

***EPOS* 70/10**

Positioning Controller Documentation

Hardware Reference



maxon document number: 752380-04

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3 Introduction

This documentation "Hardware Reference" provides the hardware details of the EPOS 70/10 positioning controller. It contains performance data, connections, specification, pin assignment and wiring examples.



Figure 1: EPOS 70/10 photo

The maxon motor EPOS 70/10 is a small-sized full digital smart motion controller. Due to the flexible and high efficient power stage the EPOS 70/10 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 to drive brushless EC motors with minimal torque ripple and low noise. The integrated position-, velocity- and current

control functionality allows sophisticated positioning applications. It is specially designed being commanded and controlled as a slave node in the CANopen network. In addition the unit can be operated through any RS-232 communication port.

The latest edition of these "Hardware Reference", additional documentation and software to the EPOS positioning controller may also be found on the internet in <http://www.maxonmotor.com> category <Service>, subdirectory <Downloads>.

4 How to use this guide

Setup



Getting Started

Installation



- Cable Starting Set



- Hardware Reference

Configuration



- Graphical User Interface

Programming



- Windows DLL
- IEC1131 libraries



- Firmware Specification



- Communication Guide

Application



- Application Notes
- Application Samples

Figure 2: EPOS documentation hierarchy

5 Safety Instructions

**Skilled Personnel**

Installation and starting of the equipment shall only be performed by experienced, skilled personnel.

**Statutory Regulations**

The user must ensure that the positioning controller and the components belonging to it are assembled and connected according to local statutory regulations.

**Load Disconnected**

For primary operation the motor should be free running, i.e. with the load disconnected.

**Additional Safety Equipment**

An electronic apparatus is not fail-safe in principle. Machines and apparatus must therefore be fitted with independent monitoring and safety equipment. If the equipment breaks down, if it is operated incorrectly, if the control unit breaks down or if the cables break, etc., it must be ensured that the drive or the complete apparatus is kept in a safe operating mode.

**Repairs**

Repairs may be made by authorized personnel only or by the manufacturer. It is dangerous for the user to open the unit or make repairs to it.

**Danger**

Do ensure that during the installation of the EPOS 70/10 no apparatus is connected to the electrical supply. After switching on, do not touch any live parts!

**Max. Supply Voltage**

Make sure that the supply voltage is between 11 and 70 VDC. Voltages higher than 77 VDC or of wrong polarity will destroy the unit.

**Electrostatic Sensitive Device (ESD)**

6 Performance Data

6.1 Electrical data

Power supply voltage V_{CC} (Ripple < 10%)	11 ... 70 VDC
Logic supply voltage V_C (Ripple < 10%) (optional)	11 ... 70 VDC
Max. output voltage	$0.9 \cdot V_{CC}$
Max. output current I_{max} (<1sec)	25 A
Continuous output current I_{cont}	10 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 (motors with 2 poles)	25 000 rpm
Built-in motor choke per phase	25 μ H / 10 A

6.2 Inputs

Hall sensor signals	Hall sensor 1, Hall sensor 2 and Hall sensor 3
	for Hall effect sensor IC's (Schmitt trigger with open collector output)
Encoder signals	A, A\, B, B\, I, I\ (max. 1MHz)
	internal line receiver EIA standard RS-422
Digital input 1 ("General Purpose")	opto-isolated +9 ... +24 VDC ($R_i = 1.8k\Omega$)
Digital input 2 ("General Purpose")	opto-isolated +9 ... +24 VDC ($R_i = 1.8k\Omega$)
Digital input 3 ("General Purpose")	opto-isolated +9 ... +24 VDC ($R_i = 1.8k\Omega$)
Digital input 4 ("Home Switch")	opto-isolated +9 ... +24 VDC ($R_i = 1.8k\Omega$)
Digital input 5 ("Positive Limit Switch")	opto-isolated +9 ... +24 VDC ($R_i = 1.8k\Omega$)
Digital input 6 ("Negative Limit Switch")	opto-isolated +9 ... +24 VDC ($R_i = 1.8k\Omega$)
Digital input 7 ("High Speed Command")	internal line receiver EIA standard RS-422
Digital input 8 ("High Speed Command")	internal line receiver EIA standard RS-422
Analogue input 1	resolution 10-bit 0 ... +5 V (differential)
Analogue input 2	resolution 10-bit 0 ... +5 V (differential)
+V Opto IN	+12 ... +24 VDC
CAN-ID (CAN identification)	ID 1-127 configured by DIP-Switch or Software

6.3 Outputs

Digital output 1 ("General Purpose")	opto-isolated max. 24 VDC ($I_L < 20$ mA)
Digital output 2 ("General Purpose")	opto-isolated max. 24 VDC ($I_L < 20$ mA)
Digital output 3 ("General Purpose")	opto-isolated max. 24 VDC ($I_L < 20$ mA)
Digital output 4 ("Brake")	opto-isolated max. 24 VDC ($I_L < 500$ mA)

6.4 Voltage outputs

Encoder supply voltage	+5 VDC, max. 100 mA
Hall sensors supply voltage	+5 VDC, max. 30 mA
Reference Output voltage	+5 VDC ($R_i = 1$ k Ω)

6.5 Motor connections

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

6.6 Interfaces

RS-232	RxD; TxD	max. 115 200 bit/s
CAN (1)	CAN_H (high); CAN_L (low)	max.1 MBit/s
CAN (2)	CAN_H (high); CAN_L (low)	max.1 MBit/s

6.7 LED indicator

2 colours LED	ENABLE / FAULT
.....	green = ENABLE, red = FAULT

6.8 Ambient temperature- / Humidity range

Operating	-10 ... +45°C
Storage	-40 ... +85°C
Non condensating	20 ... 80 %

6.9 Mechanical data

Weight	approx. 330 g
Dimensions (L x W x H)	150 x 93 x 27 mm
Mounting plate	for M3 screws

6.10 Connections

Power	on board:	dual row male header (2 poles) Molex Mini-Fit Jr.™
Supply	Suitable plug:	dual row female receptacle (2 poles) Molex Mini-Fit Jr.™ 39-01-2020
	Suitable terminal:	female crimp terminal Molex Mini-Fit Jr.™ 444-76-1111 (AWG 18-24)
Logic	On board:	dual row male header (2 poles) Molex Mini-Fit Jr.™
Supply	Suitable plug:	dual row female receptacle (2 poles) Molex Mini-Fit Jr.™ 39-01-2020
	Suitable terminal:	female crimp terminal Molex Mini-Fit Jr.™ 444-76-1111 (AWG 18-24)
Motor	On board:	dual row male header (4 poles) Molex Mini-Fit Jr.™
	Suitable plug:	dual row female receptacle (4 poles) Molex Mini-Fit Jr.™ 39-01-2040
	Suitable terminal:	female crimp terminal Molex Mini-Fit Jr.™ 444-76-1111 (AWG 18-24)
Hall	On board:	dual row male header (6 poles) Molex Micro-Fit 3.0™
	Suitable plug:	dual row female receptacle (6 poles) Molex Micro-Fit 3.0™ 430-25-0600
	Suitable terminal:	female crimp terminal Molex Micro-Fit 3.0™ 430-30-0010 (AWG26-30)
Signal 1	On board:	dual row male header (16 poles) Molex Micro-Fit 3.0™
	Suitable plug:	dual row female receptacle (16 poles) Molex Micro-Fit 3.0™ 430-25-1600
	Suitable terminal:	female crimp terminal Molex Micro-Fit 3.0™ 430-30-0010(AWG26-30)
Signal 2	On board:	dual row male header (12 poles) Molex Micro-Fit 3.0™
	Suitable plug:	dual row female receptacle (12 poles) Molex Micro-Fit 3.0™ 430-25-1200
	Suitable terminal:	female crimp terminal Molex Micro-Fit 3.0™ 430-30-0010(AWG26-30)
RS232	On board:	dual row male header (6 poles) Molex Micro-Fit 3.0™
	Suitable plug:	dual row female receptacle (6 poles) Molex Micro-Fit 3.0™ 430-25-0600
	Suitable terminal:	female crimp terminal Molex Micro-Fit 3.0™ 430-30-0010(AWG26-30)
CAN 1	On board:	dual row male header (4 poles) Molex Micro-Fit 3.0™
	Suitable plug:	dual row female receptacle (4 poles) Molex Micro-Fit 3.0™ 430-25-0400
	Suitable terminal:	female crimp terminal Molex Micro-Fit 3.0™ 430-30-0010(AWG26-30)
CAN 2	On board:	dual row male header (4 poles) Molex Micro-Fit 3.0™
	Suitable plug:	dual row female receptacle (4 poles) Molex Micro-Fit 3.0™ 430-25-0400
	Suitable terminal:	female crimp terminal Molex Micro-Fit 3.0™ 430-30-0010(AWG26-30)
Encoder	On board:	Plug DIN41651 (10 poles) for flat band cable
	pitch 1.27mm, AWG 28
	Suitable locking clip:	Tyco C42334-A421-C42 (right)
	Tyco C42334-A421-C52 (left)

6.11 Order number

EPOS 70/10	300583
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7 Connections 300583



Figure 3: EPOS photo with connector description

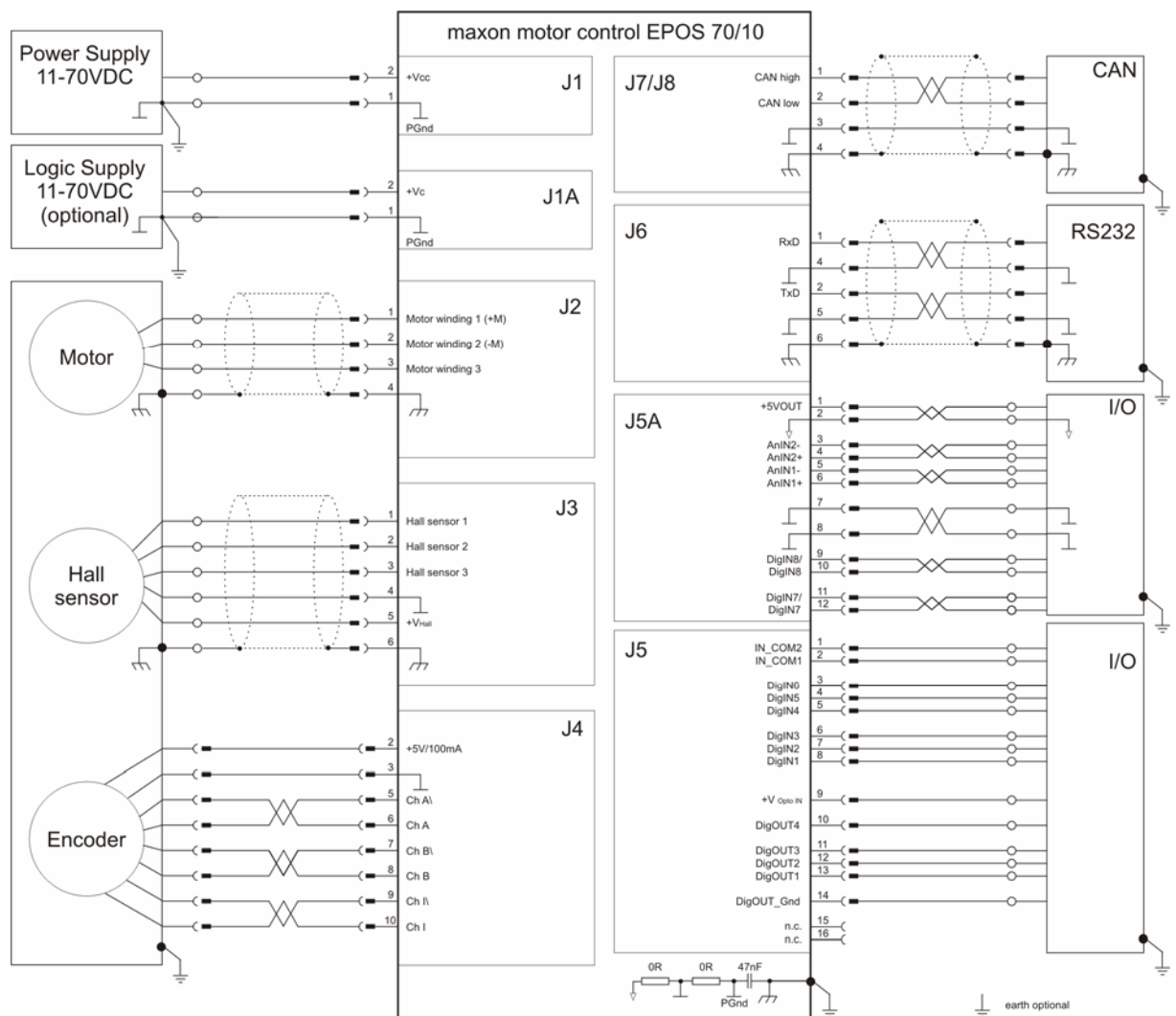


Figure 4: Wiring diagram (overview)

7.1 Power supply connector (J1)

Any available power supply can be used, provided it meets the minimal requirements set out below.

During set up and adjustment phases, we recommend separating the motor mechanically from the machine to prevent damage due to uncontrolled motion.

Power supply requirements

Output voltage	V_{CC} min. 11 VDC; V_{CC} max. 70 VDC
Ripple	< 10 %
Output current	Depending on load, continuous min. 10 A acceleration, short-time min. 25 A

The required voltage can be calculated as follows:

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:

$$V_{CC} = \frac{U_N}{n_0} \cdot \left(n_B + \frac{\Delta n}{\Delta M} \cdot M_B \right) \cdot \frac{1}{0.9} + 1 [V]$$

Choose a power supply capable of supplying this calculated voltage under load. The formula takes a max. PWM cycle of 90 % and a 1 volts max. voltage drop at EPOS 70/10 into account.

Consider:

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 (235811).

When using an electronically stabilized power supply observe that the over current protection shall not be activated in any operating state

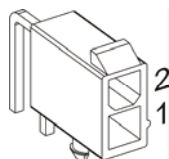


Figure 5: Power connector (J1)

Pin No.	Signal	Description
1	Power_Gnd	Ground of supply voltage
2	+ V_{CC}	Power supply voltage +11 ... +70 VDC

Accessories: EPOS power cable

maxon order number: **275829**

Notes: Suitable connector: Molex Mini-Fit Jr.TM 2 poles (39-01-2020)
 Suitable crimp terminals: Molex Mini-Fit Jr.TM female crimp terminals (444-76-1111)
 Suitable hand crimper: Molex hand crimper (69008-0724)

7.2 Logic supply connector (J1A)

Optionally, the logic supply voltage can be sourced separately. This allows a safe and economical power backup feature. In case no separate Logic supply is applied, the Logic supply will be sourced by the Power supply voltage automatically.

Any available power supply can be used, provided it meets the minimal requirements set out below.

Logic supply requirements

Output voltage	V_{CC} min. 11 VDC; V_{CC} max. 70 VDC
Ripple	< 10 %
Min. Output power	P_{CC} min. 5W

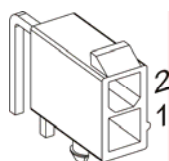


Figure 6: Logic supply connector (J1A)

Pin No.	Signal	Description
1	Power_Gnd	Ground of supply voltage
2	+V _C	Logic supply voltage +11 ... +70 VDC

Accessories: EPOS power cable

maxon order number: **275829**

Notes: Suitable connector: Molex Mini-Fit Jr.TM 2 poles (39-01-2020)
 Suitable crimp terminals: Molex Mini-Fit Jr.TM female crimp terminals (444-76-1111)
 Suitable hand crimper: Molex hand crimper (69008-0724)

7.3 Motor connector (J2)

7.3.1 maxon EC motor

Connect the maxon EC motor (brushless) motor windings on motor connector (J2).

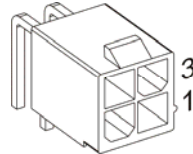


Figure 7: Motor connector (J2)

Pin No.	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

Accessories: EPOS motor cable

maxon order number: **275851**

Notes: Suitable connector:

Molex Mini-Fit Jr.™ 4 poles
(39-01-2040)

Suitable crimp terminals:

Molex Mini-Fit Jr.™ female crimp
terminals (444-76-1111)

Suitable hand crimper:

Molex hand crimper (69008-0724)

7.3.2 maxon DC motor with separated motor and encoder cable

Connect the maxon DC motor (brush) on motor connector (J2).

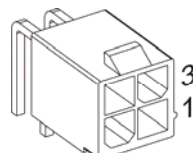


Figure 8: Motor connector (J2)

Pin No.	Signal	Description
1	Motor (+M)	DC motor: Motor +
2	Motor (-M)	DC motor: Motor -
3	Do not connect	Do not connect
4	Motor shield	Cable shield

Accessories: EPOS motor cable

maxon order number: **275851**

Notes: Suitable connector:

Molex Mini-Fit Jr.™ 4 poles
(39-01-2040)

Suitable crimp terminals:

Molex Mini-Fit Jr.™ female crimp
terminals (444-76-1111)

Suitable hand crimper:

Molex hand crimper (69008-0724)

7.4 Hall sensor connector (J3)

Hall sensors are needed for detecting rotor position of maxon EC motors (brushless).
 Suitable for Hall Effect sensors IC using Schmitt-trigger with open collector output.

Hall sensor supply voltage	+5 VDC
Max. Hall sensor supply current	30 mA
Input voltage	0...+10 VDC
Logic 0	typical < 0.8 VDC
Logic 1	typical > 2.4 VDC
Internal pull-up resistor	2.7 kΩ (against +5 VDC)

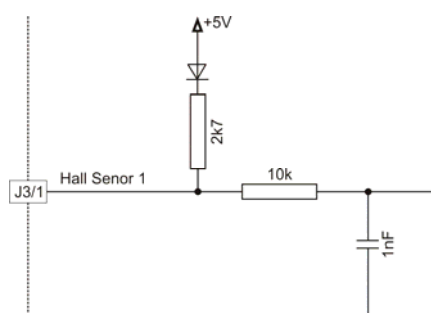


Figure 9: Hall sensor input circuit

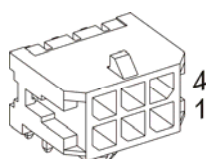


Figure 10: Hall sensor connector (J3)

Pin No.	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	+V _{Hall}	Hall sensor supply voltage +5 VDC / 30 mA
6	Hall shield	Cable shield

Accessories: EPOS Hall sensor cable

maxon order number: **275878**

Notes: Suitable connector:

Molex Micro-Fit 3.0™ 6 poles
(430-25-0600)

Suitable crimp terminals:

Molex Micro-Fit 3.0™ female crimp
terminals (430-30-0010)

Suitable hand crimper:

Molex hand crimper (69008-0983)

7.5 Encoder connector (J4)

It is necessary that an encoder with a built-in line driver is used (3-channel recommended).

The standard encoder adjustment (original packing) refers to a 500-count per turn encoder. For other encoders the adjustment must be modified with the software.

Encoder supply voltage	+5 VDC
Max. encoder supply current	100 mA
Min. differential Input voltage	± 200 mV
Line receiver (internal)	EIA standard RS-422
Max. encoder input frequency	1 MHz

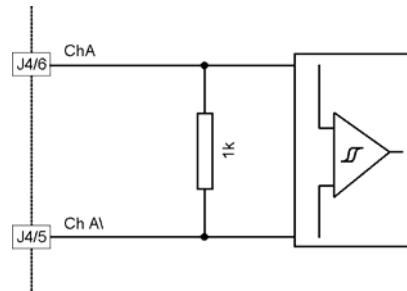


Figure 11: Encoder input circuit sketch

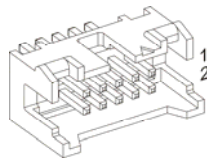


Figure 12: Encoder connector (J4)

Pin No.	Signal	Description
1	n.c.	Not connected
2	+5 VDC / 100 mA	Encoder supply voltage
3	GND	Ground
4	n.c.	Not connected
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

Encoder pin out suits for example to:

- maxon digital MR-Encoder type ML, L all with Line Driver
- maxon digital encoder HEDL 55__ with Line Driver RS 422

Accessories: EPOS encoder cable

maxon order number: **275934**

Notes: Suitable connector:

DIN 41651 Plug, pitch 2.54 mm,
10 poles, plug strain relief

7.6 Signal 1 connector (J5)

Signal connector contains smart multi-purpose digital I/O's configurable as: "Positive- and Negative Limit Switches", "Home Switch" and "Brake Output".

Additionally "General Purpose" digital I/O's are provided.

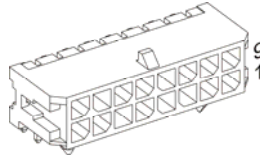


Figure 13: Signal connector (J5)

Pin No.	Signal	Description
1	IN_COM 2	Common signal 2 for DigIN 4...6
2	IN_COM 1	Common signal 1 for DigIN 1...3
3	DigIN 6	Digital input 6 "Negative Limit Switch"
4	DigIN 5	Digital input 5 "Positive Limit Switch"
5	DigIN 4	Digital input 4 "Home Switch"
6	DigIN 3	Digital input 3 "General Purpose"
7	DigIN 2	Digital input 2 "General Purpose"
8	DigIN 1	Digital input 1 "General Purpose"
9	+V Opto IN	External supply Input voltage for Digital Outputs (+12 ... 24VDC)
10	DigOUT 4	Digital output 4 "Brake"
11	DigOUT 3	Digital output 3 "General Purpose"
12	DigOUT 2	Digital output 2 "General Purpose"
13	DigOUT 1	Digital output 1 "General Purpose"
14	DigOUT_Gnd	Digital OUT Ground referred to "+V Opto IN"
15	n.c.	Not connected
16	n.c.	Not connected

Accessories: EPOS signal cable

maxon order number: **275932**

Notes: Suitable connector:

Molex Micro-Fit 3.0™ 16 poles (430-25-1600)

Suitable crimp terminals:

Molex Micro-Fit 3.0™ female crimp terminals (430-30-0010)

Suitable hand crimper:

Molex hand crimper (69008-0983)

7.6.1 Digital input 1, 2, 3 “General Purpose”

These opto-isolated inputs are defined as “General Purpose” by default and can be configured via software setting.

Digital input 1	[DigIN1]	Connector [J5] Pin number [8]
Digital input 2	[DigIN2]	Connector [J5] Pin number [7]
Digital input 3	[DigIN3]	Connector [J5] Pin number [6]
Common signal	[IN_COM1]	Connector [J5] Pin number [2]

Type of Input	Optical isolated Single ended, Bipolar
Input voltage	±24 VDC
Max. input voltage	± 30 VDC
Logic 0	$ I_{in} < 1 \text{ mA}$ $ U_{in} < 5 \text{ VDC}$
Logic 1	$ I_{in} > 3 \text{ mA}$ $ U_{in} > 9 \text{ VDC}$

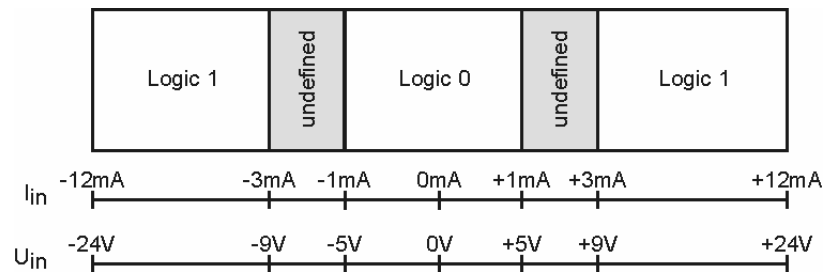


Figure 14: Logic level

Input resistance	typical 1.8 kΩ
Input current at logic 1	typical 13.2 mA @ 24 VDC
Switching delay	< 300 μs @ 24 VDC

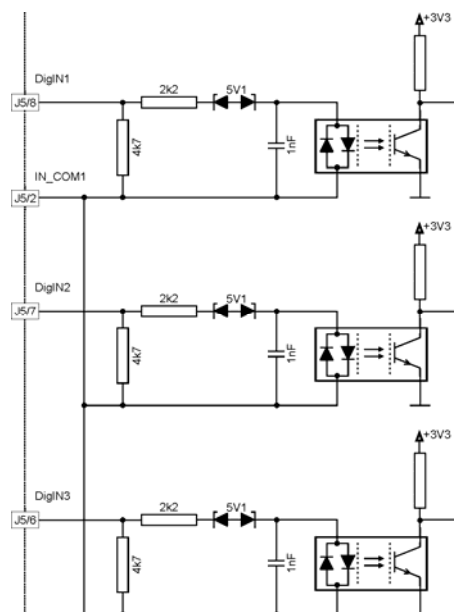


Figure 15: Digital input 1..3

7.6.2 Digital input 4, 5, 6 "Home Switch", "Positive and Negative Limit Switch"

These opto-isolated inputs are defined as:

Digital input 4: "Home Switch"

Digital input 5: "Positive Limit Switch"

Digital input 6: "Negative Limit Switch"

by default and can be configured via software setting.

Digital input 4	[DigIN4]	Connector [J5] Pin number [5]
Digital input 5	[DigIN5]	Connector [J5] Pin number [4]
Digital input 6	[DigIN6]	Connector [J5] Pin number [3]
Common signal	[IN_COM2]	Connector [J5] Pin number [1]

Type of Input	Optical isolated Single ended, Bipolar
Input voltage	± 24 VDC
Max. input voltage	± 30 VDC
Logic 0	$ I_{in} < 1$ mA $ U_{in} < 5$ VDC
Logic 1	$ I_{in} > 3$ mA $ U_{in} > 9$ VDC

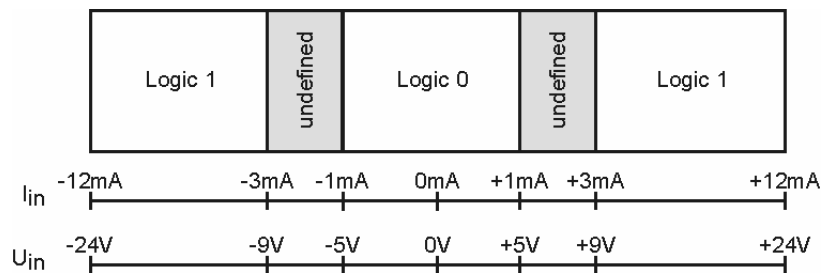


Figure 16: Logic level

Input resistance	typical 1.8 k Ω
Input current at logic 1	typical 13.2 mA @ 24 VDC
Switching delay	< 300 μ s @ 24 VDC

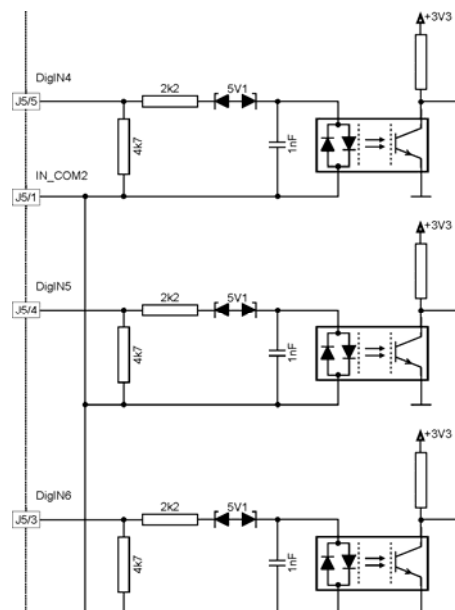
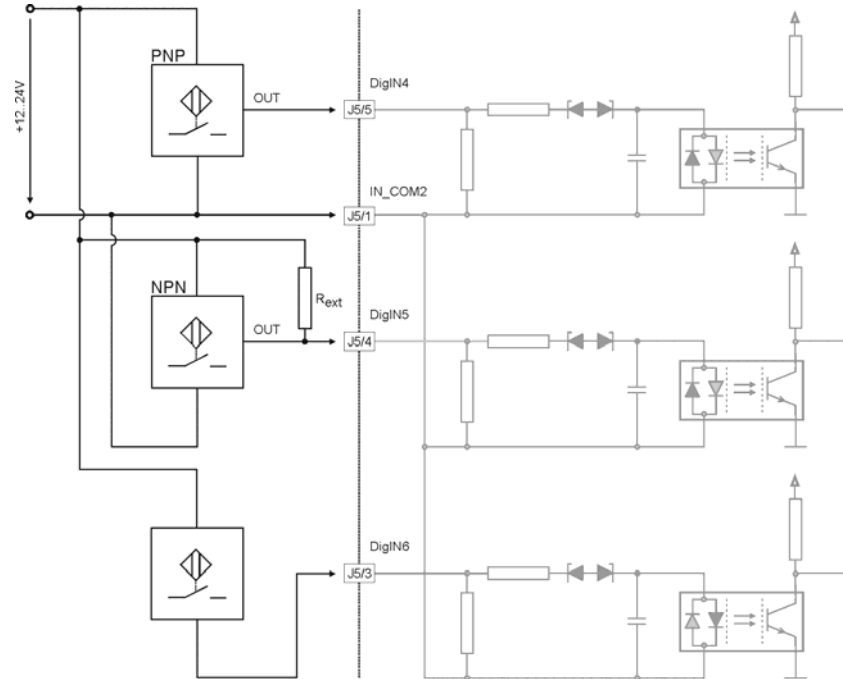


Figure 17: Digital input 4...6

Wiring examples:

Different types of proximity switches

*Figure 18: Digital input 4,5,6 external wiring examples***Notes:**

- Use of 3-wire PNP proximity switches is preferred.
- Use of 3-wire NPN proximity switches needs an additional external pull-up resistor
 $R_{ext} (12V) = 560 \Omega (300mW)$
 $R_{ext} (24V) = 3 k\Omega (200mW)$
- Use of 2-wire proximity switches is possible.

7.6.3 “+V Opto IN” external supply Input voltage for Digital Outputs

An external supply voltage has to be applied for supplying the EPOS 70/10 digital optical-isolated outputs.

+V Opto IN	[+V Opto IN]	Connector [J5] Pin number [9]
Digital OUT Ground	[DigOUT_Gnd]	Connector [J5] Pin number [14]

Any available power supply can be used, provided it meets the minimal requirements set below.

Supply voltage	+12...+24 VDC
Min. current	560 mA

7.6.4 Digital output 1, 2, 3 “General Purpose”

These opto-isolated outputs are defined as “General Purpose” by default and can be configured via software setting.

Digital output 1	[DigOUT1]	Connector [J5] Pin number [13]
Digital output 2	[DigOUT2]	Connector [J5] Pin number [12]
Digital output 3	[DigOUT3]	Connector [J5] Pin number [11]
+V Opto IN	[+V Opto IN]	Connector [J5] Pin number [9]

Type of Output	Optical isolated Open-Emitter
Output voltage	$U_{out} \geq +V \text{ Opto IN} - 3V$
Max. load current	$I_{load} \leq 20 \text{ mA}$
Leakage current	$I_{leak} \leq 20 \mu A$
Switching delay	$< 500 \mu s @ 24 \text{ VDC}$

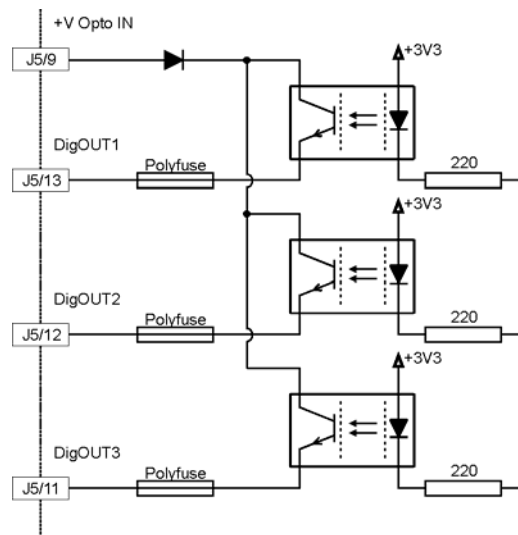


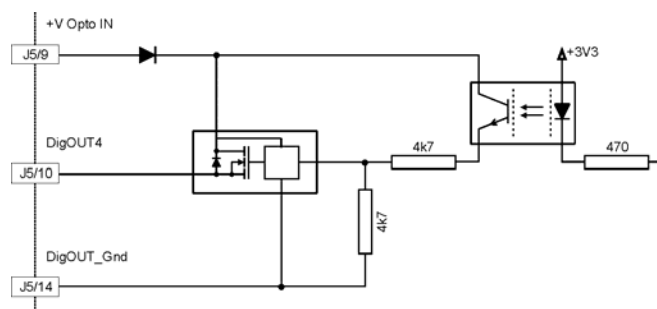
Figure 19: Digital output 1, 2, 3 circuit

7.6.5 Digital output 4 "Brake"

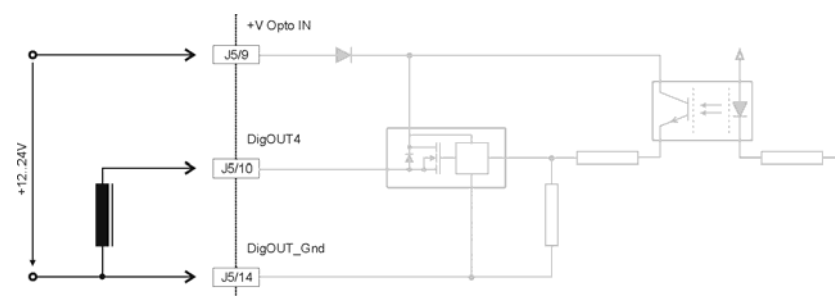
Apply permanent magnet brake for DC voltage.

Digital output 4	[DigOUT4]	Connector [J5] Pin number [10]
+V Opto IN	[+V Opto IN]	Connector [J5] Pin number [9]
Digital OUT Ground	[DigOUT_Gnd]	Connector [J5] Pin number [14]

Type of Output	Optical isolated Open-Emitter
Output voltage	$U_{out} \geq +V \text{ Opto IN} - 1V$
Max. load current	$I_{load} \leq 500 \text{ mA}$
Leakage current	$I_{leak} \leq 50 \mu A$
Switching delay	$< 300 \mu s @ 24 \text{ VDC}$
Max. inductive load	$2 \text{ H @ } 24\text{VDC}; 500\text{mA}$



Wiring example:
Permanent magnet brake



7.7 Signal 2 connector (J5A)

Signal 2 connector contains differential “High Speed Command” digital I/O's and additionally differential analogue inputs are provided.

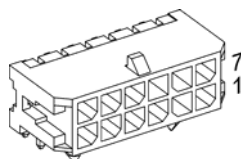


Figure 20: Signal connector (J5A)

Pin No.	Signal	Description
1	+5VOUT	Reference Output voltage +5V
2	A_Gnd	Analogue signal ground
3	AnIN2 -	Negative analogue signal input 2
4	AnIN2 +	Positive analogue signal input 2
5	AnIN1 -	Negative analogue signal input 1
6	AnIN1 +	Positive analogue signal input 1
7	D_Gnd	Digital signal ground
8	D_Gnd	Digital signal ground
9	DigIN 8/	Digital input 8 “High Speed Command” complement signal
10	DigIN 8	Digital input 8 “High Speed Command”
11	DigIN 7/	Digital input 7 “High Speed Command” complement signal
12	DigIN 7	Digital input 7 “High Speed Command” complement signal

Accessories: EPOS signal 2 cable

maxon order number: **300586**

Notes: Suitable connector:

Molex Micro-Fit 3.0™ 12 poles (430-25-1200)

Suitable crimp terminals:

Molex Micro-Fit 3.0™ female crimp terminals (430-30-0010)

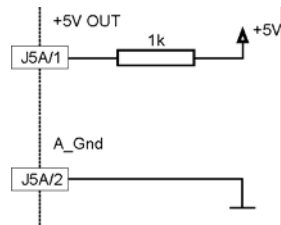
Suitable hand crimper:

Molex hand crimper (69008-0983)

7.7.1 Reference Output voltage

Reference Output voltage can be used as supply voltage for external loads connected to EPOS 70/10 analogue inputs.

Connector No. and Pin No.	Connector [J5A] Pin number [1]
Output voltage	+5 VDC
Output resistance	1.0 k Ω



7.7.2 Analogue input 1 "General Purpose"

"General Purpose" differential analogue input by default. **Not** configurable via software setting.

Connector No. and Pin No.	Connector [J5A] Pin number [5] Connector [J5A] Pin number [6]
Input voltage range	0 ... 5 VDC (differential)
Max. input voltage	- 30 ... + 30 VDC
Common-mode voltage range	- 5 ... + 10 VDC (referenced to AGnd)
Input resistance	30.2 k Ω (differential) 25.1 k Ω (referenced to AGnd)
A/D converter	10-bit
Resolution	0.005 V
Bandwidth	2 KHz

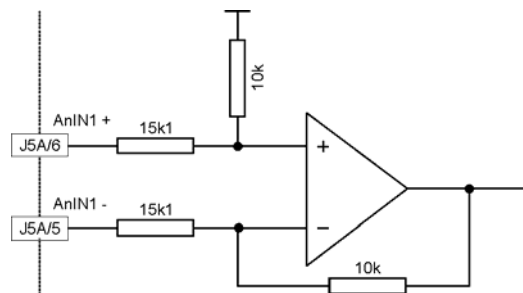


Figure 21: Analogue input 1 circuit

7.7.3 Analogue input 2 "General Purpose"

"General Purpose" differential analogue input by default. **Not** configurable via software setting.

Connector No. and Pin No.	Connector [J5A] Pin number [3] Connector [J5A] Pin number [4]
Input voltage range	0 ... 5 VDC (differential)
Max. input voltage	- 30 ... + 30 VDC
Common-mode voltage range	- 5 ... + 10 VDC (referenced to AGnd)
Input resistance	30.2 k Ω (differential) 25.1 k Ω (referenced to AGnd)
A/D converter	10-bit
Resolution	0.005 V
Bandwidth	2 KHz

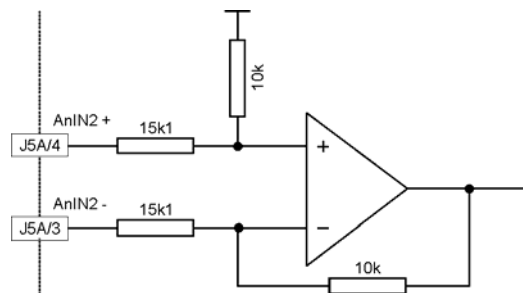


Figure 22: Analogue input 2 circuit

7.7.4 Digital input 7 "High Speed Command"

"High Speed Command" differential input by default and can be configured via software setting.

Differential

Connector No. and Pin No.	Connector [J5A] Pin number [11] Connector [J5A] Pin number [12]
Min. differential input voltage	±200 mV
Line receiver (internal)	EIA standards RS-422
Max. input frequency	1 MHz

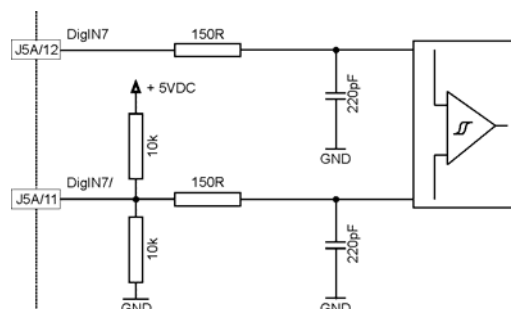


Figure 23: Digital input 7 "Differential" circuit

Single-ended DigIN7

Connector No. and Pin No.	Connector [J5A] Pin number [12]
Input voltage	0...5 VDC
Max. input voltage	± 24 VDC
Logic 0	< 2.0 V
Logic 1	> 3.0 V
Input resistance	typical 48 kΩ (referenced to D_Gnd)

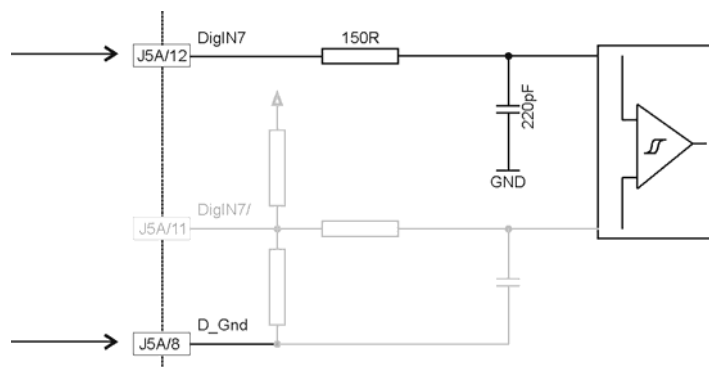


Figure 24: Digital input 7 "Single-ended" circuit

Notes: Connect signal to DigIN7 [J5A/12] and do not connect DigIN7/ [J5A/11]

7.7.5 Digital input 8 "High Speed Command"

"High Speed Command" differential input by default and can be configured via software setting.

Connector No. and Pin No.	Connector [J5A] Pin number [9] Connector [J5A] Pin number [10]
Min. differential Input voltage	± 200 mV
Line receiver (internal)	EIA standards RS-422
Max. input frequency	1 MHz

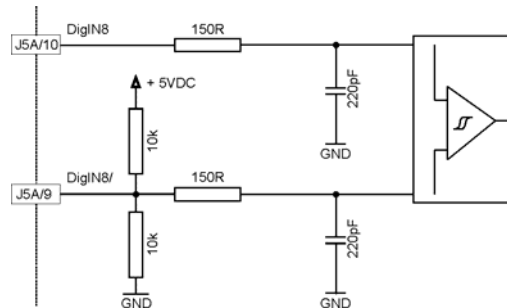


Figure 25: Digital input 8 "Differential" circuit

Single-ended DigIN8

Connector No. and Pin No.	Connector [J5A] Pin number [10]
Input voltage	0...5 VDC
Max. input voltage	± 24 VDC
Logic 0	< 2.0 V
Logic 1	> 3.0 V
Input resistance	typical 48 k Ω (referenced to D_Gnd)

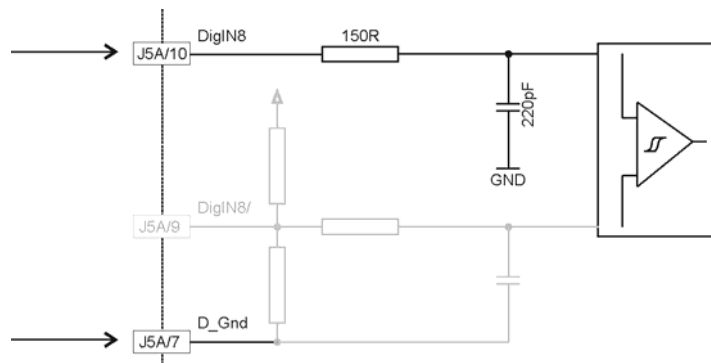


Figure 26: Digital input 8 "Single-ended" circuit

Notes: Connect signal to DigIN8 [J5A/10] and do not connect DigIN8/ [J5A/9]

7.8 RS-232 connector (J6)

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

Note:

- Please consider your PC's serial port maximal baud rate.
- The standard baud rate setting (factory setting) is 38'400 bauds.

Connection EPOS - PC

Positioning Controller EPOS 70/10	PC Interface (RS232), DIN41652
Connector J6 pin 4 + 5 "GND"	Pin 5 "GND"
Connector J6 pin 1 "EPOS RxD"	Pin 3 "PC TxD"
Connector J6 pin 2 "EPOS TxD"	Pin 2 "PC RxD"

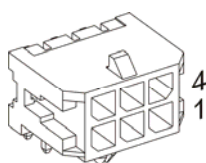


Figure 27: RS232 cable connector (J6)

Pin No.	Signal	Description
1	EPOS RxD	EPOS RS232 receive
2	EPOS TxD	EPOS RS232 transmit
3		
4	GND	RS232_Ground
5	GND	RS232_Ground
6	Shield	Cable shield

Accessories: EPOS RS232-COM cable

maxon order number: **275900**

Notes: Suitable connector:

Molex Micro-Fit 3.0™ 6 poles
(430-25-0600)

Suitable crimp terminals:

Molex Micro-Fit 3.0™ female crimp
terminals (430-30-0010)

Suitable hand crimper:

Molex hand crimper (69008-0983)

7.9 CAN connector (J7, J8)

Standard type	CAN high-speed ISO 11898 compatible
Maximum bit rate	1 MBit/s
Max. number of CAN nodes	127
Protocol	CANopen DS-301 V4.02
Identifier setting	by DIP-Switch or software

Connection EPOS - CAN
bus line CiA DS-102

Positioning Controller EPOS 70/10	CAN 9 pin D-Sub (DIN41652)
Connector J7 (J8) pin 1 "CAN high"	Pin 7 "CAN_H" high bus line
Connector J7 (J8) pin 2 "CAN low"	Pin 2 "CAN_L" low bus line
Connector J7 (J8) pin 3 "CAN GND"	Pin 3 "CAN_GND" Ground
Connector J7 (J8) pin 4 "CAN shield"	Pin 5 "CAN_Shield" Cable shield

Note:

- Please consider your CAN Master port maximal baud rate.
- The standard baud rate setting (factory setting) is 1 MBit/s.
- Further CAN information may be found in the "Communication Guide" documentation.
- Use termination resistor on both ends of the CAN bus.

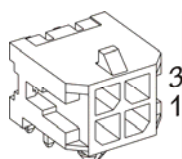


Figure 28: CAN connector (J7,J8)

Pin No.	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: EPOS CAN-COM cable
EPOS CAN-CAN cable
EPOS CAN termination plug

maxon order number: **275908**
maxon order number: **275926**
maxon order number: **275937**

Notes: Suitable connector:

Molex Micro-Fit 3.0™ 4 poles
(430-25-0400)

Suitable crimp terminals:

Molex Micro-Fit 3.0™ female crimp
terminals (430-30-0010)

Suitable hand crimper:

Molex hand crimper (69008-0983)

7.10 CAN Node Identification (JP 1)

The CAN-ID (node address) is set at DIP-Switch 1 ... 7.
All addresses can be coded from 1 ... 127 using the binary code.

Switch	Binary	Value
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

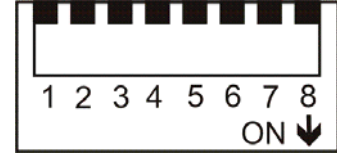


Figure 29: Table binary code value

If the value of all switches set at “ON” are added together, this gives the set CAN-ID (node address).

Examples:

The following table can be used as a guide, but is not comprehensive.

		Switch	1	2	3	4	5	6	7		
		Value	1	2	4	8	16	32	64		
CAN-ID	Switch setting									Calculation	
1		1	0	0	0	0	0	0	0	1	
2		0	1	0	0	0	0	0	0	2	
32		0	0	0	0	0	1	0	0	32	
35		1	1	0	0	0	1	0	0	1 + 2 + 32	
127		1	1	1	1	1	1	1	1	1 + 2 + 4 + 8 + 16 + 32 + 64	

Figure 30: CAN ID examples

Notes:

- The Node ID set by software is valid, if DIP-Switch is set to value 0.
- DIP-Switch 8 has no impact on the CAN-ID.

8 LED status

The green LED shows the operating status and the red LED indicates an error of the positioning controller EPOS 70/10. Detailed information may be found in the Firmware Specification document.

Red LED	Green LED	Description
OFF	Slow blinking ($\approx 1\text{Hz}$)	The EPOS is in state: - <i>Switch ON Disabled</i> - <i>Ready to Switch ON</i> - <i>Switched ON</i> The power stage is disabled
OFF	ON	The EPOS is in state: - <i>Operation Enable</i> - <i>Quick Stop Active</i> The power stage is enabled
ON	OFF	The EPOS is in state - <i>Fault</i>
ON	ON	The EPOS is in temporary state - <i>Fault Reaction Active</i> The power stage is enabled
ON	Flashing	There is no valid firmware on the EPOS (due to a failed firmware download)

9 Dimension drawing

Dimensions in [mm]

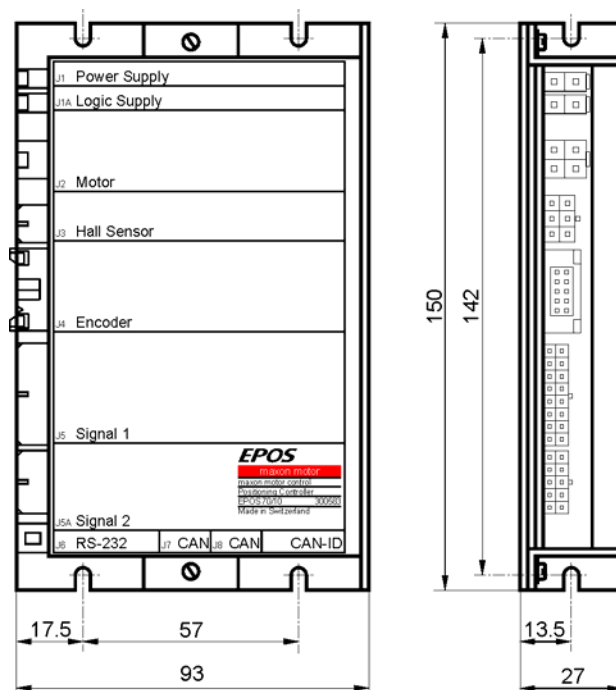


Figure 31: Dimensions EPOS 70/10