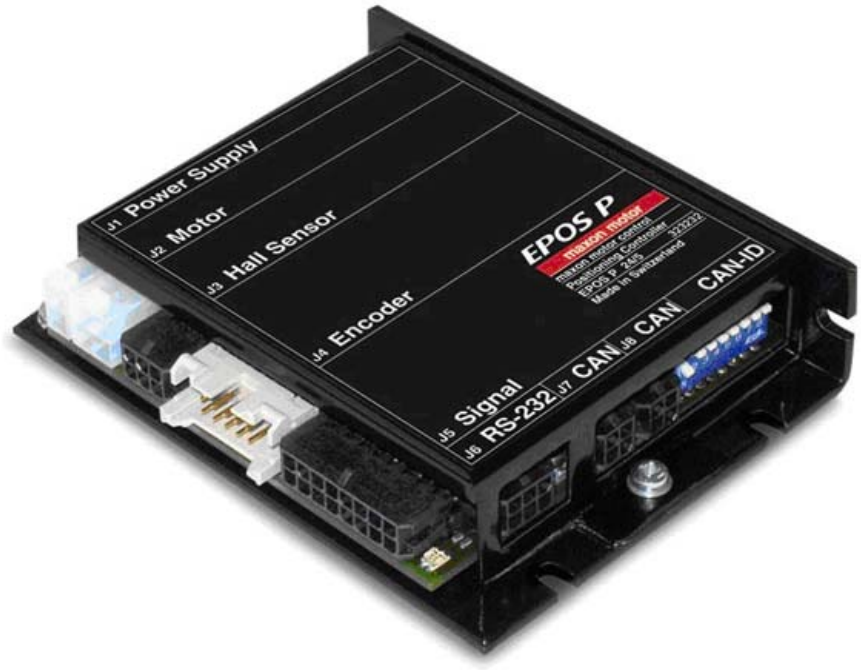
maxon motor control **EPOS P Programmable Positioning Controller**

Getting Started **Edition March 2011**

EPOS P 24/5

Programmable Positioning Controller

Getting Started



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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 EPOS P 24/5 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!*

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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
«Abcd»	indicating a title or a name (such as of document, product, mode, etc.)
¤Abcd¤	indicating an action to be performed using a software control element (such as folder, menu, drop-down menu, button, check box, etc.) or a hardware element (such as switch, DIP switch, etc.)
(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

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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!

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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

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2 Introduction

The present document provides you with information on the first steps using EPOS P 24/5 Programmable Positioning Controller. It describes the standard procedure when putting the device into operation and is meant to facilitate installation and configuration of a basic EPOS P 24/5 system.

maxon motor control's EPOS P 24/5 is a small-sized, full digital and free programmable positioning control unit. Due to its flexible and high efficient power stage, the EPOS P 24/5 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 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 EPOS P 24/5 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 EPOS controllers. In addition, the unit can be operated via any RS232 communication port.

Find the latest edition of the present document, as well as additional documentation and software to the EPOS P 24/5 Programmable Positioning Controller also on the internet:

➔www.maxonmotor.com – category «Service & Downloads»

➔shop.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:

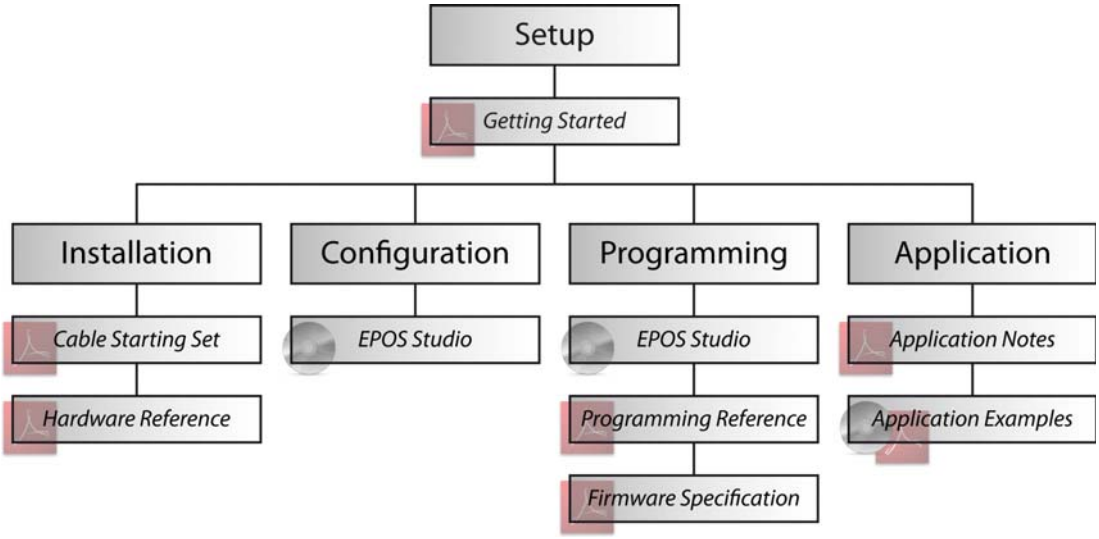

Figure 2-1 Documentation Structure

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2.2 Safety Precautions

Prior continuing …

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

DANGER

High Voltage and/or Electrical Shock
Touching live wires causes death or serious injuries!

- *Consider any power cable as connected to 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…24 VDC.*
- *Supply voltages above 27 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.*

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3 Installation and Configuration

3.1 Important Notice: Prerequisites for Permission to commence Installation

The EPOS P 24/5 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 Step 1: Software Installation

Install the software from the «EPOS Positioning Controller» CD-ROM. It contains all necessary information and tools (such as manuals, firmware, tools, Windows DLLs) required for installation and operation of the EPOS P Programmable Positioning Controller.

You can download the latest software version from the internet (for URLs ➔chapter "2 Introduction" on page 2-9.

3.2.1 Minimum System Requirements

Component	Minimum Requirement
Operating System	Windows 7, Windows Vista, Windows XP SP2
Processor	Core2Duo 1.5 GHz
Drives	Hard disk drive, 1.5 GB available space DVD drive
Memory	1 GB RAM
Monitor	Screen resolution 1024 x 768 pixels at high color (16-Bit)

Table 3-3 Minimum System Requirements

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3.2.2 Installation

1) **Insert «EPOS Positioning Controller» CD-ROM** into CD-ROM drive of your computer. Autorun will commence automatically. If autorun should fail to start, find the installation file named “EPOS Positioning Controller.msi” on your explorer, then doubleclick to start.

2) **Follow the instructions** during the installation program.
Please read every instruction carefully. Indicate location of working directory when prompted.

Best Practice

- *We recommend following location as working directory: C:\Program Files\maxon motor ag (note that designation of program directory may vary depending on the system language installed).*

3) **View new shortcuts and items in the start menu**.

- The files have been copied to the menu “maxon motor ag”, where you can access the program as well as the entire documentation set.
- Clicking the ¤EPOS Studio¤ shortcut on your desktop will launch the program.

4) If needed: Modify or remove the software.
To change application features or to uninstall the software, start the installation program “EPOS Positioning Controller.msi” anew and follow the instructions given.

3.3 Step 2: Hardware Presetting

There are three possible motor configurations:

- maxon EC motor
- maxon DC motor with separated motor and encoder cable
- maxon DC motor with integrated motor/encoder ribbon cable

For the first two configuration types, no additional presetting is required. When using **EPOS P 24/5 with a maxon DC motor with integrated motor/encoder ribbon cable**, you will need to perform additional presetting.

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

1) Open housing and find jumpers JP2 and JP3.

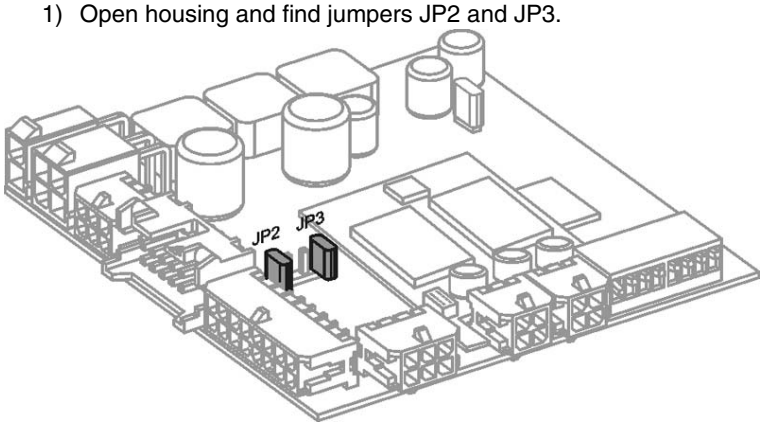

Figure 3-2 Jumpers JP2 and JP3 (Location and Factory Setting)

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2) Set jumpers JP2 and JP3 to “closed” position (➔Figure 3-3):

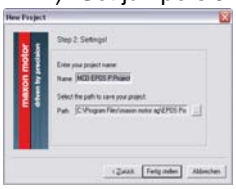

Figure 3-3 Jumpers JP2 and JP3 (maxon DC motor with integrated motor/encoder ribbon cable)

3.4 Step 3: Minimum External Wiring

Wiring depends on the type of motor you are using.

1) Decide on type of motor you wish to connect to your EPOS P 24/5 Programmable Positioning Controller.
2) Chose applicable chapter.
   - ➔“Minimum Wiring for maxon EC motor” on page 3-14
   - ➔“Minimum Wiring for maxon DC motor with separated motor/encoder cable” on page 3-15
   - ➔“Minimum Wiring for maxon DC motor with integrated motor/encoder ribbon cable” on page 3-16
3) Observe notes below.
4) Go to respective chapter.

Maximal permitted Supply Voltage

- *Make sure that supply power is between 11…24 VDC.*
- *Supply voltages above 27 VDC or wrong polarity will destroy the unit.*
- *Note that necessary output current is depending on load (continuous max. 5 A; acceleration/short-time max. 10 A).*

Note

- *For every motor variant, you will find a table stating type of cable to be used and respective from/to connections as well as a corresponding illustration (at the end of this chapter).*
- *If you decide not to use ready-made maxon cables, you must perform wiring according to separate document “Cable Starting Set”.*

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3.4.1 Minimum Wiring for maxon EC motor

1) Install EPOS P 24/5 Programmable Positioning Controller (323232).
2) Connect maxon cable assemblies (➔Table 3-4 and Figure 3-4).

Cable		Connection	
Designation	Order #	from …	… to
EPOS power cable	275829	J1	power supply +11…+24 VDC
EPOS motor cable	275851	J2	terminal blocks
EPOS Hall sensor cable	275878	J3	terminal blocks
EPOS encoder cable	275934	J4	encoder of the motor
EPOS RS232-COM cable	275900	J6	an available RS232 port of your computer

Table 3-4 Minimum Wiring: maxon EC motor

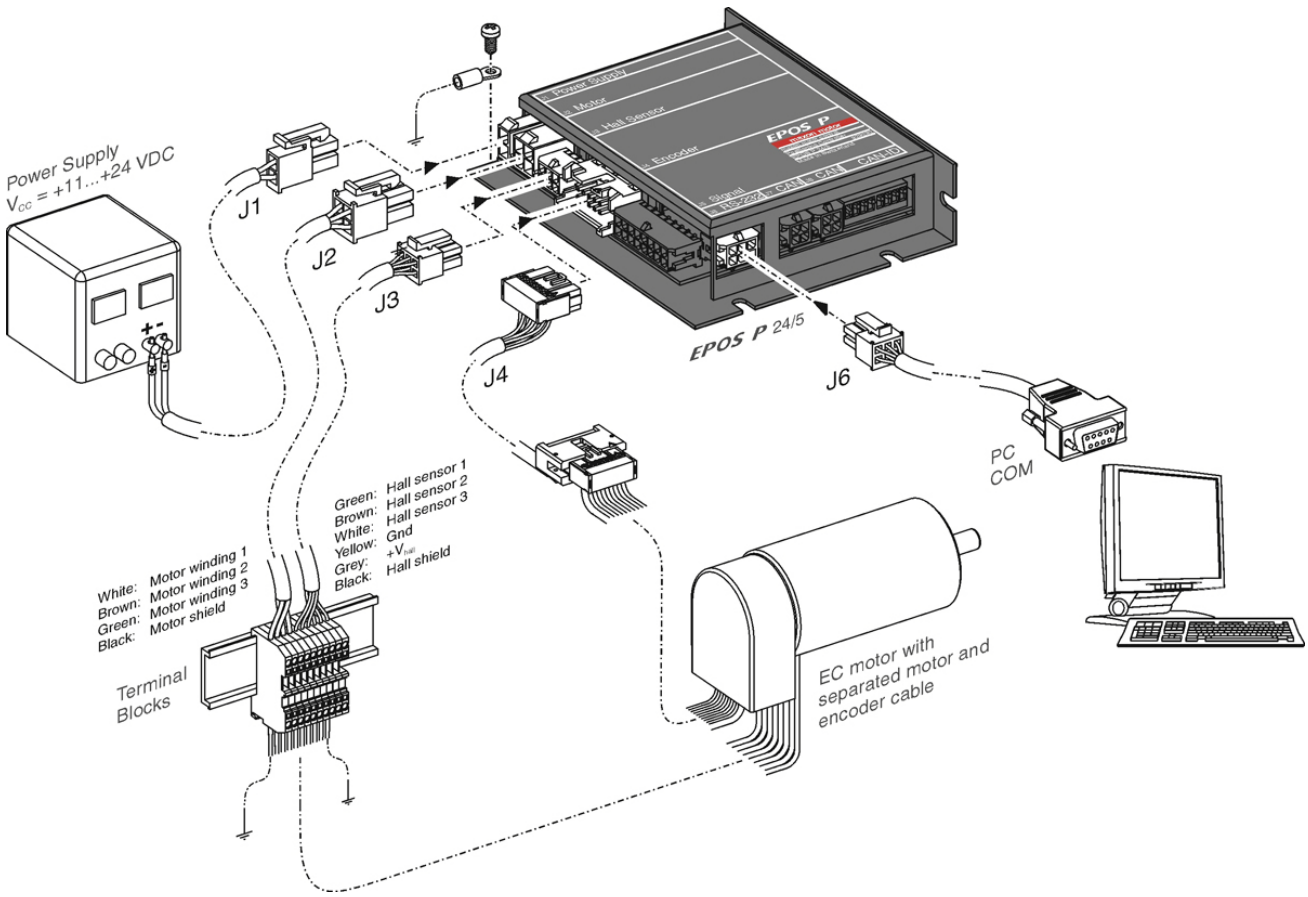

Figure 3-4 Minimum Wiring: maxon EC motor

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3.4.2 Minimum Wiring for maxon DC motor with separated motor/encoder cable

1) Install EPOS P 24/5 Programmable Positioning Controller (323232).
2) Connect maxon cable assemblies (➔Table 3-5 and Figure 3-5).

Cable		Connection	
Designation	Order #	from …	… to
EPOS power cable	275829	J1	power supply +11…+24 VDC
EPOS motor cable	275851	J2	terminal blocks
EPOS encoder cable	275934	J4	encoder of the motor
EPOS RS232-COM cable	275900	J6	an available RS232 port of your computer

Table 3-5 Minimum Wiring: maxon DC motor with separated motor/encoder cable

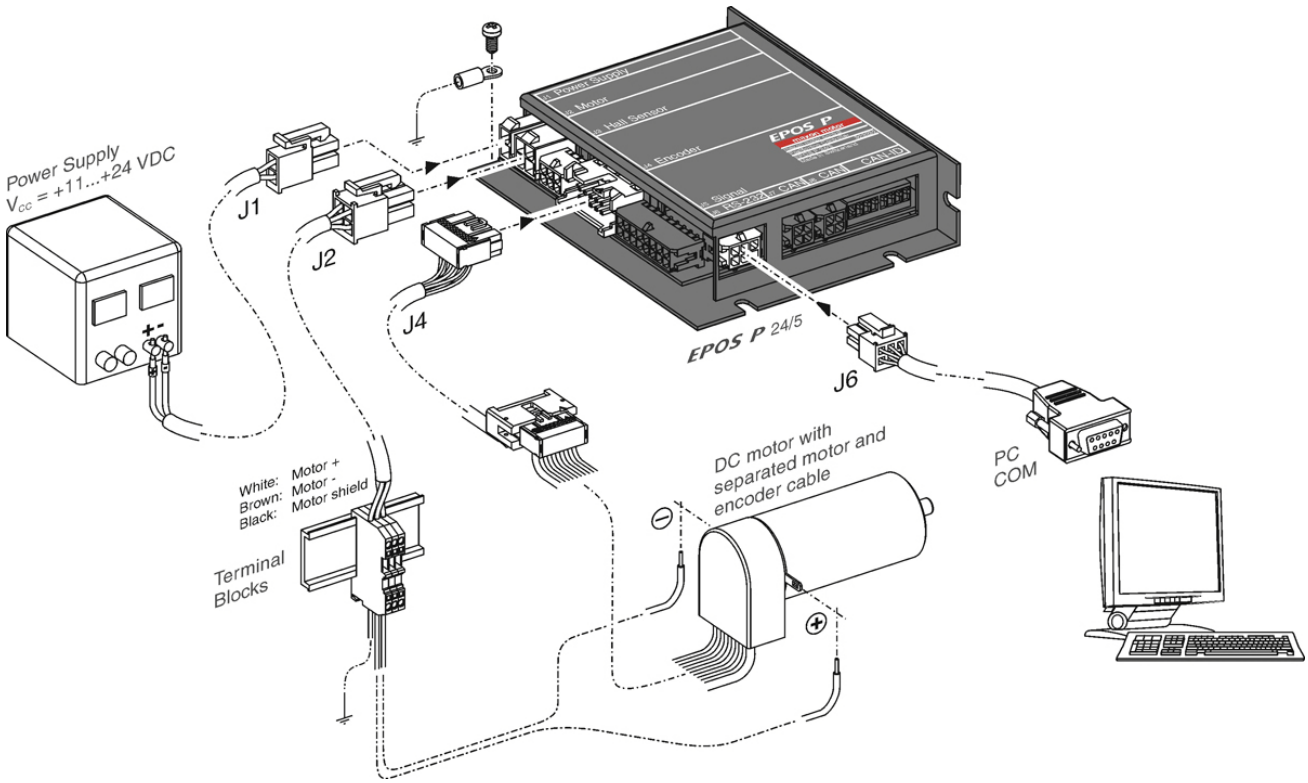

Figure 3-5 Minimum Wiring: maxon DC motor with separated motor/encoder cable

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3.4.3 Minimum Wiring for maxon DC motor with integrated motor/encoder ribbon cable

1) Install EPOS P 24/5 Programmable Positioning Controller (323232).
2) Connect maxon cable assemblies (➔Table 3-6 and Figure 3-6).

Cable		Connection	
Designation	Order #	from …	… to
EPOS power cable	275829	J1	power supply +11…+24 VDC
EPOS encoder cable	275934	J4	encoder of the motor
EPOS RS232-COM cable	275900	J6	an available RS232 port of your computer

Table 3-6 Minimum Wiring: maxon DC motor with integrated motor/encoder ribbon cable

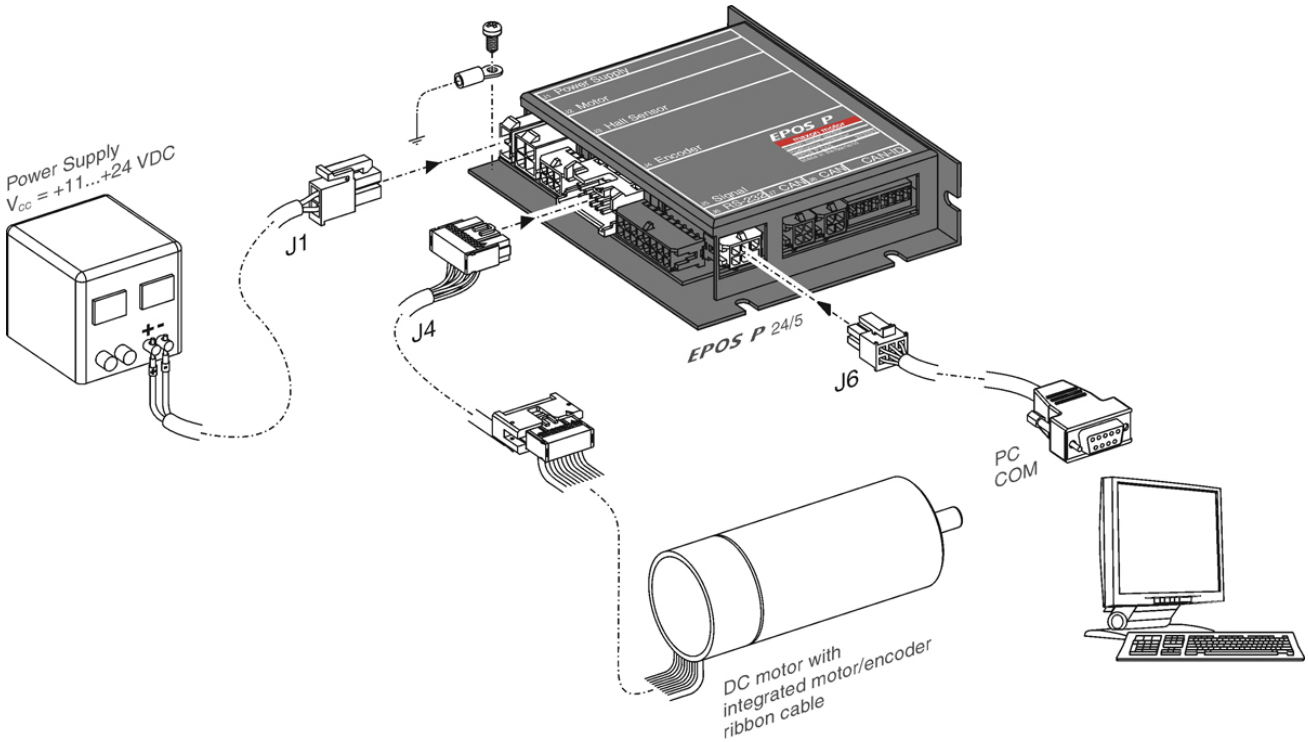

Figure 3-6 Minimum Wiring: maxon DC motor with integrated motor/encoder ribbon cable

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3.5 Step 4: System Configuration

Read separate Instructions

You will need to know ceratin technical data of your system

- *Refer to maxon catalog or respective data sheets of components used.*

3.5.1 General initial Steps

1) Switch on EPOS P 24/5 power supply.
2) Doubleclick ¤EPOS Studio.exe¤ shortcut on your desktop.
   «EPOS Studio» will start and the “New Project Wizard” will automatically be launched.
3) Make sure that you are using the latest version of «EPOS Studio». If you are in doubt on the version you are currently using, proceed as follows:
   a) Click menu ¤Help¤, then select menu ¤About EPOS Studio¤. The currently installed version will be displayed.
   b) Click one of the displayed hyperlinks to find out on the latest version available. Download the latest version, if needed.
4) Load an existing EPOS P Project:
   a) Select ¤EPOS P Project¤ from list.
   b) Click ¤Next¤ to proceed.

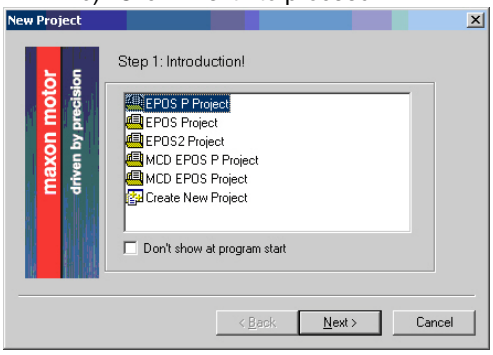

Figure 3-7 Project Configuration Dialog

5) Set project settings:
   a) Click browse icon (arrow) to set path and project name for your project.
   b) Click ¤Finish¤ to create new project.

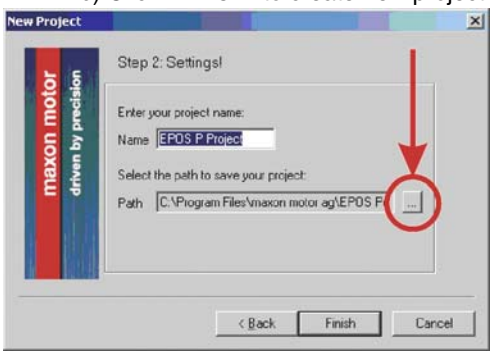

Figure 3-8 Project Path and Name

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6) Clear CAN Warning:
The Project Tree will be displayed in the “Page Navigator Window”. If CAN is not connected, the warning “CanPassiveError on CAN Port” will appear (arrow).
a) Click right on warning.
b) Click ¤Clear All Entries¤.

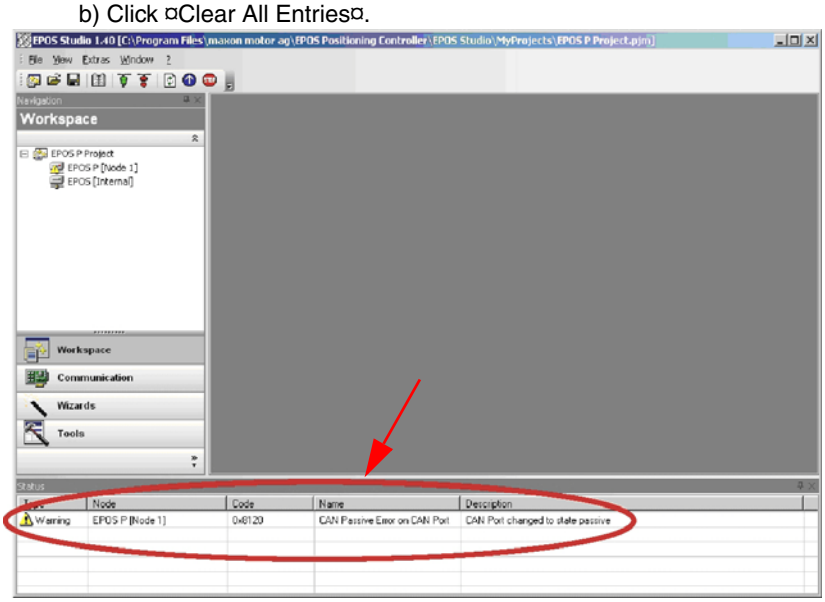

Figure 3-9 Project Tree and Warnings

7) Start “Startup Wizard”
a) Click ¤Wizards¤
b) Select ¤EPOS P¤ from Device Selection Combo Box (arrow)
c) Doubleclick ¤Startup Wizard¤ item in Wizard Tree

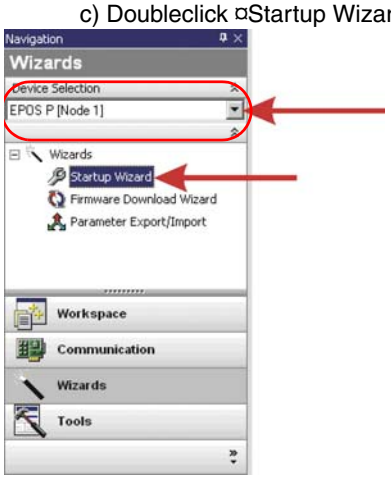

Figure 3-10 Page Navigator Window

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8) Startup Wizard (Step 1): Minimum External Wiring
a) Verify correct hardware installation (➔chapter “3.4 Step 3: Minimum External Wiring” on page 3-13).
b) Make sure you have read “Getting Started” and confirm by clicking ¤Confirm that you’ve read the “Getting Started” document¤.
c) Click ¤Next¤ to proceed.

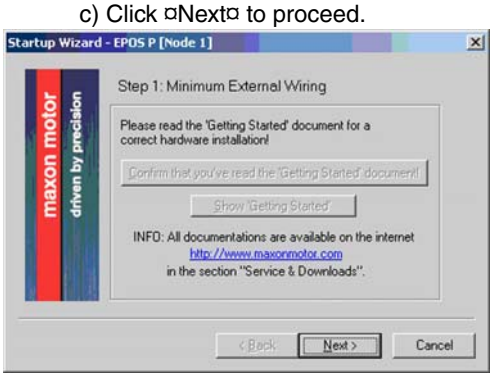

Figure 3-11 Startup Wizard Dialog: Minimum external Wiring

9) Startup Wizard (Step 2): Communication Setting
a) Verify correct wiring to RS232 interface (➔chapter “3.4 Step 3: Minimum External Wiring” on page 3-13).
b) Click ¤Search Communication Setting¤ to search COM port and to automatically adjust baud rate (arrow).

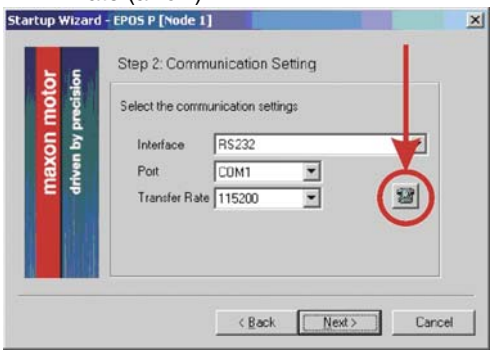

Figure 3-12 Startup Wizard Dialog: RS232 Communication

c) If correct communication settings were found, a respective message will be displayed.

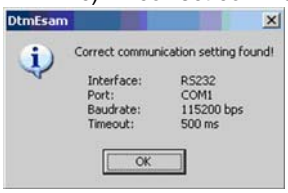

Figure 3-13 Communication Settings

d) Click ¤OK¤ to confirm.
e) Click ¤Next¤ to proceed.

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10) Startup Wizard (Step 3): Motor Type
    a) Select used motor type.
    b) Click ¤Next¤ to proceed.

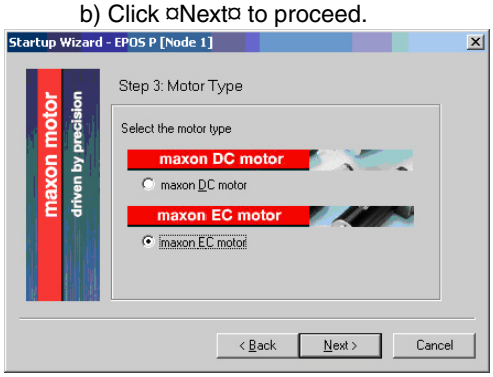

Figure 3-14 Startup Wizard Dialog: Motor Type

11) Decide on how to further proceed:
    a) To setup **EC motors** proceed to chapter “3.5.2 Configuration of EC Motors” on page 3-20, then continue with chapter “3.5.4 General closing Steps” on page 3-23.
    b) To setup **DC motors** proceed to chapter “3.5.3 Configuration of DC Motors” on page 3-22, then continue with chapter “3.5.4 General closing Steps” on page 3-23.

3.5.2 Configuration of EC Motors

1) Startup Wizard for EC motors (Step 4): Motor Pole Pair
    a) Select correct number of pole pairs.
    b) Click ¤Next¤ to proceed.

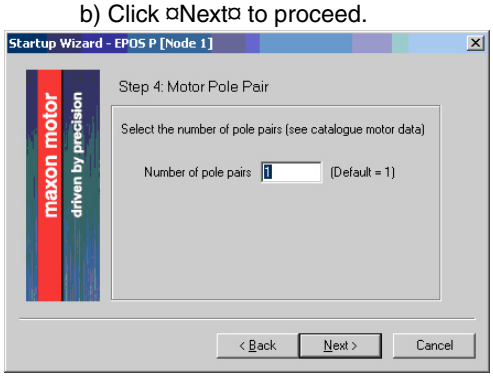

Figure 3-15 Startup Wizard Dialog for EC Motors: Motor Pole Pair

2) Startup Wizard for EC motors (Step 5): Motor Data
    a) Select maximum permitted speed.
    b) Select nominal current (maximum continuous current).
    c) Select thermal time constant of winding
    d) Click ¤Next¤ to proceed.

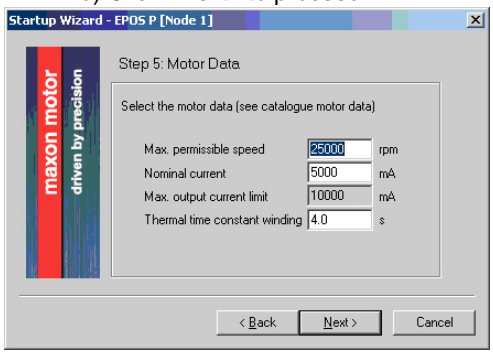

Figure 3-16 Startup Wizard Dialog for EC Motors: Motor Data

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3) Startup Wizard for EC motors (Step 6): Position Sensor Type
   a) Select position sensor type used.
   b) Click ¤Next¤ to proceed.

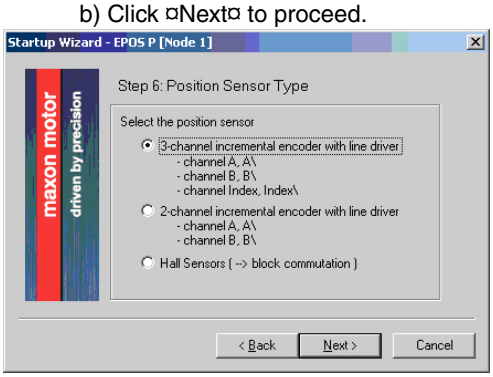

Figure 3-17 Startup Wizard Dialog for EC Motors: Position Sensor Type

Best Practice

- *Make sure to carefully consider following information!*
- *Do not click ¤Accept¤ unless you are perfectly aware of low position resolution effect if configuration does not apply to your system!*

   c) Consider message on use of Hall sensor carefully.
   d) Click ¤Accept¤, if configuration matches your system.
   e) Click ¤Next¤ to proceed.

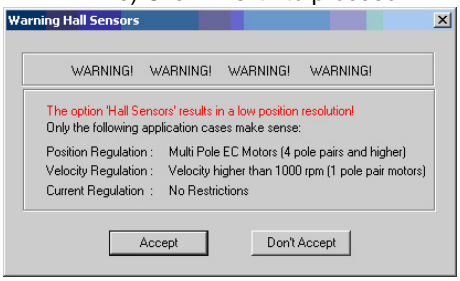

Figure 3-18 Confirmation of Configuration

4) Startup Wizard for EC motors (Step 7): Position Resolution
   a) Enter resolution of encoder used.
   b) Click ¤Next¤ to proceed.

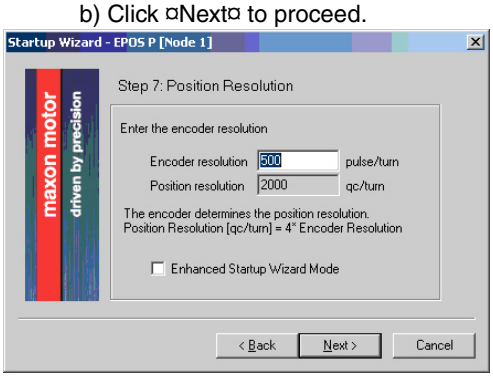

Figure 3-19 Startup Wizard Dialog for EC Motors: Position Resolution

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5) Startup Wizard for EC motors (Step 8): Summary
   A short summary of most important configuration values will be displayed.
   a) If configuration is not correct: Click ¤Back¤ to modify settings.
   b) If configuration is correct: Click ¤Finish¤ to close the startup wizard.

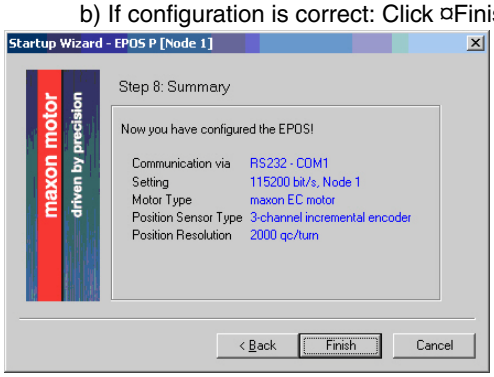

Figure 3-20 Startup Wizard Dialog for EC Motors: Summary

3.5.3 Configuration of DC Motors

6) Startup Wizard for DC motors (Step 4): Motor Data
   a) Select maximum permitted speed.
   b) Select nominal current (maximum continuous current).
   c) Select thermal time constant of winding
   d) Click ¤Next¤ to proceed.

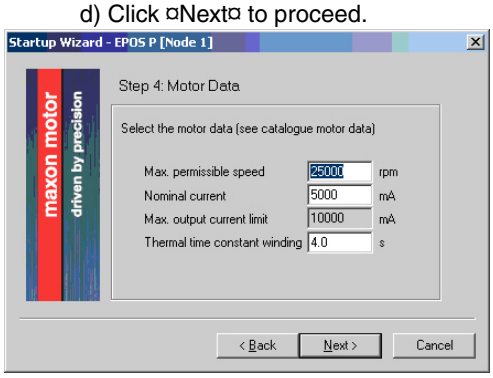

Figure 3-21 Startup Wizard Dialog for DC Motors: Motor Data

7) Startup Wizard for DC motors (Step 5): Position Sensor Type
   a) Select position sensor type used.
   b) Click ¤Next¤ to proceed.

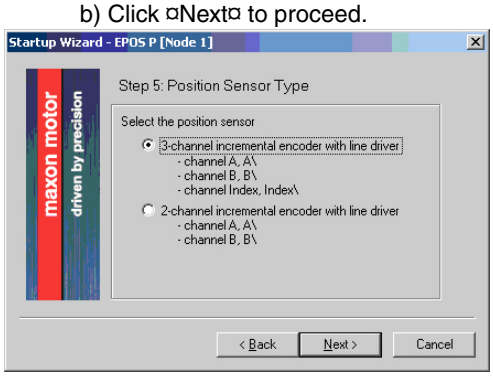

Figure 3-22 Startup Wizard Dialog for DC Motors: Position Sensor Type

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8) Startup Wizard for DC motors (Step 6): Position Resolution
   a) Enter resolution of encoder used.
   b) Click ¤Next¤ to proceed.

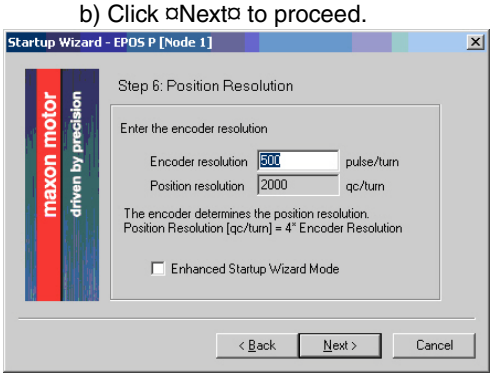

Figure 3-23 Startup Wizard Dialog for DC Motors: Position Resolution

9) Startup Wizard for DC motors (Step 7): Summary
   A short summary of most important configuration values will be displayed.
   a) If configuration is **not correct**: Click ¤Back¤ to modify settings.
   b) If configuration is **correct**: Click ¤Finish¤ to close the startup wizard.

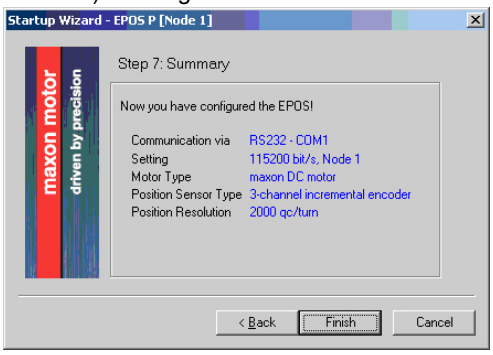

Figure 3-24 Startup Wizard Dialog for DC Motors: Summary

3.5.4 General closing Steps

1) Save parameters!
   a) Click ¤Yes¤ to accept and save parameters.

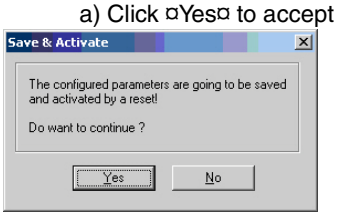

Figure 3-25 Save/activate configured Parameters

   b) Click ¤OK¤ to confirm activation of parameters.

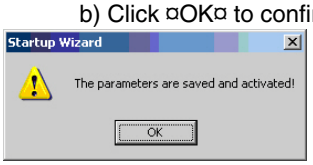

Figure 3-26 Confirmation of Parameter Activation

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3.6 Step 5: Regulation Gains Tuning

EPOS P 24/5 offers a way to perform auto-tuning of regulation gains, fast and reliable. The function permits tuning of current, velocity and position gains on the regulators and provides a good starting point for further manual tuning.

Best Practice

- *The auto-tuning function is a good way to start, nevertheless optimal regulation parameters cannot be guaranteed.*
- *Use following procedure to efficiently tune regulation gains.*

3.6.1 Starting Auto-Tuning

1) Click ¤Wizards¤.
2) Select ¤EPOS [Internal]¤ from Device Selection Combo Box (arrow).
3) Doubleclick ¤Regulation Tuning¤ item in Wizard Tree

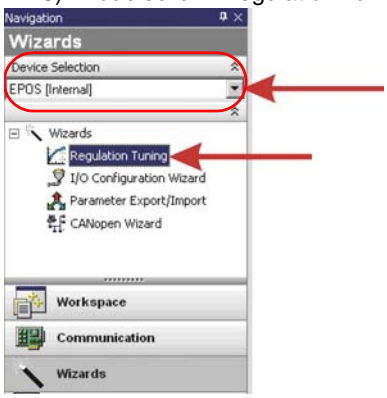

Figure 3-27 Page Navigator Window

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3.6.2 Auto-Tuning of Current Regulator

1) Leave all settings to default values.
2) Click ¤Start Tuning¤ (arrow).

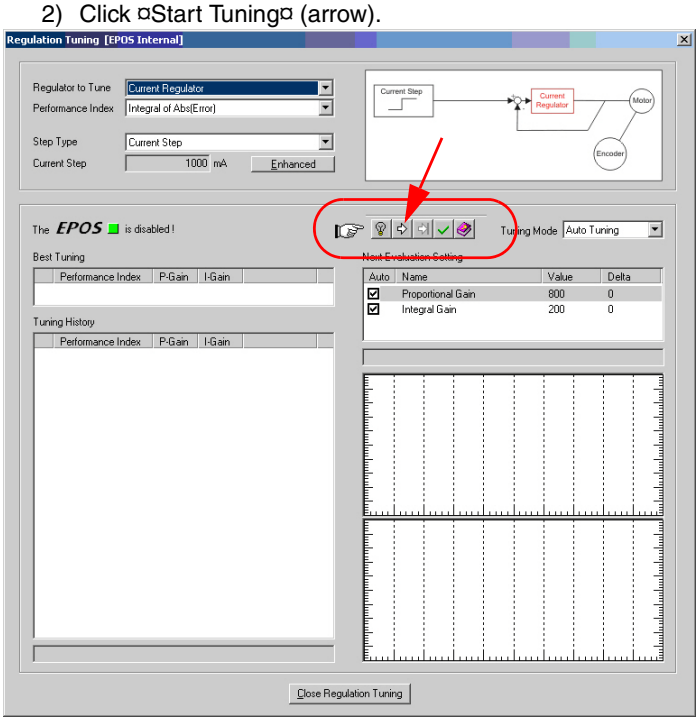

Figure 3-28 Auto-Tuning of Current Regulator

CAUTION

Drawn-in and/or Affright Hazard
Unprepared attitude can lead to drawing-in or affright.

- *Check on motor's power rating to become aware of potential produced torque!*
- *Decide on how to block the shaft, whether by hand, or by using an appropriate tool!*
- *Be prepared for torque produced/noise emitted by the motor once you confirmed initiation of procedure!*

3) Consider message carefully.
4) Block motor shaft – seize and continuously keep fixed – until current regulator auto-tuning has completed.
5) Click ¤Yes¤ to initiate auto-tuning.

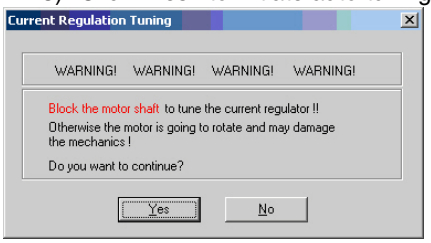

Figure 3-29 Confirmation of Shaft Blockage

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6) Auto-tuning will commence automatically and will define suitable regulation gains for current regulation mode. This procedure can take a few minutes. All tuning steps will be displayed for further analysis.
In case of error follow next steps.
If auto-tuning has been successfully completed ➔step 8.

7) In case of occurring error or if auto-tuning does not start:
a) Confirm error message by clicking ¤OK¤.
b) Clear error by clicking ¤X¤ (arrow).
b) Adjust starting parameters (➔chapter “3.6.5 Manual Tuning” on page 3-30).
d) Then start auto-tuning again.

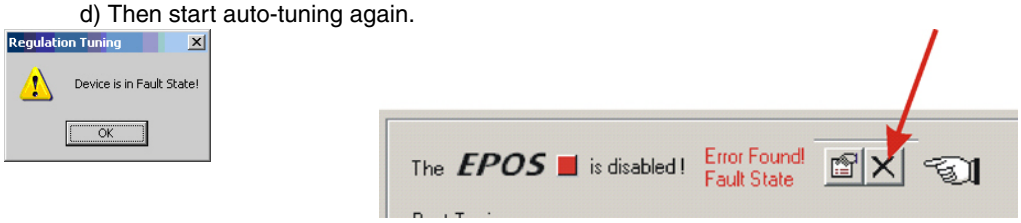

Figure 3-30 Error Messages

8) A summary will be displayed.
a) If configuration is not correct: Click ¤No¤ to start auto-tuning anew.
b) If configuration is correct: Click ¤Yes¤ to close the wizard.

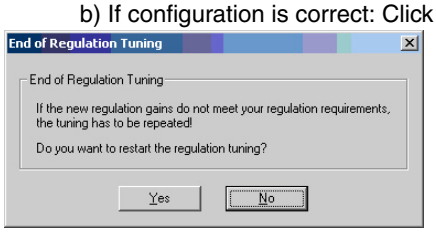

Figure 3-31 Confirmation of terminated Auto-Tuning

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3.6.3 Auto-Tuning of Velocity Regulator

1) Leave all settings to default values.
2) Click ¤Start Tuning¤ (arrow).

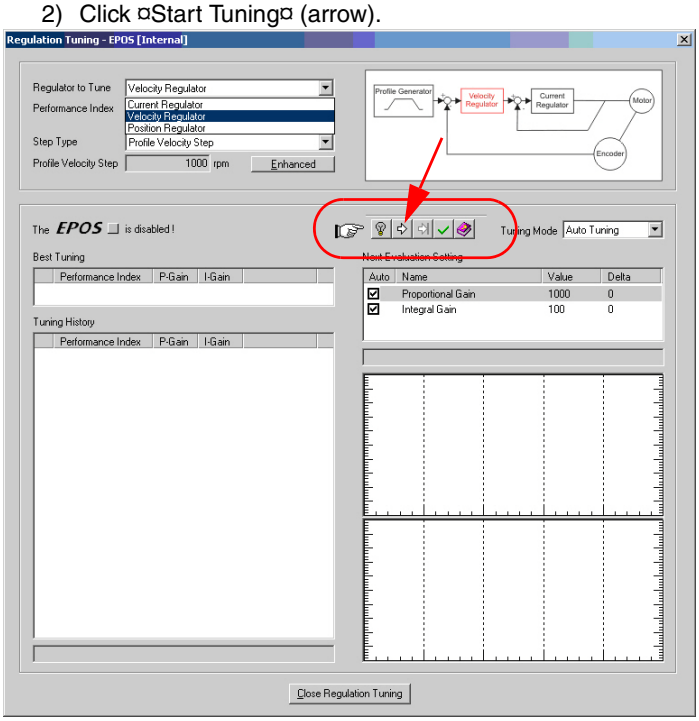

Figure 3-32 Auto-Tuning of Velocity Regulator

3) Consider message carefully.
4) Make sure that motor shaft is free running.
5) Click ¤Yes¤ to initiate auto-tuning.

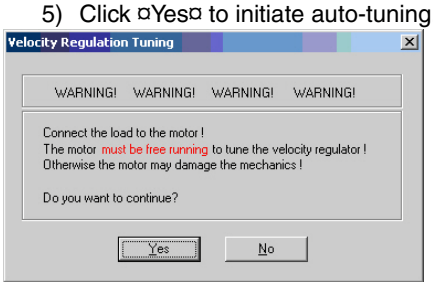

Figure 3-33 Confirmation of free running Shaft

6) Auto-tuning will commence automatically and will define suitable regulation gains for velocity regulation mode. This procedure can take a few minutes. All tuning steps will be displayed for further analysis.
In case of error follow next steps.
If auto-tuning has been successfully completed ➔step 8.

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7) In case of occurring error or if auto-tuning does not start:
   a) Confirm error message by clicking ¤OK¤.
   b) Clear error by clicking ¤X¤ (arrow).
   b) Adjust starting parameters (➔chapter “3.6.5 Manual Tuning” on page 3-30).
   d) Then start auto-tuning again.

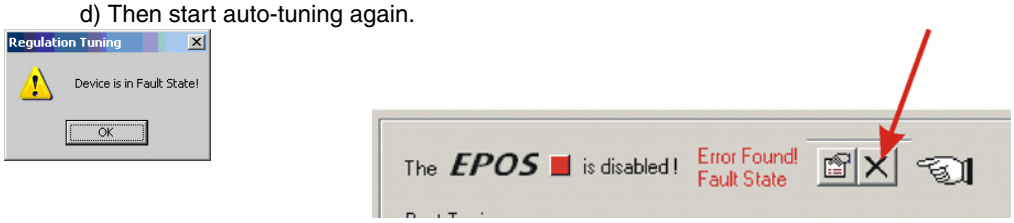

Figure 3-34 Error Messages

8) A summary will be displayed.
   a) If configuration is not correct: Click ¤No¤ to start auto-tuning anew.
   b) If configuration is correct: Click ¤Yes¤ to close the wizard.

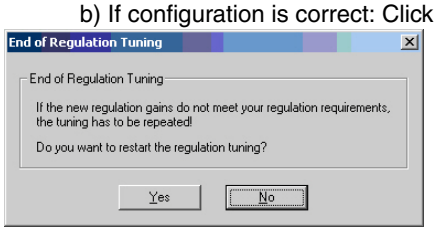

Figure 3-35 Confirmation of terminated Auto-Tuning

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3.6.4 Auto-Tuning of Position Regulator

1) Leave all settings to default values.
2) Click ¤Start Tuning¤ (arrow).

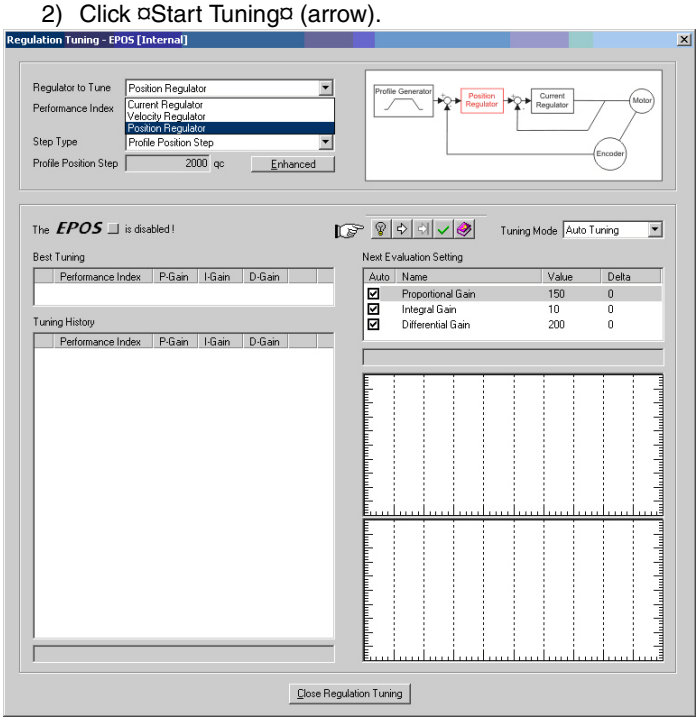

Figure 3-36 Auto-Tuning of Position Regulator

3) Consider message carefully.
4) Make sure that motor shaft is free running.
5) Click ¤Yes¤ to initiate auto-tuning.

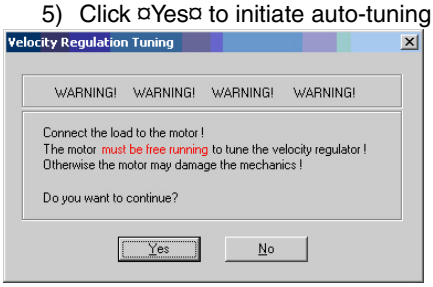

Figure 3-37 Confirmation of free running Shaft

6) Auto-tuning will commence automatically and will define suitable regulation gains for position regulation mode. This procedure can take a few minutes. All tuning steps will be displayed for further analysis.
   In case of error follow next steps.
   If auto-tuning has been successfully completed ➔step 8.

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7) In case of occurring error or if auto-tuning does not start:
   a) Confirm error message by clicking ¤OK¤.
   b) Clear error by clicking ¤X¤ (arrow).
   b) Adjust starting parameters (➔chapter “3.6.5 Manual Tuning” on page 3-30).
   d) Then start auto-tuning again.

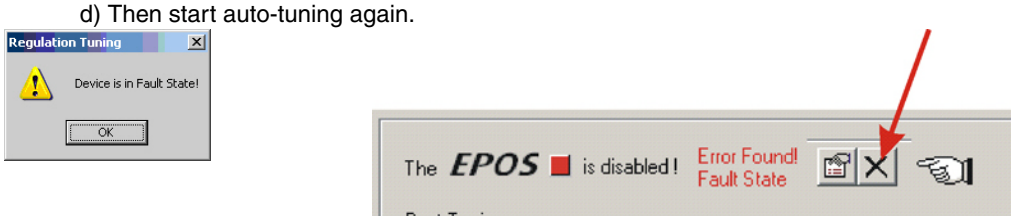

Figure 3-38 Error Messages

8) A summary will be displayed.
   a) If configuration is not correct: Click ¤No¤ to start auto-tuning anew.
   b) If configuration is correct: Click ¤Yes¤ to close the wizard.

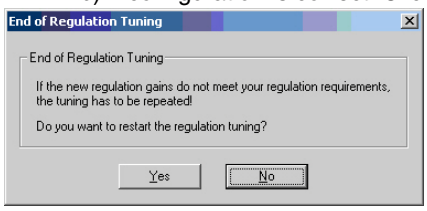

Figure 3-39 Confirmation of terminated Auto-Tuning

3.6.5 Manual Tuning

If auto-tuning shows an error, or if self-adjusted result should prove dissatisfactory, you will need to tune manually and you will need to commence an iterative search for appropriate regulation gains.

Best Practice
- *Change system parameters manually.*
- *Start a single step movement and check the recorded data.*

1) Select ¤Manual Tuning¤ from drop-down list.
2) Click ¤Start Tuning¤ (arrow).

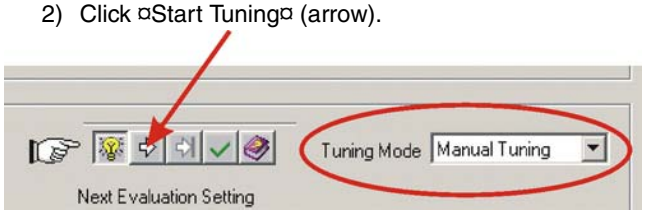

Figure 3-40 Manual Tuning

3) Select ¤Next Evaluation Setting¤ (arrow).

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4) Alter regulation gains (➔Best Practice below).

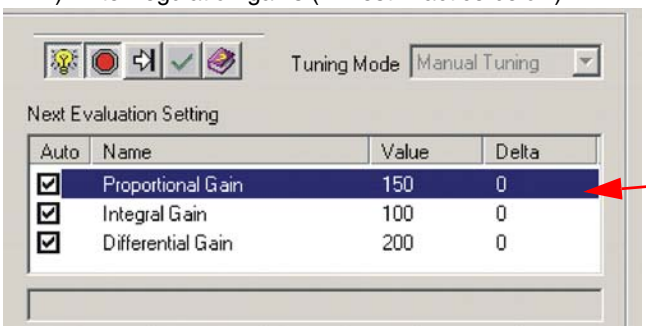

Figure 3-41 Next Evaluation Setting

Best Practice

Start values for current and velocity regulator are normally not difficult to find. For positioning regulator, following rule of thumb will be helpful:

- ***Start values**: 'Integral Gain' = 0 'Proportional Gain' = 2 x 'Differential Gain'.*
- ***Overshoot**: Reduce 'Proportional Gain' or increase 'Differential Gain'.*
- ***Position Error**: Increase 'Proportional Gain' and 'Differential Gain'.*
- ***Integral Gain**: Adjust 'Integral Gain' at the end, if the other two gains are optimized. Increase 'Integral Gain' until static position error is small enough.*

5) Click ¤Start Tuning¤ (arrow).

Figure 3-42 Next tuning Step

6) Judge recorded data.

7) Repeat iteration (➔steps 3 thru 6) until all regulation gains are optimized.

3.6.6 Save Regulation Gains

All regulation gains found during auto-tuning have been saved locally (on your PC). For operation, now data will be transferred to EPOS P 24/5.

1) Click ¤Save¤ (arrow).

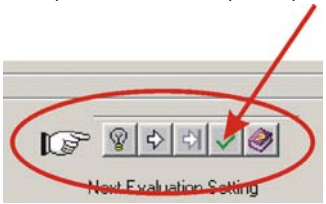

Figure 3-43 Save Settings

2) Click ¤OK¤ to save regulation tuning gains.

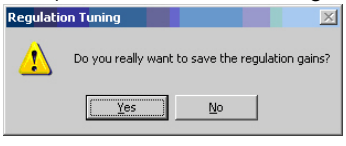

Figure 3-44 Confirmation of Regulation Tuning Gains

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4 Programming

4.1 Step 1: Opening Sample Project

4.1.1 Open “IEC-61131 Programming”

1) Select ¤EPOS P¤ from Device Selection Combo Box (arrow).
2) Doubleclick ¤IEC 61131 Programming¤ item in Tools Tree.

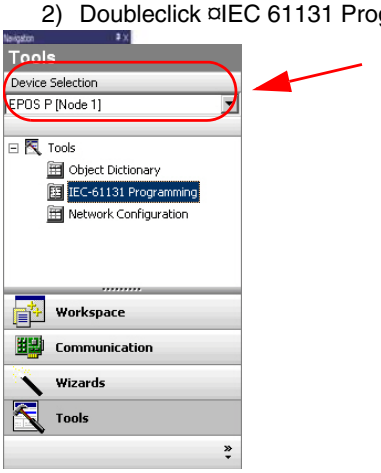

Figure 4-45 Page Navigator Window

4.1.2 Open Sample Project

1) Select sample project ¤SimpleMotionSequence¤.
2) Click ¤Open Sample Project¤ will open external programming tool “OpenPCS”.

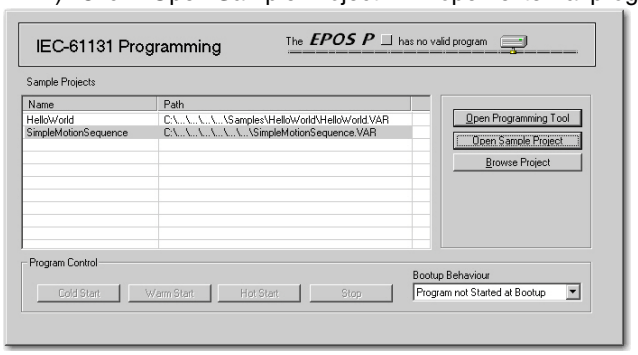

Figure 4-46 Tool “IEC-61131 Programming”

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4.1.3 Open Program Code

1) Select tab ¤Files¤ from project window.
2) Doubleclick ¤PROG_Main.SFC¤ to open program code.

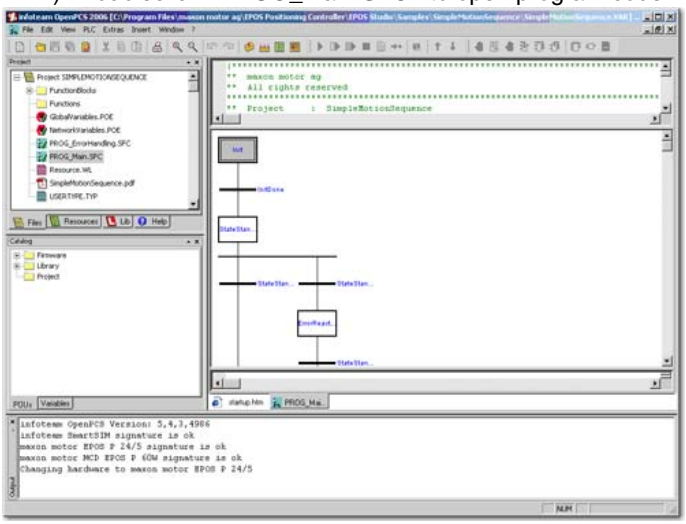

Figure 4-47 Program Code

4.2 Step 2: Programming Tool “OpenPCS” Configuration

4.2.1 Licence Key Configuration

1) Open menu ¤Extras¤, then submenu ¤Tools¤.
2) Click ¤Info¤ to check if valid license is available.
   If no license is registered, enter valid serial number and license key (➔”ReadMe.txt” in EPOS Studio directory).

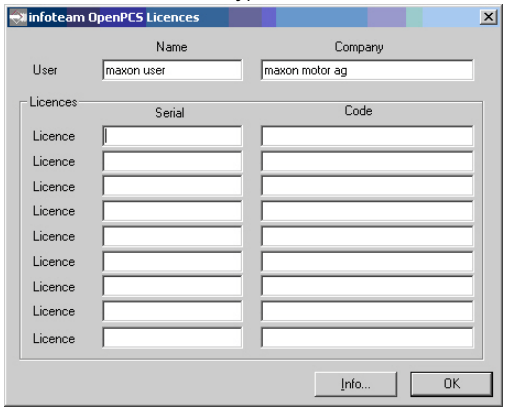

Figure 4-48 OpenPCS License Registration

If you find the license key out of date, download latest version of «EPOS Studio» from the internet (for URLs ➔chapter “2 Introduction” on page 2-9.

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4.2.2 Communication Setup

1) Open menu ¤PLC¤, then click menu item ¤Connections¤.
2) Select connection ¤ProxyEpos¤ and click ¤Edit¤.

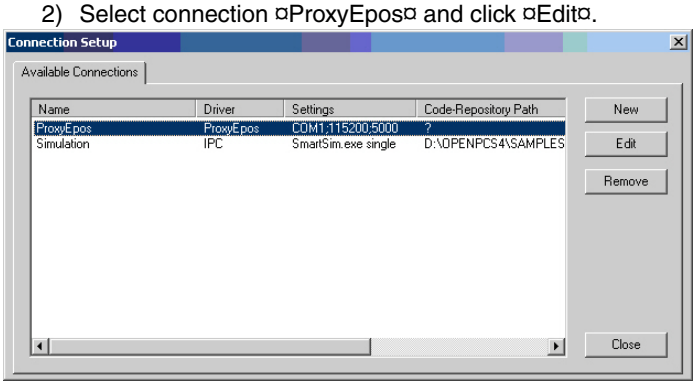

Figure 4-49 Connection Setup Window

3) Click ¤Settings¤.

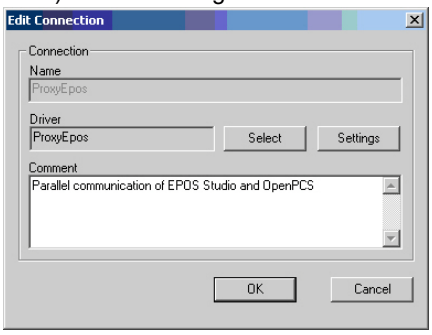

Figure 4-50 Edit Connection Window

4) Select same settings as in EPOS Studio.

Please note: Default baud rate is 115200 Bd

5) Click ¤OK¤ to confirm settings and to close dialog.

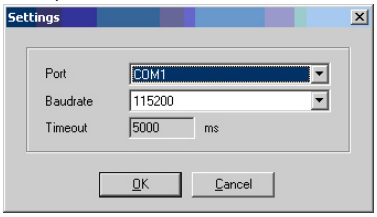

Figure 4-51 Communication Settings

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4.3 Step 3: Compiling and Executing Sample Project

4.3.1 Compiling Sample Project

1) Open menu ¤PLC¤ and select menu item ¤Build Active Resource¤. A logging output similar to below figure will be displayed.

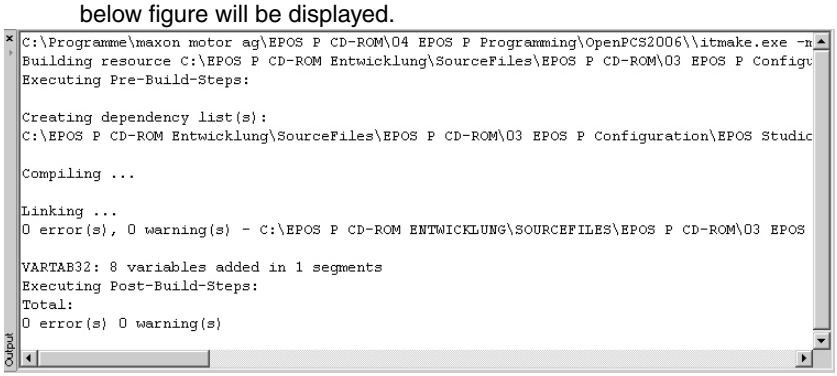

Figure 4-52 Compiler Logging Output

4.3.2 Downloading Sample Project

1) Open menu ¤PLC¤ and select menu item ¤Online¤. An online connection will be established.
2) If new code is detected, you will be asked whether you wish to download the code or not. Click ¤Yes¤.

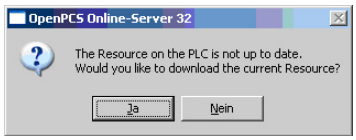

Figure 4-53 Confirmation of Code Download

4.3.3 Starting Sample Project

The following sample project is performing a motion sequence of two relative movements. Make sure the axis is free rotating.

1) Open menu ¤PLC¤ and select menu item ¤Cold Start¤. The program will be launched.

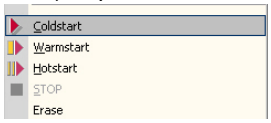

Figure 4-54 Cold Start'

2) Click ¤STOP¤ to stop the program.

4.4 Further Information

If you require additional information about programming, please read separate document «EPOS P Programming Reference» available from EPOS P CD-ROM or download it from the internet (for URLs ➔chapter “2 Introduction” on page 2-9.

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