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

SINAMICS S120   SIMATIC S7-300/400F

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1 Overview

The short docu on hand describes the blocks which can be used for connecting a PROFINET/PROFIBUS of a SINAMICS G120 to a failsafe SIMATIC S7300/400F in STEP 7 V5. This short docu does not give any explanations and only shows the most important points for integrating the blocks into your own projects.

The following functions can be realized with this:

Table 1-1

Block	Function	Explanation
FB11 "CtrlUnit_FB"		The FB performs the communication between the PLC and the Control Unit drive object of the S120. Its digital inputs/outputs are read/controlled, errors and alarms are transmitted and errors acknowledged. The FB uses the system functions SFC14 and SFC15 and uses the SIEMENS frame 390 with frame expansion (alarm, error) for data transmission.
FB12 "LineModule_FB"	Cyclic access to process data	The FB performs the communication between the PLC and the line module drive object of the S120. The module is switched on/off with FB12, the mode is read out, errors and alarms are transmitted and errors are acknowledged. The FB uses the system functions SFC14 and SFC15 uses the SIEMENS frame 370 with frame expansion (alarm, error) for data transmission.
FB13 "Drive_FB"		The FB performs the communication between the PLC and the "Drive" drive object of the S120. With FB12 status and control word are exchanged and speed setpoint and actual value are transmitted. Errors and alarms are furthermore transmitted and errors are acknowledged. The FB used the system functions SFC14 and SFC15, and uses the default frame 1 for the data transmission with frame expansion (alarm, error).
FB10 "Process_Data_Exchange"		FB is only used as jump table for FB11, FB12 and FB13. In addition it provides the information for WinCC flexible whether the created drive object (Line Module and Drive 1-6) has been configured.
FB20 "Parameter_Access"	Access to parameters	With this FB the PLC can have read and write access to selected parameters in one of the drive objects. The two parameters of each of the configured drive object are given read and write access with the job DB of the application example and the fault memory is read out.

1.1 Requirements

- You require a SIMATIC S7-300/400F CPU, which supports data record routing, (see /10/).

- You require a SINAMICS S120 with firmware 4.5 or higher.

- SINAMICS G120 must be connected to the local PROFIBUS or PROFINET interface of the SIMATIC S7-300/400F using a CP is not supported.

2 Explanation of the Blocks

2.1 FB11 "CtrlUnit_FB"

The FB coordinates the cyclic process data transfer between the PLC and the Control Unit (CU_S) of the SINAMICS S120 on the basis of the extended SIEMENS frame 390. This requires the drive (STARTER) as well as the controller (STEP 7, HW Config) to be configured with the SIEMENS frame 390 that was extended by the alarm and error code.

With the extended SIEMENS frame 390 the following data is exchanged:

Table 2-1: Data transferred with the extended SIEMENS frame 390

PZD Word	S7-300/400F → SINAMICS S120	SINAMICS S120 → S7-300/400F
1	CU_STW1 (CU_S control word)	CU_ZSW1 (CU_S status word)
2	A_DIGITAL (CU_S digital outputs)	E_DIGITAL (CU_S digital inputs)
3		WARN_CODE
4		FAULT_CODE

Details on the frame contents can be found in the SINAMICS S120/S150 list manual in chap. 2.3 (/7/).

The FB11 uses the system functions SFC14 and SFC15.

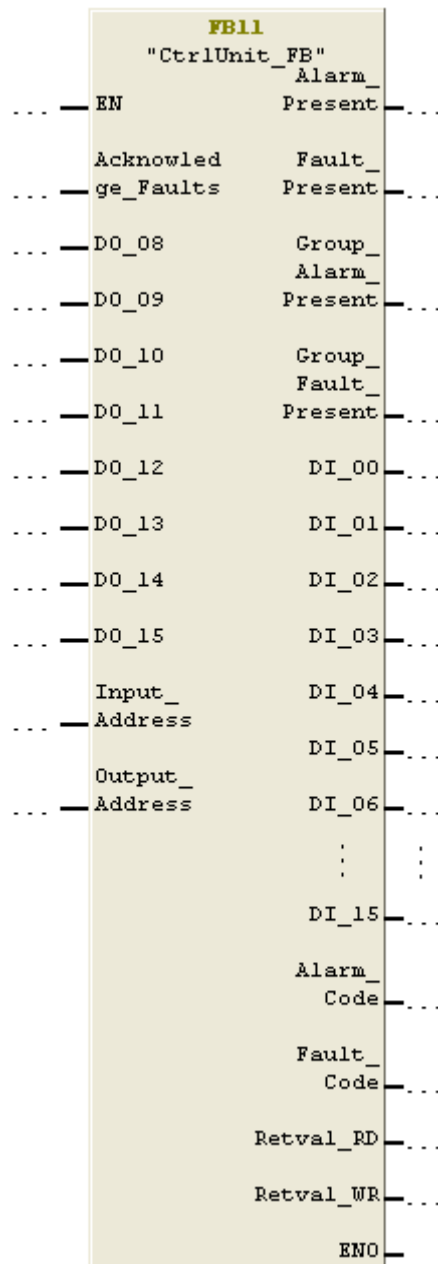With regard to the control unit you can do the following with FB11 …

- acknowledge errors
- detect pending alarms and errors,
- signal group alarms and group errors,
- read/write access to DO/DI of the CU.

You can therefore use the FB 11 as interface to SINAMICS G120 in your own applications. You should call it cyclically in OB1.

2.1 FB11 "CtrlUnit_FB"

Block interface

Figure 2-1: FB11 "CtrlUnit_FB"

```
                    FB11
                 "CtrlUnit_FB"
                                  Alarm_
   ... — EN               Present —...

        Acknowled          Fault_
   ... — ge_Faults        Present —...

   ... —DO_08             Group_
                          Alarm_
   ... —DO_09            Present —...

   ... —DO_10             Group_
                          Fault_
   ... —DO_11            Present —...

   ... —DO_12              DI_00 —...

   ... —DO_13              DI_01 —...

   ... —DO_14              DI_02 —...

   ... —DO_15              DI_03 —...

        Input_             DI_04 —...
   ... —Address
                           DI_05 —...
        Output_
   ... —Address            DI_06 —...

                             :       :

                           DI_15 —...

                          Alarm_
                           Code —...

                          Fault_
                           Code —...

                       Retval_RD —...

                       Retval_WR —...

                            ENO —
```

Interface Description

Table 2-2: Interface of FB11 "CtrlUnit_FB"

Parameter	Data type	Description
Input parameters		
Acknowledge_Faults	Bool	Pending errors are acknowledged with rising edge.
DO_nn (n = 08…15)	Bool	Controls the CU digital output nn, if the respective channel is configured as output.

Parameter	Data type	Description
Input_Address	Word	CU_S I/O input address (from HW Config or STARTER)
Output_Address	Word	CU_S I/O output address (from HW Config or STARTER)
Output parameters		
Alarm_Present	BOOL	CU_S: alarm pending.
Fault_Present	BOOL	CU_S: fault pending.
Group_Alarm_Present	BOOL	CU_S: group alarm pending.
Group_Fault_Present	BOOL	CU_S: group fault pending.
DI_nn (n = 00…15)	BOOL	Read out of CU digital input nn.
Alarm_Code	Int	Alarm code of a pending CU_S alarm.
Fault_Code	Int	Error code of a pending CU_S fault.
Retval_RD	Int	Error information of SFC14 (output parameter RET_VAL of SFC14)
Retval_WR	Int	Error information of SFC15 (output parameter RET_VAL of SFC15)

All of the above input parameters have an initial value of 0 or FALSE.

Access to the individual CU_STW1 bits – with the exception of Acknowledge_Faults – is not supported by FB11.

2.2 FB12 "LineModule_FB"

The FB coordinates the cyclic process data transfer between the PLC and the Line Module (A_INF) of the SINAMICS S120 on the basis of the extended SIEMENS frame 370. This requires the drive (STARTER) as well as the controller (STEP 7, HW Config) to be configured with the SIEMENS frame 370 that was extended by the alarm and error code.

With the extended SIEMENS frame 370 the following data is exchanged:

Table 2-3: Data transferred with the extended SIEMENS frame 370

PZD Word	S7-300/400F → SINAMICS S120	SINAMICS S120 → S7-300/400F
1	E_STW1 (A_INF control word)	E_ZSW1 (A_INF status word)
2		WARN_CODE
3		FAULT_CODE

Details on the frame contents can be found in the SINAMICS S120/S150 list manual in chap. 2.3 (/7/).

The FB12 uses the system functions SFC14 and SFC15.

With regard to the line module you can do the following with FB12 …

- switch it on and off,
- request the status (ready for switch-on, in operation, PLC control requested),
- acknowledge errors
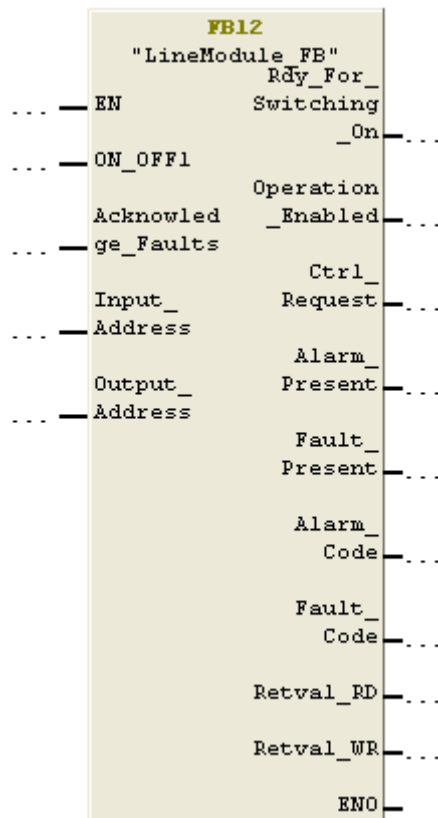- detect pending alarms and errors.

2.2 FB12 "LineModule_FB"

FB 12 can therefore be used as interface with SINAMICS S120 in your own applications. You should call it cyclically in OB1.

Block interface

Figure 2-2: FB12 "LineModule_FB"

```
              FB12
          "LineModule_FB"
                       Rdy_For_
 ... ── EN             Switching
                          _On ── ...
 ... ── ON_OFF1
                       Operation
      Acknowled        _Enabled ── ...
 ... ── ge_Faults
                          Ctrl_
      Input_          Request ── ...
 ... ──Address
                         Alarm_
      Output_         Present ── ...
 ... ──Address
                         Fault_
                       Present ── ...

                         Alarm_
                          Code ── ...

                         Fault_
                          Code ── ...

                      Retval_RD ── ...

                      Retval_WR ── ...

                           ENO ──
```

Interface Description

Table 2-4: Interface of FB12 "LineModule_FB"

Parameter	Data type	Description
Input parameters		
ON_OFF1	Bool	The line module is switched on with a rising edge at ON_OFF1 (if no error is pending).
Acknowledge_Faults	Bool	Pending errors are acknowledged with rising edge.
Input_Address	Word	A_INF I/O input address (from HW Config or STARTER)
Output_Address	Word	A_INF I/O output address (from HW Config or STARTER)
Output parameters		
Rdy_For_Switching_On	Bool	Line module is ready to be switched on.
Operation_Enabled	Bool	Line module is in operation.
Ctrl_Request	Bool	Control to PLC requested. The drive object is ready for taking over.
Alarm_Present	Bool	A_INF: alarm pending.
Fault_Present	Bool	A_INF: fault pending.

Parameter	Data type	Description
Alarm_Code	Int	Alarm code of a pending A_INF alarm.
Fault_Code	Int	Error code of a pending A_INF fault.
Retval_RD	Int	Error information of SFC14 (output parameter RET_VAL of SFC14)
Retval_WR	Int	Error information of SFC15 (output parameter RET_VAL of SFC15)

All of the above input parameters have an initial value of 0 or FALSE.

Access to the individual E_STW1 bits – with the exception of ON_OFF1 and Acknowledge_Faults – is not supported by FB12.

Other switch-on conditions

To be able to switch on the line module the following bits have to be additionally set in the control word (E_STW1):

Table 2-5: A_INF: Other switch-on conditions

STW1	
Bit 01	No_OFF2
Bit 03	Enable operation
Bit 10	Master control by PLC

The above bits are set to TRUE by the FB12. They do not have to be supplied by you.

2.3　FB13 "Drive_FB"

The FB coordinates the cyclic process data transfer between the PLC and the respective drive (SERVO) of the SINAMICS S120 on the basis of the extended default frame 1. This requires the drive (STARTER) as well as the controller (STEP 7, HW Config) to be configured with default frame 1 extended by the alarm and error code.

With the extended default frame 1 the following data is exchanged:

Table 2-6: Data transferred with the extended default frame 370

PZD Word	S7-300/400F → SINAMICS S120	SINAMICS S120 → S7-300/400F
1	STW1 (SERVO control word)	ZSW1 (SERVO status word)
2	NSOLL_A (setpoint speed)	NIST_A (actual speed)
3		WARN_CODE
4		FAULT_CODE

Details on the frame contents can be found in the SINAMICS S120/S150 list manual in chap. 2.3 (/7/).

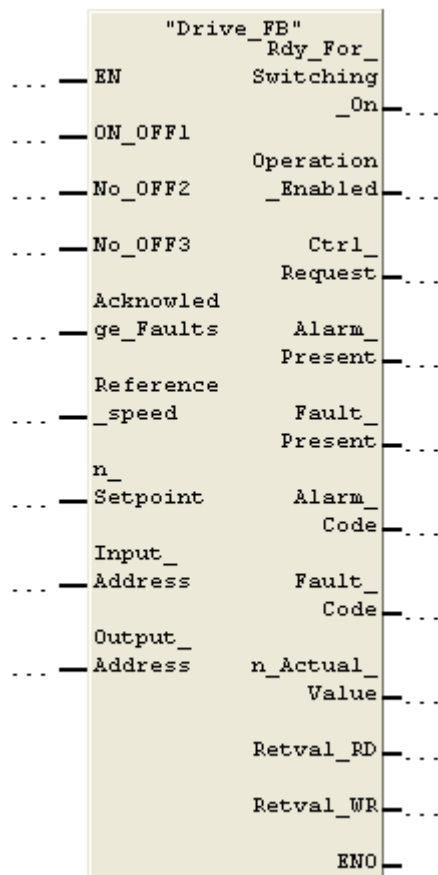The FB13 uses the system functions SFC14 and SFC15.

2.3 FB13 "Drive_FB"

Regarding the respective SINAMICS S120 drive, you can do the following with the FB13 …

- switch it on and off
- acknowledge errors
- specify the setpoint speed
- request the status (ready for switch-on, in operation, PLC control requested),
- detect pending alarms and errors,
- read out actual speed value.

FB 13 can therefore be used as interface with SINAMICS S120 in your own applications. You should call it cyclically in OB1.

Block interface

Figure 2-3: FB13 "Drive_FB"

```
                 "Drive_FB"
                    Rdy_For_
... ━ EN          Switching
                        _On ━ ...
... ━ ON_OFF1
                   Operation
... ━ No_OFF2      _Enabled ━ ...

... ━ No_OFF3         Ctrl_
                    Request ━ ...
     Acknowled
... ━ ge_Faults     Alarm_
                    Present ━ ...
     Reference
... ━ _speed        Fault_
                    Present ━ ...
     n_
... ━ Setpoint      Alarm_
                       Code ━ ...
     Input_
... ━ Address       Fault_
                       Code ━ ...
     Output_
... ━ Address    n_Actual_
                      Value ━ ...

                  Retval_RD ━ ...

                  Retval_WR ━ ...

                        ENO ━
```

2.3 FB13 "Drive_FB"

Interface Description

Table 2-7: Interface of FB13 "Drive_FB"

Parameter	Data type	Description
Input parameters		
ON_OFF1	Bool	The drive is switched on with a rising edge at ON_OFF1. Requirements: • No_OFF2 and No_OFF3 must already be TRUE beforehand. • no fault must be pending. • No safety function must have triggered.
No_OFF2	Bool	With falling edge the motor coasts to a halt.
No_OFF3	Bool	Emergency stop of the motor with falling edge
Acknowledge_Faults	Bool	Pending faults of the drive are acknowledged with rising edge.
Reference_speed	Real	Reference speed of the drive [1/min] (p2000 of the respective drive)
n_Setpoint	Real	Speed setpoint [1/min]
Input_Address	Word	SERVO I/O input address (from HW Config or STARTER)
Output_Address	Word	SERVO I/O output address (from HW Config or STARTER)
Output parameters		
Rdy_For_Switching_On	Bool	Drive ready for switch-on.
Operation_Enabled	Bool	The drive is in operation.
Ctrl_Request	Bool	Control to PLC requested. The drive object is ready for taking over.
Alarm_Present	Bool	SERVO: alarm pending.
Fault_Present	Bool	SERVO: fault pending.
Alarm_Code	Int	Alarm code of a pending SERVO alarm.
Fault_Code	Int	Error code of a pending SERVO fault.
n_Actual_Value	Real	Actual speed [1/min].
Retval_RD	Int	Error information of SFC14 (output parameter RET_VAL of SFC14)
Retval_WR	Int	Error information of SFC15 (output parameter RET_VAL of SFC15)

All of the above input parameters have an initial value of 0 or FALSE.

Access to the individual STW1 bits – with the exception of ON_OFF1, No_OFF2, No_OFF3 and Acknowledge_Faults – is not supported by FB13.

Other switch-on conditions

To be able to switch on the drive, the following bits have to be additionally set in the control word (STW1):

Table 2-8: SERVO: Other switch-on conditions

STW1	
Bit 03	Enable operation
Bit 04	Enable ramp function generator
Bit 05	Continue ramp function generator
Bit 06	Enable setpoint
Bit 10	Master control by PLC

The above bits are set to TRUE by the FB13. They do not have to be supplied by you.

2.4 FB20 "Parameter_Access"

2.4.1 Describing the block

The FB coordinates the acyclic parameter transfer between the PLC and the respective drive object of the SINAMICS S120 on the basis of a data exchange that is based on the data structure of "data record 47"[1]. Send the respective SINAMICS S120 drive object jobs for read-out or for changing the inverter parameters and responses received, embedded in this structure. They may include error detection[1] if applicable, and the requested parameters if it was a read job.

With the help of the FB20 block input parameter you specify…
- the address of the drive system (=address of the CU), you would like to address,
- the source address of the order data records in the PLC,
- the target address of the response data records in the PLC,

Via the content of the order data record (data record 47) you specify…
- the drive object number within the drive system
- the function (change or read out parameters)
- the number of parameters
- the parameter number,
- the parameter index (if present),
- the parameter data type

You can simply use the FB20 in independent applications. You should call it cyclically in OB1 or in OB3x.

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[1] SINAMICS S120 Function manual ([\7\]),
Chap. 11.1.4.2 Acyclic communication > Structure of orders and responses
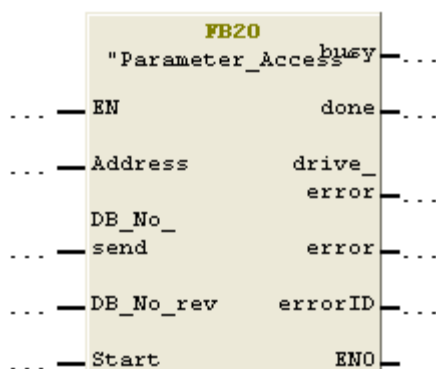
2.4 FB20 "Parameter_Access"

Block interface

Figure 2-4: FB20 "Parameter_Access"

Interface Description

Table 2-9: Interface of the FB20 "Parameter_Access"

Parameter	Data type	Description
Input parameters		
Address	Int	I/O address of the control unit of the respective SINAMICS S120 drive system (from HW Config orSTARTER). Input and output address must be identical to be able to be able to use the FB20.
DB_No_send	Int	Number of the DB in which the order data record to be sent is stored. For the order data record an independent DB has to be created in order to be able to use the FB20.
DB_No_rev	Int	Number of the DB, in which the received order reply is to be stored. For the order reply an independent DB has to be created in order to be able to use the FB20.
Start	Bool	With increasing edge the data record transmission will be started.
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)

All of the above input parameters have an initial value of 0 or FALSE.

2.4 FB20 "Parameter_Access"

Error list

The FB 20 "Parameter_Access" can output the following error codes in the "errorID" parameter:

Table 2-10: Error codes in "errorID" parameter

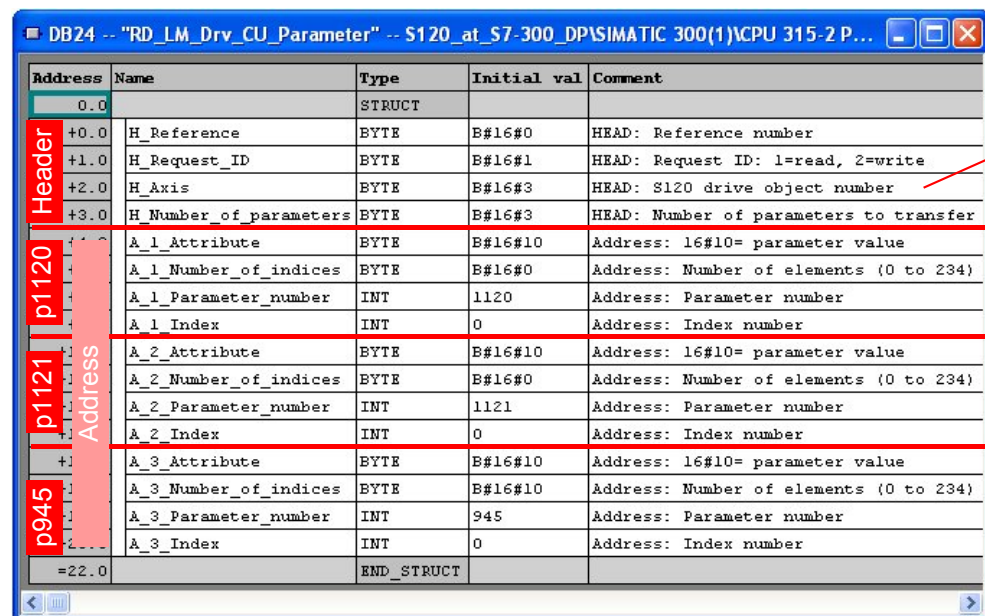| Error number	Description	Note
0	No error	☺
8000	DB_No_send and DB_No_rev are identical.	Check the parameters of FB 20 "Parameter_Access".
8001	DB_No_rev or DB_No_send is zero.	
8002	SFC53 "WEREC" outputs errors	In the instance DB of FB20, the error code of the SFC53 is stored in #WD_REC_STATUS.
8003	SFC52 "RDREC" outputs errors	In the instance DB of FB20, the error code of the SFC52 is stored in #RD_REC_STATUS.
8004	The SFC24 "TEST_DB" reports: Send DB is empty (length 0), non-existent or faulty.	In the instance DB of FB20, the error code of the SFC24 is stored in #TEST_DB_1_STATUS. If it is 0, the DB is empty or write protected.
8005	The SFC24 "TEST_DB" reports: Receive DB is empty (length 0), non-existent or faulty.	In the instance DB of FB20, the error code of the SFC24 is stored in #TEST_DB_2_STATUS. If it is 0, the DB is empty or write protected.

2.4.2 Job and response data record

The FB 20 "Parameter_Access" only coordinates the data exchange between PLC and SINAMICS S120. It furthermore checks whether the transmission was successful and whether an error ID was set in the response of the drive. However, you have to create the order and response data records yourself. Since their form regarding structure and length depends on the data to be transmitted, it is very difficult to write on data records universally valid. However, you can orientate yourself on the template of data record 47 () and the example DBs of this short docu listed in the following application example.

Reading parameters

The parameters p1120 (run-up time), p1121 (ramp-down time) and p945 (fault memory, with 16 indices) are to be read-out from the SERVO 1 drive object of the SINAMICS S120 drive system.

Figure 2-5: Reading parameter – order data record (order DB)

Address	Name	Type	Initial val	Comment
0.0		STRUCT		
+0.0	H_Reference	BYTE	B#16#0	HEAD: Reference number
+1.0	H_Request_ID	BYTE	B#16#1	HEAD: Request ID: 1=read, 2=write
+2.0	H_Axis	BYTE	B#16#3	HEAD: S120 drive object number
+3.0	H_Number_of_parameters	BYTE	B#16#3	HEAD: Number of parameters to transfer
	A_1_Attribute	BYTE	B#16#10	Address: 16#10= parameter value
	A_1_Number_of_indices	BYTE	B#16#0	Address: Number of elements (0 to 234)
	A_1_Parameter_number	INT	1120	Address: Parameter number
	A_1_Index	INT	0	Address: Index number
	A_2_Attribute	BYTE	B#16#10	Address: 16#10= parameter value
	A_2_Number_of_indices	BYTE	B#16#0	Address: Number of elements (0 to 234)
	A_2_Parameter_number	INT	1121	Address: Parameter number
	A_2_Index	INT	0	Address: Index number
	A_3_Attribute	BYTE	B#16#10	Address: 16#10= parameter value
	A_3_Number_of_indices	BYTE	B#16#10	Address: Number of elements (0 to 234)
	A_3_Parameter_number	INT	945	Address: Parameter number
	A_3_Index	INT	0	Address: Index number
=22.0		END_STRUCT		

❶ The number of the drive object is entered here[2]:

CU_S (Control unit)   = 1 (always 1)
A_INF (Line module)   = 2
SERVO 1 (drive 1)   = 3
SERVO 2 (drive 2)   = 4

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[2] SINAMICS S120 Function manual (\7\),
Chap. 11.1.4.3 Acyclic communication > Determining the drive object numbers

2.4 FB20 "Parameter_Access"

Figure 2-6: Reading parameter – response data record (response DB)

Address		Name	Type	Initial value	Comment
0.0			STRUCT		
Header	+0.0	H_Reference	BYTE	B#16#0	HEAD: Reference number (mirrored)
	+1.0	H_Response_ID	BYTE	B#16#0	HEAD: Response ID: 8xh=error, 0xh=ok
	+2.0	H_Axis	BYTE	B#16#0	HEAD: S120 drive object number
	+3.0	H_Number_of_parameters	BYTE	B#16#0	HEAD: Number of parameters to transfer
p1120	+4.0	V_1_Format	BYTE	B#16#0	Value: Format of parameter value (44h=error)
	+5.0	V_1_Number_of_index_valu	BYTE	B#16#0	Value: Number of index values
	+6.0	V_1_Value	REAL	0.000000e+000	Value: Parameter value
p1121	+10.0	V_2_Format	BYTE	B#16#0	Value: Format of parameter value
	+11.0	V_2_Number_of_index_valu	BYTE	B#16#0	Value: Number of index values
	+12.0	V_2_Value	REAL	0.000000e+000	Value: Parameter value
	+16.0	V_3_Format	BYTE	B#16#0	Value: Format of parameter value
	+17.0	V_3_Number_of_index_valu	BYTE	B#16#0	Value: Number of index values
	+18.0	V_3_Value_00	WORD	W#16#0	Value: Parameter value
	+20.0	V_3_Value_01	WORD	W#16#0	Value: Parameter value
	+22.0	V_3_Value_02	WORD	W#16#0	Value: Parameter value
	+24.0	V_3_Value_03	WORD	W#16#0	Value: Parameter value
	+26.0	V_3_Value_04	WORD	W#16#0	Value: Parameter value
	+28.0	V_3_Value_05	WORD	W#16#0	Value: Parameter value
p945	+30.0	V_3_Value_06	WORD	W#16#0	Value: Parameter value
	+32.0	V_3_Value_07	WORD	W#16#0	Value: Parameter value
	+34.0	V_3_Value_08	WORD	W#16#0	Value: Parameter value
	+36.0	V_3_Value_09	WORD	W#16#0	Value: Parameter value
	+38.0	V_3_Value_10	WORD	W#16#0	Value: Parameter value
	+40.0	V_3_Value_11	WORD	W#16#0	Value: Parameter value
	+42.0	V_3_Value_12	WORD	W#16#0	Value: Parameter value
	+44.0	V_3_Value_13	WORD	W#16#0	Value: Parameter value
	+46.0	V_3_Value_14	WORD	W#16#0	Value: Parameter value
	+48.0	V_3_Value_15	WORD	W#16#0	Value: Parameter value
=50.0			END_ST		

DB25 -- "RD_Answer_From_LM_Drv" -- S120_at_S7-300_DP\SIMATIC 300(1)\CPU 315-2 PN/DP\...

If the parameters are read incorrectly an error value will be output instead of a parameter value. The error codes can be found in the SINAMICS S120 function manual ().
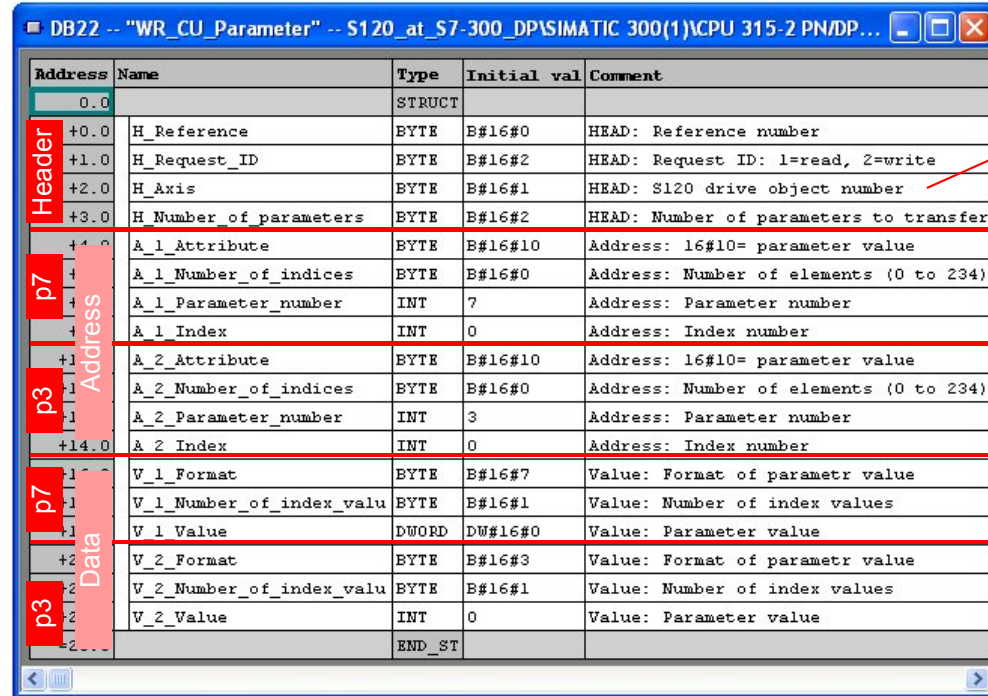
2.4 FB20 "Parameter_Access"

Changing parameters

The parameters p7 (BOP backlight) and p3 (BOP access level) in the CU_S drive object of the SINAMICS S120 drive system is to be changed.

Figure 2-7: Writing parameters – order data record (order DB)

Address	Name	Type	Initial val	Comment
0.0		STRUCT		
+0.0	H_Reference	BYTE	B#16#0	HEAD: Reference number
+1.0	H_Request_ID	BYTE	B#16#2	HEAD: Request ID: 1=read, 2=write
+2.0	H_Axis	BYTE	B#16#1	HEAD: S120 drive object number
+3.0	H_Number_of_parameters	BYTE	B#16#2	HEAD: Number of parameters to transfer
+4.0	A_1_Attribute	BYTE	B#16#10	Address: 16#10= parameter value
+	A_1_Number_of_indices	BYTE	B#16#0	Address: Number of elements (0 to 234)
+	A_1_Parameter_number	INT	7	Address: Parameter number
+	A_1_Index	INT	0	Address: Index number
+1	A_2_Attribute	BYTE	B#16#10	Address: 16#10= parameter value
1	A_2_Number_of_indices	BYTE	B#16#0	Address: Number of elements (0 to 234)
1	A_2_Parameter_number	INT	3	Address: Parameter number
+14.0	A_2_Index	INT	0	Address: Index number
+1	V_1_Format	BYTE	B#16#7	Value: Format of parametr value
1	V_1_Number_of_index_valu	BYTE	B#16#1	Value: Number of index values
1	V_1_Value	DWORD	DW#16#0	Value: Parameter value
+2	V_2_Format	BYTE	B#16#3	Value: Format of parametr value
2	V_2_Number_of_index_valu	BYTE	B#16#1	Value: Number of index values
2	V_2_Value	INT	0	Value: Parameter value
+2		END_ST		

DB22 -- "WR_CU_Parameter" -- S120_at_S7-300_DP\SIMATIC 300(1)\CPU 315-2 PN/DP...

❶ Number of the drive object (see Figure 2-5)

Figure 2-8: Writing parameters – response data record (response DB)

Address	Name	Type	Initial val	Comment
0.0		STRUCT		
+0.0	H_Reference	BYTE	B#16#0	HEAD: Reference number (mirrored)
+1.0	H_Response_ID	BYTE	B#16#0	HEAD: Response ID: 8xh=error, 0xh=ok
+2.0	H_Axis	BYTE	B#16#3	HEAD: S120 drive object number
+3.0	H_Number_of_parameters	BYTE	B#16#0	HEAD: Number of parameters to transfer
+4.0	Value_01	BYTE	B#16#0	
+5.0	Value_02	BYTE	B#16#0	
+6.0	Value_03	BYTE	B#16#0	
+7.0	Value_04	BYTE	B#16#0	
+8.0	Value_05	BYTE	B#16#0	
+9.0	Value_06	BYTE	B#16#0	
+10.0	Value_07	BYTE	B#16#0	
+11.0	Value_08	BYTE	B#16#0	
+12.0	Value_09	BYTE	B#16#0	
+13.0	Value_010	BYTE	B#16#0	
+14.0	Value_011	BYTE	B#16#0	
+15.0	Value_012	BYTE	B#16#0	
+16.0	Value_013	BYTE	B#16#0	
+17.0	Value_014	BYTE	B#16#0	
+18.0	Value_015	BYTE	B#16#0	
+19.0	Value_016	BYTE	B#16#0	
=20.0		END_ST		

Header (rows +0.0 to +3.0)
empty or error records (rows +4.0 to +19.0)

DB23 -- "WR_Answer_From_LM_Drv_CU" -- S120_at_S7-300_DP\SIMATIC 300(1)\CP...

If the parameters are changed incorrectly, an error data record is output for each incorrect parameter. Its structure and the error codes can be found in the SINAMICS S120 function manual (see footer 1 on page 13).

2.5 FB200 "Safety"

The F functionality of the example is confined to using the respective signals of the F input module for controlling/disabling 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 and safety control word 1 of drive 2 is sent via the output bytes 6 and 7.

FB200, FC201 and FC202 are blocks that can be edited by the user. FB200 calls the save functions FC201 and FC202. They control the safety functions of the drives via PROFIsafe. In the example, they read the safe inputs of the F input module and write the respective functions of the PROFIsafe frames of drive 1 and 2.

3 Commissioning

Follow the respective instructions in the appropriate documentation[3] of the application example for commissioning (\2\):

- Chapter 3, if you want to use the STEP 7 example project.
- Chapter 6, if you create your own project.

For the latter of the two above cases, here a brief step-by-step instruction:

Table 3-1: Key points for commissioning

	PROFINET variant	PROFIBUS variant
1.	Establish the physical Ethernet connections between the SIMATIC S7-300/400F controller, the SINAMICS S120 and the PG/PC.	Establish the physical Ethernet connection between the SIMATIC S7-300/400F controller and the PG/PC and the PROFIBUS connection between the SIMATIC S7-300/400F controller and the SINAMICS S120.
2.	--	Set the PROFIBUS address of the SINAMICS S120 on the rotary encoding switch.
3.	Make sure that the IP address of the network card of your PG/PCs is located in the same subnet as that of the SIMATIC S7-300/400F and that this address is not otherwise assigned in your project.	
4.	Set the F target address of the F-DI module used on its DIP switch.	
	…in the SIMATIC Manager	
5.	Assign the IP addresses, the subnet masks and the PROFINET device names to the SIMATIC CPU and SINAMICS S120 components that can be reached online.	--
6.	Create a STEP 7 project and establish the hardware configuration consisting of SIMATIC S7-300/400F and the SINAMICS S120 in HW Config. Assign the device names from step 5 to the configured CPU.	Create a STEP 7 project and establish the hardware configuration consisting of SIMATIC S7-300/400F, SINAMICS S120 and your development system in HW Config.
7.	Network the SIMATIC S7 with the SINAMICS S120 via PROFINET in HW Config.	Network the SIMATIC S7 with the SINAMICS S120 via PROFIBUS and the PG/PC station with the controller via PROFINET in HW Config.
8.	Select protection level 3 in the properties of the CPU and assign a password and enable the safety mode. Furthermore, specify the time interval of the cyclic interrupt in the CPU properties with which the safety program is to be called. Set the F target address in the properties of the F-DI module used according to step 4 and select "Sensor supply via module".	
9.	Create your controller program.	
10.	Regarding your safety program, create at least one F runtime group, one F CALL block and a safety FB.	
11.	Download the entire configuration into the SIMATIC controller.	
	… in the STARTER	
12.	Connect with the SINAMICS S120 in the STARTER online.	
13.	Reset the drive to its factory settings.	
14.	Perform an automatic configuration. Configure the drive objects that have not been fully automatically configured manually offline.	
15.	Configure the required frames (SIEMENS frame 390, SIEMENS frame 370, default frame 1) for all drive objects and add the required frame extensions. Specify the contents of the additional words (current alarm and fault code). Compare the frames with HW Config.	

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[3] There is a detailed documentation for the example project, for the PROFINET and a PROFIBUS communication each.

	PROFINET variant	PROFIBUS variant
16.	Add the "PROFIsafe default frame 30" to each drive object.	
17.	Compare the frames with HW Config.	
18.	Download the online created STARTER project into the SINAMICS S120 (with the "Copy RAM to ROM" option) and save it onto the hard disk.	
19.	Configure the safety functions for the drives (SERVO). Select "Extended functions via PROFIsafe" and release them. Assign each drive a PROFIsafe address. Select a DI for the "Test stop selection" and set the monitoring time for the forced dormant error detection of the shutdown paths. Secure the changed parameters in ROM.	
20.	Perform a "POWER ON" in the SINAMICS S120 and secure the STARTER project on the hard disk.	
	…in the SIMATIC Manager	
21.	Adjust the "F_Dest_Add" I/O addresses in HW Config in the PROFIsafe properties of the drives according to the assigned PROFIsafe addresses in step 19. Download the HW Config into the CPU.	
22.	Generate the safety program and load it into the CPU.	

4 Related Literature

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

Table 4-1

	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\		Automating with STEP 7 in STL and SCL Author: Hans Berger Publisher: Publicis Publishing ISBN: 978-3-89578-412-5
\4\	STEP7 SIMATIC S7-300/400F	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

5 History

Table 5-1

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.