

SIEMENS

SIMATIC
Easy Motion Control

Getting Started

Edition 02/2003

First Steps in Commissioning

programmieren



Safety Guidelines

This manual contains notices intended to ensure personal safety, as well as to protect the products and connected equipment against damage. These notices are highlighted by the symbols shown below and graded according to severity by the following texts:



Danger

indicates that death, severe personal injury or substantial property damage will result if proper precautions are not taken.



Warning

indicates that death, severe personal injury or substantial property damage can result if proper precautions are not taken.



Caution

indicates that minor personal injury can result if proper precautions are not taken.

Caution

indicates that property damage can result if proper precautions are not taken.

Notice

draws your attention to particularly important information on the product, handling the product, or to a particular part of the documentation.

Qualified Personnel

Only **qualified personnel** should be allowed to install and work on this equipment. Qualified persons are defined as persons who are authorized to commission, to ground and to tag circuits, equipment, and systems in accordance with established safety practices and standards.

Correct Usage

Note the following:



Warning

This device and its components may only be used for the applications described in the catalog or the technical description, and only in connection with devices or components from other manufacturers which have been approved or recommended by Siemens.

This product can only function correctly and safely if it is transported, stored, set up, and installed correctly, and operated and maintained as recommended.

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Disclaimer of Liability

We have checked the contents of this manual for agreement with the hardware and software described. Since deviations cannot be precluded entirely, we cannot guarantee full agreement. However, the data in this manual are reviewed regularly and any necessary corrections included in subsequent editions. Suggestions for improvement are welcomed

Introduction

Using an IM 178-4 as an example of a distance measurement and output module, this primer leads you through six commissioning steps to a working application. It allows you to familiarize yourself with the basic functions of Easy Motion Control.

Depending on your experience, it will take between one and two hours of your time.

At the end of this primer, you will find information on testing in simulation mode without hardware and drive.

Using other distance measurement and output modules

Of course, the commissioning tasks described here can also be carried out using other distance measurement and output modules if an IM178-4 is not available. Easy Motion Control provides other special drivers for this purpose.

You can also perform the commissioning described here with other distance measurement and output modules supported by Easy Motion Control.

This documentation assumes the use of an IM178-4.

All text sections involving hardware are highlighted with a colored background. This indicates that the tasks may differ if you use different hardware.

Requirements

The following requirements must be fulfilled:

- You must have configured and wired an S7 station consisting of a power supply module, CPU with DP connection and a locally connected IM 178-4 as well as your drive together with encoder.
- For installation and wiring of the IM 178-4, see the "IM 178-4 Drive Interface" manual.
Wiring includes connecting the enable input of your power unit to a digital output of the IM 178-4 (see step 5.9).
- STEP 7 (\geq V5.0 + Service Pack 3) is correctly installed on your programming device.
- Your programming device is connected to the CPU.
- You have set up a project for your S7 station.
- You are in possession of the Easy Motion Control software product.
- You are familiar with the STEP 7 configuration package, particularly with the SIMATIC Manager and the LAD/STL/FBD-Editor.
- You have provided safety limit switches and EMERGENCY STOP switches to safeguard the safety of operating staff and the system itself.



Warning

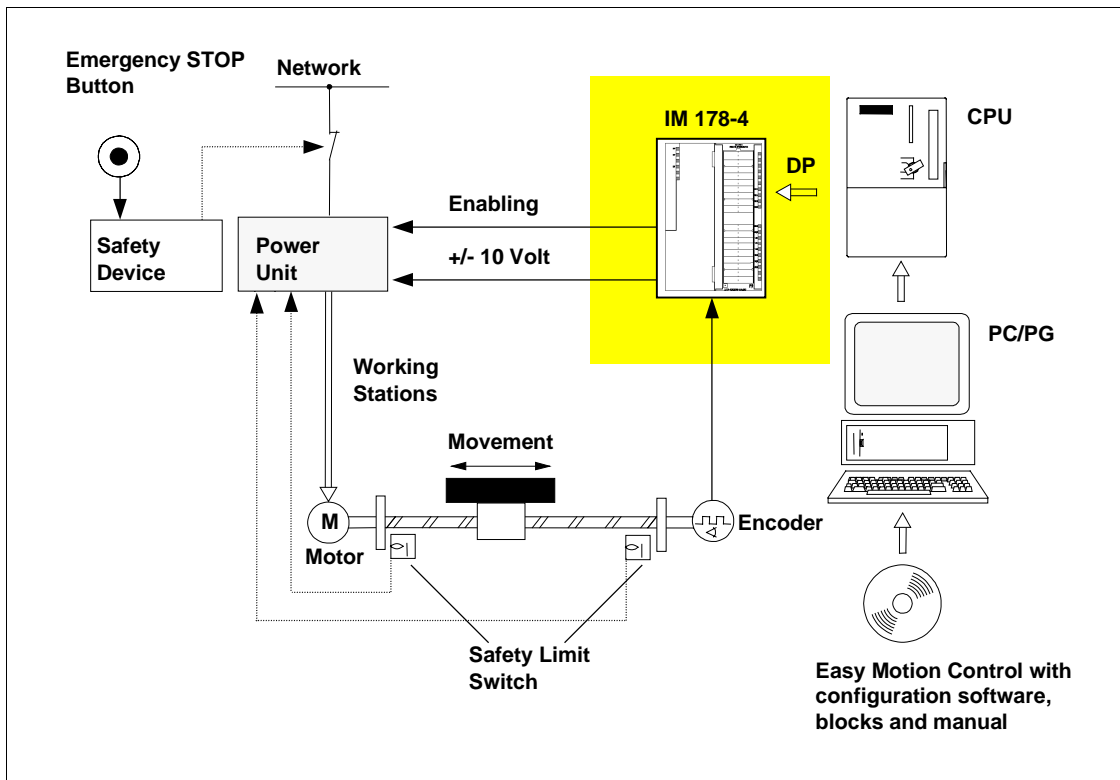
Injury may occur to persons and property.

Uncontrolled travel motions during commissioning and operation can cause severe injury to persons and property.

To avoid injury to persons and objects, take the following precautions:

- Install an EMERGENCY STOP switch in the vicinity of the computer. This is the only way to ensure that the system is reliably switched off in the event of a hardware or software failure.
- Install safety limit switches with direct control over the power units of all drives.
- Ensure that nobody has access to anywhere of the system where there are moving parts.

Configuration of Example



Functionality of Example

You generate a user program allowing you to move your axis in jogging mode.

Step 1: Easy Motion Control Installation

Install the software by starting the installation program Setup.exe on the CD-ROM and following its instructions.

More detailed information can be found in the Easy Motion Control manual under "Installation of Easy Motion Control". The manual can be found in unzipped form on the installation CD under Manuals\English\EasyMotionControlV2.pdf.

Step 2: Parameterization in HW Config

Parameterize the time interrupt of OB35 in the CPU with 10 ms (CPU 318 or S7-400) or 20 ms (S7-300 to CPU 316).

In OB35, you later launch Easy Motion Control blocks in Step 5.

Select IM 178-4 from the module catalogue in HW Config under PROFIBUS-DP > Function Modules > IM 178-4. Configure slot 4 of the IM 178-4 as "4Word AO/12Word AI/Cons. 1Word".

Parameterize the IM 178-4 as follows:

Step	Parameter	Setting
2.1	Synchronization	Software
2.2	Edge selection	Rising or falling edge

Parameter

Parameterize the other settings according to the connected encoder.

Step 3: Parameterization of Axis Data

Step	Job	Result
3.1	Open the Easy Motion Control configuration software on your PC via the Windows start menu (Start > Simatic > STEP 7 > Easy Motion Control V2).	The Easy Motion Control V 2 window appears.
3.2	Select the menu function File > New from the configuration software.	
3.3	In the "New" window, open the block container of your project.	
3.4	Under "Object Name", enter a DB that does not yet exist in your project, e.g. DB1. This DB is regenerated with "OK". UDT AXIS_REF is thereby copied from the library "EMC2 Easy Motion Control" into the "Blocks" container of your project. Note: You should not then delete this UDT AXIS_REF or change the UDT number.	The dialog is opened for parameterizing the DB.
3.5	Enter all parameters corresponding to your axis. You will find an explanation of parameters in the configuration software's online help (F1 key). In the "Commissioning" register, the configuration software offers help in determining parameters. <ul style="list-style-type: none"> • "Set encoder polarity" • "Set drive polarity" • "Axis distance per encoder revolution" and • "Max. axis velocity" see step 4.	
3.6	Save the axis DB that has just been parameterized in your offline database organization.	The DB is generated and parameterized.

Step 4: Commissioning the Axis using Configuration Software



Warning

The start-up aids described here cause your axis to move. Faulty wiring or parameterization results in incorrect speed or polarity. You must therefore make sure that your system cannot be damaged by being moved, e.g. using safety limit switches which switch your drive off.

The axis is commissioned without a user program and only functions if nothing else is accessing the analog output channel controlling your drive.

Step	Job	Result
4.1	Bring your CPU into RUN.	
4.2	Open the register "Commissioning" in the configuration software.	
4.3	Use the "wiring test" to check the wiring of your encoder and analog output and if necessary set the encoder or drive polarity. Press the "Wiring test" button and follow the instructions in Wizard.	The axis is moved. The parameters "Set encoder polarity" and "Set drive polarity" are adjusted so as to ensure correct direction of control action of the position control loop.
4.4	"Distance measurement" allows you to determine the parameter "Axis distance per encoder revolution". "Distance measurement" is only necessary if you do not know what distance your axis covers in one encoder revolution. Press the "Distance measurement" button and follow the instructions in Wizard.	The axis is moved. The parameter "Axis distance per encoder revolution" is set correctly.
4.5	"Velocity measurement" allows you to determine the parameter "Maximum axis velocity". "Velocity measurement" is only necessary if you do not know what maximum axis velocity your axis reaches. Press the button "Velocity measurement" and follow the instructions in Wizard.	The axis is moved. The parameter "Maximum axis velocity" is set correctly.
4.6	Save the axis DB in your offline database organization.	

Step 5: Generating a position control program

The program described here is included in the Easy Motion Control V2.0 sample project (English project: **ZEn20_02_EMC2**; Programm: **GettingStarted**).

Step	Job	Result
5.1	Give the axis DB generated in step 3 the symbolic name "DB_Axis".	
5.2	From the "Blocks" container of the "EMC2 Easy Motion Control" library, copy the blocks <ul style="list-style-type: none"> • FC Mc_Init (function for initializing all blocks) • FB EncoderIM178 (input driver for IM 178-4) • FB MC_MoveJog (travel block for jogging mode) • FB MC_Control (control block) • FB OutputIM178 (output driver for IM 178-4) into your project's "Blocks" container.	
5.3	Insert the new FC1 in your project, giving it the symbolic name "GetStarted". Open it with the KOP/AWL/FUP Editor e.g. in the generation language KOP.	
5.4	In FC GetStarted, insert calls of the blocks specified in Step 5.2 in the sequence indicated.	
5.5	Interconnect the following parameters of the blocks with the axis DB <ul style="list-style-type: none"> • Parameter axis with DB_Axis.Ax. • Parameter Init with DB_Axis.Ax.Init.Ixx. Ixx in this case stands for one of the parameters I0 to I31. Interconnect each Parameter Init with exactly one initialization bit in the axis DB which is not used by any other FB. e.g. EncoderIM178 with DB_Axis.Ax.Init.I0, MC_MoveJog with DB_Axis.Ax.Init.I1 etc. 	
5.6	Ensure a conditional launch of FC MC_Init, e.g. by placing a make contact with M100.0 in front of the parameter EN in the ladder diagram symbol.	
5.7	Reset the condition for launching FC MC_Init (reset M100.0).	
5.8	Interconnect the "EnableDrive" input of FB Output IM178 with the "DriveEnabled" output of FB MC_Control.	
5.9	Interconnect the digital output which you use to enable your power unit with the "DriveEnabled" output of FB MC_Control.	
5.10	Give symbolic names to the instance DBs of the launched FBs. For this, in the context menu to FB call (right mouse button on FB call), open the menu entry "Edit symbols".	
5.11	Save the FC GetStarted that has just been generated.	The position control program is generated but is not yet launched.
5.12	In the OB35 time interrupt, launch FC GetStarted that has been generated above. Save OB35.	The position control program is called using timer control.
5.13	In OB100 startup, set the condition for launching FC MC_Init in FC GetStarted (e.g. M100.0 see Step 5.6). Save OB100.	The position control program is initialized in CPU startup.

Step 6: Starting up Position Control in Jogging Mode

Step	Job	Result
6.1	Bring the CPU into STOP, load the previously generated program into the CPU and bring this into RUN again.	
6.2	Open the "Axis error" register of the configuration software for your axis.	The error "Stop status requiring acknowledgement" is displayed. This error is set on launching FC MC_Init, to prevent your axis from running away uncontrollably after CPU startup.
6.3	Open the register "Axis status" of the configuration software for your axis in order to monitor position changes and axis status. Note: As the axis is not yet synchronized, the displayed positions do not coincide with the actual axis position. You can only recognize whether the axis is moving in the right direction. The software limit switch is also not monitored in this status.	
6.4	Enable your drive by setting the "EnableDrive" input of FB MC_Control at TRUE (e.g. using a variable table).	
6.5	Acknowledge the axis error that is present (group error) by pressing the button "Group acknowledgement" in the register "Axis status" of the configuration software.	Your axis is at a position-controlled standstill (no group error is displayed). if not, open the register "Axis error" and "Parameterization error". In the Online Help (F1 key), you will find the possible causes for existing errors.
6.6	Optimal controller gain can be determined empirically at the axis. Increase controller gain in steps of 1.0 until the axis starts to oscillate during travel or at a standstill. If this is the case, reduce controller gain until the tendency to oscillate is no longer apparent.	
6.7	Create a variable table with the following variables of instance DB to FB MC_MoveJog: <ul style="list-style-type: none"> • JogPos • JogNeg • Velocity • Acceleration • Deceleration • Busy • MotionAborted 	
6.8	Specify the values for parameters Velocity, Acceleration and Deceleration. If you have any questions about the significance of the parameters, open the online help to FB MC_MoveJog by selecting the block in the SIMATIC Manager and pressing the F1 button.	
6.9	Set one of the parameters JogPos or JogNeg to start travel in the positive or negative direction. Observe the effect using the configuration software and at output parameters Busy and CommandAborted of FB MC_MoveJog.	The axis accelerates and moves as you specified in Step 6.7. If your axis does not move, there is the group error again and one of the axis errors, see Step 6.5.

Test in Simulation Mode

You can also run the test in simulation mode entirely:

- You do not need any distance measurement and output modules, or any drive or encoder.

In this case, the following steps differ from the procedure described in Getting Started:

Step	Job																							
2	Not applicable.																							
3.5	Only change the following parameters once you have recreated the axis DB.																							
	<table border="1"> <thead> <tr> <th>Register</th> <th>Parameter</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>"Configuration"</td> <td>"Simulation mode"</td> <td>Engaged</td> </tr> <tr> <td rowspan="4">"Axis"</td> <td>"SW limit switch start"</td> <td>-100 000.0</td> </tr> <tr> <td>"SW limit switch end"</td> <td>100 000.0</td> </tr> <tr> <td>"Maximum axis velocity"</td> <td>50.0</td> </tr> <tr> <td>"Maximum axis acceleration"</td> <td>10.0</td> </tr> <tr> <td rowspan="2">"Encoder/controller/motor"</td> <td>"Maximum axis deceleration"</td> <td>10.0</td> </tr> <tr> <td>"Steps per encoder revolution"</td> <td>2048</td> </tr> <tr> <td></td> <td>"Controller gain"</td> <td>10.0</td> </tr> </tbody> </table>	Register	Parameter	Value	"Configuration"	"Simulation mode"	Engaged	"Axis"	"SW limit switch start"	-100 000.0	"SW limit switch end"	100 000.0	"Maximum axis velocity"	50.0	"Maximum axis acceleration"	10.0	"Encoder/controller/motor"	"Maximum axis deceleration"	10.0	"Steps per encoder revolution"	2048		"Controller gain"	10.0
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4	Entirely inapplicable. Start-up aids only function with a real drive.																							
5.2	Also copy FB MC_Simulation into your project.																							
5.4	After FC MC_Init, call FB MC_Simulation.																							
5.9	Not applicable.																							