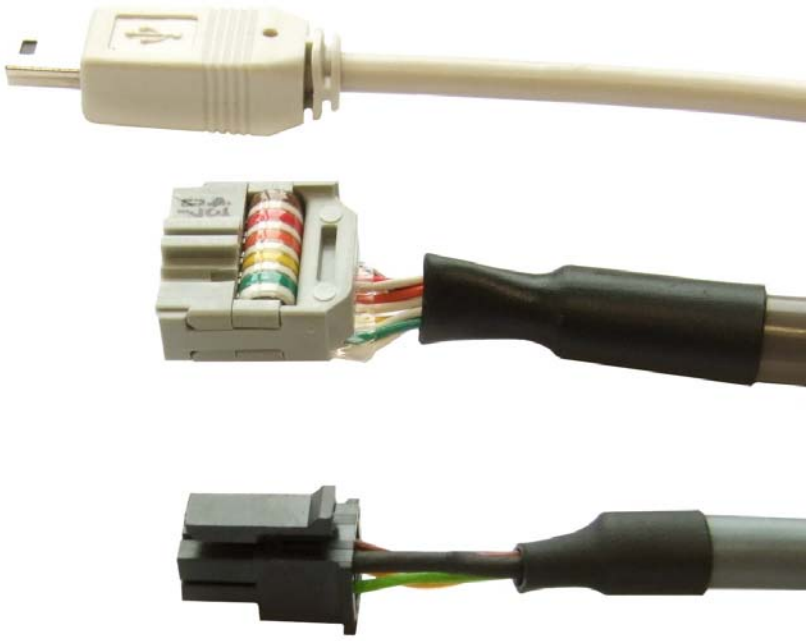
EPOS2 24/2

Positioning Controller

Cable Starting Set



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PLEASE READ THIS FIRST

Theseinstructionsareintendedforqualifiedtechnicalpersonnel.Priorcommencingwithanyactivities …

- *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.

Followanystatedreference–observerespectiveinformation–thengobackandcontinuewiththetask!

PREREQUISITES FOR PERMISSION TO COMMENCE INSTALLATION

The EPOS2 24/2 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

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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 …
Micro-Fit™ Mini-Fit Jr.™	© Molex, USA-Lisle, IL

Table 1-2 Brand Names and Trademark Owners

1.6 Copyright

maxon motor ag
Brünigstrasse 220
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Switzerland

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

www.maxonmotor.com

2 Introduction

The present document provides you with information on the wiring details for each cable which will be used with the EPOS2 24/2 hardware. It contains pictures, drawings, cable specification, pin assignment and detailed connector information. The included «Cable Selector» will help you to choose the correct cable for the setup you are using.

The EPOS2 24/2 Positioning Controller is available in different variants possessing an identical basic setup, however, their individual configuration varies slightly. The present document covers the entire scope on all variants, thus providing you with all relevant information regardless of the actual type of controller you are using.

Find the latest edition of the present document, as well as additional documentation and software to the EPOS2 24/2 Positioning Controller also on the internet: ➔www.maxonmotor.com

2.1 Documentation Structure

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

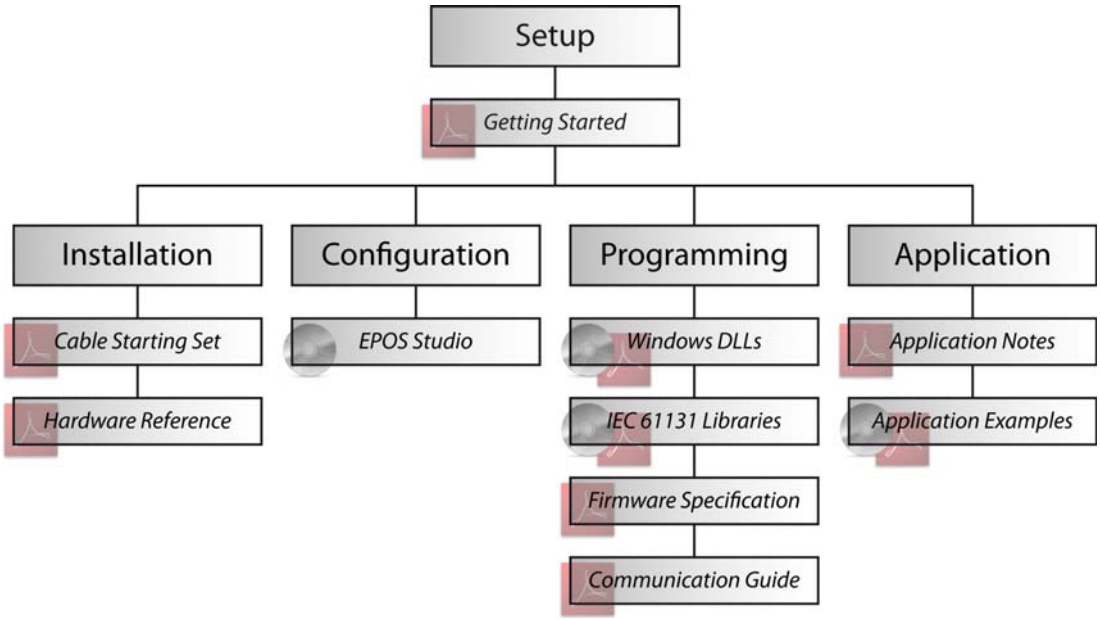

Figure 2-1 Documentation Structure

2.2 Safety Precautions

Prior continuing …

- make sure you have read and understood chapter " PLEASE READ THIS FIRST" on page A-2,
- do not engage with any work unless you possess the stated skills (➔chapter "1.2 Target Audience" on page 1-5),
- refer to chapter "1.4 Symbols and Signs" on page 1-5 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.*

Electrostatic Sensitive Device (ESD)

- *Make sure to wear working cloth in compliance with ESD.*
- *Handle device with extra care.*

3 Cables

3.1 Important Notice: Prerequisites for Permission to commence Installation

The EPOS2 24/2 is considered as partly completed machinery according to EU's directive 2006/42/EC, Article 2, Clause (g) and therefore **is only intended to be incorporated into or assembled with other machinery or other partly completed machinery or equipment**.

WARNING

Risk of Injury
Operating the device without the full compliance of the surrounding system with the EU directive 2006/42/EC may cause serious injuries!

- *Do not operate the device, unless you have made sure that the other machinery fulfills the requirements stated in EU's directive!*
- *Do not operate the device, unless the surrounding system fulfills all relevant health and safety aspects!*
- *Do not operate the device, unless all respective interfaces have been established and fulfill the stated requirements!*

3.2 Tools

If you should decide not to use the ready-made cable assemblies, we strongly recommenced to employ the following hand tools.

Tools	
Crimper	Molex hand crimper (63819-0000)
	Molex hand crimper (63819-0900)

Table 3-3 Recommended Tools

3.3 Cable Selector

Use the following table to find the matching cables for the maxon motor variant and type of equipment you will be using:

Cable		EPOS2 24/2						Communication		
			390438	380264	390003					
Designation	**Order #**	**Connector**	**DC** motor **with integrated** motor/encoder ribbon cable	**EC** motor **with integrated** motor/Hall sensor cable	**DC** motor **with separated** encoder cable	**DC** motor **with integrated** motor/encoder ribbon cable	**EC** motor **with separated** Hall sensor & encoder cables	**USB**	**RS232**	**CAN**
Encoder Cable	275934	J3	O							
		J9		O						
		J11			O	O	O			
Motor/Hall Sensor Cable	302948	J10					X			
DC Motor Cable	303490	J10			X					
Signal Cable 16core	275932	J14			X	X	X			
RS232-COM Cable	275900	J12			O	O	O		X	
CAN-COM Cable	275908	J13			O	O	O			X
CAN-CAN Cable	275926	J13			O	O	O			O
CAN-Y Cable	319471	J13			O	O	O			O
USB Type A - mini B Cable	370513	J15	X	X	X	X	X	X		
Legend: X = required / O = optional										

Table 3-4 Cable Selector

3.4 Cable Assemblies

3.4.1 Encoder Cable (275934) – Connector J3

Head A **Head B**

Figure 3-2 Encoder Cable

Technical Data	
Cable cross-section	10 x AWG28, round-jacket, twisted pair flat cable, pitch 1.27 mm
Length	3.20 m
Head A	DIN 41651 female connector, pitch 2.54 mm, 10 poles, plug strain relief
Head B	DIN 41651 Plug, pitch 2.54 mm, 10 poles, plug strain relief

Table 3-5 Encoder Cable – Technical Data

Wire	Head A Pin	Head B Pin	Twisted Pair	Signal	Description
brown	1	1	1	Motor+	Motor terminal “+”
white	2	2		+5 VDC / 100 mA	Encoder supply voltage
red	3	3	2	GND	Ground
white	4	4		Motor-	Motor terminal “-”
orange	5	5	3	Channel A\	Channel A complement
white	6	6		Channel A	Channel A
yellow	7	7	4	Channel B\	Channel B complement
white	8	8		Channel B	Channel B
green	9	9	5	Channel I\	Index complement
white	10	10		Channel I	Index

Table 3-6 Encoder Cable – Pin Assignment, J3

Note

Encoder Cable head B. The pin out suits, for example:

- *maxon digital MR Encoder type M, S (all with Line Driver)*

3.4.2 Encoder Cable (275934) – Connector J9

Head A **Head B**

Figure 3-3 Encoder Cable

Technical Data	
Cable cross-section	10 x AWG28, round-jacket, twisted pair flat cable, pitch 1.27 mm
Length	3.20 m
Head A	DIN 41651 female connector, pitch 2.54 mm, 10 poles, plug strain relief
Head B	DIN 41651 Plug, pitch 2.54 mm, 10 poles, plug strain relief

Table 3-7 Encoder Cable – Technical Data

Wire	Head A Pin	Head B Pin	Twisted Pair	Signal	Description
brown	1	1	1	not connected	–
white	2	2		+5 VDC / 100 mA	Encoder supply voltage
red	3	3	2	GND	Ground
white	4	4		not connected	–
orange	5	5	3	Channel A\	Channel A complement
white	6	6		Channel A	Channel A
yellow	7	7	4	Channel B\	Channel B complement
white	8	8		Channel B	Channel B
green	9	9	5	Channel I\	Index complement
white	10	10		Channel I	Index

Table 3-8 Encoder Cable – Pin Assignment, J9

Note

Encoder Cable head B. The pin out suits, for example:

- *maxon digital MR-Encoder type L, M, ML (all with Line Driver)*
- *maxon digital encoder HEDL 55_ (with Line Driver RS422)*

3.4.3 Motor/Hall Sensor Cable (302948) – Connector J10

Head A **Head B**

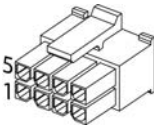

Figure 3-4 Motor/Hall Sensor Cable

Technical Data	
Cable cross-section	Cable 1: 1 x 3 x 0.25 mm^2, shielded Cable 2: 1 x 5 x 0.14 mm^2, shielded
Length	3 m
Head A	Molex Micro-Fit 3.0 8 poles (430-25-0800) Molex Micro-Fit 3.0 female crimp terminals (43030-xxxx) Cable lug Ø3.2 mm (for M3 screws)
Head B	Cable end sleeves 0.25 mm^2 Cable end sleeves 0.14 mm^2

Table 3-9 Motor/Hall Sensor Cable – Technical Data

DC Motor

Wire	Head A Pin	Head B Pin	Twisted Pair	Signal	Description
white2	1		–	not connected	–
brown2	2		–	not connected	–
green1	3		–	not connected	–
white1	4		–	Motor+	Motor terminal “+”
grey2	5		–	not connected	–
green2	6		–	not connected	–
yellow2	7		–	not connected	–
brown1	8		–	Motor-	Motor terminal “-”

Table 3-10 Motor/Hall Sensor Cable – Pin Assignment (DC Motor), J10

EC Motor

Wire	Head A Pin	Head B Pin	Twisted Pair	Signal	Description
white2	1		–	Hall sensor 3	Hall sensor 3 input
brown2	2		–	Hall sensor 2	Hall sensor 2 input
green1	3		–	Motor winding 3	Winding 3
white1	4		–	Motor winding 1	Winding 1
grey2	5		–	$+V_{Hall}$	Hall sensor supply voltage (+5 VDC / 30 mA)
green2	6		–	Hall sensor 1	Hall sensor 1 input
yellow2	7		–	GND	Ground
brown1	8		–	Motor winding 2	Winding 2

Table 3-11 Motor/Hall Sensor Cable – Pin Assignment (EC Motor), J10

3.4.4 DC Motor Cable (303490) – Connector J10

Head A **Head B**

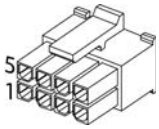

Figure 3-5 Motor/Hall Sensor Cable

Technical Data	
Cable cross-section	2 x 0.25 mm^2, shielded
Length	3 m
Head A	Molex Micro-Fit 3.0 8 poles (430-25-0800) Molex Micro-Fit 3.0 female crimp terminals (43030-xxxx) Cable lug Ø3.2 mm (for M3 screws)
Head B	Cable end sleeves 0.25 mm^2

Table 3-12 Motor/Hall Sensor Cable – Technical Data

Wire	Head A Pin	Head B Pin	Twisted Pair	Signal	Description
white	1		–	not connected	–
brown	2		–	not connected	–
green	3		–	not connected	–
white	4		–	Motor+	Motor terminal “+”
grey	5		–	not connected	–
green	6		–	not connected	–
yellow	7		–	not connected	–
brown	8		–	Motor-	Motor terminal “-”

Table 3-13 Motor/Hall Sensor Cable – Pin Assignment, J10

3.4.5 Encoder Cable (275934) – Connector J11

Head A **Head B**

Figure 3-6 Encoder Cable

Technical Data	
Cable cross-section	10 x AWG28, round-jacket, twisted pair flat cable, pitch 1.27 mm
Length	3.20 m
Head A	DIN 41651 female connector, pitch 2.54 mm, 10 poles, plug strain relief
Head B	DIN 41651 Plug, pitch 2.54 mm, 10 poles, plug strain relief

Table 3-14 Encoder Cable – Technical Data

Wire	Head A Pin	Head B Pin	Twisted Pair	Signal	Description
brown	1	1	1	Motor+	Motor terminal “+”
white	2	2		+5 VDC / 100 mA	Encoder supply voltage
red	3	3	2	GND	Ground
white	4	4		Motor-	Motor terminal “-”
orange	5	5	3	Channel A\	Channel A complement
white	6	6		Channel A	Channel A
yellow	7	7	4	Channel B\	Channel B complement
white	8	8		Channel B	Channel B
green	9	9	5	Channel I\	Index complement
white	10	10		Channel I	Index

Table 3-15 Encoder Cable – Pin Assignment, J11

Note
Encoder Cable head B. The pin out suits, for example:
- *maxon digital MR Encoder type M, S (all with Line Driver)*

3.4.6 RS232-COM Cable (275900) – Connector J12

Head A **Head B**

Figure 3-7 RS232-COM Cable

Technical Data	
Cable cross-section	2 x 2 x 0.14 mm^2, twisted pair, shielded
Length	3 m
Head A	Molex Micro-Fit 3.0 6 poles (430-25-0600) Molex Micro-Fit 3.0 female crimp terminals (43030-xxxx)
Head B	Female D-Sub connector DIN 41652, 9 poles, with mounting screws

Table 3-16 RS232-COM Cable – Technical Data

Wire	Head A Pin	Head B Pin	Twisted Pair	Signal	Description
yellow	1	3	1	EPOS RxD	EPOS RS232 receive
white	2	2	2	EPOS TxD	EPOS RS232 transmit
green	4	5	1	GND	RS232 ground
brown	5	5	2	GND	RS232 ground
black	6	–	–	Shield	Cable shield
–	–	Housing	–	Shield	Cable shield, soldered to connector housing
Remark: pin assignment according to RS232 Standard					

Table 3-17 RS232-COM Cable – Pin Assignment, J12

3.4.7 CAN-COM Cable (275908) – Connector J13

Head A **Head B**

Figure 3-8 CAN-COM Cable

Technical Data	
Cable cross-section	2 x 2 x 0.14 mm^2, twisted pair, shielded
Length	3 m
Head A	Molex Micro-Fit 3.0 4 poles (430-25-0400) Molex Micro-Fit 3.0 female crimp terminals (43030-xxxx)
Head B	Female D-Sub connector DIN 41652, 9 poles, with mounting screws

Table 3-18 CAN-COM Cable – Technical Data

Wire	Head A Pin	Head B Pin	Twisted Pair	Signal	Description
yellow	1	7	1	CAN high	CAN high bus line
green	2	2		CAN low	CAN low bus line
brown	3	3	–	CAN GND	CAN ground
black	4	5	–	CAN shield	Cable shield
Remark: pin assignment according to CiA DS102-2					

Table 3-19 CAN-COM Cable – Pin Assignment, J13

3.4.8 CAN-CAN Cable (275926) – Connector J13

Head A **Head B**

Figure 3-9 CAN-CAN Cable

Technical Data	
Cable cross-section	2 x 2 x 0.14 mm^2, twisted pair, shielded
Length	3 m
Head A / Head B	Molex Micro-Fit 3.0 4 poles (430-25-0400) Molex Micro-Fit 3.0 female crimp terminals (43030-xxxx)

Table 3-20 CAN-CAN Cable – Technical Data

Wire	Head A Pin	Head B Pin	Twisted Pair	Signal	Description
yellow	1	1	1	CAN high	CAN high bus line
green	2	2		CAN low	CAN low bus line
brown	3	3	–	CAN GND	CAN ground
black	4	4	–	CAN shield	Cable shield

Table 3-21 CAN-CAN Cable – Pin Assignment, J13

3.4.9 CAN-Y Cable (319471) – Connector J13

Head A
Head B

Head C

Figure 3-10 CAN-Y Cable

Technical Data	
Cable cross-section	2 x 4 x 0.14 mm^2, single wires
Length	0.05 m
Head A / Head B	Molex Micro-Fit 3.0 4 poles (430-25-0401) Molex Micro-Fit 3.0 male crimp terminals (43031-xxxx)
Head C	Molex Micro-Fit 3.0 4 poles (430-25-0400) Molex Micro-Fit 3.0 female crimp terminals (43030-xxxx)

Table 3-22 CAN-Y Cable – Technical Data

Wire	Head A Pin	Head B Pin	Head C Pin	Twisted Pair	Signal	Description
yellow	2	2	1	–	CAN high	CAN high bus line
green	1	1	2	–	CAN low	CAN low bus line
brown	4	4	3	–	CAN GND	CAN ground
black	3	3	4	–	CAN shield	Cable shield

Table 3-23 CAN-Y Cable – Pin Assignment, J13

Note
The CAN-Y Cable fits the other CAN cables.

3.4.10 Signal Cable 16core (275932) – Connector J14

Head A **Head B**

Figure 3-11 Signal Cable 16core

Technical Data	
Cable cross-section	16 x 0.14 mm^2
Length	3 m
Head A	Molex Micro-Fit 3.0 16 poles (430-25-1600) Molex Micro-Fit 3.0 female crimp terminals (43030-xxxx)
Head B	Cable end sleeves 0.14 mm^2

Table 3-24 Signal Cable 16core – Technical Data

Wire	Head A Pin	Head B Pin	Twisted Pair	Signal	Description
white	1		–	D_Gnd	Digital signal ground
brown	2		–	D_Gnd	Digital signal ground
green	3		–	DigIN6	Digital input 6 “Negative Limit Switch”
yellow	4		–	DigIN5	Digital input 5 “Positive Limit Switch”
grey	5		–	DigIN4	Digital input 4 “Home Switch”
pink	6		–	DigIN3	Digital input 3 “General Purpose”
blue	7		–	DigIN2	Digital input 2 “General Purpose”
red	8		–	DigIN1	Digital input 1 “General Purpose”
black	9		–	+VOUT	Auxiliary supply voltage Output (+5 VDC / 10 mA)
violet	10		–	DigOUT4	Digital output 4 “General Purpose”
grey/ pink	11		–	DigOUT3	Digital output 3 “General Purpose”
red/blue	12		–	+VCC	Power supply voltage (+9…24 VDC)
white/ green	13		–	Power_Gnd	Power ground
brown/ green	14		–	A_Gnd	Analog signal ground
white/ yellow	15		–	AnIN2	Analog Input 2
yellow/ brown	16		–	AnIN1	Analog Input 1

Table 3-25 Signal Cable 16core – Pin Assignment, J14

3.4.11 USB Type A - mini B Cable (370513) – Connector J15

Head A **Head B**

Figure 3-12 USB Type A - mini B Cable

Technical Data	
Cable cross-section	1 x 28 AWG non-twisted power pair / 1 x 28 AWG twisted data pair, aluminum-metallized polyester inner shield, 28 AWG stranded tinned copper drain wire, > 65%, tinned copper wire interwoven (braided) outer shield, PVC jacket
Length	3 m
Head A	USB Type mini B, male
Head B	USB Type A, male

Table 3-26 USB Type A - mini B Cable – Technical Data

Wire	Head A Pin	Head B Pin	Twisted Pair	Signal	Description
red	1	1	–	V_{BUS}	USB BUS supply voltage input +5 VDC
white	2	2	1	D-	USB Data-
green	3	3		D+	USB Data+
–	4	–	–	ID	not connected
black	5	4	–	GND	USB_Ground
Jacket	Shield	Shield	–	Cable shield	Cable shield, soldered to connector housing
Remark: pin assignment according to USB 2.0 standard					

Table 3-27 USB Type A - mini B Cable – Pin Assignment, J15

3.5 EPOS2 24/2 Connector Set (303807)

If you decide not to use the ready-made cable assemblies, you can take advantage of a prepackaged set containing all required connectors.The set contains following items:

Connector	Specification	Quantity
J10	Molex Micro-Fit 3.0 8 poles (430-25-0800)	1
J12	Molex Micro-Fit 3.0 6 poles (430-25-0600)	1
J13	Molex Micro-Fit 3.0 4 poles (430-25-0400)	1
J14	Molex Micro-Fit 3.0 16 poles (430-25-1600)	1
	Molex Micro-Fit 3.0 female crimp terminal (43030-0010)	40
	Tyco C42334-A421-C42 (right), encoder clip right	1
	Tyco C42334-A421-C52 (left), encoder clip left	1

Table 3-28 EPOS2 24/2 Connector Set – Content

Best Practice
For best results use original manufacturer's tools (➔chapter "3.2 Tools" on page 3-10).

LIST OF FIGURES

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