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SINAMICS S: Speed Control of a S120 with SIMATIC S7-300/400F (STEP7 V5) via PROFIBUS DP with Safety Integrated (via PROFIsafe) and HMI

SINAMICS S120 SIMATIC S7-300/400F

http://support.automation.siemens.com/WW/view/en/68624711

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1 Task

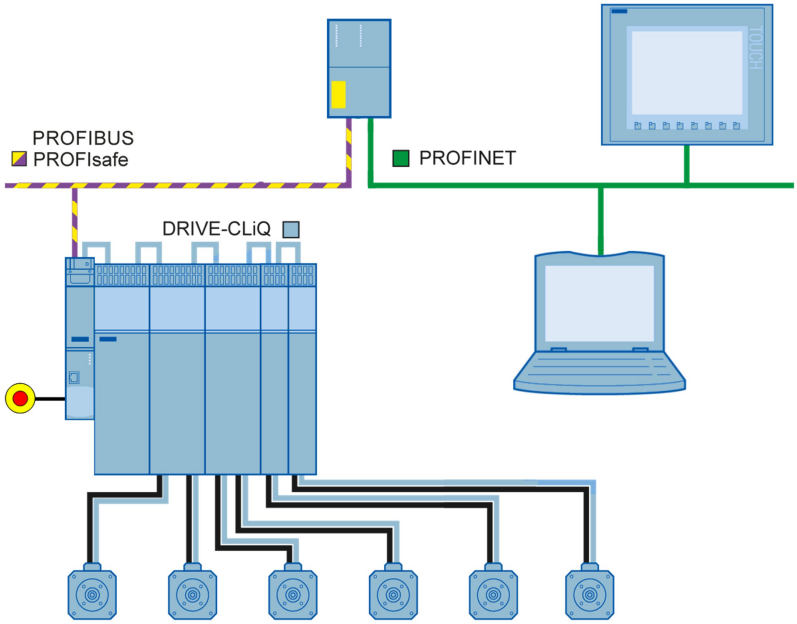
The SIMATIC S7 300/400F can be operated as a PROFIBUS master. A SINAMICS S120 can be used as PROFIBUS slave and be controlled by the SIMATIC S7-300/400F.

This application example illustrates how to configure the SINAMICS S120 and the S7-300/400F, start it up and access process data and parameters. At the same time, safety-related data can be exchanged between S7-300/400F and SINAMICS S120.

Overview of the automation task

The figure below provides an overview of the automation task.

Figure 1-1



Automation task requirements

Table 1-1

Requirement	Explanation
Access to process data	The SINAMICS S120 shall be switched on and off via the control word, and the speed value is to be specified as quickly as possible.
Access to parameters	Read and write access from/to the parameters in the SINAMICS S120 by SIMATIC S7-300/400F (in this example: Control Unit, Line Module, Drives) shall be possible and performed using as few resources as possible, i.e. small communication load.
Safety function of SINAMICS S120	The SINAMICS S120 converters have the option of performing a fail-safe shutdown (e.g. emergency-stop, safe speed). These functions are safely triggered by the S7-300/400F CPU.

2 Solution

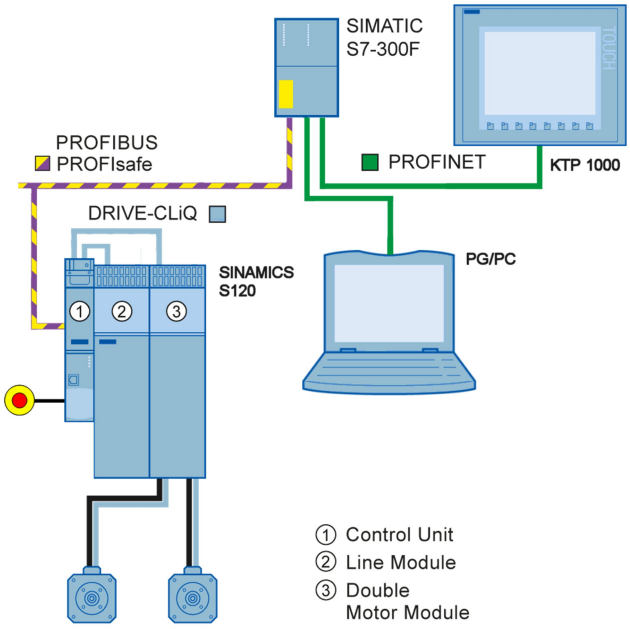
This application example gives an example of how to connect drive objects of a SINAMICS S120 to an SIMATIC S7-300F. It uses blocks which can be directly applied to your own application.

2.1 Solution overview

Schematic layout

The following figure gives a schematic overview of the most important components of the solution:

Figure 2-1



The example shows you how ...

- ...the SIMATIC S7-300/400F controller is configured.
- ...the communication is programmed in the SIMATIC S7-300/400F controller.
- ...the SINAMICS S120 converter is configured using STARTER.
- ...the basic and extended safety functions of SINAMICS S120 are addressed by the S7-300/400F CPU.

NOTICE	**This example is only valid for frequency converter SINAMICS S120 as of FW4.5 and STARTER as of V4.3.1.2** **With other software versions, please follow the configuration steps in chapter 6.2.**

2.2 Description of the core functionality

2.2.1 Configuring the communication

The program for SIMATIC S7-300/400F and the configuration of the SINAMICS S120 are centrally stored in a STEP 7. The respectively required editors are called up via the SIMATIC Manager.

SIMATIC S7-300/400F

In this example, the SIMATIC S7-300/400F is programmed with STEP 7 V5. The SIMATIC S7 and the stations connected via PROFIBUS, such as SINAMICS S120, are configured in HW Config.

SINAMICS S120

The configuration of SINAMICS S120 is performed using the STARTER commissioning tool.

With SINAMICS S120 drive objects, one of several message frame types can be selected for cyclic data exchange or PROFISAFE communication. This defines which data is transmitted or received in which order for the individual drive objects. After STARTER has been integrated into the SIMATIC Manager, the frames set in STARTER are transferred to STEP 7 HW Config with a click, and the I/O address is also defined. These addresses must be used by SIMATIC S7-300/400F for accessing the SINAMICS S120.

2.2.2 Data exchange

Data exchange between SIMATIC S120 and SIMATIC S7-300/400F occurs in two areas:

- Process data (cyclic communication)
  i.e. control word(s) and setpoint(s), or status word(s) and real value(s)
- Parameter area (acyclic communication)
  i.e. reading/writing of parameter values

Note The two areas, process data and parameters, are independent of each other and can also be used individually.

Cyclic process data exchange

Process data is transferred cyclically, which means in each bus cycle. Data transfer is performed as quickly as possible.

The SIMATIC S7-300/400F sends the control words and setpoints to the SINAMICS S120 drive objects and receives status words and the actual values in return.

Depending on the message frame type, two further setpoint or real values, or extended control or status words respectively, can be transferred.

In this example,

- the “SIEMENS telegram 370” frame with frame expansion (alarm, fault) for the Line Module drive object,
- the “SIEMENS Telegram 390” frame with frame expansion (alarm, fault) for the Control Unit drive object (in the documentation still referred to as CU320-2 DP), and
- the “SIEMENS telegram 1” frame with frame expansion (alarm, fault) for drive object “Drive” are used.

The fail-safe communication is also transferred cyclically.

- In STARTER, the PROFIsafe communication is enabled by selecting and transferring the additional PROFIsafe message frame to HW Config. Accordingly, the parameterization of the safety functions to be used must be defined in SINAMICS S120.

Frame configuration:

- in SINAMICS S120, the process data is interconnected automatically when selecting the frame. The frame expansions must be configured manually.
- on the SIMATIC S7-300/400F side, the process data is supplied as I/O input or output words.

Acyclic data exchange (parameter access)

The original PROFIBUS specification (now referred to as PROFIBUS DPV0) only allowed exchanging cyclic data. To be able to transfer parameters, message frame types are defined where additionally four words are provided for a parameter transfer. Since these four words, like the process data, are transmitted cyclically, a permanent communication load is produced even though the parameter transmission itself is generally only rarely used.

PROFIBUS DPV1 provides the option to use acyclic data exchange, used only when required, in addition to cyclic data exchange.

This makes it possible to transfer the parameter area acyclically on demand, without creating a permanent communication load. The acyclic transfer takes clearly longer than the cyclic transfer of the process data.

In the example, the acyclic data exchange is used to access the parameters.

- In SIMATIC S7-300/400F, parameter jobs are sent to the SIMATIC S120 drive objects by writing “Data record 47”, and the response from the SIMATIC S120 drive objects is read by reading “Data record 47”.
- No particular action is required on the SIMATIC S120 side.

Note When using a CP342-5 as a DP master, the parameters of the SINAMICS S120 drive objects cannot be accessed with acyclic data transfer.

2.3 Hardware and software components used

The application was set up with the following components:

General hardware components

Table 2-1: Hardware components

Component	No.	Order number	Note
CPU 315F-2 DP/PN	1	6ES7315-2FJ14-0AB0	or other SIMATIC S7-300/400F CPU with PN/DP interface
MMC 128kB	1	6ES7953-8LG30-0AA0	or larger MMC
SM 326	1	6ES7326-1BK02-0AB0	or another module with F-DIs
SIMATIC Panel KTP1000 Basic color PN	1	6AV6647-0AF11-3AX0	or another operator panel, or WinCC flexible Runtime
PROFINET connector plug	4	6GK1901-1BB10-2AA0	Two for the PG/PC connection with the S7-CPU and two for the connection between S7-CPU and operator panel.
PROFINET line		6XV1840-2AH10	
PROFIBUS connector plug	2	6ES7972-0BB60-0XA0	or another PROFIBUS connector for the connection between SINAMICS S120 and S7-CPU
PROFIBUS line		6XV1830-0EH10	

SINAMICS S120 hardware components

Table 2-2: SINAMICS components

Component	No.	Order number	Note
CU320-2 DP	1	6SL3040-1MA00-0AA0	SINAMICS S120 Control Unit with PROFIBUS interface
CompactFlash card (CF card) with SINAMICS Firmware V4.5	1	6SL3054-0EF01-1BA0	or CF with higher firmware version
Active line module 16kW	1	6SL3130-7TE21-6AA4	or other line module with appropriate power
Active interface module for 16kW active line module	1	6SL3100-0BE21-6AB0	Only for active line module, see also device manual Booksize power units \7\
Double motor module	1	6SL3120-2TE15-0AA4	or other motor module with appropriate power

Component	No.	Order number	Note
Motor 1	1	1FK7042-5AF71-1DH0	or other motor SERVO_03 in the project (with break)
Motor 2	1	1FK7042-5AF71-1FG0	or other motor SERVO_04 in the project (with break)
DRIVE-CLiQ line IP20/IP20 0.31m	2	6SL3060-4AK00-0AA0	For the connection: control unit to line module, or control unit to motor module
DRIVE-CLiQ line IP20/IP67 1.0m	2	6FX5002-2DC10-1AB0	DRIVE-CLiQ line for the connection: motor module to the motors
Power line without break line 1m	1	6FX5002-5CS01-1AB0	Power line for SERVO_03
Power line with break pipe 1m	1	6FX5002-5DS01-1AB0	Power line for SERVO_04

Standard software components

Table 2-3: Software components

Component	No.	Order number	Note
SIMATIC STEP 7 V5.5 SP4	1	Floating License 6ES7810-4CC10-0YA5	Always use the latest Service Pack / Update
Distributed Safety V5.4 SP5	1	6ES7833-1FC02-0YA5	
STARTER V4.4 HF3	1	6SL3072-0AA00-0AG0 (download for free \6\)	
WinCC flexible Version: 2008 SP3	1	6AV6613-0AA51-3CA5	

Sample files and projects

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

Table 2-4

Component	Note
68624711_SINAMICS_S120_DP_at_S7-300400F_CODE_V1d1.zip *(for SINAMICS S120 with firmware version 4.7)*	These zip files contain the STEP 7 project with SINAMICS S120 and HMI.
68624711_SINAMICS_S120_DP_at_S7-300400F_CODE_V1d0.zip *(for SINAMICS S120 with firmware version 4.5)*	
68624711_SINAMICS_S120_DP_at_S7-300400F_SHORT-DOCU_V1d1_en.pdf	Short documentation for experienced users
68624711_SINAMICS_S120_DP_at_S7-300400F_DOCU_V1d1_en.pdf	This document

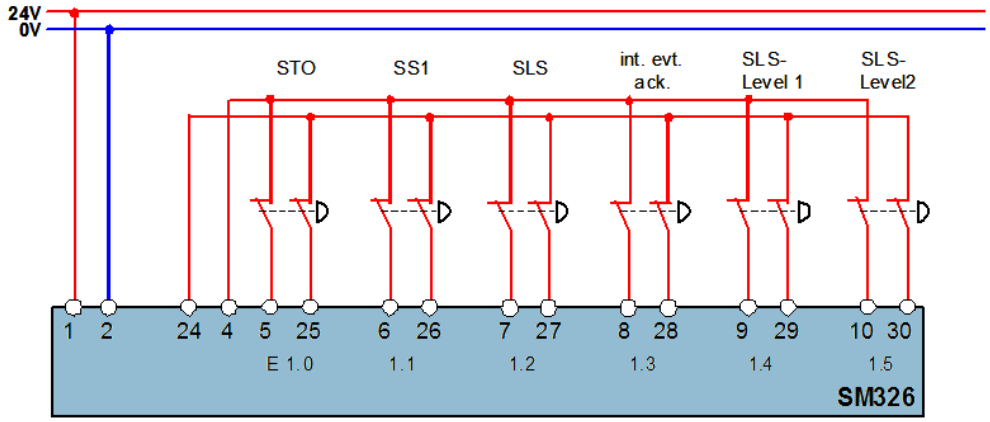
CAUTION **The example projects have been designed for usage with the example components listed in Table 2-1 and Table 2-2. Converters and/or motors can be damaged or destroyed if a SINAMICS S120 with a different configuration or different motors is connected without adjusting the respective parameters.**

3 Setting up and Commissioning the Application

3.1 Wiring

The following safety wiring diagram specifies the terminals of the F-DI module with the individual safety functions.

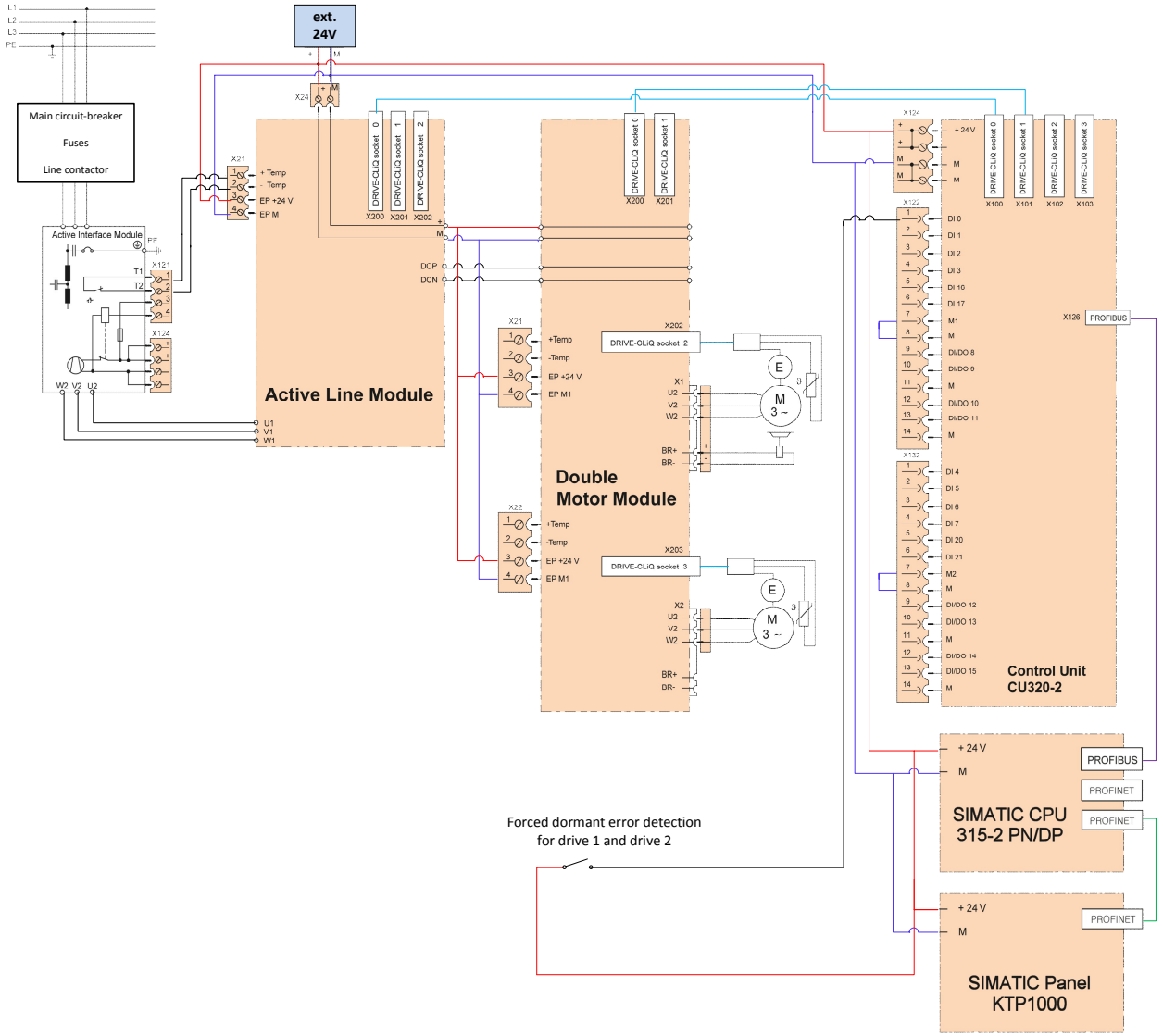
Figure 3-1 F-DI module interconnection



The figure below (see next page) shows the system components, the PROFIBUS connections, power lines, the encoder connection as well as the DRIVE-CLiQ wiring.

Note The setup guidelines in the SINAMICS S120 device manuals (see \7\) and SIMATIC must generally be followed.

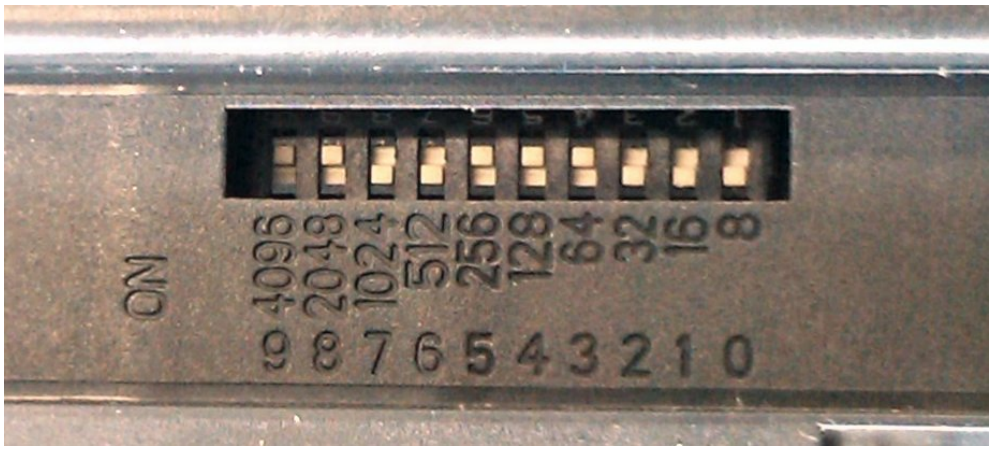
3.1 Wiring



3.2 Setting the PROFIsafe address

For the F-DI module, the PROFIsafe address must be set with the DIP switches on the rear. For this example project, set switches 0, 1, 2, 6 and 7 on the rear of the F-DI module to ON.

Figure 3-2



3.3 IP addresses and PN names

The following IP addresses and device names are used in the example:

Table 3-1

IP	Component	Device Name
192.168.0.1	S7-CPU	s7-cpu
192.168.0.3	KTP1000	KTP1000
192.168.0.200	PG/PC	

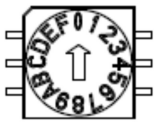
The network mask is always 255.255.255.0 and no router is used.

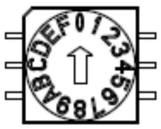
3.4 Settings at the SINAMICS S120

For SINAMICS S120 the PROFIBUS address can either be specified as a default at the control unit via rotary encoding switch, or if both rotary encoding switches on 0 or 7F, via the SINAMICS parameter p918.

In the example, the SINAMICS S120 has address 3 and it is set using the rotary encoding switch.

Table 3-2

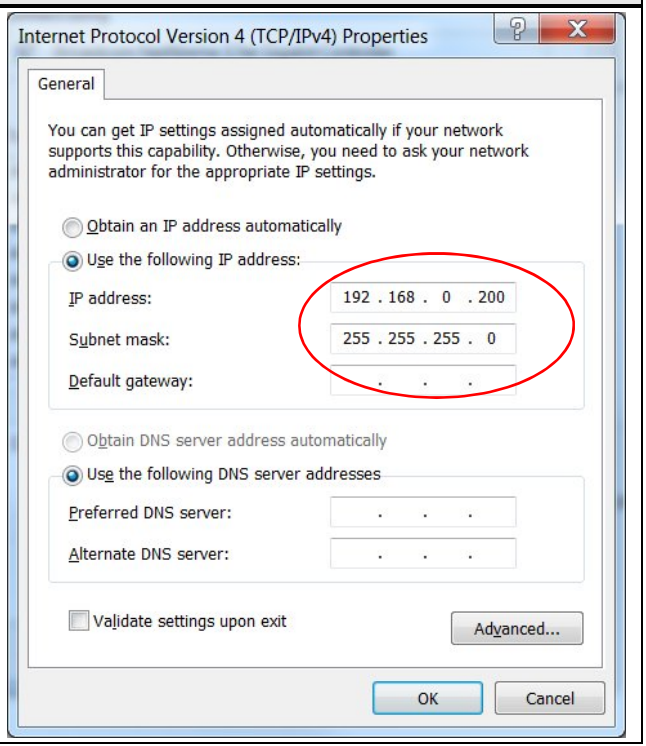
Rotary encoding switch	Valuation	Examples		
		3_{dec}	35_{dec}	126_{dec}
		03_{hex}	23_{hex}	$7E_{hex}$
	$16^1 = 16$	0	2	7

Rotary encoding switch	Valuation	Examples		
 DP L	$16^0 = 1$	3	3	E

After changing the PROFIBUS address, a restart / power reset must be performed to apply the changes.

3.5 PG/PC settings

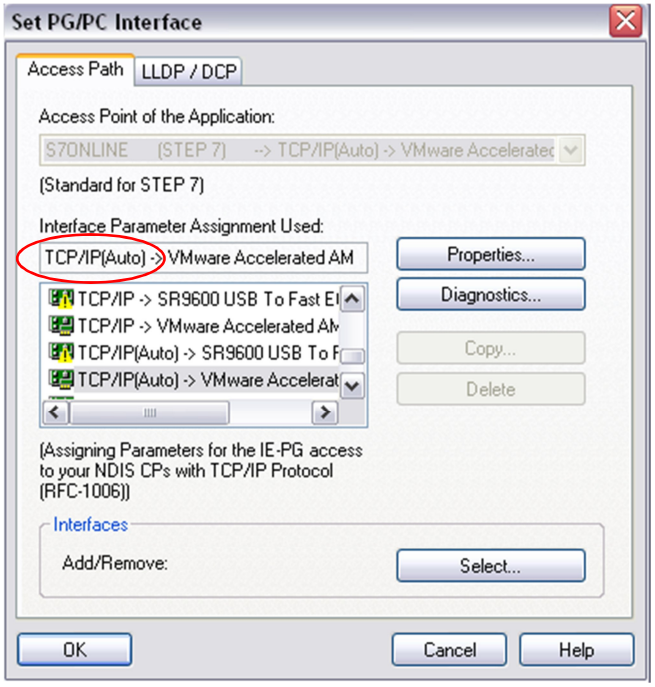
Table 3-3

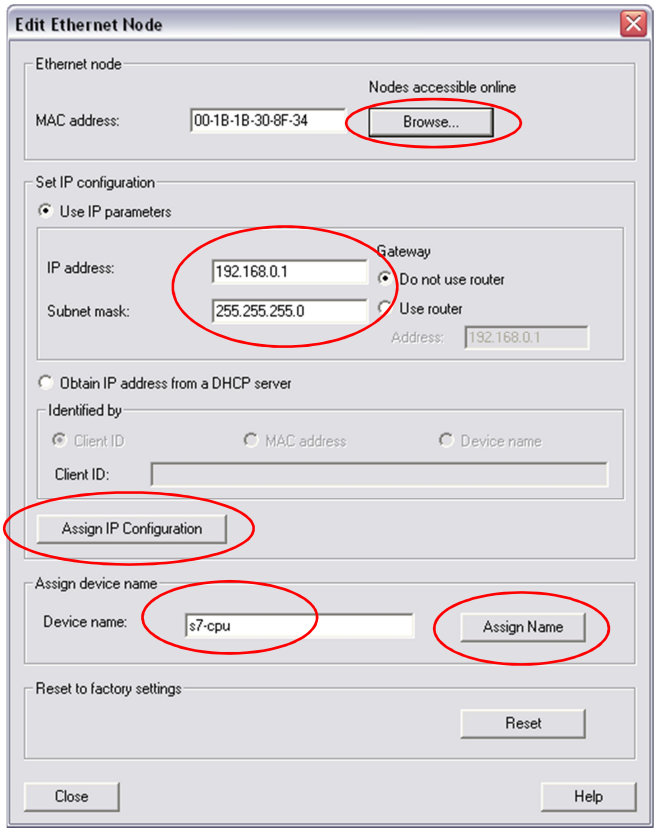
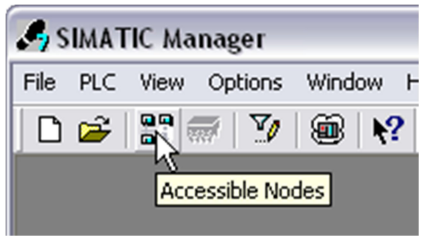
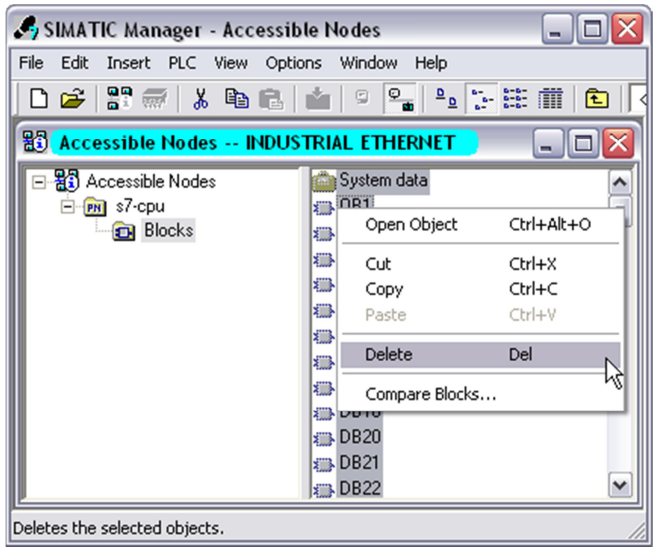
Action	Comments
Set the fixed TCP/IP address 192.168.0.200 and the network mask 255.255.255.0 in the Windows settings for the network card to be used. You may also enter any other IP address (192.168.0.x).	

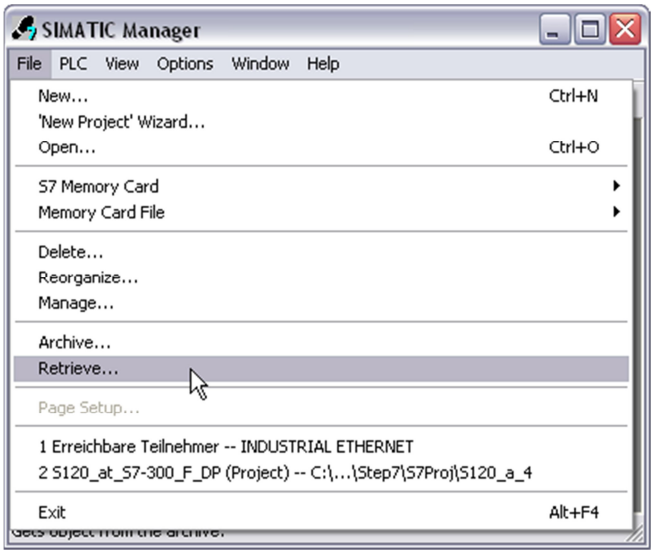
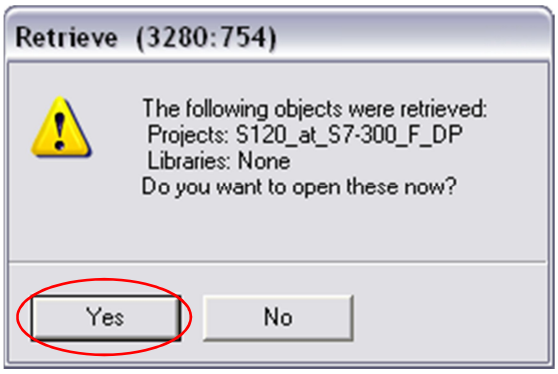
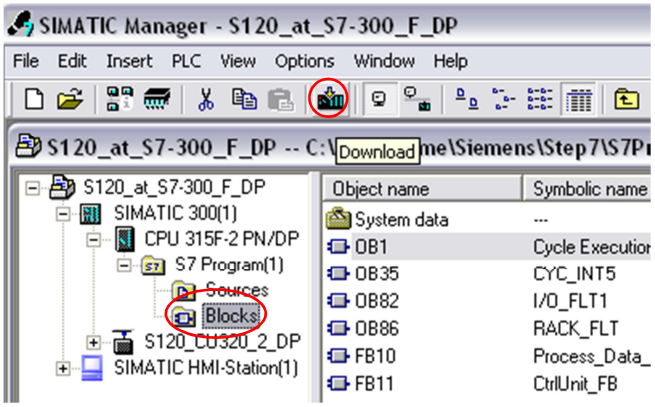
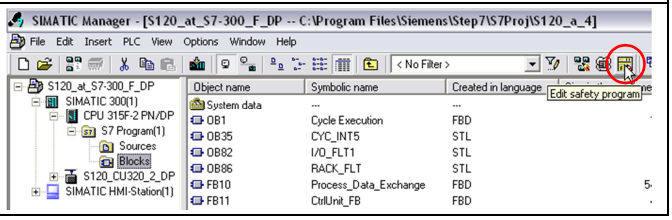
3.6 Downloading the SIMATIC S7 program

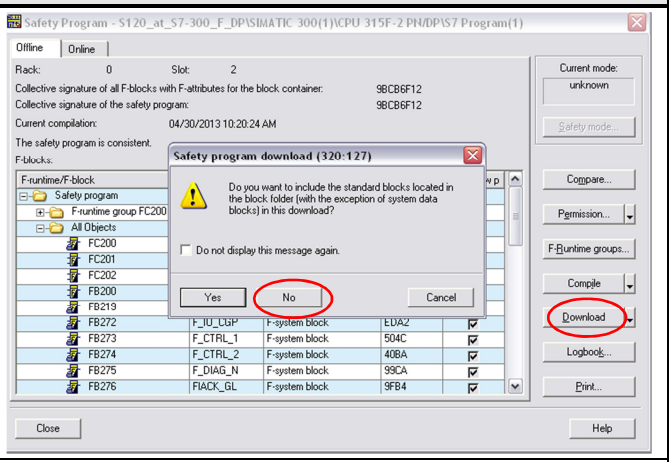
This chapter describes the steps for the installation of the example code.

Table 3-4

No.	Action	Comments
1.	Connect the controller with the SIMATIC S7-300/400F using a network cable.	You can connect both devices directly or via other SIMATIC components.
2.	Start STEP 7.	
3.	• Via “Extras > Set PG/PC Interface...” you open the settings of the online interface. • Select the “TCP/IP network card” with the network card used by you.	
4.	Call up the “Edit Ethernet Node…” dialog.	

No.	Action	Comments
5.	• Click on “Browse...” - Select the CPU and click OK. • Enter the IP address 192.168.0.1 and the subnet mask 255.255.255.0, and click on “Assign IP Configuration”. • Enter the device name “s7-cpu” and click on “Assign Name”. Exit the dialog by clicking “Close”.	
6.	Click on “Accessible Nodes”.	
7.	• Mark all of the blocks in the CPU with <STRG><A> and delete them. • Acknowledge that system blocks, system data, and possibly the configured safety attribute cannot be deleted.	

No.	Action	Comments
8.	If you have not yet retrieved the project, click on “File > Retrieve…” to select the project file (see Table 2-4) and retrieve it.	 
9.	• Open the project, select the “Blocks” folder and click on “Download”. • Also download the system data.	
10.	Click on “Edit safety program” Answer any query for the safety password by entering “siemens”.	

No.	Action	Comments
11.	Click on the “Download” button in the “Safety Program” dialog. • When queried if the standard blocks shall be downloaded as well, respond with “No”. • Enable stopping the S7-300/400F CPU for a consistent download. • Let the S7 300/400F CPU go back to RUN mode. • Close the “Safety Program” dialog.	
12.	Restart the CPU after downloading.	
13.	If you want to use the operator panel, assign the address 192.168.0.3 and load the HMI configuration into the panel using WinCC flexible.	

3.7 Downloading the SINAMICS S120 configuration

This chapter describes the steps for downloading the example configuration.

This can either be performed with SIMATIC S7-300/400F (as in the example) via routing or directly via the PROFIBUS interface or the commissioning interface X127 of the SINAMICS control unit.

Notes

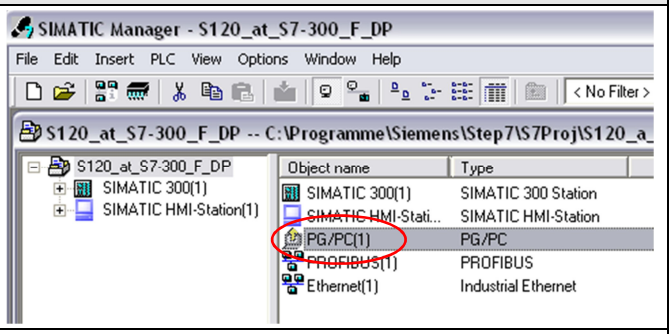
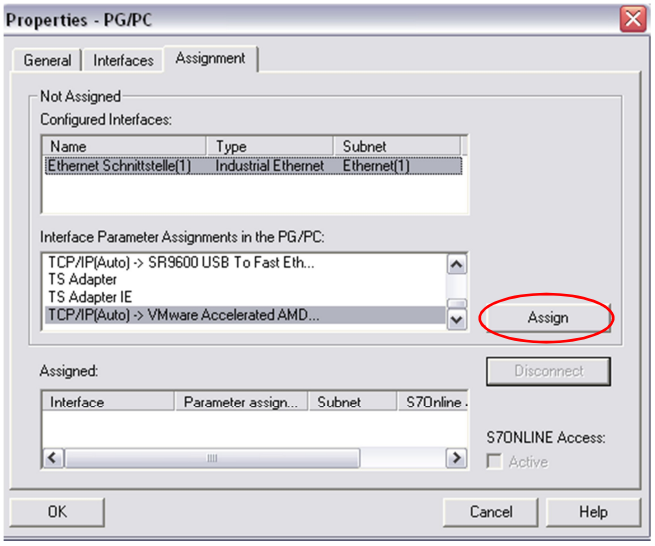
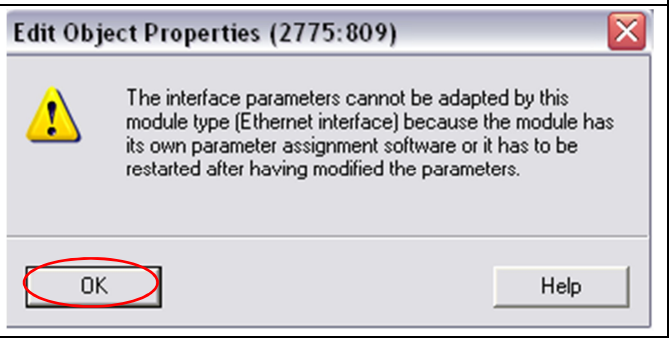
Should you use different SINAMICS S120 components or motors, you need to perform your own configuration. In that case, follow the instructions in chapter 6.2.

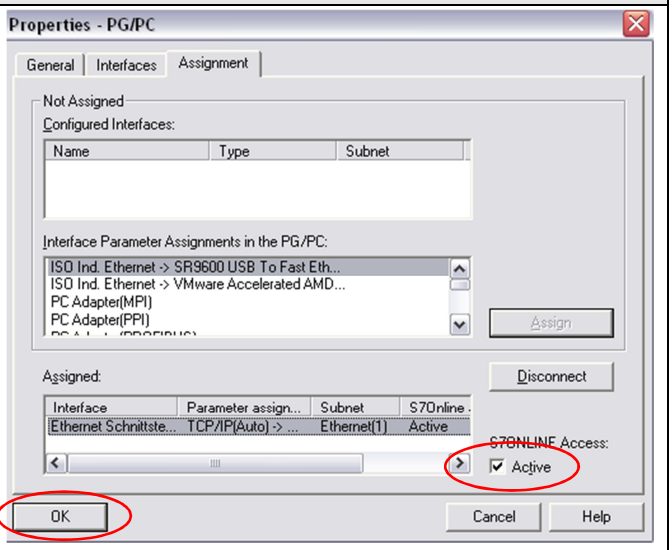
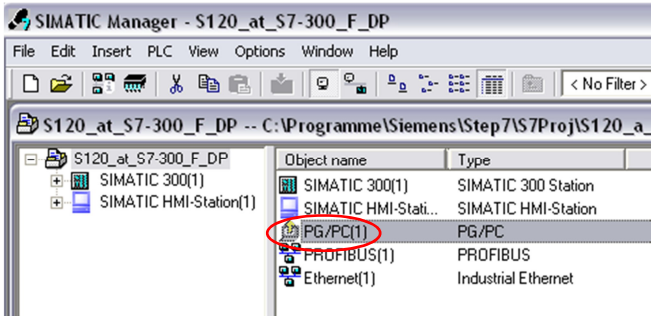
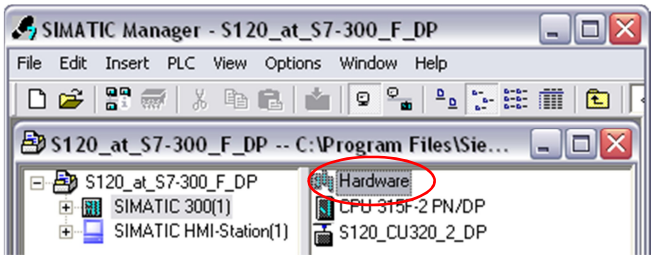
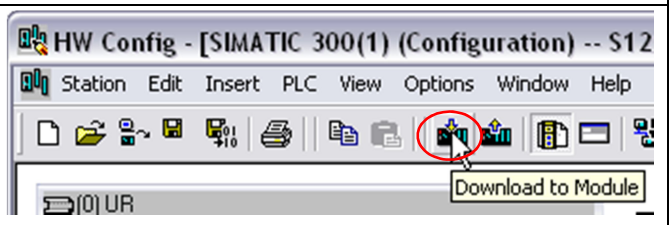
To be able to use routing, in the sample program the PG/PC was inserted into the network configuration and an Ethernet network was configured.
As you are using a network card that differs from the one used when creating the project, your network card must be assigned to the configured PG/PC.

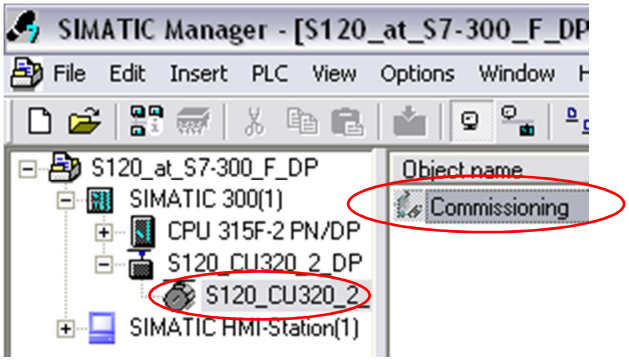
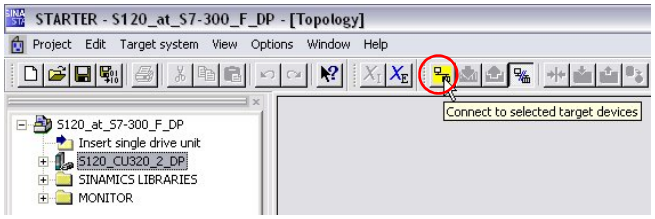
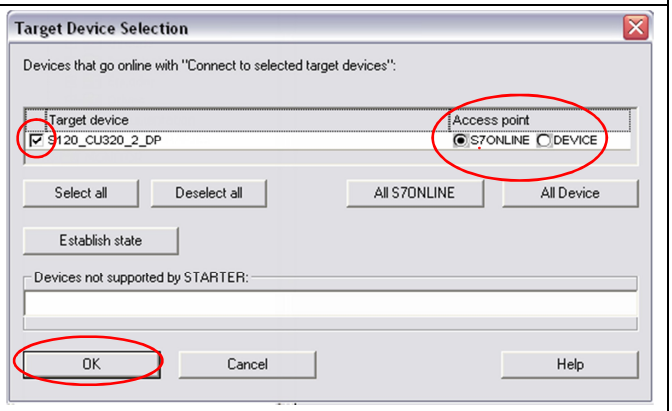
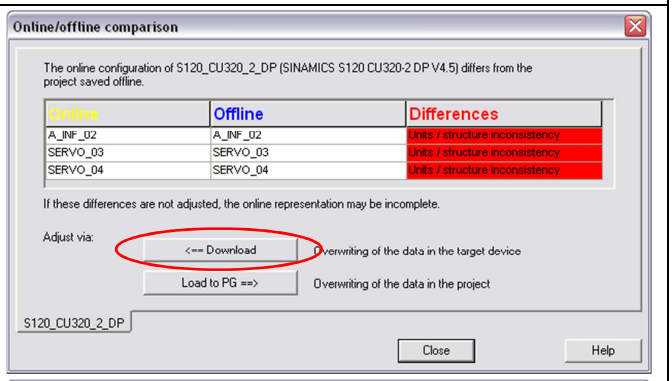
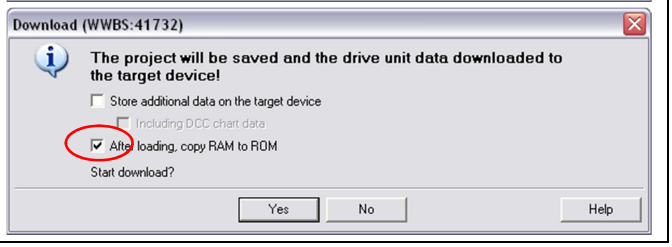
In addition, the following requirements must be met:

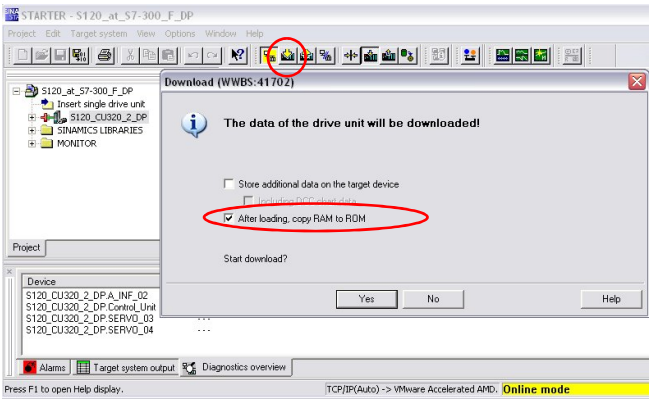
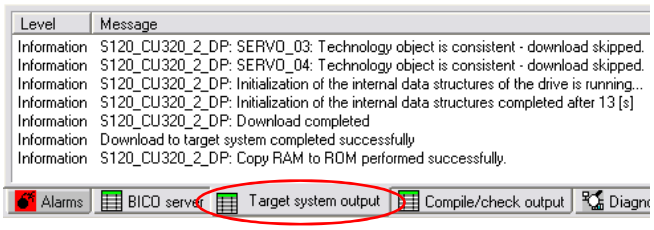
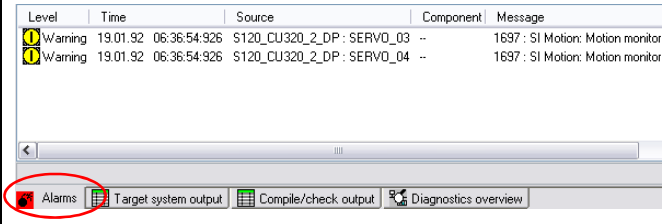
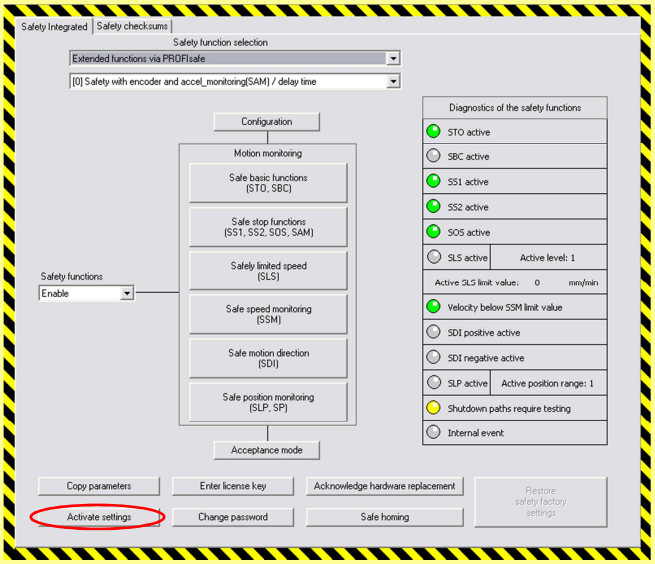
- The SIMATIC program has already been downloaded to the SIMATIC S7 CPU, see chapter 3.6.
- The PROFIBUS connection between SIMATIC S7-300/400F and SINAMICS S120 was established.
- SIMATIC S7-300/400F is networked with the PG/PC via Ethernet.
- The PROFIBUS address (in the example: 3) of the SINAMICS S120 was set using the rotary encoding switches (or via P918), followed by a restart / power reset.

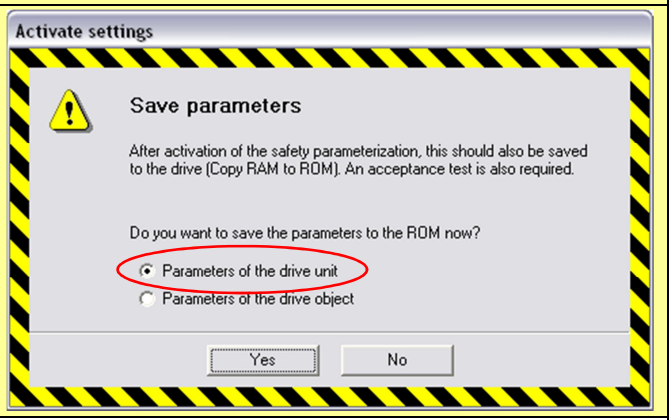
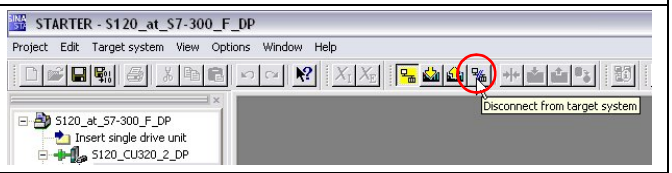
Table 3-5

No.	Action	Comments
1.	• Open the project. • Double-click to open the properties of the “PG/PC”.	
2.	• In the Assignment tab, select “TCP/IP --> *network card*”; instead of *network card*, the name of the network card you want to use must be listed. • Click on “Assign”.	
3.	If necessary, acknowledge that the network card cannot be configured by STEP7.	

No.	Action	Comments
4.	• Make sure that the selected component is shown in “Assigned” and single-click on it. • Make sure that “Active” is checked. • Click on “OK”.	
5.	Make sure that the yellow arrow is now displayed in STEP 7 in “PG/PC(1)”: 	
6.	Open HW Config by double-clicking on “Hardware”	
7.	• Start the download of HW Config • Answer the query whether the CPU shall be started with “Yes” • Close the HW Config.	

No.	Action	Comments
8.	• Click on the SINAMICS S120 named - S120_CU320_2_DP • Double-click on "Commissioning" This opens the commissioning tool STARTER with the current project.	
9.	Go online.	
10.	If the "Target Device Selection" window opens, • set the checkmark at SINAMICS S120, • select the S7Online access point and click on "OK".	
11.	If the "Online/offline comparison" window opens, • click on "Load to PG" • with the "After loading, copy RAM to ROM" option and then on "Close" • proceed with step 13.	 

No.	Action	Comments
12.	If in the preceding step the window has not opened, • start the download yourself and • select the “After loading, copy RAM to ROM” option.	
13.	In the “Target system output” window you verify that the project has been downloaded without errors. Should you receive the note, that some parameters could not be written, or other modules exist in the system, you need to make your own configuration. In that case, follow the instructions in chapter 6.2.	
14.	In the “Alarms” window below you verify that the system was configured without errors. Should there be some errors, remove them and acknowledge. Double-clicking on the error gives you the appropriate description of the STARTER help.	
	Warning “1697: SI Motion: Motion monitoring functions must be tested” is displayed for the drives, which can be deleted by the digital input DI0 of the control unit (see forced dormant error detection in the Safety Integrated function manual \7\ and in chapter 4.1).	
15.	• In the tree you navigate to > S120_CU320_2_DP > Drives > SERVO_03 > Functions > Safety Integrated • first click on “Change settings”, and • then click on “Activate settings”.	

No.	Action	Comments
16.	The standard password is “0”. Enter a new password (e.g. “siemens”) and click on “OK”.	
17.	Select “Parameters of the drive unit” and “Yes” to save the parameters in ROM.	
18.	Repeat the safety settings (steps 15 to 17) with SERVO_04 as well.	
19.	Go offline.	
20.	Execute a restart / power ON reset	Switch off all 24V supply voltages of SINAMICS S120, wait until all LEDs are off, and then switch back on.

4 Operating the Application

4.1 Operating the safety functions

The table below shows the input of the F-input module via which the respective function can be triggered parallel with the example configuration:

Table 4-1

Terminal FDI module of the S7-300F	Function for drive 1 AND drive 2
5+25	STO
6+26	SS1
7+27	SLS
8+28	Ack int event.
9+29	SLS Level Bit 0
10+30	SLS Level Bit 1

If the passivation bits of the F input module or the SINAMICS S120 are set, the acknowledge signal at terminal 8, 28 (F input channel 3, 15) for reintegrating both 'modules' can be used.

The SLS limits have been set to the standard value (200U/min) for both drives.

Note Please note, that the safety functions in SINAMICS S120 can be enabled by the F input module with the logic "0" state.

Note Please note, that the inputs of the F input module for both drives were used. In this way, the functions listed in Table 4-1 are enabled parallel for both drives and equally affect both drives.

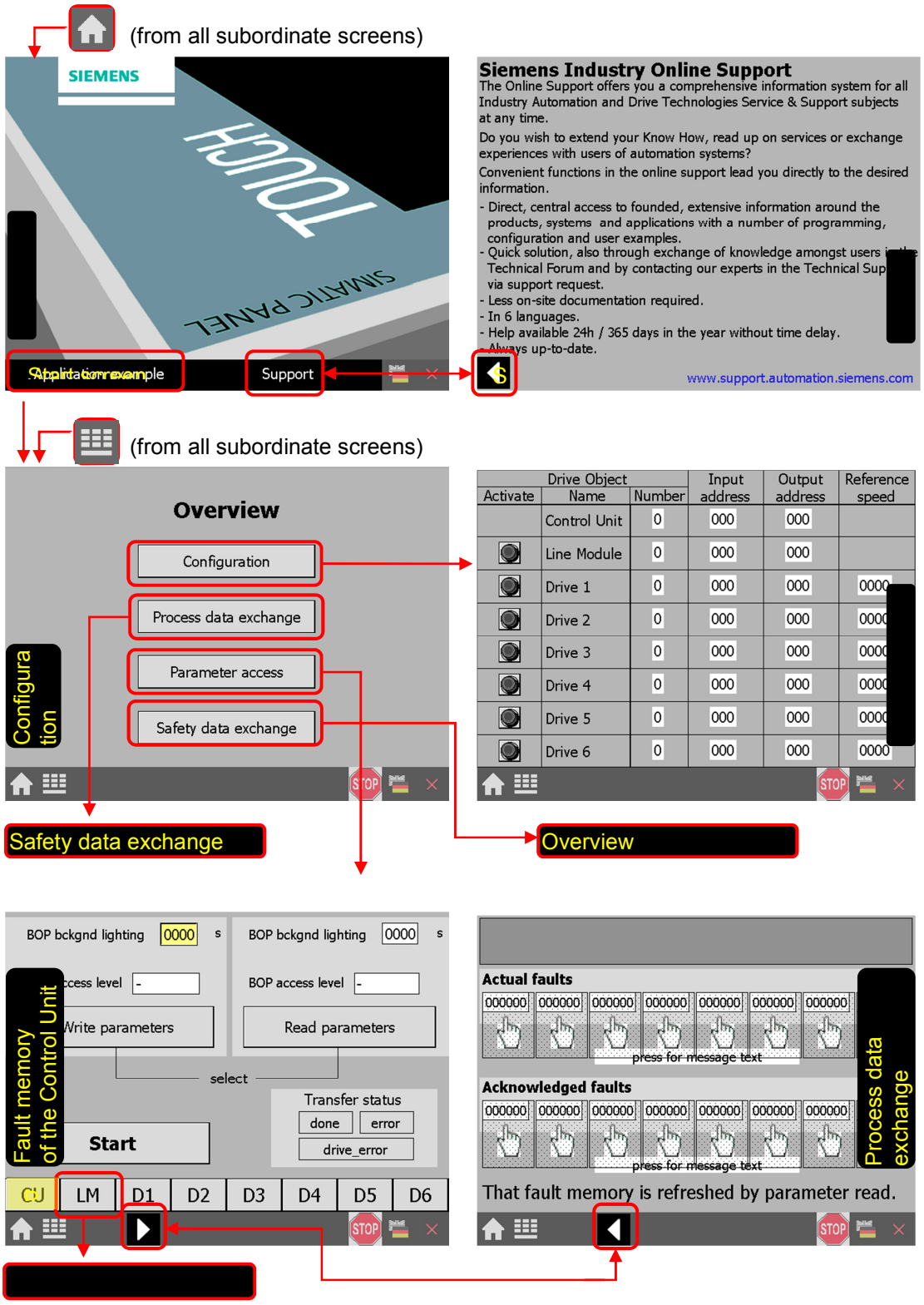
Forced dormant error detection

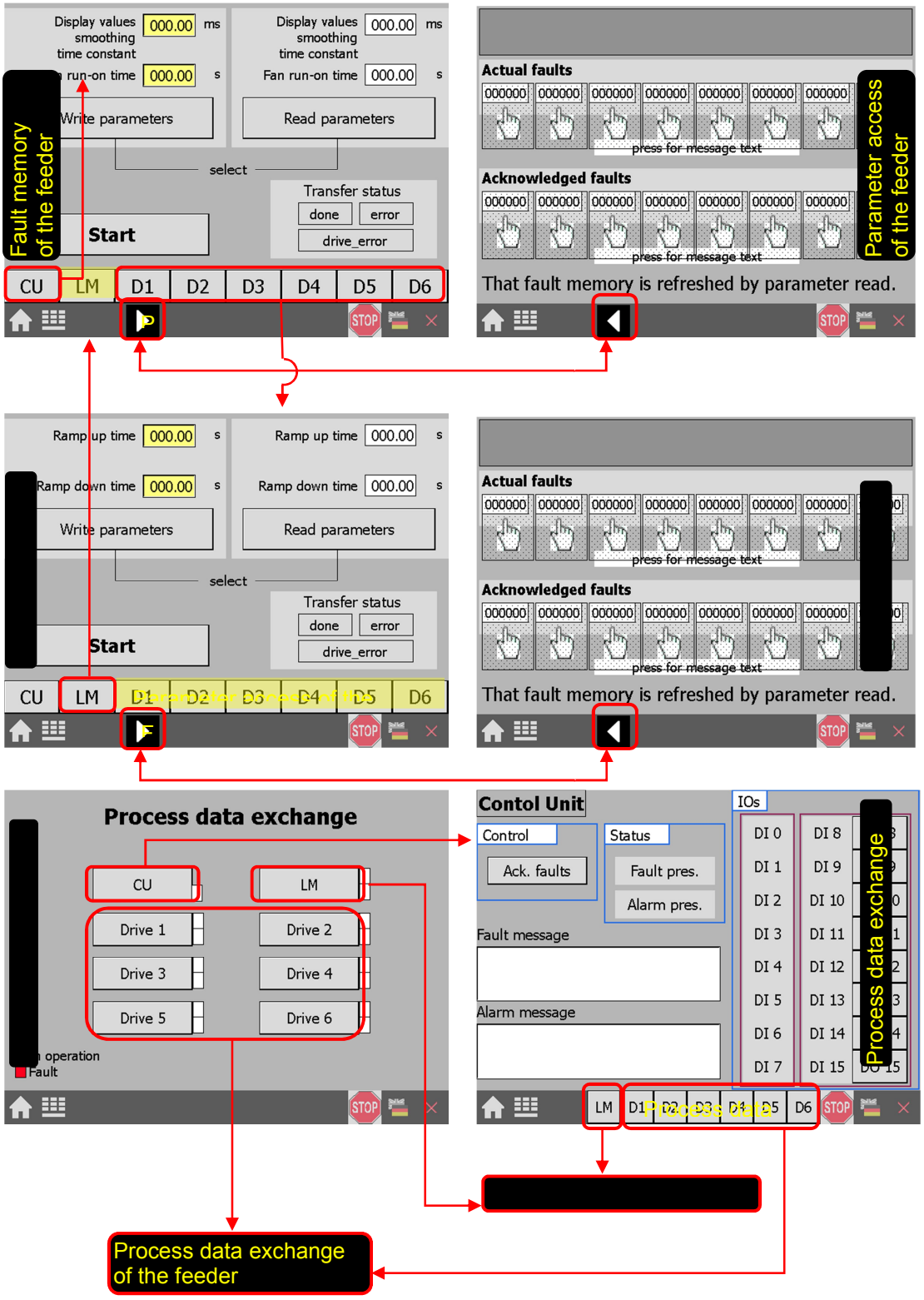
The internal test of the shut-down paths of drive 1 and drive 2 can be started with input DI0 of the control unit. Switch off the drives and enable the DI0 of the control unit for a short moment. Further information is available in the Safety Integrated function manual (see \7\).

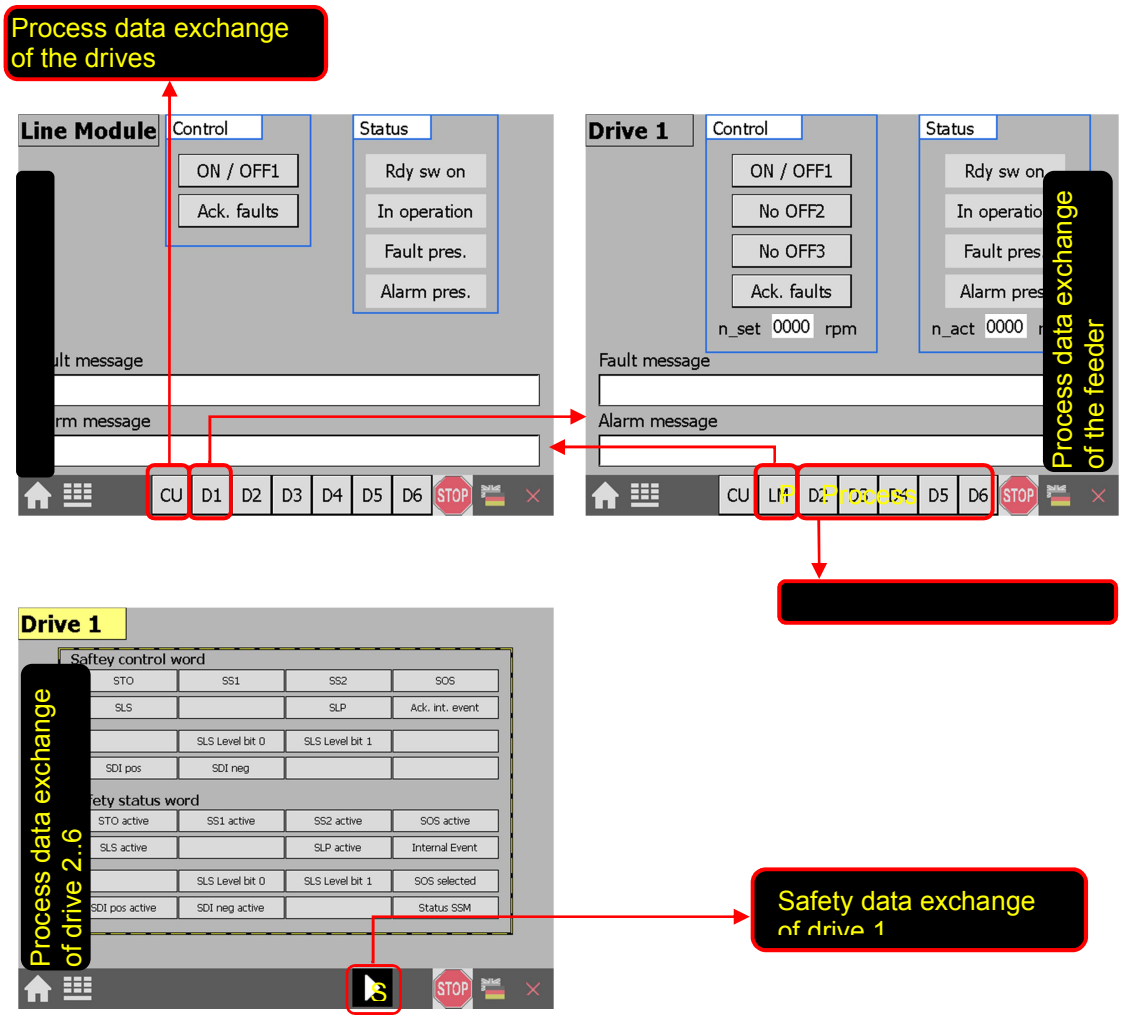
4.2 Configuring, monitoring and parameter access via operator panel

The application can be configured and controlled via operator panel, apart from the safety functions.

4.2.1 Screens and screen navigation







Stop runtime

Switch over language (German/English)

Enable OFF3 and OFF1 for all drives and reset OFF3 (afterwards, the drives can be switched back on with OFF1)

4.2.2 Configuration

In order to use the example, the application must first be configured. In the configuration window, the existing drive objects must be configured. The configuration data is saved in the instance data block iDB_prozess_Data_Exchang (DB10).

In the configuration mask you set the following parameters (when using the example application):

Figure 4-1

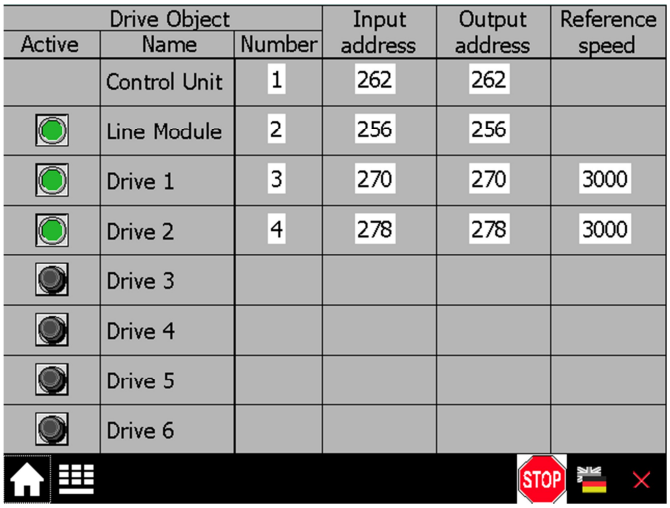


Table 4-2

Parameter	Note
Enable drive object	Enable, if the object exists and can be accessed via PROFIBUS
Drive object number	see in the STARTER: S120_CU320_2_DP / Communication / Message frame configuration
Input address	Enter decimal number, see in STARTER: S120_CU320_2_DP / Communication / Message frame configuration
Output address	Enter decimal number, see in STARTER: S120_CU320_2_DP / Communication / Message frame configuration
Reference speed	Reference speed of the drive [1/min] as decimal number. See p2000 of the configured drive in the STARTER: S120_CU320_2_DP >Drives>SERVO_xy>ExpertList

Note When the drive objects have not been configured completely, or the cyclic communication has failed, the masks (process data exchange parameter access) assigned to the drive object do not appear in the operator panel.

Note The configuration data is saved non-volatile in the instance data block iDB_prozess_Data_Exchang (DB10). The parameters need only be entered once as long as the DB content is not deleted.

4.2.3 Process data exchange

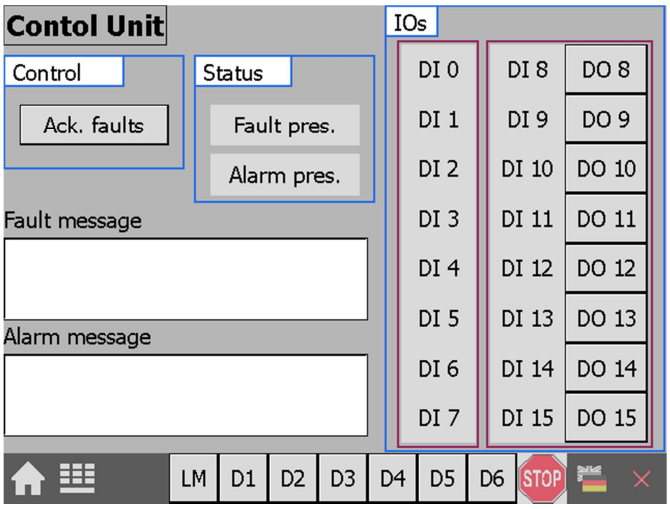
Both screens for the process data exchange access the S120_Data data block (DB30).

Control and status masks of the control unit

The digital inputs/outputs can be read/controlled via the mask of the control unit.

In the case of a fault or an alarm, you can read the texts in the Fault/Alarm lines. The faults can be acknowledged with the “Ack. faults” button.

Figure 4-2



Note

The bidirectional channels (DI/DO8..DI/DO15) can either be configured as inputs or as outputs. The configuration is available in the STARTER, at

S120_CU320_2_DP>Control_Unit>Input/output components>Bidirectional digital inputs/outputs.

The mask of the control panel does not take into account how the individual inputs/outputs are switched. If, for example, DI/DO8 has been configured as input, the DO8 button is without function. It does change the color, however, the output at the CU is not affected. If, for example, DI/DO12 has been configured as the output, DI12 is always grayed.

The operator is responsible for the inputs/outputs being used according to the configuration.

Control and status masks of the line module

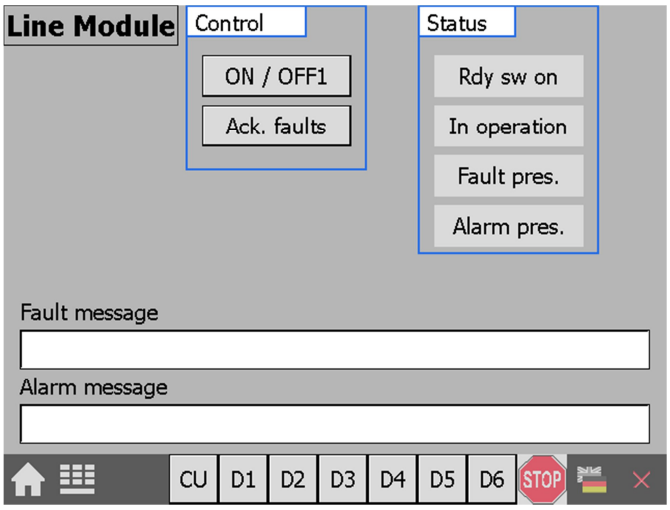
If a line module has been configured, it can be monitored and controlled via process data exchange / line module.

A falt or an alarm you can read in the corresponding output field. The faults can be acknowledged with the “Ackn. Faults” button.

Note

Before switching on the drives, also the line module needs to be switched on with the ON/OFF button.

Figure 4-3



CAUTION

Before interrupting the communication between operator panel and SIMATIC S7-300/400F, please ensure that the line module was switched off.

Otherwise, the switch-on command remains non-volatile in DB30, the line module remains in operation or can be automatically operated after a startup, and link voltage remains pending.

Control and status masks of the drive

The configured drives can be controlled and monitored via the “Process data exchange/Drive x” masks.

Note

Before switching on the drives, also the line module needs to be switched on with the ON/OFF button.

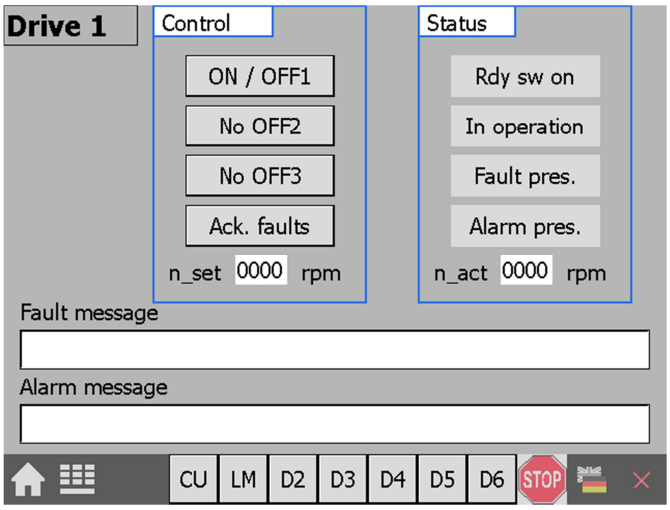
A falt or an alarm you can read in the corresponding output field. The faults (apart from Safety messages) can be acknowledged with the “Ackn. Faults” button.

The drives include OFF1/2/3. In the error-free state, they can be switched on with OFF1, if “no OFF2” and “no OFF3” have already been enabled.
After switching on, the selected drive accelerates to the setpoint speed value, taking into consideration the set ramp-up time.

For switching off, “ON/OFF1” is deleted again and the drive decelerates until standstill, taking into consideration the ramp-down time.

The ramp-up and ramp-down times can be configured. See chapter 4.2.5.

Figure 4-4



CAUTION

Before interrupting the communication between operator panel and SIMATIC S7-300/400F, please ensure that the drives are switched off.

Otherwise, the switch—on command and the setpoint speed value in DB30 remain non-volatile and the drives can keep spinning.

Note

The operator gets no message in the process data exchange window, if the STO safety functions are enabled. If the drive does not switch on, or was switched off, please ensure that the safety functions are not active.

4.2.4 Safety data exchange

The pictures for the safety data exchange directly access the inputs and outputs.

For the Safety masks of the operator panel, the 16 bits wide control word of the PROFIsafe “Standard telegram 30” frame is displayed, irrespective of whether a certain function in the control word can be enabled with the inputs of the digital F input module. In Figure 4-5, the functions that can be enabled via the F input module are marked in green.

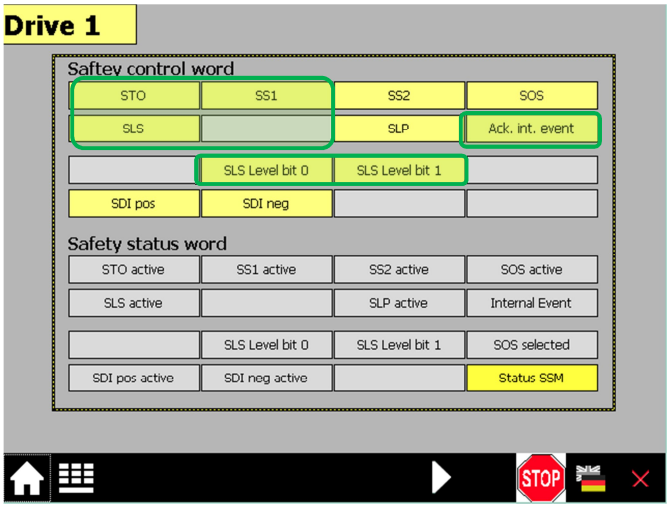
The current state of the Safety function is given to you via the 16 bit wide Safety status word of the PROFIsafe “Standard telegram 30” frame.

Note Please note that signal state “1” (depicted in color) signifies the non-active function and signal state “0” (gray) refers to the active function.

The bits of the SLS threshold are only shown in the Safety status word if the function is also active.

Safety control and status words

Figure 4-5 Safety control and Safety status word



Note The Safety part of the example application was prepared with an F input module for two drives. The Safety masks also only exist for drive 1 and drive 2.

4.2.5 Parameter access

Both masks for the process data exchange access the idb_Parameter_Access data block (DB11).

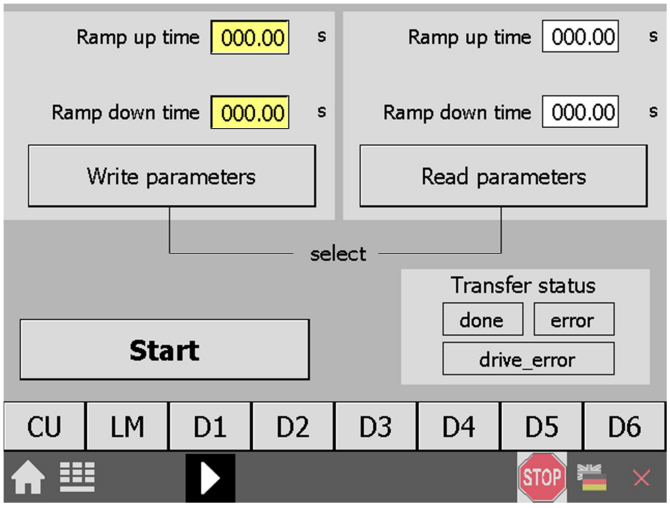
Reading/writing parameters

As an example, the parameter access function uses two parameters and the fault memory for each drive object.

Table 4-3

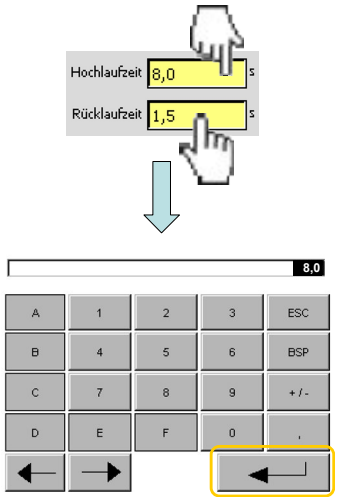
Drive object	Parameter
Line Module	Smoothing the readings (p45)
	Fan ramp-down time (p295)
	Fault memory (p945) – read only
Control Unit	BOP background lighting (p7)
	BOP access level (p3)
	Fault memory (p945) – read only
Drive	Ramp-up time (p1120)
	Ramp-down time (p1121)
	Fault memory (p945) – read only

Figure 4-6 Parameter access at a drive



Operating the masks of the individual drive objects is identical. The operating steps are listed in the following table.

Table 4-4

	Action	Remark
1.	Select the access type with the “Read parameters” and “Write parameters” buttons.	The selected access type is displayed via a bright green button.
2.	Read parameters: Proceed with step 3 in the table. Write parameters: When tapping or clicking the yellow input field for the ramp-up/ramp-down time, a keyboard mask for the value input opens. Finish your input with the Return key.	
3.	Start the write or read job with the “Start” button.	The job status specifies how the job was completed: done = completed without error error = job aborted with error The status refers to the processing of the SFB 52 “RDREC” and SFB 53 “WRREC” system function blocks in the STEP7 code. For error diagnosis see \5\. If a job is completed with done and drive_error it was transferred without error, however, the SINAMICS S120 could not or only partially process the job. For the error codes, please refer to chapter 11.1.4 “Communication, communication with PROFIdrive, acyclic communication” in the operating instructions (\7\).
4.	Click “Start” again to terminate the transmission requirement.	The bits of the job status are deleted as soon as the transmission requirement is no longer pending.

Note If you wish to check the transmitted parameters after a write job, you must trigger an additional read job.

Fault buffer

The fault codes of eight current and eight acknowledged faults, stored in the drive object of the selected SINAMICS S120, are displayed in the mask.

Note

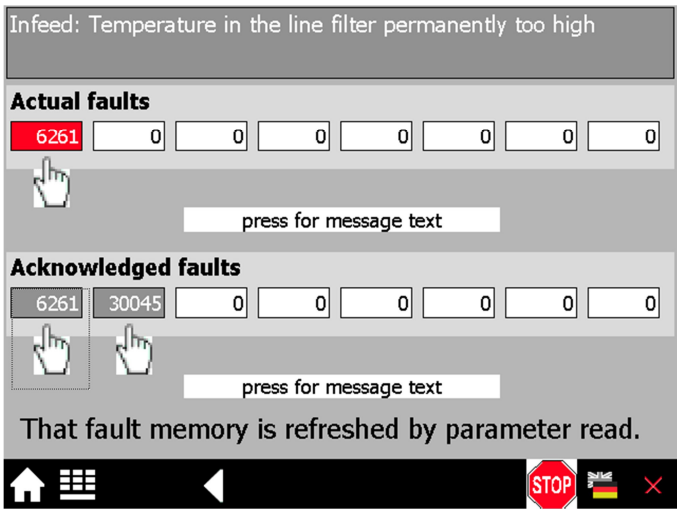
The values are read by the respective drive object of the SINAMICS S120 via the “Read parameters” function in Figure 4-6 and saved in the SIMATIC S7-300/400F.

When the “Fault buffer” screen comes up, the data stored in S7-300/400F is displayed and may therefore already be out of date.

A new “Read parameters” job also updates these entries for the selected drive object.

Tap or click on the message number to display the respective message text. The message text is displayed for as long as the message number is pressed.

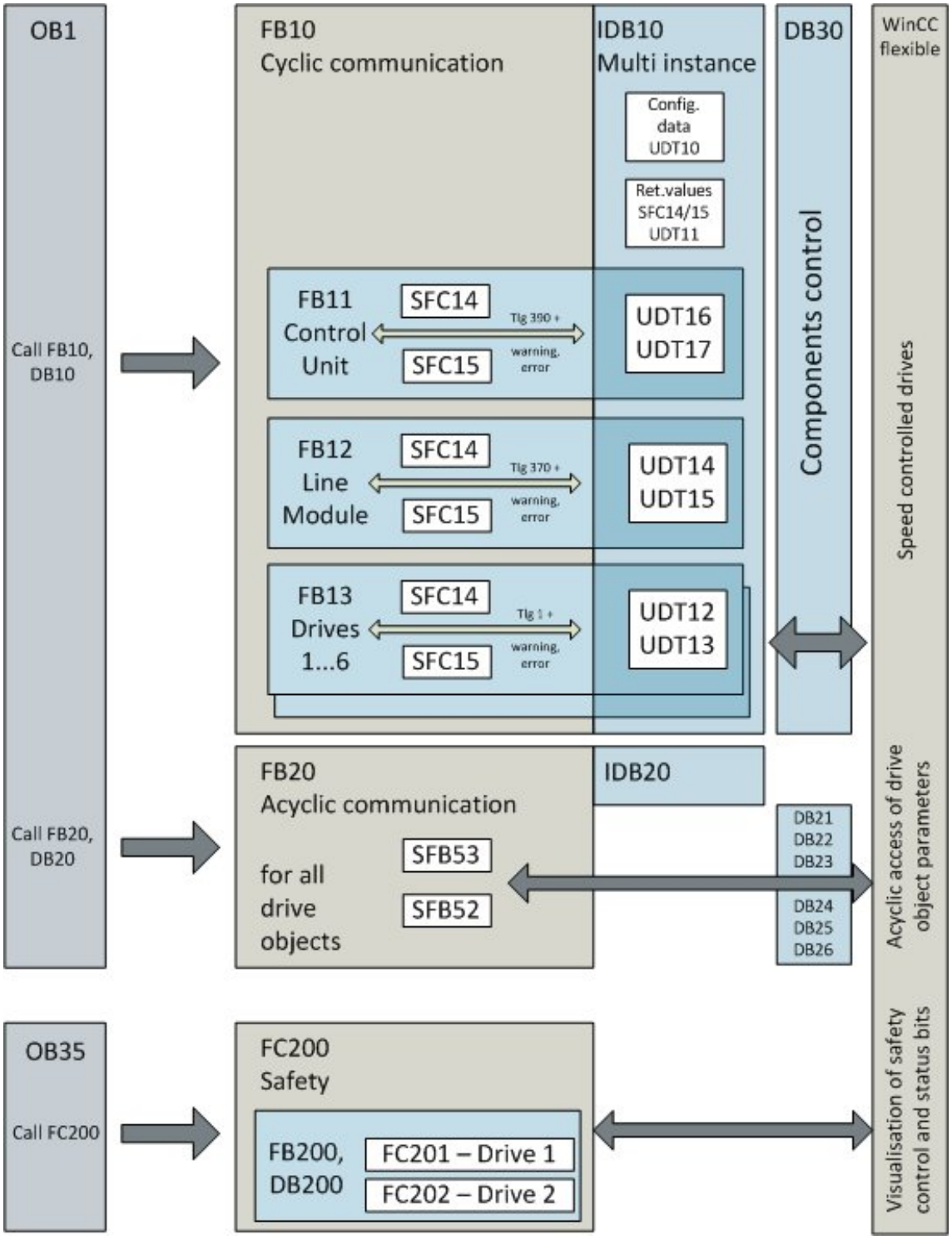
Figure 4-7



5 Function Mechanisms of this Application

Program overview

Figure 5-1



The SIMATIC S7-300/400F program consists of three areas:

- Process data exchange
  In this area, the process data is sent to or received from the SINAMICS S120.
- Parameter access
  In this area, the parameters of the SINAMICS S120 drive objects are accessed.
- Safety program
  In this area the failsafe program is processed.

Note The two communication areas, process data and parameter access, are independent of each other and can each also be used individually.

5.1 Configuration of the application

The versatile, modular structure of the SINAMICS S120 family enables several HW configurations.

Up to six drives can be configured for the CU320-2 DP control unit of the SINAMICS S120. If the line module at the control unit is connected via DRIVE-CLiQ, it can also be accessed via PROFIBUS.

The example application layout enables configuring a structure with line module and six drives.

Note Please ensure that the Safety part of the example application was prepared with an F input module for two drives. The Safety programs also only exist for drive 1 and drive 2. If you wish to use the application with several drives or another Safety configuration, you need to adjust the programs manually.

A SINAMICS S120 HW configuration must be specified in iDB_Process_Data_Exchang (DB10) from byte 6 on. See table below:

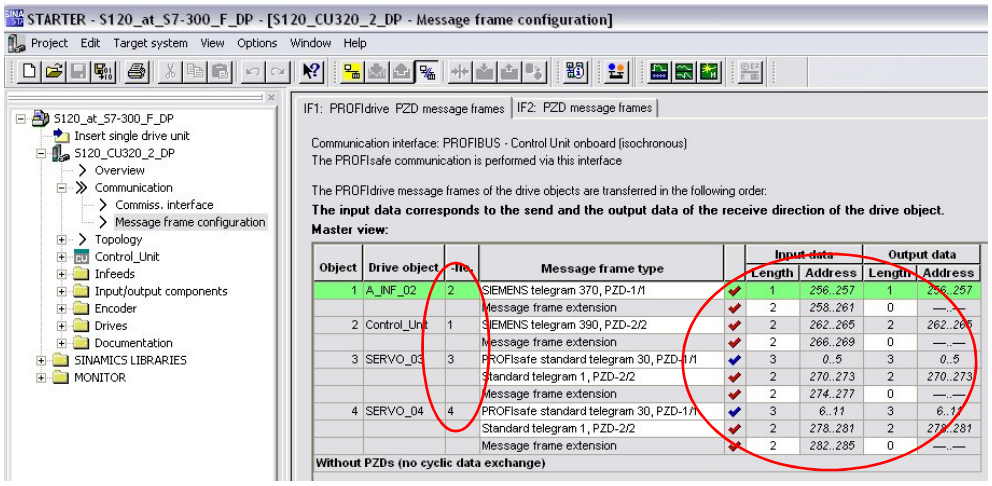
Table 5-1: Configuration data in DB10

Parameter	Data type	Initial value	Description
Drive object – Control Unit (CU_S)			
Config.CU_Drive_Object_Nr DB10.DBB6	BYTE	0 Dec.	Drive object number of the control unit
Config.CU_Input_Address DB10.DBW8	WORD	0 Hex.	Start address of the control unit
Config.CU_Input_Address DB10.DBW10	WORD	0 Hex.	Output address of the control unit

Parameter	Data type	Initial value	Description
Drive object – Line Module (A_INF)			
Config.LM_Used DB10.DBX12.0	BOOL	FALSE Bin.	TRUE, if a line module exists and is accessible via PROFIBUS, i.e. it is connected with the control unit via DRIVE-CLiQ. FALSE, if no line module exists and or is not connected with the control unit via DRIVE-CLiQ.
Config.LM_Drive_Object_Nr DB10.DBB13	BYTE	0 Dec.	Drive object number of the line module
Config.LM_Input_Address DB10.DBW14	WORD	0 Hex.	Input address of the line module
Config.LM_Input_Address DB10.DBW16	WORD	0 Hex.	Output address of the line module
Drive object – Drive 1 (SERVOxy, prefix in DB: D1)			
Config.D1_Used DB10.DBX18.0	BOOL	FALSE Bin.	TRUE, if drive 1 exists. FALSE, if drive 1 does not exist.
Config.D1_Drive_Object_Nr DB10.DBB19	BYTE	0 Dec.	Drive object number of the drive
Config.D1_Reference_Speed DB10.DBD20	REAL	0.0 Dec.	Reference speed of the drive [1/min], see p2000 of the configured drive in the STARTER expert list
Config.D1_Input_Address DB10.DBW24	WORD	0 Hex.	Input address of the drive
Config.D1_Output_Address DB10.DBW26	WORD	0 Hex.	Output address of the drive
Drive object – Drive 2 .. 6 (SERVOxy, prefix in DB: D2 .. 6)			
For drive 2 .. 6 the structure of drive 1 repeats with prefix D2 .. D6. The description of drive 1 therefore also applies to drive 2 .. 6 with the following address areas: D2: DB10.DBB28-DBW36 D3: DB10.DBB38-DBW46 D4: DB10.DBB48-DBW56 D5: DB10.DBB58-DBW66 D6: DB10.DBB68-DBW76			

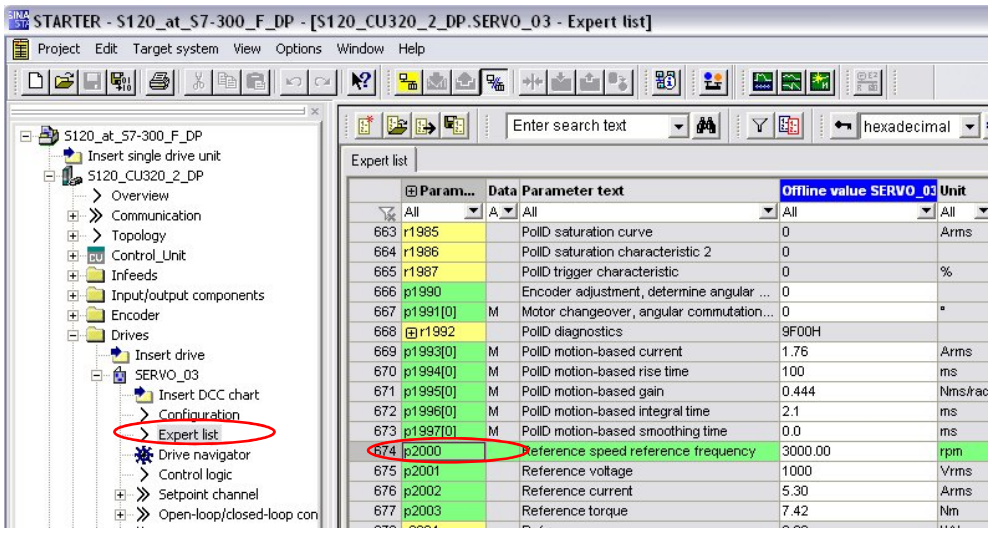
The drive object numbers and I/O addresses are available in the STARTER, at Communication / Message frame configuration:

Figure 5-2



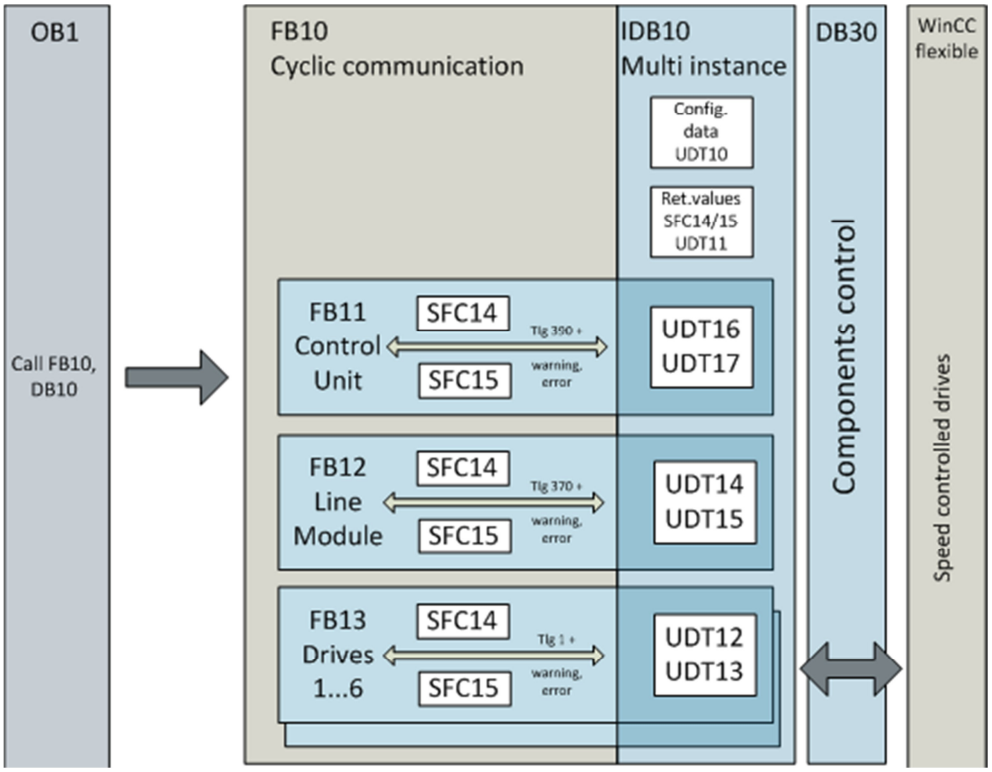
The reference speed is listed in the respective parameter p2000 of the drive. You can access p2000 e.g. via the expert list in the STARTER:

Figure 5-3



5.2 Functionality of process data exchange

Figure 5-4



The process data contains values which are regularly exchanged between SIMATIC S7-300/400F and SINAMICS S120 drive objects. These values are at least the control and status word as well as the setpoint and actual value. Selecting the message frame type specifies the exact length and structure.

Depending on the drive objects, only certain frame types can be used. Irrespective of the selected frame type, two further setpoint or actual values, or extended control or status words can also be transferred.

In the example the following frame types and frame expansions are used:

Table 5-2

SINAMICS S120 drive object	Frame type / Expansion
Line module (A_INF)	"SIEMENS telegram 370" frame, extended by current alarms and faults in receive direction
Control unit (CU_S)	"SIEMENS telegram 390" frame, extended by current alarms and faults in receive direction
Drive 1…6 (SERVO)	"Standard telegram 1" frame, extended by current alarms and faults in receive direction

5.2.1 Accessing process data in the user program of the SIMATIC S7-300/400F

At the start of the cycle, the operating system of SIMATIC S7-300/400F stores the (user) data received by the SINAMICS S120 in the I/O input area of the CPU and transmits the data stored in the I/O output area to the SINAMICS S120 at the end of the cycle.
If the I/O is accessed with the SFC 14/15 system functions, the consistency is ensured across the entire data.

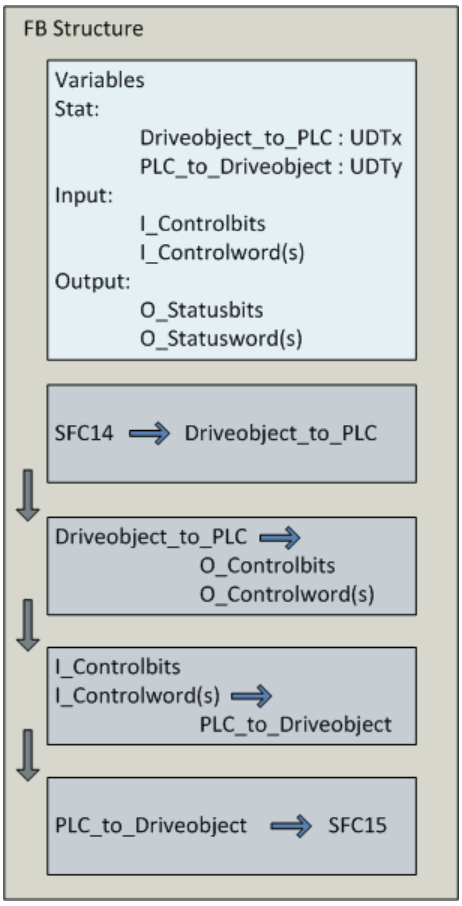
The address areas used are defined by the hardware configuration when specifying the frames in STARTER. See step 19 in Table 6-2.

The cyclic communication of the drive objects is realized with individual FBs:

- ControlUnit_FB (FB11) – Control Unit
- LineModule_FB (FB12) – Line Module
- Drive_FB (FB13) – Drives

The structures of the FBs are equal:

Figure 5-5



The data structures of the used frames are reflected in UDTs (User-Defined Data Types). In the FBs, the respective UDTs are declared as static variables. These are written and read by calling the system functions SFC14/15.

The FBs (FB11/12/13) are inserted and called up as multi-instances in FB10.

Only the most important control or status bits of the standard frames are supplied as input/output variables of the FBs.

DB30 – User interface

The control and status words, setpoint and actual values are already predefined and are available in DB30 as user interface. Here, the process data for the drive objects can be entered and read in send/receive direction. The subsequent tables show the structure of DB30 and the interfaces with the individual drive objects.

Table 5-3: Interface for the control unit

Parameter	Data type	Initial value	Description
SIMATIC S7-300/400F → Control Unit			
PDU.CU_Ack_Faults DB30.DBX0.0	BOOL	FALSE	Pending faults at the control unit are acknowledged with rising edge.
PDU.CU_DO_8 DB30.DBX0.1	BOOL	FALSE	Setting digital output 8, if the I/O has been set to output.
PDU.CU_DO_9 DB30.DBX0.2	BOOL	FALSE	Setting digital output 9, if the I/O has been set to output.
PDU.CU_DO_10 DB30.DBX0.3	BOOL	FALSE	Setting digital output 10, if the I/O has been set to output.
PDU.CU_DO_11 DB30.DBX0.4	BOOL	FALSE	Setting digital output 11, if the I/O has been set to output.
PDU.CU_DO_12 DB30.DBX0.5	BOOL	FALSE	Setting digital output 12, if the I/O has been set to output.
PDU.CU_DO_13 DB30.DBX0.6	BOOL	FALSE	Setting digital output 13, if the I/O has been set to output.
PDU.CU_DO_14 DB30.DBX0.7	BOOL	FALSE	Setting digital output 14, if the I/O has been set to output.
PDU.CU_DO_15 DB30.DBX1.0	BOOL	FALSE	Setting digital output 15, if the I/O has been set to output.
Control Unit → SIMATIC S7-300/400F			
PDU.CU_Alarm_Present DB30.DBX1.1	BOOL	FALSE	The control unit outputs an alarm.
PDU.CU_Fault_Present DB30.DBX1.2	BOOL	FALSE	The control unit outputs a fault.
PDU.CU_Group_Alarm_Present DB30.DBX1.3	BOOL	FALSE	Group alarm: alarm pending at a SINAMICS S120 drive object.
PDU.CU_Group_Fault_Present DB30.DBX1.4	BOOL	FALSE	Group fault: fault pending at a SINAMICS S120 drive object.
PDU.CU_DI_0 DB30.DBX1.5	BOOL	FALSE	Status of the digital input 0.
PDU.CU_DI_1 DB30.DBX1.6	BOOL	FALSE	Status of the digital input 1.
PDU.CU_DI_2 DB30.DBX1.7	BOOL	FALSE	Status of the digital input 2.
PDU.CU_DI_3 DB30.DBX2.0	BOOL	FALSE	Status of the digital input 3.
PDU.CU_DI_4 DB30.DBX2.1	BOOL	FALSE	Status of the digital input 4.
PDU.CU_DI_5 DB30.DBX2.2	BOOL	FALSE	Status of the digital input 5.
PDU.CU_DI_6 DB30.DBX2.3	BOOL	FALSE	Status of the digital input 6.
PDU.CU_DI_7 DB30.DBX2.4	BOOL	FALSE	Status of the digital input 7.

Parameter	Data type	Initial value	Description
PDU.CU_DI_8 DB30.DBX2.5	BOOL	FALSE	Status of the digital input 8.
PDU.CU_DI_9 DB30.DBX2.6	BOOL	FALSE	Status of the digital input 9.
PDU.CU_DI_10 DB30.DBX2.7	BOOL	FALSE	Status of the digital input 10.
PDU.CU_DI_11 DB30.DBX3.0	BOOL	FALSE	Status of the digital input 11.
PDU.CU_DI_12 DB30.DBX3.1	BOOL	FALSE	Status of the digital input 12.
PDU.CU_DI_13 DB30.DBX3.2	BOOL	FALSE	Status of the digital input 13.
PDU.CU_DI_14 DB30.DBX3.3	BOOL	FALSE	Status of the digital input 14.
PDU.CU_DI_15 DB30.DBX3.4	BOOL	FALSE	Status of the digital input 15.
PDU.CU_Alarm_Code DB30.DBW4	WORD	0	Alarm number of the currently pending alarm
PDU.CU_Fault_Code DB30.DBW6	WORD	0	Fault number of the currently pending fault

Table 5-4: Interface to line module

Parameter	Data type	Initial value	Description
SIMATIC S7-300/400F → Line Module			
PDU.LM_ON_OFF1 DB30.DBX8.0	BOOL	FALSE	The line module is switched on with a rising edge at ON_OFF1. Requirement: no fault must be pending.
PDU.LM_Ack_Faults DB30.DBX8.1	BOOL	FALSE	Pending faults at the line module are acknowledged with rising edge.
Line Module → SIMATIC S7-300/400F			
PDU.LM_Rdy_For_Switch_ON DB30.DBX8.2	BOOL	FALSE	Line module is ready to be switched on.
PDU.LM_Operation_Enabled DB30.DBX8.3	BOOL	FALSE	Line module in operation.
PDU.LM_Alarm_Present DB30.DBX8.4	BOOL	FALSE	The line module outputs an alarm.
PDU.LM_Fault_Present DB30.DBX8.5	BOOL	FALSE	The line module outputs a fault.
PDU.LM_Alarm_Code DB30.DBW10	WORD	0	Alarm number of the currently pending alarm
PDU.LM_Fault_Code DB30.DBW12	WORD	0	Fault number of the currently pending fault

Table 5-5: Interfaces to the drives

Parameter	Data type	Initial value	Description
SIMATIC S7-300/400F → Drive 1			
PDU.D1_ON_OFF1 DB30.DBX14.0	BOOL	FALSE	The drive is switched on with a rising edge at ON_OFF1. Requirements: • No_OFF2 and No_OFF3 must already be TRUE beforehand • No error must be pending • No safety function must have triggered
PDU.D1_No_OFF2 DB30.DBX14.1	BOOL	TRUE	No_OFF2 = FALSE: let the drive coast down.
PDU.D1_No_OFF3 DB30.DBX14.2	BOOL	TRUE	No_OFF3 = FALSE: enable drive emergency-stop function.
PDU.D1_Ack_Faults DB30.DBX14.3	BOOL	FALSE	Pending faults of the drive are acknowledged with rising edge.
PDU.D1_n_Setpoint DB30.DBD16	REAL	0.0	Setpoint speed value [1/min].
Drive 1 → SIMATIC S7-300/400F			
PDU.D1_Rdy_For_Switch_On DB30.DBX20.0	BOOL	FALSE	Drive 1 ready for switch on.
PDU.D1_Operation_Enabled DB30.DBX20.1	BOOL	FALSE	Drive 1 in operation.
PDU.D1_Alarm_Present DB30.DBX20.2	BOOL	FALSE	Drive 1 outputs a warning.
PDU.D1_Fault_Present DB30.DBX20.3	BOOL	FALSE	Drive 1 outputs a fault.
PDU.D1_n_Actual_Value DB30.DBD22	REAL	0.0	Current speed in [1/min].
PDU.D1_Alarm_Code DB30.DBW26	WORD	0	Alarm number of the currently pending alarm
PDU.D1_Fault_Code DB30.DBW28	WORD	0	Fault number of the currently pending fault
SIMATIC S7-300/400F → Drive 2..6			
Interface: as for drive 1, Dx must be used instead of prefix D1 (x – drive number) Addresses: as for drive 1 + 16 words in DB30			
Drive 2..6 → SIMATIC S7-300/400F			
Interface: as for drive 1, Dx must be used instead of prefix D1 (x – drive number) Addresses: as for drive 1 + 16 words in DB30			

Note A control word in S120_Data (DB30), for which all bits are 0, is accepted by the SINAMICS S120 drive objects as valid, provided that the respective LM/D1..6.Used bits in the DB10.Config area have been set to TRUE.

Bit 10 (“priority request”) in the previously set frames (in UDTs) has been set to TRUE.

5.2.2 Standardizing the setpoint and actual values

The setpoint and actual speed values are transferred as standards. The reference values are stored in parameter p2000 of the SINAMICS S120 drives and for configuration data in DB10, see Table 5-1.

16384dec = 4000hex = 100% applies here, with 100% referring to the reference value for the transferred variable. With the communication between drive and SIMATIC S7-300/400F process values are sent. The interface in DB30 expects and displays the speed values as REAL numbers [1/min].

5.2.3 Diagnostic information of the SFC14/SFC15 calls

The cyclic communication between SIMATIC S7-300/400F and the drive objects has been realized with system function SFC14 “DPRD_DAT” and SFC15 “DPWR_DAT”. The diagnostic information (returned value) of the system functions has been entered in DB10 as integer value.

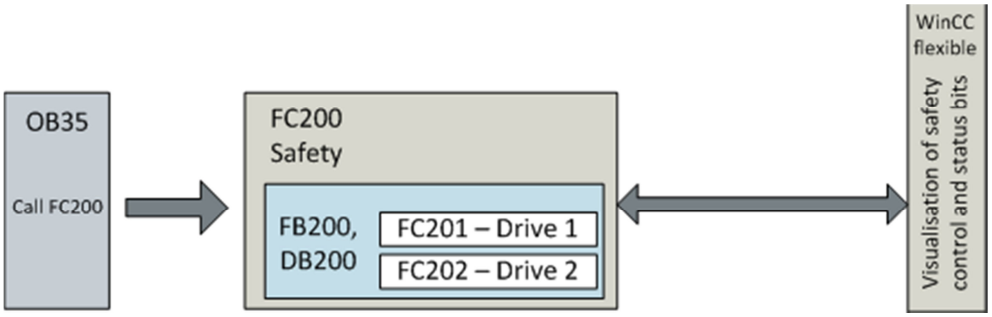
Table 5-6

Drive object	Address	Description
Control Unit	Status.Retval_CU_RD DB10.DBW78	Control Unit – returned value SFC14
	Status.Retval_CU_WR DB10.DBW80	Control Unit – returned value SFC15
Line Module	Status.Retval_LM_RD DB10.DBW82	Line Module – returned value SFC14
	Status.Retval_LM_WR DB10.DBW84	Line Module – returned value SFC15
Drive 1	Status.Retval_D1_RD DB10.DBW86	Drive 1 – returned value SFC14
	Status.Retval_D1_WR DB10.DBW88	Drive 1 – returned value SFC15
Drive 2..6	As for drive 1, Dx must be used instead of prefix D1 (x – drive number) Addresses: as for drive 1 + x * 4 words in DB10	

The description of the possible faults of SFC14/SFC15 is available in the “Reference manual system and standard functions for SIMATIC S7-300/400F”, see \5\.

5.3 Safety functionality

Figure 5-6



5.3.1 FB 200 “Safety”

When programming the fail-safe program parts, only the normal restrictions and programming rules for distributed safety have to be observed.

The F programs of the example (FB200, FC201, FC202) are confined to using the respective signals of the F input module for controlling/deactivating the individual safety functions in the SINAMICS S120 drives.

Furthermore, the passivation bit of the F input module and the SINAMICS S120 drives are read, and the acknowledge signal for reintegrating both ‘modules’ is used.

The safety bits of the SINAMICS S120 can be accessed just as the bits of F-DI/DOs in the safety program:

- In the example the input bytes 0 and 1 contain the Safety status word 1 of drive 1 and the input bytes 6 and 7 the Safety status word 1 of drive 2.
- In the example, the Safety control word 1 of drive 1 is sent via the output bytes 0 and 1, Safety control word 1 of drive 2 via the output bytes 6 and 7.

Note Please ensure that the Safety part of the example application was prepared with an F input module for two drives. The Safety programs also only exist for drive 1 and drive 2. If you wish to use the application with several drives or another Safety configuration, you need to adjust the programs manually.

The safe functions FC201 and FC202 are called up by FB200; these are responsible for controlling the Safety functions of the drives via PROFIsafe. FC201 and FC202 read the safe inputs of the F input module and write the respective functions of the PROFIsafe frame of drive 1 and 2.

5.3.2 Safety control and status word

Figure 5-7 Safety control word 1

Bit	Meaning	Remarks	
0	STO	1	Deselect STO
		0	Select STO
1	SS1	1	Deselect SS1
		0	Select SS1
2	SS2	0	–[1]
3	SOS	0	–[1]
4	SLS	0	–[1]
5	Reserved	–	–
6	Deselect SLP	0	–[1]
7	Internal Event ACK	1/0	Acknowledgment
		0	No acknowledgment
8	Reserved	–	–
9	Select SLS bit 0	0	–[1]
10	Select SLS bit 1	0	
11	Reserved	–	–
12	SDI positive	0	–[1]
13	SDI negative	0	
14, 15	Reserved	–	–

[1] Signals not relevant for Basic Functions: Should be set to "0".

Figure 5-8 Safety status word 1

Bit	Meaning	Remarks	
0	STO active	1	STO active
		0	STO not active
1	SS1 active	1	SS1 active
		0	SS1 not active
2	SS2 active	0	–[1]
3	SOS active	0	–[1]
4	SLS active	0	–[1]
5	Reserved	–	–
6	SLP active	0	–[1]
7	Internal Event	1	Internal event
		0	No internal event
8	Reserved	–	–
9	Active SLS level bit 0	0	–[1]
10	Active SLS level bit 1	0	
11	SOS selected	0	–[1]
12.	SDI positive active	0	–[1]
13	SDI negative active	0	–[1]
14	Reserved	–	–
15	SSM (speed below limit value)	0	–[1]

[1] Signals not relevant for Basic Functions: May not be evaluated.

5.3.3 F-DI PROFIsafe address

In Properties of the F-DI module you find the “F_dest_address” and the “DIL switch setting (9 to 0)” in the “Parameter” tab. Both lines contain the same information in different representation. The DIP switches of the F-DI module must be set to this value.

Figure 5-9

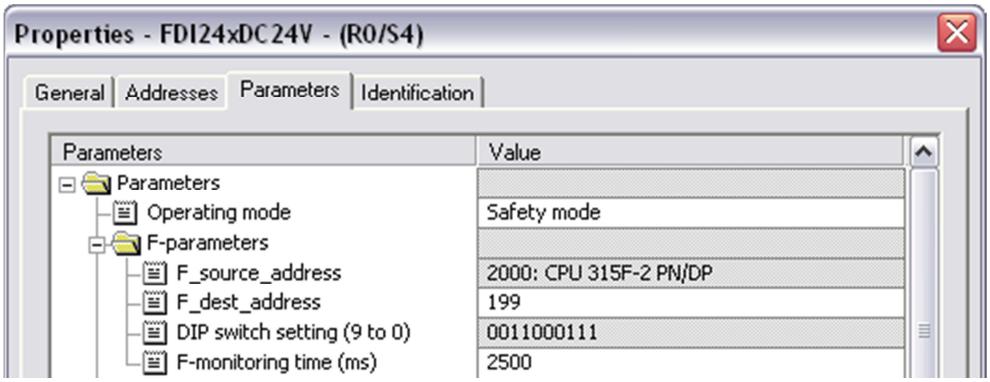
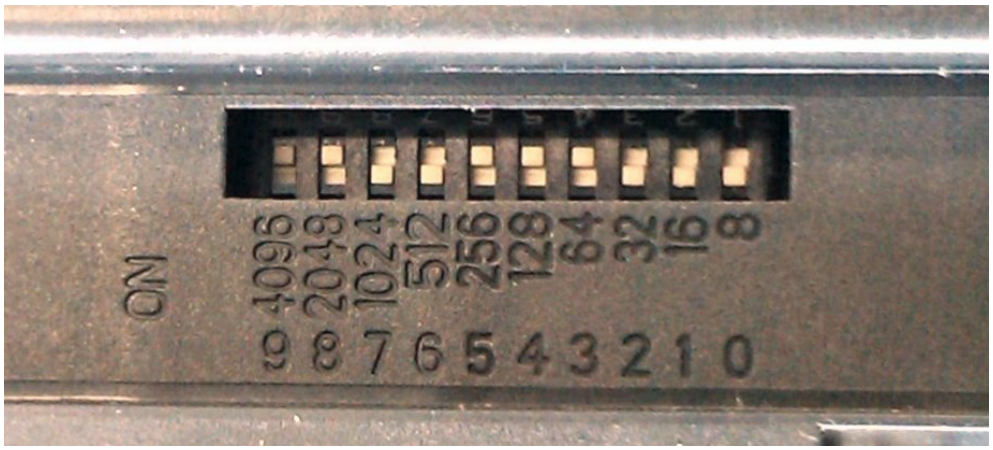
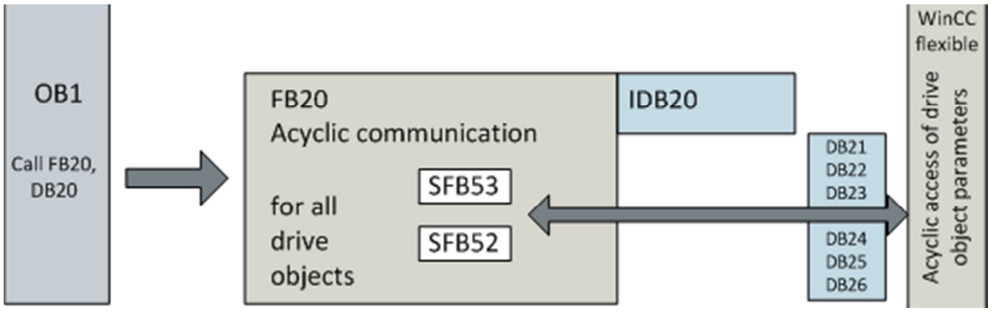


Figure 5-10



5.4 Parameter access functionality

Figure 5-11



Acyclic parameter access occurs parallel to the cyclic process data exchange. This saves resources, since data is only transmitted on demand, i.e. when accessing a parameter.

In S7-300/400F, the “Write data record” and “Read data record” functions must be used. “Data record 47” must always be used.

Writing “Data record 47” sends a job to the SINAMICS S120 which performs the job and provides a response. Reading “Data record 47” makes the response of SINAMICS S120 available in SIMATIC S7-300/400F and can be evaluated.

For reading and writing data records, the system function blocks SFB 53 “WRREC” and SFB 52 “RDREC” are used in SIMATIC S7-300/400F.

For the structure of the data record, please refer to chapter 11.1.4 “Communication, communication with PROFIdrive, acyclic communication” in the operating instructions (\7\).

Note Since SFB53 “WRREC” and SFB52 “RDREC” are not used with CP341-1, the parameter access is not possible when using this CP.

5.4.1 FB 20 “Parameter_Access”

The parameters are accessed in FB20 “Parameter_Access”. It is called cyclically in OB1. The block was created so they can simply be used in own applications.

Figure 5-12

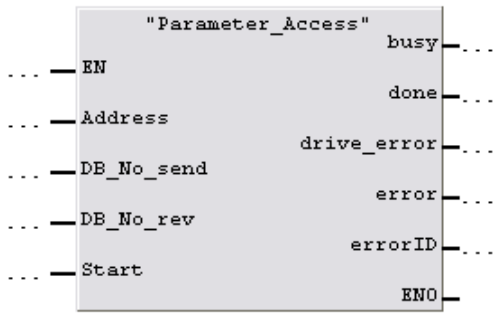


Table 5-7: Interfaces of FB 20 “Parameter_Access”

Parameter	Data type	Initial value	Description
Input parameters			
Address	INT	0	IO address of the SINAMICS S120 drive system’s control unit (from HW Config or STARTER). Input and output addresses must be identical to be able to use this block.
DB_No_send	INT	0	Number of the DB in which the data record to be sent is stored.
DB_No_rev	INT	0	Number of the DB in which the response from SINAMICS S120 is to be stored.
START	BOOL	FALSE	The transmission is started with a rising edge at START.
Output parameters			
Busy	BOOL		Transmission active
Done	BOOL		Job successfully transferred
Drive_Error	BOOL		Job successfully transferred; however, the job could not or only partially be completed by SINAMICS S120. The response contains the error detection.
Error	BOOL		Access aborted with transmission error
ErrorID	WORD		Cause of the abort (see subsequent error list)

Error list

The FB 20 “Parameter_Access” can output the following error codes:

Table 5-8

Error number	Description	Note
0	No error	
8000	DB_No_send and DB_No_rev are identical.	Check the parameters of FB 20 “Parameter_Access”.
8001	DB_No_rev or DB_No_send is zero.	
8002	SFC53 “WEREC” outputs	In the instance DB, the error code of the SFC is stored in

Error number	Description	Note
	errors	#WD_REC_STATUS.
8003	SFC53 “WEREC” outputs errors	In the instance DB, the error code of the SFC is stored in #RD_REC_STATUS.
8004	Send DB is empty (length 0), non existent or faulty.	In the instance DB, the error code of the SFC24 “TEST_DB” is stored in #TEST_DB_1_STATUS. If the code is 0, the DB is empty or write protected.
8005	Receive DB is empty (length 0), non existent or faulty.	In the instance DB, the error code of the SFC24 “TEST_DB” is stored in #TEST_DB_2_STATUS. If the code is 0, the DB is empty or write protected.

Drive error

If during processing a job in SINAMICS S120 an error occurred, and the error detection was set in the response, the response DB must be analyzed to find out the cause of the error.

Function

FB 20 “Parameter_Accesss” only transfers the selected DBs to or from the SINAMICS S120 drive object and checks, whether the transmission was successful. It is also checked, whether the error detection was set in the response of the SINAMICS S120.

For the structure of error detection, please refer to chapter 11.1.4 “Communication, communication with PROFIdrive, acyclic communication” the operating instructions (\7\).

Structure

The “Parameter” FB consists of three parts:

- Checking the DB_No_xx input parameters
  Network 1
- A step chain which controls the sequence of the parameter access.
  Networks 2 to 10
- Call of the system functions “Read data record” or “Write data record”.
  Network 11

Checking the DB_No_xx input parameters

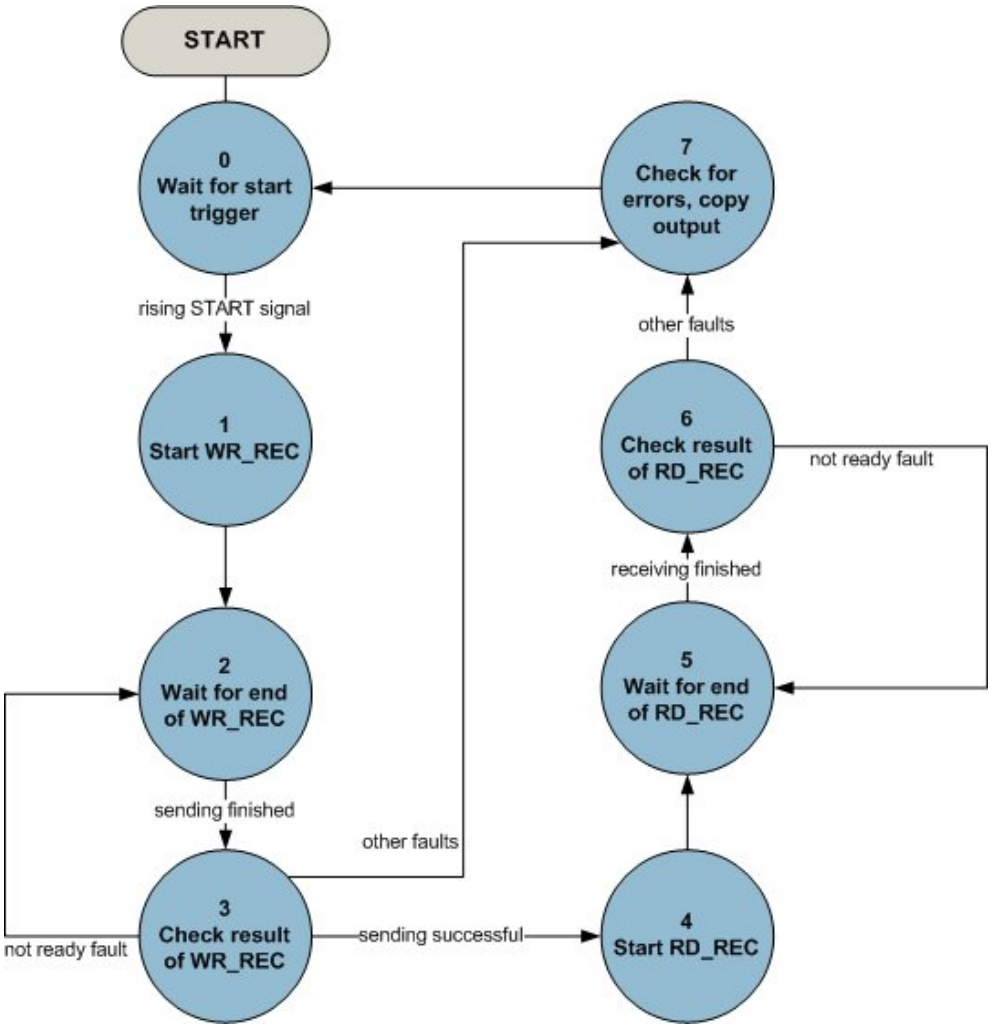
It is checked, whether input parameters DB_No_send and DB_No_rev are equal or if they were parameterized with “0”. One respective error message each is output.

Note Network 1 with the DB_No_xx input parameter check can be deleted to save computing time and storage space without affecting the other functions of the block.

Step chain

The step chain of FB 20 “Parameter_access” is represented in the following graphic. The possible transitions between the individual steps are also displayed there.

Figure 5-13 Step chain



In the individual states of the step chain, the following functions are executed:

Table **5**-9: Function of the states of FB 20 “Parameter_access”

State		Function
0	Wait for start trigger	Waiting for a rising edge of the “START” signal. If it is detected, all output signals will be deleted, “BUSY” will be set and step 1 will be activated.
1	Start WR_REC	The “REQ” signal of SFB 53 “WRREC” is set and step 2 is activated.
2	Wait for end of WR_REC	Waiting until the “busy” signal of SFB 53 “WRREC” becomes 0 again. Then step 3 is activated.
3	Check result of WR_REC	It is checked whether the data record was written successfully. If so, the “REQ” signal of SFB 53 “WRREC” will be deleted again and step 4 will be activated. If SFB 53 “WRREC” reports the error 16#DF80_B500 (peer not ready), step 3 will be activated again and SFB 53 “WRREC” will repeat the job. If a different error has occurred, the “REQ” signal of SFB 53 “WRREC” will be deleted, an internal error bit will be set and step 7 will be activated.
4	Start RD_REC	The “REQ” signal of FB “RDREC” is set and step 5 is activated.
5	Wait for end of RD_REC	It is waited until the “busy” signal of FB “RDREC” becomes 0 again. Then step 6 is activated.
6	Check result of RD_REC	Check whether the data record has been read successfully. If so, the “REQ” signal of SFB 52 “RDREC” will be deleted again and step 7 will be activated. If SFB 52 “RDREC” reports the error 16#DE80_B500 (peer not ready), step 5 will be activated again and FB “RDREC” will repeat the job. If a different error has occurred, the “REQ” signal of SFB 52 “RDREC” will be deleted, an internal error bit will be set and step 7 will be activated.
7	Check for errors, copy outputs	It is checked whether one of the internal error bits has been set. If an error bit has been set, - the “ERROR” signal will be set, - the “BUSY” signal deleted, - step 0 activated. If no error bit has been set, the read times will be output, the “BUSY” will be deleted, the “DONE” will be set and step 0 will be activated.

Call of the “Read data record” or “Write data record” system functions

After the currently required control bits were set in the sequence chart of FB 20 “Parameter_access”, the “Write data record” and “Read data record” system functions (SFB 53 “WRREC” and SFB 52 “RDREC”) are called in network 10.

Initially, it is checked whether the DB to be used exists in the SIMATIC S7-CPU and how long it is. This creates an ANY pointer which references the data to be send/received. With this data the corresponding SFC is called.

5.4.2 DBs for the write and read jobs

To access the parameters, a given job structure must be kept. The response of SINAMICS S120 also contains a given response structure.

Job and response structure

For the structure of the jobs and responses, please refer to chapter 11.1.4 “Communication, communication with PROFIdrive, acyclic communication” in the operating instructions (\7\).

Note

Since the structure of the data record to be sent or received depends on the number of jobs and their number format, a generally valid structure cannot be used.

FB 20 “Parameter_Access” is therefore limited to sending and receiving the data record. The DBs for the data record to be send and received must be set by the user.

The job to access a parameter consists of at least 10 words. Therefore, the job should be assembled in a DB. The response from the SINAMICS S120 also consists of several words.

A job may contain the access to several parameters. Since the length of the data to be transferred per job depends on the number and data types of the SINAMICS S120 parameters, no generally valid structure can be devised.

In the example, the following parameters with the respective DBs are accessed for the individual drive objects.

Table 5-10

Drive object	Parameter	Parameter type	Job DB	Response DB
Reading parameters				
Line Module	Smoothing the readings p45	Floating-point32	DB24 “RD_LM_Drv-_CU_Parameter”	DB25 “RD_Answer_from-_LM_Drv”
	Fan ramp-down time p295	Floating-point32		
	Fault memory p945	Unsigned16		
Control Unit	BOP background lighting P7	Unsigned32	DB24 “RD_LM_Drv-_CU_Parameter”	DB26 “RD_Answer_from-_CU”
	BOP access level p3	Integer16		
	Fault memory p945	Unsigned16		
Drive	Run-up time p1120	Floating-point32	DB24 “RD_LM_Drv-_CU_Parameter”	DB25 “RD_Answer_from-_LM_Drv”
	Ramp-down time p1121	Floating-point32		
	Fault memory p945	Unsigned16		

Drive object	Parameter	Parameter type	Job DB	Response DB
Writing parameters				
Line Module	Smoothing the readings p45	Floating-point32	DB21 "WR_LM_Drv-_Parameter"	DB23 "WR_Answer-_from_LM_Drv_CU"
	Fan ramp-down time p295	Floating-point32		
Control Unit	BOP background lighting P7	Unsigned32	DB22 "WR_CU-_Parameter"	DB23 "WR_Answer-_from_LM_Drv_CU"
	BOP access level p3	Integer16		
Drive	Run-up time p1120	Floating-point32	DB21 "WR_LM_Drv-_Parameter"	DB23 "WR_Answer-_from_LM_Drv_CU"
	Ramp-down time p1121	Floating-point32		

Table 5-11 summarizes the SINAMICS parameter types and the respective SIMATIC S7-300/400F data types.

Table 5-11

Parameter type in SINAMICS	Data type in S7 300/400F
Integer8	INT (16 Bit)
Integer16	INT (16 Bit)
Integer32	DINT (32 Bit)
Unsigned8	BYTE (8 Bit)
Unsigned16	WORD (16 Bit)
Unsigned32	DWORD (32 Bit)
floatingPoint32	REAL (64 Bit)

When writing parameters, the parameter values entered via the control panel are initially written to the respective positions in the DBs (DB21 with line module and drives and DB 22 with the control unit) and then the system function SFC53 "WRREC" is called. The response of the write process is stored in the receive DB (DB23).

When reading parameters, a job DB (DB24) is sent to the respective drive object and the response is saved in the receive DB (DB25 with Line Module and Drives and DB26 with the Control Unit). The operator panel then shows the value of the buffer cells corresponding to the parameter contents.

Since the data types of the parameters to be written or read are identical for the line module and for the drives (2x Floatingpoint32, resp. 2x Floatingpoint32 and 16x Unsigned16), the same DBs, DB21 for writing and DB25 for reading, are used for both drive objects (Drive and Line Module).

Note The data blocks (DB21, DB22, DB24, DB25) used for parameter access are in this example configured with the WinCC flexible masks depending on the selected drive object.

5.5 Further code/data elements in the example project

Apart from OB1, FB10, FB11, FB12, FB13 and FB20 further blocks are contained in the example projects which are necessary to make the examples runnable. These are:

Table 5-12

Block	Function
OB86	If the connection to a PROFIBUS/ PROFINET station is interrupted or restored, the S7-CPU processes this error organization block, provided that it was loaded. Thus the PLC is prevented to switch to STOP. If this OB does not exist in the S7-CPU, it goes to STOP instead. In this OB, the user can program a reaction to a failed or restored station. In this example it is empty.
UDT10	Configuration data, used in DB10.
UDT11	Call status of the SFC14/15, used in DB10.
UDT12	Mapping the structure of the “Standard telegram 1” frame with the expansion of fault/alarm number in the direction Drive -> S7 300/400F, used in FB13.
UDT13	Mapping the structure of the “Standard telegram 1” frame in direction Drive -> S7 300/400F, used in FB13.
UDT14	Mapping the structure of the “SIEMENS telegram 370” frame with the expansion of fault/alarm number in direction Line Module -> S7 300/400F, used in FB12.
UDT15	Mapping the structure of the “SIEMENS telegram 1” frame in direction Line Module -> S7 300/400F, used in FB12.
UDT16	Mapping the structure of the “SIEMENS telegram 390” frame with the expansion of fault/alarm number in direction Control Unit -> S7 300/400F, used in FB11.
UDT17	Mapping the structure of the “SIEMENS telegram 390” frame in direction Control Unit -> S7 300/400F, used in FB11.
UDT30	SINAMICS S120 PDU (process data unit), used in DB30.
VAT_PZD_S120	Value tables for monitoring and control of FB10 and FB20.
VAT_Parameter_Access_LM	
VAT_Parameter_Access_CU	
VAT_Parameter_Access_Drv	

6 Configuration and Settings

Note If you only wish to download and commission the example program, please follow the instructions in chapter 3.

The step tables below describe what you have to do if you do not want to or cannot use the sample code and you would like to or have to configure SINAMICS S120 and SIMATIC S7 CPU yourself.

6.1 Configuring the SIMATIC S7-300/400F controller

This chapter describes how the SIMATIC S7-300/400F must be configured for the example program. This chapter does not discuss integrating the operator panel or programming the SIMATIC S7-300/400F.

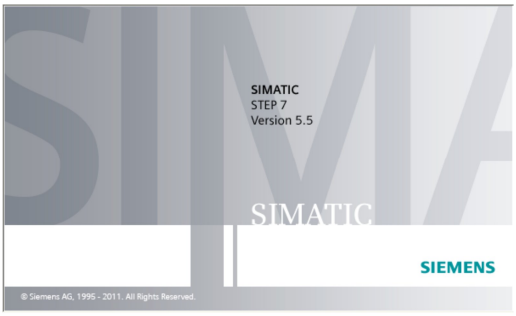
6.1.1 Preparations for using the PG/PC LAN port

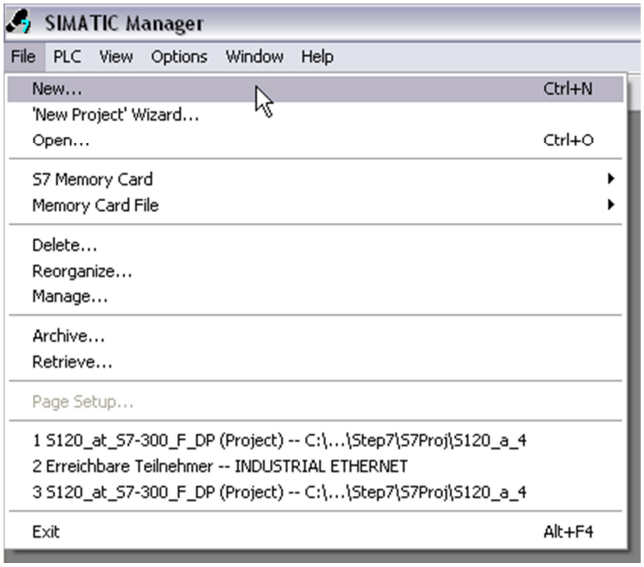
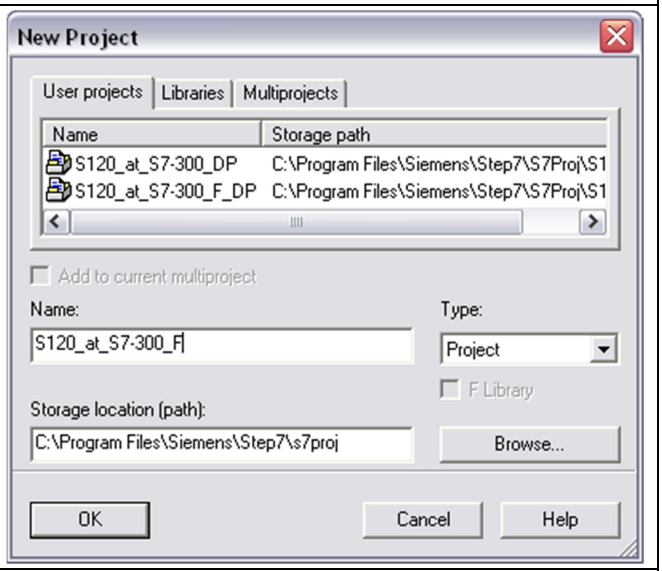
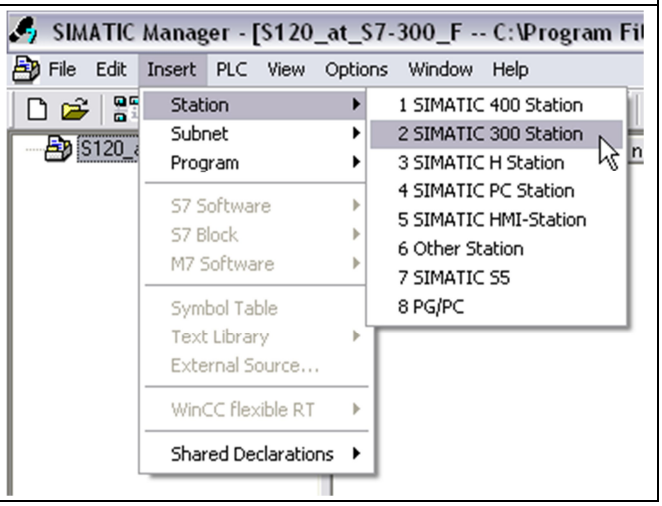
To be able to use routing, the PG/PC must be inserted in the network configuration and an Ethernet be configured.
As you are using a network card that differs from the one used when creating the project, your network card must be assigned to the configured PG/PC.

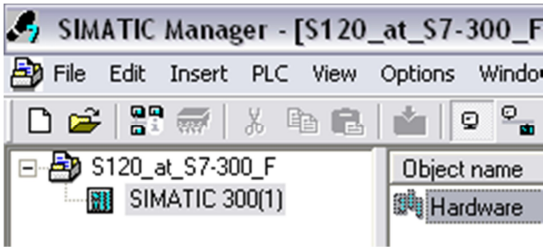
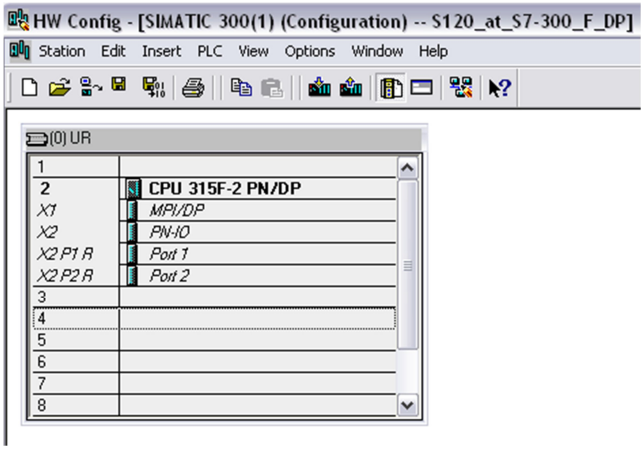
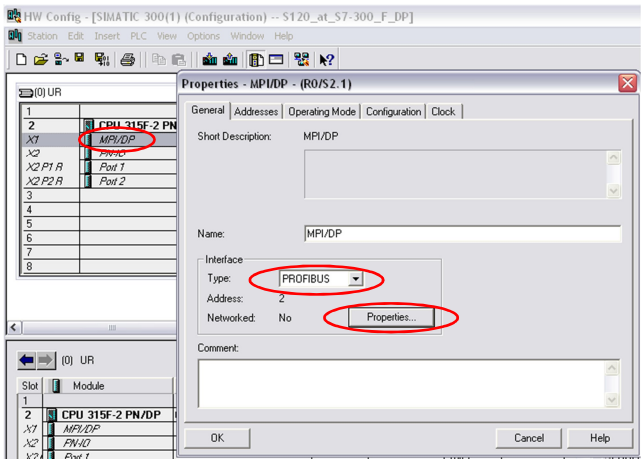
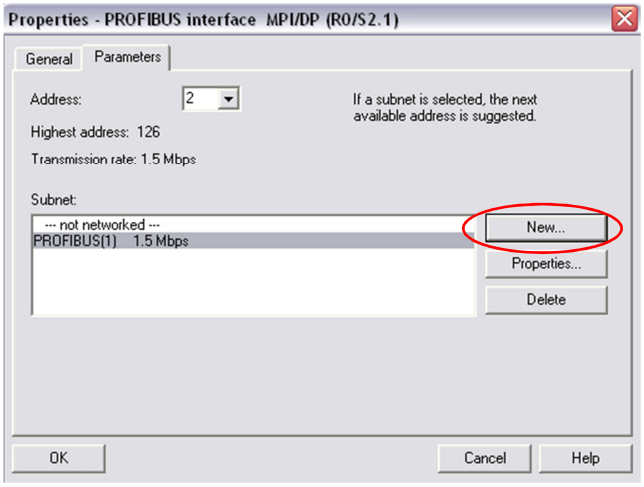
In addition, the following requirements must be met:

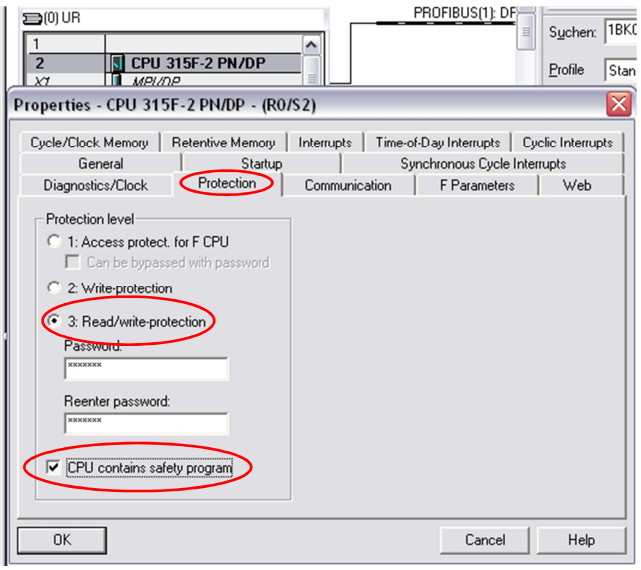
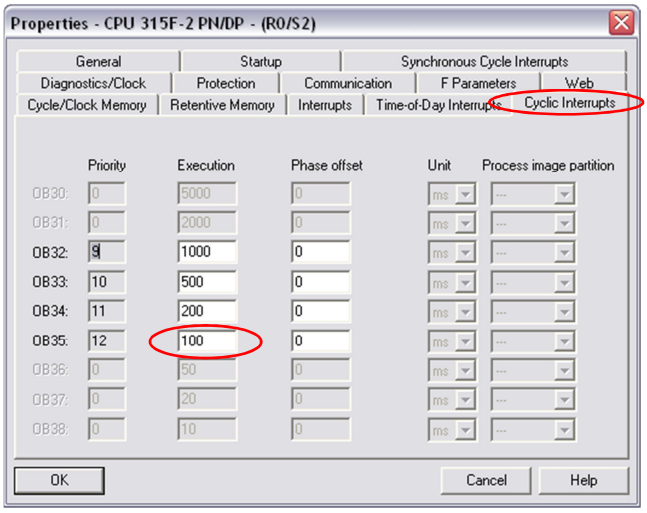
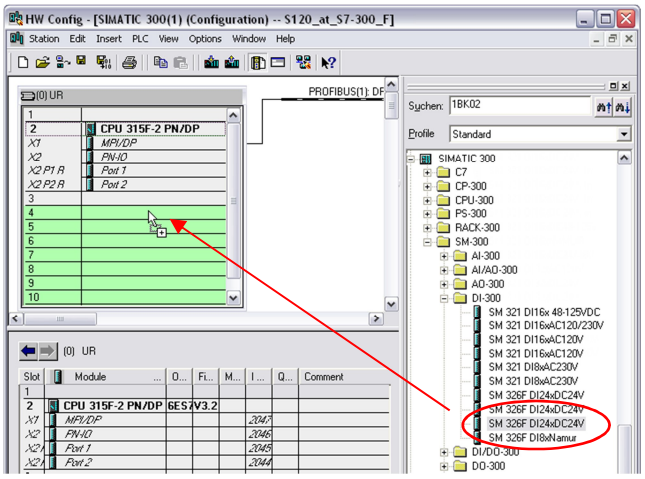
- The SIMATIC program has already been downloaded to the S7 CPU, see chapter 3.6.
- The PROFIBUS connection between SIMATIC S7-300/400F and SINAMICS S120 was established.
- SIMATIC S7-300/400F is networked with the PG/PC via Ethernet.
- The PROFIBUS address (in the example: 3) of the SINAMICS S120 was set using rotary encoding switches (or via P918), followed by a restart / power reset.

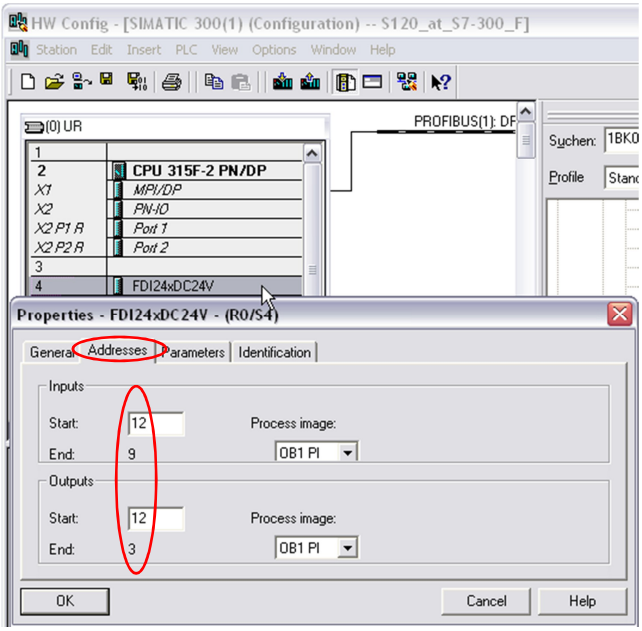
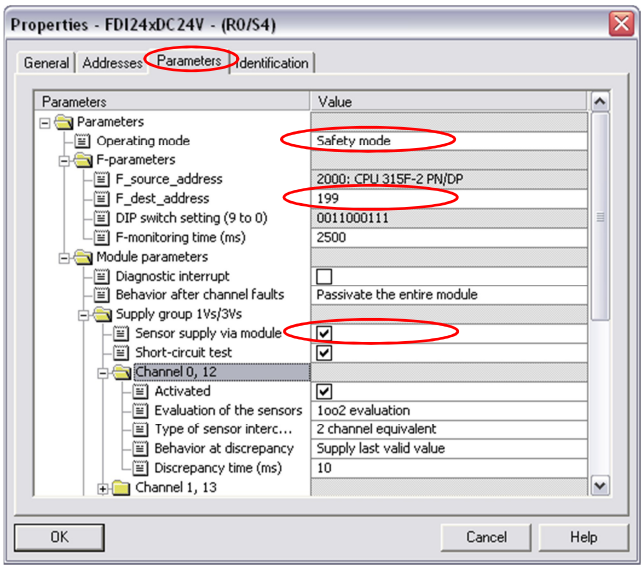
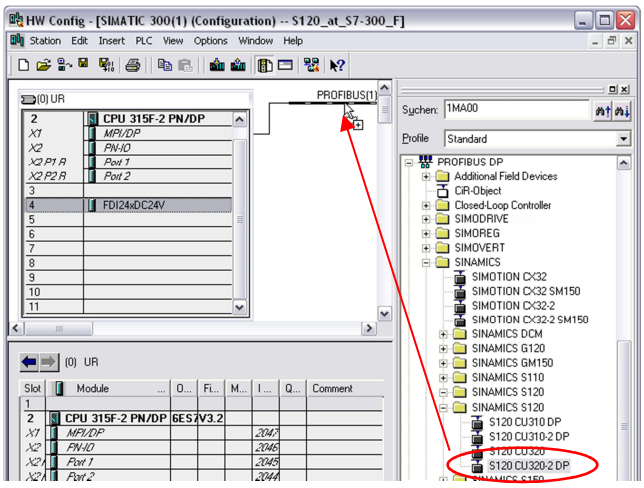
Table 6-1

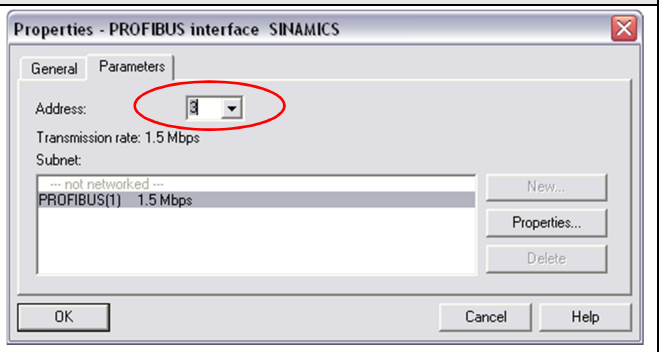
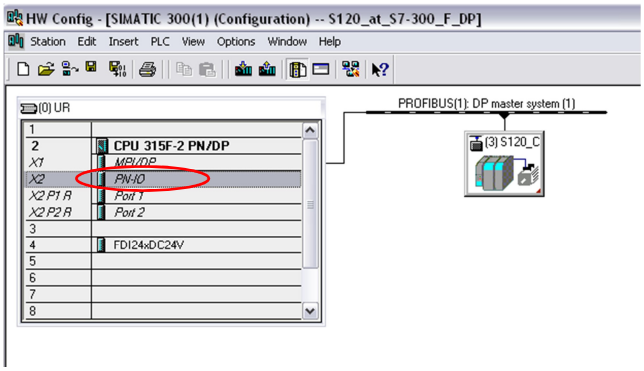
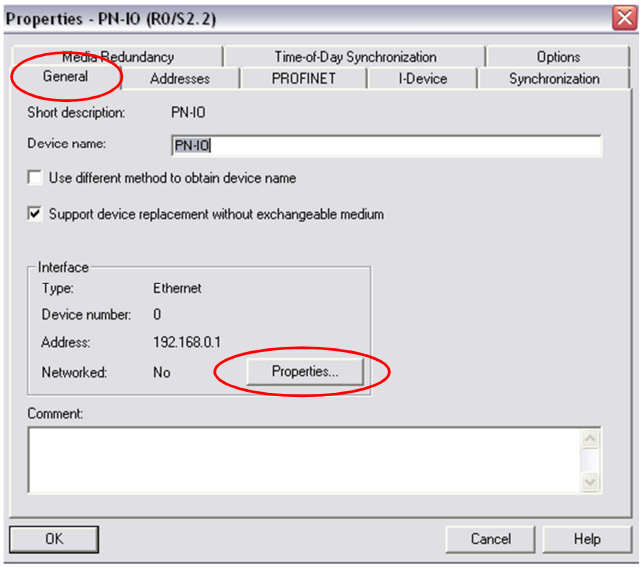
No.	Action	Comments
1.	Start STEP 7 V5.5	

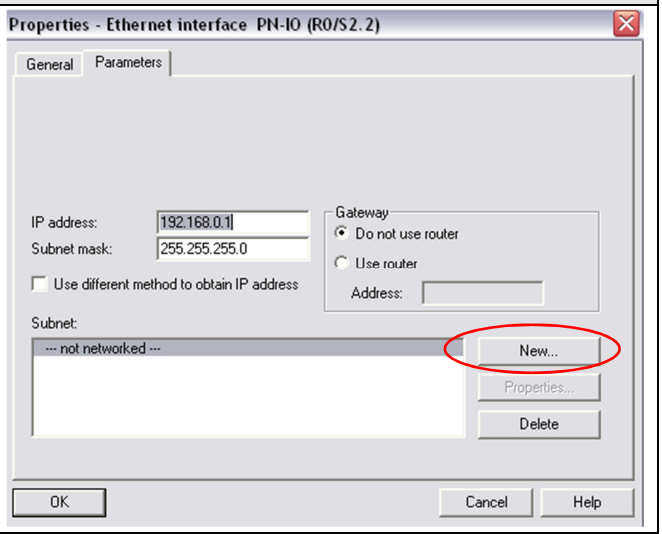
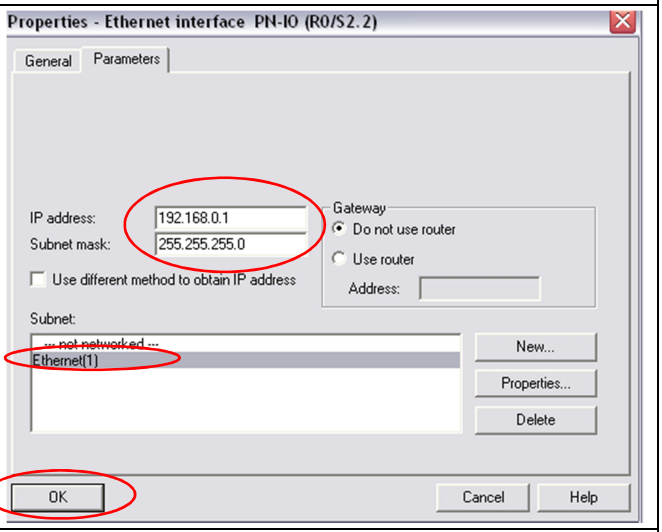
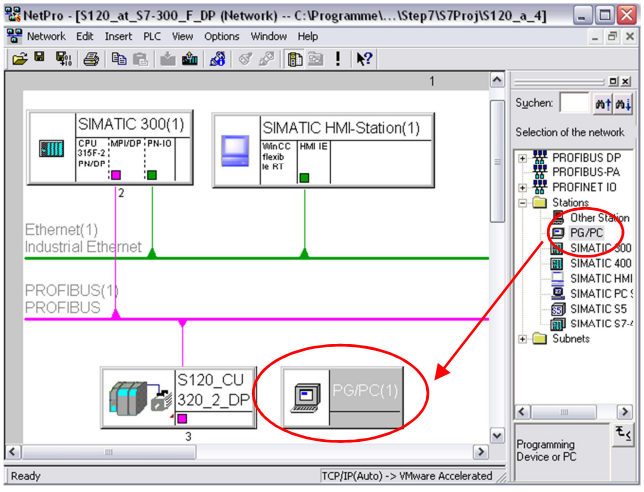
No.	Action	Comments
2.	• Create a new project: - Assign the IP address192.168.0.1 with subnet mask 255.255.255.0 (For the connection to the HMI) - Create a new Ethernet network	
3.	Assign a name for the project (e.g. “S120_at_S7-300_F”).	
4.	Add an S7-300 station.	

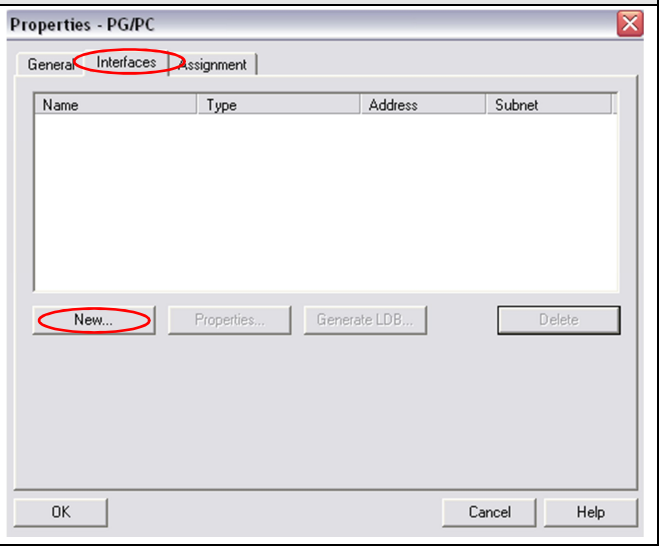
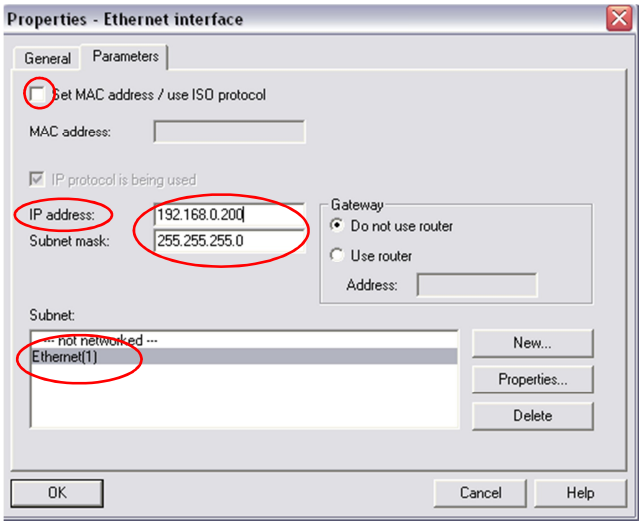
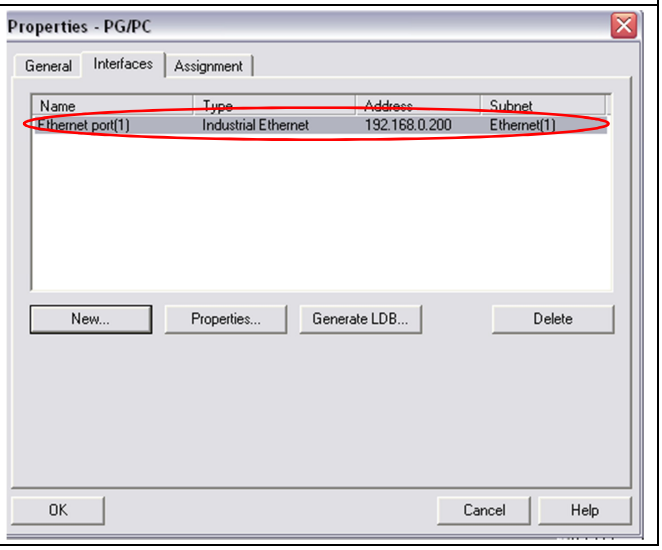
No.	Action	Comments
5.	• Click on the SIMATIC S7-300 station • Double-click on the “Hardware” icon to open the hardware configuration.	
6.	• Enter a CPU 315F-2PN/DP (6ES7315-2FJ14-0AB0) or another S7-F CPU in the hardware configuration of the new station.	
7.	• Double-click on the MPI/DP interface of the CPU to open it. • For the type, select PROFIBUS and click on Properties.	
8.	• Select address 2 and create a new PROFIBUS string. • Then close the interface configuration.	

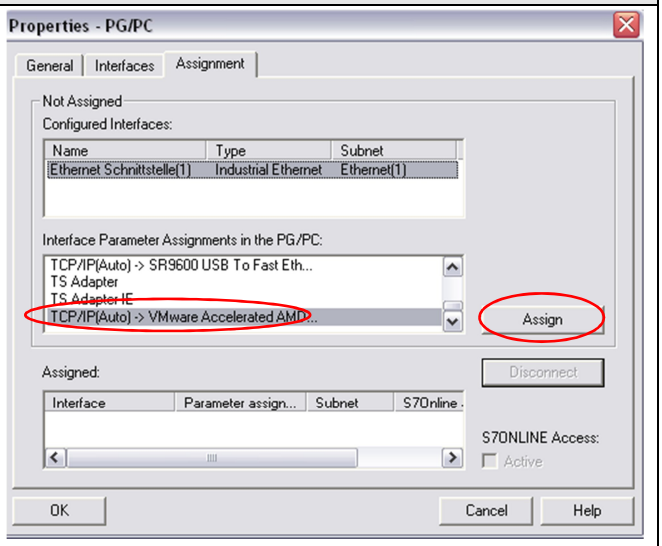
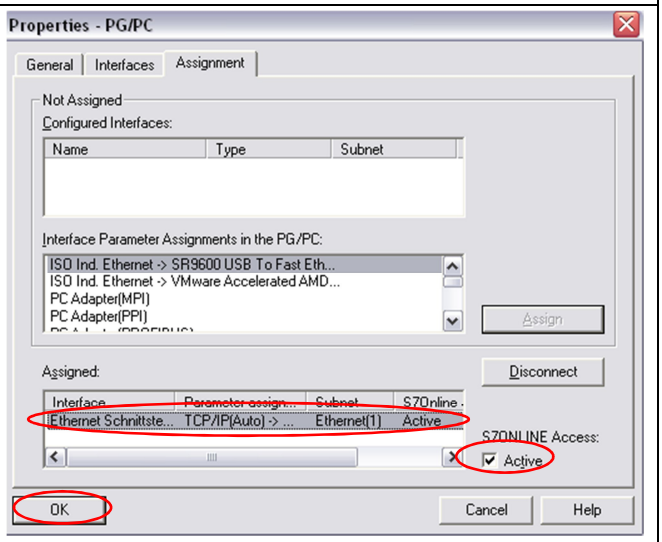
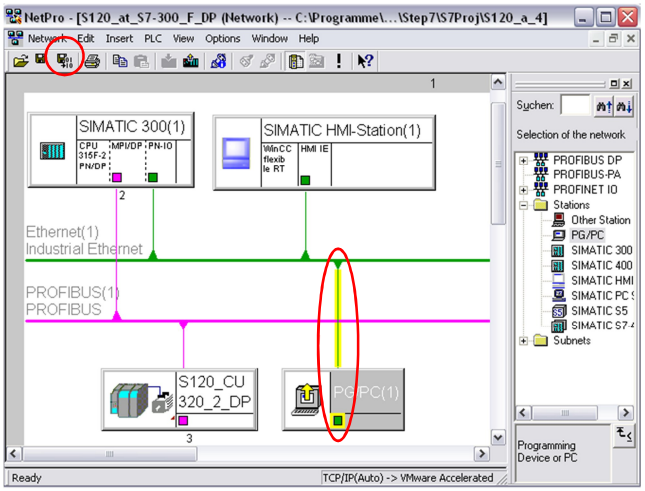
No.	Action	Comments
9.	Call up the properties of the S7-CPU • Select level 3 in the “Protection” tab and assign a password (e.g. “siemens”) • Select “CPU contains safety program”.	
10.	Select the Cyclic Interrupts tab. • Make sure that the time for OB35 is set to 100ms. • Close the Properties of the S7-CPU with OK.	
11.	Please enter an F-DI module on slot 4 of the central rack (e.g. 6ES326-1BK02-0AB0).	

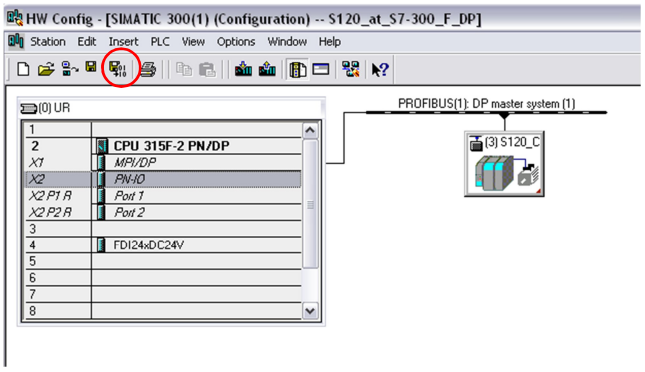
No.	Action	Comments
12.	Open the Properties of the F-DI module and go to the “Addresses” tab. • Set the start address of the I/O area to 12. States of the F input module can be read in the program at this address.	
13.	Change to the “Parameter” tab. • Set the DIP switches on the rear of the F-DI module according to the details in > F-parameters > DIP switch setting (9 to 0) (see chap. 3.2) • Activate “Sensor supply via module” in the Module parameters in the tree. Close the dialog with “OK”.	
14.	• Search your SINAMICS S120 in the catalog. The path in the catalog is: > PROFIBUS-DP > SINAMICS > SINAMICS S120 > S120 CU320-2 DP • Move the selected control unit (CU320-2 DP) onto the PROFIBUS line and release the mouse button.	

No.	Action	Comments
15.	The window for selecting the PROFIBUS interface opens automatically: • select the address for the SINAMICS S120[1], 3 in this example. • Click on the OK button. • Set the firmware version and acknowledge with OK. • The message frame is configured in STARTER. For the message frame configuration you click on "OK". [1] The address must match the one set on the SINAMICS S120.	
16.	Open the properties of the PROFINET interface of the S7-CPU by double-clicking on "PN-IO".	
17.	In the "General" tab of the "Interface" area, click on "Properties…"	

No.	Action	Comments
18.	• Click on “New” • In the “Properties – Industrial Ethernet” dialog that opens, press only “OK”.	
19.	• Make sure that the Ethernet network was created and that the CPU is connected to it. • Check the IP address and the subnet mask. • Quit the dialog box with “OK”. • Also close the properties of the PROFINET interface with “OK”.	
20.	Open NetPro from HW Config.	
21.	Add a PG/PC station.	

No.	Action	Comments
22.	• Double-click on the PG/PC station icon to open its properties. • Go to the “Interfaces” tab. • Click on “New” and select “Industrial Ethernet”.	
23.	• Remove the checkmark at the “Set MAC address / use ISO protocol” option • Enter the IP address 192.168.0.200 and the subnet mask 255.255.255.0. • In Subnet, select “Ethernet(1)”. • Quit the dialog box with “OK”.	
24.	Make sure that the Ethernet interface of the PG/PC has been created.	

No.	Action	Comments
25.	• Go to the “Assignment” tab. • Select “TCP/IP -> *your network card*” and click on “Assign” • If necessary, confirm message 2775:809 that the parameters could not be adjusted.	
26.	• Make sure that the selected component is shown in “Assigned” and single-click on it. • Make sure that “Active” is checked. • Quit the dialog box with “OK”.	
27.	• Make sure that the PG/PC station is connected to Ethernet and that the connection is active (marked in yellow). • Click on “Save and Compile”. • If it has been compiled without errors, open NetPro.	

No.	Action	Comments
28.	In HW Config: • Also click on “Save and Compile”. • Then download the configuration to the SIMATIC S7 CPU. • Close HW Config.	
29.	Copy the blocks from the example project into your just created project and load them to the SIMATIC S7-300/400F.	

Note The selection of the frames to be used is in this example made in STARTER and from there copied to HW Config. The addresses were assigned in HW Config and are automatically adopted by the STARTER. HW Config is downloaded to the PLC after the message frame configuration.

Note To be able to use the safety data of the drive in the safety program, the following must be created according to the programming regulations of Distributed Safety. At least

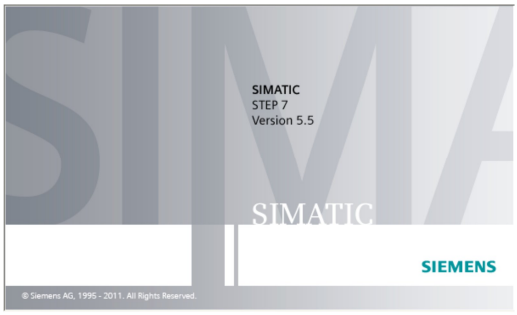
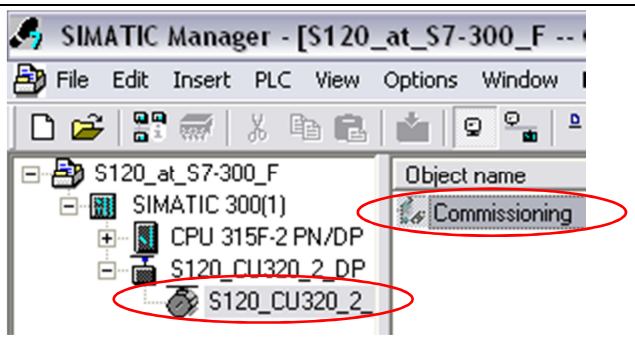
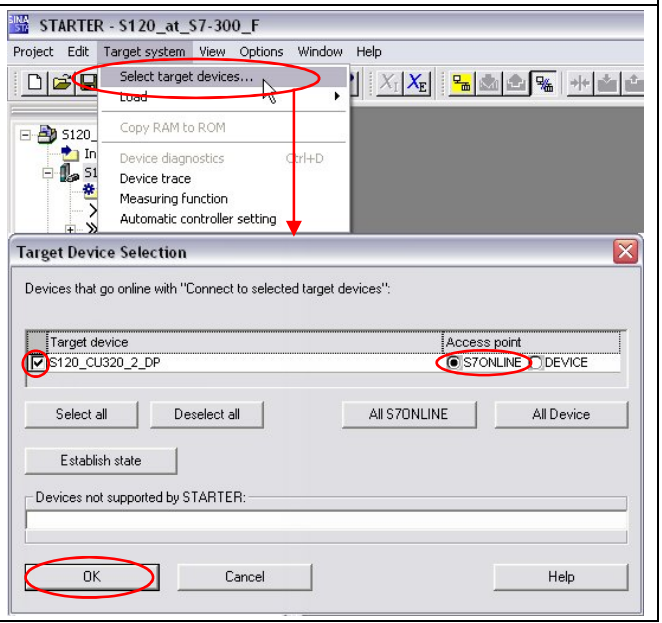
- one F-runtime group
- one F-CALL block and
- one safety FB

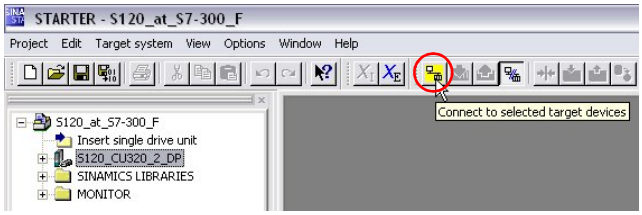
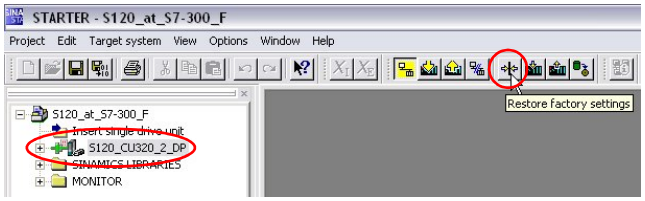
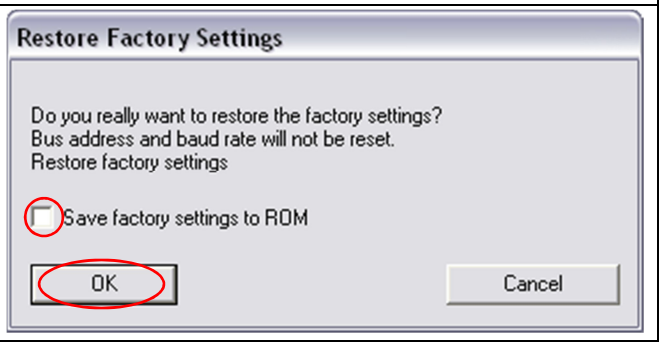
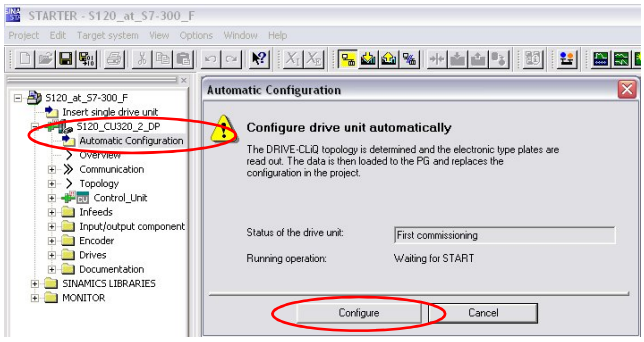
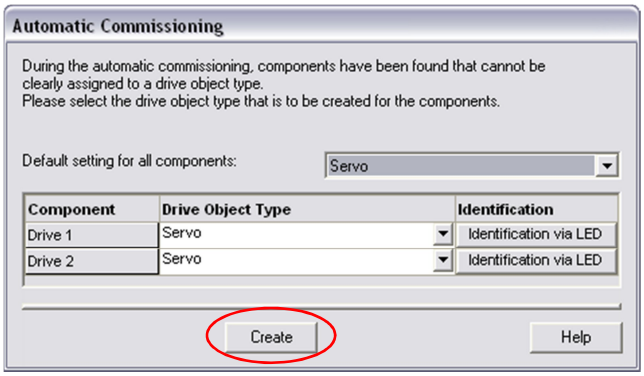
Further information is available in the “S7 Distributed Safety – Configuration and programming” manual, see \9\.

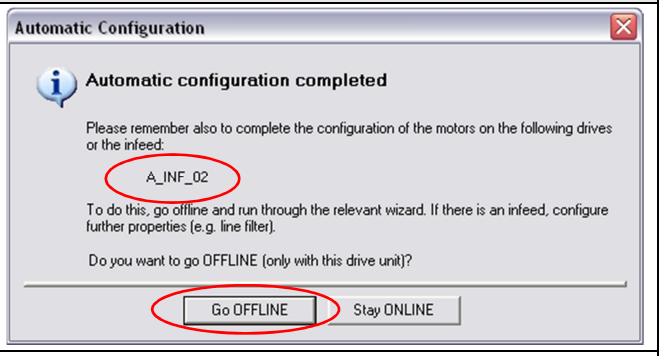
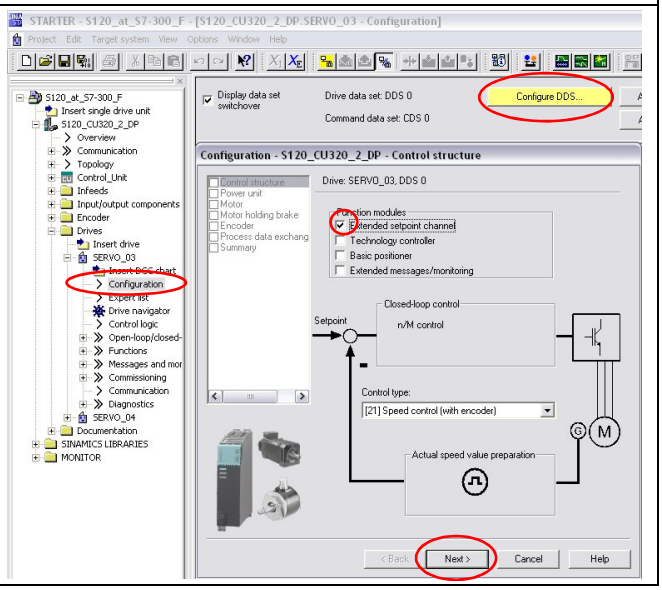
Note Please ensure that the Safety part of the example application was prepared with an F input module for two drives. The Safety programs also only exist for two drives. If you wish to use the application with several drives or a different Safety configuration, you need to adjust the programs manually.

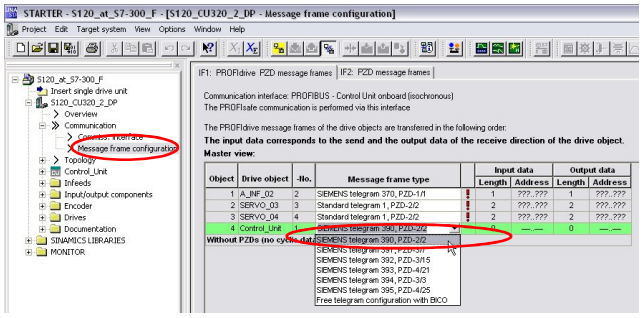
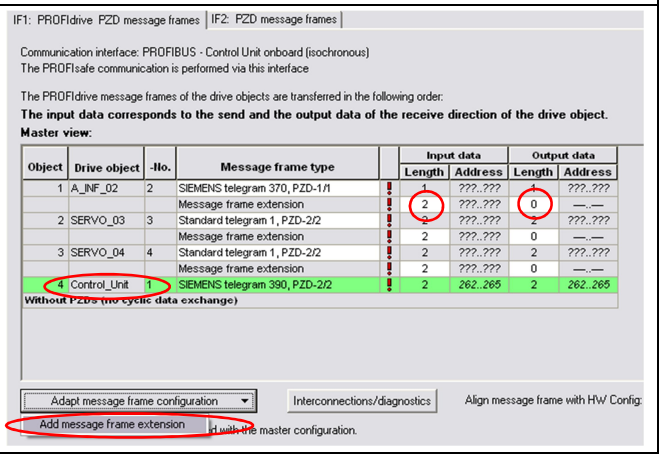
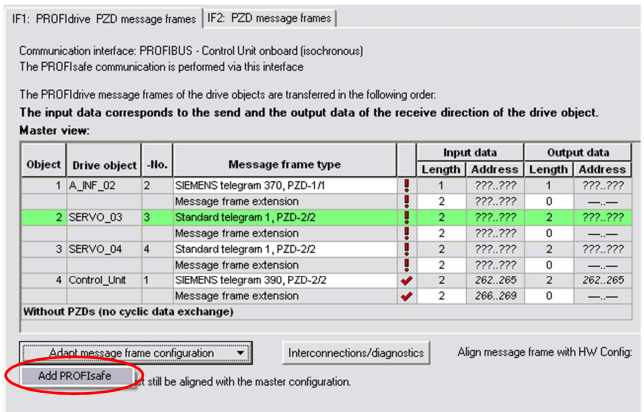
6.2 Configuring the SINAMICS S120 drive

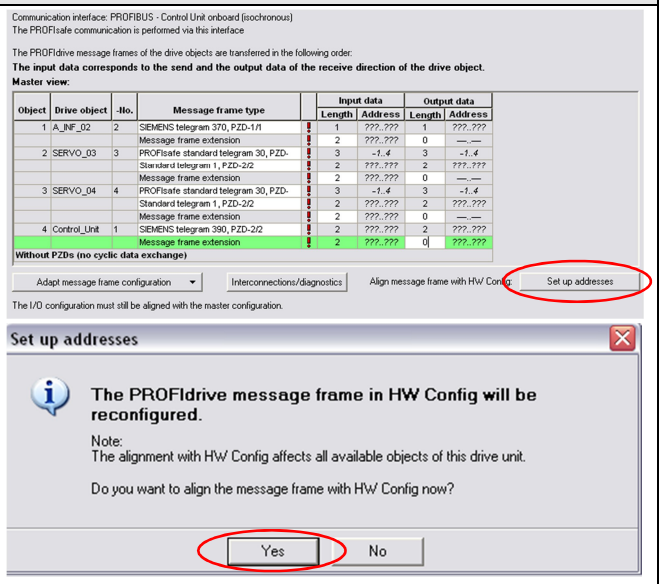
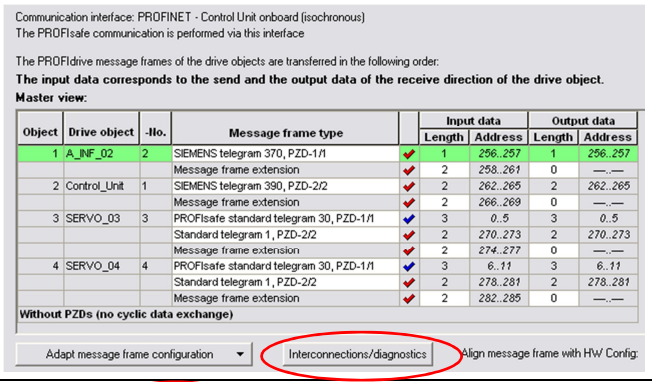
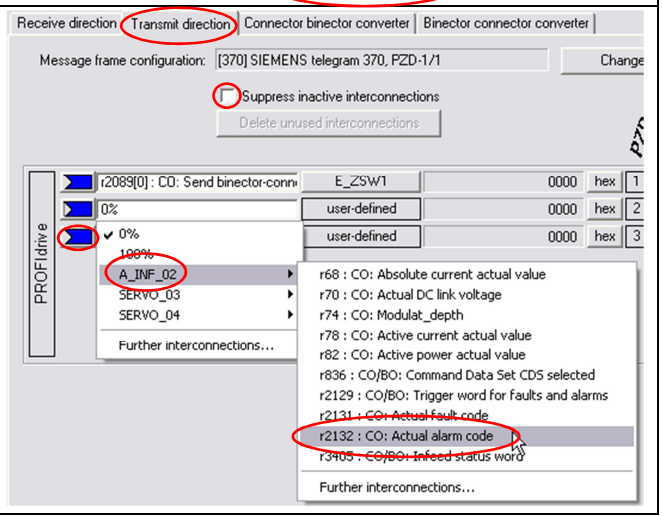
Table 6-2

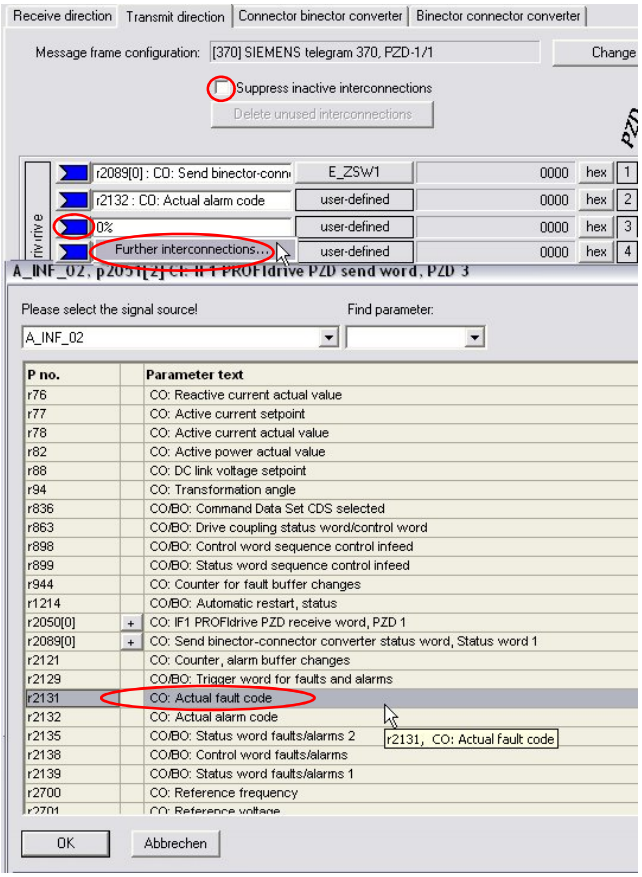
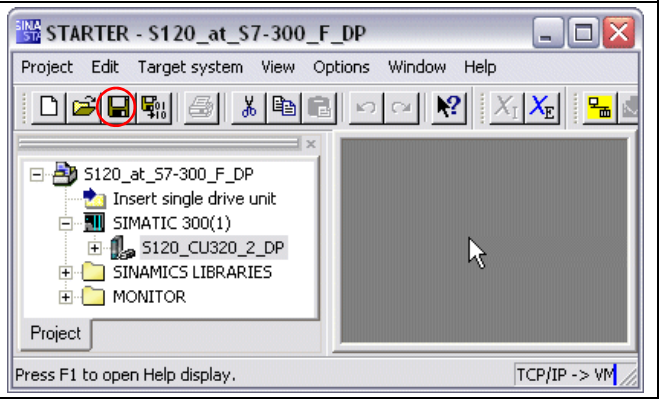
No.	Action	Comments
1.	Unless already performed, install the STARTER commissioning software (see also /6/).	
2.	Connect the controller with the SIMATIC S7-300/400F using a network cable.	You can connect both devices directly or via other SIMATIC or SINAMICS components. For SINAMICS please make sure you are using the communication interfaces and not the DRIVE-CLiQ interfaces.
3.	Start the SIMATIC Manager and open the project created in chapter 6.1.	
4.	In the tree of the SIMATIC Manager, select the SINAMICS S120 and start commissioning (e.g., by double-clicking on the Commissioning icon), which opens the STARTER.	
5.	• Call up the “Target Device Selection” dialog in the STARTER via > Target system > Select target device...” • Select the CU and the “S7ONLINE” access point and then click on OK.	

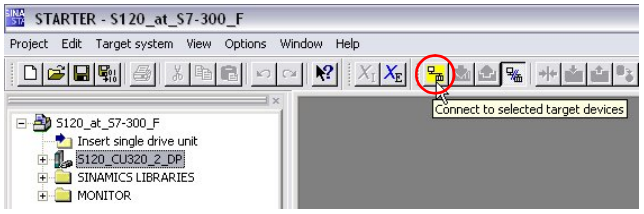
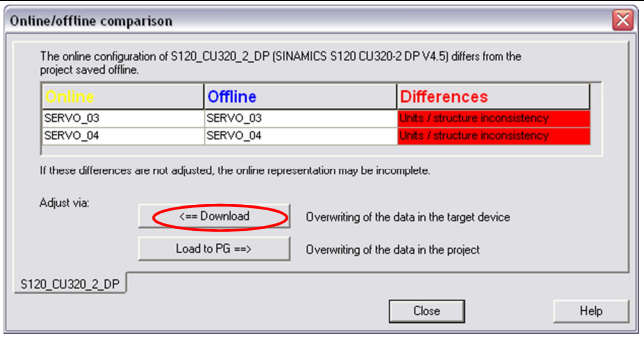
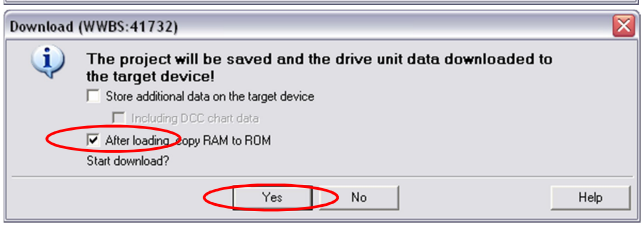
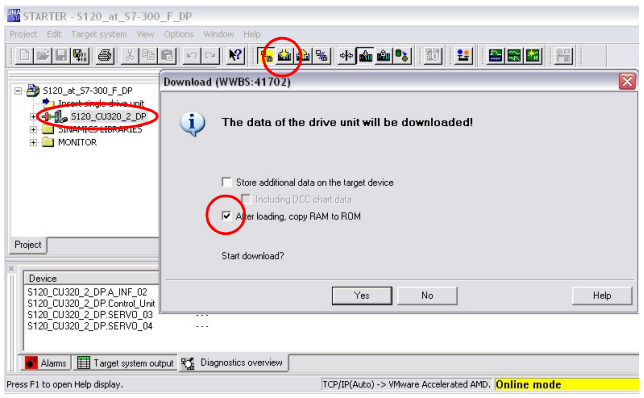
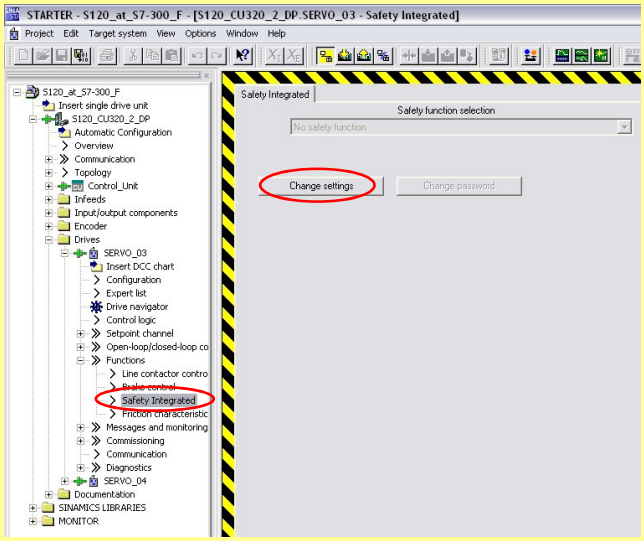
No.	Action	Comments
6.	Go online.	
7.	Select the SINAMICS S120 in the tree and then press “Restore factory settings”.	
8.	Remove the checkmark for “Save factory settings to ROM” and then click “OK”.	
9.	• Expand the tree and double-click on “Automatic Configuration”. • Then call up the wizard and click on “Configure”.	
10.	Click on the “Create” button. In the case of needing a firmware update for the DRIVE-CLiQ components, the process may take several minutes.	

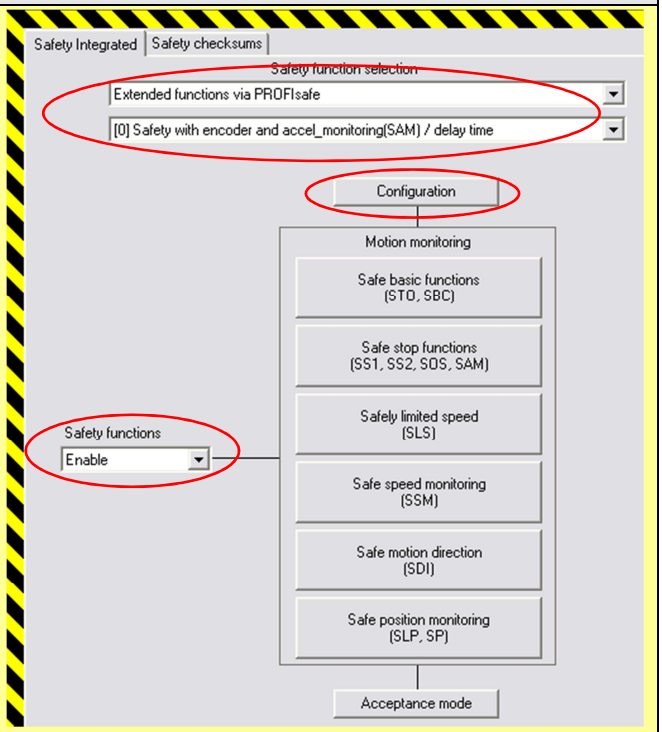
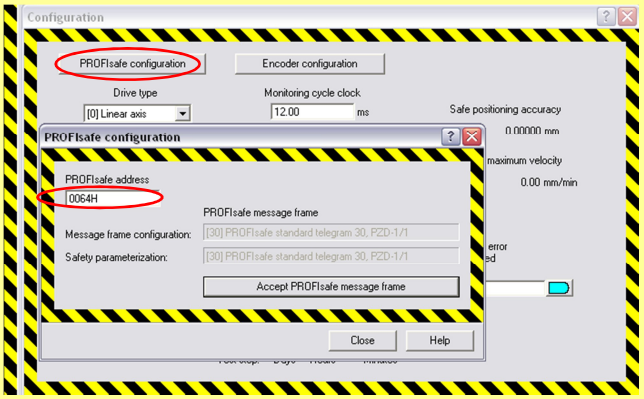
No.	Action	Comments
11.	The drive objects not completely configured by the automatic parameterization are listed in a message window. These components, however, still need to be configured manually in the offline state. Go offline.	
12.	In the offline mode you configure the components listed in step 11. • Open the listed components (e.g. feeds for A_INF_02) • In “Configuration” you start the wizard and run through it even if you are not making any changes. This is the only way to complete the commissioning process for these components.	
Note Please note, that the modules which are not connected via DRIVE-CLiQ, are also not created by the automatic parameterization.		
13.	In the offline mode you enter the components existing in your configuration yet not detected via the automatic configuration and parameterize them. Only proceed with the next step after configuring the components not automatically detected.	
14.	• Double-click on “SERVO_03” in the project. • Activate the wizard by clicking on “Configure DDS”. • For the drive configuration you activate the “Extended setpoint channel” option. • Follow the steps of the wizard by repeatedly clicking on “Next>” without changing the configuration and finish the wizard with “Complete” at the end. Repeat this step for SERVO_04 as well.	

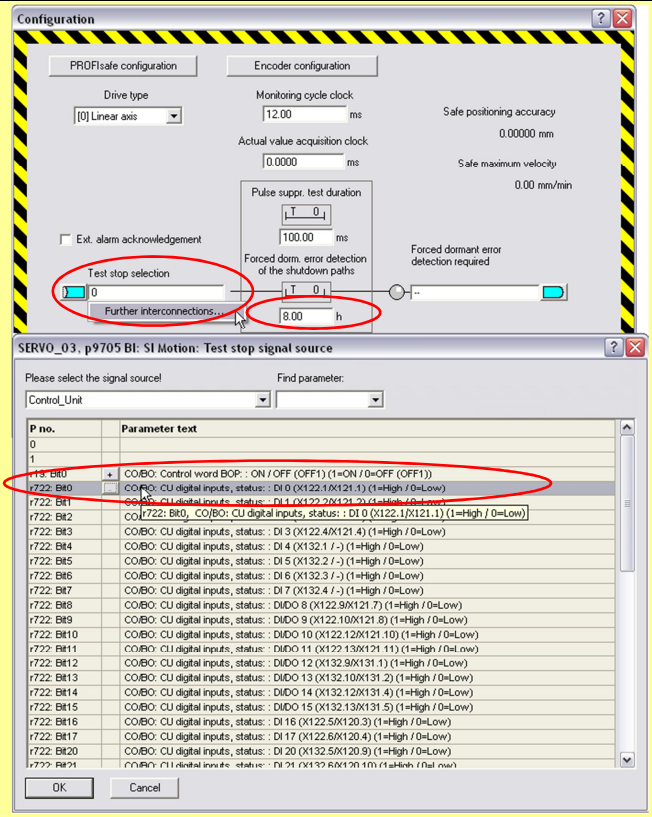
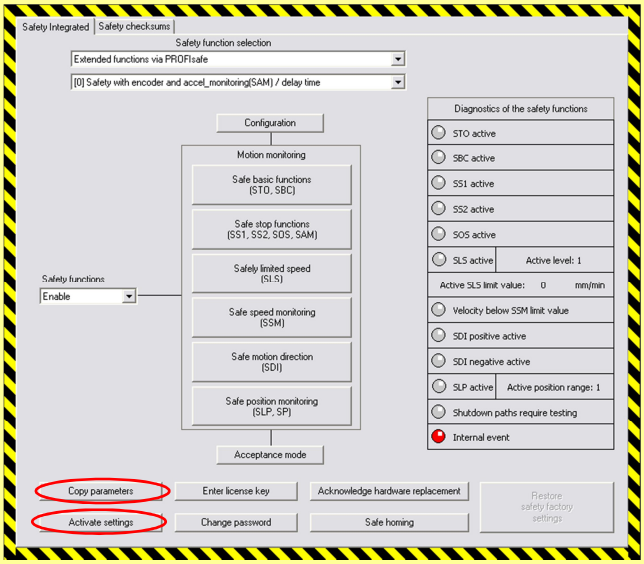
No.	Action	Comments
15.	In the tree you double-click on > Communication > Message frame configuration" and select • "Siemens telegram 370, PZD-1/1" for A_INF_02 • "Siemens telegram 1, PZD-2/2" for SERVO_03 • "Standard telegram 1, PZD-2/2" for SERVO_04 • "Siemens telegram 390, PZD-2/2" for Control_Unit	 Note: The message frame types and addresses match the example.
16.	• Select a drive object. • Select "Add message frame extension" in "Adapt message frame configuration". • Specify the length of the message frame extension. Input data: 2 words Output data: 0 words Repeat this step with the other drive objects.	
17.	• Select a drive object. • Select "Add PROFIsafe" in "Adapt message frame configuration". • Enter the "PROFIsafe Standard telegram 30" frame. • Repeat this step with other drive objects.	

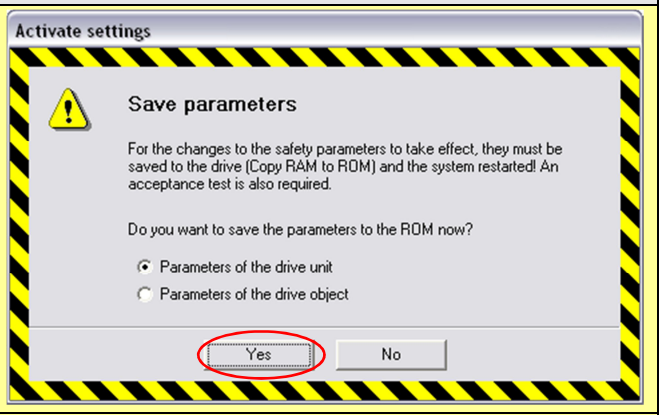
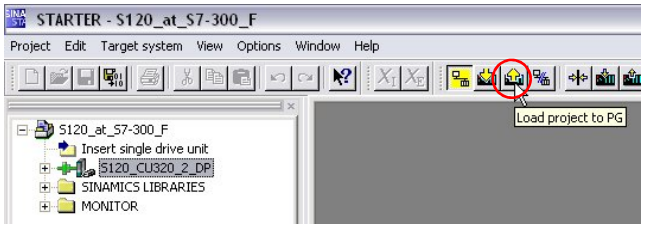
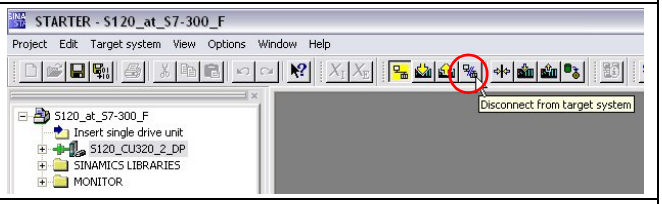
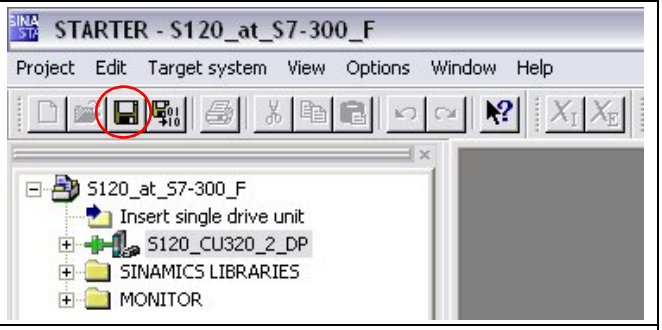
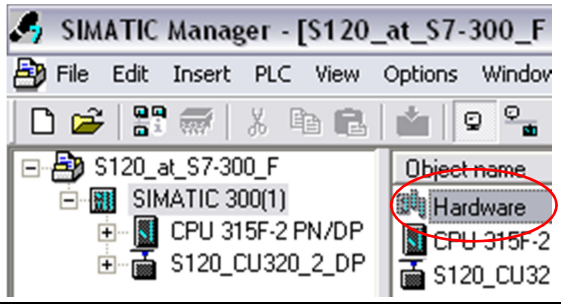
No.	Action	Comments
18.	• Click on “Set up addresses” • Answer the query with “Yes”. The message frame settings are transferred to HW Config and the addresses are assigned to the individual drive objects. After successfully completing the settings, checkmarks will appear at the entries (see next step).	
19.	Mark the message frame extension of the line module (“A_INF_02” in the picture) and click on “Interconnections/diagnostics”.	
20.	• Select the “Transmit direction” tab. • Delete the checkmark at “Suppress inactive interconnections”. • In the second line (PZD2) you select “A_INF_02” and r2132 “CO:Actual alarm code”.	

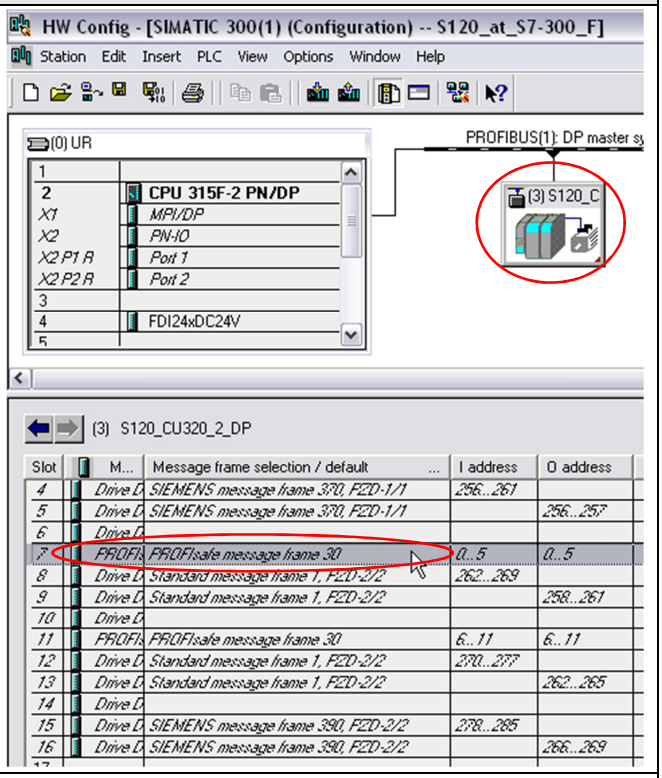
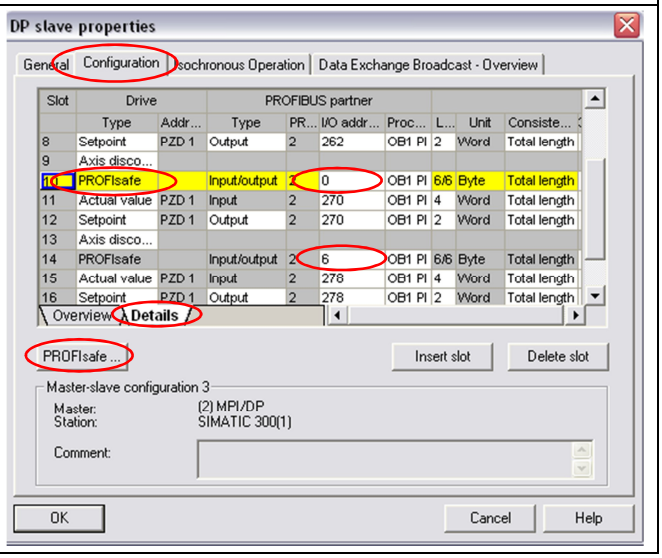
No.	Action	Comments
21.	• In the third line (PZD3) you select “A_INF_02” and r2131 “CO:Actual fault code”. • Press “Close” to close the subwindow in order to display the frame configuration again.	
22.	Repeat steps 19 to 21 for the control unit, or SERVO_03 and SERVO_04. • Select the respective components in the frame configuration. • Click on “Interconnections/diagnostics” • Select the transmit direction • Have the inactive interconnection displayed • At the end you add r2132 and r2131 • Close the subwindow again (in order to get back to the message frame configuration) Make sure that you are using the parameters of the drive object whose settings you are currently changing (in step 20 and 21). For example, for the message frame configuration SERVO_03 the alarm and fault codes of the SERVO_03 drive object need to be used.	
23.	Save the project on your hard disc.	

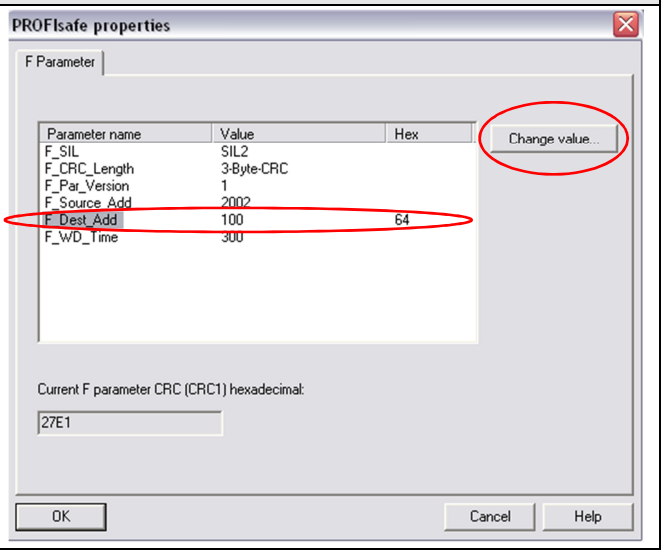
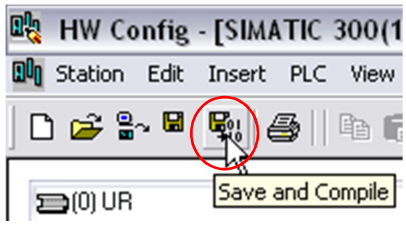
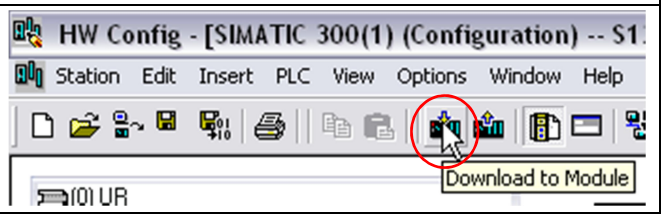
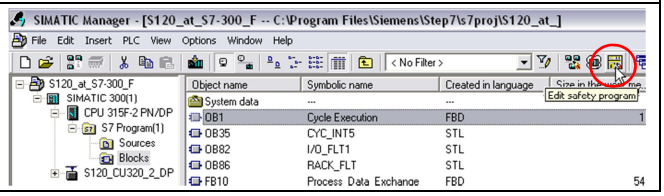
No.	Action	Comments
24.	Go online.	
25.	If the “Online/offline comparison” window opens, • click on “Load to PG”. • with the “After loading, copy RAM to ROM” option and then on “Close”. • proceed with step 27.	 
26.	If in the preceding step the window has not opened, • start the download yourself and • select the “After loading, copy RAM to ROM” option.	
27.	Open > Drives > SERVO_03 > Functions > Safety Integrated in the tree and click on “Change settings”.	

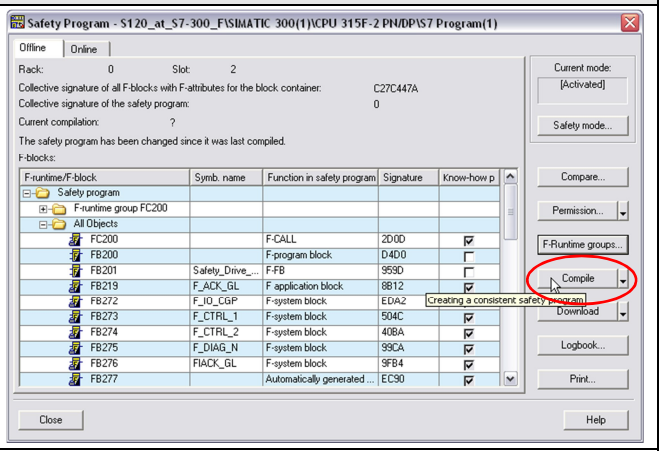
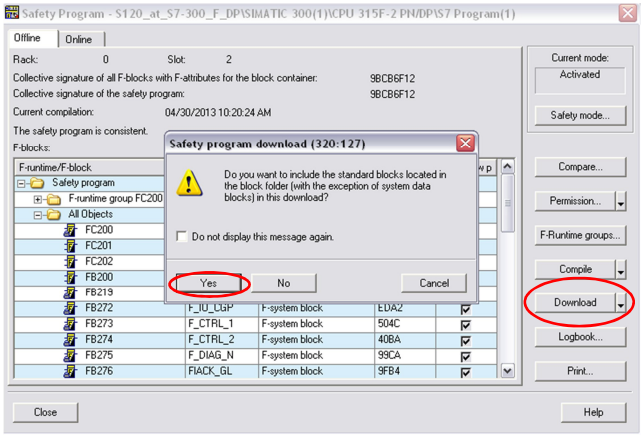
No.	Action	Comments
28.	• Select “Extended functions via PROFIsafe” and “Safety with encoder and accel_monitoring(SAM) / delay time”. • Select “Enable” at the Safety functions • Click on “Configuration”.	
29.	• Click on the PROFIsafe configuration. • Enter the “PROFIsafe address” (e.g. 64Hex for the first and C8Hex later for the second drive). The same addresses also need to be entered when configuring the SIMATIC S7-300F (step 42). • Press “Close” to close the PROFIsafe configuration dialog.	

No.	Action	Comments
30.	• Then select the DI0 of the control unit as “Test stop selection”. • Set the monitoring of the Forced dormant error detection for the expanded functions to 8h. Press “Close” to close the dialog box.	
31.	Click on “Copy parameters” and then “Activate settings“.	
32.	Enter a password (e.g. “siemens”) and then click on “Activate settings” again.	

No.	Action	Comments
33.	Choose “Yes”, to save the parameters in ROM.	
34.	Repeat the steps 27 to 33 for all drives. Note in step 29 that the PROFIsafe addresses need to be different.	
35.	Press “Load project to PG” to load the configuration created online into the PG.	
36.	Go offline.	
37.	Save the project on your hard disc.	
38.	Execute a restart / power ON reset.	Switch off all 24V supply voltages of SINAMICS S120, wait until all LEDs are off, and then switch back on.
39.	Open HW Config.	

No.	Action	Comments
40.	Click on the SINAMICS S120 and double-click “PROFIsafe message frame 30” to open the message frame configuration.	
41.	• In the “Configuration” tab you select “Details”. • Check the I/O addresses and, if necessary, correct them to 0 (drive 1) and 6 (drive 2). • Click on the first slot in the message frame configuration, where the PROFIsafe message frame is located (belongs to drive 1). • Then, click on the PROFIsafe button. • If the password window pops up, enter the password you have specified before.	

No.	Action	Comments
42.	• Click on “F_Dest_Add” and on “Change value…” • Enter the drive’s Safety address which you have used in step 29 (64Hex = 100Dec, C8Hex = 200Dec) as a decimal number. • Click “OK” to close the window. Due to the Safety configuration you need to accept the value twice with “OK” after the changes.	
43.	Repeat steps 41 and 42 for the second drive and set the value previously configured in STARTER (step 29) as the safety address.	
44.	Click on “Save and Compile”.	
45.	• Then download the configuration to the SIMATIC S7 CPU. • Close HW Config.	
46.	Click on “Edit safety program” Answer any query for the safety password by entering the previously set password.	

No.	Action	Comments
47.	Click on the “Compile” button in the “Safety Program” dialog. Make sure that the compilation was performed correctly.	
48.	Click on the “Download” button in the “Safety Program” dialog. • When queried if the standard blocks shall be downloaded as well, respond with “YES”. • Enable stopping the S7-300/400F CPU for a consistent download. • Let the S7 300/400F CPU go back to RUN mode. Close the “Safety Program” dialog.	

7 Related Literature

This list is not complete and only represents a selection of relevant information

Table 7-1

	Topic	Title / link
\1\	Siemens Industry Online Support	http://support.automation.siemens.com
\2\	Download page of this entry	http://support.automation.siemens.com/WW/view/en/68624711
\3\	STEP7 SIMATIC S7-300/400F	Automating with STEP 7 in STL and SCL Author: Hans Berger Publisher: Publicis Publishing ISBN: 978-3-89578-412-5
\4\		Automating with STEP 7 in LAD and FBD Author: Hans Berger Publisher: Publicis Publishing ISBN: 978-3-89578-410-1
\5\		Reference Manual System and Standard Functions for SIMATIC S7-300/400 Vol. 1/2 http://support.automation.siemens.com/WW/view/en/44240604
\6\	STARTER	Download page http://support.automation.siemens.com/WW/view/en/26233208
\7\	SINAMICS S120 Manuals	Function Manual Drive Functions (V4.7): http://support.automation.siemens.com/WW/view/en/99686093 List manual (V4.7) (parameters and error list): http://support.automation.siemens.com/WW/view/en/99682911 Function manual Safety Integrated (V4.7): http://support.automation.siemens.com/WW/view/en/99668646 Commissioning manual (V4.7): http://support.automation.siemens.com/WW/view/en/99687313 Device manual control unit and supplemented components: http://support.automation.siemens.com/WW/view/en/99679173 Booksize power units: http://support.automation.siemens.com/WW/view/en/99687925
\8\	Application example without PROFIsafe	SINAMICS S: Speed Control of a S120 with SIMATIC S7-300/400 (STEP7 V5) via PROFINET with Safety Integrated (via terminal) and HMI http://support.automation.siemens.com/WW/view/en/68585847
\9\	Distributed Safety Manual	S7 Distributed Safety, configuring and programming http://support.automation.siemens.com/WW/view/de/100648623
\10\	FAQ about data record routing	http://support.automation.siemens.com/WW/view/en/7000978 http://support.automation.siemens.com/WW/view/en/50037141

8 History

Table 8-1

Version	Date	Modifications
V1.0	06/2013	First version
V1.1	12/2014	Extended by SINAMICS S120 with FW 4.7 and STARTER V4.4.