maxon motor control **MCD EPOS P Programmable Compact Drive**

Hardware Reference **Edition December 2011**

MCD EPOS P 60 W

Programmable Compact Drive

Hardware Reference

Document ID: rel2895

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 MCD EPOS P 60 W is considered as partly completed machinery according to EU's 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 the 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

••page intentionally left blank••

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
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 15 50

www.maxonmotor.com

••page intentionally left blank••

2 Introduction

The present document provides you with information on the MCD EPOS P 60 W Programmable Compact Drive's hardware. It contains…

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

maxon motor control's MCD EPOS P 60 W is a small-sized, free programmable compact drive. It contains a brushless EC motor with Hall sensors, digital encoder and a digital position control unit. The optimized commutation by space vector control offers to drive the integrated brushless EC motor with minimal torque ripple and low noise. The integrated position, velocity and current control functionality allows sophisticated positioning applications.

The MCD EPOS P 60 W is programmable with a very efficient software tool. The programming languages are according to IEC 61131-3 standard. The built-in CANopen interface allows the design of an easy-to-use standalone multiple axis system, particularly with standard maxon MCD EPOS controllers or standard maxon EPOS controllers. In addition, the unit can be operated via any RS232 interface.

Find the latest edition of the present document, as well as additional documentation and software to the MCD EPOS P 60 W Programmable Compact Drive 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:

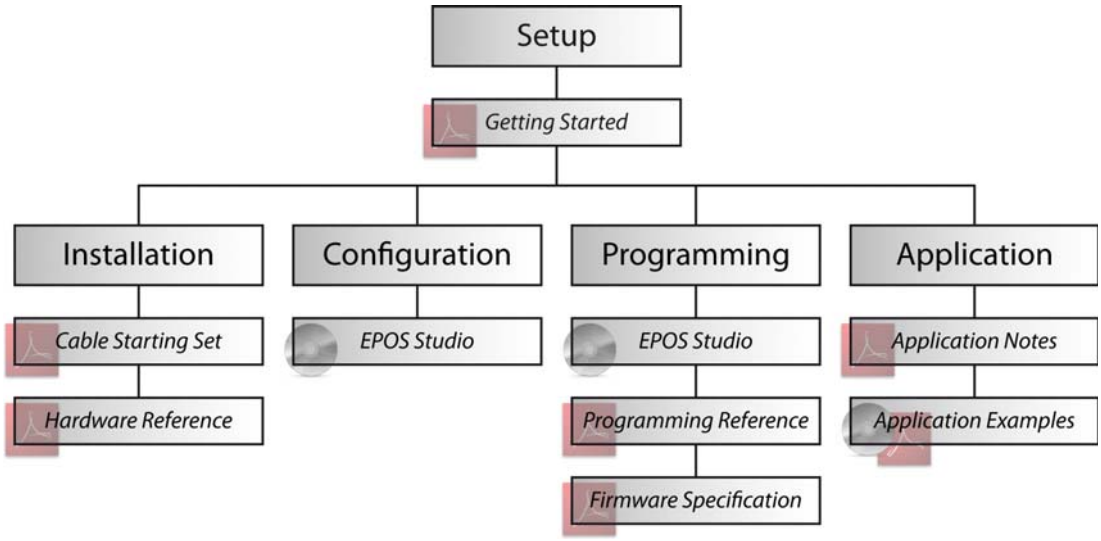

Figure 2-1 Documentation Structure

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 12…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 Motor Data

Motor	
Nominal torque (max. continuous torque)	54 mNm (T_a = 25°C, 5000 rpm, ➔Remark on page 3-12)
Max. torque	218 mNm
Max. permissible speed (restricted by encoder)	12000 rpm
Max. efficiency	70%
Torque constant	24.3 mNm/A
Speed constant	393 rpm/V
Speed/torque gradient	20.6 rpm/mNm
Rotor inertia	21.9 gcm²
Axial play (at load <6 N / >6 N)	0 mm / 0.14 mm
Radial play	preloaded
Max. axial load (dynamic)	5.5 N
Max. force for press fits (static)	100 N
Max. radial loading (projecting 5 mm from flange)	25 N

Table 3-3 Motor Data – Rating

3.2 Electrical Data

Rating	
Nominal power supply voltage V_{CC}	12…50 VDC
Nominal logic supply voltage V_C (optional)	12…50 VDC
Absolute min. supply voltage	11 VDC
Absolute max. supply voltage	54 VDC
Max. output voltage	0.9 • V_{CC}
Max. output current I_{max} (<1sec)	9 A
Continuous output current I_{cont}	2.6 A (T_a = 25°C, 5000 rpm, ➔Remark on page 3-12)
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
Position resolution	0.09°
Position accuracy	typically ±1°
Position reproducibility	typically ±0.09°
Hall sensor signals	Hall sensor 1, Hall sensor 2, Hall sensor 3
Encoder signals	A, A\, B, B\, I, I\ (max. 200 KHz) 1000 increments

Table 3-4 Electrical Data – Rating

Remark

Valid for T_a = 25°C, thermally isolated, no convection, 5000 rpm.
Higher values (I_{cont} max.3 A) are possible under more favorable ambient conditions, such as…

- *free convection or forced air cooling*
- *thermal coupling*
- *lower speed*

Inputs	
Digital Input 1 (“General Purpose”), optically isolated	+9…+24 VDC
Digital Input 2 (“Home Switch”), optically isolated	+9…+24 VDC
Digital Input 3 (“Positive Limit Switch”), optically isolated	+9…+24 VDC
Digital Input 4 (“Negative Limit Switch”), optically isolated	+9…+24 VDC
Digital Input 7 (“High Speed Command”)	internal line receiver EIA RS422 Standard
Digital Input 8 (“High Speed Command”)	internal line receiver EIA RS422 Standard
+V Opto IN	+12…+24 VDC

Table 3-5 Electrical Data – Inputs

Outputs	
Digital Output 3 (“General Purpose”), optically isolated	max. 24 VDC (I_L <350 mA)
Digital Output 4 (“General Purpose”), optically isolated	max. 24 VDC (I_L <350 mA)

Table 3-6 Electrical Data – Outputs

Interfaces		
RS232	RxD; TxD	max. 115 200 bit/s
CAN	CAN_H (high); CAN_L (low)	max.1 Mbit/s
CAN ID	no mechanical switch, configured according to LSS CiA DSP-305	

Table 3-7 Electrical Data – Interfaces

Memory	
Total memory	512 kByte
Application memory (free programmable)	256 kByte
Non-volatile memory	512 Byte

Table 3-8 Electrical Data – Memory

Status Indicators	
Bicolor LED	green = ENABLE, red = FAULT
Blue LED	PROGRAM STATUS

Table 3-9 Electrical Data – LEDs

Connections		
J1 Power	On board: Suitable plug:	D-Sub connector High Density 15 poles (female) D-Sub connector High Density 15 poles (male)
J2 Power	On board: Suitable plug:	D-Sub connector 9 poles (male) D-Sub connector 9 poles (female)

Table 3-10 Electrical Data – Connections

3.3 Mechanical Data

Mechanical Data	
Weight	approx. 528 g
Dimensions (L x W x H)	120 x 33 x 53 mm
Mounting plate	for M3x4.5 screws

Table 3-11 Mechanical Data

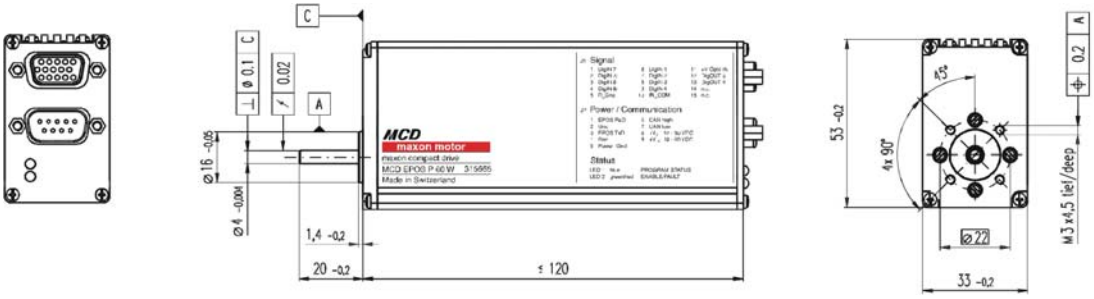

Figure 3-2 Dimensional Drawing [mm]

3.4 Environmental Conditions

Environmental Condition	
Protection class	IP42 (IP54 optional)
Temperature (operation)	-20…+85°C (power derating 1.4%/K above T_a = 25°C, ➔Remark on page 3-12)
Temperature (storage)	-40…+85°C
Max. case temperature	<100°C
Humidity	20…80% (condensation not permitted)

Table 3-12 Environmental Conditions

3.5 Order Details

Order Details	
MCD EPOS P 60 W	Order number 315665

Table 3-13 Order Details

4 Connections

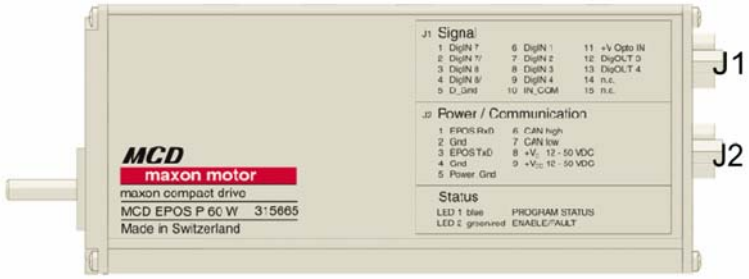

Figure 4-3 Interfaces – Designations and Location

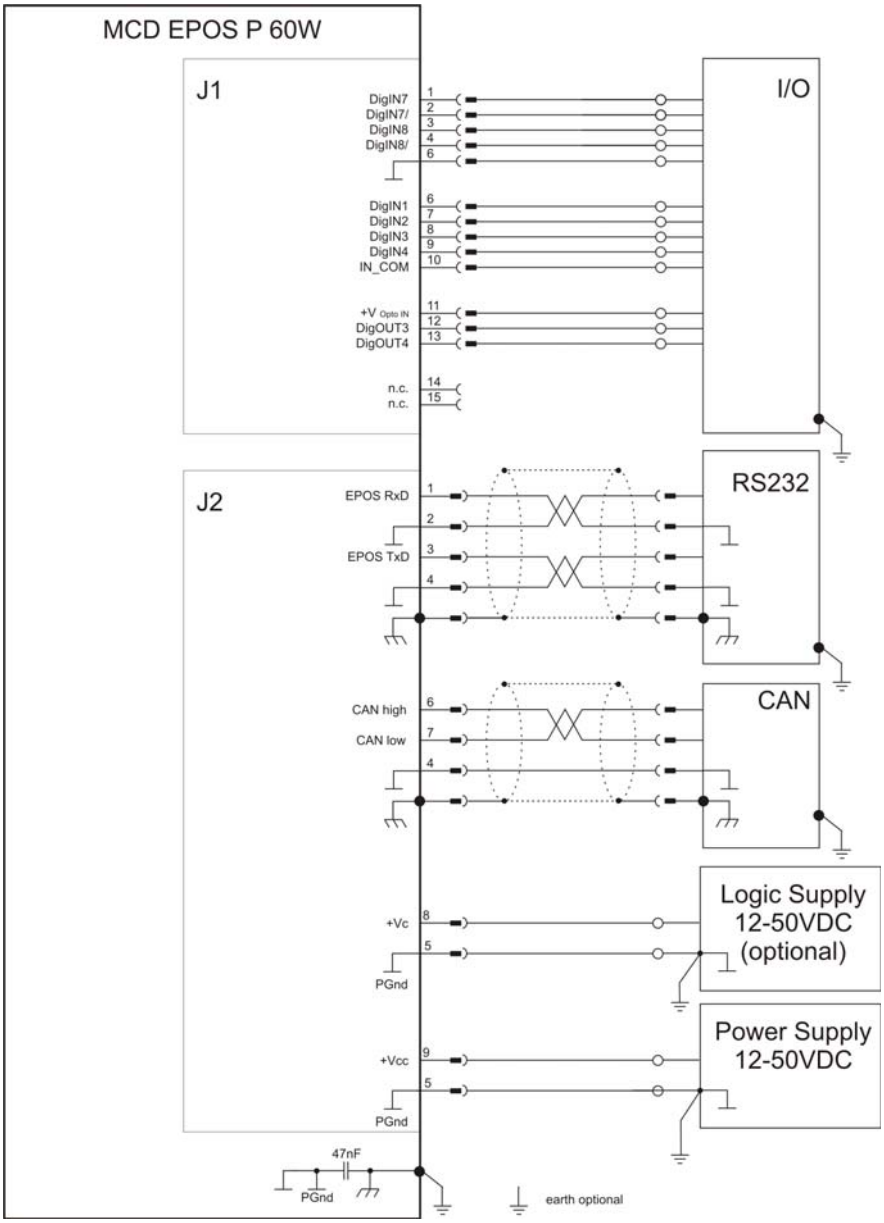

Figure 4-4 Wiring Diagram

4.1 Power/Communication Connector (J2)

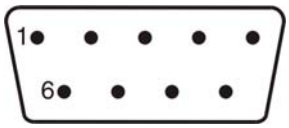

Figure 4-5 Power/Communication Connector (J2)

Pin	Signal	Description
1	EPOS RxD	EPOS RS232 receive
2	Gnd	Ground
3	EPOS TxD	EPOS RS232 transmit
4	Gnd	Ground
5	Power_Gnd	Ground of supply voltage
6	CAN high	CAN high bus line
7	CAN low	CAN low bus line
8	$+V_C$	Logic supply voltage +12…+50 VDC (optional)
9	$+V_{CC}$	Power supply voltage +12…+50 VDC

Accessories	Cables	MCD EPOS Power/RS232-CAN Cable (325939) MCD EPOS Power/CAN-CAN Cable (325235) MCD EPOS CAN Termination Plug (326925)
Notes	Suitable connector	D-Sub connector 9 poles (female)

4.1.1 Power Supply

$+V_{CC}$ Power_Gnd	Connector [J2] Pin [9] Connector [J2] Pin [5]

Best Practice

Keep the drive 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. 12 VDC; V_{CC} max. 50 VDC
Absolute supply voltage	min. 11 VDC; max. 54 VDC
Output current	Depending on load (continuous min. 2.6 A / acceleration, short-time min. 9 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 MCD EPOS P 60 W into account):

Known values:

- Operating torque M_B [mNm]
- Operating speed n_B [rpm]
- Speed constant k_n = 393 [rpm/V]
- Speed/torque gradient of the motor $\Delta n/\Delta M$ = 20.6 [rpm/mNm]

Sought value:

- Supply voltage $+V_{CC}$ [Volt]

Solution:

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

$$V_{CC} = \frac{1}{393\left[\frac{rpm}{V}\right]} \cdot \left(n_B + 20.6\left[\frac{rpm}{mNm}\right] \cdot M_B \right) \cdot \frac{1}{0.9} + 1[V]$$

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.

4.1.2 Logic Supply (optional)

$+V_C$ Power_Gnd	Connector [J2] Pin [8] Connector [J2] Pin [5]

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. 12 VDC; V_C max. 50 VDC
Absolute supply voltage	min. 11 VDC; max. 54 VDC
Min. output power	P_C min. 3 W

4.1.3 RS232 Communication

EPOS RxD Gnd EPOS TxD Gnd	Connector [J2] Pin [1] Connector [J2] Pin [2] Connector [J2] Pin [3] Connector [J2] Pin [4]
Max. input voltage	±30 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

MCD EPOS P 60 W	PC Interface (RS232), DIN41652
Connector [J2] Pins [2] / [4] “GND”	Pin 5 “GND”
Connector [J2] Pin [1] “EPOS RxD”	Pin 3 “PC TxD”
Connector [J2] Pin [3] “EPOS TxD”	Pin 2 “PC RxD”

Note

- *The RS232 port serves as programming interface using maxon motor’s programming tool «EPOS Studio». It can not be used by the application program.*
- *Consider your PC's serial port maximal baud rate.*
- *The standard baud rate setting (factory setting) is 115'200 bauds.*

4.1.4 CAN Communication

CAN high CAN low Gnd	Connector [J2] Pin [6] Connector [J2] Pin [7] Connector [J2] Pin [4]
Standard type	CAN high-speed ISO 11898 compatible
Max. bit rate	1 Mbit/s
Max. number of CAN nodes	127
Protocol	CANopen DS-301 V4.02
CAN ID	LSS CiA DSP-305

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

MCD EPOS P 60 W	CAN 9 pin D-Sub (DIN41652)
Connector [J2] Pin [6] “CAN high”	Pin 7 “CAN_H” high bus line
Connector [J2] Pin [7] “CAN low”	Pin 2 “CAN_L” low bus line”
Connector [J2] Pin [4] “CAN GND”	Pin 3 “CAN_GND” Ground

Note

- *Consider CAN Master’s maximal baud rate.*
- *The standard baud rate setting (factory setting) is 1 Mbit/s.*
- *Use termination resistor at both ends of the CAN bus.*
- *For detailed CAN information ➔separate document «EPOS Communication Guide».*

4.2 Signal Connector (J1)

Contains smart multi-purpose digital I/Os preconfigured as…

- “Positive Limit Switch”
- “Negative Limit Switch”
- “Home Switch”.

Additionally, “General Purpose” digital I/Os are provided.

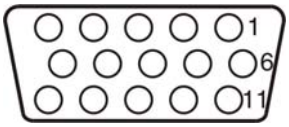

Figure 4-6 Signal Connector (J1)

Pin	Signal	Description
1	DigIN7	Digital Input 7 “High Speed Command”
2	DigIN7/	Digital Input 7 “High Speed Command” complement
3	DigIN8	Digital Input 8 “High Speed Command”
4	DigIN8/	Digital Input 8 “High Speed Command” complement
5	D_Gnd	Digital signal ground
6	DigIN1	Digital Input 1 “General Purpose”
7	DigIN2	Digital Input 2 “Home Switch”
8	DigIN3	Digital Input 3 “Positive Limit Switch”
9	DigIN4	Digital Input 4 “Negative Limit Switch”
10	IN_COM	Common signal for DigIN1…4
11	+V Opto IN	Input for external supply voltage for DigOUT3…4 (+12…+24 VDC)
12	DigOUT3	Digital Output 3 “General Purpose”
13	DigOUT4	Digital Output 4 “General Purpose”
14	not connected	–
15	not connected	–

Accessories	Cable	MCD EPOS Signal Cable (326923)
Notes	Suitable connector	D-Sub connector High Density 15 poles (male)

4.2.1 Digital Inputs 1, 2, 3 and 4 “General Purpose”

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

- Digital Input 1 “General Purpose”
- Digital Input 2 “Home Switch”
- Digital Input 3 “Positive Limit Switch”
- Digital Input 4 “Negative Limit Switch”

DigIN1 “General Purpose” DigIN2 “Home Switch” DigIN3 “Positive Limit Switch” DigIN4 “Negative Limit Switch” IN_COM (common signal)	Connector [J1] Pin [6] Connector [J1] Pin [7] Connector [J1] Pin [8] Connector [J1] Pin [9] Connector [J1] Pin [10]
Type of input	Optically isolated, singe-ended
Input voltage	0…+24 VDC
Max. input voltage	±30 VDC
Logic 0	$\lvert I_{in} \rvert$ <1 mA / $\lvert U_{in} \rvert$ <5 VDC
Logic 1	$\lvert I_{in} \rvert$ >2 mA / $\lvert U_{in} \rvert$ >9 VDC
Input current at logic 1	typically 3 mA @ 24 VDC
Switching delay	<300 µs @ 24 VDC

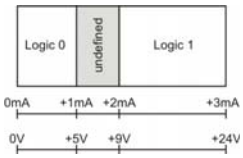

Figure 4-7 DigIN1…4 Logic Level

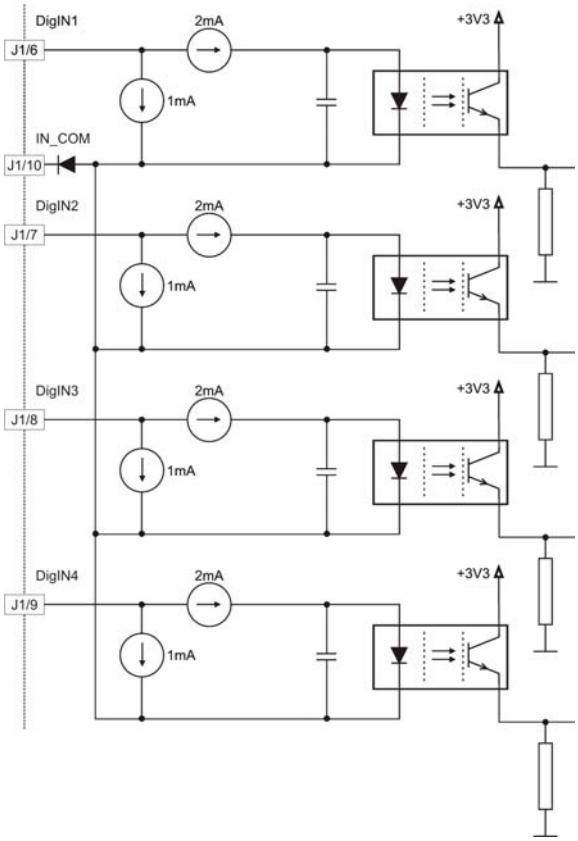

Figure 4-8 DigIN1…4 Circuit

Document ID: rel2895
Edition: December 2011

Wiring Example: “Different Types of Proximity Switches”

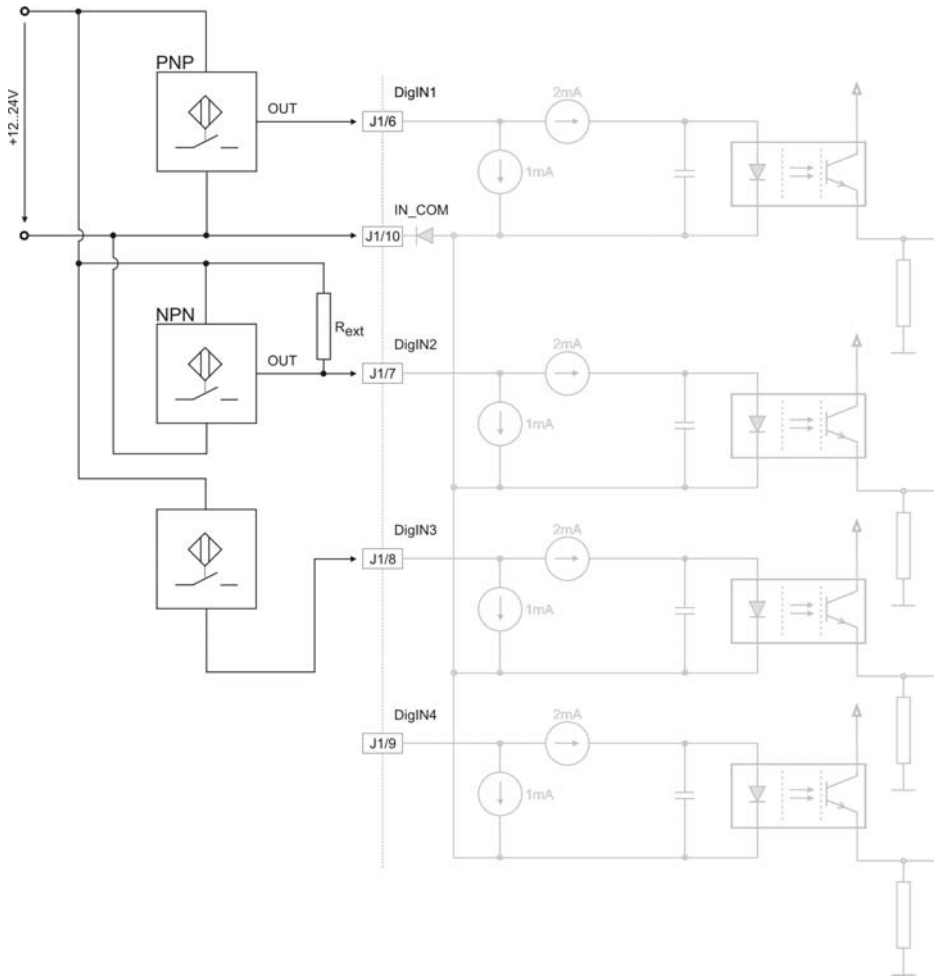

Figure 4-9 DigIN1…4 – Wiring Example for different Types of Proximity Switches

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) = 1 kΩ (150 mW)
  R_{ext} (24 V) = 5 kΩ (120 mW)
- *By principle, using 2-wire proximity switches is possible. Thereby observe a minimal load current of approximately 5 mA. Depending on type, an additional parallel resistor may be required.*

4.2.2 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 [J1] Pins [1] / [2] Connector [J1] Pins [3] / [4]
Min. differential input voltage	±200 mV
Line receiver (internal)	EIA RS422 Standard
Max. input frequency	500 kHz

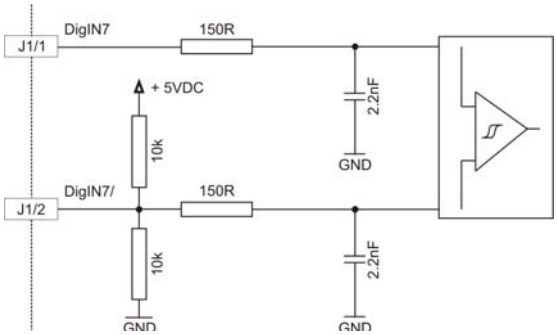

Figure 4-10 DigIN7 “Differential” Circuit (analogously valid also for DigIN8)

Single-ended	
DigIN7 “High Speed Command” DigIN8 “High Speed Command” D_Gnd (digital signal ground)	Connector [J1] Pin [1] Connector [J1] Pin [3] Connector [J1] Pin [5]
Input voltage	0…5 VDC
Max. input voltage	±24 VDC
Logic 0	<2.0 V
Logic 1	>3.0 V
Input resistance	typically 48 kΩ (referenced to D_Gnd)

Note
Do not *connect DigIN’s complements!*

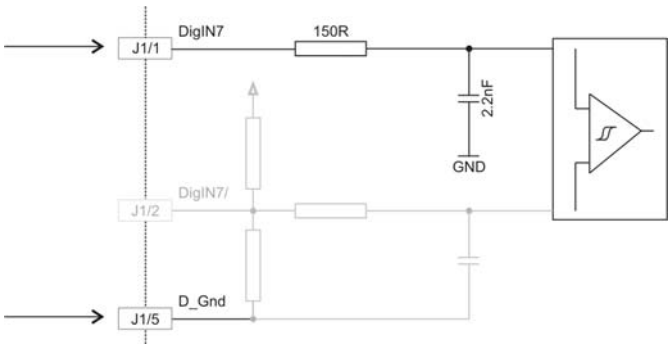

Figure 4-11 DigIN7 “Single-ended” Circuit (analogously valid also for DigIN8)

4.2.3 External Supply Input 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 IN_COM (common signal)	Connector [J1] Pin [11] Connector [J1] Pin [10]
Supply voltage	+12…+24 VDC
Min. current (if max. load on DigOUTs is required)	700 mA

4.2.4 Digital Outputs 3 and 4 “General Purpose”

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

DigOUT3 DigOUT4 +V Opto IN IN_COM (common signal)	Connector [J1] Pin [12] Connector [J1] Pin [13] Connector [J1] Pin [11] Connector [J1] Pin [10]
Type of output	Optically isolated, open emitter
Output voltage	$U_{out} \geq$ (+V Opto IN - 1.5 V)
Max. load current	$I_{load} \leq$350 mA
Leakage current	$I_{leak} \leq$50 µA
Switching delay	<300 µs @ 24 VDC
Max. inductive load	2 H @ 24 VDC; 500 mA

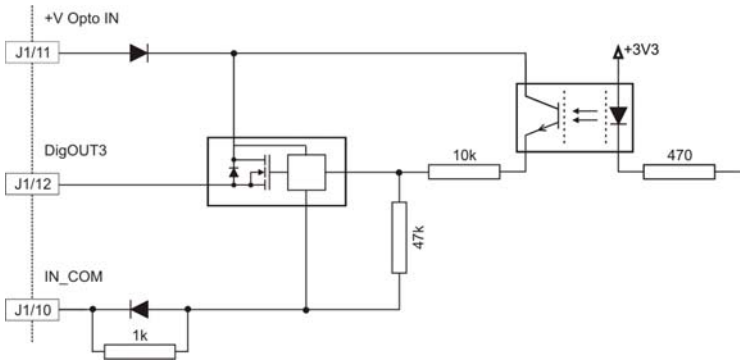

Figure 4-12 DigOUT3 Circuit – (analogously valid also for DigOUT4)

4.3 Status LEDs

Three LEDs display the current status of the MCD EPOS P 60 W and its application program, as well as possible errors:

- Green LED shows the operating status
- Red LED indicates errors
- Blue LED shows the status of the application program

For detailed information please read separate document «EPOS Firmware Specification».

LED			Status / Error
Red	**Green**	**Blue**	
OFF	**Slow**	–	MCD EPOS P 60 W is in status … • “Switch ON Disabled” • “Ready to Switch ON” • “Switched ON” Power stage is disabled
OFF	**ON**	–	MCD EPOS P 60 W is in status … • “Operation Enable” • “Quickstop Active” Power stage is enabled
ON	OFF	–	MCD EPOS P 60 W is in status … • “Fault”
ON	**ON**	–	MCD EPOS P 60 W is in temporary status … • “Fault Reaction Active” Power stage is enabled
ON	**Flashing**	–	No valid firmware (firmware download failed)
–	–	**Fast**	No valid application program
–	–	**Slow**	Application program has stopped
–	–	**ON**	Application program is running
–	–	**Flashing**	Application program in Error state
Legend: – = ignore status / Slow = Slow blinking (≈1 Hz) / Fast = Fast blinking (≈4 Hz)			

Table 4-14 LEDs – Interpretation of Condition

LIST OF FIGURES

LIST OF TABLES

INDEX

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

Phone +41 (41) 666 15 00
Fax +41 (41) 666 15 50

www.maxonmotor.com