



PC-Software
FAULHABER Motion Manager 4

Instruction Manual

EN

Imprint

Version:
4th issue, 02.03.2010
Software status 4.4

Copyright
by Dr. Fritz Faulhaber GmbH & Co. KG
Daimlerstr. 23/25 · 71101 Schönaich

All rights reserved, including those to the translation.

This description, whether in part or whole, may not be duplicated, reproduced, stored in an information system or processed or transferred in any other form without the explicit written consent of Dr. Fritz Faulhaber GmbH & Co. KG.

The Motion Manager's online update function uses the compression program "7-Zip", whose sole copyright holder is Igor Pavlov.

Parts of the product are subject to US American export regulations.

This instruction manual has been prepared with due care.
However, Dr. Fritz Faulhaber GmbH & Co. KG does not accept any liability for possible errors in this instruction manual and their consequences. Equally, no liability is accepted for direct losses or consequential damages resulting from improper use of the devices.

The relevant regulations regarding safety engineering and interference suppression as well as the requirements specified in this instruction manual are to be noted and followed when using the software.

Subject to change without notice.

Contents

1	Important Information	5
1.1	Symbols used in this instruction manual	5
1.2	Safety instructions	6
2	Description	7
2.1	General product description	7
3	Installation	8
3.1	System requirements	8
3.2	Installing the software	8
3.3	Updating the software	9
3.4	Uninstalling the software	9
4	Basic Functions	10
4.1	Starting the software	10
4.1.1	Starting Motion Manager 4 via the Start menu	10
4.1.2	Starting Motion Manager 4 with command options	10
4.1.3	Automatic scan for connected devices	10
4.1.4	Connection Wizard	11
4.1.5	Setting up connections manually	12
4.2	The user interface	14
4.2.1	The Menu bar	14
4.2.2	The Quick Start bar	16
4.2.3	The command input field	17
4.2.4	The FAULHABER motor	17
4.2.5	The Node Explorer	18
4.2.6	The Input/Output area	19
4.2.7	The Status bar	20
4.3	The Configuration dialogs	21
4.3.1	Configuring the Motion Controller	21
4.3.2	Configuring the Speed Controller	24
5	Additional Functions	25
5.1	Sequential programs	25
5.2	Parameter files	28
5.3	Analysis	29
5.3.1	Status display	29
5.3.2	Graphic analysis function	29
5.4	Visual Basic Script programs	32
5.4.1	Creating the script program	32
5.4.2	Motion Manager functions	32
5.4.3	Starting the script program	36
5.4.4	Cancelling the script program	36

Contents

5.5	Advanced Motion Manager commands for CAN	37
6	Maintenance	39
6.1	Software update	39
6.2	Troubleshooting	39
7	Licence Agreement	40

1 Important Information

This instruction manual describes the installation, configuration and use of the Motion Manager 4 software from FAULHABER.

- Please read through the complete instruction manual before using the software.
- Keep this instruction manual in a safe place for later use.
- Motion Manager 4 is 32 bit software for PCs with Microsoft® Windows® operating system.
- FAULHABER is not liable for any data loss, damage or other problems which arise due to use of this software.

1.1 Symbols used in this instruction manual

NOTE



Note

This "Note" pictogram provides tips and recommendations for use and handling of the program.

1 Important Information

1.2 Safety instructions

Compliance with the following safety instructions is a precondition for working with FAULHABER Motion Manager 4. You should therefore carefully read through all instructions and follow them when using the software.

Intended use

The FAULHABER Motion Manager 4 is designed for the configuration and putting into service of FAULHABER drive controls.

Depending on the models concerned, the controls to be configured can be connected to the PC via various interfaces. Depending on the control's features a programming adapter will also be required, which is available from FAULHABER on request.

The Motion Manager 4 software is designed for the following tasks:

- Configuring the device functions and the drive parameters with the help of graphic dialogs
- Operating the devices via serial RS232, USB or CAN interface
- Command input with plain text support
- Creating, transferring and managing sequential programs and parameter files
- Dynamic setting of the controller parameters
- Graphic online analysis of the drive's performance
- Creating and executing simple program sequences with the help of VBScript

NOTE



The functions listed above are not available in all controls and depend on the features of the respective control to be configured.

The following controls are supported:

- | | | | |
|------------------|------------------|-----------|-----------|
| ■ 3564K024B CS | ■ 3564K024B C | ■ SC 1801 | ■ BX4 CS |
| ■ MCBL 3003/06 S | ■ MCBL 2803/05 | ■ SC 2804 | ■ BX4 CSD |
| ■ MCDC 3003/06 S | ■ MCDC 2803/05 | ■ SC 2402 | ■ BX4 CC |
| ■ 3564K024B CC | ■ MCLM 3003/06 S | ■ BX4 SC | ■ BX4 CCD |
| ■ MCBL 3003/06 C | ■ MCLM 3003/06 C | | |
| ■ MCDC 3003/06 C | | | |

The following interfaces are supported:

- Serial RS232
 - CAN (by default interfaces from IXXAT)
- Additional supported interfaces:
- ESD
 - EMS
- USB (for Speed Controller)

2 Description

2.1 General product description

Motion Manager 4 software from FAULHABER provides convenient access to the settings and parameters of the connected motor controls.

The graphic user interface can be used to read out, change and reload configurations. Individual commands or complete parameter sets and program sequences can be entered and transferred to the control. Command responses are logged together with the sent commands in the "History" tab. In addition, analysis options are available in the form of status displays and graphic trace windows. Communication with the motor control takes place either via a serial RS232, a USB or a CAN interface.

Starting the software

After the software has started the enabled interfaces are opened one after the other and the specified address range is searched for connected devices (scanning process).

The program interface

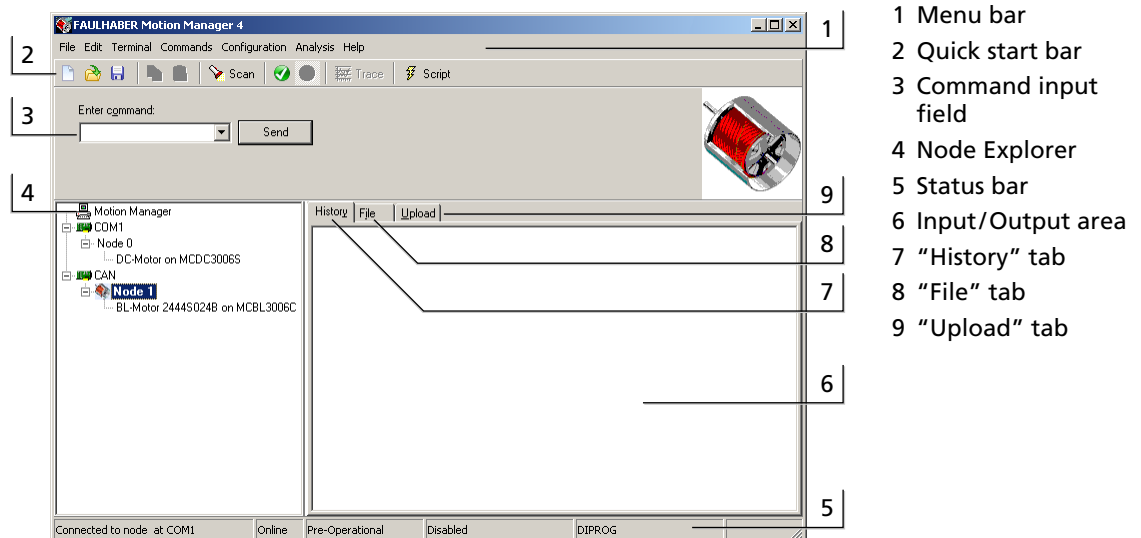
Directly after the start the main window is displayed, which is divided into several areas.

NOTE



The program interface is dynamically designed so that the layout of the toolbars and menus match the respective connected device. Various functions and commands are therefore not always visible.

The main controls are arranged as follows:



Devices found

The devices found are displayed in the Node Explorer (4) after the end of the scanning process.

3 Installation

3.1 System requirements

The Motion Manager 4 software from FAULHABER has been developed for PC systems with Microsoft® Windows® 2000 or higher operating systems installed.

Recommended minimum configuration of the PC system:

- Hard disk drive space required: 20 MB

3.2 Installing the software

The "SetupFAULHABERMoMan4_*.exe" file is required to install Motion Manager 4.

- Run the "SetupFAULHABERMoMan4_*.exe" file.
- Confirm the Start window of the installation program by clicking "Next".
- Read the complete End User licence agreement. If you agree to the terms of the licence agreement, tick the relevant selection box and confirm your selection by clicking "Next".
- Enter your name and the name of your organisation in the fields provided and then click "Next".
- If necessary, change the installation path for the software and then click "Next".
- Use the summary displayed to check the settings made and start the installation by clicking "Install".
- The installation process is carried out.
- Select whether the software is to be started after installation or not and end the installation by clicking "Finish".

3 Installation

3.3 Updating the software

The updating of the installed software version differs depending on the predecessor version.

Updating Version 3.xx or older

An already existing Version 3.xx or older of Motion Manager is not impaired by the installation of Motion Manager 4. The two versions can exist alongside each other on the same PC system. In this case the installation process is as described in Chapter 3.2 "Installing the software".

Updating Version 4.xx

If an older version of Motion Manager 4 exists on the system it is updated when a newer version is installed.

The "Options" menu item of the "Extras" menu can also be used to activate an automatic online update function.

3.4 Uninstalling the software

To completely remove Motion Manager 4, complete the following steps:

- Open the "Add/Remove Programs" menu in the Windows Control Panel.
- Select "FAULHABER Motion Manager 4" from the list and click "Remove".
- Confirm the renewed prompt whether Motion Manager 4 is to be removed or not.

4 Basic Functions

4.1 Starting the software

4.1.1 Starting Motion Manager 4 via the Start menu

Following installation the "FAULHABER" group in the Start menu contains the "Motion Manager 4" link which can be used to start the software.

4.1.2 Starting Motion Manager 4 with command options

The program file moman4.exe contains various command options which can be used when starting the software from the command line or adjusted link.

Example for command line invocation:

```
C:\Programme\Faulhaber\Motion Manager 4\>moman4.exe /H /RUN:script.vbs /E
```

► *Motion Manager 4 is started in the background (/H), the script script.vbs is run (/RUN:script.vbs) and then the program is exited (/E).*

List of the available command options

Parameter	Function
/RUN:script.vbs	Runs the given Visual Basic Script immediately after the Motion Manager starts.
/E	Exits the Motion Manager in conjunction with /RUN: immediately after the script has been run through.
/H	Runs Motion Manager invisibly in the background.
/ENG	Starts Motion Manager with an English user interface, if the English version is installed and German is set as the default.
/DEU	Start Motion Manager with a German user interface, if the English version is installed.

Example for switching to the German interface if the English version is installed:

```
C:\Programme\Faulhaber\Motion Manager 4\>Moman4.exe /deu
```

NOTE



The German version contains the German resources only, the English version on the other hand contains both the English and the German resources. It is therefore only possible to switch over languages if the English version is installed!

The command options listed above can be given individually or in combination with each other on opening moman4.exe (see example).

4.1.3 Automatic scan for connected devices

After starting the software, Motion Manager automatically searches the interfaces selected under "Connections..." (see Chapter 4.1.5 "Setting up connections manually") for connected controls within the specified address ranges (scanning area of the node No.). To this end the interface and protocol plug-ins selected for each interface are used.

Default connection parameters

Parameter	Function
PC interface	COM1
Scanning range	0 – 10
Protocol	Serial FAULHABER protocol for devices with command interface (e.g. Motion Controller)
Interface	Standard serial interface

4 Basic Functions

4.1 Starting the software

Following completion of the start procedure, all detected controls are displayed in the Node Explorer. If no control was detected, Motion Manager automatically starts the Connection Wizard.

As an alternative to the Connection Wizard the connection parameters can also be set under "Connections" (see Chapter 4.1.5 "Setting up connections manually").

NOTE



The scanning process can also be invoked manually at any time after Motion Manager has been started.

- ▶ Menu bar - Terminal - Node Search
- ▶ Scan button on the Quick Start bar
- ▶ "F2" key

4.1.4 Connection Wizard

If no connected nodes are found when the Motion Manager is started the Connection Wizard appears. It helps the user to set up the connection with the connected control.

Step 1: Select the device family

- Motion Controller with RS232 interface
- Motion Controller with CAN interface
- Speed Controller without command interface

Step 2: Setting the connection parameters

Depending on the device family set, the corresponding connection parameters are queried.

Step 3: Summary and completion

The settings made are displayed in a summary for final checking. You can correct incorrect settings by clicking the "Back" key. The connection setup is finished with the "Finish" key.

After completion the node is visible in the Node Explorer.

NOTE



The Connection Wizard can also be opened manually at any time after Motion Manager has been started.

- ▶ Menu bar - Help - First Steps (Connection Wizard)

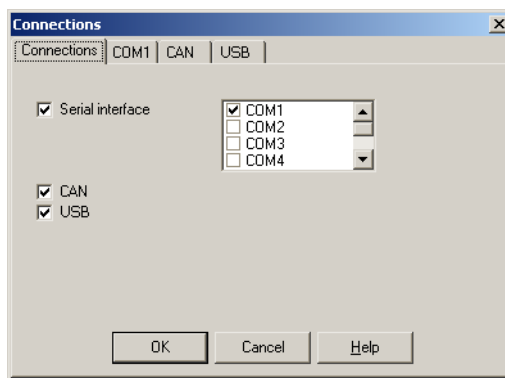
4 Basic Functions

4.1 Starting the software

4.1.5 Setting up connections manually

If the connection from Motion Manager to the connected control is to be set up without the Connection Wizard, this can be done using the "Connections..." function in the "Terminal" menu of the Menu bar.

"Connections" tab



Enabling the required interfaces (serial RS232, CAN, USB).

If the serial interface is enabled the ports at which controls are connected must also be selected (COM1, COM2, ...).

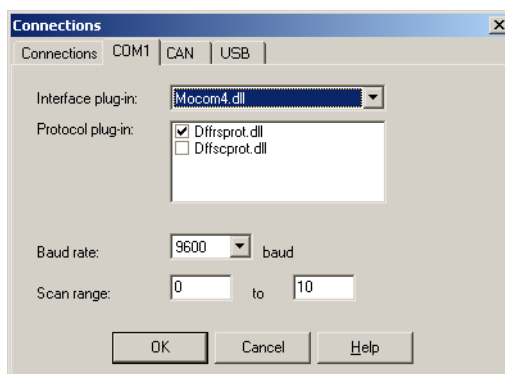
A tab for setting the respective connection parameters is displayed for each enabled interface/port.

NOTE



A corresponding driver must be installed to enable access to a Speed Controller with programming adapter via USB. The first time the programming adapter is plugged in, the Windows Hardware Wizard performs the driver installation process (see quick reference guide of the programming adapter).

"COMx", "CAN" and "USB" tabs



Connection settings for the respective interface.

Interface plug-in:

Select the DLL file which makes the connection between Motion Manager and the interface driver.

- COMx: Default "Mocom4.dll"
- CAN: As a default, "lxxat_vci3.dll" is installed for IXXAT CAN interfaces via their VCI3 driver. A corresponding plug-in file is required for other manufacturers' interfaces or for other drivers (e.g. "ems_cpc.dll" for EMS-Wuensche interfaces).
- USB: "SerialDL.dll"

Protocol plug-in:

Selection of the DLL file with the communication protocol of the devices to be addressed.

- COMx with Motion Controller: "Dffrsprot.dll"
- COMx with Speed Controller: "Dffscprot.dll"
- CAN with Motion Controller: "Dffcanprot.dll"
- USB with Speed Controller: "Usbscprot.dll"

4 Basic Functions

4.1 Starting the software

NOTE

It is also possible to use several protocols via one interface as long as no protocol conflicts occur. Then when scanning the network, all the given protocol plug-ins are loaded one after the other to search for supported nodes.

Transfer rate:

Setting for the speed of the data transfer (baud rate). Please check beforehand whether all devices to be addressed at this interface also support the required baud rate.

Scanning range:

Setting the range of the node numbers in which connected devices are to be looked for (no significance for FAULHABER Speed Controllers).

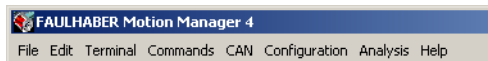
Click "OK" to save the settings and automatically search through the selected interfaces. Any controls found are displayed in the Node Explorer.

4 Basic Functions

4.2 The user interface

The main window of the FAULHABER Motion Manager is divided into different areas (see Chapter 2.1 “General product description”), which are described in greater detail here.

4.2.1 The Menu bar



The menu bar contains all functions and commands required to use the Motion Manager. Its appearance is dynamic and depends on the currently selected control so that several functions are only available if they are actually supported by the control.

“File” menu

The “File” menu contains the standard functions for creating, opening, saving and printing Motion Manager files.

The following file types can be processed with Motion Manager:

- Motion Control files * `.mcl`
- Motion Parameter files * `.mcp`
- Visual Basic Script files * `.vbs`

The “New” menu item deletes the input/output area of the displayed tab.

“Edit” menu

In addition to the standard functions of the “Edit” menu, the “Program File” item can be used here to activate program editing mode for several controls.

If this menu item is enabled, commands selected from the Commands menu are not sent directly to the drive, but instead are copied into the file editing area where they can be used to create a sequential program.

A new toolbar for debugging sequential programs appears above the file editing area (see Chapter 5.1).

“Terminal” menu

All settings and actions based on the connection with the control can be controlled in this menu. In addition, functions for transferring, receiving and comparing program and parameter files are available for several controls.

4 Basic Functions

4.2 The user interface

“Commands” menu

This menu is only available if a control with command interface has been selected (see Chapter 4.2.5 “The Node Explorer”). It contains the most important commands of the connected control. After selecting a command and possibly entering a value the command is copied into the command input field. From here the command can be sent directly to the control, whereby the node number of the selected device is automatically placed in front in network mode (see Chapter 4.2.3 “The Input field”). Touch the commands with the mouse and a precise explanation of them appears in the Status bar at the bottom edge of the Motion Manager window.

“CAN” menu

This menu is only available if a CAN node has been selected (see Chapter 4.2.5 “The Node Explorer”). The “CAN” menu contains special functions for operating CAN controls, among other things the telegrams for controlling the CANopen state machines (NMT, Device Control) and for motion control, access to the CANopen object dictionary or node configuration via the LSS protocol. Any CAN telegrams can also be sent.

“Configuration” menu

The “Configuration” menu contains configuration dialogs for setting drive functions and parameters. For example, the following settings can be made here:

- General basic settings such as operating mode, connected motor / encoder, etc.
- Drive parameters such as positioning range limits, speed ranges, etc.
- Controller parameters
- Function of the inputs/outputs and definition of a reference run
- Connection parameters of the control such as transfer rate and node No.

NOTE



The layout of the menus and the dialogs is dynamic and depends on the control to be configured.

4 Basic Functions

4.2 The user interface

“Analysis” menu

Motion Manager provides the opportunity to display the status of the control (status display) and to visualise the control's performance (Graphic Analysis), provided the selected device supports this function. See Chapter 5.3 “Analysis”.

“Help” menu















The “Help” menu contains the reference to this instruction manual, options for contacting FAULHABER via its homepage and by eMail, a reference to the Help file of Visual Basic Script, and the option of starting the Connection Wizard manually (“First Steps”), see Chapter 4.1.4 “Connection Wizard”.

4.2.2 The Quick Start bar



Like the Menu bar, the Quick Start bar also has a dynamic layout and adjusts to the options of the selected control.

The buttons correspond to the respective functions in the Menu bar:

	■ File – New (also Delete the active tab in the input/output area)
	■ File – Open
	■ File – Save
	■ Edit – Copy
	■ Edit – Paste
	■ Terminal – Node Search
	■ Commands – Motion Control – Enable Drive (“EN”)
	■ CAN – Device Control (DSP402) – Switch on
	■ Commands – Motion Control – Disable Drive (“DI”)
	■ CAN – Device Control (DSP402) – Disable Voltage
	■ Commands – Sequential Program – Start Program Sequence
	■ Commands – Sequential Program – Stop Program Sequence
	■ Analysis – Graphic Analysis
	■ Terminal – Run Script

4 Basic Functions

4.2 The user interface

4.2.3 The command input field



The command input field enables the manual input of commands. If the selected control has a command interface, depending on the "Program File" setting, the entered command can then be sent directly to the control or can be copied into the "File" editor window.

In the case of controls with serial command interface the entered text is sent unchanged to the active COM port, irrespective of which serial node is selected. In the case of CAN devices the entered command is translated into a corresponding CAN telegram in accordance with the set CAN protocol with identifier according to the Node No. of the selected device. The CAN telegram is forwarded via the set interface plug-in to the driver of the CAN interface card.

The commands can either be entered in the input field manually, or can be selected from the list of available commands in the "Commands" menu. If applicable, following a parameter query, the selected command is copied into the input field together with the entered value.

The possible commands can be looked up in the command reference of the respective Motion Controller and in Chapter 5.5 "Advanced Motion Manager commands for CAN".

Program file

Enable the "Program File" function in the "Edit" menu to change the button next to the input field from "Send" to "Apply". Motion Manager then does not send the commands in the input field to the control but to the Editor window of the "File" tab in the input/output area.

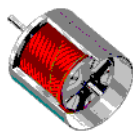
NOTE



When you switchover tabs in the input/output area the "Program File" function is automatically disabled. Commands entered in the input field are once again sent to the control.

The Debug toolbar is retained until the file editing area is deleted using "File" - "New", or you switch to another node.

4.2.4 The FAULHABER motor

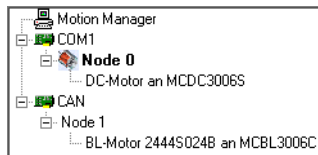


The image of a cut open FAULHABER motor in the top right-hand corner of the Motion Manager window shows the activity state of the selected control. After entering a command sequence for activating the control the motor begins to turn. If the control is disabled the animation does not move.

4 Basic Functions

4.2 The user interface

4.2.5 The Node Explorer



The Node Explorer displays all the controls found with which Motion Manager was able to successfully set up a connection. The display is divided into three hierarchies:

- Interface (COMx/CAN/USB)
- Node No.
- Drive and control

NOTE



If the interface symbol is crossed out in the Node Explorer display the set interface is not available (e.g. blocked by another application, not available or an incorrect CAN driver has been set).

Selecting a control

The control whose settings are to be edited is selected by double-clicking the corresponding node. The active node is displayed in bold and with a motor symbol.

Tool Tip

If you move the mouse cursor in the Node Explorer window a Tool Tip box appears briefly with further info on the selected node and the set interface parameters.

The Context menu

Click the right-hand mouse button ("right-click") on the window of the Node Explorer and a Context menu appears for controls with command interface; this Context menu makes various functions available depending on the control selected.

For example:

- Display info about the selected node, e.g. Firmware version and Serial No. (Node Info)
- CAN functions according to CAN menu

NOTE

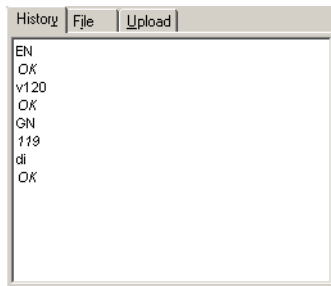


The Speed Controllers cannot respond to Scan Commands. Therefore the corresponding node appears in the Node Explorer permanently, if this control type is set, irrespective of the presence of a connected control or not.

4 Basic Functions

4.2 The user interface

4.2.6 The Input/Output area



The input/output area is divided into three tabs, each of which contains a Text Editor window.

History

All commands sent and all data received is displayed in the "History" tab of the input/output area. Received data is shown in italics. The corresponding CAN telegrams are displayed for CAN commands (not for FAULHABER commands which are transferred via the FAULHABER channel).

NOTE



Feedback responses from FAULHABER commands for CAN drives (OK or errors) are displayed if the transfer type of PDO2 in the drive is set to asynchronous (SOBJ 1801 02 FF).

File

The "File" tab can be used to write your own program files or scripts. Files created here can be sent to the control (sequential programs) or can be executed on the PC (VBScripts) and stored locally on the PC. Files loaded via the "File" – "Open" command also appear in this tab. In this case the tab name changes to the file name.

If program editing mode is enabled, another toolbar for debugging sequential programs is also displayed in this tab.

4 Basic Functions

4.2 The user interface

Upload

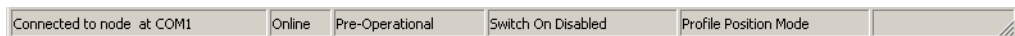
If data records are loaded from the control onto the PC (parameter or program files), the data appears in the "Upload" tab. The data can be edited and saved in the Upload window and transferred back to the control.

NOTE



The content of each Editor window in the input/output area can be saved, printed out and deleted ("File" – "New").

4.2.7 The Status bar



The status bar displays the current status of Motion Manager and the selected control. In normal status, if none of the buttons are touched with the mouse cursor, the display is divided up as follows:

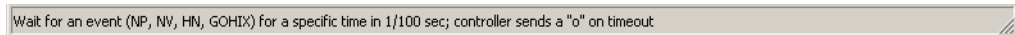
- Currently selected nodes and interface or program editing mode
- Status of the connection
- CANopen NMT status
- Status of the control
- Currently set mode of the control

NOTE



Apart from the layout in normal status the status bar also displays useful information on many buttons or commands, if they are touched with the mouse cursor.

Example: Display if the "Commands" – "Sequential Program" – "TIMEOUT" command is touched



4 Basic Functions

4.3 The Configuration dialogs

Extensive graphic configuration dialogs are available for each device group, which enable convenient drive configuration and parameter assignment (“Configuration” menu or “Configuration” button). The configuration dialogs are usually divided into several pages. Changes can be made directly on the graphic interface and transferred to the drive unit by pressing the “Send” button.

NOTE



Note:

The parameter settings possible for each configuration and the function of the individual parameters are described in the relevant chapter of the device's operating instructions.

4.3.1 Configuring the Motion Controller

With the Motion Controller the parameter commands of the changed settings are sent. The new setting is then immediately active and is retained until the power supply to the control is switched off.

If the new setting is to be permanently saved, the “EEPSAV” button must then be pressed; this causes the current parameters to be transferred into the non-volatile memory of the drive unit.

With CAN controllers it is necessary to note that the configuration dialogs are only accessible in “Operational” status; therefore, the drive unit must be placed in the relevant status beforehand using the CAN-NMT menu (Start Remote Node). The “Basic Settings” tab is available here in FAULHABER mode (OPMOD-1) only, as Faulhaber-specific configurations can be made here, which are not supported by the CANopen standard.

NOTE



Note:

If a sequential program is running in the control which independently sends data to the serial interface, it must be stopped before opening the configuration dialog to avoid incorrect display values!

Optimization for connected motor

If a new BL motor or linear motor has been connected to the controller, select the correct motor type according to the connected motor in the “Basic Settings” tab and send the setting to the drive.

For a motor which is not listed in the motor type list, select “Special Motor” and enter the motor resistance RM and the speed constant KN parameters for BL motors and the pole pitch TM parameter for linear motors, according to the catalogue details in the displayed fields.

For even better adjustment of the controller to the connected motor, you can optimise the Hall sensor signals and the phase angle of the sinus commutation using the corresponding button. The motor must be able to run freely for several seconds without load.

Non-optimised Hall sensor signals can result in irregular motor running during the first few seconds after switching on and in less accuracy. A non-optimised phase angle results in increased power consumption and as a result to a poorer efficiency.

After pressing the “Optimization for connected motor” button you are guided through automatic optimisation of the Hall sensor signals and the phase angle.

4 Basic Functions

4.3 The Configuration dialogs

After completing the optimisation the determined system parameters then only have to be permanently saved with "EEPSAV".

If you cannot run the connected motor with maximum velocity in no load because, for example, a gear is flange-mounted, it is possible that the automatic setting of the phase angle cannot be used. For this case it is possible to correct the phase angle manually:

First, set the required output voltage on the relevant page. The setting can be made most accurately at 100% (corresponds to 15 000 rpm or no load speed of the drive). With certain connected drive units it is however advisable to reduce the value, e.g. so that a maximum gear input speed is not exceeded.

In this case, move the slide controller for the phase angle in one direction or the other and observe the current value. The phase angle is optimally set at the point where the smallest current value is displayed.

After successfully setting this page manually, quit it with "Next". The Hall sensor signals are then readjusted. Finally, run "EEPSAV" again to permanently save the determined system parameters.

Dynamic setting of the controller parameters

Under the menu item "Configuration" - "Controller Parameters..." the controller parameters can be changed online using the arrows of the input fields or by entering a value via the keyboard. As soon as the value of an input field has changed it is automatically sent to the drive. With keyboard entries the corresponding field remains grey until the field is quit or "Enter" has been pressed; only then is the value sent to the drive.

This enables dynamic synchronisation of the parameters, similar to the case with a potentiometer. The controller parameter dialog is a non-modal dialog, which can also be opened alongside other windows, unlike the other configuration dialogs, which remain in the foreground until they are closed. In this way, e.g., while a graphic analysis is displayed, it is possible to turn the controller parameters and observe the effect on speed or position stability.

After setting the optimum controller parameters do not forget "EEPSAV" so that the parameters are retained even after the control is switched on again!

See also the "Setting the Controller Parameters" chapter in the Motion Controller Instruction Manual.

Configuring the connection parameters

The menu item "Configuration" - "Connection Parameters..." can be used to set the transfer rate and node No. of a connected drive unit.

Motion Controller with serial interface

If a connection has not yet been made with a drive node, the transfer rate set in the drive is determined when the dialog is started by scanning all possible baud rates. However, this is only possible if one drive only is connected to the serial interface.

If the set baud rate has been determined it can also be changed here and a new node No. set for network operation.

For operation in a network it is important that none of the node addresses are assigned more than once and that all nodes operate with the same transfer rate!

4 Basic Functions

4.3 The Configuration dialogs

After pressing the “Send” button the serial interface is opened again with the transfer rate set here and is scanned for drive nodes.

Here too “EEPSAV” must be run to permanently save the connection parameters!

Motion Controller with CAN interface

Transfer rates and the node address for the CANopen drives of FAULHABER are set here in accordance with the LSS protocol (Layer Setting Services and Protocol) according to CiA DSP305 V1.

This protocol offers two configuration options:

a.) Switch Mode Global:

All connected LSS slaves are placed in configuration mode. The baud rate and node ID (node address) can only be set if one LSS slave only is connected.

b.) Switch Mode Selective:

Precisely one LSS slave, whose Vendor ID, product code and serial No. are known, is placed in configuration mode. This mode can be used to configure individual drives in the network via their serial No.

An additional dialog is available for selecting the LSS mode, via which either an individual node can be configured globally or a node whose LSS data (vendor ID, product code and serial No.) are given in the following, can be configured selectively.

If an already configured node selected via the Node Explorer is to be reconfigured (e.g. other node No.), its LSS data is displayed directly so that the details then only have to be confirmed with “OK”.

If an unconfigured node (Node ID = 0xFF) is to be configured in the network, the vendor ID and the product code are already filled, the serial No. of the required node still has to be entered. If only one drive is connected, Global mode can be selected, for which no other data must be entered.

NOTE



It must be noted that a connection with the Motion Controller can only be made if it is either set to AutoBaud or it is set to the same baud rate as the Motion Manager. For this reason the current setting should always be properly documented so that the stored transfer rate does not have to be determined at a later time by trial and error!

Apart from the vendor ID, the product code and the serial No., the LSS protocol also requires a revision number. But this number is not used by FAULHABER Motion Controllers in the LSS protocol, therefore Motion Manager always transfers “0.0” here and the user does not have to make any entries!

After a connection has been set up with the required node you can change the transfer rate (fixed transfer rate or AutoBaud) and the node No.

After sending a new configuration it is saved in Motion Controller, which then performs a reset. The Motion Manager then uses the set or new transfer rate to scan the network again and the new configured drive nodes should now be correctly displayed in the Node Explorer.

4 Basic Functions

4.3 The Configuration dialogs

4.3.2 Configuring the Speed Controller

In the case of the Speed Controllers the configuration change is made via a firmware download.

To check the effect of the change immediately, after downloading the "Run" button can be pressed, which switches the drive unit from configuration mode to operating mode. No configuration changes are possible in operating mode. To make new changes the "Stop" button must be pressed, which switches the drive unit back into configuration mode.

The control can only be switched to configuration mode after the power supply has been switched on. If the connection is interrupted during the configuration, use "Run"/"Stop" to switch back to configuration mode.

If the configuration dialog is quit, the drive unit is also placed in operating mode and immediately starts with the set configuration. If the drive is not to be started immediately the power supply must be switched off first.

5 Additional Functions

5.1 Sequential programs

Functions are available for editing, transferring, debugging and managing sequential programs for Motion Controllers which support the saving and running of sequential programs.

Loading an existing program sequence

Existing program sequences can be loaded in the File Editor window via "File" – "Open...".

File format

The Motion Controller files have the default extension *.mcl. However, files created with any text editor can also be read in as the mcl files are saved in ASCII format.

Creating a sequential program

To create a new sequential program, select "Program File" from the "Edit" menu or click the "File" tab in the input/output area.

The code can now be entered. If program editing mode is enabled ("Edit" – "Program File" menu), which can be recognised by information in the status bar on the bottom left-hand side or by the tick in front of the menu item "Edit" – "Program File", the commands from the "Commands" menu can be copied directly into the program code ("Send" button changes to "Apply"). In addition, a new toolbar for debugging and transferring sequential programs appears at the top of the file edit area.

Syntax explanation

- Each line contains a command, some followed by a number as an argument (e.g.: LA1000).
- Spaces at the beginning and between the command and argument are ignored. Alphanumeric characters only are sent.
- In addition to the commands, comments can also be entered. Comments are introduced by a semi-colon (;) and can be positioned at the end of a command line or in a separate line (e.g.: HO ;Define Home Position).
- Comments are not sent to the drive, they are only used to document the program stored in the PC.
- Each letter and each number in a line of the program is sent to the Motion Controller up to the appearance of a semi-colon. The Motion Controller saves the program line, provided it is a valid command.
- The "PROGSEQ" and "END" commands do not have to be entered as they are automatically sent by the "Transfer program file" function.

To quit program editing mode, select the menu item "Edit" – "Program File" again or switch to the "History" tab. Commands can now be sent directly to the drive again ("Apply" button changes back into "Send").

5 Additional Functions

5.1 Sequential programs

Transfer sequential program to the control

The entered or loaded program can be sent to the control by using the menu item "Terminal" – "Transfer File..." and then selecting "Sequential Program".

If the Debug toolbar is displayed the sequential program can also be transferred using the Start button which also starts the program immediately.

Compare sequential programs

By using the menu item "Terminal" – "Compare Files" and then selecting "Sequential Program" it is possible to check the program code of the File Editor window with the program code stored in the control to see whether they are the same or not.

If the sequential program is transferred using the Debug toolbar, the program is automatically compared with subsequent syntax error display before the program is started.

Load sequential program from the control into Motion Manager

A sequential program stored in the control can be transferred to the Motion Manager using the menu item "Terminal" – "Receive File" and by then selecting "Sequential Program". The program code is then displayed in the "Upload" editor window and from here it can be edited, saved, printed out and also transferred again.

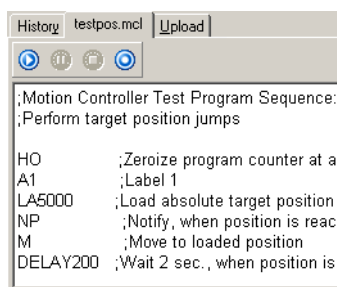
Start sequential program

After the program has been sent to the control it can be started via the "ENPROG" command or by clicking the "Start Program Sequence" button (see Chapter 4.2.2 "The Quick Start bar").

If the sequential program is transferred using the Debug toolbar the program starts automatically.

Debug sequential program

In program editing mode (menu item "Edit" – "Program File" enabled), an additional toolbar is available in the File Editor window for debugging the sequential program:






■ Transfer and execute sequential program

After the transfer the sequential program is first read back again and checked that it is the same. If there are any syntax errors, the command line entered cannot be interpreted by the Motion Controller and the faulty program line is then displayed in the Editor window in red. Following error free transfer of the program the whole File Editor window is displayed grey. In this status the program runs on the controller and debug mode is enabled.

5 Additional Functions

5.1 Sequential programs

-  ■ **Hold sequential program**
If the program is running in debug mode, this button can be used to interrupt the running program. The current program line is then displayed in green in the Editor window.
-  ■ **Stop sequential program**
If the program is running in debug mode, this button can be used to quit the program and the debug mode. The File Editor window switches back to Edit mode and changes can once again be made to the program code.
-  ■ **Single step.**
The displayed sequential program is transferred to the Motion Controller and is compared. Following error free transfer of the program the whole File Editor window is displayed in grey and the first program line is displayed in green. The sequential program is now in the displayed program line and can be moved forward by one program step each time the button is pressed.

NOTE



Examples of sequential programs are provided in the installation directory under \Motion Manager 4\Examples.

5 Additional Functions

5.2 Parameter files

In addition to the file functions for sequential programs, there are also functions for transferring, receiving and comparing parameter files and for the complete configuration of parameter file and sequential program.

Loading an existing parameter file

Existing parameter files (with and without sequential program) can be loaded in the File Editor window via "File" – "Open...".

File format

The Motion Controller parameter files are text files and have the default extension * .mcp.

Transfer parameter file

A loaded parameter set can be sent to the control using the menu item "Terminal" – "Transfer Parameter File" or "Terminal" – "Transfer File..." and by then selecting "Parameter File".

If a configuration file is loaded with program sequence and parameter listing, this can be transferred by selecting "Parameter File with Sequential Program".

Receive parameter file

By using the menu item "Terminal" – "Receive Parameter File" or "Terminal" – "Receive File..." and then selecting "Parameter File" or "Parameter File with Sequential Program" it is possible to create an image of the drive configuration stored in the control.

The parameter configuration read in (with and without sequential program) is then displayed in the Upload Editor window, from where it can be edited, saved, printed out and transferred again.

Compare parameter file

By using the menu item "Terminal" – "Compare Parameter File" or "Terminal" – "Compare File..." and then selecting "Parameter File" or "Parameter File with Sequential Program" it is possible to check whether the loaded configuration file is the same as the control's current configuration.

Edit parameter file

Before saving, comments can be added to parameter files for documentation purposes, as described in Chapter 5.1 under "Syntax explanation".

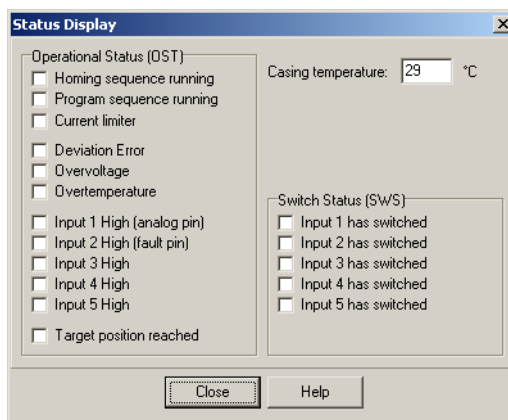
5 Additional Functions

5.3 Analysis

Under the “Analysis” menu the Motion Manager provides two options for displaying the current status of the control and connected motor.

5.3.1 Status display

The status display can be started via the “Analysis” – “Status Display” menu, provided the selected control supports this function.

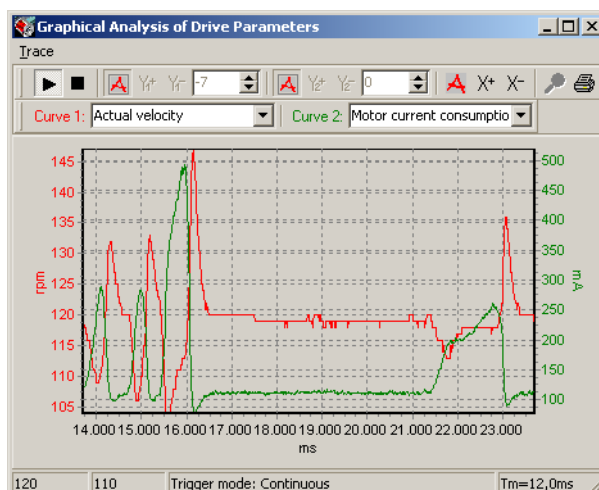


Changes to the listed values are identified by showing and hiding the tick in front of the value names. The display is updated every 500 ms

5.3.2 Graphic analysis function

The graphic analysis function of Motion Manager provides numerous options for monitoring and evaluating the performance of the drive, provided the selected control supports this function. One possible application is the assessment of the dynamic performance of the motor and control or optimising the controller parameters (inclusion of step responses).

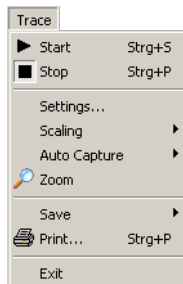
The analysis is started via the “Analysis” – “Graphic Analysis” menu or the corresponding button in the Quick Start bar (see Chapter 4.2.2 “The Quick Start bar”).



5 Additional Functions

5.3 Analysis

The "Trace" menu



The "Trace" menu contains all available settings for the analysis function.

- Start: Starts the recording of the set values.
- Stop: Stops the recording.
- Settings: Opens the dialog with setting options for signal triggering and data buffer.
- Scaling: Contains the options for the scaling setting of the two Y axes and the X axis.
- Auto Capture: Moves the offset of one or both curves so that they are visible in the display window. The scaling is not changed (not available with automatic scaling).
- Zoom: Enables/Disables Zoom mode. If Zoom mode is enabled the content of the display window can be moved with the mouse, or enlarged if the Shift key is pressed.
- Save: The currently displayed curve can be optionally saved graphically as a bitmap or as an ASCII table in text form. An ASCII table can for example be read into mathematics or spreadsheet programs for further processing.
- Print: The currently displayed curve can be printed out.











The Toolbars

The toolbars in the main window of the graphic analysis enable direct access to the selected menu items.

"Scaling" toolbar








The buttons correspond to the respective functions in the Menu bar:

-  ■ Trace – Start
-  ■ Trace – Stop
-  ■ Trace – Scaling – Automatic (Y1)
-  ■ Trace – Scaling – Y1+
-  ■ Trace – Scaling – Y1–
-  ■ Offset setting for Y1 (cannot be reached via the menu)
-  ■ Trace – Scaling – Automatic (Y2)
-  ■ Trace – Scaling – Y2+
-  ■ Trace – Scaling – Y2–
-  ■ Offset setting for Y2 (cannot be reached via the menu)

5 Additional Functions

5.3 Analysis

-  ■ Trace – Scaling – Automatic (X)
-  ■ Trace – Scaling – X+
-  ■ Trace – Scaling – X-
-  ■ Trace – Zoom
-  ■ Trace – Print

“Data Sources” toolbar



The toolbar contains two list boxes, from which the data sources for curves 1 and 2 can be selected.

5 Additional Functions

5.4 Visual Basic Script programs

The FAULHABER Motion Manager enables simple sequential programs or automation scripts to be created and run on the PC within the Motion Manager.

The Visual Basic Script Code entered is run via the Microsoft Scripting Host (integrated in Windows from Internet Explorer 3).

5.4.1 Creating the script program

Script programs can be created or loaded in the file window and usually have the extension `"*.vbs"`.

Script programs always begin with `"SUB MAIN"` and end with `"END SUB"`. The Visual Basic Code can be written within this identifier.

NOTE



An explanation of the VBScript command set is given in the Microsoft Help for Visual Basic Script.

5.4.2 Motion Manager functions

In addition to the VBScript command set there are special Motion Manager functions for exchanging data with the Motion Controllers. These functions are explained in the following and must always be invoked with the object identifier `"MC."`:

MC.SendCommand (STR command)

Sends an ASCII command to the Motion Controller

command: String which is to be sent to the Motion Controller.

Example:

```
MC.SendCommand ("V100")
```

STR answer = MC.WaitAnswer (long timeout, long answ)

Waits for the given time in milliseconds for an answer from the Motion Controller.

answer: String sent by the Motion Controller.

answer = "": No answer after timeout.

timeout: Integer value in ms, by which answer must be received.

answ: Integer value for extended details of the data to be read in.

answ = 0: Notify commands (`"p"`, `"v"`, `"h"`, etc.) and acknowledgements (`"OK"`, etc.) are filtered out.

answ = 1: All answers are read in except of acknowledgements.

answ = 3: CAN answers in integer format.

answ = 4: Notify commands only are filtered out (acknowledgements are read in).

Example:

```
a = MC.WaitAnswer (1000, 0)
```

5 Additional Functions

5.4 Visual Basic Script programs

MC.WriteToHistory(STR text)

Writes the given text line into the History window of the Motion Manager.

text: String which is to be output in the History window.

Example:

```
MC.WriteToHistory("Position 1 has been reached")
```

MC.SendProgFile(long nodeadr, STR file name)

Sends the given sequential program to the Motion Controller with the relevant node address.

nodeadr: Integer value which gives the node address of the drive to be addressed.

nodeadr = -1: Program is sent to all connected nodes.

filename: String which gives the file name of the drive program, possibly with path.

Example:

```
CALL MC.SendProgFile(0,"progr.mcl")
```

long ret = MC.CompareProgFile(long nodeadr, STR filename)

Compares the sequential program in the Motion Controller of the corresponding node address with the program from the given file.

nodeadr: Integer value which gives the node address of the drive to be addressed.

nodeadr = -1: Read in command is sent unaddressed.

filename: String which gives the file name of the drive program, possibly with path.

ret: Integer return value.

ret = -2: Error while reading in the drive program

ret = -1: Motion Controller is not answering

ret = 0: Files are identical

ret = 1: Files are not the same

Example:

```
ret = MC.CompareProgFile(0,"progr.mcl") 'Compare program file with MC program
IF ret = 1 THEN
    MsgBox("Programs not the same !")
ELSEIF ret = -1 THEN
    MsgBox("No answer from Motion Controller !")
END IF
```

5 Additional Functions

5.4 Visual Basic Script programs

MC.SendParamFile(long nodeadr, STR file name)

Sends the given parameter file to the Motion Controller with the relevant node address.

nodeadr: Integer value which gives the node address of the drive to be addressed.

nodeadr = -1: File is sent to all connected nodes.

filename: String which gives the file name of the parameter file, possibly with path.

Example:

```
CALL MC.SendParamFile(0,"para.mcp")
```

MC.SetBinMode(long mode1, long mode2)

Sets binary send mode for Parameter 1 and 2, in order to simultaneously read in up to two variables via the binary interface of serial Motion Controllers. In CAN controllers Trace mode is set here.

mode1: Integer value which gives the send mode for Parameter 1.

mode2: Integer value which gives the send mode for Parameter 2.

Available values for mode1 or mode2 (for further Trace parameters see documentation of the relevant Motion Controller):

0: Actual velocity [rpm]

1: Command velocity [rpm]

2: Controller output [integer]

24: Motor current [mA]

200: Actual position [Long]

201: Command position [Long]

44: Housing temperature [°C]

46: Coil temperature or Mosfet temperature [°C]

255: mode2 only -> Parameter 2 is not to be sent

5 Additional Functions

5.4 Visual Basic Script programs

long ret = MC.BinRequest(long timeout)

Data request. Reads in the parameter set with SetBinMode at the current time with time code. The results can be read in via the properties

long MC.BinVal1, long MC.BinVal2, long MC.BinTimecode.

The Timecode value corresponds to a multiple of the time base used by the Motion Controller (see Instruction Manual of the respective control) and defines the time interval until the last transmission (send) (value between 1 and 31).

BinVal1 and BinVal2 are the results of mode1 and mode2.

ret: Integer return value.

ret = 1: Data received

ret = 0: No data received within the timeout time

timeout: Integer value in ms, by which answer must be received.

Example:

```
CALL MC.SetBinMode(0,1) 'Read in actual and command velocity
IF MC.BinRequest(500) THEN 'Data request
    ActualVelocity = MC.BinVal1
    CommandVelocity = MC.BinVal2
    Timecode = MC.BinTimecode
END IF
```

MC.SendBin(long value)

Sends a binary value to the active Motion Controller.

value: Integer 8 bit value which is to be sent.

Binary values are used for setting system parameters in serial Motion Controllers only and are not usually accessible to users.

MC.CloseCom

Closes the currently active communications interface.

long ret = MC.OpenCom

Opens the selected communications interface.

ret: Integer return value.

ret = 1: Interface successfully opened

ret = 0: Error while opening the interface

5 Additional Functions

5.4 Visual Basic Script programs

MC.CmdExecute (STR command)

Runs the given command at system level. This function can be used, e.g. to start an external program.

filename: String which gives the command or file name of the application to be run, possibly with path.

MC.UpdateWindows

Forwards queued Windows messages to the relevant window. If this function is regularly opened in a script program (especially in waiting loops), other Motion Manager functions (e.g. graphic analysis) are also available parallel to script processing. Notify commands are forwarded to the History window after this function is opened.

NOTE



Examples of Visual Basic script programs are provided in the installation directory under \Motion Manager 4\Examples.

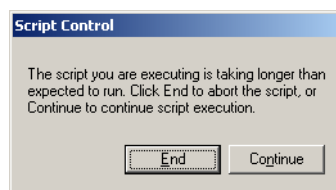
5.4.3 Starting the script program

The script program can be started via the Script button in the Quick Start bar (see Chapter 4.2.2 "The Quick Start bar"), via the key combination "Ctrl+R" or via the menu item "Terminal" – "Run Script".

5.4.4 Cancelling the script program

After starting a script program a dialog appears in which the time until a user cancel option can be entered. Before this time has expire there is no access to a running script program.

If the script program runs longer than the given time the following dialog appears:



While the dialog is displayed the script program continues to run. It is now possible to prematurely quit the program by pressing the "End" button.

Press the "Continue" button to hide the dialog for the given time - it then reappears.

NOTE



It is advisable to set the time until the user cancel option to the value "0" to test a program. This means it is possible to cancel the program at any time.

After finishing the program and implementing your own cancel options the value can be increased according to the program run time.

5 Additional Functions

5.5 Advanced Motion Manager commands for CAN

In addition to the FAULHABER commands for the Motion Controller, which can be read about in the command reference of the respective device, several advanced commands are available for CAN which are implemented in the command interpreter of the protocol plug-in “dffcanprot.dll” in the corresponding CAN telegrams. The commands can either be entered directly in the command input field or used within a VBScript.

GOBJ: Get Object

Reads an entry from the CANopen object dictionary via its index and subindex.

Input format: NodeNo. GOBJ Index Subindex

NodeNo.: Decimal, Index / Subindex: Hexadecimal

Example: Read out the current status word value (Index 0x6041) of node No. 3

```
3 GOBJ 6041 00
```

SOBJ: Set Object

Describes an entry of the CANopen object dictionary via its index and subindex.

Input format: NodeNo. SOBJ Index Subindex Data

NodeNo.: Decimal, Index / Subindex / Data: Hexadecimal (lowest byte value on the right). The number of data bytes given must correspond to the type of object entry (Int8: 1 byte, Int16: 2 byte, Int32: 4 byte). One byte is displayed by 2 hex characters (00 – FF).

Example: Change the maximum velocity (Index 0x607F: max profile velocity [Int32]) of Node No. 3 to value 500

```
3 SOBJ 607F 00 000001F4
```

TRANSMIT: Transmit CAN Data

Sends any CAN telegram directly on a specific identifier.

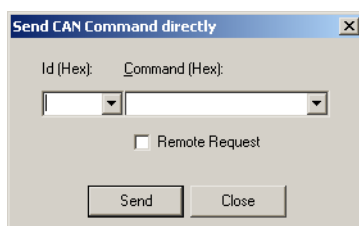
Input format: TRANSMIT Identifier Data

Identifier: 3-digit hex value (000 – 9FF), Data: Hexadecimal (lowest byte value on the left, corresponding to CAN telegram).

Example: Send NMT command “Reset Node” to Node No. 3

```
TRANSMIT 000 8103
```

In the CAN menu or in the Context menu of the Node Explorer with enabled CAN control there is the entry “Send CAN command directly”, which opens a dialog via which CAN telegrams can be entered and transferred directly (corresponds to TRANSMIT command):



PDOs can also be queried here in that a request (RTR) is sent to the corresponding identifier (“Remote Request” selected).

5 Additional Functions

5.5 Advanced Motion Manager commands for CAN

NOTE

The data must be entered as hex values according to the position in the CAN telegram (byte[0] = lowest byte value = left-hand side). Spaces may be entered between the individual bytes (e.g.: 0xAF3, input F3 0A).

Further commands for controlling the NMT state machine:

The commands can be entered directly with preceding Node No. and according to the menu entries under network management (NMT).

- START: Start Remote Node
- STOP: Stop Remote Node
- PREOP: Enter Pre-Operational
- STARTALL: Start all Remote Nodes

Further commands for controlling the device control state machine:

The commands can be entered directly with preceding Node No. and according to the menu entries under Device Control (DSP402).

- SHUTDOWN: Shutdown
- SWITCHON: Switch On
- DISABLE: Disable Voltage
- QUICKSTOP: Quick Stop
- DIOP: Disable Operation
- ENOP: Enable Operation
- FAULTRESET: Fault Reset

6 Maintenance

6.1 Software update

The respective current version of the FAULHABER Motion Manager software can be downloaded from the FAULHABER internet site:

<http://www.faulhaber.com/MotionManager>

6.2 Troubleshooting

Switchboard: +49(0)7031/638-0

eMail: support@faulhaber.de

Internet: www.faulhaber.com

7 Licence Agreement

End User Licence Agreement for the Faulhaber

Motion Manager of Dr. Fritz Faulhaber
GmbH & Co. KG

between

1. Dr. Fritz Faulhaber GmbH & Co. KG, Daimlerstraße 23/25, 71101 Schönaich, represented by the Directors
Dr. Fritz Faulhaber, Gert Frech-Walter, Dr. Thomas Bertolini

- hereinafter referred to as "Faulhaber" -

and

2. you as the user

- hereinafter referred to as the "Licensee" -

Preliminary remarks:

1. Faulhaber designs miniature and micro drive systems and produces them. Faulhaber has developed the "Faulhaber Motion Manager" software (hereinafter referred to as "MoMan"). This enables the control of certain miniature and micro drive systems manufactured by Faulhaber to change their configuration and for assigning parameters. Details result from the program description of MoMan. MoMan is a standard software product which as such is not adapted to the individual needs of individual customers. Faulhaber makes MoMan available to the customer free of charge.
2. The Licensee intends using MoMan in their company. The details of this result from Article 2.

This having been explained, the Parties to the Contract conclude the following Licence Agreement

§ 1

Subject of the Contract

- (1)The subject of this Contract is the granting of rights to use MoMan by Faulhaber to the Licensee.
- (2)The components of MoMan are
 - a) the machine-readable object code,
 - b) the user documentation including the program description.

§ 2

Content and Scope of the Rights of Use

- (1)Faulhaber grants the Licensee the unlimited spatial, non-exclusive right for an unlimited time to use MoMan for its intended use.

7 Licence Agreement

- (2) For intended use the Licensee shall use MoMan solely for putting into service, changing the configuration and for setting the parameters of miniature or microdrive systems manufactured by Faulhaber. "Putting into service" means controlling the respective miniature or microdrive systems manufactured by Faulhaber using MoMan for the purpose of changing the configuration and for setting the parameters. In the event of such a change to the configuration and setting the parameters, the instruction manual of the respective miniature or microdrive system shall always be noted and followed and the specifications given there shall be complied with by the Licensee. The Licensee shall not use MoMan in productive operation. "Productive Operation" means using MoMan to control the respective miniature or microdrive systems manufactured by Faulhaber in the company's on-going operations, alone or in combination with other components of an overall system. Such use does not represent intended use of MoMan. The same applies to the use of MoMan for controlling miniature and microdrive systems, which have not been manufactured by Faulhaber as well as its use to control miniature and microdrive systems, which have been manufactured by Faulhaber but which are not listed in the program description.
- (3) The rights to use MoMan do not include, in particular, the right to edit (change) or to distribute without Faulhaber drive system. In this case too, MoMan shall only be distributed for no extra charge, in an unchanged form and subject to enclosure of this License Agreement. The Licensee is not entitled to demand that Faulhaber issue the source code or the source code documentation of MoMan. The Licensee is also not entitled to assign the software, the documentation or parts thereof to third parties by way of rental or leasing for a limited time. Third parties are also deemed to be companies within the Licensee's Group.
- (4) Otherwise, any further use of MoMan, especially the transfer of rights of use to third parties or the granting of sub-licenses, shall require the prior explicit and written consent of Faulhaber.
- This does not apply to sale of the miniature and microdrive systems, provided their proper use requires use of MoMan.

§ 3

Handover of MoMan

- (1) The copy of MoMan required to exercise the rights of use granted with this Contract is made available to the Licensee in digital, machine-readable form.
- (2) The Licensee also receives a copy of the user documentation in electronic form by means of downloading MoMan. This user documentation also contains the program description.

§ 4

Performance Limits

In particular, the following services by Faulhaber are not the subject of this Contract:

- a) Installation of MoMan on the Licensee's premises;
- b) Individual setting of variable parameters of MoMan according to the Licensee's requirements (customizing);
- c) Individual program extensions for the Licensee (individual modifications);
- d) Adjusting MoMan interfaces to the needs of the Licensee;
- e) Instructing and training the Licensee's program users;
- f) Maintenance of MoMan, in particular the supply of new, subsequent program versions.

7 Licence Agreement

§ 5

Licensee's claims in the event of deficiency in title

- (1) Faulhaber undertakes to assign MoMan free of third parties' rights, which stand in the way of contractual use of MoMan.
- (2) In the case that third parties claim such rights, the Licensee shall immediately notify Faulhaber of the claiming of such rights by third parties and shall issue Faulhaber with all legal powers and authorities necessary to defend Faulhaber against the rights claimed by third parties.
- (3) In this case (cf. No. (2)) Faulhaber is entitled at its own discretion,
 - a) to take suitable measures to remove the rights of third parties or their claim which impair contractual use of MoMan or
 - b) to change or replace MoMan in such a way that the external rights of third parties are no longer breached, if and provided that this does not impair the guaranteed function of MoMan.

If Faulhaber does not succeed to do this within a reasonable period to be set by the Licensee, the Licensee is entitled to terminate the Licence Agreement without notice.

§ 6

Licensee's claims in the event of defects

- (1) Faulhaber and the Licensee agree that it is not possible to develop software programs so that they are error-free for all application conditions. Faulhaber guarantees the suitability of MoMan in the version made available for downloading according to Article 3 for the intended use according to Article 2 in compliance with the program description valid at the time the Contract was concluded, also made available for downloading. However, in the event that the Licensee combines MoMan with third party software, Faulhaber does not accept any defects liability for the compatibility of such third party software with MoMan.
- (2) In the event of substantial deviations from the program description, Faulhaber is obliged to make subsequent improvements. If Faulhaber does not succeed to remove or bypass the deviations through subsequent improvement within a reasonable period so that contractual use is made possible or if the subsequent improvement is to be deemed to have failed for other reasons, the Licensee is entitled to terminate the Licence Agreement without notice.
- (3) Claims due to defects expire within one year of downloading MoMan including the user documentation. The reduction in limitation period does not apply to cases of deliberate action.

§ 7

Liability, Compensation

- (1) Faulhaber is basically only liable in the event of intended use of MoMan by the Licensee in accordance with Article 2.
- (2) Faulhaber has unlimited liability for losses caused by deliberate intent or gross negligence. The same also applies to claims for culpably caused losses which cause fatal or physical injury, damage to health or are due to wilful concealment of a defect.
- (3) Faulhaber is liable in the cases of product liability according to the Product Liability Law.
- (4) Faulhaber is liable for losses caused by the breach of so-called "cardinal obligations". Cardinal obligations are fundamental contractual duties which were decisive for conclusion of the Contract by the Licensee and which they could trust to be complied with. If Faulhaber has breached cardinal obligations due to slight negligence, the resulting liability for compensation is limited to replacement of the foreseeable loss typical for the Contract.

7 Licence Agreement

- (5) Faulhaber does not accept any liability for the loss or destruction of data unless this has been caused by gross negligence or deliberate breach of contractual or statutory duties. In the event of data loss on the Licensee's premises, Faulhaber is liable only up to the amount of the typical cost of restoring the data which is incurred despite regular data backup according to state of the art standards.
- (6) Otherwise any liability for compensation by Faulhaber is excluded, regardless of the legal reason.
- (7) Following termination of this Licence Agreement the Licensee is obliged to completely delete MoMan including the user documentation and any backup copies of MoMan.

§ 8

Closing Provisions

- (1) Changes or additions to this Contract shall be made in writing. If they do not satisfy this clause they are invalid. The same also applies to changes to this clause requiring the written form.
- (2) This Contract shall be subject to and shall be interpreted according to the laws of the Federal Republic of Germany with the exception of the CISG - United Nations Convention on Contracts for International Sale of Goods dated 11.04.1980.
- (3) The sole juridicial venue is Stuttgart, if the Licensee is a businessperson in the meaning of the Commercial Code, a legal person under public law or a public law special asset or on bringing the action the Licensee does not have any registered offices or usual place of residence (permanent address) in the Federal Republic of Germany.
- (4) Should a provision of this Contract be or become invalid, all other provisions shall remain unaffected. In such a case the Parties to the Contract are obliged to participate in creating provisions which best achieve the economic result of the invalid provisions in a legally valid way.

