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Faceplate for Editing the “Command Table”

SIMATIC S7-1200

<http://support.automation.siemens.com/WW/view/en/86221902>

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1 Task

1.1 Controller

1.1.1 SIMATIC S7-1200

The S7-1200 controller offers you the required flexibility and performance for controlling a wide range of devices for your automation solution. Compact design, flexible configuration and a high-performance command set makes the S7-1200 perfectly suitable for a variety of control applications.

Figure 1-1 SIMATIC S7-1200 (e.g. CPU 1215C DC/DC/DC)



The CPU comprises a micro-processor, an integrated power supply, input circuits and output circuits, integrated PROFINET, periphery for motion control at high-speed as well as integrated analog inputs in a compact housing and represents a powerful control. After your program has been downloaded, the CPU contains the required logic so you can monitor and control the devices in your application. The CPU monitors inputs and changes outputs using the commands of your user program, which can comprise Boolean operations, count and time functions, complex arithmetic operations and communication with other intelligent devices.

1.1.2 “Motion Control” with SIMATIC S7-1200

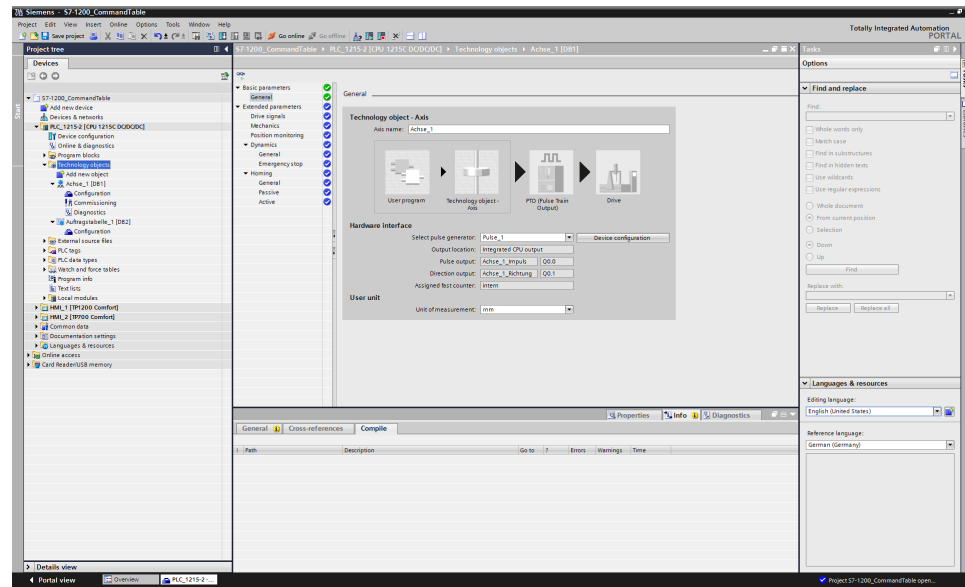
The S7-1200 CPU combines the functionality of a programmable logic controller with the Motion Control functionality for operating stepper and servo motors with pulse interface. The Motion Control functionality takes over control and monitoring of the drives.

1 Task

1.2 Technology object "Command table"

The DC/DC/DC variants of the S7-1200 CPU have on-board outputs for direct control of the drives. The relay variants of the CPU require an optimal signal board for controlling a drive.

Figure 1-2 Technology objects of the SIMATIC S7-1200 in the TIA Portal



Together with the "Motion Control" functionality of the S7-1200 CPU, the TIA Portal supports you in controlling stepper and servo motors with pulse interface:

- In TIA Portal, you configure the "Axis" and "Command table" technology objects. Using these technology objects, the S7-1200 CPU controls the pulse and direction outputs which control the drives.
- In the user program you control the axis with Motion Control instructions and to initiate motion commands of your drive.

1.2 Technology object "Command table"

Axis commands for technology object "Axis" can be saved as motion sequences in a table via the technology object "Command table" and be executed in the S7-1200 CPU.

In TIA Portal, the command table of the technology object can be filled with up to 32 commands. These motion commands can be executed in the S7-1200 CPU via technology function "MC_CommandTable".

The command table itself is stored in the control program of the S7-1200 CPU as technology data block. The command table can also be accessed via this data block during the runtime of the user program, and it can even be changed prior to the execution via technology function "MC_CommandTable". However, such modifications must be realized in the control program by means of access to the individual elements of a structure in the data block which represents each line of the command table.

1 Task

1.2 Technology object "Command table"

Figure 1-3 Technology object "Command table" – Basic parameters

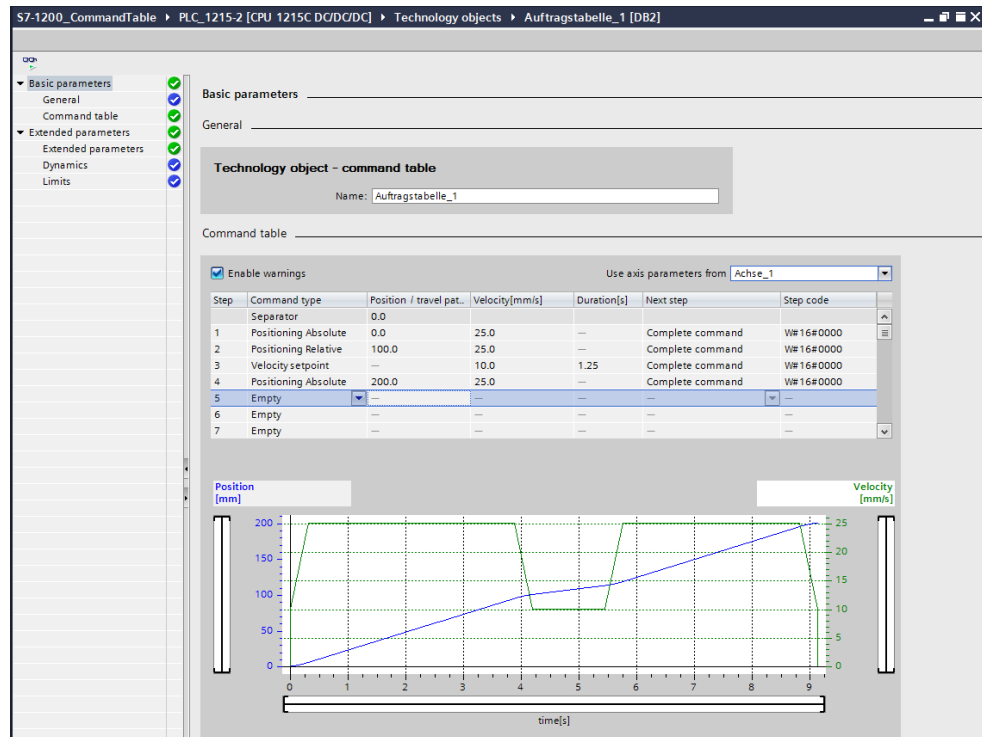
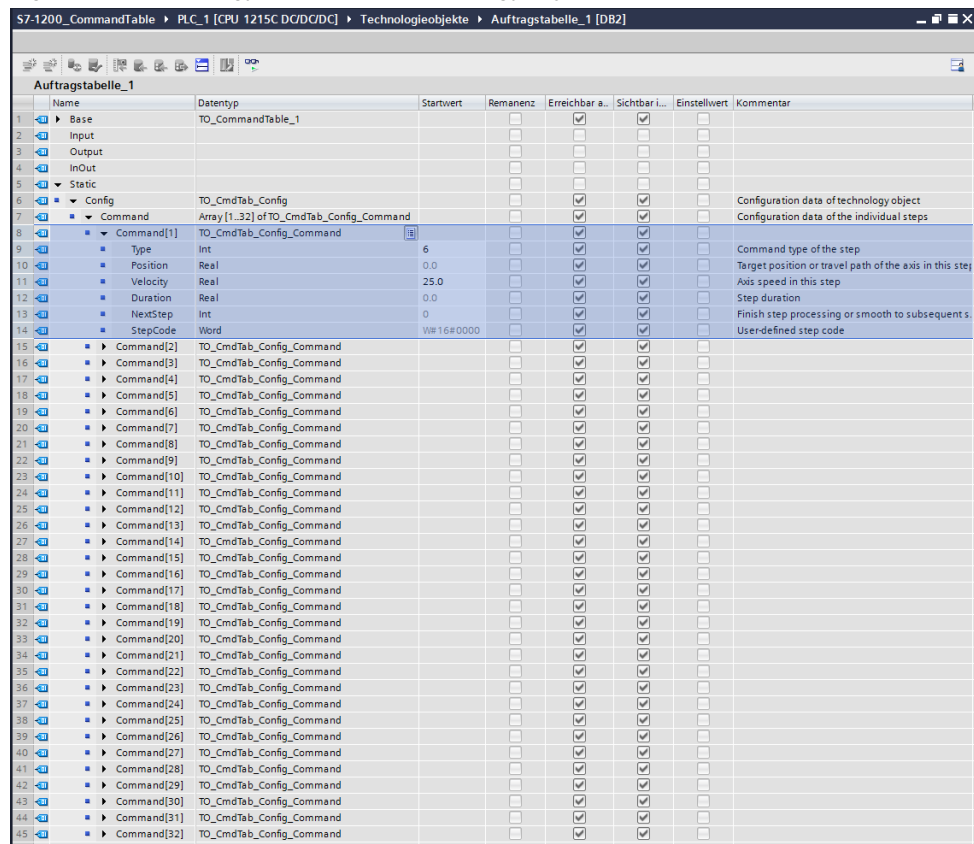


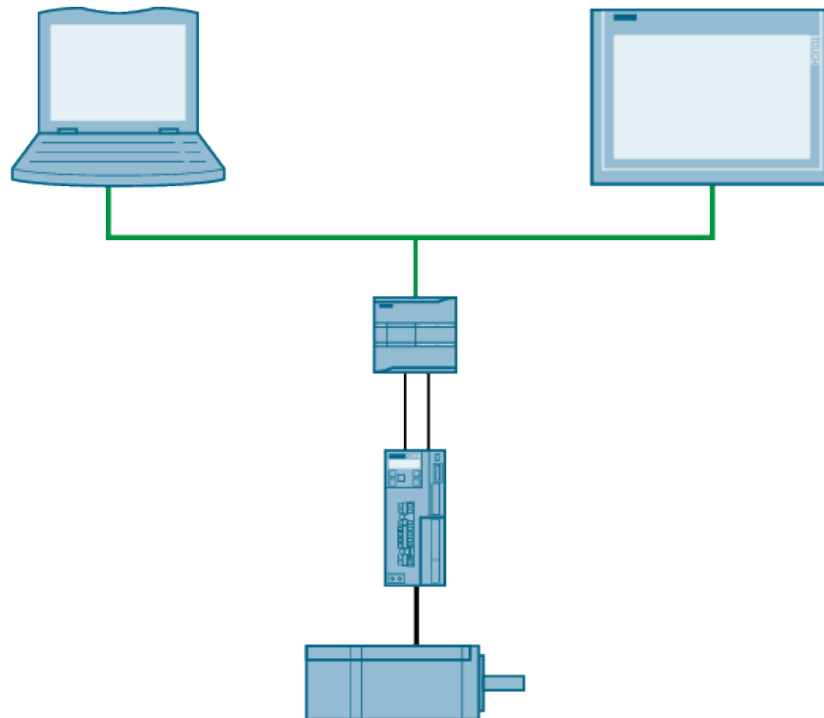
Figure 1-4 Technology data block of technology object "Command table"



1.3 Changing the “Command table” during program runtime

To be able to change the motion sequences stored in the “Command table” technology object during runtime of the user program as well, and without the TIA Portal engineering system, an access to the technology data block of the “Command table” must be realized via the HMI.

Figure 1-5 Overview of the automation task



In this document, a quick and simple option for realizing such an access to the motion sequences of the “Command table” technology object shall be illustrated.

Note

The explicit usage of the “command table” in an application, and commissioning the drive are not discussed in this documentation.

Further information is available in the documentation on the SIMATIC S7-1200 and the TIA Portal engineering system.

2 Solution

2.1 HMI faceplate "CommandTable Editor"

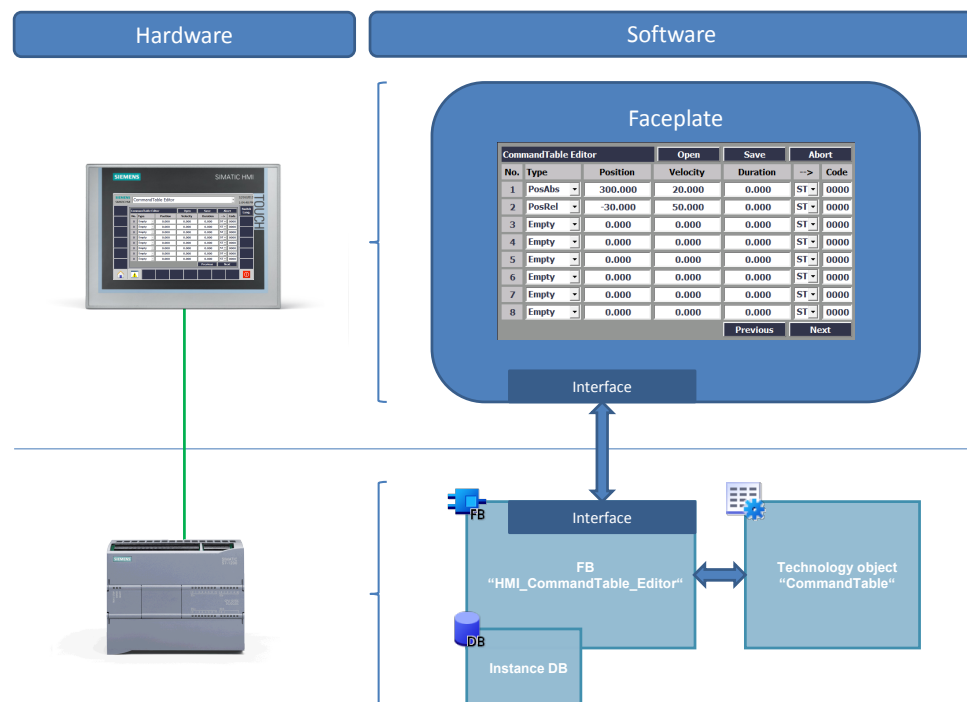
The quick and simple access to the "Command table" technology object of the HMI is, in this example, realized for the S7-1200 CPU with a faceplate and a respective function block. Here, the faceplate is the interface to the operator via the HMI. The respective function block realizes the actual access to the "Command table" technology object in the S7-1200 CPU.

2.1.1 Structure

A faceplate represents a coherent object consisting of different HMI objects which can be integrated easily and quickly into user-generated HMI interfaces via drag&drop.

In addition to this faceplate, this solution also has a function block in the CPU S7-1200, which makes the connection to the actual command table and provides the operator functionalities of the faceplate. This function block is used for defining the connection to the command table to be processed by the faceplate in the user program.

Figure 2-1 Overview of the principle of operation of the technology template



2.1.2 Advantages

The solution presented here has the following advantages for the user:

- Time and cost saving by means of prefabricated HMI elements and function blocks.
- Simple integration of the functionality into self-realized HMI user interfaces.
- Provision of the complete functionality for processing a command table during runtime of the user program via the HMI user interface.

2.1.3 Delimitation

This documentation does not contain a description of...

- ...creating and managing faceplates of the TIA Portal in WinCC.
- ...creating HMI user interfaces.
- ...the technology functions of the S7-1200 CPU for processing Motion Control functions, especially with regards to executing a command table existing in the S7-1200 CPU.

Basic knowledge of these topics is assumed.

2.2 Hardware and software components

2.2.1 Validity

This application is only valid for the following versions of the mentioned hardware and software components:

- all SIMATIC S7-1200 CPUs as of version V2.0
- SIMATIC Comfort Panels as of TP700 or higher
- STEP 7 as of version V12 SP1 (TIA Portal)
- WinCC as of version V12 SP1 (TIA Portal)

Note

The 100% size of the faceplate has been designed for SIMATIC Comfort Panel TP700 with a width of 640 pixels and a height of 360 pixels of the faceplate.

The faceplate can be adjusted to all other SIMATIC Comfort panels via the zoom function; however, the height of the dropdown lists cannot be adjusted. The height of these fields is connected to the text size of the field.

2.2.2 Components used

This application was generated with the following components:

Hardware components

Table 2-1

Component	No.	Order number	Note
CPU S7-1215C Variant: DC/DC/DC	1	6ES7 215-1AG31-0XB0	
Comfort Panel TP700 Comfort	1	6AV2 124-0GC01-0AX0	Smallest Comfort panel for the display of the faceplate.
Comfort Panel TP1200 Comfort	1	6AV2 124-0MC01-0AX0	Alternative to TP700 Comfort

Note

If the relay variant DC/DC/RLY of the S7-1200 CPU is used, an additional signal board is required for controlling the drive via pulse and direction output.

Software components

Table 2-2

Component	No.	Order number	Note
STEP 7 Professional V12 SP1 Update 2	1	6ES7 822-1AA02-0YA5	Including TIA Portal
WinCC Comfort V12 SP1 Update 2	1	6AV2 101-0AA02-0AA5	

Note

When working only with the SIMATIC CPUs of the S7-1200 product family, the STEP 7 Basic software is sufficient as engineering system and can be used as an alternative to STEP 7 Professional.

Sample files and projects

The following list includes all files and projects that are used in this example.

Table 2-3

Component	Note
86221902_S7-1200_Faceplate_CommandTable_CODE_v10.zip	This zipped file contains the faceplate for the adaptation into user-created automation projects.
86221902_S7-1200_Faceplate_CommandTable_DOKU_v10_e.pdf	This document.

3 Basics

3.1 Faceplates

Faceplates represent prefabricated HMI objects contained in the delivery scope of a TIA Portal library and which can be adopted in a user-created HMI interface via drag&drop.

A faceplate usually has a simple and defined interface used for making the connection with the SIMATIC CPU.

Note

Not all operating devices support any display and operator object. The faceplates which are not available at the respective operating device are not displayed when using the faceplate.

3.2 Motion Control with S7-1200

In the SIMATIC S7-1200 CPUs, the control of stepper and server motors can be realized easily and quickly with pulse interface via the "Motion Control" functionality of the TIA Portal.

In TIA Portal, the "Axis" technology object representing the interface of the user program to the drive is configured respectively. The pulse and direction outputs of the SIMATIC S7-1200 used for moving the axis are controlled via this technology object.

Additionally, the TIA Portal also contains the "Command table" technology object in which a list of instructions for the "Axis" technology object can be stored.

In the user program, the technology objects are then controlled using Motion Control instructions, the co-called technology function blocks, and the desired motion of the axis is initiated.

A separate technology function "MC_CommandTable" is available for processing the instructions for an axis stored in the "Command table" technology object.

Note

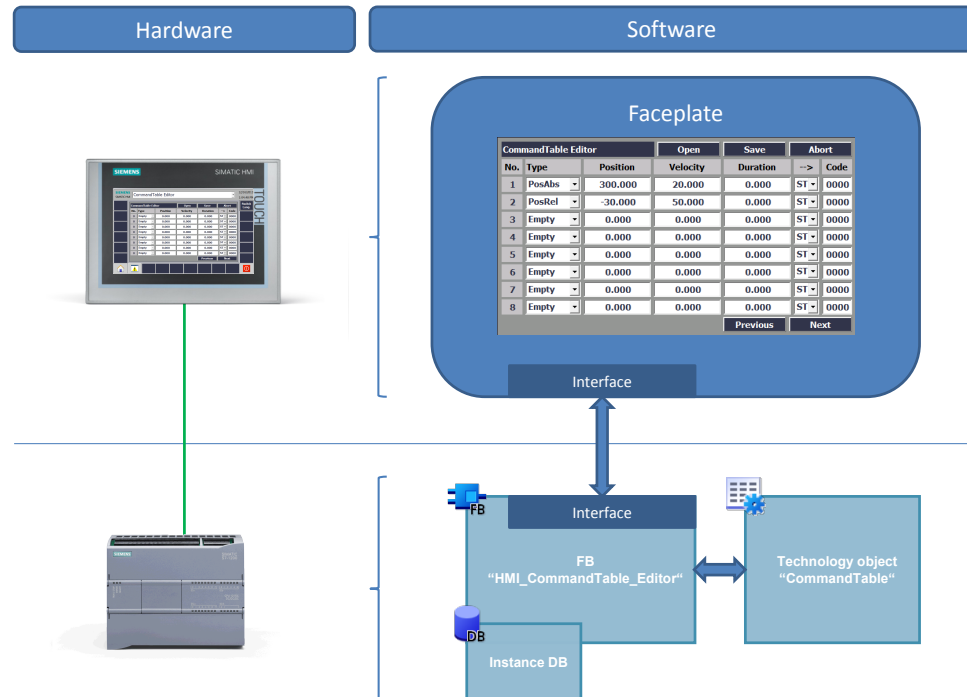
For more detailed information on the Motion Control functionality of the S7-1200 please refer to the manual or the online help on the TIA Portal.

4 Principle of Operation

4.1 Overview

The figure below gives you a general overview of the access of the HMI faceplate to the command table in the S7-1200 CPU.

Figure 4-1 Overview of the principle of operation of the technology template



4.2 “CommandTable_Editor” faceplate

The faceplate represents the interface for the operator or user. The faceplate can be integrated quickly and easily into an HMI user interface via drag&drop and has an interface that matches the respective “HMI_CommandTable_Editor” function block.

The command table connected with the respective function block in the S7-1200 CPU can be opened, edited and saved in the HMI user interface via the faceplate.

The execution of the command table by the respective axis is not contained in this technology template or faceplate and needs to be programmed separately by the user.

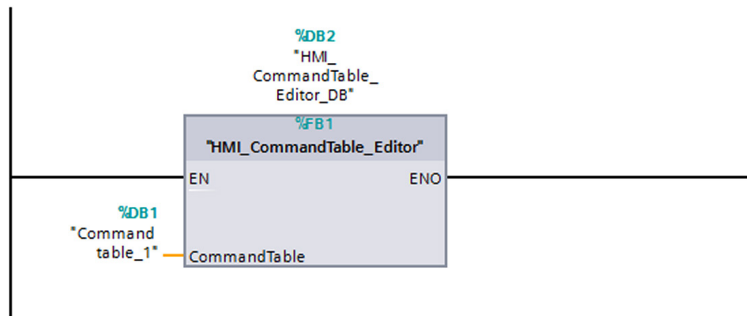
4.3 Function block “HMI_CommandTable_Editor”

The “HMI_CommandTable_Editor” function block maps the function of the faceplate within the user program of the S7-1200 CPU. The faceplate in the HMI user interface is connected with the function block via one interface only.

4.4 Technology object "Command table"

The data definition of the interface is stored in the TIA Portal in PLC data type "UDT_CommandTable", which is supplied together with the faceplate. The interface is located in the "static data area" of the instance data block of the "HMI_CommandTable_Editor" function block.

Figure 4-2 Function block "HMI_CommandTable_Editor"

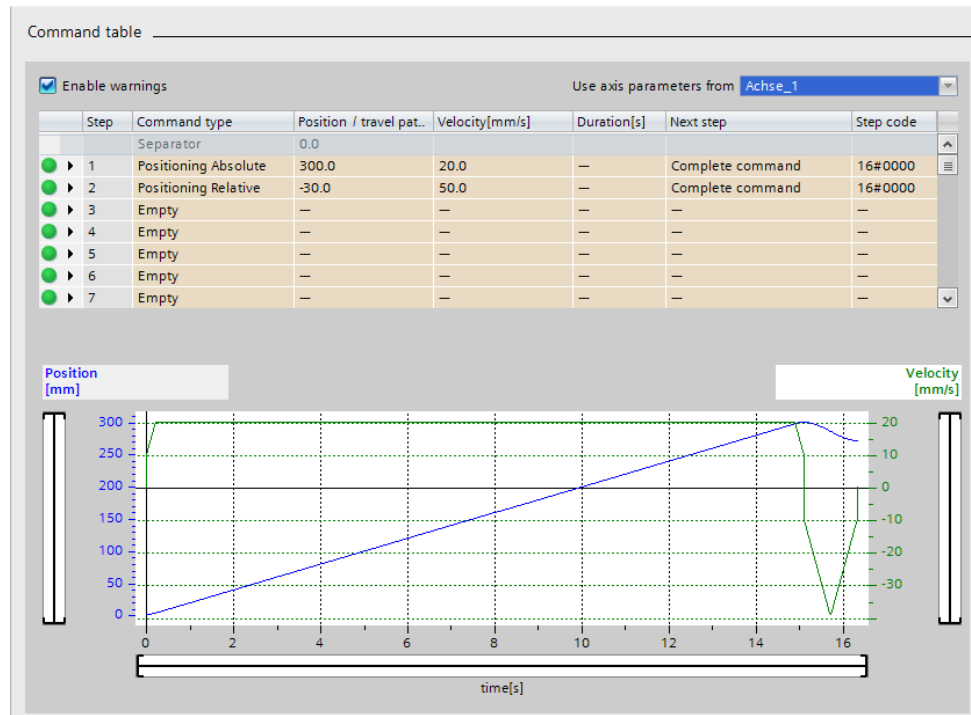


When generating the user program of the S7-1200 CPU, the command table is defined via the "CommandTable" input of FB "HMI_CommandTable_Editor", which can be influenced via the faceplate.

4.4 Technology object "Command table"

The actual table of the motion commands is stored in technology object "Command table".

Figure 4-3 Technology object "Command table" in the TIA Portal



4.4 Technology object "Command table"

In the TIA Portal, the current state of command table or "Command table" technology object can be monitored and checked in online mode. This also enables monitoring and tracking the changes made to the table via the faceplate.

Note

The assignment of the axis controlled by the command table, however, is only specified via technology block "MC_CommandTable" when calling up the execution of the command table. At the "CommandTable" input of this block, the command table is combined with the axis defined at the "Axis" input.

5 Installation and Commissioning

5.1 Introduction

The technology template with the faceplate for the HMI and the respective function block is supplied as library for the TIA Portal. All of the elements required for the technology template can hence be quickly integrated into the TIA Portal and added to your user project.

5.2 Integrating the library into TIA Portal

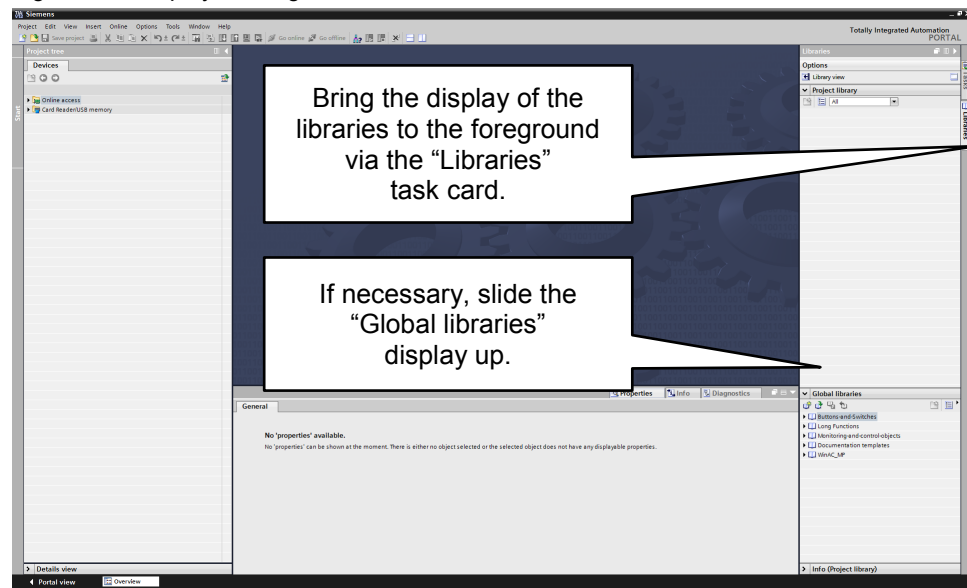
5.2.1 Global library as ZIP-archive

The global library of the technology templates is supplied as a ZIP-archive. Therefore, you unzip the ZIP-archive into a suitable folder on your PC from where you wish to open the global library.

5.2.2 Open a global library

In the TIA Portal you call the display of the global library from which you wish to open the library of the technology templates.

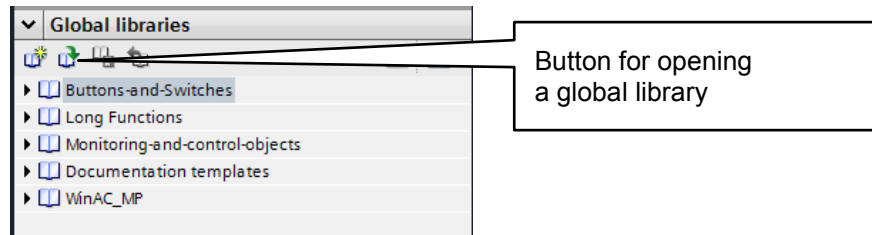
Figure 5-1 Display of the global libraries



In the display of the global libraries you can now open the library of the technology template which you unzipped via the ZIP-archive.

Press the respective button for opening a library, select the storage location where you unzipped the ZIP-archive and the library file, and press the "Open" button of the dialog.

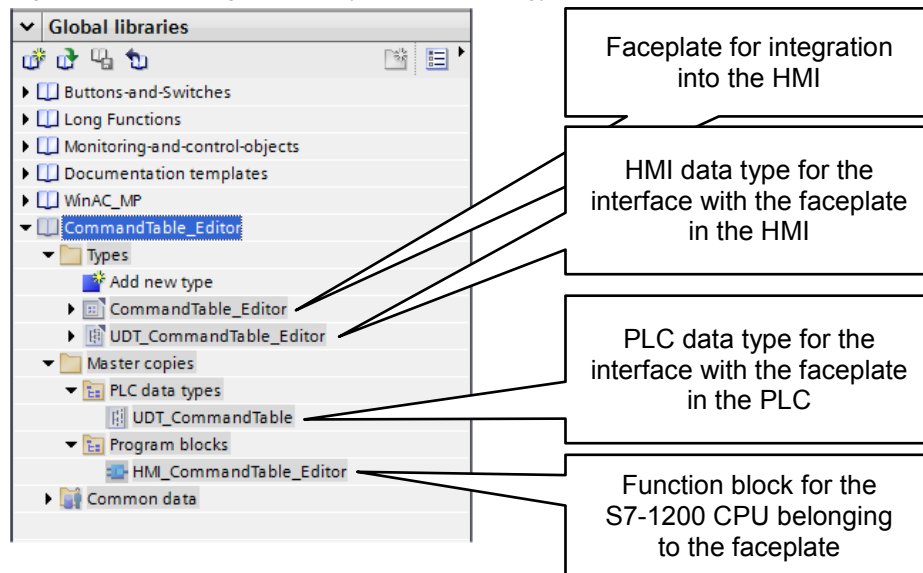
Figure 5-2 Opening the global library



In the opened global library of the technology template you now see all contained components structured as follows:

- Types
Here, the components for the faceplate of the HMI are stored.
- Master copies
Here, the function block, which is part of the faceplate and the PLC data type for the interface tag, is stored in the S7-1200 CPU of the faceplate.

Figure 5-3 Opened global library of the technology template



Note The elements of the global library are shaded gray in the above figure since the “CommandTable_Editor” library was opened write protected (default setting when opening a library).

5.2.3 Adopting elements of the library into the user program

The elements contained in the global library can be adopted directly into your own user programs.

5 Installation and Commissioning

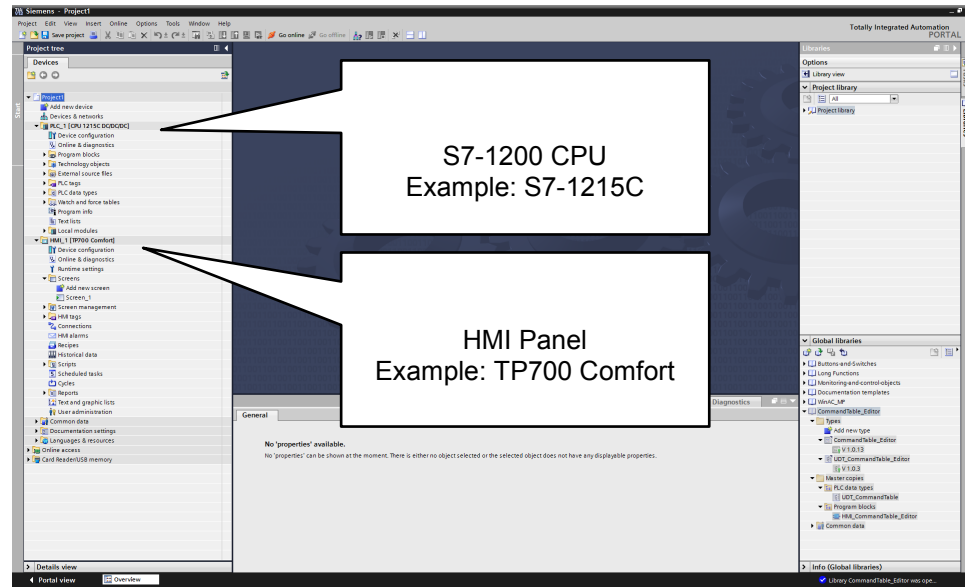
5.3 Integrating the function block into the program

5.3 Integrating the function block into the program

5.3.1 Adopting the function block into the user program

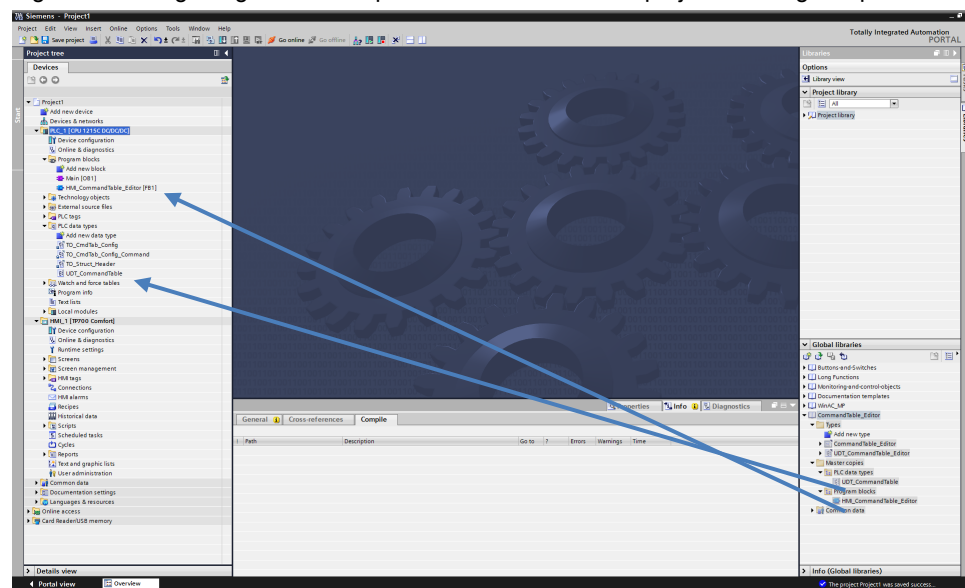
First, you generate a new TIA Portal project with an S7-1200 CPU and a Comfort panel, or open an already existing TIA Portal project into which you wish to integrate the technology template.

Figure 5-4 Create new project



In order to adopt the function block from the technology template into your user program, move the “HMI_CommandTable_Editor” block from the global library into the block folder of the S7-1200 CPU of your TIA Portal project via drag&drop.

Figure 5-5 Integrating master templates into the TIA Portal project via drag&drop



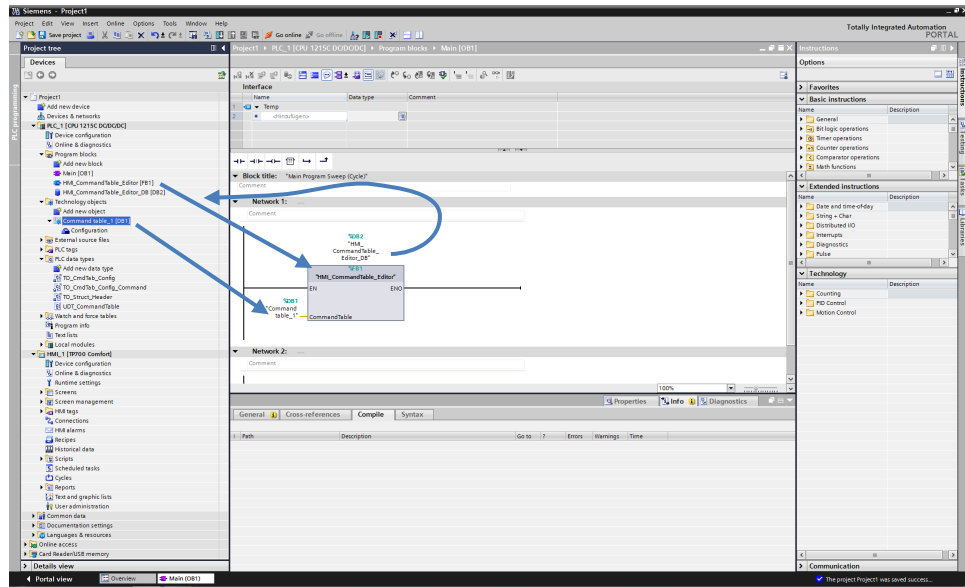
5 Installation and Commissioning

5.3 Integrating the function block into the program

5.3.2 Calling the function block in the user program

To be able to use the function block of the technology template in the user program, it needs to be called up in a cyclic organization block, e.g. OB 1 “Main”, and be connected with the desired “Command table” technology object, which needs to be created new or already exists in the user program.

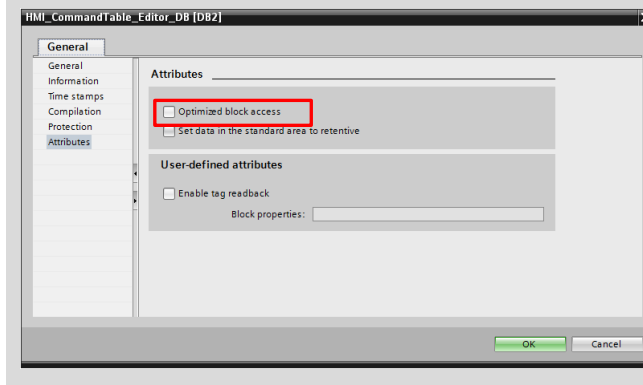
Figure 5-6 Calling the function block in the cyclic organization block (e.g. OB 1)



Note

The instance data block of FB “HMI_CommandTable_Editor” must not be created in the S7-1200 CPU with the attribute “Optimized block access”.

If necessary, you check the settings the settings of the attributes via the context menu of the “Properties” instance data block:



This completes the integration of the technology template into the user program of the S7-1200 CPU.

5 Installation and Commissioning

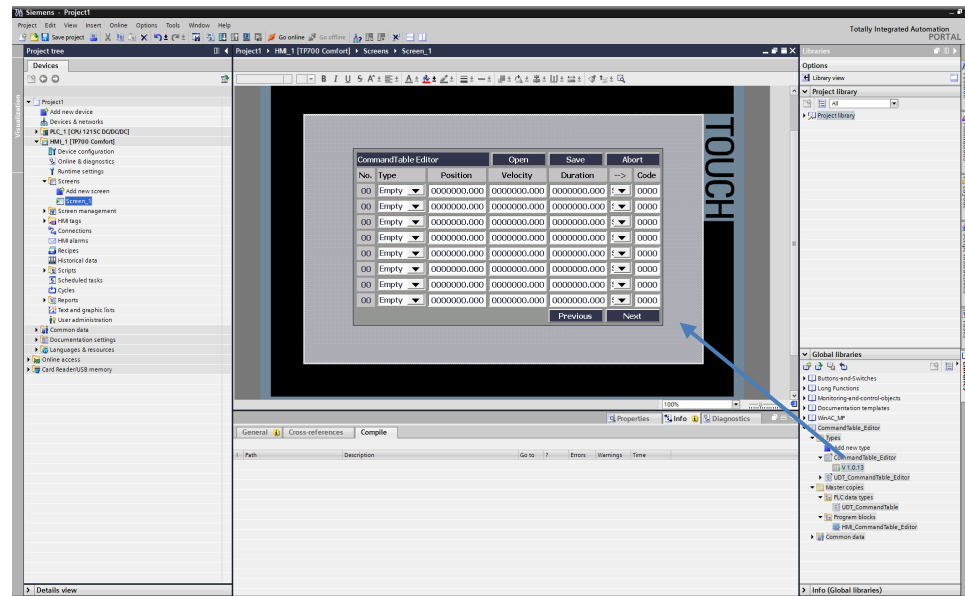
5.4 Integrating the faceplate into the HMI

5.4 Integrating the faceplate into the HMI

5.4.1 Integrating the faceplate in the HMI

Integrating the faceplate into the HMI user interface only requires moving the “CommandTable_Editor” faceplate from the “Types” folder of the global library to the desired HMI screen on the panel via drag&drop.

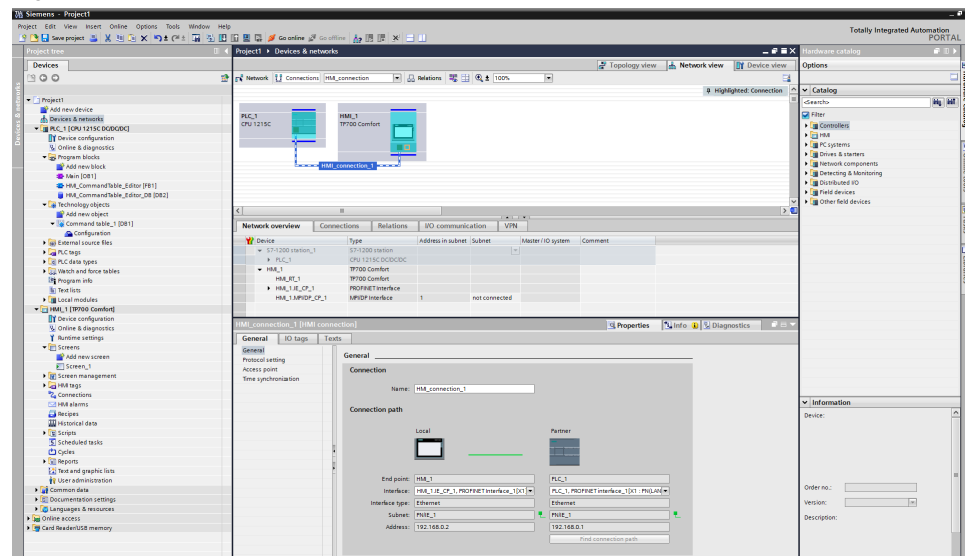
Figure 5-7 Integrating the faceplate into the HMI user interface



5.4.2 Connecting the data interface with the function block

A prerequisite for connecting the faceplate with the respective function block in the S7-1200 CPU is the existence of an HMI connection between the HMI panel and the S7-1200 CPU.

Figure 5-8 HMI connection between panel and CPU

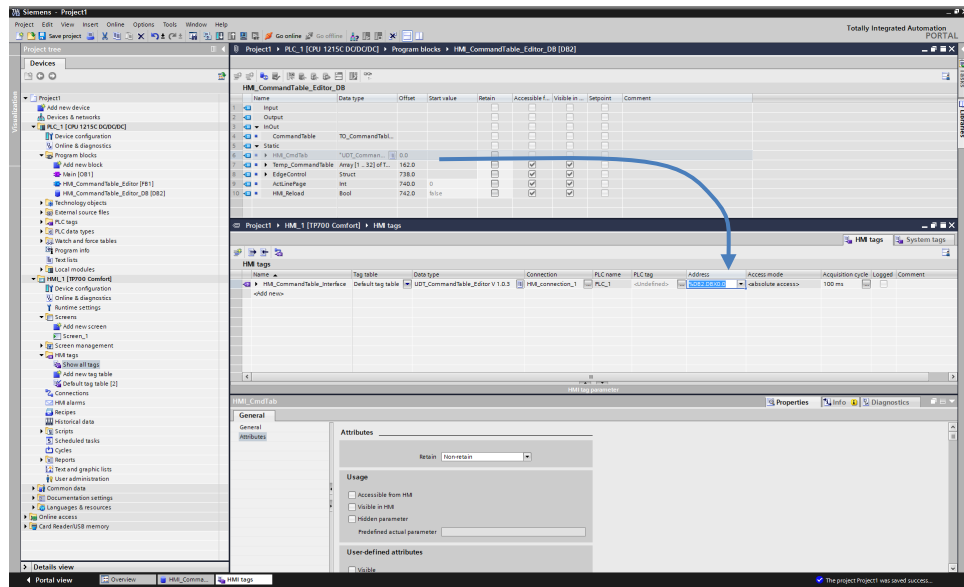


5 Installation and Commissioning

5.4 Integrating the faceplate into the HMI

Furthermore, an HMI tag must be created for connecting the HMI user interface to the S7-1200 CPU connected to the instance data block of the respective function block of the faceplate via absolute addressing.

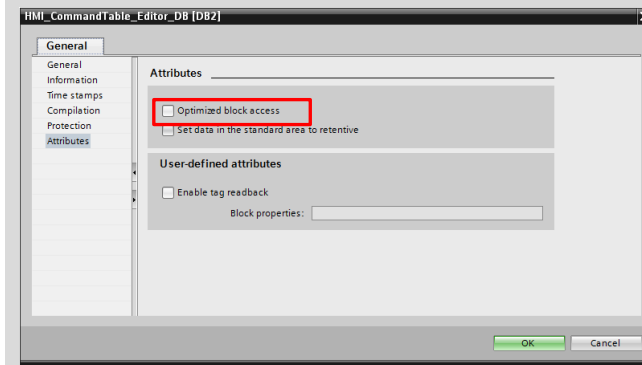
Figure 5-9 Creating an HMI tag with absolute access to the instance DB



Note

The instance data block of FB “HMI_CommandTable_Editor” must not be created in the S7-1200 CPU with the attribute “Optimized block access”.

If necessary, you check the settings the settings of the attributes via the context menu of the “Properties” instance data block:

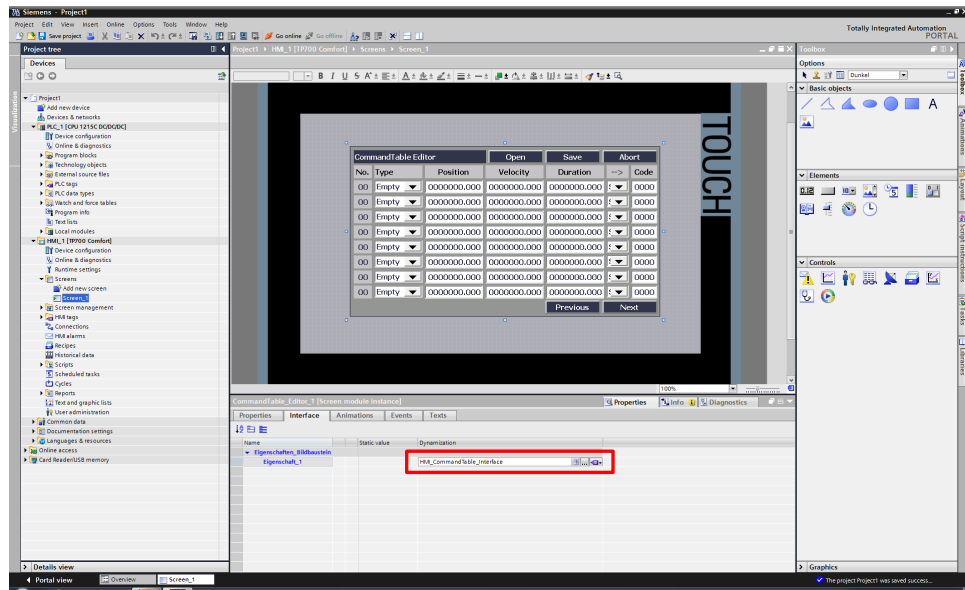


In the HMI user interface, the faceplate can now be connected to the instance data block of the “HMI_CommandTable_Editor” in the S7-1200 CPU via the created HMI tag.

5 Installation and Commissioning

5.4 Integrating the faceplate into the HMI

Figure 5-10 Assignment of the HMI tags at the interface of the faceplate



Installation and commissioning of the faceplate has now been completed.

6 Operation of the Application

6.1 Overview

The editor gives you access to all data of the command table connected to the respective function block and can check and modify these during runtime of the user program.

Figure 6-1 Editor (faceplate) – Display language “German”

Editor zur Auftragsstabelle						Öffnen	Speichern	Verwerfen
Nr.	Typ	Position	Geschw.	Dauer	-->	Code		
1	PosAbs	300,000	20,000	0,000	ST	0000		
2	PosRel	-30,000	50,000	0,000	ST	0000		
3	Leer	0,000	0,000	0,000	ST	0000		
4	Leer	0,000	0,000	0,000	ST	0000		
5	Leer	0,000	0,000	0,000	ST	0000		
6	Leer	0,000	0,000	0,000	ST	0000		
7	Leer	0,000	0,000	0,000	ST	0000		
8	Leer	0,000	0,000	0,000	ST	0000		
							Zurück	Weiter

Figure 6-2 Editor (faceplate) – Display language “English”

CommandTable Editor						Open	Save	Abort
No.	Type	Position	Velocity	Duration	-->	Code		
1	PosAbs	300.000	20.000	0.000	ST	0000		
2	PosRel	-30.000	50.000	0.000	ST	0000		
3	Empty	0.000	0.000	0.000	ST	0000		
4	Empty	0.000	0.000	0.000	ST	0000		
5	Empty	0.000	0.000	0.000	ST	0000		
6	Empty	0.000	0.000	0.000	ST	0000		
7	Empty	0.000	0.000	0.000	ST	0000		
8	Empty	0.000	0.000	0.000	ST	0000		
							Previous	Next

The editor is operated via the respective keys at the editor, which have the following functions and are discussed in greater detail in the chapters below:

- Open
Open the command table connected to the function block in the editor.
- Save
Saves the changes made in the editor to the command table.

6.2 Opening the command table

- **Abort**
Rejects the changes made in the editor and does not save in the command table.
- **Previous / Next**
Scrolling through the individual display pages (respectively 8 lines per page) of the editor for the 32 lines of the command table. The current line number is here displayed in the first column of the editor.

6.2 Opening the command table

The “Open” button opens the command table connected with the “CommandTable” input at the respective function block for processing via the faceplate. The data of the command table is here copied to the internal memory of the function block and displayed via the faceplate.

When the command table has been opened, use the “Previous” and “Next” keys to scroll through the entire table. When the command table has been opened, the numbers of the currently displayed lines in the command table are displayed in the “No” column of the faceplate.

6.3 Editing the command table

If the command table has been opened, the parameters of all lines in the command table are edited via the input fields of the faceplate.

The following parameters exist in the command table and can partly be modified with the input help via dropdown lists:

Table 6-1 Parameters of the command table

Parameter		Function
German	English	
Nr.	No.	Line number of the command table (1 to 32) The line number is only displayed in the faceplate and forms the reference to the array entry in the data block of the command table.
Typ	Type	Command for the Motion Control function to be executed when processing the command table.
Position	Position	Target position or travel path for the selected Motion Control function.
Geschwindigkeit	Velocity	Travel velocity for the selected Motion Control function.
Dauer	Duration	Specified travel duration for axis motions at constant speed, or wait time for the wait command.
→ (Übergangs- verhalten)	→ (Blending Mode)	Defining the transition behavior from the Motion Control function currently executed via the command table to the next Motion Control function.

6 Operation of the Application

6.3 Editing the command table

Parameter		Function
German	English	
Code	Code	Assigning a number value or a bit pattern to be output at output parameter "StepCode" of the "MC_CommandTable" during processing the command.

The following commands or command types are available for specifying the Motion Control functions of the command table via the faceplate:

Table 6-2 Command types of the command table

Command		Command code in the DB	Function
German	English		
Leer	Empty	0	The entry serves as a wildcard for possibly added commands. When processing the command table, this entry is ignored.
Halt	Halt	2	Stops the axis. The command only becomes effective after a "Velocity" command.
PosRel	PosRel	5	Relative positioning of the axis relatively by the given travel length.
PosAbs	PosAbs	6	Absolute positioning of the axis relatively on the given target position.
Geschw.	Velocity	7	Moving the axis at the given velocity.
Warten	Wait	151	Waiting until the given duration has elapsed. Then the next command is executed. Note: However, this command does not stop any running travel motion!

The following settings can be selected for defining the transition behavior from the Motion Control function currently executed via the command table to the next Motion Control function.

Table 6-3 Parameter selection for defining the transition behavior

Parameter selection		Parameter code in the DB	Function
German	English		
ST (Stopp)	ST (Stop)	0	Completing the command The currently running command is fully completed. The axis motion is brought to standstill at the given target position. The next command is attached without any time delay.

6.4 Saving the performed changes

Parameter selection		Parameter code in the DB	Function
German	English		
ÜS (Über- schleifen)	BL (Blending)	1	<p>Blending the motion</p> <p>The motion of the current command is blended with the motion of the subsequent command, i.e., the axis does not stand still between the motions.</p> <p>The "blending motion" mode is only effective for the following command types:</p> <ul style="list-style-type: none"> • PosRel – Relative positioning • PosAbs – Absolute positioning <p>The current motion can only be blended with the following motion types:</p> <ul style="list-style-type: none"> • PosRel – Relative positioning • PosAbs – Absolute positioning • Velocity – Traversing at a defined velocity <p>No blending with other motion types.</p>

Note

The detailed behavior of the axis when attaching or blending a job is available in function manual 08/2013 (V4) "SIMATIC STEP 7 - S7-1200 Motion Control V12 SP1" in chapter: Transition from "Complete command" to "Blend motion" (on page 71)

6.4 Saving the performed changes

Pressing the "Save" button transfers (saves) the changes made to the command table displayed in the faceplate to the command table in the CPU, and the command table in the faceplate is closed.

The performed changes in the command table are only available in the CPU and can be processed there after saving.

Pressing the "Save" button, returns the data saved in the instance data block of the respective function block to the command table technology object in the CPU.

6.5 Rejecting the performed changes

Pressing the "Abort" button rejects the changes made to the command table displayed in the faceplate and prevents them from being transferred to the command table in the CPU. The command table is also closed again in the faceplate.

The performed changes are hence lost and not available in the CPU for processing via the command table.

7 Literature

Table 7-1

	Topic	Title
\1\	Siemens Industry Online Support	http://support.automation.siemens.com
\2\	Download page of the entry	http://support.automation.siemens.com/WW/view/en/86221902
\3\	SIMATIC S7-1200	System Manual "SIMATIC S7-1200 Automation system" Edition: 04/2012 Document ID Number: A5E02486681-06 http://support.automation.siemens.com/WW/view/en/36932465
\4\	SIMATIC S7-1200	Function Manual "SIMATIC STEP 7-1200 Motion Control V12 SP1" Edition: 08/2013 Document ID Number: A5E03790550-02 http://support.automation.siemens.com/WW/view/en/80384402
\5\	SIMATIC WinCC (TIA-Port.)	System Manual "WinCC Advanced V12.0 SP1" Edition: 07/2013 Document ID Number: http://support.automation.siemens.com/WW/view/en/78318776
\6\	SIMATIC WinCC (TIA-Port.)	System Manual "WinCC Professional V12.0 SP1" Edition: 07/2013 Document ID Number: http://support.automation.siemens.com/WW/view/en/78327231

8 History

Table 8-1

Version	Date	Modifications
V1.0	01/2014	First version