

Technical Documentation

Product manual

Commissioning tool

lclA easy

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Writing conventions and symbols

Work steps If work steps must be carried out in sequence, they are shown as follows:

- Special prerequisites for the following work steps
- ▶ Step 1
- ◁ Important response to this work step
- ▶ Step 2

If a response to a work step is specified, this will inform you that the step has been carried out correctly.

Unless otherwise stated, the individual instruction steps must be carried in the given sequence.

Lists Lists can be sorted alphanumerically or by priority. Lists are structured as follows:

- Point 1
- Point 2
 - Subpoint to 2
 - Subpoint to 2
- Point 3

Making work easier Information on making work easier can be found at this symbol:



*This offers supplementary information on making work easier.
See the chapter on safety for an explanation of the safety instructions.*

Menu paths "⇒" Action steps within the menu are described with complete menu path and the "⇒" symbol, e.g. "⇒ File ⇒ Save As...".

1 Introduction

1.1 General features

The IcIA easy commissioning software is a program for PCs for commissioning and diagnostics of many Berger Lahr products.

The functions of the commissioning software automatically adapt to the products. Some functions may not be available. For details see the product manual.

Functions of the commissioning software

The functions of the commissioning software include:

- Display and input of device parameters
- Archiving and duplication of device parameters
- Manual positioning of motor
- Testing input and output signals
- Recording, evaluating and archiving courses of travel
- Diagnosis of operating faults
- Optimisation of control behaviour

Supported devices

The product manual of the specific device specifies whether the commissioning software can be operated with the device.



You must be familiar with the Windows operating system to work with the commissioning software.

2 Safety

2.1 Qualification of personnel

Only technicians who are familiar with and understand the contents of this manual and the other relevant manuals are authorised to work on and with this drive system. The technicians must be able to detect potential dangers that may be caused by parameterisation, changing parameter values and generally by the mechanical, electrical and electronic equipment.

The technicians must have sufficient technical training, knowledge and experience to recognise and avoid dangers.

The technicians must be familiar with the relevant standards, provisions and accident prevention regulations that must be observed when working on the drive system.

2.2 General safety instructions

▲ WARNING

Loss of control

Malfunctions on the PC or in the software may prevent control over the system (no stop, unexpected reactions).

- Make sure that a functioning button for EMERGENCY STOP is within reach.
- Make sure that the system is free and ready for the movement before connecting the system to the PC.

Failure to follow these instructions can result in death, serious injury or equipment damage.

▲ WARNING

Unexpected movement

When the drive is operated for the first time there is a high risk of unexpected movements because of possible wiring errors or unsuitable parameters.

- If possible, run the first test movement without coupled loads.
- Make sure that a functioning button for EMERGENCY STOP is within reach.
- Also anticipate a movement in the incorrect direction or oscillation of the drive.
- Make sure that the system is free and ready for the movement before starting the function.

Failure to follow these instructions can result in death, serious injury or equipment damage.

3 Installation

Reference source of commissioning software

The current commissioning software is available for download from the internet.

<http://www.berger-lahr.com/download>

3.1 Requirements for the PC

System requirements

The minimum hardware requirements for installation and operation of the software are:

- IBM-compatible PC
- approx. 50 MB of space on the hard disk
- 128 MB RAM
- graphics board and monitor with a resolution of at least 1024x768 pixels
- free serial interface (RS232) or free USB interface
- Windows 2000 or Windows XP Professional operating system

Required accessories

- RS232 to RS485 converter or USB to RS485 converter

| Compact drive interface | PC interface | Required field bus converter | Supplier |
|-------------------------|--------------|------------------------------|---|
| RS485 | USB | NuDAM ND-6530 | http://www.acceed.com |
| RS485 | RS232 | NuDAM ND-6520 | http://www.acceed.com |
| CAN | USB | PCAN-USB, Peak | http://www.peak-system.com |
| Profibus-DP | USB | PROFusb PB-USB | http://www.softing.com |

3.2 Installation procedure

We recommend backing up important data regularly and always before installing new software.

- ▶ Check the requirements on the PC.
- ▶ Start the installation from the file "IcIA_easy_VXXX_DE.msi".
- ▶ Follow the prompts of the installation routine.

In the default settings the program is installed in the folder %Program-Files%\Berger Lahr\IcIA easy.

A program link is created in the Windows start menu for starting the commissioning software.

4 Operation

The commissioning software can be started with the program link in the Windows start menu.

4.1 The user interface

The following figure shows the user interface of the commissioning software.

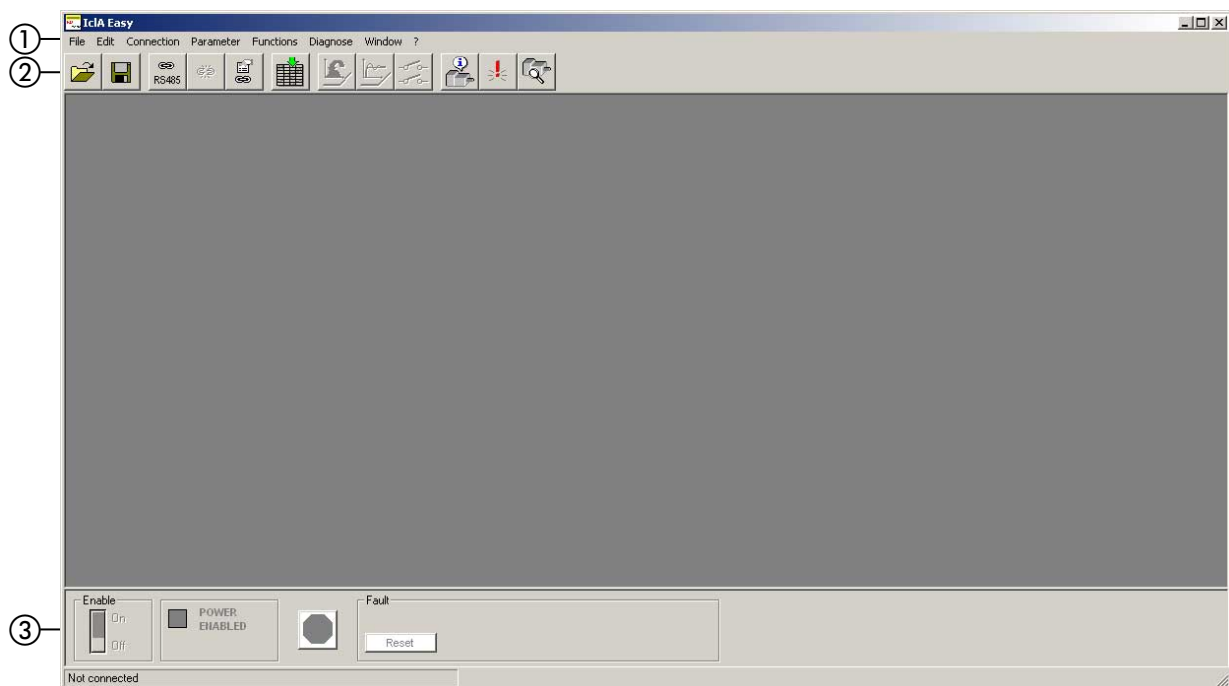


Figure 4.1 The components of the active window

- (1) Menu bar
- (2) Tool bar
- (3) Control and status bar

The functions of the commissioning software can be executed from the menu bar, the tool bar and the control and status bar.

4.1.1 The menu bar

The menu bar adapts itself to the current task. It only shows the functions required and possible for operation.

For example, if there is no connection to the device, the function "⇒ Connection ⇒ Disconnect connection" can also not be run.

4.1.2 The tool bar

The tool bar allows frequently used functions from the menu bar to be started with one click.

The buttons represent the following functions of the menu bar:

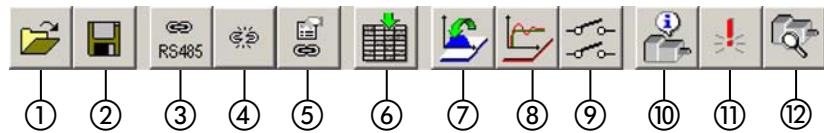


Figure 4.2 Tool bar

- (1) ⇒ File ⇒ Open...
- (2) ⇒ File ⇒ Save
- (3) ⇒ Connection ⇒ RS485 connection...
- (4) ⇒ Connection ⇒ Disconnect connection
- (5) ⇒ Connection ⇒ options
- (6) ⇒ Parameter ⇒ Open parameter window...
- (7) ⇒ Functions ⇒ Operating modes...
- (8) ⇒ Functions ⇒ Recording/optimisation...
- (9) ⇒ Functions ⇒ Inputs and outputs...
- (10) ⇒ Diagnostics ⇒ Device info...
- (11) ⇒ Diagnostics ⇒ Error memory...
- (12) ⇒ Diagnostics ⇒ Observe parameter...



If the mouse pointer is above a button "Tooltip" shows a short description of the assigned function.

4.1.3 Control and status bar

The control and status bar is for access to the device. The monitoring and status bar can be used to activate the power amplifier and shows various status information.

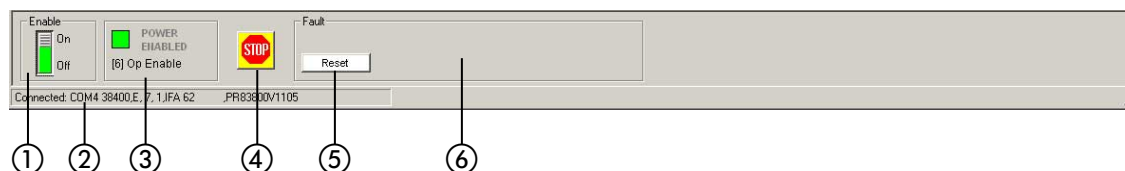


Figure 4.3 Control and status bar

- (1) Enable
- (2) Status information
- (3) Operating status
- (4) Stop
- (5) Reset
- (6) Current breakdown

Enable The power amplifier of the device can be enabled or disabled with the "Enable" switch. For more information on enabling or disabling the power amplifier see the product manual of the device.

Status information This information consists of:

- line 1 shows whether the "Halt" function is active
- line 2 shows the current motor position
- line 3 shows the status of the access control
- line 4 shows the control mode

Operating status The commissioning software shows the current operating status of the connected device. For more information on the operating status see the product manual of the device.

Stop Press the "Stop" button to stop the motor with "Quick Stop". For more information on "Quick Stop" see the product manual of the device.

Reset Press the "Reset" button to acknowledge an error message. For more information on acknowledging error messages see the product manual of the device.

Current breakdown The field shows the current pending breakdown of the device (asynchronous errors).

5 Work with the commissioning software

5.1 First steps

5.1.1 Important terms

Data interface The connection for data exchange is a RS485 interface. It is the standard commissioning interface and is installed on every device.

Device data Device data are all parameter values of a device. They are saved in the EEPROM memory of the device to prevent loss in case of power failure.

Transferring device data Device data can be transferred between the device and the PC only if there is a connection. The parameters of the device can be sent in full or in groups.

IMPORTANT: The commissioning software transfers modified parameter in the first step to the RAM memory of the device. They remain there until the controller supply voltage is switched off. Note that the device data must be backed up separately in the EEPROM memory to save them permanently in the product.

Parameter file The device data can be saved and loaded to the PC.

On the PC all device data are saved in one file, the parameter file. The commissioning software always saves the complete parameter set in the file.

There must not be a connection between the PC and the device in order to process the parameter file.

5.1.2 The first connection

The device must be connected to the PC via a data interface.

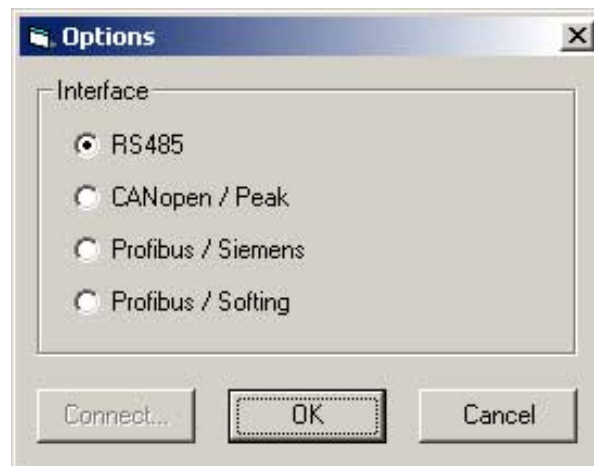
A data link to the device is established with the menu item "⇒ Connection ⇒ RS485 connection...". The "Connection" window is opened.

The figure below shows an example.



Figure 5.1 Selection of the connection data

If a different fieldbus interface is to be used, it can be selected with the menu item "⇒ Connection ⇒ Options...":



Connection The device data are transferred to the PC when connecting. After transfer the commissioning software is connected online to the device.

5.2 Parameter file

Parameter files have the file-name extension ".ifx". A device file can be opened by the PC and edited even without a connection to the device. The file contains the parameter values and also the contents of the error memory, all actual values and the recorded data.

5.2.1 Save file

Device data on the PC can be backed up to a parameter file, for example, to archive it for maintenance and service purposes. It can be used to commission additional devices of the same device version quickly.

A parameter file can be backed up on the PC with the menu item "⇒ File ⇒ Save..." and "⇒ File ⇒ Save As...".



After commissioning a device we recommend backing up the device data as a parameter file on the PC. This means that the device can be put back into operation immediately after a repair.

5.2.2 Open file

A parameter file can be opened on the PC with the menu item "⇒ File ⇒ Open...".

If there is a connection to the device, the commissioning software checks that the parameter file is compatible with the device.

If the parameter file is compatible with the device, the saved parameter values of the parameter file are compared with the parameter values of the device. Differences are highlighted in colour.

If the parameter file is not compatible with the device, the loading process is stopped and an error message is output.

5.2.3 Export parameter

All writable device parameters can be saved as a .csv file for further processing. This function can be run from the menu item "⇒ File ⇒ Export parameter...".

The file is saved with the extension ".csv". This file can be opened with Microsoft Excel and edited.

5.2.4 Print parameter

The device data can be output to a printer with the menu item "⇒ File ⇒ Print parameter...". The file is output in the following groups:

- Config
- RS485
- Settings
- Motion
- I/O
- Homing
- Manual
- DataSet
- ProgIO0
- ProgIO1
- ProgIO2
- ProgIO3

In addition, the device type, serial number and information on the software can be output.

5.3 Configuration

The data of a device can be edited in the "Parameter" window. A data link is not required. The parameter values of a file can be modified in off-line operation and sent to the device at a later time.

5.3.1 Open parameter window

The parameter window is opened with the menu item "⇒ Parameter ⇒Open parameter window..."

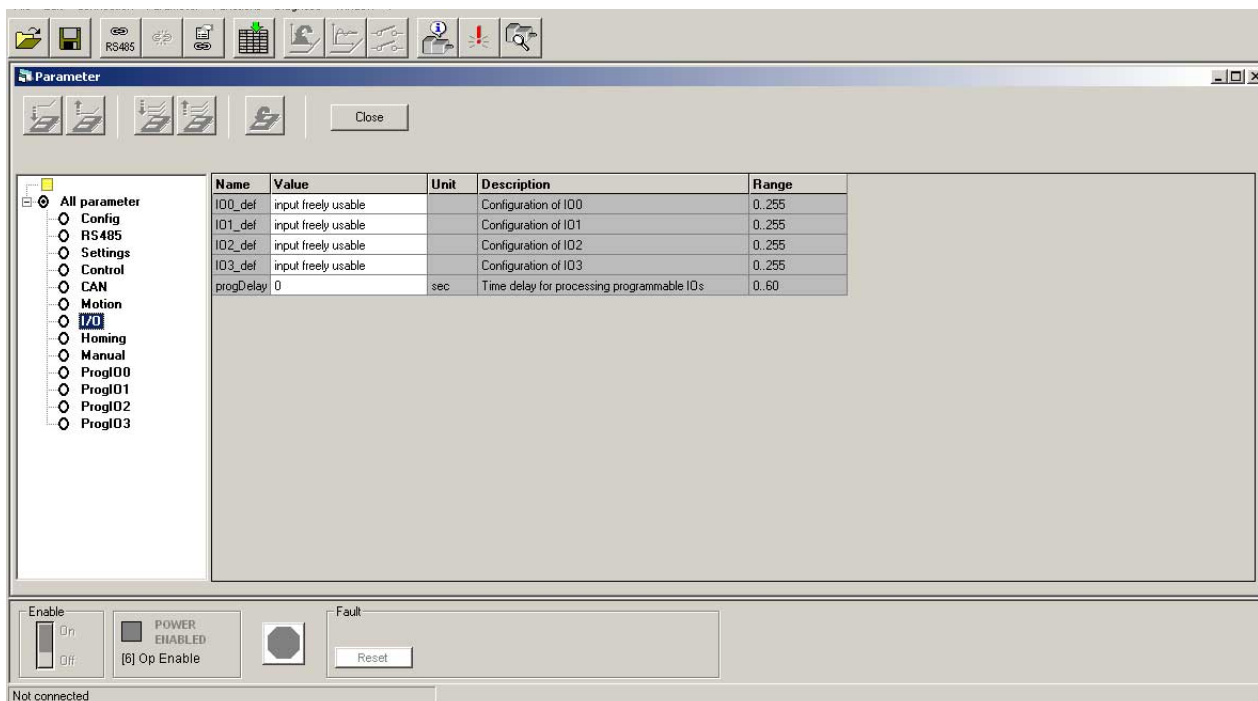


Figure 5.2 Parameter window

The figure shows the parameter window. The contents of this window depends on the device version. However, the general structure is always the same. General headings are in the left section, the associated parameters in the right section.

Parameters of a group

The parameter window shows the parameters associated with the selected general term. The list shows the names, values, unit, a description, the range and the Modbus address.

Change parameter values

The value of a parameter is changed in the "Value" column. Values with grey background are read-only and cannot be modified.

Modified values that have not been transferred to the device are highlighted in colour. At the same time the parameter group belonging to the parameter is highlighted by a red exclamation mark. When the values are transferred to the device the highlight is reset.

A change to a parameter value may be input directly or selected from a list.

Checking the value range

The commissioning software checks whether the input parameter values in the permissible value range. If the input value is not in the valid range, the value is not accepted.

5.3.2 Transfer parameter values

After switching on the controller supply voltage to the device the device data are automatically copied from the EEPROM memory to the RAM. The devices only operate with the data of the RAM.

The data exchange between the device and the PC is controlled by the following menu items and buttons.

Menu items Parameter values are sent from the PC to the device with the menu item "⇒ Parameter ⇒ Send parameter group to drive" and "⇒ Parameter ⇒ Send all parameters to drive".

Parameter groups are sent from the device to the PC with the menu item "⇒ Parameter ⇒ Load parameter group from drive" and "⇒ Parameter ⇒ Load all parameters from drive".

Buttons The buttons represent the following functions of the menu bar:

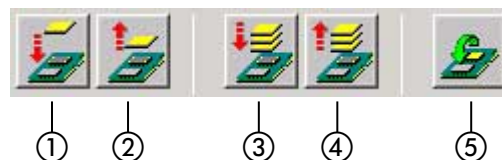


Figure 5.3 Buttons for data transmission

- (1) ⇒ Parameter ⇒ Send parameter group to drive
- (2) ⇒ Parameter ⇒ Load parameter group from drive
- (3) ⇒ Parameter ⇒ Send all parameters to drive
- (4) ⇒ Parameter ⇒ Load all parameters from drive
- (5) ⇒ Parameter ⇒ Save device parameters in EEPROM



Not all parameters can be transferred in operating status "Operation Enable". Parameter values that cannot be transferred remained highlighted in colour.

5.3.3 Reset factory setting

All device parameters can be reset to the factory setting with the menu item "⇒ Parameter ⇒ Reset factory settings".



Figure 5.4 Reset to factory settings

After validation with "OK" all device parameters are reset to the factory setting.

5.4 Functions

The "Functions" menu item includes the basic tasks:

- Operating modes
- Recording and tuning
- Inputs and outputs



The following illustrations may contain different functions or functions that are not available because of different functions of the devices.

5.4.1 Changing the operating status

▲ WARNING

Unexpected movement

When the drive is operated for the first time there is a high risk of unexpected movements because of possible wiring errors or unsuitable parameters.

- If possible, run the first test movement without coupled loads.
- Make sure that a functioning button for EMERGENCY STOP is within reach.
- Also anticipate a movement in the incorrect direction or oscillation of the drive.
- Make sure that the system is free and ready for the movement before starting the function.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Now the device can be set to operating status 6 "Operation Enable" with the commissioning software. In this operating status the power amplifier of the device is active. This is done with the "Enable" switch. For more information on enabling or disabling the power amplifier see the product manual of the device.

Operating status 6 "Operation Enable" is the prerequisite for running the functions of the commissioning software.

5.4.2 Operating modes

Use menu item "⇒ Functions ⇒ Operating modes..." to call the "Operating modes" function.

The various operating modes can be selected from the tabs in the operating modes window.

The window has two sections:

- tab for the selected operating mode and for setting specific parameters (top section)
- display of some status information (bottom section)

The user can switch between the tabs in the operating modes window without interfering with a currently active operating mode.

Device monitoring

During movement mode the data link to the device is periodically monitored. If the connection between the PC and device is cut, the motor stops within the cycle time.

The commissioning software can also not be exited during the movement mode.



All operating modes are described in detail in the product manuals. Therefore this documentation does not describe the details of the operating modes.

Profile position

In profile position operating mode a movement with an adjustable travel profile is run from a start position to a target position. The value of the target position can be given as either a relative or an absolute position.

A movement profile can be set with values for acceleration and deceleration ramps and final speed.

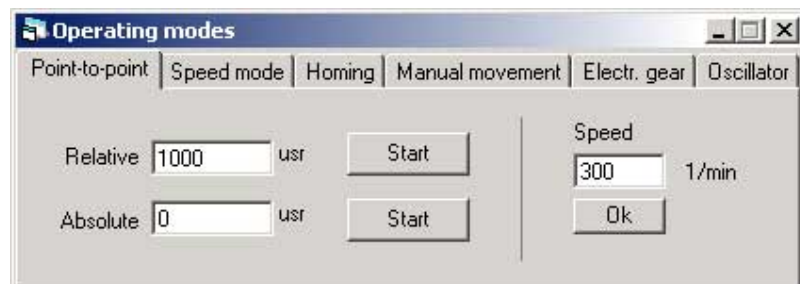


Figure 5.5 Profile position operating mode

Profile velocity In the profile velocity operating mode it is accelerated to an adjustable setpoint speed. A movement profile can be set with values for acceleration and deceleration.

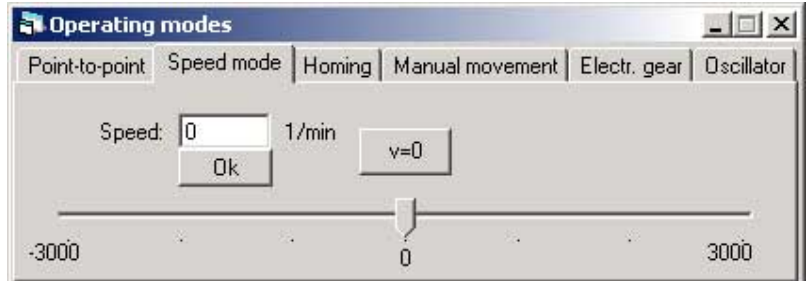


Figure 5.6 Operating mode Profile velocity

Homing In homing mode, an absolute scale reference of the motor position at a defined axis position is established. Homing can be carried out by a reference movement or by set dimensions.

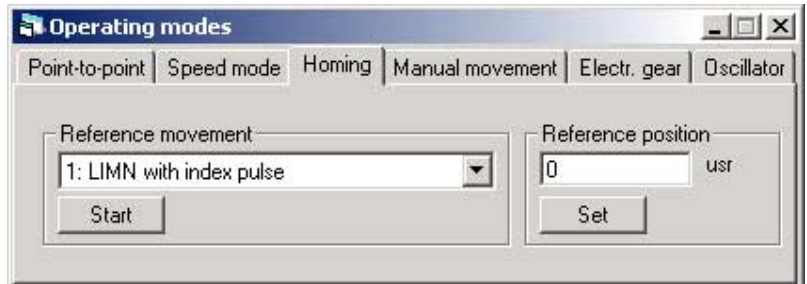


Figure 5.7 Homing tab

Jog The motor is switched between slow or fast manual speed with the buttons. The movement continues only while the button is enabled. When the button is disabled the motor is braked to standstill.

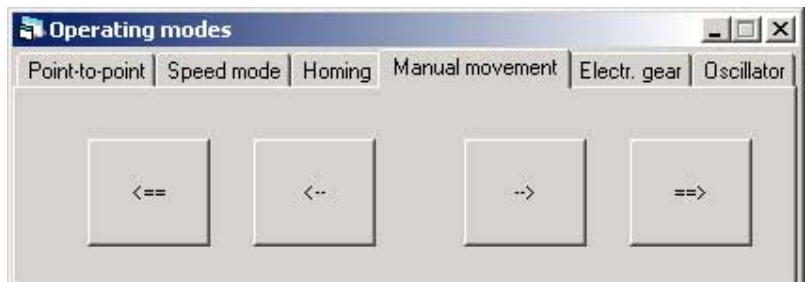


Figure 5.8 Jog operating mode

Electronic gear In the electronic gear operating mode reference signals are fed in as A/B signals or as pulse/direction signals. They are offset to a new position preset with an adjustable gear ratio.

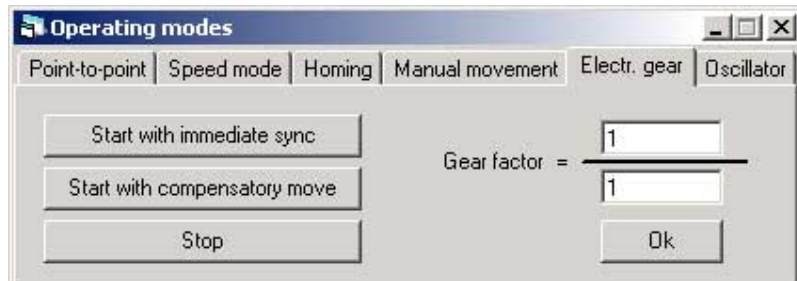


Figure 5.9 Electronic gearbox operating mode

Oscillator

⚠ WARNING

Unexpected movement may cause injury and damage to the system

In the operating mode an unknown voltage value at the analogue input may cause an unexpectedly high speed of rotation of the motor.

- When starting the operating mode note the voltage value at the analogue input.

Failure to follow these instructions can result in death, serious injury or equipment damage.

In the oscillator operating mode the motor is moved corresponding to a voltage-dependent speed default. There are two options:

- Selection of speed of rotation directly in the window by input or the slide regulator.
- selection via the analogue input ANA1. The voltage value can also be set in the "inputs and outputs" window for this option.

The actual movement is started or stopped with the "Start" and "Stop" buttons.

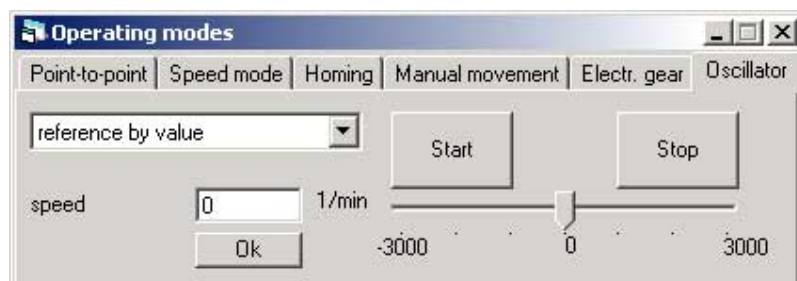


Figure 5.10 Oscillator operating mode

*Speed control***▲ WARNING****Unexpected movement may cause injury and damage to the system**

In the operating mode an unknown voltage value at the analogue input may cause an unexpectedly high speed of rotation of the motor.

- When starting the operating mode note the voltage value at the analogue input.

Failure to follow these instructions can result in death, serious injury or equipment damage.

In the speed control operating mode the motor is moved corresponding to a voltage-dependent speed default. There are two options:

- selection of the value directly in the window by input or the slide regulator
- selection via the analogue input ANA1. The voltage value can also be set in the "inputs and outputs" window for this option.

The actual movement is started or stopped with the "Start" and "Stop" buttons.

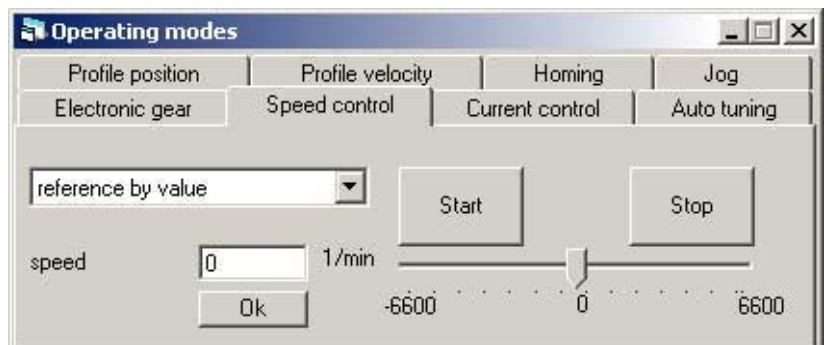


Figure 5.11 Speed control operating mode

Current control

⚠ WARNING**Unexpected movement may cause injury and damage to the system**

In the operating mode an unknown voltage value at the analogue input may cause an unexpectedly high speed of rotation of the motor.

- When starting the operating mode note the voltage value at the analogue input.

Failure to follow these instructions can result in death, serious injury or equipment damage.

In the current control operating mode the motor is moved corresponding to a voltage-dependent current value default. There are two options:

- Selection of current directly in the window by input or the slide regulator
- selection via the analogue input ANA1. The voltage value can also be set in the "inputs and outputs" window for this option.

The actual movement is started or stopped with the "Start" and "Stop" buttons.

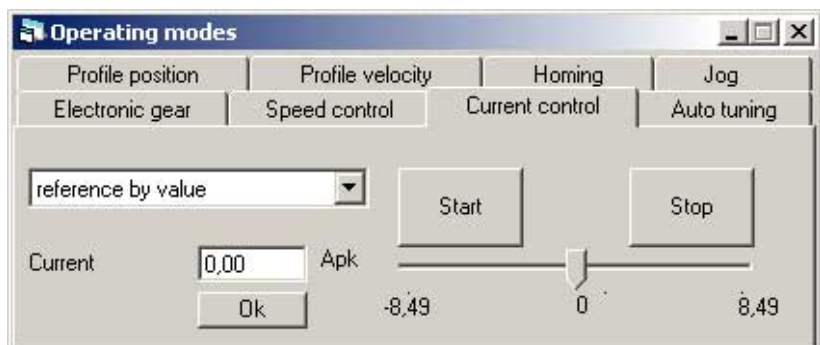


Figure 5.12 Current control mode.

Autotuning

⚠ WARNING

Unexpected movement

Autotuning moves the motor to set the drive controller. If incorrect parameters are input unexpected movements may occur or monitoring functions may be disabled.

- Check the parameters `AT_dir` and `AT_dismax`. The travel for the braking ramp in case of error must also be taken into account.
- Check that the parameter `LIM_I_maxQSTP` for Quick Stop is correctly set.
- If possible, use the limit switches `LIMN` and `LIMP`.
- Make sure that a functioning button for EMERGENCY STOP is within reach.
- Make sure that the system is free and ready for the movement before starting the function.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Autotuning determines the friction torque, an ever present load torque, and considers it in the calculation of the mass moment of inertia of the total system.

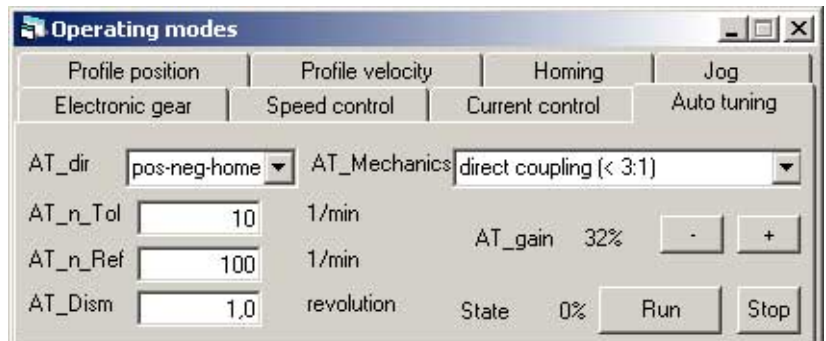


Figure 5.13 Autotuning

5.4.3 Recording and optimising

Introduction The commissioning software provides the "recording/tuning" function for visualising internal device data during movement mode. The connected device reads the travel data to an internal memory during a defined recording period and then sends it to the PC. In the PC the data are graphically processed and can be displayed as a graph or a table.

A recording can be saved on the PC, see Chapter 5.2.1 "Save file" and can be archived or printed for documentation.

Use the menu item "⇒ Functions ⇒ Recording/optimising..." to call the "recording" function.

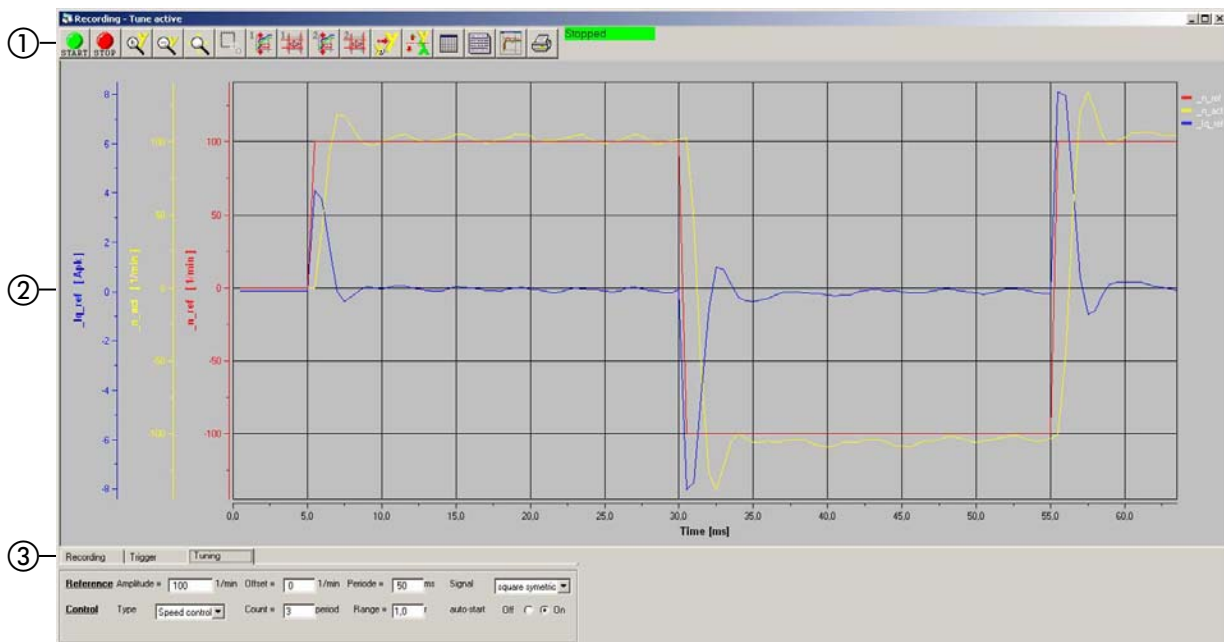


Figure 5.14 Recording

The recording window shows:

- (1) Buttons
- (2) Graph with the recorded data
- (3) Tabs for recording, trigger and tuning

Diagram A diagram is only shown if at least one parameter was selected.

Each of the selected parameters is shown in a distinct colour.

Buttons

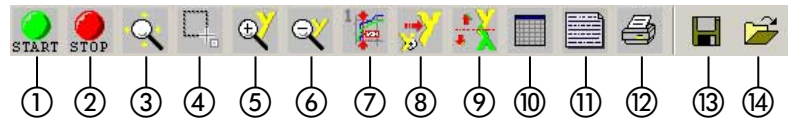


Figure 5.15 Buttons

- (1) Start recording
- (2) Stop recording
- (3) Manual zoom, infinite zoom of x-axis and y-axis
- (4) Zoom Box
- (5) Magnify y-axis zoom
- (6) Reduce y-axis zoom
- (7) 1. Show values for a specific time
- (8) Reset zoom, auto zoom
- (9) Invert Y-axis
- (10) Display recorded values as table
- (11) Input comment
- (12) Print recording
- (13) Save recording
- (14) Open recording

"Recording" tab The desired recording is configured in the "Recording" tab.

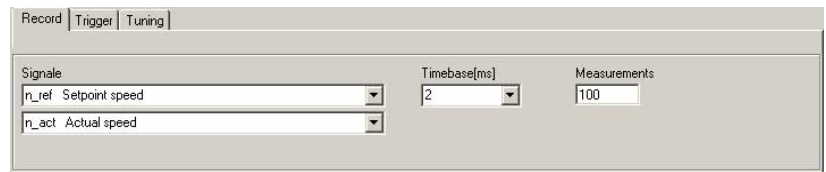


Figure 5.16 Recording tab

The desired parameters are selected in the "Parameter" input fields. The desired recording increment is select in the "Time base" input field. The smaller the "Time base" the smaller the maximum recording time. The desired number of measurement points is set in the "Measurements" input field. A maximum of 100 measurements can be run in one recording.

"Trigger" tab The desired triggering for the recording is configured in the "Trigger" tab. The recording starts once the specified condition has been met.



Figure 5.17 Trigger tab

The parameters for monitoring are selected in the "Trigger" input field. The condition that the selected parameter must meet to start the recording is selected in the "Condition" input field. The decimal whose comparison value the parameter must meet to start the recording is selected in the "Comparison value" input field.

The "Mask" check specified whether the value of the read-out material is to be hidden before it is compared with the specified value of the condition.

The Mask function offers the option of hiding individual bits of an actual value before it is compared with the "Comparison value". The mask is input in the hexadecimal system. Every position of the hex value describes 4 bits that through the 8 hex values shows all of the maximum 32 possible bits of a value. The actual value of the monitored parameter added to the mask in binary form. If the revenue matches the specified comparison value, the recording is deleted.

For example, if the value 0x00000005 is set, this means that only bit 0 and bit 3 are used for comparison with the "comparison value".

The delay with which the recording is to be started after the condition has been met is set in the "delay" input field.

"Tuning" tab

Movements, for example a positive jump, can be triggered in the "Tuning" tab. They can be evaluated for graphic optimisation.

Tuning can only be executed if the "Enable" switch is set to "On".

The screenshot shows a software window with three tabs: 'Record', 'Trigger', and 'Tuning'. The 'Tuning' tab is active. It contains two main sections: 'Reference' and 'Control'.
 - In the 'Reference' section, there are three input fields: 'Amplitude = 100 [rpm]', 'Period = 50 [ms]', and a dropdown menu for 'Control' set to 'Positive square-wave'.
 - In the 'Control' section, there are two input fields: a dropdown menu for 'Signal' set to 'Speed controller' and a text input for 'Count = 1'.

Figure 5.18 Tuning tab

The "Amplitude" input field sets the maximum value at which the reference value is to apply.

The duration of a period is set in the "Period" input field.

The signal form of the reference value is set in the "signal shape" input field.

The controller that is to be stimulated is set in the "Type" input field.

The number of periods is specified in the "number" input field.

Start recording

The desired recording is started with the "Start recording" button.

After recording the data are sent to the PC. Then they are graphically processed.

5.4.4 Inputs and outputs

⚠ WARNING

Risk of injury and damage to system components!

Changing the settings may cause unpredictable motor movements.

- Only changes settings if the motor can be operated without danger.

Failure to follow these instructions can result in death, serious injury or equipment damage.



The following illustrations may contain different functions or functions that are not available because of different functions of the devices.

The "inputs and outputs" function is used for monitoring and display of the analogue and digital inputs and the digital outputs.

Use menu item "⇒ Functions ⇒ Inputs and outputs..." to access the inputs and outputs function."

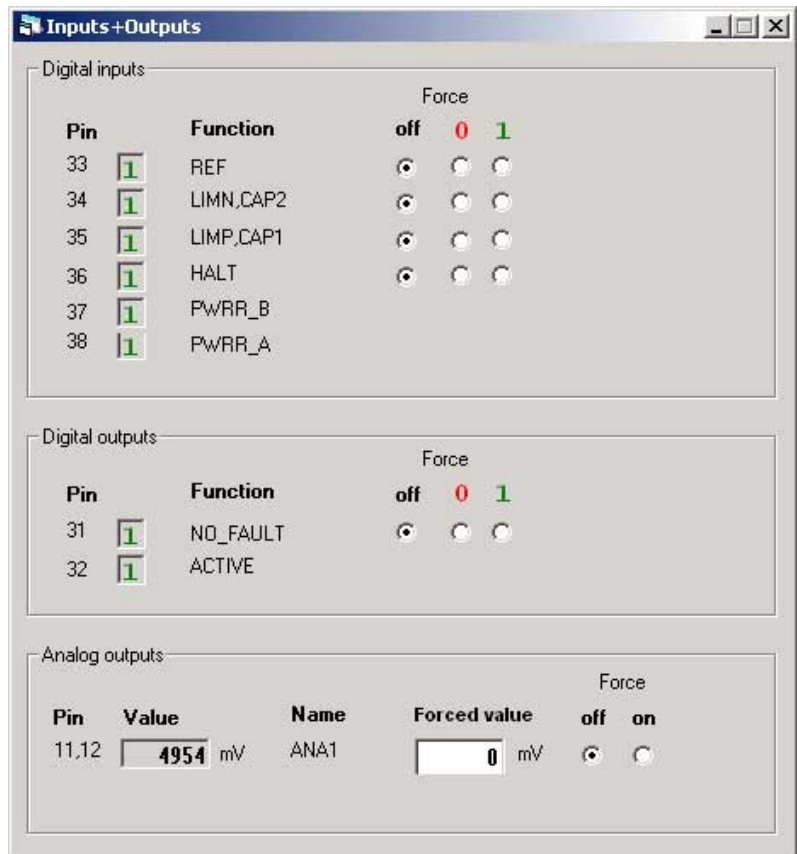


Figure 5.19 Inputs and outputs

Forcing The "Forcing" function offers the option of setting specific digital inputs, specific digital outputs and the voltage at the analogue inputs directly. The actual pending signal is disabled during this process. For example, this option can be used to apply the specified voltage via the analogue input in "Oscillator" mode.

5.5 Diagnostics

IcIA easy places diagnostic functions and information on error detection and error evaluation in various windows.

5.5.1 Device information

Information on the device is displayed with the menu item "⇒ Diagnostics ⇒ Device info...".

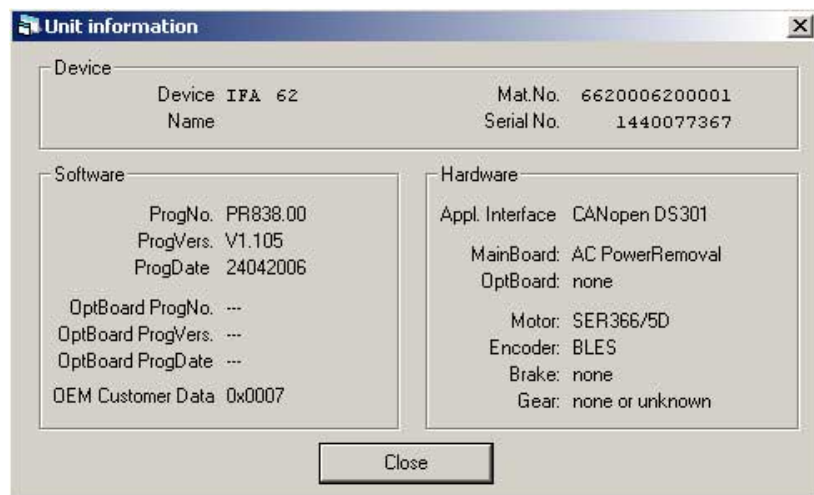


Figure 5.20 Device info

Important data for diagnostics and service, such as device type or serial number, can be found in this information.

5.5.2 Error memory

The error memory is opened with the menu item "⇒ Diagnostics ⇒ Error memory...".

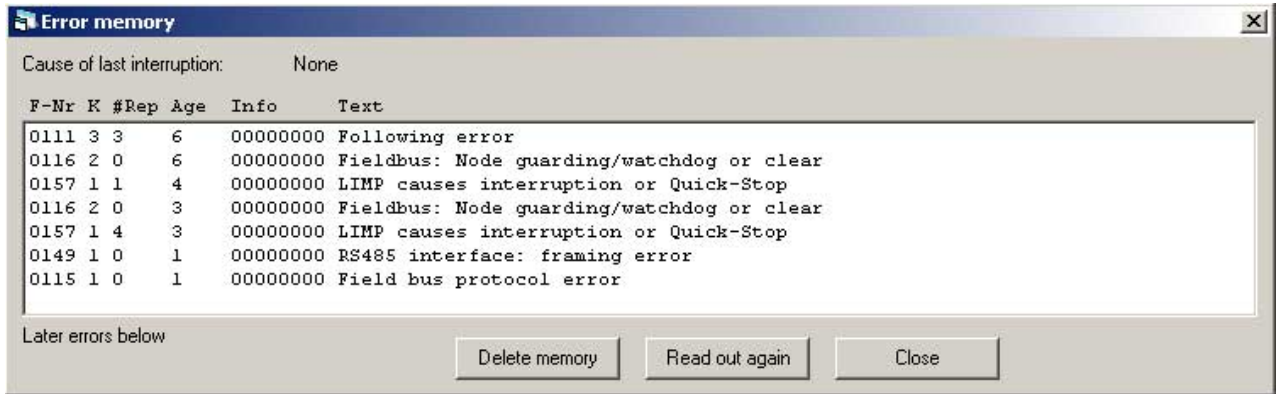


Figure 5.21 Output of error memory

The "Clear memory" button clears the error memory and with it the error list.

The "Read again" button updates the error list.

The "Close" button closes the "error memory" window.

Current error The current error, e.g. limit switch (LIMP/LIMN/REF), is output in the left section.

Last error The current hour meter and the error messages are output in the right section.

The "error history" list shows the error messages in chronological order. The "device status" column consists of:
(error time)-(detailed error number)-(error class)

The "additional information" list shows additional information on the error for every error message.

Erase error memory Use the menu item "⇒ Diagnostics ⇒ Delete error memory..." and the button "Delete error memory" to delete the "error history" list.

5.5.3 Observe parameter

Selected parameters of the device can be observed with the menu item "⇒ Diagnostics ⇒ Observe parameter...".

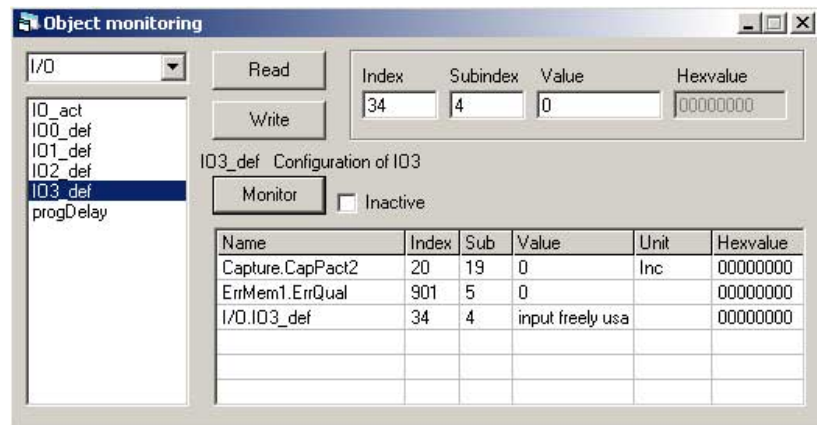


Figure 5.22 Observe parameter

The parameter for observation is selected in the list. The selected parameter is added to the table with the "Observe" button. Multiple parameters can be added to the table and observed.

A value can be written directly to a parameter with the "Write" button.

6 Diagnostics and troubleshooting

6.1 Error display

- Overview* The commissioning software shows diagnostic functions and information on error detection in various windows or parts of windows:
- Diagnostic functions for the device
⇒ Diagnostics ⇒ Device info (see 5.5.1 "Device information")
 - Error message for the device
⇒ Diagnostics ⇒ Error memory (see 5.5.2 "Error memory")
 - Monitoring parameters
⇒ Diagnostics ⇒ Observe parameters (see 5.5.3 "Observe parameter")
 - Error message in the toolbar which is permanently displayed in the active window.

- Error display* The cause of a breakdown is displayed:
- On the device with the device-specific equipment, e.g. LED or segment displays
 - By the error response of the device
 - In the commissioning software as an error message in the toolbar and the last error message in the error memory
- The error messages in the toolbar are output with the specific error number with additional information in the grey field below.

- Reset error message* The additional information can be deleted by double-click, but will remain available in the error history.
- The error status can be reset with the "Reset" button after the cause of the error has been corrected.

7 Glossary

7.1 Units and conversion tables

The value in the specified unit (left column) is calculated for the desired unit (top row) with the formula (in the field).

Example: conversion of 5 metres [m] to yards [yd]
 $5 \text{ m} / 0.9144 = 5.468 \text{ yd}$

7.1.1 Length

| | in | ft | yd | m | cm | mm |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| in | - | / 12 | / 36 | * 0.0254 | * 2.54 | * 25.4 |
| ft | * 12 | - | / 3 | * 0.30479 | * 30.479 | * 304.79 |
| yd | * 36 | * 3 | - | * 0.9144 | * 91.44 | * 914.4 |
| m | / 0.0254 | / 0.30479 | / 0.9144 | - | * 100 | * 1000 |
| cm | / 2.54 | / 30.479 | / 91.44 | / 100 | - | * 10 |
| mm | / 25.4 | / 304.79 | / 914.4 | / 1000 | / 10 | - |

7.1.2 Mass

| | lb | oz | slug | kg | g |
|-------------|---------------|----------------------------|----------------------------|--------------|------------|
| lb | - | * 16 | * 0.03108095 | * 0.4535924 | * 453.5924 |
| oz | / 16 | - | * $1.942559 \cdot 10^{-3}$ | * 0.02834952 | * 28.34952 |
| slug | / 0.03108095 | / $1.942559 \cdot 10^{-3}$ | - | * 14.5939 | * 14593.9 |
| kg | / 0.453592370 | / 0.02834952 | / 14.5939 | - | * 1000 |
| g | / 453.592370 | / 28.34952 | / 14593.9 | / 1000 | - |

7.1.3 Force

| | lb | oz | p | dyne | N |
|-------------|-------------|-------------|-------------------------|--------------------|-------------------------|
| lb | - | * 16 | * 453.55358 | * 444822.2 | * 4.448222 |
| oz | / 16 | - | * 28.349524 | * 27801 | * 0.27801 |
| p | / 453.55358 | / 28.349524 | - | * 980.7 | * $9.807 \cdot 10^{-3}$ |
| dyne | / 444822.2 | / 27801 | / 980.7 | - | / $100 \cdot 10^3$ |
| N | / 4.448222 | / 0.27801 | / $9.807 \cdot 10^{-3}$ | * $100 \cdot 10^3$ | - |

7.1.4 Power

| | HP | W |
|-----------|-------------|-------------|
| HP | - | * 745.72218 |
| W | / 745.72218 | - |

7.1.5 Rotation

| | 1/min (RPM) | rad/s | deg./s |
|---------------|--------------|--------------|------------|
| 1/min (RPM) - | | $* \pi / 30$ | $* 6$ |
| rad/s | $* 30 / \pi$ | - | $* 57.295$ |
| deg./s | / 6 | / 57.295 | - |

7.1.6 Torque

| | lb-in | lb-ft | oz-in | Nm | kp-m | kp-cm | dyne-cm |
|---------|-------------------------|--------------------------|---------------------------|----------------------|--------------------------|--------------------------|-----------------|
| lb-in | - | / 12 | $* 16$ | $* 0.112985$ | $* 0.011521$ | $* 1.1521$ | $* 1.129*10^6$ |
| lb-ft | $* 12$ | - | $* 192$ | $* 1.355822$ | $* 0.138255$ | $* 13.8255$ | $* 13.558*10^6$ |
| oz-in | / 16 | / 192 | - | $* 7.0616*10^{-3}$ | $* 720.07*10^{-6}$ | $* 72.007*10^{-3}$ | $* 70615.5$ |
| Nm | / 0.112985 | / 1.355822 | / 7.0616*10 ⁻³ | - | $* 0.101972$ | $* 10.1972$ | $* 10*10^6$ |
| kp-m | / 0.011521 | / 0.138255 | / 720.07*10 ⁻⁶ | / 0.101972 | - | $* 100$ | $* 98.066*10^6$ |
| kp-cm | / 1.1521 | / 13.8255 | / 72.007*10 ⁻³ | / 10.1972 | / 100 | - | $* 0.9806*10^6$ |
| dyne-cm | / 1.129*10 ⁶ | / 13.558*10 ⁶ | / 70615.5 | / 10*10 ⁶ | / 98.066*10 ⁶ | / 0.9806*10 ⁶ | - |

7.1.7 Moment of inertia

| | lb-in ² | lb-ft ² | kg-m ² | kg-cm ² | kp-cm-s ² | oz-in ² |
|----------------------|--------------------|--------------------|----------------------|--------------------|----------------------|--------------------|
| lb-in ² | - | / 144 | / 3417.16 | / 0.341716 | / 335.109 | $* 16$ |
| lb-ft ² | $* 144$ | - | $* 0.04214$ | $* 421.4$ | $* 0.429711$ | $* 2304$ |
| kg-m ² | $* 3417.16$ | / 0.04214 | - | $* 10*10^3$ | $* 10.1972$ | $* 54674$ |
| kg-cm ² | $* 0.341716$ | / 421.4 | / 10*10 ³ | - | / 980.665 | $* 5.46$ |
| kp-cm-s ² | $* 335.109$ | / 0.429711 | / 10.1972 | $* 980.665$ | - | $* 5361.74$ |
| oz-in ² | / 16 | / 2304 | / 54674 | / 5.46 | / 5361.74 | - |

7.1.8 Temperature

| | °F | °C | K |
|----|---------------------------|-------------------|----------------------------|
| °F | - | $(°F - 32) * 5/9$ | $(°F - 32) * 5/9 + 273.15$ |
| °C | $°C * 9/5 + 32$ | - | $°C + 273,15$ |
| K | $(K - 273.15) * 9/5 + 32$ | $K - 273.15$ | - |

7.1.9 Conductor cross section

| AWG | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|-----------------|------|------|------|------|------|------|------|-----|-----|-----|-----|-----|-----|
| mm ² | 42.4 | 33.6 | 26.7 | 21.2 | 16.8 | 13.3 | 10.5 | 8.4 | 6.6 | 5.3 | 4.2 | 3.3 | 2.6 |

| AWG | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 |
|-----------------|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|
| mm ² | 2.1 | 1.7 | 1.3 | 1.0 | 0.82 | 0.65 | 0.52 | 0.41 | 0.33 | 0.26 | 0.20 | 0.16 | 0.13 |

7.2 Terms and Abbreviations

| | |
|------------------------------|---|
| <i>Asynchronous error</i> | Error detected and reported by the internal controller monitoring equipment. |
| <i>Default value</i> | Factory settings. |
| <i>Direction of rotation</i> | Rotation of the motor shaft in a positive or negative direction of rotation. A positive direction of rotation is defined as the motor shaft rotating clockwise as the observer faces the end of the protruding shaft. |
| <i>DOM</i> | (Date of manufacturing) , the nameplate of the device shows the date of manufacture in the format DD.MM.YY, e.g. 31.12.06 (31. December 2006). |
| <i>LED</i> | Light-Emitting Diode |
| <i>Limit switch</i> | Switch that signals an overrun of the permissible travel range. |
| <i>Node Guarding</i> | Monitoring function with slave at an interface for cyclic communication. |
| <i>Parameter</i> | Device functions and values that can be set and called by the user. |
| <i>Power amplifier</i> | A device that generates current for controlling the motor in accordance with the positioning signals from the controller. |
| <i>RS485</i> | Fieldbus interface compliant with EIA-485, which enables serial data transmission with multiple devices. |
| <i>Synchronous errors</i> | Error reported by the controller if it is unable to execute a command sent by the master. |

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