

Change from Motion Controllers V2.5 to V3.0 – Control via RS232 interface

Summary

This Application Note accompanies the change from Motion Controllers of generation 2.5 to Motion Controllers of generation 3.0.

The present document is intended for customers familiar with Motion Controllers V2.5 with RS232 interface who are transitioning to Motion Controllers V3.0 in a new machine. For customers familiar with Motion Controllers V2.5 with CANopen interface, Application Note 195 is recommended.

First of all, benefits of changing from generation 2.5 to 3.0 are mentioned, followed by some hints for the selection of a suitable Motion Controller.

Afterwards the Application Note focusses on essential information of the communication interface, including typical command sequences and queries. Application Note 197 provides more detailed information on how to implement the communication layers.

For more information please refer to the drive functions and communications manual or ask our experts in the [Motion Control Support](#).

Applies To

Motion Controller V2.5	Motion Control Systems V2.5
MCBL/MCDC/MCLM 3002 F/P/S	2232/2250 ... BX4 CSD
MCBL/MCDC/MCLM 3003 P	3242/3268 ... BX4 CS
MCBL/MCDC/MCLM 3006 S	3564 ... B CS

The family of Motion Controllers and Motion Control Systems V2.5 with RS232 interface is described as MC V2.5 RS in the following.

Motion Controller V3.0	Motion Control Systems V3.0
MC 3001 B/P	2232/2250 ... BX4 IMC RS
MC 3603 S	MCS 3242/3268 ... BX4 RS
MC 5004 P	MCS 3274 ... BP4 RS
MC 5005 S	
MC 5010 S	

The family of Motion Controllers and Motion Control Systems V3.0 with RS232 interface is described as MC V3.0 RS in the following.

Benefits of changing from Motion Controller V2.5 to V3.0

Power range and dynamic behavior:

The new MC V3.0 family offers a significantly higher power range compared to MC V2.5. Starting with a rated power of 30W for small motors, there are Controllers available up to a rated power of 500W for larger motors.

Not only the rated power is extended, but also the maximum power for short-term operation. Combined with an improvement in the feedback control loop, MC V3.0 are able to operate a motor much more dynamically. Also applications with higher load inertia can now be operated.

One Controller for all types of motors and sensor systems:

While for MC V2.5 different Controllers are necessary for operating either a DC-Motor, a BLDC-Motor or a linear motor, MC V3.0 are now able to operate all FAULHABER motor technologies with the same hardware.

Furthermore, the extended amount of inputs and outputs allows the usage of many different sensor systems. MC V3.0 can evaluate digital and linear Hall sensors, as well as incremental and absolute encoders.

Extended diagnostic and protection functions:

MC V3.0 are monitoring the state of the connected motor and the Motion Controller itself on a cyclical basis. The handling of the monitoring results is significantly expanded. There are different error codes available, combined with more options how to react on an error like e.g. switching off the drive automatically.

One purpose of the monitoring is to protect the connected motor from overheating by calculating the actual winding temperature. The thermal model is improved, leading to a more precise calculation of the temperature. This allows the power of the motor to be better utilized.

Fast and easy commissioning with the FAULHABER Motion Manager:

The configuration software Motion Manager from FAULHABER is used to configure the connected motor and sensor system and to integrate the drive system into the application. When the commissioning of an MC V3.0 is performed, many of the tools in Motion Manager 6 will be recognized from the commissioning of an MC V2.5. Beyond that, the software offers various improvements and extensions in order to make the commissioning of an MC V3.0 as easy as possible.

All of the operating modes covered from an MC V2.5 are available at an MC V3.0 as well, including the definition of the target value by an analog or pulse-width modulated voltage.

Sequence programs:

The capabilities of sequence programs have expanded significantly with the change from Motion Controller generation 2.5 to generation 3.0. The programming language BASIC now allows the usage of common structures like IF-ELSE-statements or WHILE-loops. Pre-defined functions and macros simplify the implementation of a sequence program.

FAULHABER offers various resources like a [Webinar](#) and [Application Note 165](#) to get familiar with the BASIC-environment.

Selection of a suitable Motion Controller V3.0

The following figure shows an extract of Motion Controllers and Motion Control Systems of both, generation 2.5 and 3.0.

 Generation 2.5	 Motion Control Systems • 22xx ... BX4 CxD • 32xx ... BX4 Cx • 3564 ... B Cx	 Motion Controllers with pin header (P-Version) • MCxx 3002 P • MCxx 3003 P	 Motion Controllers with connectors (F/S-Version) • MCxx 3002 F/S • MCxx 3006 S
 Generation 3.0	 Motion Control Systems • 22xx ... BX4 IMC RS/CO • MCS 32xx BX4 RS/CO/ET • MCS 3274 BP4 RS/CO/ET	 Motion Controllers with pin header (B/P-Version) • MC 3001 B/P • MC 5004 P	 Motion Controllers with connectors (S-Version) • MC 3603 S • MC 5005 S • MC 5010 S

Figure 1: Overview on FAULHABER Motion Controllers and Motion Control Systems

For the selection of a suitable MC V3.0, the following aspects must be taken into consideration:

Rated power:

The rated power (defined by maximum supply voltage and maximum continuous output current) of the MC V3.0 must fit the motor and further requirements of the application.

Form factor and mounting situation:

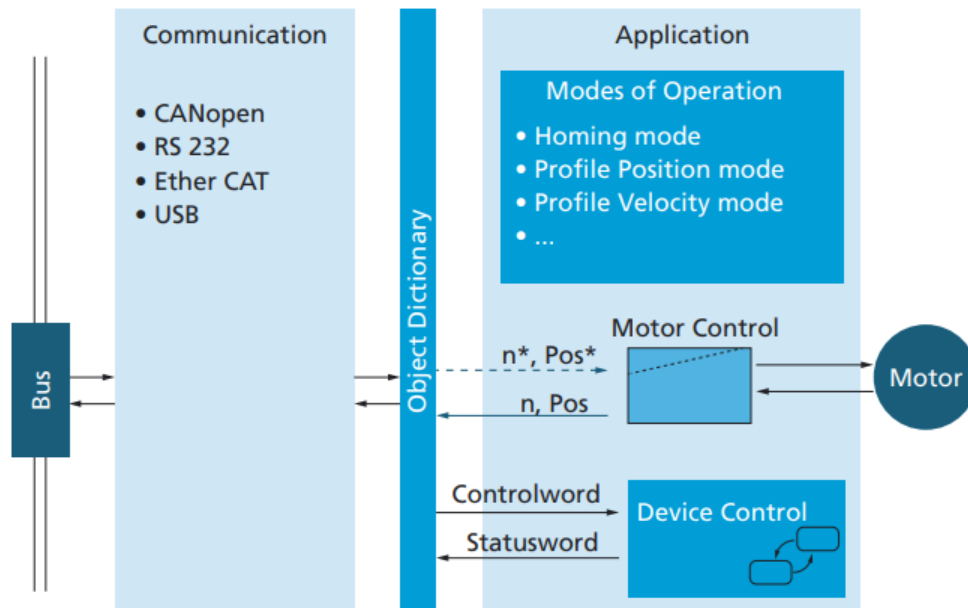
In general it can be distinguished between Motors with integrated Drive Electronics (Motion Control Systems) and Motion Controllers. Motion Control Systems V2.5 will most likely be replaced with the MCS-series. If the pin-header version of an MC V2.5 was used, the pin-header version of an MC V3.0 might be the right choice. For the connector version of an MC V2.5 the connector version of an MC V3.0 might be a suitable replacement.

Communication interface:

The MC V3.0 family offers controllers with EtherCAT, CANopen or RS232 interface. An USB interface is available for configuration.

Interface via Object Dictionary

The communication via the serial interface of an MC V3.0 is done via the object dictionary. Instead of proprietary ASCII-commands (MC V2.5) all kind of interactions with the Motion Controller are done by writing or querying objects. This type of communication is based on the CANopen standard, but tailored to the RS232 interface.



An object is represented by a 2 byte index and a 1 byte subindex. E.g. the target position for a position controlled application is defined by object 0x607A.00. Overall, the object dictionary is divided into three parts:

Index	Assignment of the objects
0x1000 to 0x1FFF	Communication objects
0x2000 to 0x5FFF	Manufacturer-specific objects
0x6000 to 0x6FFF	Objects of the drive profile acc. to CiA 402

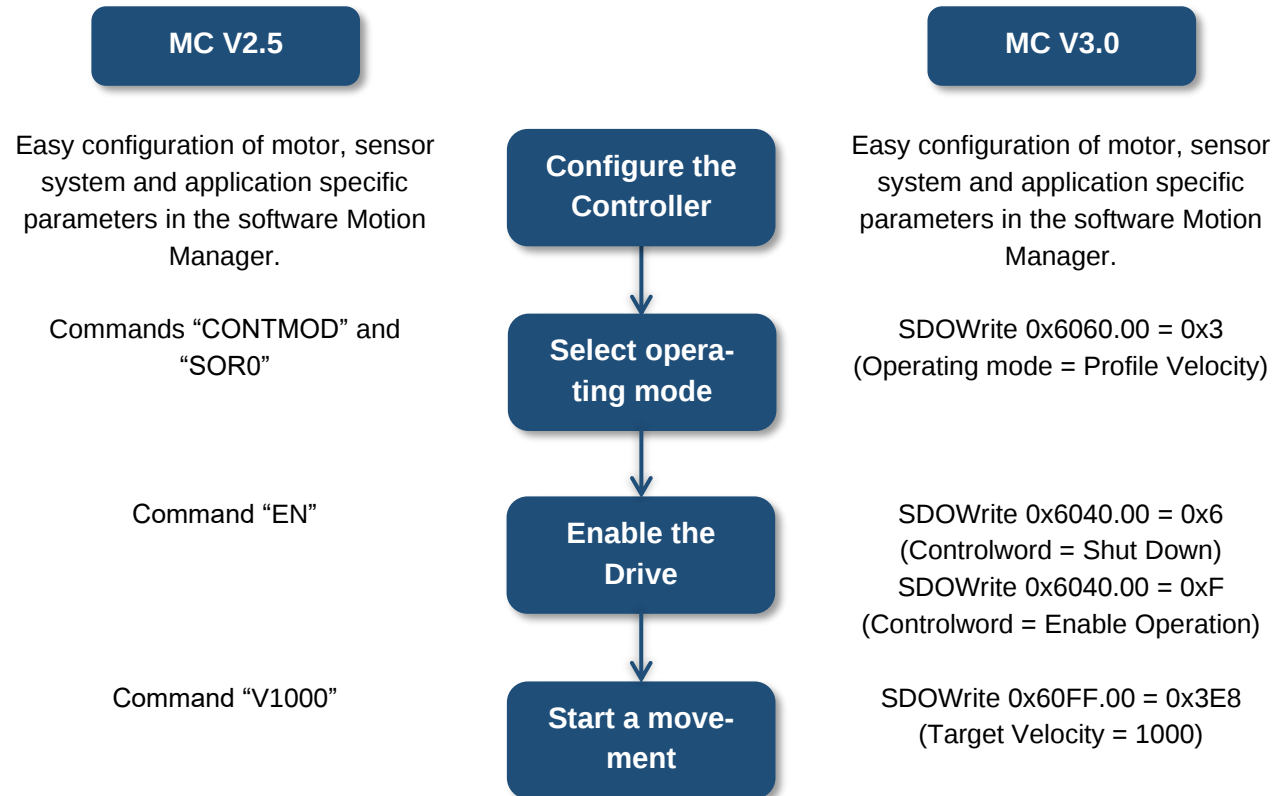
Most of the objects are configured during the commissioning in the Motion Manager software. For typical applications only a few objects need to be written or queried during operation. Among them the mode of operation, target and actual values of position, velocity or torque, as well as the Control- and the Statusword.

For customers familiar with Motion Controller V2.5 with RS232-interface, Control- and Statusword are new characteristics. The Controlword is represented by object 0x6040 and is used for tasks like enabling the drive and starting the movement in some operating modes. The Statusword, represented by object 0x6041, indicates the actual state of the drive state machine like "Operation Enabled" and provides further informations, e.g. if the target position is reached.

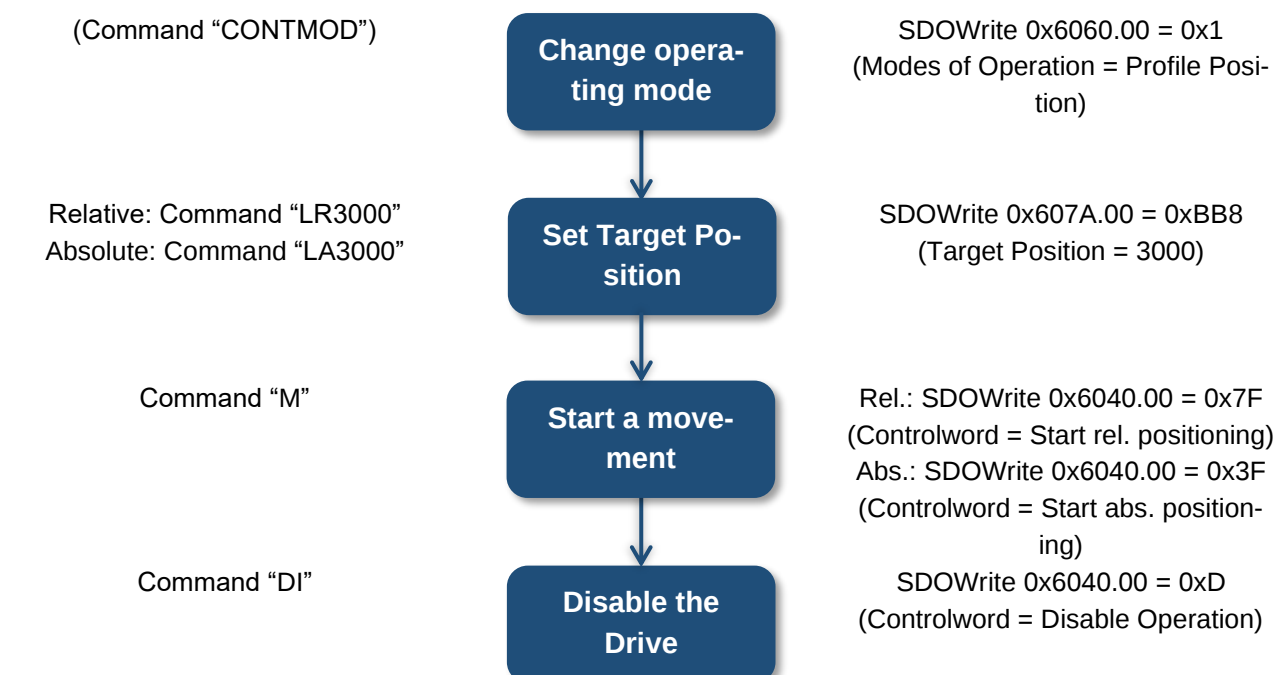
The following section shows some typical command sequences for position- or velocity-controlled applications, as well as typical queries of actual values. All examples include a comparison of the procedure between MC V2.5 RS and MC V3.0 RS.

Typical command sequences and queries

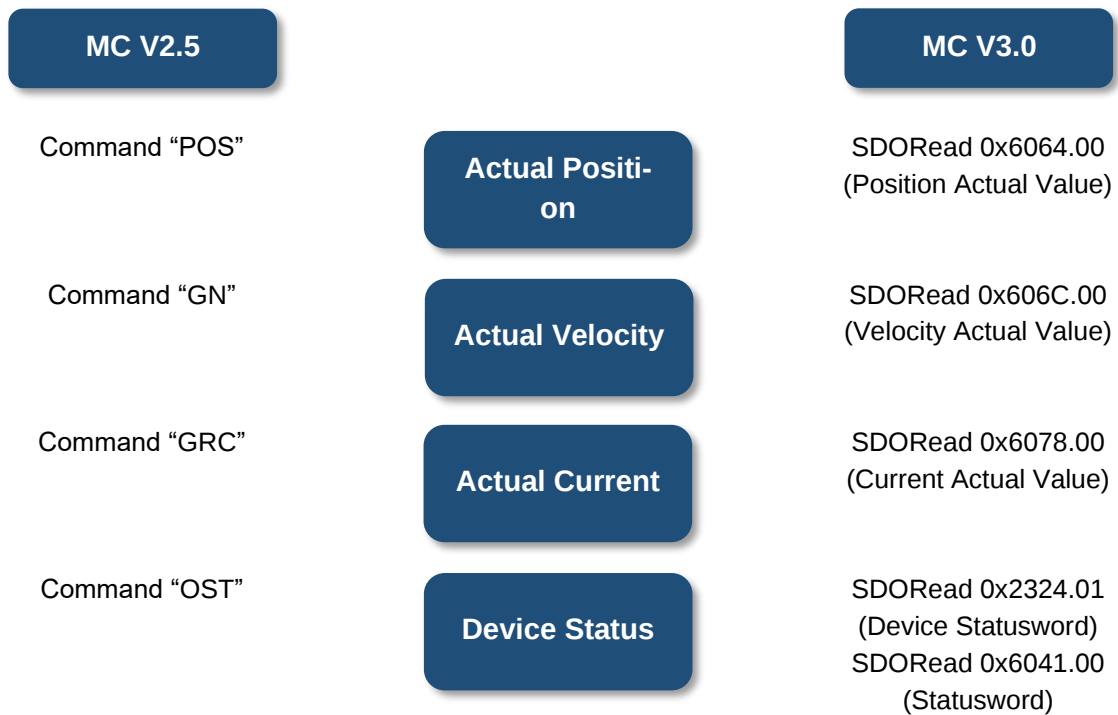
The first example includes the necessary steps to start a drive in velocity-controlled mode, assuming the Motion Controller is not configured yet.



In the second example, the operating mode is changed to position-control, a movement is executed and the drive is disabled afterwards.



Another typical usecase is the query of actual values:



For customers familiar with MC V2.5 RS a good opportunity to get to know the different SDOWrite and SDORead commands is the "Terminal" in the Motion Manager software. The following excerpt shows the log of the first sequence described on page 5. In addition to the Log, the Communication tab shows the complete command telegram.

Terminal		
Enter command		
Log	Communication	
Time	Message	Info
10:31:41.677	1 SOBJ 6060.00 03 (3)	Modes of operation
10:31:41.683	OK	
10:31:43.934	1 SOBJ 6040.00 000E (14)	Controlword
10:31:43.938	OK	
10:31:44.060	1 SOBJ 6040.00 000F (15)	Controlword
10:31:44.064	OK	
10:31:44.918	1 SOBJ 60FF.00 000003E8 (1000)	Target velocity
10:31:44.924	OK	

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