maxon motor control **EPOS2 Positioning Controller**

Hardware Reference **Edition October 2014**

EPOS2 50/5

Positioning Controller

Hardware Reference

Document ID: rel5191

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 50/5 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

1.4.1 Safety Alerts

Take note of when and why the alerts will be used and what the consequences are if you should fail to observe them!

Safety alerts are composed of…

- a signal word,
- a description of type and/or source of the danger,
- the consequence if the alert is being ignored, and
- explanations on how to avoid the hazard.

Following types will be used:

1) **DANGER**
   Indicates an **imminently hazardous situation**. If not avoided, the situation will result in death or serious injury.
2) **WARNING**
   Indicates a **potentially hazardous situation**. If not avoided, the situation **can** result in death or serious injury.

3) **CAUTION**
Indicates a **probable hazardous situation** and is also used to alert against unsafe practices. If not avoided, the situation **may** result in minor or moderate injury.

Example:

DANGER

High Voltage and/or Electrical Shock
Touching live wires causes death or serious injuries!
- *Make sure that neither end of cable is connected to life 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!*

1.4.2 Prohibited Actions and Mandatory Actions

The signs define prohibitive actions. So, you **must not**!

Examples:

Do not touch!

Do not operate!

The signs point out actions to avoid a hazard. So, you **must**!

Examples:

Unplug!

Tag before work!

1.4.3 Informatory Signs

Requirement / Note / Remark
Indicates an action you must perform prior continuing or refers to information on a particular item.

Best Practice
Gives advice on the easiest and best way to proceed.

Material Damage
Points out information particular to potential damage of equipment.

Reference
Refers to particular information provided by other parties.

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
Micro-Fit™ Mini-Fit Jr.™	© Molex, USA-Lisle, IL
Pentium®	© Intel Corporation, USA-Santa Clara, CA
Windows®	© Microsoft Corporation, USA-Redmond, WA

Table 1-2 Brand Names and Trademark Owners

1.6 Copyright

maxon motor ag
Brünigstrasse 220
P.O.Box 263
CH-6072 Sachseln
Switzerland

Phone +41 41 666 15 00
Fax +41 41 666 16 50

www.maxonmotor.com

••page intentionally left blank••

2 Introduction

The present document provides you with information on the EPOS2 50/5 Positioning Controller's hardware. It contains…

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

maxon motor control's EPOS2 50/5 is a small-sized, full digital, smart motion controller. Due to its flexible and high efficient power stage, the EPOS2 50/5 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 50/5 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 or RS232 interface.

Find the latest edition of the present document, as well as additional documentation and software to the EPOS2 50/5 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:

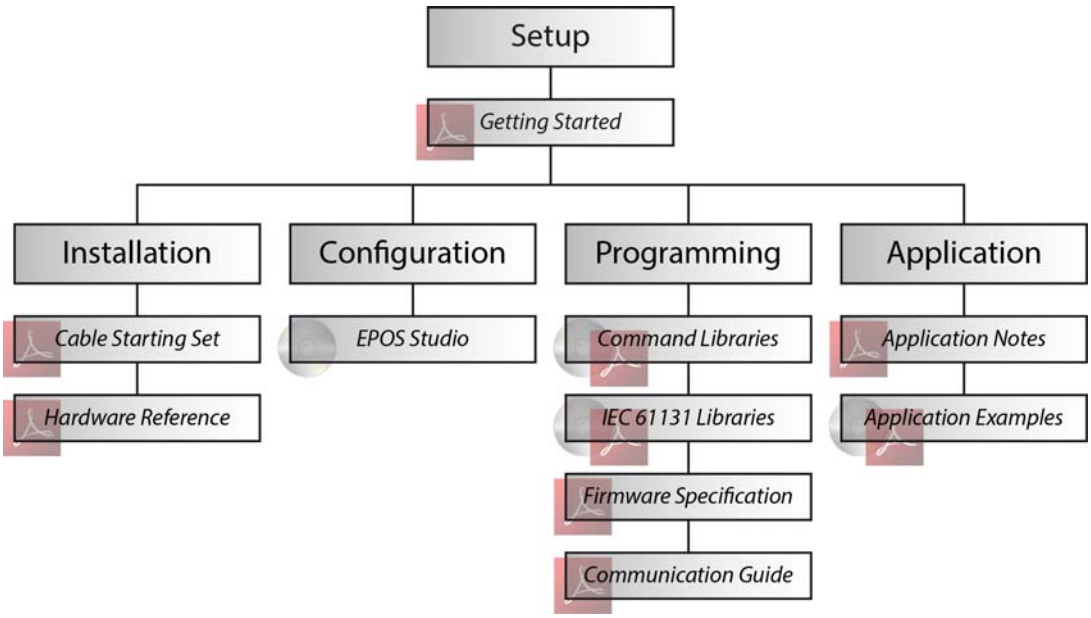


Figure 2-1 Documentation Structure

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 1-5 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 life power, unless having proven the opposite!*
- *Make sure that neither end of cable is connected to life 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…50 VDC.*
- *Supply voltages above 55 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.*

3 Technical Data

3.1 Electrical Data

Rating	
Nominal power supply voltage V_{CC}	11…50 VDC
Nominal logic supply voltage V_C (optional)	11…50 VDC
Absolute minimum supply voltage	10 VDC
Absolute max. supply voltage	54 VDC
Max. output voltage	0.9 • V_{CC}
Max. output current I_{max} (<1sec)	10 A
Continuous output current I_{cont}	5 A
Switching frequency	50 kHz
Max. efficiency	94%
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	22 µH / 5 A

Table 3-3 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”), optically isolated	+9…+24 VDC (Ri = 1.8 kΩ)
Digital Input 2 (“General Purpose”), optically isolated	+9…+24 VDC (Ri = 1.8 kΩ)
Digital Input 3 (“General Purpose”), optically isolated	+9…+24 VDC (Ri = 1.8 kΩ)
Digital Input 4 (“Home Switch”), optically isolated	+9…+24 VDC (Ri = 1.8 kΩ)
Digital Input 5 (“Positive Limit Switch”), optically isolated	+9…+24 VDC (Ri = 1.8 kΩ)
Digital Input 6 (“Negative Limit Switch”), optically isolated	+9…+24 VDC (Ri = 1.8 kΩ)
Digital Input 7 (“High Speed Command”)	internal line receiver EIA RS422 Standard or (“Sin/Cos input”), resolution 12-bit, ±1.8 V (differential)
Digital Input 8 (“High Speed Command”)	internal line receiver EIA RS422 Standard or (“Sin/Cos input”), resolution 12-bit, ±1.8 V (differential)
Digital Input 9 (“High Speed Command”)	internal line receiver EIA RS422 Standard
Digital Input 10 (“High Speed Command”)	internal line receiver EIA RS422 Standard
Digital Input 11 (“Power Stage Enable”), optically isolated	+9…+24 VDC (Ri = 1.8 kΩ)
Analog Input 1	resolution 12-bit ±10 V (differential)
Analog Input 2	resolution 12-bit ±10 V (differential)
+V Opto IN	+12…+24 VDC
CAN ID (CAN identification)	ID 1…127 configurable via DIP switch or software

Table 3-4 Electrical Data – Inputs

Outputs	
Digital Output 1 (“General Purpose”), optically isolated	max. 24 VDC (I_L <20 mA)
Digital Output 2 (“General Purpose”), optically isolated	max. 24 VDC (I_L <20 mA)
Digital Output 3 (“General Purpose”), optically isolated	max. 24 VDC (I_L <500 mA)
Digital Output 4 (“Brake”), optically isolated	max. 24 VDC (I_L <500 mA)
Digital Output 5 (“High Speed Output”)	internal line driver EIA RS422 Standard
Analog Output 1	bandwidth 20 kHz, resolution 12-bit, 0…10 V (I_L <1 mA)

Table 3-5 Electrical Data – Outputs

Voltage Outputs	
Encoder supply voltage	+5 VDC (I_L <100 mA)
Hall sensors supply voltage	+5 VDC (I_L <30 mA)
Auxiliary output voltage	+5 VDC (I_L <150 mA)

Table 3-6 Electrical Data – Voltage Outputs

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

Table 3-7 Electrical Data – Motor Connections

Interfaces		
RS232	RxD; TxD	max. 115 200 bit/s
USB 2.0 / USB 3.0	Data+; Data-	full speed
CAN 1	CAN_H (high); CAN_L (low)	max.1 Mbit/s
CAN 2	CAN_H (high); CAN_L (low)	max.1 Mbit/s

Table 3-8 Electrical Data – Interfaces

Status Indicators	
Operation	green LED
Error	red LED

Table 3-9 Electrical Data – LEDs

Connections		
Power Supply	On board: Suitable plug: Suitable terminal:	dual row male header (2 poles) Molex Mini-Fit Jr dual row female receptacle (2 poles) Molex Mini-Fit Jr. 39-01-2020 female crimp terminal Molex Mini-Fit Jr. 44476-xxxx (AWG 16-20)
Logic Supply	On board: Suitable plug: Suitable terminal:	dual row male header (2 poles) Molex Mini-Fit Jr dual row female receptacle (2 poles) Molex Mini-Fit Jr. 39-01-2020 female crimp terminal Molex Mini-Fit Jr. 44476-xxxx (AWG 16-20)
Motor	On board: Suitable plug: Suitable terminal:	dual row male header (4 poles) Molex Mini-Fit Jr dual row female receptacle (4 poles) Molex Mini-Fit Jr. 39-01-2040 female crimp terminal Molex Mini-Fit Jr. 44476-xxxx (AWG 16-20)
Hall	On board: Suitable plug: Suitable terminal:	dual row male header (6 poles) Molex Micro-Fit 3.0 dual row female receptacle (6 poles) Molex Micro-Fit 3.0 430-25-0600 female crimp terminal Molex Micro-Fit 3.0 43030-xxxx (AWG 20-30)
Signal 1	On board: Suitable plug: Suitable terminal:	dual row male header (12 poles) Molex Micro-Fit 3.0 dual row female receptacle (12 poles) Molex Micro-Fit 3.0 430-25-1200 female crimp terminal Molex Micro-Fit 3.0 43030-xxxx (AWG 20-30)
Signal 2	On board: Suitable plug: Suitable terminal:	dual row male header (16 poles) Molex Micro-Fit 3.0 dual row female receptacle (16 poles) Molex Micro-Fit 3.0 430-25-1600 female crimp terminal Molex Micro-Fit 3.0 43030-xxxx (AWG 20-30)
Signal 3	On board: Suitable plug: Suitable terminal:	dual row male header (8 poles) Molex Micro-Fit 3.0 dual row female receptacle (8 poles) Molex Micro-Fit 3.0 430-25-0800 female crimp terminal Molex Micro-Fit 3.0 43030-xxxx (AWG 20-30)
RS232	On board: Suitable plug: Suitable terminal:	dual row male header (6 poles) Molex Micro-Fit 3.0 dual row female receptacle (6 poles) Molex Micro-Fit 3.0 430-25-0600 female crimp terminal Molex Micro-Fit 3.0 43030-xxxx (AWG 20-30)
USB	On board: Suitable plug:	USB connector type B jack (4 poles) Standard USB cable with type B plug connector (4 poles)
CAN 1	On board: Suitable plug: Suitable terminal:	dual row male header (4 poles) Molex Micro-Fit 3.0 dual row female receptacle (4 poles) Molex Micro-Fit 3.0 430-25-0400 female crimp terminal Molex Micro-Fit 3.0 43030-xxxx (AWG 20-30)
CAN 2	On board: Suitable plug: Suitable terminal:	dual row male header (4 poles) Molex Micro-Fit 3.0 dual row female receptacle (4 poles) Molex Micro-Fit 3.0 430-25-0400 female crimp terminal Molex Micro-Fit 3.0 43030-xxxx (AWG 20-30)
Encoder	On board: Suitable locking clip:	Plug DIN41651 (10 poles) for flat band cable, pitch 1.27mm, AWG 28 Tyco C42334-A421-C42 (right) / Tyco C42334-A421-C52 (left)

Table 3-10 Electrical Data – Connections

3.2 Mechanical Data

Mechanical Data	
Weight	approx. 240 g
Dimensions (L x W x H)	120 x 93.5 x 27 mm
Mounting plate	for M3 screws

Table 3-11 Mechanical Data

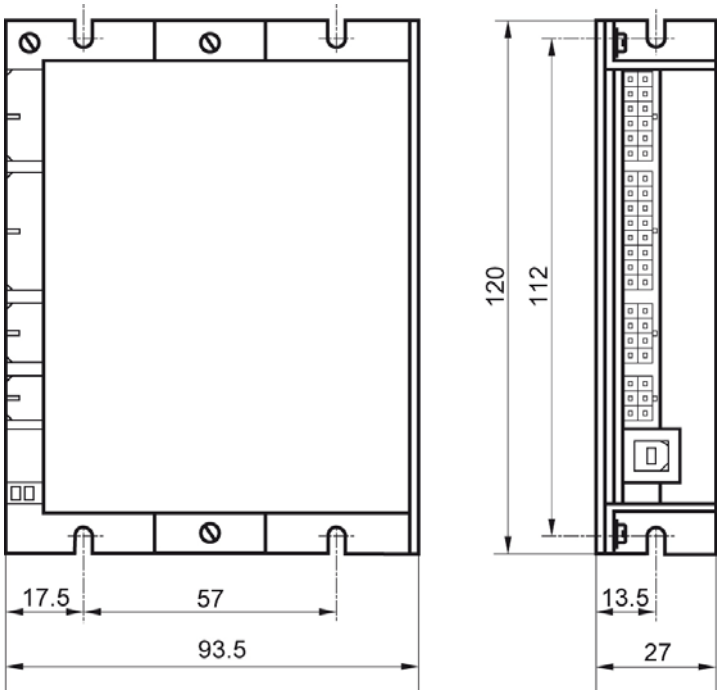


Figure 3-2 Dimensional Drawing [mm]

3.3 Environmental Conditions

Environmental Condition		
Temperature	Operation	-10…+45°C
	Extended Range *1)	+45…+80°C / Derating: -0.143 A/°C
	Storage	-40…+85°C
Humidity		20…80% (condensation not permitted)

Remark:
*1) Operation within the extended temperature range is permitted. However, a respective derating (declination of max. output current) as to the stated value will apply.

Table 3-12 Environmental Conditions

3.4 Order Details

Order Details	
EPOS2 50/5	Order number 347717

Table 3-13 Order Details

3.5 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 61000-4-2	Electrostatic discharge immunity test 8 kV/6 kV
	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)
	MIL-STD-810F	Random transport
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): 282'013 hours

Table 3-14 Standards

••page intentionally left blank••

4 Connections

Figure 4-3 Interfaces – Designations and Location

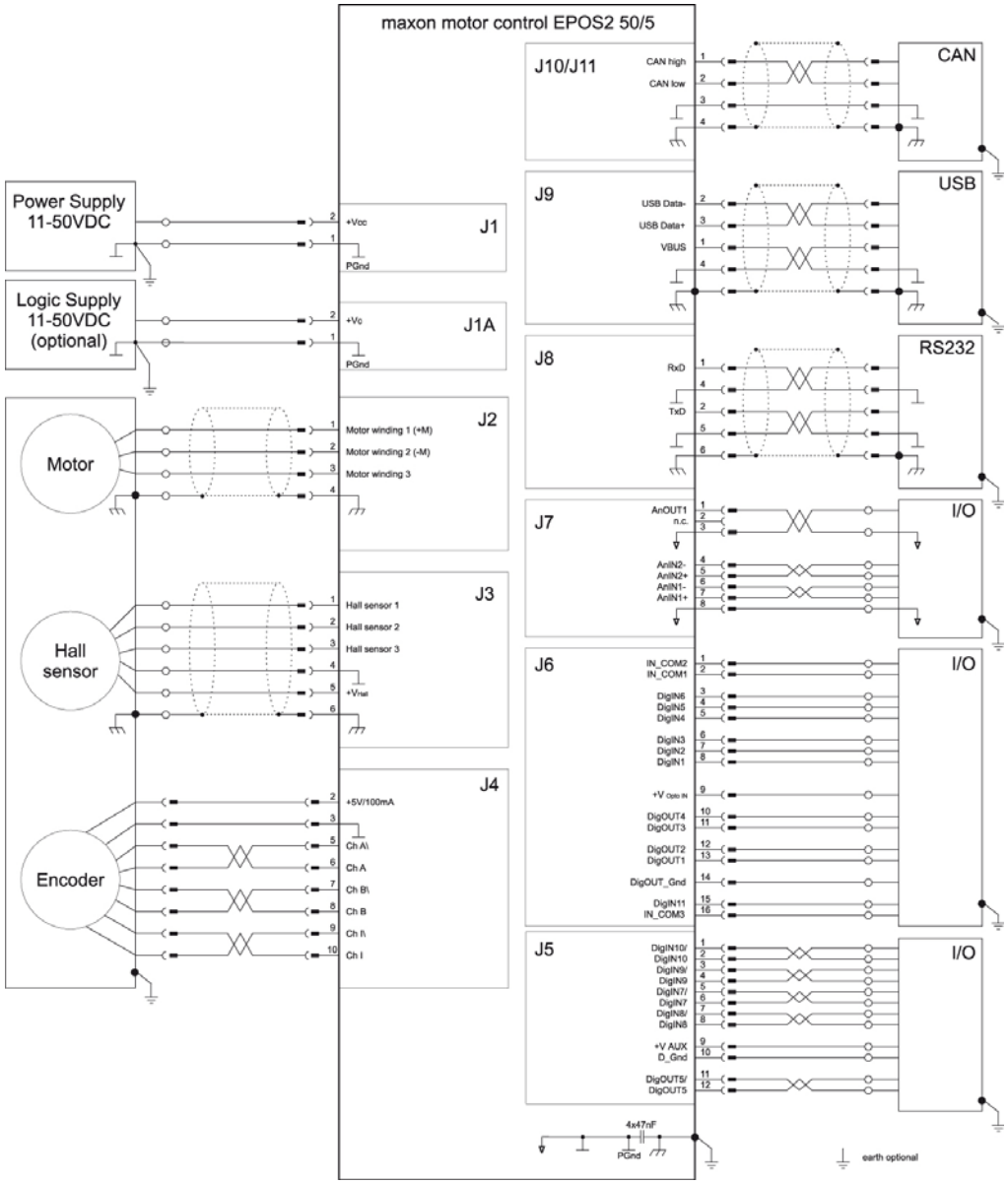


Figure 4-4 Wiring Diagram

4.1 Power Supply Connector (J1)

Best Practice

Keep the motor mechanically disconnected during setup and adjustment phase.

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. 50 VDC
Absolute output voltage	min. 10 VDC; max. 54 VDC
Output current	Depending on load (continuous max. 5 A / acceleration, short-time max. 10 A)

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 50/5 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.

   b) When using an electronically stabilized power supply, observe that the overcurrent protection must not be activated in any operating state.

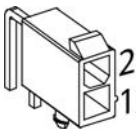


Figure 4-5 Power Connector (J1)

Pin	Signal	Description
1	Power_Gnd	Ground of supply voltage
2	$+V_{CC}$	Power supply voltage +11…+50 VDC

Accessories	Cable	Power Cable (275829)
Notes	Suitable connector Suitable crimp terminals Suitable hand crimper	Molex Mini-Fit Jr. 2 poles (39-01-2020) Molex Mini-Fit Jr. female crimp terminals (44476-xxxx) Molex hand crimper (63819-0900)

4.2 Logic Supply Connector (J1A)

By default, the logic is powered by the regular supply voltage. Optionally, you may wish to feed the logic supply voltage separately, permitting a safe and economical power backup feature.

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

Power Supply Requirements	
Output voltage	V_C min. 11 VDC; V_C max. 50 VDC
Absolute output voltage	min. 10 VDC; max. 54 VDC
Min. output power	P_C min. 5 W

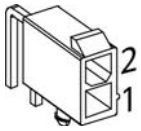


Figure 4-6 Power Connector (J1A)

Pin	Signal	Description
1	Power_Gnd	Ground of supply voltage
2	$+V_C$	Logic supply voltage +11…+50 VDC

Accessories	Cable	Power Cable (275829)
Notes	Suitable connector Suitable crimp terminals Suitable hand crimper	Molex Mini-Fit Jr. 2 poles (39-01-2020) Molex Mini-Fit Jr. female crimp terminals (44476-xxxx) Molex hand crimper (63819-0900)

4.3 Motor Connector (J2)

By default, the controller is set to drive either maxon EC motor (brushless) or maxon DC motor (brushed) with separated motor/encoder cable. Using a **maxon DC motor with integrated motor/ encoder ribbon cable**, you will need to change the jumpers JP2 and JP3.

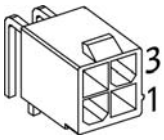


Figure 4-7 Motor Connector (J2)

Accessories	Cable	Motor Cable (275851)
Notes	Suitable connector Suitable crimp terminals Suitable hand crimper	Molex Mini-Fit Jr. 4 poles (39-01-2040) Molex Mini-Fit Jr. female crimp terminals (44476-xxxx) Molex hand crimper (63819-0900)

4.3.1 maxon EC motor (brushless)

Pin	Signal	Description
1	Motor winding 1	EC motor: Winding 1
2	Motor winding 2	EC motor: Winding 2
3	Motor winding 3	EC motor: Winding 3
4	Motor shield	Cable shield

4.3.2 maxon DC motor with separated Motor/Encoder Cable

Pin	Signal	Description
1	Motor (+M)	DC motor: Motor +
2	Motor (-M)	DC motor: Motor -
3	do not connect	
4	Motor shield	Cable shield

4.3.3 maxon DC motor with integrated Motor/Encoder Ribbon Cable

STOP!
Check on safety precautions before continuing (➔page 2-10).

1) Open housing and find jumpers JP2 and JP3.
2) Set jumpers JP2 and JP3 to “closed” position (➔Figure 4-9, right).
3) For encoder connections ➔chapter “4.5 Encoder Connector (J4)” on page 4-23.

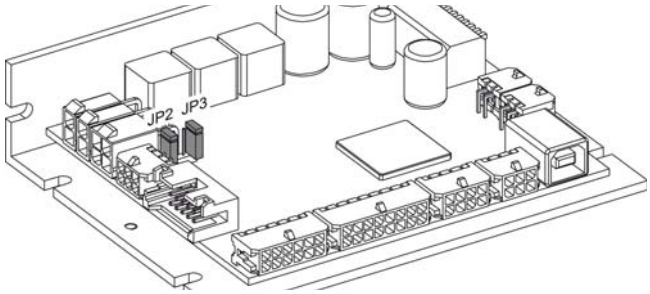


Figure 4-8 Jumpers JP2/JP3 – Location and Factory Setting

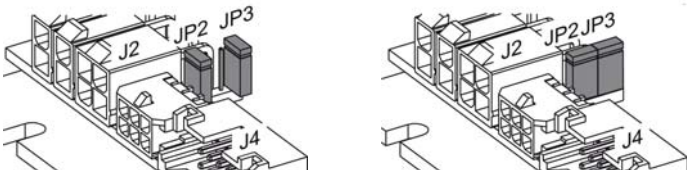


Figure 4-9 Jumpers JP2/JP3 – open (left) / closed (right)

4.4 Hall Sensor Connector (J3)

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	typically <0.8 VDC
Logic 1	typically >2.4 VDC
Internal pull-up resistor	2.7 kΩ (against +5 VDC)

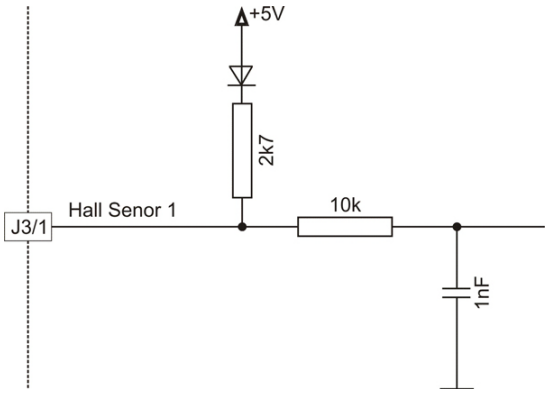


Figure 4-10 Hall Sensor Input Circuit

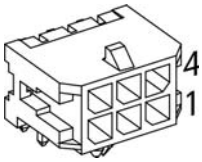


Figure 4-11 Hall Sensor Connector (J3)

Pin	Signal	Description
1	Hall sensor 1	Hall sensor 1 Input
2	Hall sensor 2	Hall sensor 2 Input
3	Hall sensor 3	Hall sensor 3 Input
4	GND	Ground of Hall sensor supply
5	+VHall	Hall sensor supply voltage +5 VDC / 30 mA
6	Hall shield	Cable shield

Accessories	Cable	Hall Sensor Cable (275878)
Notes	Suitable connector Suitable crimp terminals Suitable hand crimper	Molex Micro-Fit 3.0 6 poles (430-25-0600) Molex Micro-Fit 3.0 female crimp terminals (43030-xxxx) Molex hand crimper (63819-0000)

4.5 Encoder Connector (J4)

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!

Implemented are three high-speed RS422 receivers featuring fault detection circuitry and fault status outputs. The receivers' inputs feature fault thresholds that detect the device's "not in valid state".

The receivers indicate whether a receiver input is in open circuit condition (except index channel), short-circuit condition, or beyond the common mode range (smaller -10 V or higher +13.2 V). They also generate a fault indication if the differential input voltage drops below the 475 mV threshold.

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	± 475 mV
Line receiver (internal)	EIA RS422 Standard
Max. encoder input frequency	5 MHz

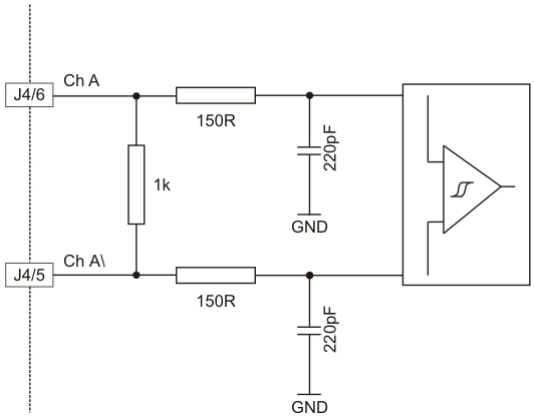


Figure 4-12 Encoder Input Circuit (Channels A and B)

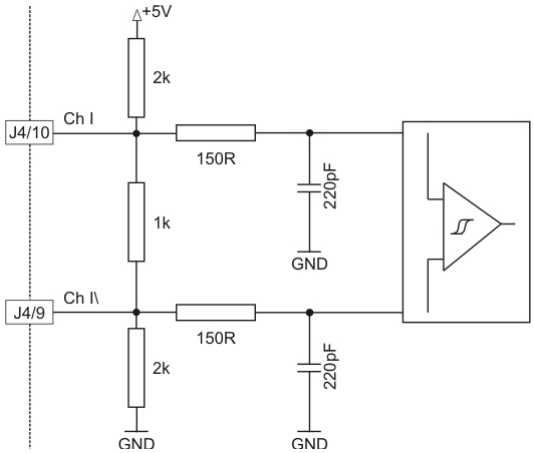


Figure 4-13 Encoder Input Circuit (Index Channel)

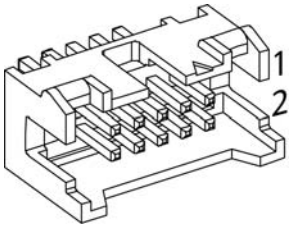


Figure 4-14 Encoder Connector (J4)

Pin	Signal	Description
1	EC motor: none DC motor: Motor +	EC motor: not connected DC motor: + Motor *1)
2	+5 VDC / 100 mA	Encoder supply voltage
3	GND	Ground
4	EC motor: none DC motor: Motor -	EC motor: not connected DC motor: - Motor *1)
5	Channel A\	Channel A complement
6	Channel A	Channel A
7	Channel B\	Channel B complement
8	Channel B	Channel B
9	Channel I\	Index complement
10	Channel I	Index

REMARK:

*1) may require change of jumper (J2 / J3) settings (➔chapter “4.3.3 maxon DC motor with integrated Motor/Encoder Ribbon Cable” on page 4-21)

Accessories	Cable	Encoder Cable (275934)
Notes	Suitable connector	DIN 41651 Plug, pitch 2.54 mm, 10 poles, plug strain relief

4.6 Signal 1 Connector (J5)

Contains differential “High Speed” digital inputs and outputs.

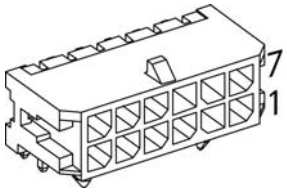


Figure 4-15 Signal 1 Connector (J5)

Pin	Signal	Description
1	DigIN10/	Digital Input 10 “High Speed Command” complement
2	DigIN10	Digital Input 10 “High Speed Command”
3	DigIN9/	Digital Input 9 “High Speed Command” complement
4	DigIN9	Digital Input 9 “High Speed Command”
5	DigIN7/	Digital Input 7 “High Speed Command” complement
6	DigIN7	Digital Input 7 “High Speed Command”
7	DigIN8/	Digital Input 8 “High Speed Command” complement
8	DigIN8	Digital Input 8 “High Speed Command”
9	$+V_{AUX}$	Auxiliary output voltage (+5 VDC / 150 mA)
10	D_Gnd	Digital signal ground
11	DigOUT5/	Digital Output 5 “High Speed Output” complement
12	DigOUT5	Digital Output 5 “High Speed Output”

Accessories	Cable	Signal Cable 6x2core (300586)
Notes	Suitable connector Suitable crimp terminals Suitable hand crimper	Molex Micro-Fit 3.0 12 poles (430-25-1200) Molex Micro-Fit 3.0 female crimp terminals (43030-xxxx) Molex hand crimper (63819-0000)

4.6.1 Auxiliary Supply Voltage for DigINs

Can be used as supply voltage for external loads connected to EPOS2 50/5’s digital inputs.

Auxiliary Output Voltage	Connector [J5] Pin [9]
Output voltage	+5 VDC (referenced to D_Gnd)
Output current	max. 150 mA

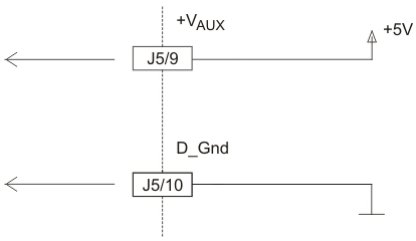


Figure 4-16 Auxiliary Output Voltage Circuit

4.6.2 Digital Inputs 7 and 8 “High Speed Command”

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”	Connector [J5] Pins [5] / [6] Connector [J5] Pins [7] / [8]
Min. differential input voltage	±200 mV
Line receiver (internal)	EIA RS422 Standard
Max. input frequency	5 MHz

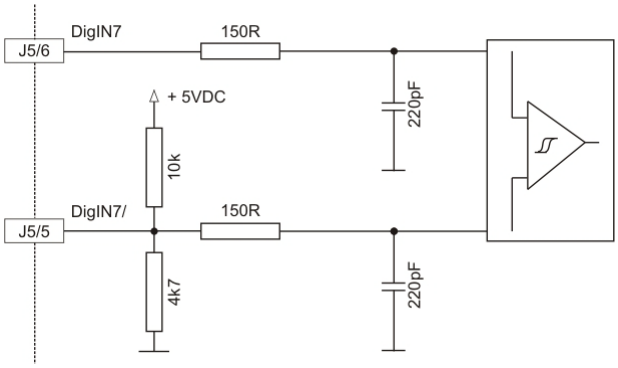


Figure 4-17 DigIN7 “Differential” Circuit (analogously valid also for DigIN8)

Sin/Cos	
Input voltage	±1.8 V (differential)
Max. input voltage	±12 VDC
Common mode voltage	-1…+4 VDC (referenced to D_Gnd
Input resistance	>10 kΩ (differential)
A/D converter	12-bit
Resolution	0.88 mV
Bandwidth	5 kHz

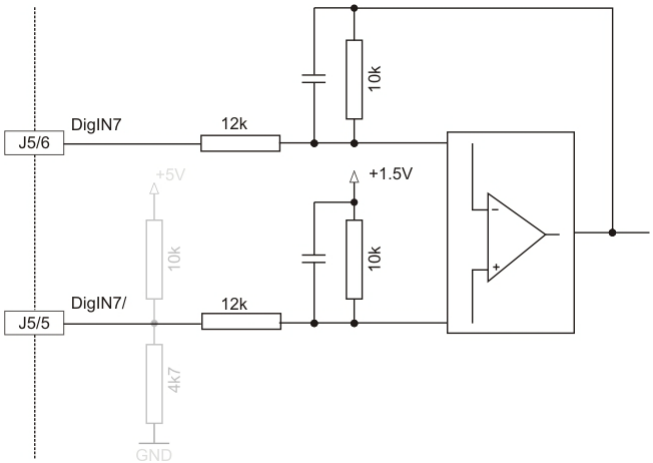


Figure 4-18 DigIN7 “Sin/Cos” Circuit (analogously valid also for DigIN8)

Single-ended	
Input voltage	0…5 VDC
Max. input voltage	±12 VDC
Logic 0	<1.0 V
Logic 1	>2.4 V
Input high current	I_{IH} = typically +350 µA @ 5 V
Input low current	I_{IL} = typically -130 µA @ 0 V
Max. input frequency	2.5 MHz

Note
***Do not** connect DigIN's complements!*

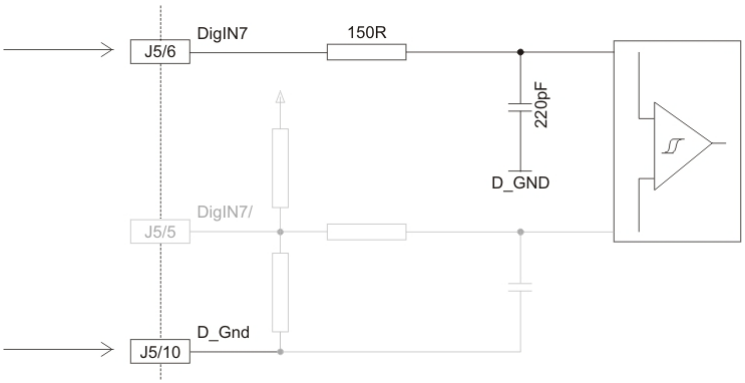


Figure 4-19 DigIN7 "Single-ended" Circuit (analogously valid also for DigIN8)

4.6.3 Digital Inputs 9 and 10 “High Speed Command”

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

Differential	
DigIN9 “High Speed Command” DigIN10 “High Speed Command”	Connector [J5] Pins [3] / [4] Connector [J5] Pins [1] / [2]
Min. differential input voltage	±200 mV
Line receiver (internal)	EIA RS422 Standard
Max. input frequency	5 MHz

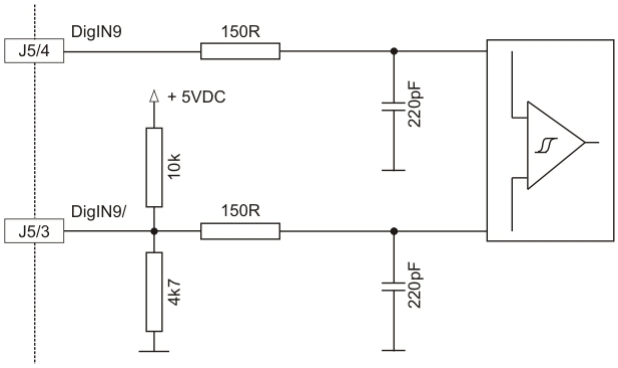


Figure 4-20 DigIN9 “Differential” Circuit (analogously valid also for DigIN10)

Single-ended	
DigIN9 “High Speed Command” DigIN10 “High Speed Command”	Connector [J5] Pin [4] Connector [J5] Pin [2]
Input voltage	0…5 VDC
Max. input voltage	±12 VDC
Logic 0	<1.0 V
Logic 1	>2.4 V
Input high current	I_{IH} = typically +60 µA @ 5 V
Input low current	I_{IL} = typically 0 A @ 0 V
Max. input frequency	2.5 MHz

Note
Do not *connect DigIN’s complements!*

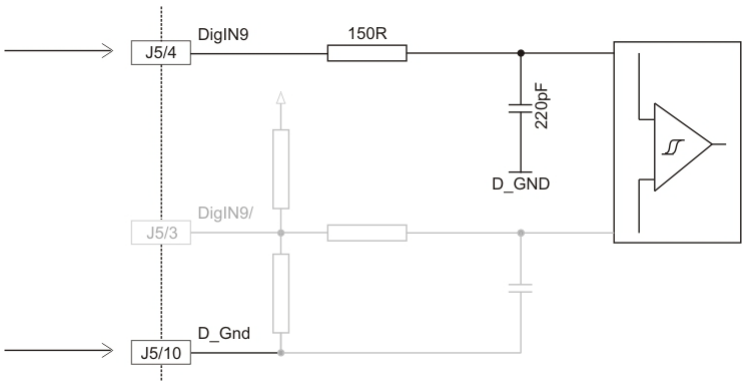


Figure 4-21 DigIN9 “Single-ended” Circuit (analogously valid also for DigIN10)

4.6.4 Digital Output 5 “High Speed Output”

The “High Speed” differential output is set by default and may be configured via software.

Differential	
DigOUT5 “High Speed Output”	Connector [J5] Pins [11] / [12]
Differential output voltage	min 1.5 V @ R_L = 54 Ω
Output current	max. 60 mA
Line transceiver (internal)	EIA RS422 Standard
Max. output frequency	5 MHz

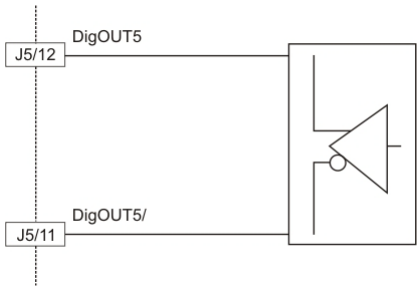


Figure 4-22 DigOUT5 “Differential” Circuit

Single-ended	
DigOUT5 “High Speed Output”	Connector [J5] Pins [12]
Output voltage	+5 VDC @ 0 mA
Max. load current	±60 mA
Logic 0	<2.0 V @ 60 mA (sink)
Logic 1	>2.5 V @ 60 mA (source)

Note
Do not *connect DigOUT’s complement!*

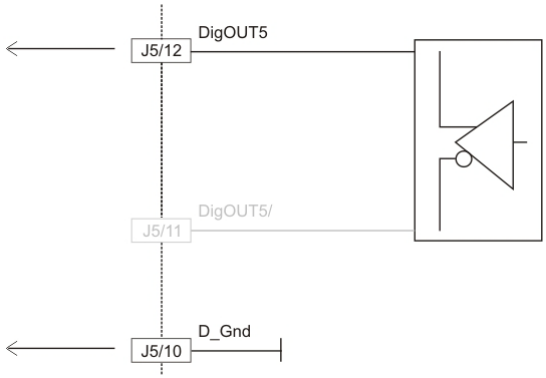


Figure 4-23 DigOUT5 “Single-ended” Circuit

4.7 Signal 2 Connector (J6)

Contains smart multi-purpose digital I/Os configurable as “Positive Limit Switch”, “Negative Limit Switch”, “Home Switch” and “Brake Output”.

Additionally offered are “General Purpose” digital I/Os.

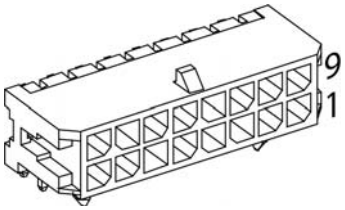


Figure 4-24 Signal 2 Connector (J6)

Pin	Signal	Description
1	IN_COM2	Common signal 2 for DigIN4…6
2	IN_COM1	Common signal 2 for DigIN1…3
3	DigIN6	Digital Input 6 “Negative Limit Switch”
4	DigIN5	Digital Input 5 “Positive Limit Switch”
5	DigIN4	Digital Input 4 “Home Switch”
6	DigIN3	Digital Input 3 “General Purpose”
7	DigIN2	Digital Input 2 “General Purpose”
8	DigIN1	Digital Input 1 “General Purpose”
9	+V Opto IN	External supply voltage for DigOUTs (+12…24 VDC)
10	DigOUT4	Digital Output 4 “Brake” / “General Purpose”
11	DigOUT3	Digital Output 3 “Brake” / “General Purpose”
12	DigOUT2	Digital Output 2 “General Purpose”
13	DigOUT1	Digital Output 1 “General Purpose”
14	DigOUT_Gnd	Digital Output Ground (referenced to +V Opto IN)
15	DigIN11	Digital Input 11 “Power stage Enable”
16	N_COM 3	Common signal 3 for DigIN11

Accessories	Cable	Signal Cable 16core (275932)
Notes	Suitable connector Suitable crimp terminals Suitable hand crimper	Molex Micro-Fit 3.0 16 poles (430-25-1600) Molex Micro-Fit 3.0 female crimp terminals (43030-xxxx) Molex hand crimper (63819-0000)

4.7.1 Digital Inputs 1, 2 and 3

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

DigIN1 “General Purpose” DigIN2 “General Purpose” DigIN3 “General Purpose” Common signal	Connector [J6] Pin [8] Connector [J6] Pin [7] Connector [J6] Pin [6] Connector [J6] Pin [2]
Type of input	Optically isolated, single-ended, bipolar
Input voltage	±24 VDC
Max. input voltage	±30 VDC
Logic 0	$\lvert I_{in} \rvert$ <1 mA / $\lvert U_{in} \rvert$ <5 VDC
Logic 1	$\lvert I_{in} \rvert$ >3 mA / $\lvert U_{in} \rvert$ >9 VDC
Input resistance	typically 1.8 kΩ
Input current at logic 1	typically 13.2 mA @ 24 VDC
Switching delay	<300 µs @ 24 VDC

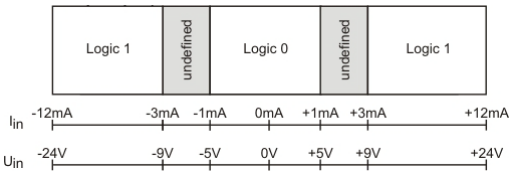


Figure 4-25 DigIN1…3 Logic Level

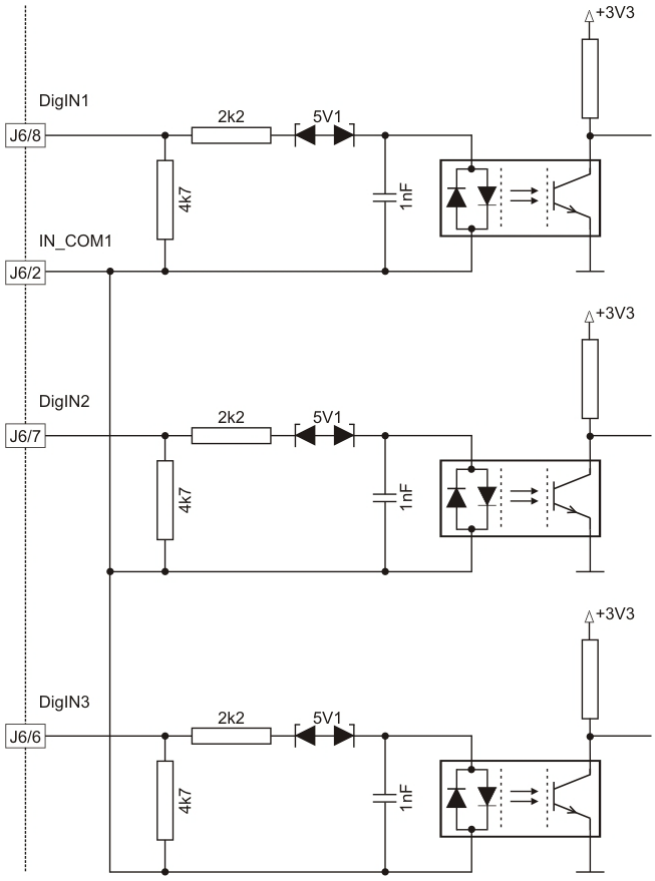


Figure 4-26 DigIN1…3 Circuit

4.7.2 Digital Inputs 4, 5 and 6

By default, the optically isolated digital inputs are defined as follows and may be configured via software.

- Digital Input 4 “Home Switch”
- Digital Input 5 “Positive Limit Switch”
- Digital Input 6 “Negative Limit Switch”

DigIN4 “Home Switch” DigIN5 “Positive Limit Switch” DigIN6 “Negative Limit Switch” IN_COM2 (common signal)	Connector [J6] Pin [5] Connector [J6] Pin [4] Connector [J6] Pin [3] Connector [J6] Pin [1]
Type of input	Optically isolated, single-ended, bipolar
Input voltage	±24 VDC
Max. input voltage	±30 VDC
Logic 0	$\lvert I_{in} \rvert$ <1 mA / $\lvert U_{in} \rvert$ <5 VDC
Logic 1	$\lvert I_{in} \rvert$ >3 mA / $\lvert U_{in} \rvert$ >9 VDC
Input resistance	typically 1.8 kΩ
Input current at logic 1	typically 13.2 mA @ 24 VDC
Switching delay	<300 µs @ 24 VDC

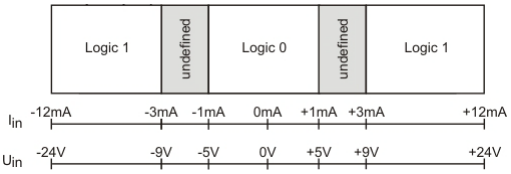


Figure 4-27 DigIN4…6 Logic Level

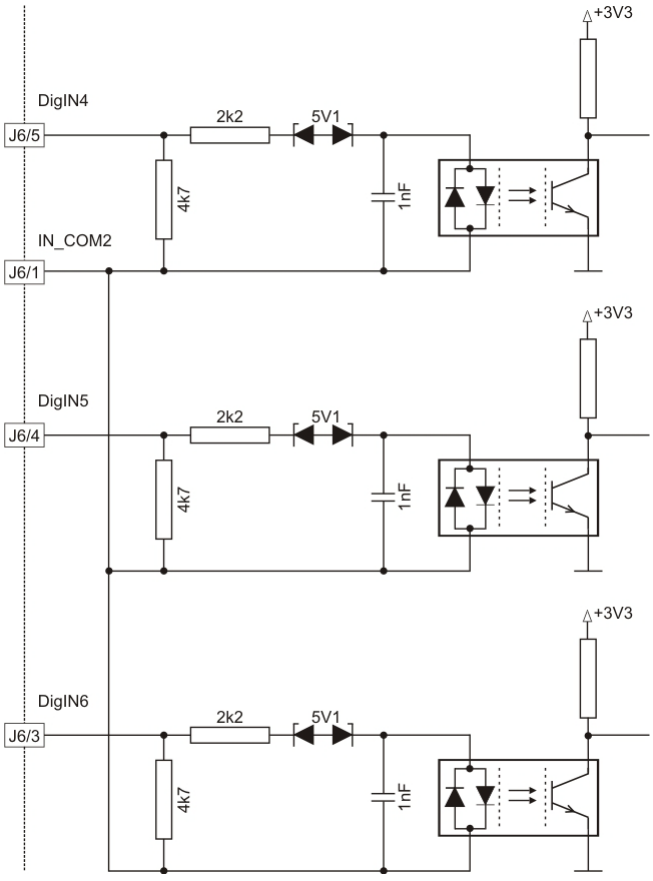


Figure 4-28 DigIN4…6 Circuit

Document ID: rel5191
Edition: October 2014

WIRING EXAMPLE: "DIFFERENT TYPES OF PROXIMITY SWITCHES"

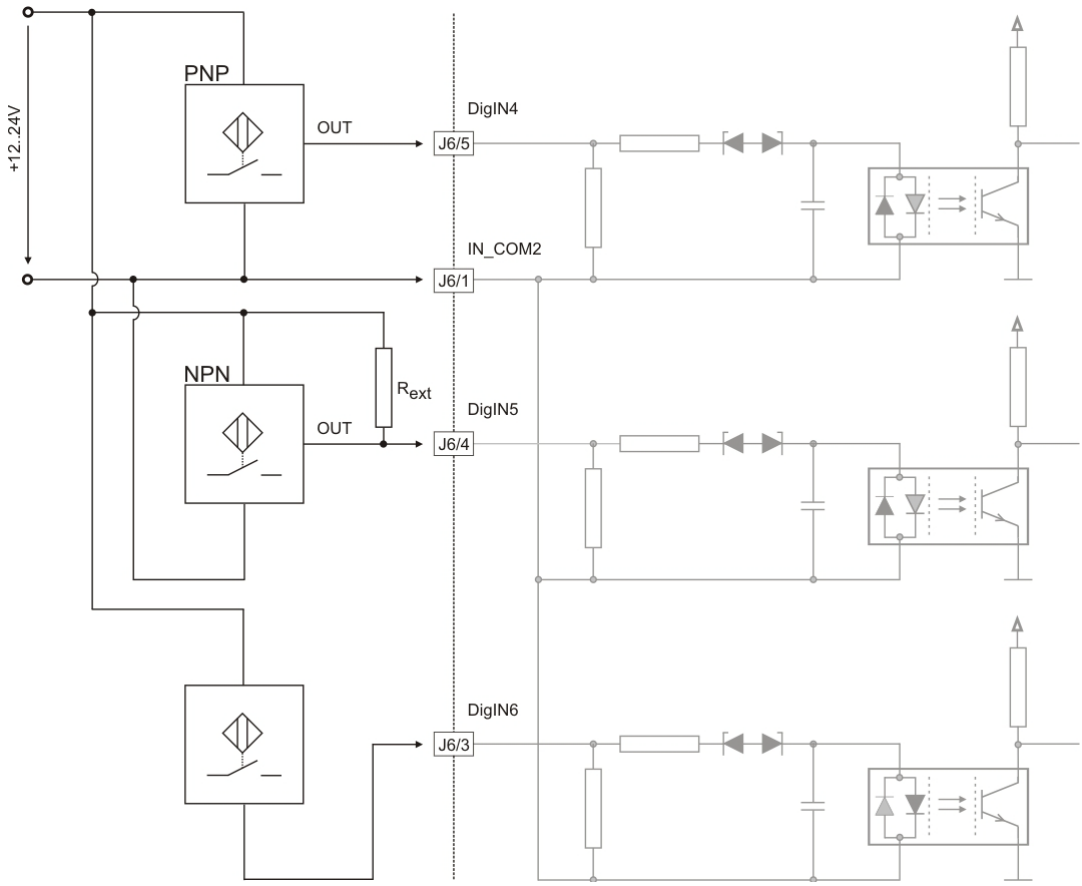


Figure 4-29 DigIN4…6 – Wiring Example for different Types of Proximity Switches

Best Practice

- *Preferably, use 3-wire PNP proximity switches.*
- *Using 3-wire NPN proximity switches requires an additional pull-up resistor.*
  R_{ext} (12 V) = 560 Ω (300 mW)
  R_{ext} (24 V) = 3 kΩ (200 mW)
- *By principle, using 2-wire proximity switches is possible.*

4.7.3 Digital Input 11

By default, the optically isolated digital input is defined as “Power Stage Enable” and may be activated by internal DIP switch.

- DIP switch JP4, switch 2 “ON” (factory setting): “Power Stage Enable” deactivated
- DIP switch JP4, switch 2 “OFF”: “Power Stage Enable” activated

DigIN11 IN_COM3 (common signal)	Connector [J6] Pin [15] Connector [J6] Pin [16]
Type of input	Optically isolated, single-ended, bipolar
Input voltage	±24 VDC
Max. input voltage	±30 VDC
Logic 0	$\lvert I_{in} \rvert$ <1 mA / $\lvert U_{in} \rvert$ <5 VDC
Logic 1	$\lvert I_{in} \rvert$ >3 mA / $\lvert U_{in} \rvert$ >9 VDC
Input resistance	typically 1.8 kΩ
Input current at logic 1	typically 13.2 mA @ 24 VDC
Switching delay	<300 µs @ 24 VDC

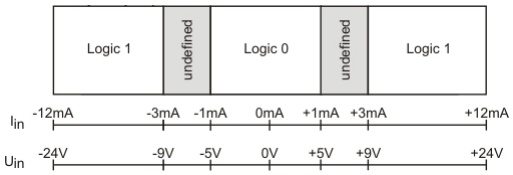


Figure 4-30 DigIN11 Logic Level

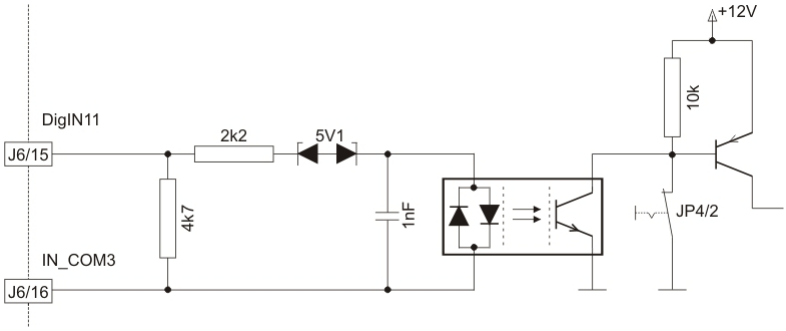


Figure 4-31 DigIN11 Circuit

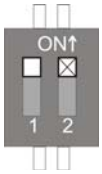


Figure 4-32 DIP Switch JP4/2 – Activation of DigIN11

4.7.4 Supply Voltage for DigOUTs

For optically isolated digital outputs, an external supply voltage must be applied. Basically, any power supply may be used, provided it meets below stated minimal requirements.

+V Opto IN DigOUT_Gnd	Connector [J6] Pin [9] Connector [J6] Pin [14]
Supply voltage	+12…+24 VDC
Min. current	1040 mA (depending on load)

4.7.5 Digital Outputs 1 and 2

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

DigOUT1 DigOUT2 +V Opto IN	Connector [J6] Pin [13] Connector [J6] Pin [12] Connector [J6] Pin [9]
Type of output	Optically isolated, open emitter
Output voltage	$U_{out} \geq$ (+V Opto IN - 3 V)
Max. load current	$I_{load} \leq$20 mA
Leakage current	$I_{leak} \leq$20 µA
Switching delay	<500 µs @ 24 VDC

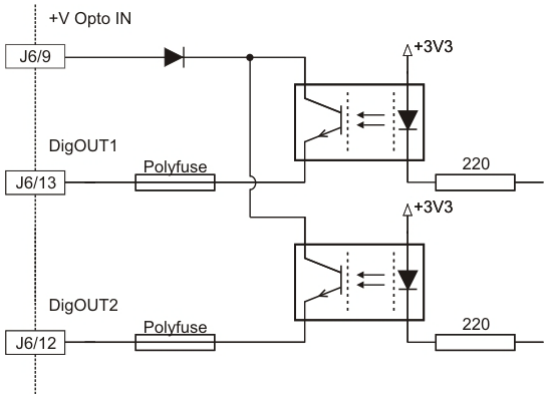


Figure 4-33 DigOUT1/2 Circuit

4.7.6 Digital Outputs 3 and 4

By default, the optically isolated digital outputs are defined as “General Purpose” and may be configured via software as “Brake” (permanent DC voltage applied to serve as magnet brake).

DigOUT3 DigOUT4 +V Opto IN DigOUT_Gnd	Connector [J6] Pin [11] Connector [J6] Pin [10] Connector [J6] Pin [9] Connector [J6] Pin [14]
Type of output	Optically isolated, open emitter
Output voltage	$U_{out} \geq$ (+V Opto IN - 1 V)
Max. load current	$I_{load} \leq$500 mA
Leakage current	$I_{leak} \leq$50 µA
Switching delay	<300 µs @ 24 VDC
Max. current load	2 H @ 24 VDC; 500 mA

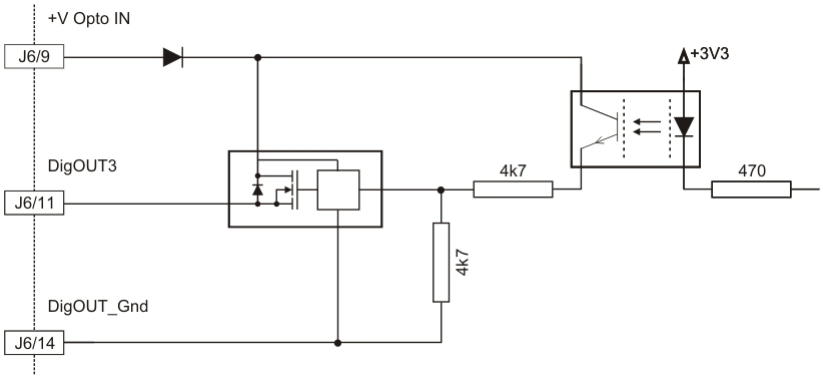


Figure 4-34 DigOUT3 Circuit (analogously valid also for DigOUT4)

WIRING EXAMPLE: “PERMANENT MAGNET BRAKE”

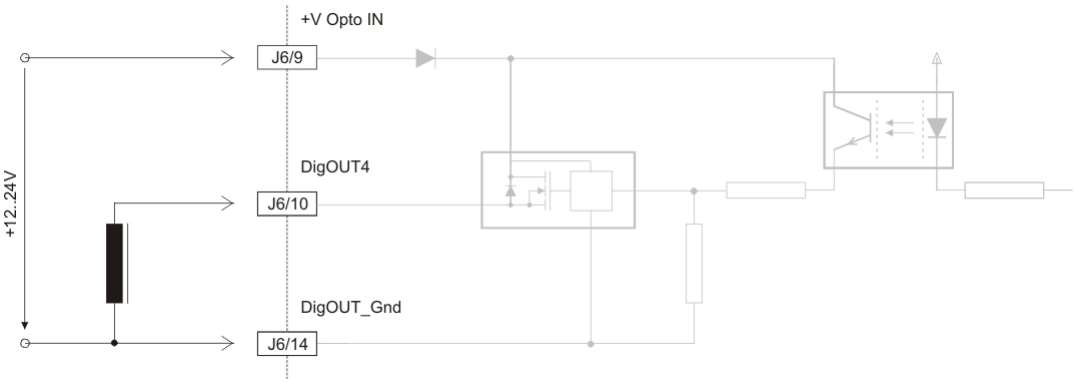


Figure 4-35 DigOUT4 – Wiring Example for Permanent Magnet Brake

Document ID: rel5191
Edition: October 2014

4.8 Signal 3 Connector (J7)

Contains differential analog I/Os.

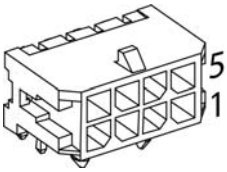


Figure 4-36 Signal 3 Connector (J7)

Pin	Signal	Description
1	AnOUT1	Analog Output 1 “General Purpose”
2	not connected	
3	A_Gnd	Analog signal ground
4	AnIN2 -	Analog Input 2 “General Purpose”, negative signal
5	AnIN2 +	Analog Input 2 “General Purpose”, positive signal
6	AnIN1 -	Analog Input 1 “General Purpose”, negative signal
7	AnIN1 +	Analog Input 1 “General Purpose”, positive signal
8	A_Gnd	Analog signal ground

Accessories	Cable	Signal Cable 4x2core (350390)
Notes	Suitable connector Suitable crimp terminals Suitable hand crimper	Molex Micro-Fit 3.0 8 poles (430-25-0800) Molex Micro-Fit 3.0 female crimp terminals (43030-xxxx) Molex hand crimper (63819-0000)

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+ AnIN1- AnIN2+ AnIN2-	Connector [J7] Pin [7] Connector [J7] Pin [6] Connector [J7] Pin [5] Connector [J7] Pin [4]
Input voltage	±10 VDC (differential)
Max. input voltage	±30 VDC
Common mode voltage	±10 VDC (referenced to A_Gnd)
Input resistance	200 kΩ (differential) 100 kΩ (referenced to A_Gnd)
A/D converter	12-bit
Resolution	4.97 mV
Bandwidth	5 kHz

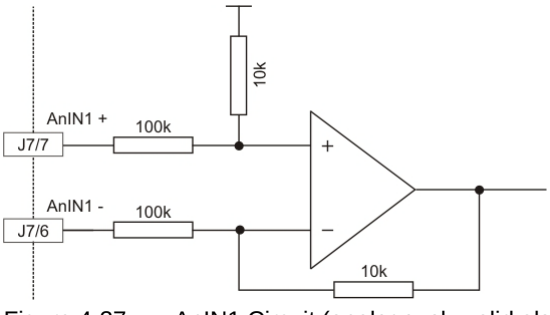


Figure 4-37 AnIN1 Circuit (analogously valid also for AnIN2)

4.8.2 Analog Output 1

By default, the AnOUT1 is defined as “General Purpose” and may be configures via software.

AnOUT1 A_Gnd	Connector [J7] Pin [1] Connector [J7] Pin [3]
Output voltage	0…+10 VDC (referenced to A_Gnd)
A/D converter	12-bit
Resolution	2.40 mV
Bandwidth	20 kHz

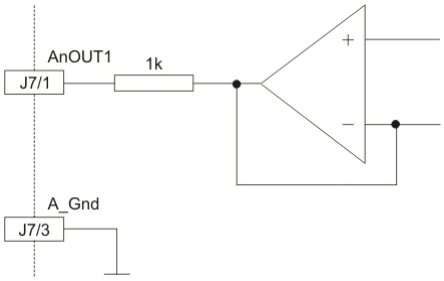


Figure 4-38 AnOUT1 Circuit

4.9 RS232 Connector (J8)

Max. input voltage	±24 V
Output voltage	typically ±9 V @ 3 kΩ to Ground
Max. bit rate	115 200 bit/s
Internal RS232 driver/receiver	EIA RS232 Standard

CONNECTION OF POSITIONING CONTROLLER TO PC

EPOS2 50/5	PC Interface (RS232), DIN41652
Connector [J8] Pins [4] + [5] “GND”	Pin 5 “GND”
Connector [J8] Pin [1] “EPOS RxD”	Pin 3 “PC TxD”
Connector [J8] Pin [2] “EPOS TxD”	Pin 2 “PC RxD”

Note

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

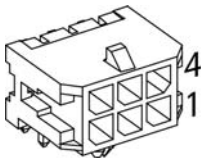


Figure 4-39 RS232 Connector (J8)

Pin	Signal	Description
1	EPOS RxD	EPOS RS232 receive
2	EPOS TxD	EPOS RS232 transmit
3	not connected	
4	GND	RS232_Ground
5	GND	RS232_Ground
6	Shield	Cable shield

Accessories	Cable	RS232-COM Cable (275900)
Notes	Suitable connector Suitable crimp terminals Suitable hand crimper	Molex Micro-Fit 3.0 6 poles (430-25-0600) Molex Micro-Fit 3.0 female crimp terminals (43030-xxxx) Molex hand crimper (63819-0000)

4.10 USB Connector (J9)

USB Standard	USB 2.0 / USB 3.0 (full speed)
Max. bus supply voltage	+5.25 VDC
Typical input current	15 mA
Max. DC data input voltage	-0.5…+3.8 VDC

CONNECTION OF POSITIONING CONTROLLER TO PC

EPOS2 50/5	PC Interface (USB 2.0 / USB 3.0)
Connector [J9] Pin [1] "V_{BUS}"	Pin 1 "V_{BUS}"
Connector [J9] Pin [2] "USB D-"	Pin 2 "USB D-"
Connector [J9] Pin [3] "USB D+"	Pin 3 "USB D+"
Connector [J9] Pin [4] "GND"	Pin 4 "GND"

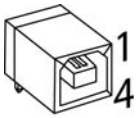


Figure 4-40 USB Connector (J9)

Pin	Signal	Description
1	V_{BUS}	USB bus supply input voltage +5 VDC
2	USB D-	USB Data-
3	USB D+	USB Data+
4	GND	USB Ground
	Shield	Cable Shield

Accessories	Cable	USB Type A - B Cable (350392)
Notes	Suitable connector	Standard USB cable with type B plug (4 poles)

4.11 CAN Connector (J10, J11)

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	DIP switch or software

Connection of Positioning Controller to CAN Bus Line CiA DS-102

EPOS2 50/5	CAN 9 pin D-Sub (DIN41652)
Connector [J10] or [J11] Pin [1] “CAN high”	Pin 7 “CAN_H” high bus line
Connector [J10] or [J11] Pin [2] “CAN low”	Pin 2 “CAN_L” low bus line”
Connector [J10] or [J11] Pin [3] “CAN GND”	Pin 3 “CAN_GND” Ground
Connector [J10] or [J11] Pin [4] “CAN shield”	Pin 5 “CAN_Shield” cable shield

Note

- *Consider CAN Master’s maximal baud rate.*
- *The standard baud rate setting (factory setting) is “Auto Bit Rate”.*
- *Use termination resistor at both ends of the CAN bus (➔chapter “4.12.2 CAN Bus Termination” on page 4-43).*
- *For detailed CAN information ➔separate document «EPOS2 Communication Guide».*

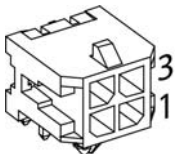


Figure 4-41 CAN Connector (J10/J11)

Pin	Signal	Description
1	CAN high	CAN high bus line
2	CAN low	CAN low bus line
3	CAN GND	CAN Ground
4	CAN shield	Cable shield

Accessories	Cables	CAN-COM Cable (275908) CAN-CAN Cable (275926) CAN Termination Plug (275937)
Notes	Suitable connector Suitable crimp terminals Suitable hand crimper	Molex Micro-Fit 3.0 4 poles (430-25-0400) Molex Micro-Fit 3.0 female crimp terminals (43030-xxxx) Molex hand crimper (63819-0000)

4.12 CAN Configuration (JP1)

4.12.1 CAN ID (Node Address)

The CAN ID is set with DIP switches 1…7. Addresses (1…127) may be coded using binary code.

Note

- *By setting the DIP switch (1…7) address 0 ("OFF"), the CAN ID may be configured by software (changing object "Node ID", range 1…127).*
- *The CAN ID results in the summed values of DIP switch addresses 1 ("ON").*
- *DIP switches 8…10 do not have any impact on the CAN ID.*
- *DIP switch 8 "ON" will activate Auto Bitrate Detection.*

Switch	Binary Code	Valence	DIP Switch
1	2^0	1	
2	2^1	2	
3	2^2	4	
4	2^3	8	
5	2^4	16	
6	2^5	32	
7	2^6	64	

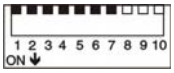


Figure 4-42 JP1 (Numbering Scheme)

Table 4-15 CAN ID – Binary Code Values

EXAMPLES:

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

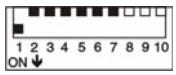
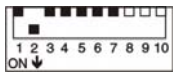
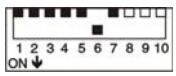
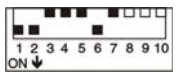
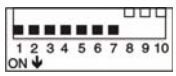
	CAN ID/Switch	1	2	3	4	5	6	7	
	Valence	1	2	4	8	16	32	64	
CAN ID	**DIP Setting**								**Calculation**
1		1	0	0	0	0	0	0	1
2		0	1	0	0	0	0	0	2
32		0	0	0	0	0	1	0	32
35		1	1	0	0	0	1	0	1 + 2 + 32
127		1	1	1	1	1	1	1	1 + 2 + 4 + 8 + 16 + 32 + 64

Table 4-16 CAN ID – DIP Switch Settings (Example)

4.12.2 CAN Bus Termination

The CAN bus must be terminated at both ends by a termination resistor of 120 Ω, typically. Depending on utilization of the controller, individual CAN bus termination settings must be performed.

Using DIP switch 9, the controller-internal bus termination resistor can be activated/deactivated. By default, bus termination is “OFF”, nevertheless, the bus is not terminated.

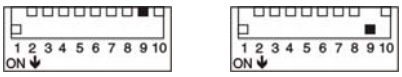


Figure 4-43 DIP Switch (JP1 [9]) – CAN Bus Termination (left “OFF” right “ON”)

EXAMPLE 1: MULTIPLE AXIS SYSTEM WITH EPOS2 50/5 WITHIN CANOPEN BUS

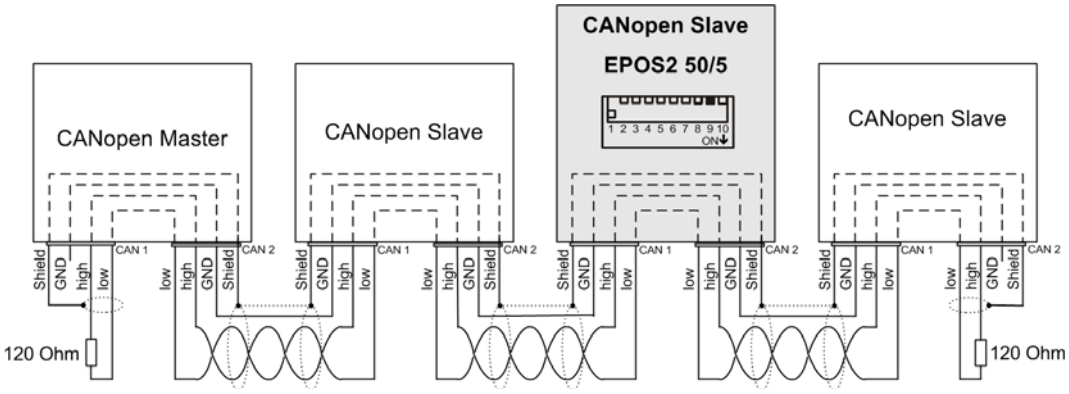


Figure 4-44 EPOS2 50/5 without CAN Bus Termination

EXAMPLE 2: MULTIPLE AXIS SYSTEM WITH EPOS2 50/5 BOTH ENDS OF CANOPEN BUS

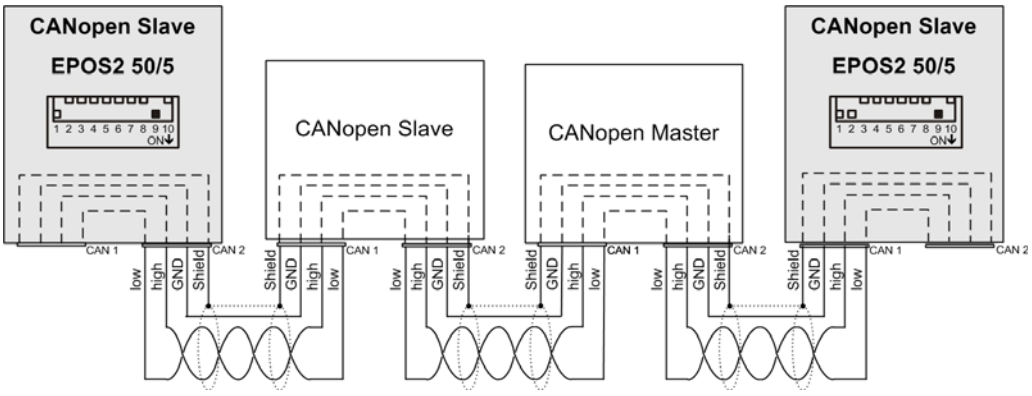


Figure 4-45 EPOS2 50/5 with CAN Bus Termination

4.13 Status LEDs

The LEDs display the current status of the EPOS2 50/5 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 4-17 LEDs – Interpretation of Condition

LIST OF FIGURES

LIST OF TABLES

INDEX

M

N

O

P

R

S

T

U

maxon motor ag
Brünigstrasse 220
P.O.Box 263
CH-6072 Sachseln
Switzerland

Phone +41 41 666 15 00
Fax +41 41 666 16 50

www.maxonmotor.com