Software Manual

Motion Manager 7

WE CREATE MOTION

EN
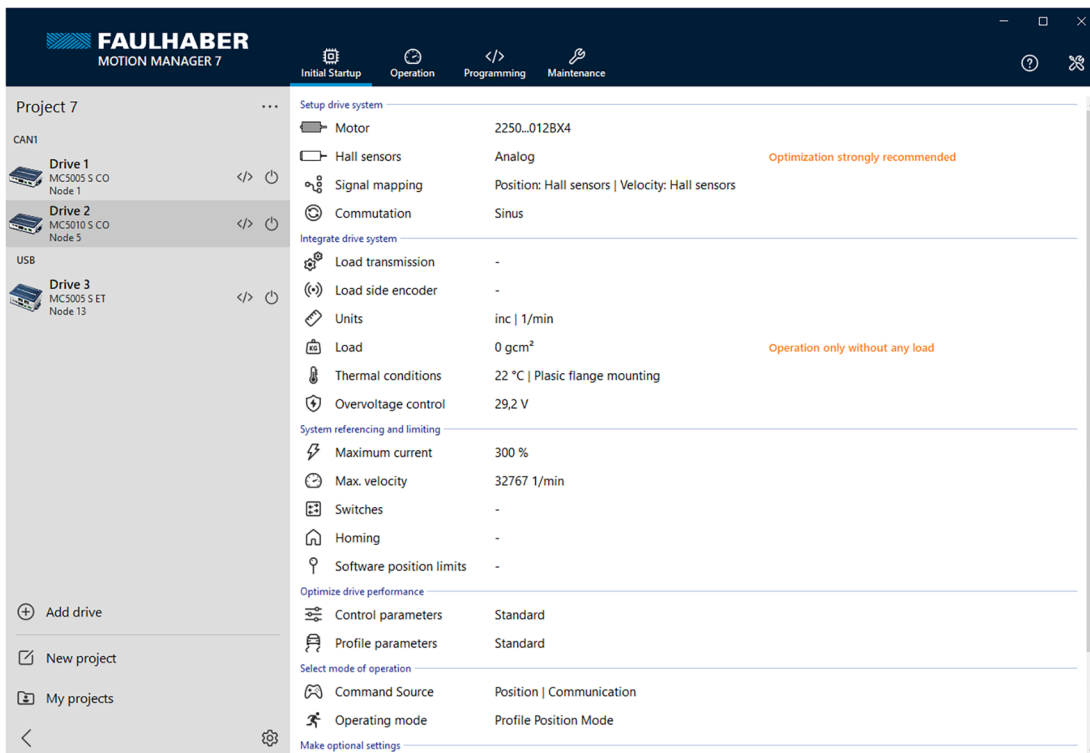
Version:
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Software status:
V7.1

The respective current version of this technical manual is
available on FAULHABER's internet site:
www.faulhaber.com

Content

Content

1 About this document

1.1 Validity of this document

This document describes the installation and use of the FAULHABER Motion Manager 7.

This document is intended for use by trained experts authorized to operate the supported products.

All data in this document relate to the standard versions of the supported series (see chap. 3, p. 8). Changes relating to customer-specific versions can be found in the corresponding data sheet.

1.2 Further documents

During certain operations during commissioning and operation of FAULHABER products, additional information from further manuals is useful. These manuals can be downloaded in pdf format from the web page www.faulhaber.com.

1.3 Using this document

This document is an electronic document. It is supplied with the Motion Manager 7 and is opened with the respective buttons at a suitable location or with the F1 key.

▸ Read this document carefully before undertaking configuration of the communication, in particular the chapter Safety (see chap. 2, p. 7)

1.4 List of abbreviations

Abbreviation	Meaning
ASCII	American Standard Code for Information Interchange
CAN	Controller Area Network
CiA	CAN in Automation e.V.
CO	CANopen interface acc. to CiA 402
COM	Serial RS232 interface
CSV	Comma-Separated Values
DLL	Dynamic Link Library
ET	EtherCAT (Ethernet for Control Automation Technology)
NMT	CANopen network management
PDO	Process Data Object
RS	Serial RS232 interface
SDO	Service Data Object
USB	Universal Serial Bus

1.5 Symbols and designations

NOTICE!
Risk of damage.
  ▶ Measures for avoidance

ⓘ Instructions for understanding or optimizing the operational procedures

  ✓ Pre-requirement for a requested action
  1. First step for a requested action
      ↳ Result of a step
  2. Second step of a requested action
  ↳ Result of an action
  ▶ Request for a single-step action

2 Safety

2.1 Intended use

The FAULHABER Motion Manager 7 supports the configuration and commissioning of FAULHABER drive systems. The software is not designed for controlling drive systems in productive operation.

Depending on the model, drive systems can be connected to the PC via different interfaces. Depending on the features of the drive, a connection adapter may also be necessary. This is available from FAULHABER on request.

The FAULHABER Motion Manager 7 is designed for the following tasks:

- Configuration and commissioning of FAULHABER drive systems
- Communication to drive control via the supported interfaces
- Support during setup of the drive functions
- Management of drive configurations
- Operation of the drives in the supported operating modes
- Analysis and monitoring of the drive behavior
- Creation, transfer and management of sequence programs to be executed in the device control
- Maintenance and firmware updates

ℹ The instructions for parameterizing and commissioning listed in the operating manuals of the respective drive controls must be observed.

2.2 Safety instructions

⚠ **NOTICE!**
Incorrect settings of the drive can damage the controller.
▶ Comply with the instructions in this software manual.

3 General product description

The Motion Manager 7 offers a graphical user interface by means of which the FAULHABER drive systems can easily be set up and adapted to one's own application.

In addition to functions for commissioning and configuring the drive systems, the Motion Manager 7 includes various tools for controlling and observing the drive behavior, a development environment for sequence programs and a maintenance area for diagnostics and firmware updates.

The Motion Manager 7 supports the following drive controllers:

- MC 5010/5005 S
- MC 5004 P
- MC 3603 S
- MC 3001 B/P

- MCS 3242/3268 BX4
- MCS 3274 BP4
- 2232/2250 BX4 IMC

Supported interfaces

Interface	Description
COM	Serial RS232 interface.
	The Motion Manager 7 supports the serial interfaces COM1 to COM256. The interfaces available in the system are detected automatically. A USB-to-serial adapter is required for access to the serial interface of a drive. In addition, the associated driver must be installed.
	The assignment of the COM port number when a USB-to-serial adapter is used, can be viewed in the Windows Device Manager and changed if required.
CAN	For operating the Motion Manager 7 with CAN interface, the driver of the CAN card used must be installed (see the CAN interface manufacturer's manual).
	Supported CAN interfaces:
	• IXXAT via HMS-IXXAT VCI4 driver
	• Peak via PEAK PCAN driver
	• Others on request
USB	In order to access drives via USB, an associated driver must be installed. The drivers for the FAULHABER controllers are installed automatically with the Motion Manager 7.
NET	EtherCAT drives connected to a remote controller can be accessed via the network interface.
	Beckhoff controllers are currently supported via TwinCAT3-ADS, which must be installed on the Motion Manager PC.
	To use a network interface, a network port with the corresponding connection settings must first be added under **Add drive**.

ℹ For drives with firmware version older than "M", a firmware update must be carried out in order to make changes to the configuration.

4 Installation

4.1 System requirements

- Operating system: Microsoft Windows 10 or higher version
- Required hard drive space: 200 MB

4.2 Installing Motion Manager 7

The setup file for installing the Motion Manager 7 software can be downloaded at no charge from the FAULHABER website.

After selecting the desired language version, follow the instructions on the screen until the installation process is finished.

4.3 Updating Motion Manager 7

4.3.1 Updating version 6 and older

An already existing version of Motion Manager 6 (or older) is not affected by the installation of Motion Manager 7. The two versions can coexist on the same PC system.

4.3.2 Updating version 7

If an earlier version of Motion Manager 7 is already on the system, installing a later version will update it to the newer version.

Using the program settings , a manual or automatic online update function can be activated that uses an existing Internet connection to keep the software constantly up to date.

4.4 Uninstalling Motion Manager 7

The Motion Manager 7 can be uninstalled via the Windows settings.

4.5 Call parameters

The Moman7.exe program file contains different call parameters which can be used when starting the software by a command line or customized link. The call parameters can be specified by calling up the Moman7.exe file.

i The program file must be called up from the Motion Manager 7 installation directory (working directory).

4.5.1 Switching the language

Parameter	Function
/ENG	Starts Motion Manager 7 with an English user interface if German is set as the default.
/DEU	Starts Motion Manager 7 with a German user interface if English is set as the default.
/CHS	Starts Motion Manager 7 with a Chinese user interface if the Chinese language pack is installed.

Example: Switch over from the English version to the German interface

Moman7.exe /DEU

ℹ When creating a Windows link with call parameters, the call-up line in the **Target** properties field must be introduced in the following form (example):

"…\Faulhaber\Motion Manager 7\Moman7.exe" /ENG

Observe the quotation marks which include the program name and its path.

5 User interface
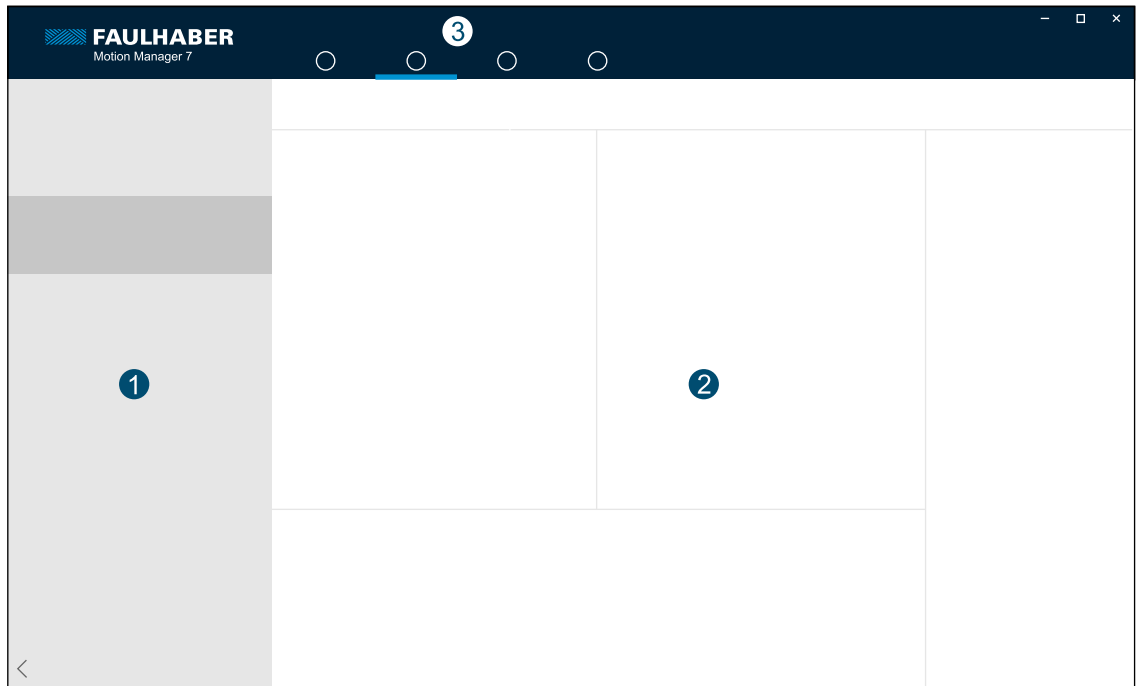
Fig. 1:   Areas of the user interface

The user interface consists of the following areas:

Area	Description
Project area (1)	The project area is located on the left edge of the user interface and can be opened and closed using the arrow in the lower left. In addition to the menu for project management (see chap. 6, p. 12), the project area contains the drive list (see chap. 7, p. 13), by means of which it is possible to switch between the drives in the project. Interface and drive properties can also thereby be changed and management functions related to the drive executed. To permanently save changes to the drive configuration in the device, the then high-lighted Save button is available.
Work area (2)	The work area is the central operating area for the following tasks: ▪ Commissioning (see chap. 8, p. 15) ▪ Operation (see chap. 9, p. 16) ▪ Programming (see chap. 10, p. 20) ▪ Maintenance (see chap. 11, p. 22)
Navigation area (3)	Use the navigation tab in the title bar to switch between the task areas. There are also buttons for calling up help and tools that are displayed along the right edge of the user interface.

ℹ The meaning of status displays and the function of buttons is displayed in a tooltip.

6 Project management

When starting the application for the first time, a new project must be created and at least one drive must be added. Later, the Motion Manager 7 always opens with the last loaded project.

To add a drive, a supported FAULHABER controller must be connected to a suitable interface on the PC. This interface must be selected in the displayed connection wizard; drives are then automatically searched for on this interface. If the desired drive appears in the list, it can be taken over in the project. Multiple drives on different interfaces can be added to the project.

If projects are to be edited further on a different PC, the project can be exported via project management and then imported on a different PC.

Alternatively, the storage location of the projects can be placed on a shared network drive via the program settings (gear symbol).

7 Drive list

Via the **drive list** in the project area, the active drive, to which the pages in the work area refer, can be selected.

The symbols to the right of the drive provide information about the current state of the drives. Press the corresponding symbol to execute additional functions:

Symbol	Status	Functions
	Drive not connected	- Update - Reconnect
	Output stage switched off or on	- Switch output stage on or off - Restart drive - Operate state machine
</> </>	Sequence program loaded or sequence program running	- Execute the sequence program - End the sequence program
	Drive in fault state	- Reset fault state - View error details
	Parameters changed but not yet saved	- Save parameters in the drive and in the project

Press the ellipses symbol (…) to open a context menu via which other options can be called up:

- Display and change properties of the drive (drive designation, node number)
- Reconnect the drive (see chap. 7.1, p. 14)
- Remove drive from project
- Apply device settings and sequence programs from another drive in the project

The interface displayed above the drives may also include a context menu or ellipses symbol (…) via which possible interface options can be called up:

- Display and change properties of the interface (port, transfer rate)
- Disconnect and restore connection

7.1 Reconnecting the drive

If a drive can no longer be found in the project, it can be reconnected using the appropriate menu item.

This is, e.g., necessary in the following cases:

- The drive is connected at a different interface.
- The connection settings (node number, transfer rate) of the drive have changed outside of the Motion Manager 7 environment.
- The drive was replaced with a new drive with a different serial number.

After selecting the menu item, the connection wizard appears, which can be used to search for the desired drive on the set interface.

After accepting a new drive, the settings and sequence programs stored in the project are transferred to the new drive, thereby replacing the old drive.

8 Commissioning

In the **Commissioning** task area, all settings for the selected drive can be made.

If no motor is set yet, this is the first step. To permanently save the settings in the device, the highlighted Save button in the project area must be pressed.

The **Commissioning** task area is divided into multiple groups. The most important settings of the groups are collected on the overview page. Click on a group entry to view details or make changes in the configuration area.

- **Set up drive system**
  The used motor can either be selected from the FAULHABER product database or entered manually. Other used components (gearhead, encoder, sensor) can then be specified. After applying the set data, the selected drive is configured accordingly and can be operated stably in idle operation (without load).

- **Integrate drive system**
  Setting of application and environment parameters that are necessary for integrating the drive system in the application.

- **Reference and limit the system**
  Configuration of switches and a reference run for referencing the drive system. The limitations allow for the definition of current, speed and position limits that are adapted to the application.

- **Optimize drive performance**
  Adjustment of control parameters for improving the dynamic behavior. Recording step responses allows the behavior of the drive system to be analyzed with changed control parameters.

- **Selecting the operating mode**
  Setting of operating modes and set-point specification.

- **Perform optional settings**
  Perform optional settings for communicating with the drive system and for using inputs and outputs.

9 Operation

The **Operation** task area includes various **tools** for controlling and observing the drive behavior.

- **Motion Cockpit**
  Functions for controlling the drive in the respective operating modes.

- **Graphical analysis**
  Recording drive parameters.

- **Status display**
  Monitoring actual values.

- **Object Browser**
  Access all parameters in the object dictionary.

- **Terminal**
  Logging the transfer, recording the communication history, input of individual commands.

- **Control parameters**
  Manual configuration of control parameters.

The tools are displayed in separate, freely positionable windows. If a tool window is moved over the task area, a positioning guide is displayed that uses arrows to indicate possible docking positions.

9.1 Motion Cockpit

The Motion Cockpit contains input and display elements that allow simple motion control.

⚠ **NOTICE!**
When the movement commands are executed, the drive moves corresponding to the entered values. Obstacles within the movement range can lead to collisions and material damage.

▸ Make sure that when performing movement commands the drive is free to move within the values that were input.

Prepare drive

1. Select the desired operating mode from the selection list.

2. Press the button to activate the operating mode.

3. Check that the output stage is switched on and, if necessary, switch it on by pressing the appropriate button.

   ✎ The output stage must be switched on so that the drive can execute the movement commands that were issued.

Enter set-points

Once the controller is in the selected operating mode, set-points can be input via the input area.

Send setpoint automatically

In this area, the set-points previously input can be sent alternately. The waiting time between movement commands can be set via the respective selection list.

9.2 Graphical analysis

The graphical analysis of the Motion Manager 7 (Trace) offers extensive possibilities for recording and analyzing parameter values.

Up to 4 parameters can be recorded simultaneously.

Types of recording
Two different types of recording are available:

Type of recording	Description
Logger	The parameter values are read out continuously. Thus, data recording over a longer period of time is possible. For drives with CAN interface, the PDO communication service is used. The resolution remains limited because each data request must pass through the available communications paths.
Recorder	The parameter values are written into an internal device buffer and then read. The trace buffer can store data at the highest possible resolution, however, it is limited by the size of the memory, so that the performance of continuous recording is not possible. The recorder has a trigger function.

Source
One of the available configurations can be selected as the source. They contain the source selection and the appropriate configuration for the logger and recorder. The configuration can be viewed and changed via the **Edit settings** link.

Mode
Selection of the type of recording: logger or recorder. If a trigger source has been defined for the recorder, the trigger mode can be selected.

ℹ️ Controllers with CAN interface must be in the Operational NMT state to allow running in logger mode.

Data sources
Every assigned data source in the current source selection list contains its own area for deactivating and activating the scaling, and for setting it.

The buttons for scaling have the following meaning (from left to right):

- Automatic scaling Switch on and off. For manual scaling the Y-axis has the values listed below for the axis minimum and maximum.
- Activate or deactivate synchronization with other Y-axes. A change made to an axis setting is applied to the other axes.
- Centering curve. If automatic scaling is active, the current axis setting is entered in the input fields. Otherwise the axis minimum and axis maximum are shifted and the spacing remains unchanged.

Recording
After recording start, the activated data sources are shown as curves in different colors.

Recording is terminated in the following cases:

- Recording stopped by pressing the button.
- Drive not responding.
- The PC cannot display the data quickly enough.
- The recording is ended in the "Recorder" recording type (single shot).
- A linear buffer is used and it is full.

Editing the recording

The recording can be edited using the buttons above the curve diagram (from left to right):

Function	Description
Start/Stop	Start and stop the recording.
Scaling	Scaling The X-axis. ▪ Activated: Automatic scaling of the X-axis, so that the entire period of the recording is displayed. ▪ Not activated (default): The scaling of the X-axis corresponds to the value of the input field in ms for the overall display range. ▪ Displayed time window in milliseconds by manual scaling.

Zoom	Activates / deactivates zoom mode. When zoom mode is activated, the following mouse functions are available:
	▪ The left mouse button as well as the mouse wheel can be used for enlarging/reducing the selected window section:
	  ▪ To enlarge a window section, place the cursor cross at the top of the recording window, and with the left mouse button pressed down drag the cross downwards.
	  ▪ To reduce a window section, place the cursor cross at the bottom of the recording window, and with the left mouse button pressed down drag the cross upwards.
	▪ With the right mouse button pressed down, the window section can be moved.

Distances	Activates the calculation mode which permits the distances between two data points to be calculated in the X and Y directions. ▪ If more than one parameter was recorded, select a curve, since the calculation of distances must be performed for a specific Y-axis. Press again for a longer time (right click) to undo the selection. ▪ Select a point on the curve or any point in the area. ▪ Select a further point. The selected points and the distances in the X and Y directions will be displayed. ▪ To recalculate, click on any point.
Export	The currently displayed recording can optionally be saved as a bitmap file or CSV file in text form. A CSV file can, for instance, be read into a mathematical or table calculation program for further processing.
Print	Opens a dialogue for printing the displayed graphics.

9.3 Status display

The status display shows the status of various device parameters that are queried cyclically.

9.4 Object Browser

The object browser allows all entries of the object dictionary to be viewed and changed.

Register

- Communication: Communication objects acc. to CiA 301

- Manufacturer: Manufacturer-specific objects

- Device: Objects of the drive profile acc. to CiA 402

Read-only parameters which cannot be changed, are identified with "–" in the **new value** column. All other values can be selected and changed by entering a new value on the respective line.

Functions

Function	Description
Search	The output displays only those objects which match the search text that was input. For this purpose, the entries in columns "Actual value" and "New value" are disregarded.
	The following rules apply to the input of the search text:
	▪ "+" can be used to combine several search expressions. ▪ Inserting "*" after the search expression selects all entries which start with the search expression. ▪ No differentiation is generally made between upper and lower case characters.
Update	The object dictionary is updated and all objects are read out again from the device.
Transfer changes	The changed settings are transferred to the device.
Export	Current device configuration is saved as an XDC file.
Import	Load a previously saved XDC- Configuration file or a new XDD- Device description file.

ℹ Device description files for integrating in PLC controls (EDS, ESI) are located under "Public documents" of the Users directory in the "\Faulhaber\Motion Manager 7\Device description" folder.

9.5 Terminal

The terminal is used for manually inputting commands (see chap. 12.1, p. 23). It records the data exchange, user actions and status messages.

9.6 Control parameters

The **Control parameters** tool allows control parameters, filter settings and profile parameters to be changed while the drive is in operation.

10 Programming

The **Programming** task area contains a development environment for sequence programs, which are saved and executed in the drive.

File management

File management is located in the left part of the programming environment. Listed here are the files that were created for the selected drive and saved in the project folder.

File management is divided into multiple groups:

Groups	Description
Device memory	Program files (.bas, .out) that were loaded in the drive.
Work	Work files (.bas) that are not currently connected to the device memory.
Include	Include files (.bi) that are used in sequence programs.
Output	Raw output files (.out) that are only displayed if there is no corresponding .bas file.
Text	Text files (.txt) for documentation purposes.
Other	Other miscellaneous files.

- File types:

File exten-sion	File type	Description
.bas	Basic sequence pro-gram	Program code that can be loaded in the drive as preprocessed output file.
.bi	Basic include file	Include files that can be referenced within a .bas file. A distinction is made between: - Project includes, which are saved in the project folder, - System includes, which are located in the Motion Manager 7 installation directory and cannot be changed. Only the project includes are displayed in file management.
.out	Output file	Preprocessed program code in the form in which it is saved in the drive. Output files are automatically created when downloading a program file or when reading out the device memory; output files cannot be changed.
.txt	Text file	Files for documentation.

- File status:

Files in the device memory can have various states:

Status	Distinguishing feature
File was transferred but not yet permanently saved in the device.	File is marked with *****.
Program was stored in the device memory.	File is marked with storage location, e.g., **P1**.
Program in the device memory was changed but not yet saved.	File is marked as changed at the storage location, e.g., **P1***.
Active program in the device.	File name is displayed with bold text.

■ Manage files:
  ▪ Using the toolbar, new files can be created or existing files opened from the file system. Saving via the toolbar will save the active file in the project folder.

  ▪ Using the Save button in the project area, the sequence programs loaded in the drive are permanently saved in the device. The program memory assignment thereby occurs automatically for new files.

  ▪ Using a context menu, programs in the device memory can be permanently assigned specific program memory locations or removed from the device memory with the **Delete** function. Program files that were removed from the device memory are then displayed in the **Work** group. If the program file is deleted from the **Work** group, it is deleted completely from the project folder.

> **i** To edit an output file, a copy with the .bas extension must be created via the context menu. The file is thereby decompiled, to the extent that this is possible, and displayed as a basic file for further editing.

Editor

Located on the right side of the programming environment is the editor area, which can display multiple files in individual tabs.

Tabs with executable program files have an additional toolbar with icons by means of which the programs in the drive can be loaded, started, stopped or used in other ways. The individual functions and the procedure for programming and debugging are described in the respective programming manual.

New files or files opened from the file system are saved in the project folder under the entered name upon executing or loading in the drive. The Save button in the editor toolbar also saves a new file in the project folder, but it is initially displayed in the **Work** group. Upon loading in the drive, the file then changes from the **Work** group to the **Device memory** group.

For basic files, additional programming tools are available on the right edge:

Tool	Description
Code templates	Small programming constructs that can be dragged into the editor area with the mouse.
Program variables	During program execution, variable values can be observed and changed here.
Call stack	The function call chain can be viewed here at breakpoints.

The list of code templates can be expanded to include your own code fragments:

■ Select the code area in the editor and use the mouse to drag into the code templates area.

■ Once added, code templates can again be deleted with the **Delete** key.

> **i** Examples of sequence programs can be found under "Public documents" in the Users directory in the "\Faulhaber\Motion Manager 7\Examples\MC Basic" folder. They can also be loaded directly via the extension menu of the editor toolbar.

Sequence programs can be edited further on a different PC in one of the following ways:

■ The entire project is exported and imported on the other PC.

■ The program file is exported via the context menu and opened on the other PC with **Open file**.

11 Maintenance

The **Maintenance** task area contains information and notices about errors and warnings that have occurred. It is also possible to perform a firmware update for connected drives.

A firmware update can be performed only via the interface that is supported by the connected controller as the update interface.

12 Appendix

12.1 Motion Manager 7 command reference

In Motion Manager 7, commands can be entered in the command input field of the terminal window.

i The commands listed in this chapter should only be used within the Motion Manager 7 environment. The commands are interpreted by the Motion Manager 7 and are converted into the protocol of the respective interface. The commands cannot be used within sequence programs, or when the drive is being actuated by other host systems.

i Any node in the network can be addressed, using the pre-assigned decimal node number. If no node number is specified, the node that is active in the Motion Manager 7 is addressed. Upper and lower case are not distinguished.

12.1.1 Control state machines

Tab. 1: Commands to control the CANopen NMT state machine

Command	Function	CAN telegram
START	Start Remote Node (drive is switched into the *Operational* state)	Id 0x000: 0x01 NodeID
STOP	Stop Remote Node (drive is switched into the *Stopped* state)	Id 0x000: 0x02 NodeID
PREOP	Enter Pre-Operational State (drive is switched into the *Pre-Operational* state)	Id 0x000: 0x80 NodeID
RESET	Reset Node (drive is restarted)	Id 0x000: 0x81 NodeID
RESETCOM	Reset Communication (only the communication interface of the drive is restarted)	Id 0x000: 0x82 NodeID
STARTALL	Start all Remote Nodes (drives are switched into the *Operational* state)	Id 0x000: 0x02 0x00

Tab. 2: Commands for controlling the CiA 402 Controlword

Command	Function	CiA 402 Controlword (0x6040)
SHUTDOWN	Shutdown (drive is switched into the *Ready to Switch On* state)	0x0006
SWITCHON	Switch On (drive is switched into the *Switched On* state)	0x0007
DISABLE	Disable Voltage (drive is switched into the *Switch On Disabled* state)	0x0000
QUICKSTOP	Quick Stop (drive is switched into the *Quick Stop Active* state)	0x0002
DIOP	Disable Operation (drive is switched into the *Switched On* state)	0x0007
ENOP	Enable Operation (drive is switched into the *Operation Enabled* state)	0x000F
FAULTRESET	Fault Reset (drive is switched into the *Switch On Disabled* state)	0x0080
MA	Move Absolute (PP)	0x003F
MR	Move Relative (PP)	0x007F
HS	Homing Start (HM)	0x001F

Example: Set node 10 to the *Operational* state:

▶ 10 START

☞ Node 10 is set to the *Operational* state.

Example: Switch-on sequence, to switch the active drive in the Motion Manager 7 into the *Operation Enabled* state:

▶ SHUTDOWN

▶ SWITCHON

▶ ENOP

☞ The drive is now in the *Operation Enabled* state

ℹ️ In PP operating mode a new position value is applied only on the rising flank of bit 4 in the Controlword. For this reason, before performing the MA or MR commands, it must be ensured that this bit is reset again e.g. by means of the ENOP command.

12.1.2 Writing objects in the object dictionary

Commands with an argument expect a decimal numeric value subsequent to a command. After successful execution, the value **OK** is returned in the terminal window. If execution is not successful, an SDO error message is output in plain text or a timeout error is output.

Tab. 3: Commands for writing objects in the object dictionary

Command	Function	Object
Commands with argument:		
OPMOD	Configure operating mode	0x6060.00 (Modes of Operation)
SPOS	Specify target position (PP)	0x607A.00 (Target Position)
V	Specify target speed (PV)	0x60FF.00 (Target Velocity)
HM	Set Homing Mode (HM)	0x6098.00 (Homing Mode)
Commands without argument:		
SAVE	Save all parameters	0x1010.01 (Store all Parameters)
SAVE_ALL	Save all parameters	0x1010.01 (Store all Parameters)
SAVE_COM	Save the communication parameters	0x1010.02 (Store all Communication Parameters)
SAVE_APP	Save the application parameters	0x1010.03 (Store all Application Parameters)
RESTORE	Load all factory parameters	0x1011.01 (Restore all Parameters)
RESTORE_ALL	Load all factory parameters	0x1011.01 (Restore all Parameters)
RESTORE_COM	Load factory communication parameters	0x1011.02 (Restore Communication Parameters)
RESTORE_APP	Load factory application parameters	0x1011.03 (Restore Application Parameters)

Example: Set Profile Position Mode (PP) and move the drive relatively by 10,000 increments (or the set positioning unit).

▸ Send the following command sequence:

   a) **OPMOD 1**

   b) **SPOS 10000**

   c) **MR**

↳ The drive has been moved in Profile Position Mode by 10,000 increments (or the set positioning unit).

12.1.3 Reading objects in the object dictionary

After successful execution, the answer is returned as a string in the terminal window (numeric values in decimal form). If execution is not successful, an SDO error message is output in plain text or a timeout message output.

Tab. 4: Commands for reading objects in the object dictionary

Command	Function	Object
GTYP	Read device name	0x1008.00 (Manufacturer Device Name)
VER	Read software version	0x100A.00 (Manufacturer Software Version)
GSER	Read serial number	0x1018.04 (Serial Number)
GSW	Read Statusword	0x6041.00 (Statusword)
GOPMOD	Read set operating mode	0x6061.00 (Modes of Operation Display)
POS	Read actual position	0x6064.00 (Position Actual Value)
POSI	Read actual position (internal units)	0x6063.00 (Position Actual Value)
TPOS	Read target position	0x6062.00 (Position Demand Value)
GV	Read target speed	0x606B.00 (Velocity Demand Value)
GN	Read actual speed	0x606C.00 (Velocity Actual Value)
GRC	Read actual standby current	0x6078.00 (Current Actual Value)

Example: Read actual position.

▸ Send the following command:

   a) **POS**

↳ The actual value of the actual position was read.

12.1.4 Writing any object in the object dictionary

Any objects in the object dictionary can be addressed by specifying the index (xxxx) and subindex (yy) in hexadecimal form. The value to be entered must then be specified as a hexadecimal argument. The length of the hexadecimal argument (number of data bytes) must correspond to that required for the type of object to be written. The lowest-value byte is placed at the far right.

- Int8 = 1 byte
- Int16 = 2 bytes
- Int32 = 4 bytes

A byte in the argument is represented with two hexadecimal characters (00...FF).

After successful execution, the value **OK** is returned in the terminal window. If execution is not successful, an SDO error message is output in plain text or a timeout message output.

Tab. 5:   Command for writing any object in the object dictionary

Command	Function
SOBJ xxxx.yy	Writing an object (Set Object)

Example: Change the acceleration value of node 10 to the value 500 (Profile Acceleration 0x6083.00, Int32).

▶ Send the following command sequence:

a) **10 SOBJ 6083.00 000001F4**

↳ The acceleration value was changed to 500.

> ℹ The command **SLOBJ** is available for writing string objects. For this purpose the hexadecimal values of the ASCII characters of the string must be set as arguments, reading left to right.

12.1.5 Reading any object in the object dictionary

Any objects in the object dictionary can be addressed by specifying the index (xxxx) and subindex (yy) in hexadecimal form. After successful execution, the answer is returned as a string in the terminal window (numeric values in decimal form). If execution is not successful, an SDO error message is output in plain text or a timeout message output.

Tab. 6:   Command for reading any object in the object dictionary

Command	Function
GOBJ xxxx.yy	Read object (Get Object)

Example: Read the acceleration value of node 10.

▶ Send the following command:

a) **10 GOBJ 6083.00**

↳ The acceleration value of node 10 was output.

> ℹ In the return data, object entries with a data length of up to 4 bytes are generally interpreted as integer values.

The command **GLOBJ** is available for reading string objects.

12.1.6 Sending any telegrams

By specifying the COB-ID for CAN communication or the node number for RS232/USB communication (xxx) in three-digit hexadecimal form, any telegrams of the basic underlying protocol can be sent. The telegram data bytes to be sent must also be specified as hexadecimal values, located in the telegram position (lowest-value byte on the left).

Tab. 7:   Commands for reading any object in the object dictionary

Command	Function
TRANSMIT xxx	Transfer telegram

Example: Send the Controlword with the value 0x007F via RxPDO1 from node 10 (COB-ID = 0x20A).

▸ Send the following command:

a) **TRANSMIT 20A 7F00**

ℹ With RS232/USB communication, the data to be sent must be specified without the SOF, EOF, length and CRC bytes.

12.2 Problem solution

12.2.1 Port not present

Make certain that a suitable port is used. The Motion Manager 7 supports the interfaces and driver connections specified in chap. 3, p. 8.

12.2.2 Port cannot be opened

If the port cannot be opened, it may be in use by another application.

▸ Close the application that is using the port.

⮑ In some cases the port is not released by the application, even when it has been closed.

▸ If the port was not released, reboot the PC.

In the event of problems with the USB connection, one of the following measures may help:

▸ Unplug the USB cable and plug it in again.

▸ Switch off the power supply of the controller and switch it back on again.

12.2.3   No connection to the connected device

Possible cause	Remedy
The device is not connected to the interface selected in the Motion Manager 7.	▪ Select the correct interface or the correct port.
The device interface is not correctly connected to the PC.	▪ Check the installation of the electrical connections as specified in the technical manual, or make those connections.
The device is not being supplied with sufficient voltage.	▪ Check the voltage supply.
The device is located in a network that is not correctly configured.	▪ Check the network configuration.

▶ Observe the communications manual of the controller when configuring a drive for network operation.

  In general the following points must be satisfied:

  ▪ All nodes must have the same transfer rate.

  ▪ Every node must have a unique node number.

▶ If in doubt, first configure all controls individually and then connect them to each other.

12.2.4   Motor does not start

1. In the **Commissioning** task area, check whether the correct motor and the correct voltage variant are set.

2. If the connected motor is set correctly, check the following possible causes:

Possible cause	Remedy
The Motor is not correctly connected.	▪ Check the connection of the motor according to the product description of the motors and the Technical manual.
The motor is not being supplied with power.	▪ Check whether the motor power supply is connected.
The power supply is too low.	▪ Check the voltage range of the controller.
The output stage is not switched on.	▪ Switch on the output stage using the button in the **drive list** or **Motion Cockpit**.
The controller is in fault state.	▪ Reset the fault state using the button in the **drive list**.

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13 Licenses

13.1 FAULHABER license contract

**End User License Agreement for software of the
Dr. Fritz Faulhaber GmbH & Co. KG**

between

(1) **Dr. Fritz Faulhaber GmbH & Co. KG**, Daimlerstraße 23, 71101 Schönaich (Germany)

- hereinafter referred to as the "FAULHABER" -

and

(2) you as the user

- hereinafter referred to as the "Licensee" -

The parties to (1) and (2) are hereafter also jointly referred to as the **"Parties"** and individually as a **"Party"**.

PRELIMINARY REMARKS

(A) FAULHABER designs and produces drive systems. Moreover, FAULHABER has designed various software products. For example, the "FAULHABER Motion Manager" (hereinafter referred to as **"Motion Manager"**) enables the commissioning and configuration of FAULHABER drive systems. Details can be found – to the extent available – in the manual for the respective software product. Unless otherwise expressly regulated, the software product is provided to the Licensee without additional remuneration as an addition to other offered hardware and software products from FAULHABER.

(B) The Licensee intends to use one or more software product(s) in his company. FAULHABER is willing to grant the Licensee usage rights to the software product(s) in accordance with the conditions of this End User License Agreement for software from Dr. Fritz Faulhaber GmbH & Co. KG (hereinafter referred to as **"Contract"**). The details of this result from § 2.

Accordingly, the Parties agree to the following:

§ 1
Subject of the contract

(1) The subject of this Contract is the transfer of one or more software products listed in Paragraph (2) (hereinafter referred to as the "**subject of the License**") and the granting of the usage rights described in § 2 by FAULHABER to the Licensee.

(2) The provisions of this Contract pertain to the following listed categories of License subjects, including corresponding manuals, if available:

    a) Motion Manager with corresponding user documentation;

    b) Programming libraries;

    c) Firmware;

    d) Sequence programs.

(3) In particular, the following services are not the subject of this Contract:

    a) Installation or other equipment that is subject of the License at the Licensee's location;

    b) Individual settings of variable parameters of the subject of the License according to the Licensee's requirements (customizing);

    c) Individual program extensions for the Licensee (individual modifications);

    d) Adjusting interfaces to the needs of the Licensee;

    e) Instructing and training the Licensee's program users;

    f) Upkeep of the subject of the License, especially the delivery of new, future versions.

§ 2
Content and scope of the rights of use

(1) All rights to the subject of the License are the exclusive property of FAULHABER or its Licensors. The Licensee is granted only those rights to the subject of the License agreed upon in this Contract.

(2) The Parties agree that the subject of the License and the corresponding documents, including future versions, are protected by copyright and, in accordance with § 6, represent confidential information and trade secrets of FAULHABER.

(3) Unless otherwise expressly regulated in Paragraph (4), FAULHABER grants the Licensee the following usage rights to the subject of the License:

a) FAULHABER grants the Licensee the spatially and temporally unlimited, non-exclusive right to use the subject of the License for its own purposes and for purposes of the customers of the Licensee in accordance with the following paragraphs.

b) This right includes the installation of the subject of the License as well as the loading, display and execution of the installed subject of the License as well as saving the subject of the License in the working memory of the hardware on which the subject of the License is installed. The Licensee is, in particular, not authorized to edit or otherwise modify the subject of the License unless this is expressly permitted in this Contract.

c) Duplications of the subject of the License are permitted only to the extent that this is necessary for the contractually stipulated use. The Licensee may make backup copies of the subject of the License in accordance with the rules of technology in the necessary scope and in unmodified form and also, in particular, within the scope of the normal backup of the Licensee's system environment.

d) The Licensee is authorized to transfer the subject of the License if (i) the Licensee transfers the subject of the License together with the original hardware components from FAULHABER, (ii) the transfer of the subject of the License occurs at no charge to the third party, (iii) the Licensee ensures that the third party is not granted any further-reaching rights to the subject of the License other than granted to the Licensee in this Contract and (iv) at a minimum, the requirements of this Contract related to the subject of the License are imposed on the third party. Third parties also include companies associated with the Licensee in the spirit of § 15 AktG (Stock Corporation Act).

e) FAULHABER is authorized to update the subject of the License without prior announcement, e.g., to rectify errors or improve or expand functions. If the updated version replaces the previously provided subject of the License, this is likewise subject to the provisions of this Contract.

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f) The Licensee may only use the subject of the License within the scope of the intended use and even then only for productive operation if the subject of the License is qualified for the specific application case. **"Productive operation"** means the control of the respective drive system manufactured by FAULHABER by the subject of the License in running operation of the application in the concrete scope of application of the Licensee, alone or in combination with other components of a complete system. Prerequisite for the qualification for the specific application case is that appropriate tests were successfully performed in the productive environment in a sufficient manner and that existing legal provisions and requirements pertaining to the use by the Licensee relevant to the specific application case are met in full (e.g., international standards and norms). This applies, in particular, for uses in medical technology and military purposes as well as in security-critical areas (e.g., in aerospace applications as well as for controlling nuclear systems).

g) The Licensee is not entitled to demand that FAULHABER issue the source code or the source code documentation. Deviating from this, usage rights of the source code of the subject of the License are granted to the extent this is expressly permitted in this Contract (especially in Paragraph (4) below).

h) To the extent that the subject of the License provided to the Licensee by FAULHABER contains open-source software or software for which FAULHABER possesses only a derived usage right (hereinafter referred to as **"third-party software"**), the utilization provisions underlying the third-party software shall also apply and take priority. Each third-party software program used within a subject of the License that is subject to the License condition(s) applicable for third-party software as well as any existing copyright notices are each mentioned in the corresponding manual or are made available for download in a separate file to the Licensee upon delivery of the subject of the License. The Licensee is obligated to comply with the respective License conditions. If the Licensee violates these License conditions, both FAULHABER as well as the Licensor are permitted to assert the ensuing claims and rights in their own name.

(4)   The usage rights per Paragraph (3) are amended or modified as follows for the subjects of the License as listed below:

a)   Motion Manager

aa)   The intended use of the Motion Manager is determined from – to the extent it exists – the respective current version of the corresponding manual, which is made available on the FAULHABER website.

bb)   The Motion Manager may only be used if the Licensee ensures that no injury or damage to health and no risk of material damages to property (e.g., systems) is possible.

cc)   The Licensee shall not use the Motion Manager in productive operation. To clarify, the Parties agree that such a use does not represent an intended use of the Motion Manager. The same applies for the use for the controlling of drive systems that have not been manufactured by FAULHABER as well as its use for the controlling of drive systems that were manufactured by FAULHABER but which are not listed in the program description. Deviating from this, sequence programs included in the Motion Manager may be modified for and used in productive operation provided these were qualified in the application in accordance with Paragraph (3)f).

dd)   The decompiling and any other types of reverse engineering are not generally permissible. Excluded from this is the right of the Licensee to observe, to examine or to test the function of the Motion Manager so as to ascertain the underlying ideas and principles of a program element if this occurs by way of actions involving the loading, display, execution, transfer or saving of the program in accordance with this Contract (§ 69d Paragraph 3 UrhG (German Copyright Law)). Deviating from sentence 1, the Licensee is also permitted to decompile to produce an interoperable program exclusively under the conditions of § 69e Paragraph 1 and within the limits set by § 69e Paragraph 2 UrhG (German Copyright Law). The above-mentioned rights exist only if the Licensee requests the information he requires from FAULHABER prior to every such action and does not receive the necessary information within a reasonable time. Within the scope of his request, the Licensee is to provide FAULHABER all information necessary for assessing the request.

ee)   Any further use of the Motion Manager, especially the granting of sublicenses, requires the prior, express and written consent from FAULHABER. This does not apply to sale of the drive systems, provided their proper use requires use of the Motion Manager.

ff)   The use of the Motion Manager is permitted only in combination with original hardware components from FAULHABER. The use of third-party hardware is prohibited.

b) Programming libraries

    aa) The Licensee is granted the right to edit source code files of the programming libraries and to transfer these edits to third parties. The editing of object code files of the programming libraries, on the other hand, is forbidden.

    bb) The use of the programming libraries is permitted only in combination with original hardware components from FAULHABER. The use of third-party hardware is prohibited.

    cc) FAULHABER shall provide the Licensee with manuals for the programming libraries for download on the FAULHABER website if necessary and at its discretion. The Licensee has no claim to the provision of a manual. Insofar as an intended use of the programming libraries is defined, this is determined from the – where present – respective current version of the corresponding manual.

    dd) The programming libraries may only be used if the Licensee ensures that no injury or damage to health and no risk of material damages to property (e.g., systems) is possible.

c) Firmware

    aa) The intended use of the firmware is determined from the respective current version of the corresponding manual, which is made available on the FAULHABER website.

    bb) The firmware may only be used if the Licensee ensures that no injury or damage to health and no risk of material damages to property (e.g., systems) is possible.

    cc) The use of the firmware is permitted only in combination with original hardware components from FAULHABER. The right to use the firmware for the hardware of a third party exists only with the prior written consent from FAULHABER.

    dd) The decompiling and any other types of reverse engineering are not generally permissible. Excluded from this is the right of the Licensee to observe, to examine or to test the function of the firmware so as to ascertain the underlying ideas and principles of a program element if this occurs by way of actions involving the loading, display, execution, transfer or saving of the program as permitted by this Contract (§ 69d Paragraph 3 UrhG (German Copyright Law)). Deviating from sentence 1, the Licensee is also permitted to decompile to produce an interoperable program exclusively under the conditions of § 69e Paragraph 1 and within the limits set by § 69e Paragraph 2 UrhG (German Copyright Law). The above-mentioned rights exist only if the Licensee requests the information he requires from FAULHABER prior to every such action and does not receive the necessary information within a reasonable time. Within the scope of his request, the Licensee is to provide FAULHABER all information necessary for assessing the request.

d) Sequence programs

  aa) Sequence programs are programs that can be executed on specific FAUL-HABER controller hardware.

  bb) The Licensee is granted the right to edit sequence programs and to transfer these edits to third parties provided these were delivered in source code form.

  cc) The use of the sequence programs is permitted only in combination with original hardware components from FAULHABER. The right to use the sequence programs on the hardware of a third party exists only with the prior written consent from FAULHABER.

§ 3
Delivery

(1) The subject of the License is delivered in the form as it exists at the time of delivery ("as is").

(2) The subject of the License is delivered in digital form through a download provided on the FAULHABER website or individually via e-mail. FAULHABER is not required to provide the subject of the License on physical data carriers.

(3) Before providing the subject of the License, it shall be checked by FAULHABER for the presence of any malware through the use of a virus scanner that is current at the time of provision. FAULHABER has no further obligations with respect to ensuring that no malware is present.

§ 4
Obligations of the Licensee

(1) The Licensee is required to ensure an adequate technical operating and system environment and for the proper operation of the subject of the License. The establishment of the operating and system environment for the subject of the License is the sole responsibility of the Licensee.

(2) If the productive operation of the subject of the License is permitted according to the terms of this Contract, the Licensee shall ensure that the requirements according to A.I. § 2(3)f) are fully satisfied prior to the productive operation of the subject of the License. § 377 of the HGB (German Commercial Code) remains unaffected.

(3) The installation and implementation of the subject of the License on the Licensee's systems is the sole responsibility of the Licensee.

(4) The Licensee shall take all necessary and reasonable measures to prevent or limit damages caused by the subject of the License. In particular, the Licensee shall make use of the current protective measures for defending against malware.

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(5) The Licensee is aware that for any necessary communication interfaces (especially with the Motion Manager and programming libraries), separate drivers from the adapter manufacturers not provided by FAULHABER may be necessary. Communication interfaces are interfaces for exchanging data between PC and controller, e.g., via CAN, RS232, USB or EtherCAT. The Licensee shall be required to independently procure, to license and to install the necessary drivers for using these communication interfaces.

(6) The Licensee is prohibited from removing or modifying any copyright information from the subject of the License.

§ 5
Liability of FAULHABER

(1) Provided the subject of the License is supplied free of charge, the following liability regulations apply:

   a) FAULHABER shall only be liable for material defects and defects of title if FAULHABER fraudulently conceals such defects.

   b) FAULHABER shall be liable for intentional acts and gross negligence according to the product liability act, fraudulent concealment of a defect, guarantee claims as well as violation of life, the body or health according to the statutory provisions. Moreover, any liability for claims for damages or for reimbursement of expenses by FAULHABER is excluded, regardless of the reason.

   c) In the event of loss or destruction of data on the Licensee's premises caused by gross negligence or deliberate breach of contractual or statutory obligations, FAULHABER is liable only up to the amount of the typical cost of restoring the data that is incurred despite regular data backup according to state of the art standards.

(2) In the case that firmware is made available for loading on hardware components from FAULHABER, the liability provisions applicable to the respective hardware components shall apply in deviation from Paragraph (1).

§ 6
Confidentiality

(1) The Parties undertake to treat all knowledge gained within the scope of Contract initiation and conclusion that is marked as confidential or that is, in nature, confidential information (**"Confidential Information"**) of the other Party confidentially for an unlimited period of time and to only use it for the purposes of executing this Contract. The Confidential Information of FAULHABER also includes the subject of the License. Deviating from this – unless otherwise agreed – the subjects of the License from FAULHABER made available for public download on the FAULHABER website are not considered Confidential Information.

(2) The Licensee shall only make the subject of the License available to his employees and other third parties to the extent that this is necessary for the granted rights of use. The Licensee shall advise all persons to whom he grants access to the subject of the License of the existing rights of FAULHABER and the obligation of confidentiality and commit in written form these persons to secrecy to the same extent as in this § 6 provided the affected persons are not obligated to confidentiality to at least the extent described above owing to other legal reasons.

(3) The obligations of confidentiality set out in the previous paragraphs do not apply for Confidential Information that (i) was already public knowledge when disclosed by the Party or was already known to the other Party; (ii) after being disclosed by the Party, was made public without negligence on the part of the other Party; (iii) after being disclosed by the Party, a third party is given access in a lawful manner without restrictions regarding confidentiality or utilization; and/or (iv) is independently developed by one Party without the use of the Confidential Information or trade secrets of the other Party. The obligations also do not apply if the Confidential Information must be published under terms of the law, especially due to official or judicial order; in this event, the publishing Party shall immediately inform the other Party and support them in defending against any instruments and decisions.

§ 7
Final 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 is subject to and shall be interpreted according to the laws of the Federal Republic of Germany. The CISG - United Nations Convention on Contracts for International Sale of Goods dated April 11th, 1980, shall not apply.

(3) The sole place of jurisdiction 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. The statutory law (§ 306 Paragraph 2 of the BGB (German Civil Code)) shall apply in place of provisions that were not included or are invalid. In addition, the parties shall undertake to replace the provision that has become invalid or ineffective with a provision which comes closest to the economic purpose of that provision provided no supplementary interpretation of the Contract takes priority or is possible.

13.2 Drivers supplied with Motion Manager 7

The license texts of the drivers supplied with Motion Manager 7 can be found in the respective installation folder under "\Motion Manager 7\Drivers" or are displayed during setup execution.

FTDI
USB-to-serial driver from Future Technology Devices International Limited for USB adapter boards on drives with RS232 interface.

MC3_WinUSB
USB driver for the MC V3.0 Motion Controller family. Uses LibusbK from Travis Lee Robinson.