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Application Example • 03/2016

Time Synchronization with an HMI Operator Panel and a SIMATIC PLC

WinCC V13 SP1, Comfort Panels, S7-1200/S7-1500 and S7-300/S7-400



https://support.industry.siemens.com/cs/ww/de/view/69864408

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1.1 Introduction

1 Task

1.1 Introduction

In order for components such as HMI operator panels and SIMATIC controllers of a plant to operate with an identical time, one of the listed components has to be the timer for all other components.

- The component acting as the timer is called the time master.
- The time receiving components are the time slaves.

The application shows the respective time synchronization options and their implementation in the program.

Use the selection aid to select the time synchronization option that suits your requirements. For more information, please see chapter 2.1.1.

1.2 Overview of the automation task

The figure below provides an overview of the automation task. Figure 1-1



Description of the automation task

Entry ID: 69864408, V4.1, 03/2016

In a plant, there are several HMI operator panels that exchange data with a SIMATIC PLC.

The following tasks are to be implemented:

- 1. For the first task, a SIMATIC PLC is to be the timer component (SIMATIC PLC \rightarrow HMI operator panel).
- 2. For the second task, an HMI operator panel is to be the timer component (HMI operator panel \rightarrow SIMATIC PLC).

2 Solution

2.1 Overview of the overall solution

WinCC TIA Portal offers various solutions for the tasks described in chapter 1. The solutions depend on

- the SIMATIC PLC used.
- the time synchronization required.
- the HMI operator panel used.

2.1.1 Selection aid

The PLC is normally used as the time master (timer component). However, it is also possible that the operator panel is the time master. This allows the user to specify, for example, the time using the operator panel (start value) and then the PLC applies the time synchronization as it has a higher accuracy.

The following figure supports you in selecting the different time synchronization variants.

Figure 2-1



2.1.2 Supported HMI operator panels:

- Basic Panels
- Comfort Panels
- Mobile Panels
- RT Advanced
- Multi Panels

The diagrammatic representation below shows the different time synchronization variants between the above-listed operator panels and the SIMATIC controllers.

Table	-2-1
TUDIC	

	S7-1200	S7-1500	S7-300	S7-400
HMI time synchronization (master) \rightarrow see sample project for variant 1	X ¹	X²		
HMI time synchronization (slave) \rightarrow see sample project for variant 1	X3	X ⁴		
Area pointer: DateTimePLC \rightarrow see sample project for variant 2	Х	Х	х	Х
Area pointer: DateTime \rightarrow see sample project for variant 3	Х	Х	Х	Х
Area pointer: JobMailbox (controller job 14 and 15) \rightarrow see sample project for variant 4	Х	х	х	х

The following chapters provide a more detailed description of the individual "time synchronization" variants.

¹ Except Basic Panels

² Except Basic Panels

³ WinCC V12 or higher also Basic Panels

⁴ WinCC V12 or higher also Basic Panels

2.1.3 Description of the time synchronization variants

The following sections provide a brief description of the individual time synchronization variants and list the functional differences.

Variant 1

Variant 1 allows the user to parameterize the operator panel as a master or slave. The functionality is only supported when using a SIMATIC S7-1200 / S7-1500 as the communications driver.

Table 2-2

Timer component (master): Operator panel or S7-1200 / S7-1500

Transferring date and time via an integrated system function

If you are using a SIMATIC S7-1200 / S7-1500, the only thing you have to do is select whether the operator panel will be the time master or slave. This is done in the "HMI configuration", "HMI time synchronization mode" option.

No other settings are required.

If, for example, the PLC is the time master, the time on the operator panel will be automatically synchronized with the PLC time every 10 minutes.

- For more information, please refer to the "Basics" chapter, <u>3.1</u>.
- For a configuration guide, please see chapter <u>5.1</u>

Note Variant 1 is the variant recommended for the current HMI device generation (e.g., Comfort Panels) in conjunction with the SIMATIC S7-1200 / S7-1500 controllers.

Variant 2

This variant is recommended when the PLC is the time master and you want synchronization to be performed automatically and continuously in a fixed time frame.

Table 2-3

Timer component (master): S7-1200 / S7-1500 / S7-300 / S7-400

Transferring date and time together

Date and time synchronization is performed on the operator panel in a fixed cycle. The current PLC system time is read out via the PLC program and the value is transferred to the "DateTimePLC" area pointer.

The refresh cycle of the area pointer is permanently stored in the HMI configuration. The time selected should not be less than 1 minute.

- For information on the area pointer, please refer to the "Basics" chapter, <u>3.2.1</u>.
- For a configuration guide, please see chapter <u>5.2.</u>

Variant 3

This variant is recommended when the PLC is the time master and you want to **manually** trigger the time for the synchronization.

Table 2-4

Timer component (master): S7-1200 / S7-1500 / S7-300 / S7-400

Transferring date and time separately

The date and time of the operator panel can be separately synchronized with the PLC system time.

The time for the synchronization is specified manually, for example, by pressing a button on the operator panel.

In terms of the example, a function block was created that facilitates handling time synchronization. The function block evaluates the "JobMailbox" area pointer (controller job 14 and 15) and transfers the data to the operator panel.

- Chapter <u>4.3</u> provides detailed information on the structure of the function block used, "FB120" or "FB210".
- For a configuration guide, please see chapter <u>5.3</u>.

Variant 4

This variant is recommended when the operator panel is the time master and you want to manually specify the time for the synchronization.

Table 2-5

Timer component (master): HMI operator panel

Transferring date and time together

Synchronization of the PLC system time with the operator panel system time is performed manually, for example, by pressing a button on the operator panel.

In terms of the example, a function block was created that facilitates handling time synchronization. The function block evaluates the "DateTime" area pointer and the "JobMailbox" area pointer (controller job 40) and transfers the operator panel data to the PLC.

- Chapter <u>4.2</u> provides detailed information on the structure of the function block used, "FB110" or "FB210".
- For a configuration guide, please see chapter <u>5.4</u>.

2.2 Description of the core functionality

2.2 Description of the core functionality

The core functionality is the implementation of the time synchronization variants described in chapter 2.1.3 (variants 1 to 4).

For each of the different time synchronization variants, the application is supplied with a sample project and an "FB_TimeSyn" TIA Portal library file.

You can customize the configurations to your tasks as needed.

The following chapters of the application provide a detailed description of the individual projects.

• Variant 1: Project_01 (includes two projects)

Note: For SIMATIC S7-1200 / S7-1500 only.

- HMI time synchronization (master).
 In this application, the operator panel is the timer component.
- HMI time synchronization (slave).
 In this application, the SIMATIC PLC is the timer component.
- Variant 2: Project_02 In this application, the SIMATIC PLC is the timer component.
 - Variant 3: Project_03 In this application, the SIMATIC PLC is the timer component and the operator panel's date and time can be synchronized independently of each other.
- Variant 4: Project_04 In this application, the operator panel is the timer component.
- TIA Portal library: FB_TimeSyn Contains the function blocks used in the projects, FB110; FB120 (FB210; FB220), and the "DB10" data block with the data areas of the individual area pointers. As an alternative, copy the appropriate blocks from the projects.

Scope

This application does not include a description of ...

- the SIMATIC PLC used.
- the HMI operator panels used.
- the WinCC V12 configuration user interface.

Basic knowledge of these topics is required. If necessary, please refer to the appropriate manuals. For a list of manuals, please see chapter $\underline{8}$ "Links & Literature".

2.3 Hardware and software components used

Required knowledge

Implementing time synchronization via area pointers requires basic knowledge of the STEP 7 configuration.

2.3 Hardware and software components used

The application was created with the following components:

Hardware components

Table 2-6

Component	No.	Article number	Note
CPU S7-1200 CPU 1212C DC/DC/DC	1	6ES7 212-1AD30-0XB0	All S7-1200 / S7-1500 controllers can be used.
CPU S7-300 CPU 315-2 PN/DP	1	6ES7 315-2EH14-0AB0	All S7-300 / S7-400 controllers can be used.
TP1200 Comfort Panel	1	6AV2124-0MC01-0AX0	All WinCC (TIA Portal) operator panels can be used. See notes in the documentation.

Standard software components

Table 2-7

Component	No.	Article number	Note
WinCC Advanced V13 SP1	1	6AV2102-0AA03-0AA5	Depending on the operator panel used, WinCC V13 Basic or higher.
STEP 7 Professional V13 SP1	1	6ES7822-1AA03-0YA5	A CPU S7-1500 can be used for WinCC V13 or higher.

Sample files and projects

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

Table 2-8

Component	Note
69864408_WinCC_TimeSyn_CODE_v40.zip	This zip file contains the STEP 7 project and the HMI project.
The zip file contains four sample projects and a library file with four function blocks.	
 Project_01 (variant 1) HMI time synchronization (master) HMI time synchronization (slave) Project 02 (variant 2) 	
- The SIMATIC PLC is the timer component.	

2.3 Hardware and software components used

	Component	Note
٠	Project_03 (variant 3)	
	 The SIMATIC PLC is the timer component. Date and time of the operator panel can be synchronized independently of each other. 	
•	Project_04 (variant 4)	
	- The HMI operator panel is the timer component.	
•	Libraries (FB_TimeSyn)	
	 Contains the function blocks used in Project_03 and Project_04, FB110; FB120 (FB210; FB220), and the DB10 data block with the data areas of the individual area pointers. 	
698	364408_WinCC_TimeSyn_DOKU_v41_e.pdf	This document.

3.1 HMI time synchronization mode

3 Basics

Introduction

The aim of this chapter is to provide a technical overview of the functions, area pointer blocks and system data blocks used in the different time synchronization variants.

This chapter is not relevant to implementing the tasks.

3.1 HMI time synchronization mode

Concerns time synchronization variant 1

If an S7-1200 or S7-1500 controller is selected as a communication partner in the WinCC engineering system, one of the following options can be selected in the connection settings in "HMI time synchronization mode".

- None: No time synchronization is used.
- Master: The operator panel specifies the time. If multiple operator panels are used, one operator panel is configured as the "master" and all other operator panels are configured as "slaves".
- Slave: The PLC specifies the time.

For this type of time synchronization, **no** further configuration steps are needed. Select menu view in the HMI configuration.

Figure 3-1

ð	Connections to S7 PLCs in Devices & Networks									
	Connections									
		Name	Communication driver	HMI time synchronization mode	Station	Partner				
	ሔ	HMI_connection_1	SIMATIC S7 1200	Slave	SIMATIC 1200 stati	PLC_1				
		<add new=""></add>		None						
				Master						
				Slave						
				•						

Time synchronization properties

- The operator panel can specify the time as a master.
 - In "Master mode", time synchronization is performed each time a connection is established.
- The operator panel can apply the time from the PLC as a slave.
 - In "Slave mode", time synchronization is performed each time a connection is established and then every 10 minutes.
- The first time synchronization is performed directly after starting Runtime on the operator panel.
- Time synchronization is only performed while running Runtime on the operator panel.

3.1 HMI time synchronization mode

Time synchronization restrictions

Time synchronization with the "HMI time synchronization mode" function can be configured with the following operator panels:

- Basic Panels
- Comfort Panels
- KTP Mobile
- Mobile 277F IWLAN V2
- WinCC Runtime Advanced
- WinCC Runtime Professional
- TP177 4
- Multi Panel 177
- Multi Panel 277
- Multi Panel 377
- Mobile Panel 277

Restrictions during the configuration

- If multiple connections to a SIMATIC S7-1200 / SIMATIC S7-1500 are configured for an operator panel, you can only configure one connection as a "slave".
- If you have enabled time synchronization for the operator panel as a "slave", you can no longer use the "DateTimePLC" global area pointer.
- Basic Panels can only be configured as a "slave".
- If you are using Basic Panels for the configuration, it is not possible to simultaneously use time synchronization via NTP and the "DateTimePLC" area pointer.
- If a PLC is configured with the "Complete protection" protection level, an
 operator panel can poll the time only if the correct access password was
 configured on the operator panel. The access password for communication
 with a PLC with the "Complete protection" protection level is configured in the
 "Connections" editor of the operator panel. The access password must match
 the configured password in the PLC. The password for the PLC is assigned in
 the PLC properties in: "General > Protection".

3.2 Area pointer

3.2 Area pointer

An area pointer allows you to access a data area in the controller. During communication, alternate read/write processes between the controller and the operator panel take place in these data areas. By evaluating the stored data, controller and operator panel mutually trigger predefined actions.

This application uses the "DateTimePLC", "DateTime" and "JobMailbox" area pointers.

3.2.1 DateTimePLC (PLC \rightarrow operator panel)

Transferring date and time from the controller to the operator panel

 \rightarrow Concerns time synchronization variant 2.

The "DateTimePLC" data area has the following structure:

Figure 3-2

Data word		Most significant byte		Least significant byte				
	7		0	7			0	
n+0		Year (80 to 99/0 to 29)		Month (1 to 12)				
n+1		Day (1 to 31)		Hour (0 to 23)				
n+2		Minute (0 to 59)		Second (0 to 59)				
n+3		Reserved			Reserved	Weekday (1 to 7, 1=S day)	/ iun-	
n+4 1)		Reserved		Reserved				
n+5 1)		Reserved		Reserved				

In the PLC, "Struct" is used as the data type. For more information, please see the structure of the configured DB10 in chapter 4.1.

3.2.2 DateTime (operator panel \rightarrow PLC)

Transferring date and time from the operator panel to the controller

 \rightarrow Concerns time synchronization variant 4.

The "DateTime" data area has the following structure:

Figure 3-3

Data word	Most significant byte					Least significant byte											
	7							0	7							0	
n+0	Reserved					Hour (0 to 23)											
n+1	Minute (0 to 59)					Second (0 to 59)						Time					
n+2	Reserved					Reserved											
n+3	Reserved					-3 Reserved Weekday (1 to 7, 1=Sunday)				()							
n+4	Day (1 to 31)			Month (1 to 12)						Date							
n+5	Year (80 to 99/0 to 29)							Rese	erveo	ł							

In the PLC, "Date_And_Time" is used as the data type. For more information, please see the structure of the configured DB10 in chapter 4.1.

3.2 Area pointer

3.2.3 Controller job

Triggering functions on the operator panel using the control program

→Concerns time synchronization variants 3 and 4

The "JobMailbox" data area has the following structure:

Figure 3-4

Word	Most significant byte	Least significant byte					
n+0	0	Job number					
n+1	Parameter 1						
n+2	Parameter 2						
n+3	Parameter 3						

The first word of the controller job mailbox contains the job number. Depending on the controller job, up to three parameters can then be transferred.

If the first word of the controller job mailbox is not equal to 0, the operator panel evaluates the controller job. For this reason, the parameters first have to be entered in the controller job mailbox (parameter 1 to parameter 3), followed by the job number.

If the operator panel has accepted the controller job, the first word is reset to 0. At this time, the controller job execution is generally **not** yet completed.

In the PLC, "Array [0..3] of Word" is used as the data type. For more information, please see the structure of the configured DB10 in chapter 4.1.

Concerns only variant 4, controller job 40 (job number)

Controller job 40 transfers the system time from the operator panel to the PLC.

Controller job 40 parameters

Figure 3-5

No	Function					
40	Transfer date/time to PLC					
	(in the S7 format DATE_AND_TIME) An interval of at least 5 seconds must be maintained between two successive jobs to prevent overload of the HMI device.					

3.2 Area pointer

Concerns only variant 3, controller job 14 (job number)

Controller job 14 transfers the (BCD-coded) time from the PLC to the operator panel.

Controller job 14 parameters

Figure 3-6

No	Function	
14	Set time (BCD-coded)	
	Parameter 1	Left byte: - Right byte: hours (0-23)
	Parameter 2	Left byte: minutes (0-59) Right byte: seconds (0-59)
	Parameter 3	-

Concerns only variant 3, controller job 15 (job number)

Controller job 15 transfers the (BCD-coded) date from the PLC to the operator panel.

Controller job 15 parameters

Figure 3-7

No	Function	
15	Setting the date (BCD coded)	
	Parameter 1	Left byte: - Right byte: weekday (1-7: Sunday-Saturday)
	Parameter 2	Left byte: day (1-31) Right byte: month (1-12)
	Parameter 3	Left byte: year

Notes:

- The KTP 600 BASIC PN operator panel ignores the weekday.
- If you are using the "DateTimePLC" area pointer, the weekday will be ignored.

4.1 Data block "DB10_HMI_AreaPointer" (DB10)

4 Functional Mechanisms of this Application

Introduction

The following sections describe the structure, principle of operation and data structure of the created data blocks and program blocks.

You only need this chapter if you need detailed information on the function block used, "DB10", or want to reproduce the method of functioning of the function blocks used, "FB110"(FB210) or "FB120" (FB220).

This chapter is **not** relevant to implementing the tasks.

4.1 Data block "DB10_HMI_AreaPointer" (DB10)

Concerns time synchronization variants 2, 3 and 4

DB10 includes a summary of the possible area pointers and their data areas. The time synchronization implementation does **not** require all of the listed area pointers.

"DB10" is included in the "FB_TimeSyn" TIA Portal library file.

- "Coordination" area pointer (unused).
- "DateTime" area pointer.
- "JobMailbox" area pointer.
- "DataRecord" area pointer (unused).
- "ProjectID" area pointer (unused).
- "ScreenNumber" area pointer (unused).
- "DateTimePLC" area pointer.

Figure 4-1

	DB10_HMI_AreaPointer								
-		Na	me	2	Data type	Offset	Start value	Retain	Visible in
1		•	St	atic	E				
2	-00	•		Coordination	Word	0.0	16#0		
З	-00	•		DateTime	Date_And_Time	2.0	DT#1990-01-01-00:00:00		
4	-00	•	•	JobMailbox	Array [03] of Word	10.0		Image: A start and a start	
5				JobMailbox[0]	Word	0.0	16#0		V
6				JobMailbox[1]	Word	2.0	16#0		~
7				JobMailbox[2]	Word	4.0	16#0		~
8				JobMailbox[3]	Word	6.0	16#0		~
9		•	۲	DataRecord	Array [04] of Word	18.0			
10		•		ProjectID	Word	28.0	16#0		
11		•	۲	ScreenNumber	Array [04] of Word	30.0			
12		•	•	DateTimePLC	Struct	40.0			
13			•	DateTime	Date_And_Time	0.0	DT#1990-01-01-00:00:00		
14			•	Reserve_01	Word	8.0	16#0		
15				Reserve_02	Word	10.0	16#0		

4.2 Function block "FB110_TimeSyn_HMI_To_PLC"

4.2 Function block "FB110_TimeSyn_HMI_To_PLC"

Time synchronization "operator panel \rightarrow PLC"

FB110 is used in the "TimeSyn_Project_04" project.

When the operator panel is the time master, use "FB110".

"FB110" has "input/output parameters" that are interconnected as specified. You can edit the FB if needed. By default, it is **not** necessary to edit the FB. "FB110" is included in the "FB_TimeSyn" TIA Portal library file.

"FB110" view



Principle of operation

Time synchronization is implemented via the following area pointers:

- "DateTime".

- "JobMailbox" with job number "40".

The block includes the following system function blocks:

- WR_SYS_T
 - (call sets the time and date of the CPU clock).
- RD_SYS_T (the "RD_SYS_T" instruction reads the current

(the "RD_SYS_T" instruction reads the current date and time out of the CPU clock).

4.2 Function block "FB110_TimeSyn_HMI_To_PLC"

FB110 functional sequence

The following table describes the program flow of FB110. The program flow is implemented as a sequencer.

Table 4-1	
Network	Comment
1.	General: Copy values from the "DateTime" area pointer to the static area.
	The " AreaPointer_DateTime " input parameter is used to read in the contents of the assigned "DateTime" area pointer.
	The input parameter has the "Date_And_Time" data type.
	For later evaluation of the time synchronization, it is necessary to divide the input parameter "byte by byte".
	The result is copied to the data area of the static "Edited_AreaPointer_DateTime" tag.
	"AreaPointer_DateTime" \rightarrow "Edited_AreaPointer_DateTime".
2.	Step 1: Start time synchronization.
	The "SetTime " InOut parameter is used to read in/out the "start signal" for enabling time synchronization.
	The InOut parameter has the "Bool" data type.
	The " AreaPointer_JobMailbox " InOut parameter is used to read in/out the contents of the "JobMailbox" area pointer.
	The input parameter has the "Array [03] of Word" data type.
	With the start of time synchronization, the "JobMailbox" area pointer assigns the default value "0" to parameters 1 to 3.
3.	Step 2: Save the current value from the DateTime area pointer.
	In the network, the "Edited_AreaPointer_DateTime" tag is read out and its contents are divided into the
	- "SaveData_Previous_HMI_Time_01" "SaveData_Previous_HMI_Time_02"
	tags and temporarily stored.
	Technical background: The "Edited_AreaPointer_DateTime" tag has the "Date_And_Time" data type, which corresponds to a length of 2 double words. The tag will later be needed for a "time comparison".
	is divided into two separate double words.

4 Functional Mechanisms of this Application

4.2 Function block "FB110_TimeSyn_HMI_To_PLC"

Network	Comment
4.	Step 3: Execute controller job "40".
	Job number "40" is transferred to the "AreaPointer_JobMailbox" InOut parameter.
	Note: The job number must be specified in "hex format".
5.	Step 4: Evaluation, job "40" done.
	The "AreaPointer_JobMailbox" InOut parameter is used to evaluate when the previously set controller job "40" was reset to "0" by the operator panel.
	Note:
	If the operator panel has accepted the controller job, the controller job will be reset to "0". At this time, the controller job execution is generally not yet completed.
6.	Step 5: Evaluation, new HMI time applied?
	The static "Edited_AreaPointer_DateTime" tag is read out via the network and its contents are divided into the - "SaveData_New_HMI_Time_01"
	- "SaveData_New_HMI_Time_02"
	tags and temporarily stored.
	Technical background: To detect that the controller job has been fully completed, the network compares the time.
	The controller job is completed when the comparison of the "SaveData_Previous_HMI_Time" and "SaveData_New_HMI_Time" tags is not equal.
7.	Step 6: Transfer new HMI system time to PLC.
	Via the network, the PLC system time is synchronized with the operator panel system time.
	For this purpose, the "AreaPointer_DateTime" input parameter tag is assigned to the "IN Parameter" of the "WR_SYS_T" system function block.
8.	General: Output current PLC time on operator panel.
	The read out PLC system time is output via the "Current_PLCTime" output parameter tag.
	For this purpose, the " Current_PLCTime " tag is assigned to the "OUT Parameter" of the "RD_SYS_T" system function block.
	The output parameter has the "Date_And_Time" data type.

4.3 Function block "FB120_TimeSyn_PLC_To_HMI"

4.3 Function block "FB120_TimeSyn_PLC_To_HMI"

Time synchronization "PLC \rightarrow operator panel"

FB120 is used in the "TimeSyn_Project_03" project.

When the PLC is the time master, use "FB120".

"FB120" has "input/output parameters" that are interconnected as specified. You can edit the FB if needed. By default, it is **not** necessary to edit the FB. "FB120" is included in the "FB_TimeSyn" TIA Portal library file.

"FB120" view



Principle of operation

The function block allows you to separately synchronize the **time** and the **date** of the HMI operator panel with the time of the PLC.

Time synchronization is implemented via the following area pointer:

- "JobMailbox" with job number "14" (time).
- "JobMailbox" with job number "15" (date).

4.3 Function block "FB120_TimeSyn_PLC_To_HMI"

FB120 functional sequence

The following table describes the program flow of FB120. The program flow is implemented as a sequencer.

Network	Comment
1.	General:
	Copy values from the "JobMailbox" area pointer to the temp area.
	The contents of the "JobMailbox" area pointer are read in via the " AreaPointer_JobMailbox " InOut parameter.
	The mout parameter has the Array [05] of word data type.
	For the later parameter assignment, it is necessary to divide the input parameter "byte by byte". The result is temporarily stored in the "temp area".
	Note:
	The InOut parameter has to be edited for the implementation.
	an FB and parameterize a function call with an ARRAY tag, please refer to Entry ID: <u>19106712</u> .
2.	General:
	Copy and exclude "ms" from PLC time.
	The current PLC system time is read out via the "Actual_PLC_Time" In parameter.
	The In parameter has the "Date_And_Time" data type.
	For the later parameter assignment, it is necessary to divide the input parameter "byte by byte" and hide the "milliseconds" contained in the time.
	For details on the structure of the "Date_And_Time" format, please refer to the WinCC Advanced system manual.
3.	Step 1: Start time synchronization via controller job "14" \rightarrow time.
	The " SetTime " InOut parameter is used to read in/out the "start signal" for enabling time synchronization.
	The InOut parameter has the "Bool" data type.
	With the start of time synchronization, the "JobMailbox" area pointer assigns the default value "0" to parameters 1 to 3.

4 Functional Mechanisms of this Application

4.3 Function block "FB120_TimeSyn_PLC_To_HMI"

Network	Comment
4.	Step 2: Enter parameters in "JobMailbox" area pointer.
	In the network, the parameters provided for job number "14" are transferred to the "JobMailbox" area pointer. For details on the structure of controller job "14", please refer to chapter <u>3.2.3</u> .
	From the tag area of the "Edited_PLC_Time" tag, the
	hour
	minute
	• second
	are read out and transferred to the parameters of the "JobMailbox" area pointer.
5.	Step 3: Execute controller job "14".
	Job number "14" is transferred to the auxiliary tag of the "AreaPointer_JobMailbox" InOut parameter.
	Note: The job number must be specified in "hex format".
6.	Step 4: Evaluation, job "14" done.
	The auxiliary tag of the "AreaPointer_JobMailbox" InOut parameter is used to evaluate when the previously set controller job "14" was reset to "0" by the operator panel.
	Note:
	If the operator panel has accepted the controller job, the controller job will be reset to "0". At this time, the controller job execution is generally not yet completed.
	The evaluation of time synchronization via controller job "14" is now complete.
7.	Step 1: Start time synchronization via controller job "15" \rightarrow date.
	The " SetDate " InOut parameter is used to read in/out the "start signal" for enabling time synchronization.
	The InOut parameter has the "Bool" data type.
	With the start of time synchronization, the "JobMailbox" area pointer assigns the default value "0" to parameters 1 to 3.

4 Functional Mechanisms of this Application

4.3 Function block "FB120_TimeSyn_PLC_To_HMI"

Network	Comment
8.	Step 2: Enter parameters in "JobMailbox" area pointer.
	In the network, the parameters provided for job number "15" are transferred to the "JobMailbox" area pointer. For details on the structure of controller job "15", please refer to chapter <u>3.2.3</u> .
	From the tag area of the "Edited_PLC_Time" tag, theweekday
	• day
	• month
	 year are read out and transferred to the parameters of the "JobMailbox" area pointer.
9.	Step 3: Execute controller job "15".
	Job number "15" is transferred to the auxiliary tag of the "AreaPointer_JobMailbox" InOut parameter.
	Note: The job number must be specified in "hex format".
10.	Step 4: Evaluation, job "15" done.
	The auxiliary tag of the "AreaPointer_JobMailbox" InOut parameter is used to evaluate when the previously set controller job "15" was reset to "0" by the operator panel.
	Note:
	If the operator panel has accepted the controller job, the controller job will be reset to "0". At this time, the controller job execution is generally not yet completed.
	The evaluation of time synchronization via control job "15" is now complete.
11.	General: Write values back to the "AreaPointer_JobMailbox" InOut tag.
	In network 1 for the evaluation, the parameter values of job numbers "14" and "15" have been written to the associated auxiliary tags (#Tmp_JobMailBox_Byte0, etc.).
	Now the values of the auxiliary tags are written back to the "AreaPointer_JobMailbox" InOut parameter.
	The implementation of "time synchronization" via controller jobs "14" and "15" is now complete.

4.4 Function block "FB210_TimeSyn_HMI_To_PLC"

4.4 Function block "FB210_TimeSyn_HMI_To_PLC"

Time synchronization "operator panel \rightarrow PLC" (operator panel is the master)

"FB210" is **only** included in the "FB_TimeSyn" TIA Portal library file that can be found in the download section of this application example.

If you are using a SIMATIC S7-1200 / S7-1500, you can use the integrated system function to synchronize the time (time synchronization for integrated connections). For more information, please see chapter 5.1 (link).

If you want to synchronize the time manually, use "FB210_TimeSyn_HMI_To_PLC".

"FB210" was implemented in "SCL" and has the same functionality as "FB110_TimeSyn_HMI_To_PLC". Therefore, the block is not described in greater detail at this point.

The block is parameterized with the same tags as "FB110".

4.5 Function block "FB220_TimeSyn_PLC_To_HMI"

Time synchronization "PLC \rightarrow operator panel" (PLC is the master)

"FB220" is **only** included in the "FB_TimeSyn" TIA Portal library file that can be found in the download section of this application example.

If you are using a SIMATIC S7-1200 / S7-1500, you can use the integrated system function to synchronize the time (time synchronization for integrated connections). For more information, please see chapter 5.1 (link).

If you want to synchronize the time manually, you can optionally use "FB220 TimeSyn PLC To HMI".

"FB220" was implemented in "SCL" and has the same functionality as "FB120_TimeSyn_HMI_To_PLC". Therefore, the block is not described in greater detail at this point.

The block is parameterized with the same tags as "FB120".

5.1 Variant 1: PLC (master/slave) ↔ HMI operator panel

5

Configuration and Project Engineering

The following sections provide a detailed description of the individual sample configurations.

Remarks

- Please note the settings in chapter <u>6.2</u>. "Adjusting the time zone on the panel and in the CPU".
- To be able to test the time synchronization functionality, additional I/O fields are configured in the bottom part of the HMI screens (1). The I/O fields are not relevant to the implementation of the time synchronization and are therefore not described in greater detail. The I/O fields are used to test the function to be executed.

Figure 5-1



5.1 Variant 1: PLC (master/slave) ↔ HMI operator panel

Time synchronization between an S7-1200 and a TP1200 Comfort Panel

Note

The guide can also be used for a SIMATIC S7-1500 controller.

Project_01, "TimeSyn_Project_01".

In the sample project, time synchronization is performed using the "HMI time synchronization mode" (Master/Slave) HMI system function.

- CPU: \$7-1200
- HMI_1: TP1200 "HMI time synchronization mode" => Slave
- HMI_2: TP1200 "HMI time synchronization mode" => Master

5.1 Variant 1: PLC (master/slave) ↔ HMI operator panel

HMI configuration

The sample project includes two HMI configurations. The configurations differ only in the type of time synchronization (master/slave).

HMI_1 (Slave)

In this configuration, the **PLC** is the timer (master). The operator panel is the time receiving component (slave).

Table 5-1

No.	Action
1.	Connections In the project tree, open the "Connections" component. The existing connections are displayed in the working window.
	Note: It is required that a connection to an S7-1200 / S7-1500 PLC has already been configured.
	Project tree
	Image: Series of Series of Series of Series and Series of Series
	Intresyn_troject_or [V11] Name Communication driver initiative synchronization mode istation in partner indoze Add news Mall_connection_1 SIMATIC 57 1200 Slave SIMATIC 1200 station_1 PLC_1 CPU 1212C DCDC Add news Add news THIM 101 TP1200 Skey (TP1200 Co.
	Device configuration Online & diagnostics Y Runtime settings Consettings Parameter Area pointer
	Image: Streen management TP1200 Comfort Station > Image:
2.	Selecting time synchronization In "HMI time synchronization mode", open the drop-down list and select the " Slave " item. The time synchronization settings are now complete.
	The connected PLC is now the timer component.
	Name Communication driver HMI time synchronization mode Station Partner Node
	Add new> SIMATIC S7 1200 Slave SIMATIC 1200 station_1 PLC_1 CPU 1212C DC/D None Master Slave
	¢ IIII >
	Parameter Area pointer
	TP1200 Comfort Interface: ETHERNET
3.	Other time synchronization settings are not required.

5.1 Variant 1: PLC (master/slave) ↔ HMI operator panel

HMI_2 (Master)

In this configuration, the operator panel is the timer (master). The PLC is the time receiving component (slave).

Та	ble	5-2
10	DIC	J-Z

No.	Action
1.	Connections In the project tree, open the "Connections" component. The existing connections are displayed in the working window. Note: It is required that a connection to an S7-1200 / S7-1500 PLC has already been configured. Project tree Connections to 57 PLCs in Devices & Networks Connections Connections to 57 PLCs in Devices & Networks Connections Communication driver Multime synchronization mode Station Partner Node Add new device Stations of S7 PLCs in Devices & Networks Connections Station Station Floce Stati
	→ Timelo () (Price only in the Construction Construction ■ Device configuration ■ Device configuration ♥ Online & diagnostics The 200 Construction
	Y Puntime settings TP1200 Comfort Station > Screen management Interface: Interface: > Hhill tags ETHERNET Interface:
2.	In "HMI time synchronization mode", open the drop-down list and select the " Master " item. The time synchronization settings are now complete. The connected HMI operator panel is now the timer component.
	Connections
	Name Communication driver HMI time synchronization mode Station Partner Node HMI_connection SIMATIC S7 1200 Master SIMATIC 1200 station_1 PLC_1 CPU 1212C DC/DC Add new> None Master Slave Slave Slave Slave
	Parameter Area pointer
	TP1200 Comfort Interface: ETHERNET
3.	Other time synchronization settings are not required.

5.2 Variant 2: PLC (master) \rightarrow HMI operator panel (slave)

Time synchronization between an S7-300 and a TP1200 Comfort Panel

Project_02, "TimeSyn_Project_02".

Time synchronization via the "DateTimePLC" area pointer

- CPU: \$7-300
- HMI: TP1200 Comfort Panel

PLC program

Table 5-3

No.		Actio	on				
1.	DB100 (DB100_HMI_DataExch	ange)					
	For data exchange between the following data structure.	PLC and the op	erator	panel, DB100) was cr	eated with the	
	DB100_HMI_DataExchange						
	Name	Data type	Offset	Start value	Retain	Visible in	
	1 🕣 👻 Static						
	2 📲 PLC_Time_RD_SYS_T	Date_And_Time 🔳	0.0	DT#1990-01-01-0	~		
	3 📶 = PLC_Time_RD_SYS_T_RetVal1	Int	8.0	0	~		
	4 - PLC_Time_RD_SYS_T_RetVal2	Int	10.0	0			
2.	OB1 (Main), network 1 In network 1, the "RD_SYS_T" sy The block is used to read out the pointer. For this purpose, the "DateTime" output of the system block. In this example: "DB10_HMI_Ad For details on DB10 (DB10_HMI_ The different time functions can be the individual time functions are	ystem block is c PLC system tir ' tag of the " Dat reaPointer".Date _AreaPointer), p be found in the "Ex	alled. ne and eTime eTimel blease	d transfer it to PLC" area po PLC.DateTime refer to chapt ctions" task ca	the " Da binter is e (DB10 ter 4.1. ard.	teTimePLC" area assigned to the 0.DBX40.0)	a
	The individual time functions are Time-of-day functions" palette.	listed in the "Ex	tende	d instructions	> Date	and time-of-day >	>

5 Configuration and Project Engineering

No. Action Ŧ Network 1: Übergabe der SPS-Systemzeit an den Bereichszeiger Datum/Uhrzeit PLC Transfer the PLC system time to the area pointer Date/Time PLC RD_SYS_T Date_And_Time ΕN ENO %DB100.DBW8 "DB100_HMI_ DataExchange' PLC_Time_RD_ SYS_T_RetVal1 RET_VAL P#DB10.DBX40.0 "DB10_HMI_ AreaPointer". "DB10_HMI_ AreaPointer". DateTimePLC. P#DB10.DBX40.0 / Date_And_Time DateTime OUT 3. **OB1**, network 2 (optional network) In network 2, the "RD_SYS_T" system block is called. The block is used to read out the PLC system time and directly output it in an I/O field on the operator panel. In terms of the example, this allows you to compare the current operator panel system time to the PLC system time. This network is not required to implement the task. Network 2: Display the current plc system time via the HMI Display the current plc system time via the HMI RD_SYS_T Date_And_Time ΕN ENO %DB100.DBW10 "DB100_HMI_ DataExchange* PLC_Time_RD SYS_T_RetVal2 RET VAL P#DB100.DBX0.0 DB100_HMI_ DataExchange PLC_Time_RD_ SYS_T OUT 4. In the PLC, other time synchronization settings are not required.

5.2 Variant 2: PLC (master) → HMI operator panel (slave)

HMI configuration

In this configuration, the **PLC** is the timer (master). The HMI operator panel is the time receiving component (slave).

Tal	ble	5-4

No.		Action
1.	Connections	
	In the project tree, of displayed in the work	pen the " Connections " component. The existing connections are king window.
	Note: It is required that a c	onnection to a SIMATIC S7 controller has already been configured.
	In this example:	SIMATIC S7 300/400
	Project tree	TimeSyn_Project_02 [V11] → HML_1 [TP1200 Comfort] → Connections _ = = = ×
		Connections to 57 PLCs in Devices & Networks
	TimeSyn_Project_02 [V11] Add new device Devices & networks Devices & networks Dig PLC_1 [CPU 315-2 PN/DP]	Name Communication driver HMI time synchronization mode Partner Node Station Online M HMI_connection SIMATIC S7 300/400 PLC_1 CPU 315-2 PN/DP S7300/ET200M station_1 Image: Station of the synchronization station of the synchronization of the synchronizatio synchronizatio synche synchronization of the sync
	HMI_1 [TP1200 Comfort] Device configuration	Parameter Area pointer
	Online & diagnostics Online & diagnostics Funtime settings Screens Screen management Screht Hult tags Connections Hull alarms Hull alarms	TP1200 Comfort Interface: ETHERNIET
	Historical data Image: Scripts Scripts Scheduled tasks Ocles Image:	HMI device PLC Address: 172 16 34 34 Access point S7ONLINE Expansion slot 2 Back: 0 Cyclic operation: Cyclic operation:

No.			Action						
2.	Selecting the area	pointer							
	In the "Connection	ons" editor, select	the "Area po	inter" tab.					
	 The "Area point Open the "Glob 	er" tab includes two al area pointer" ta	o tables with a ble. You may	area pointers.	arrow buttons (1) to				
	open the table.								
	 Assign a connect pointer, (2). 	ction to be used fo	r time synchro	onization to the "I	DateTimePLC" area				
	Parameter A	rea pointer							
	Active	Display name	PLC tag	Access mode	Address Length Ad				
		Coordination	<undefined></undefined>	<symbolic access=""></symbolic>	1 O				
		Date/time	<undefined></undefined>	<absolute access=""></absolute>	6 0				
		Job mailbox	<undefined></undefined>	<symbolic access=""></symbolic>	4 (1)				
		Data record	<undefined></undefined>	<symbolic access=""></symbolic>	5 9				
	Global area poir	ter of HMI device							
	Connection	Display name	PLC tag		Access m				
	<undefine< th=""><th>Project ID</th><th><undefined></undefined></th><th></th><th><symbolic< th=""></symbolic<></th></undefine<>	Project ID	<undefined></undefined>		<symbolic< th=""></symbolic<>				
	<undefined></undefined>	Screen number	<undefined></undefined>		<symbolic< th=""></symbolic<>				
	HMI_connection	Date/time PLC	DB10_HMI_A	reaPointer.DateTime	PLC.DateTime 🔜 <absolute< th=""></absolute<>				
0.	The figure below sho Global area pointer of HMI Connection Display na «Undefined» Project ID	device PLC tag	ized "DateTim	Address Leng	ter.				
	 <undefined> Screen nu</undefined> HMI_connection	mber <undefined> PLC DB10_HMI_AreaPointer.D</undefined>	ateTimePLC DateTime	5 %DB10.DBX40.0 ▼ 6	 <undefined> <symbolic access=""></symbolic></undefined> 1 min <absolute access=""></absolute> 				
	Parameter description								
	Connection:	In the window, se (controller) activa	lect the PLC tes the area p	connection. Selection Sele	cting the connection				
		In this example:	HMI_co	onnection					
	Display name:	Name of the area	pointer. Set l	by WinCC.					
	PLC tag:	This is where you area for the area	i select the PL pointer.	_C tag you have o	configured as the data				
		In this example:	DB10_I	HMI_AreaPointer	DateTimePLC.DateTime				
	Address:	When you have s field displays the manually.	ymbolically so tag address.	elected the tag in Alternatively, ente	the "PLC tag" field, this er the tag address				
		In this example:	%DB10	.DBX40.0					
	Length:	Length of the are	a pointer. Set	by WinCC.					
	Acquisition cycle:	In this field, define short acquisition	e the acquisiti time can influ	ion cycle. Please ience the operato	keep in mind that a very r panel performance.				
		In this example:	1 min						
4.	Other time synchron	ization settings are	e not required						

5.3 Variant 3: PLC (master) \rightarrow HMI operator panel (slave)

Time synchronization between an S7-300 and a TP1200 Comfort Panel

Project_03, "TimeSyn_Project_03".

Time synchronization via the "JobMailbox" area pointer with controller job numbers 14 (time) and 15 (date).

For this time synchronization, the time and the date of the operator panel can be synchronized with the PLC system time/date independently of each other.

- CPU: \$7-300
- HMI: TP1200 Comfort Panel
- PLC program block: FB120 (S7-300/400) or FB220 (S7-1200 / S7-1500)
- **Note** If you are using an S7-1200 / S7-1500, please follow the information provided in chapter <u>4.5</u>.

PLC program

Table 5-5

No.		Action							
1.	DB	DB10 (DB10_HMI_AreaPointer)							
	A d poir For	A data block that contains the data structure for all area pointers was created for the area pointers. For details on DB10 (DB10_HMI_AreaPointer), please refer to chapter 4.1.							
		DB	10	_HMI_AreaPo	inter				
			Na	me		Data type	_	Offset	Start value
	1	-00	•	Static					
	2	-00		Coordinatio	n	Word		0.0	16#0
	З	-00	•	DateTime		Date_And_Time		2.0	DT#1990-01-01-0
	4	-00	•	JobMailbox		Array [03] of Wor	d	10.0	
	5	-00	•	DataRecord	l	Array [04] of Wor	d	18.0	
	6	-00	•	ProjectID		Word		28.0	16#0
	7	-00	•	ScreenNum	nber	Array [04] of Wor	d	30.0	
	8	-00	•	DateTimePl	.c	Struct		40.0	

No.		Action			
2.	DB100 (DB100_HMI_DataExchange)				
	For data exchange between the PLC ar following data structure.	nd the operator pa	anel, DE	3100 was created with the	e
	DB100_HMI_DataExchange				
	Name D	ata type	Offset	Start value	
	1 🕣 🔻 Static				
	2 💷 PLC_Time_RD_SYS_T D)ate_And_Time 🔳	0.0	DT#1990-01-01-0	
	3 🕣 PLC_Time_RD_SYS_T_RetVal Ir	nt	8.0	0	
	4 🕣 = Start_TimeSyn B	lool	10.0	false	
	5 📶 🖣 Start_DateSyn B	lool	10.1	false	
3.	OB1 (Main), network 1 In network 1, the "RD_SYS_T" system I The block is used to read out the PLC s "FB120_TimeSyn_PLC_To_HMI" via a the operator panel via the used tag.	block is called. system time and t a tag. Furthermore	ransfer e, the P	it to FB120 LC system time is output	on
4	In this example: "DB100_HMI_DataEx Network 1: Read current PLC system time Comment RD_SYS_T Date_And_Time EN PDB100_HN DataExchar PLC_Time_F SYS_T OUT SYS_T OUT SYS_T OUT SYS_T	BWB MI_ nge*. RD_ /al BXD.0 MI_ nge*. RD_	me_RD	_SYS_1 (DB100.DBX0.0))
- - .	In network 2, the "FB120" program bloc (FB120_TimeSyn_PLC_To_HMI). FB120 evaluates the data of the "JobMa provides the time and date of the opera FB120 was created specifically for this t program block. The block includes all th To implement time synchronization, it is the specifications. For details on FB120	k is called. ailbox" area point tor panel. time synchroniza ne necessary func s only necessary f), please refer to o	tion. It is tions. It is to paran chapter	based on this information s not necessary to edit th neterize FB120 according <u>4.3</u> .	ı, e g to



5 Configuration and Project Engineering

5.3 Variant 3: PLC (master) → HMI operator panel (slave)

No.		Action
		synchronization on the operator panel. Link the parameter to the address of the used button.
		In this example:
		"DB100_HMI_DataExchange".Start_TimeSyn DB100.DBX10.0
	SetDate:	INOUT parameter of the "Bool" type A button on the operator panel starts date synchronization on the operator panel. Link the parameter to the address of the used button.
		In this example:
		"DB100_HMI_DataExchange".Start_DateSyn DB100.DBX10.1
	Link to the HMI configuration	<u>on</u>
7.	In the PLC, other time syn	chronization settings are not required.

HMI configuration

In this configuration, the **PLC** is the timer (master). The operator panel is the time receiving component (slave).

_			
Ta	hle	5 י	-6

No.	Action
1.	Connections
	In the project tree, open the " Connections " component. The existing connections are displayed in the working window.
	Select the connection via which the operator panel is to be synchronized. In this example: HMI_connection
	Notes:
	• It is required that a connection to a SIMATIC S7 controller has already been configured.
	 The area pointer used in this example can be activated separately for each configured connection.
	In this example: SIMATIC S7 300/400 connection
	Ar Connections to S7 PLCs in Devices & Networks
	Connections
	Name Communication driver HMI time synchronization mode Station Partner Node
	Add news
	K
	Parameter Area pointer
	TP1200 Comfort Station
	HMI device PI C
	Address: 172 16 34 200 Address: 172 16 34 34
	Access point: S7ONLINE Expansion slot: 2
	Rack
	Cyclic operation:

5 Configuration and Project Engineering

No.		Ad	tion			
2.	Selecting the area	pointer				
	In the "Connections"	editor, select the "Area p	ointer" tab (1)			
	Parameter Area	pointer N				
1	Active Display name Coordination Date/time Job mailbox	PLC tag <undefined> <undefined> DB10_HML_AreaPointerJobMailbox</undefined></undefined>	Access mode <symbolic access=""> <absolute access=""> <absolute access=""></absolute></absolute></symbolic>	Address %DB10.DB×10.0	Length 1 6 4	Acquisition cycle <undefined> <undefined> 1 s</undefined></undefined>
	Data record	<undefined></undefined>	<symbolic access=""></symbolic>		5	<undefined></undefined>
	<	- 6 UD () douise	-			>
2	Boromotorizing the	" lobMailbox" area pair	tor			
3.	Parameterizing the	"Jobiwalibox" area poin	ter			
	"JobMailbox" para	meter description				
	Active:	Check the check box to t	he left of the "	JobMailbox"	' area	pointer.
	Display name:	Name of the area pointe	. Set by WinC	C.		
	PLC tag:	This is where you select area for the area pointer In this example: D	the PLC tag yo B10_HMI_Are	ou have confi aPointer.Job	gured Mailbo	as the data
	Address:	When you have symbolic field displays the tag add Alternatively, enter the ta In this example:	cally selected to lress. Ig address mai B10.DBX10.0	he tag in the nually.	"PLC 1	tag" field, this
	Length:	Length of the area pointe	er. Set by WinC	C.		
	Acquisition cycle:	In this field, define the ad short acquisition time can In this example: 1	equisition cycle n influence the s	. Please kee operator par	p in mi nel per	ind that a very formance.
4.	HMI screen Time Synchronization Display HMI system time (Slave) 12/31/2000 10:59:39 AM Two buttons are requ • Button 1: Time In "Properties > Link the parame "DB100_HMI_D • Button 2: Date In "Properties > Link the parame "DB100_HMI_D	PLC system time (Master) 12/31/2000 10:59:39 AM 12/31/2000 10:59:39 AM 12/31/2000 10:59:39 AM uired to execute the function synchronization 12/31/2000 10:59:39 AM Events > Press", use the ster to this address: ataExchange".Start_Time synchronization 12/31/2000 10:59:39 AM Events > Press", use the ster to this address: ataExchange".Start_Time synchronization 12/31/2000 10:59:39 AM Events > Press", use the synchronization 12/31/2000 10:59:39 AM Events > Press", use the synchronization 12/31/2000 10:59:39 AM Events > Press", use the synchronization 12/31/2000 10:59:39 AM Events > Press", use the ster to this address: ataExchange".Start_Date ataExchange".Start_Date	Start HMI time Start HMI date ons (1). "SetBit" system Syn (DB100.D "SetBit" system Syn (DB100.D	1 n function. BX10.0) n function. BX10.1)		
5.	Other time synchron	ization settings are not re-	quired.			

5.4 Variant 4: HMI operator panel (master) → PLC (slave)

5.4 Variant 4: HMI operator panel (master) \rightarrow PLC (slave)

Time synchronization between an S7-300 and a TP1200 Comfort Panel

Project_04, "TimeSyn_Project_04".

Time synchronization via the "DateTime" and "JobMailbox" area pointers with job number 40.

- CPU: S7-300
- HMI: TP1200 Comfort Panel
- PLC program block: FB110 (S7-300/400) or FB210 (S7-1200 / S7-1500)
- **Note** If you are using an S7-1200 / S7-1500, please follow the information provided in chapter <u>4.4</u>.

PLC program

Table 5-7

No.	Action								
1.	DB	DB10 (DB10_HMI_AreaPointer)							
	A d poir For	data block that contains the data structure for all area pointers was created for the area binters. or details on DB10 (DB10_HMI_AreaPointer), please refer to chapter 4.1. DB10_HMI_AreaPointer							
	Name			me		Data type		Offset	Start value
	1	-	•	Sta	atic				
	2	-	•		Coordination	Word		0.0	16#0
	З		•		DateTime	Date_And_Time		2.0	DT#1990-01-01-0
	4	-	•	۶.	JobMailbox	Array [03] of Word		10.0	
	5	-	•	¥.	DataRecord	Array [04] of Word		18.0	
	6		•		ProjectID	Word		28.0	16#0
	7	-	•	•	ScreenNumber	Array [04] of Word		30.0	
	8		•	•	DateTimePLC	Struct		40.0	

5 Configuration and Project Engineering

No. Action 2. DB100 (DB100_HMI_DataExchange) For data exchange between the PLC and the operator panel, DB100 was created with the following data structure. DB100_HMI_DataExchange Name Data type Offset Start value 1 📶 🛨 Static 2 📲 🗖 Date_And_Time 🔳 0.0 DT#1990-01-01-00:00:00 PLC_Time_RD_SYS_T 8.0 3 PLC_Time_RD_SYS_T_RetVal Int 4 PLC_Time_WR_SYS_T_RetVal 10.0 0 Int 5 Start_TimeSyn Bool 12.0 false 3. OB1 (Main), network 1 In network 1, program block "FB110" (FB110_TimeSyn_HMI_To_PLC) is called. FB110 evaluates the data of the "DateTime" and "JobMailbox" area pointers and, based on this information, provides the time and date of the PLC. FB110 was created specifically for this time synchronization. It is not necessary to edit the program block. The block includes all the necessary functions. To implement time synchronization, it is only necessary to parameterize FB110 according to the specifications. For details on FB110, please refer to chapter 4.2. ▼ Block title: "Main Program Sweep (Cycle)" Network 1: Übergabe der SPS-Systemzeit an den Bereichszeiger Datum/Uhrzeit Hand-off PLC system time to the area pointer Date/Time %DB110 "DB110_ TimeSyn_HMI_ To_PLC" %FB110 "FB110_TimeSyn_HMI_To_PLC" ΕN ENO P#DB10.DBX2.0 P#DB100.DBX0.0 "DB10_HMI_ "DB100_HMI_ AreaPointer" AreaPointer_ DataExchange" DateTime DateTime PLC_Time_RD_ Current SYS T PLCTime P#DB10.DBX10.0 "DB10_HMI_ AreaPointer". AreaPointer_ JobMailbox. JobMailbox %DB100.DBX12.0 "DB100_HMI_ DataExchange' Start_TimeSyn — SetTime

5.4 Variant 4: HMI operator panel (master) → PLC (slave)

5 Configuration and Project Engineering

5.4 Variant 4: HMI operator panel (master) → PLC (slave)

No.		Action
4.	FB110, parameterization	
	Name/no. of FB:	Any FB name/number can be selected. In this example: Name: FB110_TimeSyn_HMI_To_PLC FB no: 110
	Instance DB:	Any instance DB name/number can be selected. In this example: Name: DB110_TimeSyn_HMI_To_PLC FB no.: 110
	AreaPointer_DateTime:	IN parameter of the "Date_And_Time" type Link the parameter to the address of the "DateTime" area pointer. In this example: "DB10_HMI_AreaPointer".DateTime DB10.DBX2.0
	AreaPointer_Job_Mailbox:	INOUT parameter of the "Array [03] of Word" type Link the parameter to the address of the "JobMailbox" area pointer. In this example: "DB10_HMI_AreaPointer".JobMailbox DB10.DBX10.0
	SetTime:	INOUT parameter of the "Bool" type A button on the panel starts time synchronization. Link the parameter to the address of this button. In this example:
	Current_PLCTime:	OUT parameter of the "Date_And_Time" type The tag is used to output the current PLC system time on the panel. Link the parameter to the address of this "date/time field". In this example: "DB100_HMI_DataExchange".PLC_Time_RD_SYS_T DB100.DBX0.0
	Link to the HMI configuration	n
5.	In the PLC, other time sync	hronization settings are not required.

5.4 Variant 4: HMI operator panel (master) → PLC (slave)

HMI configuration

In this configuration, the **operator panel** is the timer (master). The PLC is the time receiving component (slave).

Tab	le	5-8

No.	Action
1.	Connections
	In the project tree, open the " Connections " component. The existing connections are displayed in the working window.
	Select the connection via which the operator panel is to be synchronized. In this example: HMI_connection
	 Notes: It is required that a connection to a SIMATIC S7 controller has already been configured. The area pointers used in this example can be activated separately for each configured connection.
	In this example: SIMATIC S7 300/400 connection
	Project tree TimeSyn_Project_03 [V11] > HMI_1 [TP1200 Comfort] > Connections
	Devices
	Connections to S7 PLCs in Devices & Networks
	Commectations Communication driver Station HMII time synchronization mode Partner Node Add new device
	Y Device configuration
	Comme so diagnostics Parameter Area pointer Runtime settings
	TP1200 Comfort Station
	> Hill tags Interface:
	Z Connections ETHERNET ▼
	🔓 Recipes
	Image: Scripts HMI device PLC
	S Scheduled tasks Address: 1721634200 Address: 172163434
	Comparison slot Comp
	i User administration Oyclic operation:
	Lag Common data

5 Configuration and Project Engineering

5.4 Variant 4: HMI operator panel (master) → PLC (slave)

No.			Action					
2.	Selecting the area pointer							
	la tha "Oana a tiana"		" • • • • • • • • • • • • • •	· • - •				
	In the "Connections"	editor, select the	"Area pointer"	tab.				
	For this application, of	ppen the " Area p	bies with area pointer" table.	Jointers.				
	The "Global area point	nter" table is not r	equired.					
	Parameter Are	a pointer						
	Active Display name	PLC tag		Address	Length	Acquisi	tion cycle	Acc
	Coordination	<undefined></undefined>			1	<undef< td=""><td>ined></td><td><syi< td=""></syi<></td></undef<>	ined>	<syi< td=""></syi<>
	Date/time	DB10_HMI_AreaPoi	inter.DateTime	%DB10.DBX2.0	6	<undef< td=""><td>ined></td><td><ab< td=""></ab<></td></undef<>	ined>	<ab< td=""></ab<>
	Data record	<undefined></undefined>	inter.JobMalibox	%DB10.DBX10.0	4	<undef< td=""><td>ined></td><td><ab ⊲ab</ab </td></undef<>	ined>	<ab ⊲ab</ab
	<							>
	Global area pointe	r of HMI device						
	Connection	Display name	PLC tag	Access m	ode		Address	Leng
	<undefined></undefined>	Project ID	<undefined></undefined>	<symboli< td=""><td>c access></td><td></td><td></td><td>1</td></symboli<>	c access>			1
	<undefined></undefined>	Date/time PLC	<undefined></undefined>	<symboli <symboli< td=""><td>c access></td><td></td><td></td><td>5</td></symboli<></symboli 	c access>			5
	"DateTime" parame Active: Display name:	ter description Check the check Name of the area	box to the left a pointer. Set b	of the " DateTim e by WinCC.	e " area	pointe	r.	
		PLC tag: This is the data area for In this example :	where you sele the area point DB10_H	ect the PLC tag y er. IMI_AreaPointer.	ou hav DateTi	e confi me	gured a	IS
	Address:	When you have s field displays the manually.	symbolically se tag address. A	elected the tag in Alternatively, ente	the "Pl er the ta	LC tag" ag addi	field, tl ress	nis
	Length:	Length of the are	a pointer. Set	by WinCC.				
	"JobMailbox" parameter description							
	Active:	Check the check	box to the left	of the "JobMailt	ox" ar	ea poir	nter.	
	Display name:	Name of the area	a pointer. Set b	y WinCC.				
	PLC tag:	This is where you area for the area	u select the PL pointer.	C tag you have o	configui	red as r	the data	а
		In this example:	: DB10_H	IMI_AreaPointer.	JobMa	ilbox	.	
	Address:	When you have s field displays the manually.	symbolically se tag address. A	lected the tag in Alternatively, ente	the "PL er the ta	LC tag" ag addi	field, tl ress	nis
		In this example:	DB10.D	BX10.0				
	Length:	Length of the are	a pointer. Set	by WinCC.				
	Acquisition cycle:	In this field, defin short acquisition	e the acquisition time can influe	on cycle. Please ince the operator	keep ir panel	n mind perforr	that a v nance.	ery
		in this example:	i min					

5 Configuration and Project Engineering

5.4 Variant 4: HMI operator panel (master) → PLC (slave)

No.	Action
4.	HMI screen
	Time synchronization Display the time HMI system time (Master) PLC system time (Save) 12/31/2000 10:59:39 AM 12/31/2000 10:59:39 AM 12/31/2000 10:59:39 AM Start set plc time One button is required to execute the function (1). Button: Time synchronization In "Properties > Events > Press", use the "SetBit" system function. Link the parameter to this address:
	"DB100_HMI_DataExchange".Start_TimeSyn (DB100.DBX12.0)
5.	Other time synchronization settings are not required.

6.1 General

6 Operation of the Application

6.1 General

The functionality described below is the same for all time synchronization projects / variants.

Transferring the configuration files

To operate the application, the following requirements must be met:

- The STEP 7 program was transferred to the PLC.
- The HMI configuration was transferred to the operator panel.

Note regarding the CPU system date

To use the application, the CPU system time must be set to a time after the year 2000. This has to be taken into account particularly after a general reset of the CPU.

The "Online > Online & diagnostics > Functions > Set time" menu command allows you to edit the CPU system time.

Figure 6-1

	Project Edit View Insert	Online Options Tools W	indow Help Ctrl+K 👔 🛄 🎇 🍠 (Goonline 🖉 Gooffline 🔒 13 🖪 🕂 🛪
Start	Project tree Devices → O → Add new device → Devices & networks → Devices & network	Go offline Stop runtime/simulation Stop runtime/simulation Upownload to device Extended download to devic Download and reset FLC pr Download and reset FLC pr Download user program to Upload from device Backup from neline device Upload device to FGIPC	Ctrl+M Ctrl+L ce gram Memory Card TimeSyn_Project_04 [V11]	PLC_1 [CPU 317-2 PNDP]
	 ↓ Gommon data ↓ Documentation sett ↓ Languages & resour ↓ Gould Languages & could be access ↓ Card Reader/USB memory 	HAIL Device maintenance HAIL Device maintenance Accessible devices Start CPU Contine & diagnostics	Online access • Diagnostics • Functions Assign IP address Set time Firmware update Assign name Reset to factory settings	Set time PG/PC time: (GMT+01:00) Amsterdam, Berlin, Bern, Rome, Stockholm, Vier May 28, 2013 Module time May 28, 2013 10:24:23 AM Take from PG/PC Apply

6.1 General

6.1.1 Opening the "plant screens"

Start screen

When starting the HMI project on the operator panel, the following start screen is displayed.

The "**Application example**" button takes you to the navigation overview of the created time synchronization plant screens.

Figure 6-2



Navigation overview

This screen provides you with the navigation overview of the configured plant screens. In this example, there is only the "**Overview**" screen.

The "Overview" screen provides a summary of the task.

The "Time synchronization" button takes you to the time synchronization "plant screen".





6.1 General

6.1.2 Functionality of the plant screens

The figure below shows the user interface. Except for the labels, the objects shown in this figure are identical in all sample projects.



Section 1:

The top part of the screen contains two output fields. The system time of the operator panel and the system time of the PLC are output in the output fields. The two output fields are not mandatory for implementing time synchronization.

Section 2:

The "input/output field" in the bottom part of the screen is used to test the time synchronization functionality.

The "input/output field" is **not** mandatory for implementing time synchronization.

6.2 Adjusting the time zone on the panel and in the CPU

6.2 Adjusting the time zone on the panel and in the CPU

To make sure that the time is displayed correctly, the same time zone must be set on the panel and in the CPU.

Setting the time zone on the panel

No.	Action
1.	Date/Time
	On the panel, open the Control Panel and click the "Date/Time" dialog.
	Date/Time Properties OK X
	Date/Trne
	November 2010 Current Time 1 1 1
	M D M D F S S 25 26 27 28 29 30 31 Time Zone
	1 2 3 4 5 6 7 8 9 10 11 12 13 14 (GMT+01:00) Amsterdam, Berlin, Bern, Rom 🔻
	15 10 17 18 19 20 21 22 23 24 25 26 27 28
	29 30 1 2 3 4 5
	- In "Time Zone" colocit the active time zone for the exercise
	 In Time zone , select the active time zone for the operator panel. Select "Apply" to confirm your setting
	Coloci / pp/y to commin your colling.
	The time displayed in "Current Time" is adjusted to the selected time zone.
	Note regarding Basic Panels
	For Basic Panels, you set the time shift directly in the "Date/ I ime" dialog box.

6.2 Adjusting the time zone on the panel and in the CPU

Setting the time zone in the CPU

ble 6-2		
No.		Action
	Time zone Depending on the menu on the disp between the CPU In the configuration	e controller used, you can directly set the time zone using the blay of the CPU (e.g., S7 1500) or using an online connection J and the configuration computer. on user interface, use the project tree to open
	The "Set time" menu item allows you to change the module time. The time zone ("PG/PC time") is applied from the time zone stored in the PC's Control Panel.	
	Firmware-Update Name zuweisen Rücksetzen der PROFINE	PG/PC Zeit: (UTC-01:00) Amsterdam, Berlin, Bern, Rom, Stockholm, Wien V 08. Februar. 2016 V 11:42:46 Baugruppenzeit 08. Februar. 2014 V 11:41:45 Von PG/PC übernehmen Übernehmen

6.3 TimeSyn_Project_01 (variant 1)

6.3 TimeSyn_Project_01 (variant 1)

S7-1200 / S7-1500 time synchronization

Time synchronization between an S7-1200 and a TP1200 Comfort Panel.

HMI_01_TP1200_Slave

PLC (master) → HMI operator panel (slave)

Table 6-3

No.	Action
1.	Opening time synchronization
	Select " Application example > Overview > Time synchronization " to open the time synchronization.
2.	Specifying HMI time
	In the I/O field, change the HMI system time and press "Enter" to complete your entry (1).
	In this example: The HMI time (hour) was changed to 7 p.m.
	The HMI system time is adjusted to the PLC system time within a minute.
	5/2/2013 9:44 PM
	Time synchronization SIEMENS
	Time synchronization
	Overview Display of the system time
	HMI system time (Slave)
	5/2/2013 9:44:38 PM 5/2/2013 2:44:53 AM
	1 Manual setting of the system time
	HMI system time To test the clock synchronization, you can change the HMI system time here. 5/2/2013 9:44:38 PM b

6.3 TimeSyn_Project_01 (variant 1)

HMI_02_TP1200_Master

HMI operator panel (master) \rightarrow PLC (slave)

<u> </u>		
Tab	le	6-4

No.	Action
1.	Opening time synchronization
	Select " Application example > Overview > Time synchronization " to open the time synchronization.
2.	Specifying HMI time
	In the I/O field, change the HMI system time and press "Enter" to complete your entry (1).
	In this example: The HMI time (hour) was changed to 7 p.m.
	The PLC system time is adjusted to the HMI system time within a minute.
	5/2/2013 9:22 PM
	Time synchronization SIEMENS
	Fime synchronization
	Overview Display of the system time
	HMI system time (Master) Local plc system time (Slave)
	5/2/2013 9:22:43 PM 5/2/2013 2:23:57 AM
	Manual setting of the system time
	HMI system time 5/2/2013 9:22:44 PM by c by

6.4 TimeSyn_Project_02 (variant 2)

6.4 TimeSyn_Project_02 (variant 2)

PLC (master) \rightarrow operator panel (slave)

Time synchronization between an S7-300 controller and a TP1200 Comfort Panel. Time synchronization is performed via the "DateTimePLC" area pointer.

Table 6-5

No.	Action
1.	Opening time synchronization
	Select "Application example > Overview > Time synchronization" to open the time synchronization.
2.	Specifying HMI time
	In the I/O field, change the HMI system time and press "Enter" to complete your entry (1).
	In this example: The HMI time (hour) was changed to 9 a.m.
	The HMI system time is adjusted to the PLC system time within a minute.
	5/14/2013 9:41 AM
	Time synchronization SIEMENS
	Fime synchronization
	Overview Display the time
	HMI system time (Slave) PLC system time (Master)
	5/14/2013 9:41:02 AM 5/14/2013 12:41:27 PM
	Manual setting of the system time
	HMI system time 5/14/2013 9:41:02 AM Image: System time Im

6.5 TimeSyn_Project_03 (variant 3)

6.5 TimeSyn_Project_03 (variant 3)

PLC (master) → operator panel (slave)

Time synchronization between an S7-300 controller and a TP1200 Comfort Panel.

Time synchronization is performed via the "JobMailbox" area pointer with controller job numbers 14 (time) and 15 (date).

For this time synchronization, the time and the date of the operator panel can be synchronized with the PLC system time independently of each other.

Τ	ab	le	6-6	

No.	Action	
1.	Opening time synchronization	
	Select " Application example > Overview > Time synchronization " to open the time synchronization.	
2.	Specifying HMI date (alternatively, the time)	
	 In the I/O field, change the HMI system date and press "Enter" to complete your entry (1). Select the "Start set HMI date" button (3). 	
	In this example: The HMI date (month) was changed to "4".	
	Selecting the button (3) adjusts the HMI system date to the PLC system date.	
	4/14/2013 3:35 PM	
	Time synchronization SIEMEN	
	Fine Synchronization	
	Overview Display the time Start HMI system time (Slave) PLC system time (Master) 4/14/2013 3:35:13 PM 5/14/2013 3:35:14 PM	
	Manual setting of the system time HMI system time 3:35:13 PM 4//14/2013	

6.6 TimeSyn_Project_04 (variant 4)

6.6 TimeSyn_Project_04 (variant 4)

Operator panel (master) \rightarrow PLC (slave)

Time synchronization between a TP1200 Comfort Panel and a S7-300 controller. Time synchronization is performed via the "DateTime" and "JobMailbox" area pointers with job number 40.

Table	6-7
-------	-----

No.	Action	
1.	Opening time synchronization Select "Application example > Overview > Time synchronization" to open the time	
2.	Specifying HMI time	
	 In the I/O field, change the HMI system time and press "Enter" to complete your entry (1). Select the "Start set plc time" button (2). 	
	In this example: The HMI time (hour) was changed to 9 a.m.	
	Selecting the button adjusts the PLC system time to the HMI system time.	
	5/14/2013 9:58 AM	
	Time synchronization SIEMENS	
	Time synchronization	
	Overview Display the time	
	HMI system time (Master) PLC system time (Slave) 5/14/2013 9:58:43 AM 5/14/2013 2:58:51 PM	
	Manual setting if the system time	
	HMI system time 5/14/2013 9:58:43 AM With the system time of the plc will be synchronized with the system time of the HMI.	

7.1 Replacing the PLC

7 Notes and Tips

The aim of the following notes and tips is to provide support if you want to customize the supplied configurations to your project environment.

7.1 Replacing the PLC

Instead of the SIMATIC PLC used, other SIMATIC controllers from the WinCC TIA Portal hardware catalog can also be used.

When replacing the SIMATIC controller, consider and then check the following:

- Only SIMATIC S7-1200 and S7-1500 controllers support time synchronization via "HMI time synchronization mode".
- If you are using the function blocks from the "TimeSyn_Project_03" (FB120) or "TimeSyn_Project_04" (FB110) projects, the SIMATIC controller used must support the "STL" programming language. The FBs were created in the STL programming language.
- If, for example, the connection paths (Ethernet/PROFIBUS) have changed, check the following in the HMI configuration ...
 - the configured HMI connection
 - the connections used in the global area pointer
 - the addresses of the area pointers used.

7.2 Replacing the HMI operator panel

Instead of the TP1200 Comfort Panel used, you can also use a different operator panel from the WinCC TIA Portal hardware catalog.

When replacing the HMI operator panel, consider and then check the following.

- Area pointers used Before replacing the operator panel, make sure that the new operator panel supports the area pointer used. For more information, please refer to the WinCC (TIA Portal) system manual.
- Creating a new connection (PROFINET → PROFIBUS). If you create a new connection instead of the existing connection, you have to rebuild the area pointers.

8 Links & Literature

8.1 References

This list is not complete and only represents a selection of relevant literature. Table 8-1

	Торіс	Title
/1/	STEP7 SIMATIC S7-300/400	Automating with STEP7 in STL and SCL Author: Hans Berger Publicis Publishing ISBN: 978-3-89578-412-5
/2/	STEP7 SIMATIC S7-300/400	Automating with STEP7 in LAD and FBD Author: Hans Berger Publicis Publishing ISBN: 978-3-89578-410-1
/3/	STEP7 SIMATIC S7-300	Automating with SIMATIC S7-300 inside TIA Portal Author: Hans Berger Publicis Publishing ISBN: 978-3-89578-443-9
/4/	STEP7 SIMATIC S7-400	Automating with SIMATIC S7-400 inside TIA Portal Author: Hans Berger Publicis Publishing ISBN: 978-3-89578-383-8
/5/	STEP7 SIMATIC S7-1200	Automating with SIMATIC S7-1200 Author: Hans Berger Publicis Publishing ISBN: 978-3-89578-385-2

8.2 Internet links

This list is not complete and only represents a selection of relevant information. Table 8-2

Торіс	Title
Reference to the entry	https://support.industry.siemens.com/cs/ww/de/view/6986440 8
Siemens Industry Online Support	https://support.industry.siemens.com
WinCC Advanced V13.0	https://support.industry.siemens.com/cs/ww/en/view/91479053
System Manual	
FAQ	How do you parameterize a structured data type in the IN_OUT area of an FB and a function call with an ARRAY variable?
	TopicReference to the entrySiemens Industry Online SupportWinCC Advanced V13.0System ManualFAQ

History Table 9-1 9

Version	Date	Modifications
V1.0	08/2013	First version
V1.1	09/2013	Chapter 2.1, notes added
V1.2	11/2013	Controller job 13/14 => controller job 14/15
V1.3	04/2015	FBs adjusted. Initialization of address register
V4.0	03/2016	Documentation completely revised
V4.0	04/2017	Figures under chpater 3.2 changed (german -> english)