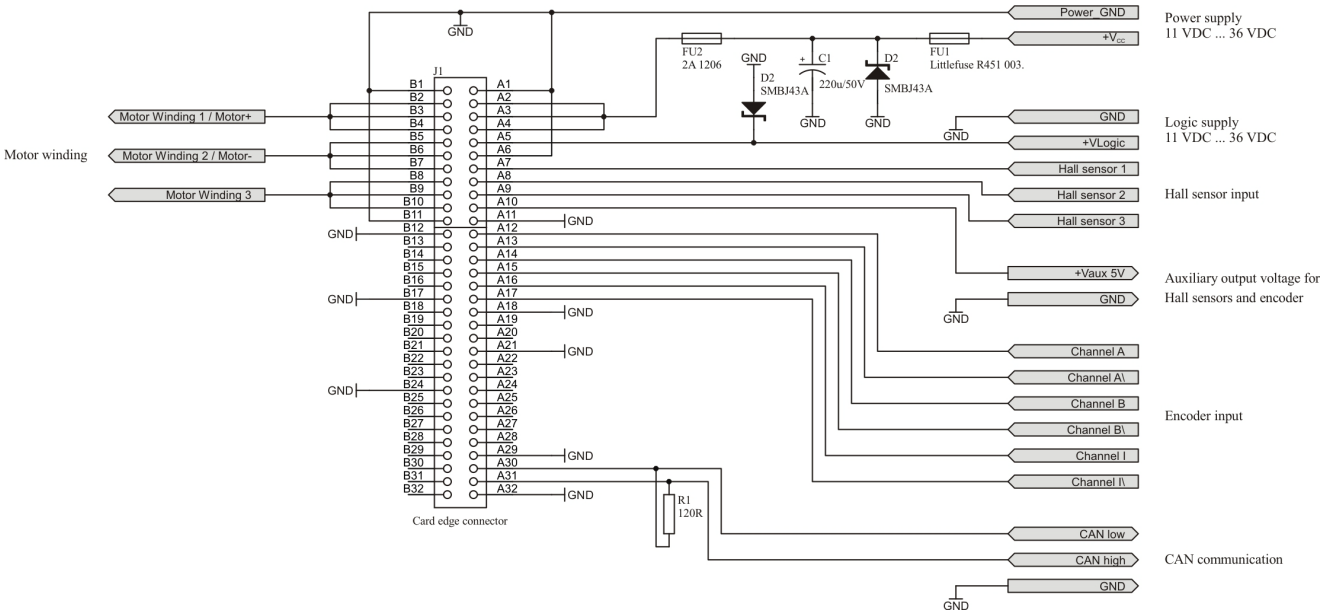

Figure 5-25 Separate Logic Supply Voltage and CAN Communication – Wiring Diagram

5.3.3 USB Interface

If an external USB to UART converter is connected to the EPOS SCI, the module can be configured and commanded by a PC through USB.

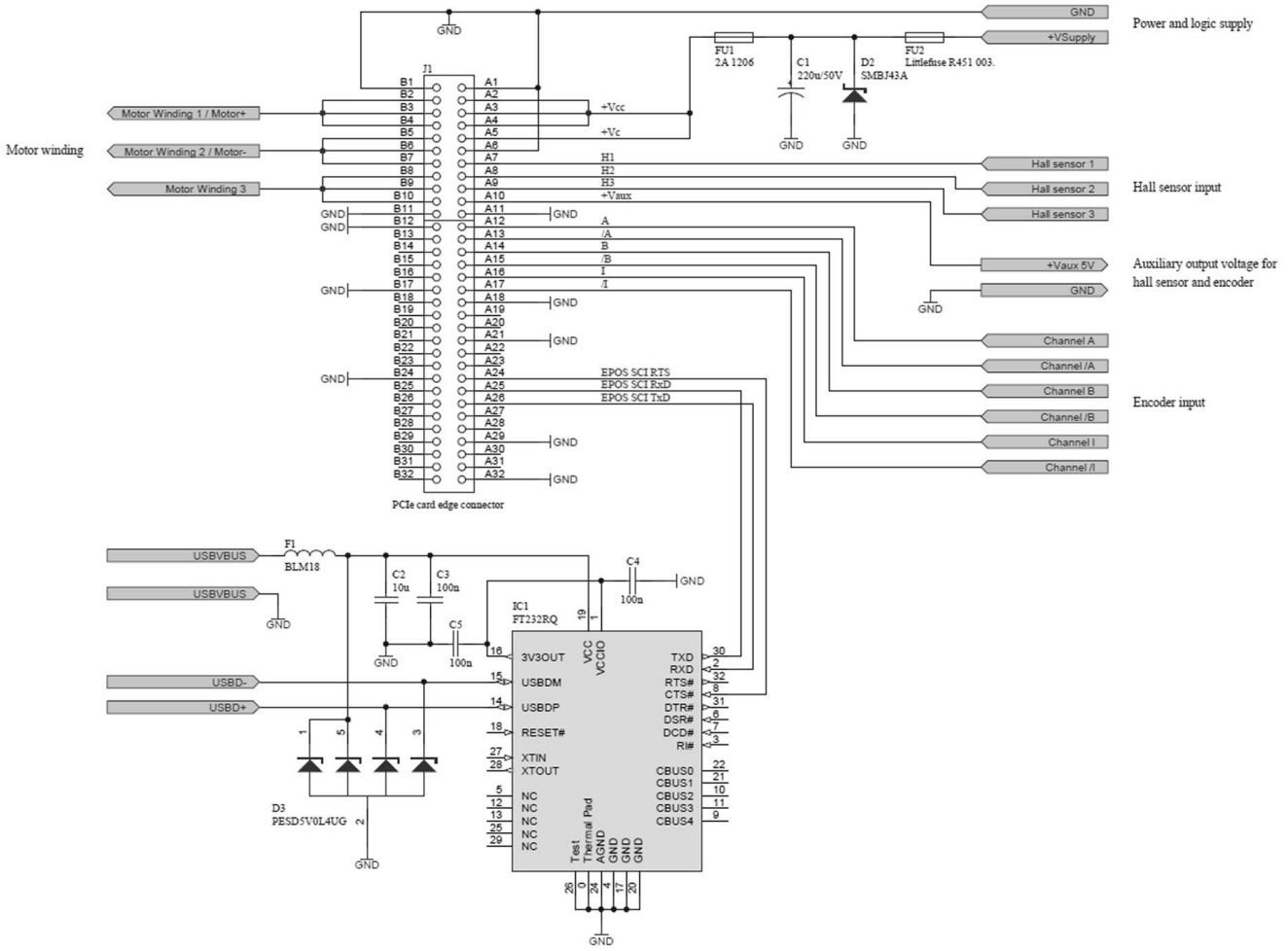

Figure 5-26 USB Interface – Wiring Diagram

5.3.4 Wiring Example: Low Supply Voltage Operation

The power stage is powered separately with a voltage between 0 and 36 VDC. The logic part must be supplied with +5 VDC connected to V_{DDin}. As a possibility, this voltage can be produced out of the power supply voltage by an appropriate voltage converter (step-up-converter or step-down-converter).

It is recommended to use this operation mode only with power supply voltages below 11 VDC.

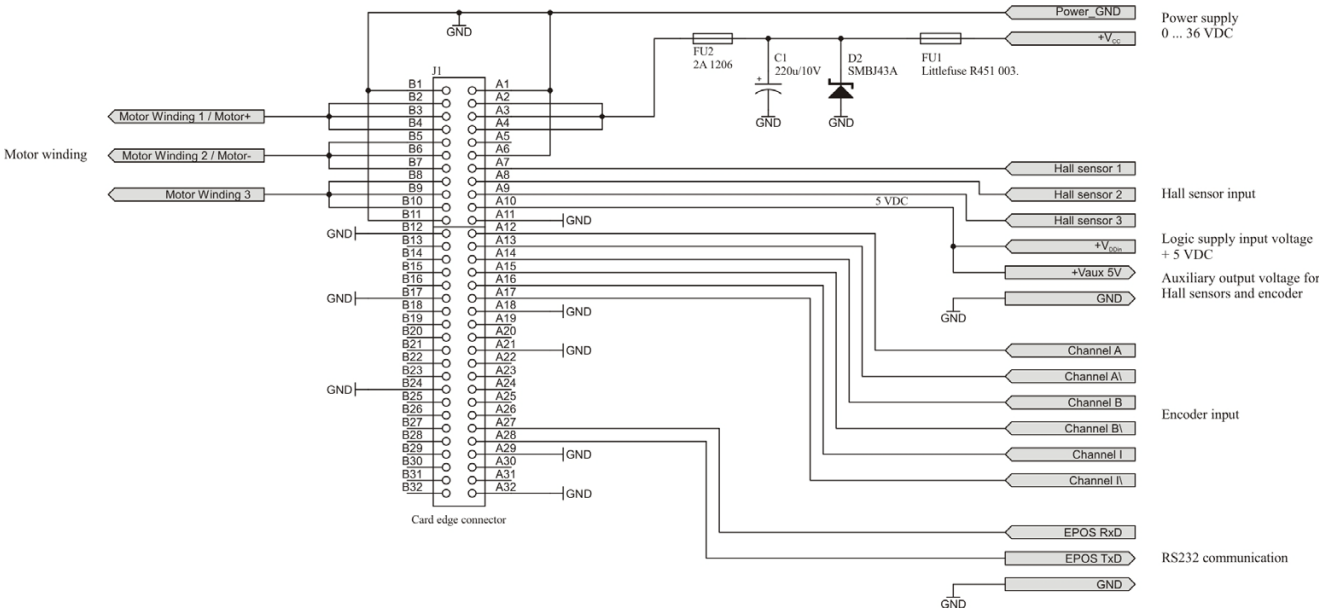

Figure 5-27 Low Supply Voltage Operation – Wiring Diagram

5.3.5 Wiring Example: Two Axes with RS232 to CAN Gateway

The logic supply is sourced by the power supply voltage and the module is configured by RS232.

Both modules are configured and commanded by a PC via RS232. The upper module is used as RS232 to CAN gateway. Further modules can be connected and commanded to the CAN bus accordingly.

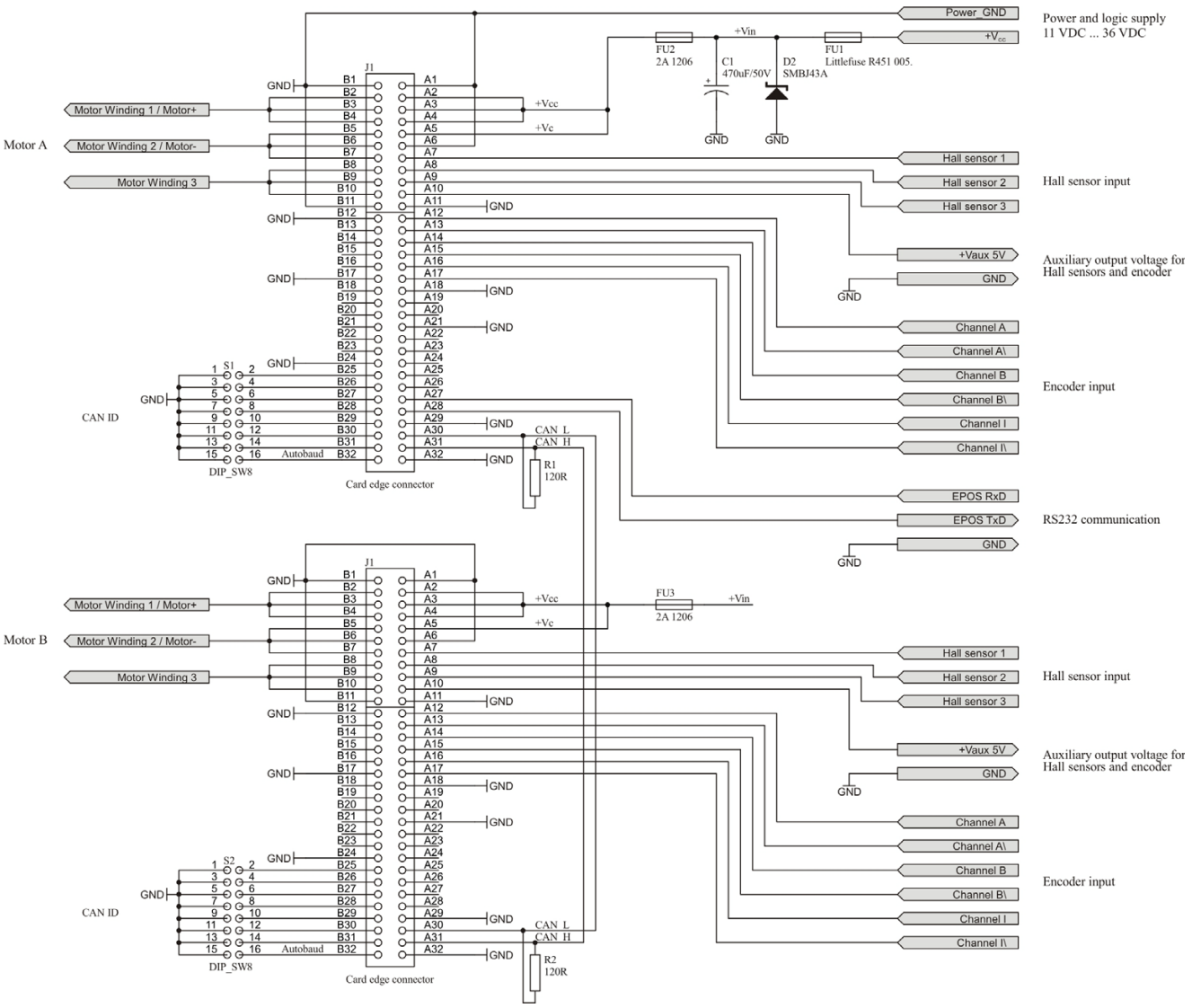

Figure 5-28 Two Axes with RS232 to CAN Gateway – Wiring Diagram

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