Controlling the CU320-2 via PROFIsafe with PROFIBUS

SINAMICS S120

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SINAMICS S120

Safety Integrated

Controlling the CU320-2 via PROFIsafe with PROFIBUS

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1 Automation task

Introduction

The following safety functions according to IEC 61800-5-2 are currently integrated in SINAMICS S120 drives:

Name	Function	Description
STO	Safe Torque Off	Safe disconnection of the torque-generating energy feed to the motor. The switching on inhibited function prevents the drive from restarting. (stop function, Category 0 according to EN 60204-1)
SBC	Safe Brake Control	SBC is only used when there is a motor brake; the motor brake is connected to the power connector through the outputs. SBC always responds in conjunction with STO or when internal safety monitoring functions respond with safe pulse suppression.
SS1	Safe Stop 1	The drive is quickly and safely stopped along the OFF3 ramp and is safely monitored. Transition to STO after a delay time has expired or the shutdown speed has been reached. (stop function, Category 1 according to EN 60204-1)
SS2	Safe Stop 2	The drive is quickly and safely stopped along the OFF3 ramp and is safely monitored. Transition to SOS after a delay time has expired; the drive remains in closed-loop control. (stop function, Category 2 according to EN 60204-1) Not available for encoderless drives.
SOS	Safe Operating Stop	This function serves to safely monitor the standstill position of a drive; the drive remains in closed-loop control. Not available for encoderless drives.
SLS	Safely-Limited Speed	The drive speed is safely monitored. Parameterizable shutdown response when the limit value is violated.
SSM	Safe Speed Monitor	Safely displays when the speed falls below a speed limit $(n < nx)$.
SDI	Safe Direction	Safe monitoring of the direction of motion (positive and negative directions). Parameterizable shutdown response when traversing in the direction that has not been enabled.

Table 1-1: Overview of the safety functions of the SINAMICS S120

These extended safety functions can be controlled via PROFIsafe with PROFIBUS or PROFINET, as well as via a TM54F terminal expansion module.

In the current example, a SIMATIC F-CPU uses the PROFIsafe telegram with PROFIBUS to control the safety functions.

Overview of the automation task

Fig. 12: Concept of the safety functions



The following safety functions are used as basis for further consideration.

Safety function	Description	Reaction
SF1	Actuation of the Emergency Stop button	Fast stopping of drive 1 and drive 2 \rightarrow after pulse suppression (SS1).
SF2	When protective door 1 is open, drive 1 must not exceed a velocity/speed configured by the user.	Speed monitoring at drive 1 (SLS).
SF3	When protective door 2 is open, drive 2 must not exceed a velocity/speed configured by the user.	Speed monitoring at drive 2 (SLS).

Table 1-3: Safety functions of the application example

The extended safety functions integrated in the SINAMICS S120 drives are to be controlled via PROFIsafe with PROFIBUS.

2.1 Overview of the overall solution

2 Automation solution

2.1 Overview of the overall solution

Schematic

The diagram below is a schematic representation of the most important components for the solution:

Fig. 2-1: Relevant components of the safety functions



This function example shows how the SS1 and SLS safety functions are controlled via PROFIsafe with PROFIBUS at a SINAMICS S120 drive line-up.

The drive line-up in the booksize format comprises an infeed and a Double Motor Module. A Control Unit CU320-2 DP controls the motor. The extended setpoint channel is used to enter the speed setpoint. The two servomotors, which are independent of one another, are controlled from the Double Motor Module. A Smart Line Module is used as infeed.

The safety-relevant signals are sensed using fail-safe inputs of the ET200M and logically processed in the F-CPU. From the fail-safe data, the F-CPU generates a PROFIsafe telegram for each drive. These are transferred to the drives via PROFIBUS where they control the safety functions.

Design

This function example is based on the SINAMICS S120 training case (6ZB2 480-0BA00) and the SAFETY training case.

2.1 Overview of the overall solution

Demarcation

This application does not include a description

- of the safety functions of the SINAMICS S120,
- the general drive functions of the SINAMICS S120 and
- the hardware interfaces of the CU320-2.
- Basic knowledge about these topics is required.

Information on these topics can be taken from the documents from the references.

Knowledge required

Basic knowledge about the configuration of SINAMICS S120 drives with the STARTER or SIMOTION SCOUT engineering software and STEP 7 are assumed.

2.2 Description of the core functions

2.2 Description of the core functions

Overview and description of the core functions

Fig. 2-2: Safety + SINAMICS S120 training case



Switches -S1 to -S4 are located on a switchbox that belongs to the Safety training case. The various safety functions are selected using these switches. Switches -S5 to -S12 are located on a switchbox that belongs to the SINAMICS training case. Using these switches, the drive is switched on and switched off, different speed setpoints entered, the test function for the safety functions initiated and faults acknowledged.

When Emergency Stop (-S1) is actuated, both drives are stopped by the safety function SS1 integrated in the drive.

Each drive is assigned a protective door. If the respective protective door is opened, the speed is safely monitored against the speed/velocity limit value that has been set (SLS). The other drive is not influenced. STOP C (SS2 \rightarrow SOS) at the respective drive is initiated as error response of SLS when the safety speed/velocity is exceeded.

Other versions to control the safety functions integrated in the drive using the TM54F terminal expansion module as well as control via PROFIsafe with PROFINET, are described in additional functional examples.

2.3 Hardware and software components that are used

Advantages of this solution

The solution presented here offers you the following advantages

- Simple control of the safety functions integrated in the drive
- Simple design using standardized technology
- The existing system can be quickly and simply expanded.
- Space-saving and low-cost design using integrated safety functions additional hardware is not required
- Complex safety concepts can be implemented on this basis.

2.3 Hardware and software components that are used

The application was created with the following components:

Hardware components

Table 2-3: SAFETY training case (essential components)

Component	Туре	Order no./Ordering data	Qty	Manufacturer
SITOP power supply	SITOP SMART 120W	6EP1 333-2AA01	1	Siemens
	CPU 315F-2 PN/DP	6ES7 315-2FH13- 0AB0	1	Siemens
SIMATIC 37-300 CPU	SIMATIC Micro Memory Card, 512KB	6ES7 953-8LJ20- 0AA0	1	Siemens
SIMATIC S7 fail-safe input module	SM 326 F-DI 24	6ES7 326-1BK01- 0AB0	1	Siemens
SIMATIC S7 fail-safe output module	SM 326 F-DO 8	6ES7 326-1BF40- 0AB0	1	Siemens
SINAMICS fail-safe Terminal Module	TM54F	6SL3055-0AA00- 3BA0	1	Siemens
Drive-CLiQ	Cable, gray, metal connector	6FX2002-1DC00- 1AC0	1	Siemens
Protective door simulation switches	Toggle switch 0-I, latching, 16 mm, black	3SB2000-2AB01	2	Siemens
S2 and S3	Holder with solder pins	3SB2908-0AB	2	Siemens
Emergency stop command device	Mushroom pushbutton, red, 16 mm	3SB2000-1AC01	1	Siemens
S1	Holder with solder pins	3SB2908-0AB	1	Siemens
Reset button	Pushbutton, flat button, 16 mm, white	3SB2000-0AG01	1	Siemens
S4	Holder with lamp holder, lamp and solder pins	3SB2455-1B	1	Siemens
Load resistors R1 R8	1 kOhm 1 W	Type PO595-0 Style 0207 Power metal oxide film resistors	1	Yageo Europe
Terminals for load	ST 2.5-QUATTRO-TG	3038451	8	Phoenix Contact
resistors (R1R8)	P-CO component connector	3036796	8	Phoenix Contact

2 Automation solution

2.3 Hardware and software components that are used

Component	Туре	Order no./Ordering data	Qty	Manufacturer
Load resistor R9	SMA0207 1K2 1% TK	WID_MET_SHT_1K2 _+- 1%_600mW_+50ppm _0207	1	Beyschlag
Terminals for load resistor (R9)	TERMINALS_ACCESSOR Y_EMPTY CONNECTOR_TYPE1_GR AY	280-801	1	WAGO
	TERMINAL_4- CONDUCTOR_GRAY	280-686	1	WAGO

Table 2-4: SINAMICS training case

Component	Туре	Order no./Ordering data	Qty	Manufactur er
SINAMICS training case	S120 CU320	6ZB2 480-0BA00	1	SIEMENS

Table 2-5: Additional components

Component	Туре	Order no./Ordering data	Qty	Manufactur er
Control Unit	CU320-2DP	6SL3040-1MA00- 0AA0	1	SIEMENS

Note The application example was tested with the hardware components listed here. Alternatively, other components with the same function may be used. In such a case, a different parameter assignment and different wiring of the components may be required. The components shown in yellow are not relevant for this function example.

Standard software components

Table 2-6: Engineering software

Component	Туре	Order no./Ordering data	Qty	Manufacturer
STEP 7	V5.5	6ES7810-4CC10-0YA5	1	Siemens
S7 Distributed Safety Programming	V5.4 SP5	6ES7833-1FC02-0YA5	1	Siemens
S7 F ConfigurationPack	V5.5 SP7	6SL3072-0AA00-0AG0	1	Siemens
STARTER	V4.2.0.0	6AU1810-1BA41-2XA0	1	Siemens
Drive ES Basic	V5.5	6SW1700-5JA00-5AA0	1	Siemens

2.3 Hardware and software components that are used

Component	Туре	Order no./Ordering data	Qty	Manufacturer
Sinamics	V4.4		1	Siemens
CPU	V2.6		1	Siemens

Note The SIMOTION SCOUT can be used as an alternative to the STARTER & DRIVE ES Basic software.

Licenses

Table 2-8: Licenses

License	MLFB/order number	Note
SINAMICS LICENSE SAFETY INTEGRATED EXTENDED FUNCTIONS	6SL3074-0AA10-0AA0	per axis

File and project examples

Table 2-9: State of the application example when supplied

Component	Note
MC_FE_I_006_V20.zip	Zipped project
29056318_MC_FE_I_006_V20.pdf	This document

3 PROFIsafe communication

Each drive with configured PROFIsafe slot in the drive unit, represents an F device or F slave with fail-safe communication to the F host via PROFIBUS.

A separate PROFIsafe telegram (PROFIsafe slot) is created for each drive. This telegram is 6 bytes long for each drive. The first two bytes contain the Safety user data.

F-CPU → drive

Fia	3-1.	The	following	control	signals	are sent	from	the	F-CPI	l to	the	drive
i iy.	5-1.	THE	lonowing	CONTROL	Signals	are sem	nom	uie	1-010	10	uie	unve

	PROFIdrive Safety Block 1 (F Process Data)														
Byte 0					Byte 1										
0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7
STO	SS1	SS2	SOS	SLS	Res.	Res.	Int. Ev. ACK	Res.	SLS Limit sel.	SLS Limit sel.	Res.	SDI pos.	SDI neg.	Res.	Res.

Drive → F-CPU

Fig. 3-2: The drive returns the status of the safety functions to the F-CPU.

	PROFIdrive Safety Block 1 (F Process Data)														
Byte 0					Byte 1										
0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7
Power rem.	SS1 act.	SS2 act.	SOS act.	SLS act.	Res.	Res.	Int. Ev.	Res.	SLS Limit	SLS Limit	SOS selected	SDI pos. act.	SDI neg. act.	Res.	SSM

Note

Safety functions that are integrated in the drive, but not used must be deselected using a high signal.

Safety Integrated V2.0, Entry ID: 29056318

4 Installation

Installing the hardware

The following diagrams show the hardware structure of the application. Fig. 4-1: Overview of the hardware structure



Fig. 4-2: DRIVE-CLiQ interconnection of the SINAMICS components





Fig. 4-3: Wiring of the control voltage at the Safety training case

5.1 Passwords

5 Configuration and project engineering

In this chapter, you get to know how the individual components must be parameterized. STARTER and DRIVE ES Basic are used as the engineering software for the SINAMICS S120. STEP7 and Distributed Safety is a prerequisite for programming the F-CPU.

How the software project belonging to this function example was created is described step-by-step in the following.

Note Most of the screenshots were created with the "English" language setting. There might be some minor differences for other languages.

5.1 Passwords

For reasons of simplicity, a common safety password is used for the program and hardware on the SIMATIC components in the project. Also when configuring the Safety functionality of the SINAMICS components, one common password is used for the drives.

- Safety password for F-CPU: "0"
- Safety password for SINAMICS: "1"

These passwords should not be used in real applications!

5.2 Preparation

5.2 Preparation

The PROFIBUS interfaces of the F-CPU and SINAMICS S120 are used in this application example for programming, for the exchange of fail-safe signals (PROFIsafe data) and for entering control word 1 (PROFIdrive data) with the exception of bit 0 (on/off1 enable).

Table 5-1: Setting the interfaces and assigning the PROFIBUS address

No.	Action	Remark
No.	Action Open the Simatic Manager to go online on the SIMATIC control. Then click on "Options" → "Set	Remark File Edit Insert PLC View Options Window Help Customize Ctrl+Alt+E Access Protection o Filter > Change Log ame Text Libraries Language for Display Devices Manage Multilingual Texts Pewire Run-Time Properties Compare Blocks Define Global Data Configure Network
	PG/PC Interface".	Configure Process Diagnostics Edit safety program
		PCS 7 license information
		Charts +
		Shared Declarations
		CAx Data 🔸
		Set PG/PC Interface

5.2 Preparation

No.	Action	Remark
2.	The adapter is now selected which is used to go online. In this case, it is the "CP5711(PROFIBUS)" → Now click on "Properties".	Set PG/PC Interface X Access Path LLDP Access Point of the Application: S70NLINE STONLINE (STEP 7) Istandard for STEP 7) CP5711(PROFIBUS) Interface Parameter Assignment Used: Properties CP5711(PROFIBUS) Accive> CP5711(PROFIBUS) Cative> CP5711(PROFIBUS) Cative> CP5711(PROFIBUS) Cative> CP5711(PROFIBUS) Cative> CP5711(PROFIBUS) Cative> CP5711(PROFIBUS) Cative> Copy Delete User parameter assignment of your communications processor CP5711 for a PROFIBUS-Network) Select Interfaces Add/Remove: Select OK Cancel Help
3.	The Profibus address "0" for the PG is defined here. The transmission rate is also set here. → OK	Properties - CP5711(PROFIBUS) PROFIBUS Mode Station Parameters PG/PC is the only master on bus Address: 0 Address: 0 Network Parameters Transmission Rate: 1.5 Mbps Highest Station Address: 126 Profile: DP Standard Universal (DP/FMS) User-Defined Net Configuration Calculate with this net configuration Master: Slaves: 0K Cancel
4.	The PROFIBUS addresses of the	SINAMICS and the F-CPU will be defined later.

5.3 HW configuration

5.3 HW configuration

Table 5-2: HW configuration

No.	Action	Remark
1.	In the SIMATIC Manager, insert a SIMATIC 300 station into the project.	File Edit Insert PLC View Options Window Help Image: Station 1 SIMATIC 400 Station 2 SIMATIC 300 Station Symbol Image: Station Subnet 2 SIMATIC 300 Station Symbol Image: Station Simatic H Station 3 SIMATIC PC Station Symbol Image: Station S7 Software 5 5 Other Station Image: Station Image: Station S7 Software 5 5 Other Station Image: Station </td
2.	Double click on "Hardware". Completely create and parameterize the station in HW Config. To do this, drag the modules contained in the parts list of Chapter 2.3 from the catalog window and drop them into the configuration window.	File Edit Insert PLC View Options Window Help Station Edit Insert PLC View Options Window Help Station Edit Insert PLC View Options Window Help Station Edit Insert PLC View Options Window Help PROFIBUS(1) DP master system (1) PROFIBUS(1) DP master

No.	Action	Remark
3.	The adjacent window is displayed when inserting the F-CPU. Simply close this with "Cancel".	Properties - Ethernet interface PN-ID (R0/S2.2) General Parameters If a subnet is selected, the next available addresses are suggested. IP address: 132.168.0.1 Subnet mask: 255.255.255.0 Subnet: Other mask: Image: Subnet: New Image: Subnet: Delete Image: DK Cancel
4.	Then double-click on "MPI/DP" and select "PROFIBUS" in the following window and then click on "Properties".	OUUR Properties - MPI/DP - (R0/S2.1) 1 1 2 IN CPU 315F-2 PN/DP X1 MPI/DP X2 Privid X3 MPI/DP X4 Privid X4
5.	The adjacent window opens. Here, select PROFIBUS address "2" and then click on the "New" button.	Properties - PR0FIBUS interface MPI/DP (R0/52.1) General Parameters Address: 2 If a subnet is selected, the next available address is suggested. Subnet:

No.	Action	Remark
6.	Acknowledge with OK A PROFIBUS line is created.	Properties - New subnet PROFIBUS X General Network Settings X Name: PROFIBUS(1) X S7 subnet ID: 00CD 000C Project path: MC_FE_1_006_V12_ X Storage location of the project: C:\Program Files\Siemens\Step7\s7proj\MC_FE_1 X Date created: 06/01/2011 08:46:08 AM X X Comment: Image: Cancel Help Image: Cancel Help X
7.	When inserting the Sinamics S120 from the catalog into the configuration window, the adjacent window is displayed in HW Config. Here, PROFIBUS address "3" is selected. Also select the already created Profibus connection. \rightarrow OK In the following window, select Version 4.4.	Properties - PROFIBUS interface SINAMICS General Parameters Address: Image: Sinamic S
8.	The adjacent window appears automatically and is confirmed with OK. The PROFIsafe Slot is inserted later in STARTER.	DP slave properties Image: Configuration Isochronous Operation Data Exchange Broadcast - Overview Object Message frame selection Object Message frame selection Object Message frame selection Object Message frame selection Overview Default Overview Default Master-slave configuration 1 Master-slave configuration 1 Master SilMATIC 300(1) Comment: Image: SilMATIC 300(1) OK Cancel

No.	Action	Remark
9.	The hardware configuration should then look like this.	Station Edit Insett PLC View Options Window Help Image: Station Edit Insett PLC View Options Window Help Image: Station Edit Insett PLC View Options Window Help Image: Station Edit Insett PLC View Options Window Help Image: Station Edit Insett PLC View Options Window Help Image: Station Edit Insett PLC View Options Window Help Image: Station Edit Insett PLC View Options Window Help Image: Station Edit Insett PLC View Options Window Help Image: Station Edit Insett PLC View Options Window Help Image: Station Edit Insett PLC View Options Window Help Image: Station Edit Insett PLC View Options Window Help Image: Station Edit Insett PLC View Options Window Help Image: Station Edit Insett PLC View Options Window Help Image: Station Edit Insett PLC View Options Window Help Image: Station Edit Insett PLC View Options Window Help Image: Station Edit Insett PLC View Options Window Help Image: Station Edit Insett PLC View Options Window Help Image: Station Edit Insett PLC View Option E
	Saving and compiling	Image: 100 UR Order number Firmware MPI address I address Q address 2 CPU 315-2 PN/DP 6ES7 315-2FH13-0A80 V2.6 2047* X2 PN/Q2 2047* 2047* X2 PN/Q2 2047* 2047* 4 FDI24xDC24V EES7 326-18K01-0480 03 03 5 FD06xDC24V/2A 6ES7 326-28F40-0480 1014 1014
10.		G 10
11.	Open NetPro as the programming device must be inserted. To do this, click on "Configure Network".	B
12.	Drag the "PC/PG" object from the "Stations" folder and drop in the work area. The properties window opens by double-clicking on PG/PC(1).	Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network

No.	Action	Remark
13.	Select the "Interfaces" tab and there, press the "New" button. Select "PROFIBUS" in the following window and confirm with "OK".	Properties -PG/PC X General Interfaces Name New Interface - Type Selection Type: Industrial Ethernet PROFIBUS PROFIBUS New OK Cancel Help
14.	Select Profibus address "0" - and for "Subnet", select the existing PROFIBUS connection.	Properties - PROFIBUS interface General Parameters Address: If a subnet is selected, the next available address is suggested. Highest address: 126 Transmission rate: 1.5 Mbps Subnet: PROFIBUS(1) 1.5 Mbps Properties Delete OK
15.	The interface must now be allocated on the PC/PG. In the example, the computer is equipped with the "CP5711(PROFIBUS)", and this interface should be connected to the existing PROFIBUS connection. The connection is established using the "Assign" button.	Properties -PG/PC X General Interfaces Not Assigned Configured Interfaces: Name Type Subnet Interface Parameter Assignments in the PG/PC: IP67711MP1 Image: Subnet ISO Ind. Ethernet -> Belkin USB Etherm ISO Ind. Ethernet -> Delink DUB-E100 ISO Ind. Ethernet -> LevelOne USB-02 X Assigned: Disconnect Interface Parameter assign Subnet Assigned: Disconnect Interface Parameter assign Subnet VI Active S70NLINE Access: X M Cancel

No.	Action	Remark
16.	The PG is now available with active interface (yellow line).	MPI PROFIBUS(1) PROFIBUS SIMATIC 300(1) CPU MPI/DP PN-IO 315F-2 PN/DP 2 PG/PC(1) 0 0 5120xCU320x 2xDPxCBE20 3
17.	Saving and compiling Then close NetPro.	
18.	Configuring the F-CPU Open HW Config in the SIMATIC Manager. In the properties window of the F-CPU, under the "Protection" tab, activate access protection for the F-CPU and protect using "0" as password. Activate the safety program (set the check mark for "CPU contains safety program").	Properties - CPU 315F-2 PN/DP - (R0/S2) Cycle/Clock Memory Retentive Memory Interrupts Time-of-Day Interrupts General Startup Synchronous Cyc Diagnostics/Clock Protection Communication F Paramet Protection level It Access protect for F CPU Mode Process mode Password: 2: Write-protection Protections: It functions: 3: Write-/read protection It structors: It structors: It structors: Image: CPU contains safety program It cance It structors: It structors: Image: OK OK Cance It structors: It structors:

No.	Action	Remark
19.	Configuring the F-DI module Configure the PROFIsafe address using DIL switches. To do this, click on the F-DI in HW Config	Properties - FD124xDC24V - (R0/S4) General Addresses Parameters Parameters Value Parameters Value Parameters Value Properties Safety mode F-parameters Proteineers Value Proteineers Value Proteineers Value Proteineers Value Value Proteineers Value
	Select "Safety mode".	Image: DIP switch setting (30) 0011000111 Image: DIP switch setting (30) 2500
20.	Configuring the F-DI module Configuring F-DI 0 (channels 0, 12)	General Addresses Parameters Parameters Safety mode Parameters Safety mode Parameters Module parameters Parameters Passivate the channel Parameters Passivate the channel Parameters Passivate the channel Passivate the channel Passivate the channel Passivate Passivate the channel Passivate Passivate Passivate Passivate

No.	Action	Remark			
21.	Configuring the F-DI module Configuring F-DI 1 (channels 1, 13) Configuring F-DI 2 (channels 2, 14) Configuring F-DI 3 (channels 3, 15) Configuring F-DI 5 (channels 5, 17)	Properties - FD124xDC24V - (R0/54) General Addresse Parameters Parameters Value E valuation of the sensors Image: Channel 1, 13 E valuation of the sensors Image: Channel 1, 13 E valuation of the sensors Image: Channel 2, 14 E channel 2, 14 Image: Channel 2, 14 E valuation of the sensors Image: Channel 2, 14 E valuation of the sensors Image: Channel 3, 15 E Activated Image: Channel 3, 15 E valuation of the sensors Image: Channel 4, 16 Image: Channel 4, 16 Image: Channel 4, 16 Image: Channel 5, 17 Image: Channel 5, 17 Image: Channel 5, 17 Image: Channel 5, 17 Image: Channel 5, 17 Image: Channel 6, 17 Image: Channel 5, 17 Image: Channel 6, 17 Image: Channel 5, 17 Image: Channel 6, 17 Image: Channel 6, 17 Image: Channel 6, 17 Image: Channel 7, 17 Image: Channel 7, 17 Image: Channel 7, 17 <thi< th=""></thi<>			
22.	Configuring the F-DO module Configure the PROFIsafe address using DIL switches. To do this, click on the F-DO in HW Config.	Properties - FD08xDC24V/2A - (R0/S5) General Addresses Parameters Parameters Value Parameters Safety mode Parameters 2000: CPU 315F-2 PN/DP Pip F_dest_address 200 DIP switch setting (90) 0011001000 Parameters 2500			

No.	Action	Remark	
23.	Configuring the F-DO module Configuring F-DO 7	Properties - FD08xDC24V/2A - (R0/S5) General Addresses Parameters Parameters Module parameters Diagnostic interrupt Behavior after channel faults Di channel 0 Activated Diagnostics: wire break Diagnostics: wire break Do channel 2 Activated Diagnostics: wire break Do channel 3 Activated Diagnostics: wire break Do channel 4 Activated Diagnostics: wire break Do Channel 4 Activated Diagnostics: wire break Do Channel 5 Activated Diagnostics: wire break Do Channel 6 Activated Diagnostics: wire break Do Channel 7 Activated Diagnostics: wire break Do Channel 7 Activated Diagnostics: wire break	Value Passivate the channel
24.	Save and compile HW Config.	F 01	
25.	Download HW Config to the F- CPU	ன்	

5.4 Configuration of the basic drive functions

5.4 Configuration of the basic drive functions

The existing hardware in the drive system must first be commissioned and the desired motion functions created.

No.	Action	Remark			
1.	Open STARTER from the SIMATIC project. To do this right-click on the SINAMICS in HW Config. Click on "Open Object with STARTER".	PROFRUS(1) DP matter system (1) Improvement			
2.	Go online.	<u></u>			
3.	Restoring factory settings.	\$ † \$			
4.	Start the automatic configuration of the drives.	Automatic Configuration Xatematic Configuration Xatematic Configuration Configure drive unit automatically The DRIVE CL2 topology is determined and the electoric type plates are read out. The data the there hadded to the PG and replaces the configuration in the project. Configure drive unit automatically The data the there hadded to the PG and replaces the configuration in the project. Configure drive unit automatically The data the there hadded to the PG and replaces the configuration in the project. Status of the drive unit initialization finished The data the drive unit initialization f			
5.	Select "Servo" as the drive object type and create with "Create".	Automatic Commissioning Components have been found that cannot be clearly assigned to a drive object type. Please select the drive object type. Please select the drive object type that is to be created for the components. Default setting for all components: Servo Component Drive Object Type Drive 1 Servo Drive 2 Servo Create Help			
6.	Go offline	早満			
7.	Save.				

Table 5-3: Configuration of the basic functions

No.	Action	Remark			
	Post configuration of both drives	Display data set switchover Drive data set: DDS 0 (Active) Configure DDS Command data set: CDS 0 (Active) Configure DDS			
8.	In the Project Navigated for drive 1 or drive 2 (SERVO_02 or SERVO_03), open the "Configuration" window.	Configuration Drive data sets Command data sets Units Reference variables - setting Block Name: SERV0_02 Drive objects type Drive object no.: 2 Control type: DRIVE CLiQ PR0FIdrive messa			
	"Configure DDS" starts the navigated post configuration.	SERVD_02.Motor_Module_2 (Power unit) SERV Component number: 2 Power unit type: Double motor module (X1)			
	Note In the following, only those screen forms are described in which a change is required.	Order no.: 6SL3120-2TE13-0AA3 Power unit rated current: 3.00 Arms Power unit rated power: 1.60 kW Current power unit operating values Identification via LED Enc. Order			
9.	Post configuration of both drives Under "Function modules" →, activate "Extended setpoint channel".	Configuration - \$120xCU320x2xDPxCBE20 - Control structure			
10.	Post configuration of both drives A signal at "Infeed in operation" (p0864) is required for operation. Fixed binector 1 is used here in the example. Note	Configuration - \$120xCU320x2xDPxCBE20 - Power unit BICO Configuration - \$120xCU320x2xDPxCBE20 - Power unit BICO Configuration - Statucture. Power unit Connection Power unit BICO Power unit BICO Infeed in operation Infeed in operation Process data exchang p0864 ON commands and enables			
	binector 1 should not be used as signal for "Infeed in operation" (p0864).	K K			

No.	Action	Remark			
11.	Post configuration, drive 2 The second drive does not have a Drive-CLiQ encoder; the motor must be manually selected. In the example, an 1FK7022 - 5AK71 - 1AG0 motor is being used.	Configuration - \$120xCU320x2xDPxCBE20 - Motor Power unit			
12.	Post configuration, drive 2 Just like the motor, the encoder must also be manually selected. The is also realized using the type number (MLFB). Here in the example, an incremental encoder with the identification code letter A is selected.	Encoder Selection via Motor Order Number X The encoders listed below are available for the selected listed motor. Select the relevant encoder via the motor order number. Motor encoder selection: Image: Constraint of the selected listed motor. Image: Constraint of the selected listed motor. Encoder type Image: Constraint of the selected listed motor. Encoder type Image: Constraint of the selected listed motor. Encoder type Image: Constraint of the selected listed motor. Encoder type Image: Constraint of the selected listed motor. Encoder type Image: Constraint of the selected listed motor. Encoder type Image: Constraint of the selected listed motor. Encoder type Image: Constraint of the selected listed motor. Encoder type Image: Constraint of the selected listed motor. Encoder type Image: Constraint of the selected listed motor. Encoder type Image: Constraint of the selected listed motor. Encoder type Image: Constraint of the selected listed motor. Encoder type Image: Constraint of the selected listed motor. Encoder type Image: Constraint of the selected listed motor. Encoder type Image: Constraint of the selected listed motor. Encoder type			
13.	Note The reason for the following steps	is the automatic calculation of the motor parameters.			
14.	Go online.	2.			
15.	Download.	2			
16.	Copy from RAM to ROM.				
17.	Upload.	- En			
18.	Offline.	84			

No.	Action				Remark
			Project Ed	dit Ta	arget system View Options V
				B	
19.	Telegram configuration The telegram configuration can be found under "Communication" and then "Message frame configuration".		■ ● mc_fe_ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■	i_006 ert sing S120» Autor Overv Comn > M > C Topo Topo Topo Infee Input. Enco Drive	gle drive unit CU320x2xDPxCBE20 natic Configuration view nunication lessage frame configuration ommiss. interface logy ontrol_Unit ds /output components der s SERV0_02 SERV0_03
		Object	Drive object	-No.	Message frame type
		1	SERVO_02	2	Standard telegram 1, PZD-2/2
			Control Unit	э. 1	Standard telegram 2, PZD-2/2
	Telegram configuration	Without	PZDs (no cycli	ic data	Standard telegram 3, PZD-5/9
	······	Thereout	1 200 (110 0)01	io data	Standard telegram 4, PZD-6/14
	Standard talogram 1 should be				Standard telegram 5, PZD-9/9 Standard telegram 6, PZD-10/14
	selected for both drives. Then				SIEMENS telegram 102, PZD-6/10
	switch back to "Free telegram				SIEMENS telegram 103, PZD-7/15
20.	configuration with BICO".				SIEMENS telegram 105, PZD-10/10 SIEMENS telegram 106, PZD-11/15
-	The reason for this is the				SIEMENS telegram 116, PZD-11/19
	automatic pre-assignment of the				SIEMENS telegram 118, PZD-11/19
	PROFIdrive control words.	Adapt message frame confl SIEMENS telegram 125, PZD-14/10 SIEMENS telegram 126, PZD-15/15			SIEMENS telegram 125, PZD-14/10
	needed which are only possible	[he I/O o	onfiguration mus	t still be	SIEMENS telegram 136, PZD-15/19 💌
	for free telegram configuration.	Object	Drive object	-No.	Message frame type
		1	SERVO 02	2	Free telegram configuration with BICO 💌
		2	SERVO_03	3	Free telegram configuration with BICO
		3	Control_Unit	1	Free telegram configuration with BICO
		Without	PZDs (no cycl	ic data	exchange)

No.	Action		Remark		
21.	Telegram configuration Using the "Adapt message frame configuration" button, for both drives create a PROFIsafe slot.	Object 1 2 3 Without Add Add	Drive object SERVO_02 SERVO_03 Control_Unit PZDs (no cycl apt message fran PROFIsafe	-No. 2 3 1 ic dat	Message frame type Free telegram configuration with BICO Free telegram configuration with BICO Free telegram configuration with BICO a exchange) Afguration Interconnections/ e aligned with the master configuration.
22.	Telegram configuration Then, transfer the configuration to HW Config. To do so, click on "Set up addresses". The telegram configuration should now look same as shown in the diagram.	IPI: PROFideve P2D in Comminication relation The PROFilation energy Nater view. Object Internet data control 1 SERVO 20 2 SERVO 20 3 SERVO 20 3 SERVO 20 4 SERVO 20 4 SERVO 20 5	ersage hows: F2 P20 message h = FNORBUS-Control Unit orobox d (s microlon is petcomed via the intelect esponds to the send and the out esponds to the send and t	ames sochronous) ferred in the folio put data to the type with BICO with BIC	aving adde: te receive direction of the drive object. Image: Control of the drive object. Image: Contro object. </td
23.	Telegram configuration In the Simatic Manager, HW Config should be again saved, compiled and downloaded again.	Image: Station Ecc Image:	Insert PLC View (More and a second	A	/indow Help PROFIBUS(1): DP master system (1)
24.	Note In the HW Config in the Simatic Manager, the telegram selection was automatically entered. The specified address can be changed here.	Slot M 4 PR: 5 Drin 6 Drin 7 Drin 8 PR: 9 Drin 10 Drin 12 Drin 13 Drin	1 Message frame so OFF, PROFisate message C User-defined re D OFF, PROFisate message OFF, PROFisate message re D User-defined re D User-defined re D User-defined	election / <i>ge frame</i> , ge frame ,	I address D address 30 64, 69 64, 69 256, 259 256, 259 30 70, 75 260, 263 280, 263 264, 267 264, 267

No.	Action	Remark
25.	Configuration of both drives If a Single Line Module is used for 230V 1AC (included in the training cases), the DC link parameters must be adapted. Note Since the 5 kW SLM has no DRIVE-CLiQ interfaces, it is not necessary to configure the infeed.	p0210: 345V p1248[0]: 240V p1244[0]: 401V See also FAQ ID: 27038754
26.	Configuration of both drives In STARTER under the item "Control logic", in the drive, interconnect the ON/OFF1 enable with digital input 0. In the control word "faults/alarms", interconnect parameter p2104[0] "2.Acknowledge faults" with digital input 6.	Control logic Control logic Control logic Control logic Control wood faults/dams Control wood faults/dams Control wood faults/dams p2003(0) 1. Acknowledge faults p2004(0) Ackn
27.	Configuration of both drives Under the item "Setpoint channel" and then "Ramp- function generator", click on the button in the red frame.	StatuszakozoPoczeczo Orwiniem

No.	Action	Remark
28.	Configuration of both drives For SS1, the OFF3 ramp-down time (p1135) is used for deceleration. The following values were set: - Ramp-up time (p1120[0]) = 5s - OFF3 ramp-down time (p1135[0]) = 0.5s - Ramp-down time (p1121[0]) = 5s	Simple samp generator Image: Constraint of the samp-down time is effective first and then the samp-up time in the opposite direction.
29.	Configuration of drive 1 Specify speeds for normal operation and for the SLS safety function. Under the item "Setpoint channel" →, click on "Fixed Setpoints".	 mc_fe_i_006 Insert single drive unit S120xCU320x2xDPxCBE20 > Overview > Commiss. interface > Topology Control_Unit Infeeds Input/output components Encoder Drives Insert drive SERV0_02 SERV0_02 SERV0_02 SERV0_02 Server list Drive navigator > Control logic > Setpoint channel > Motor potentiometer > Fixed setpoints > Speed Setpoint > Speed Setpoint > Speed Imit > Speed Imit > Speed Setpoint > Speed Imit > Speed Imit > Speed Setpoint > Speed Imit > Speed Setpoint > Speed Imit > Speed Imit > Speed Setpoint > Speed Imit > Diagnostics

No.	Action	Remark
No.	Action Configuration of drive 1 Bits 0 to 1 are used to select the various speed setpoints. The following interconnections have been made: Bit0: Control Unit DI 1	Remark
	Bit1: Control Unit DI 2	
	Bit2: 0	
	Bit3: 0	Freed value 1 20.000 rpm
30.	The following fixed values were entered: Fixed value 1: 20 rpm Fixed value 3: 800 rpm Fixed setpoint active, p1024 is interconnected with p1070 main	3 900.000 ippn 0 0 1 1 4 0:000 ippn 0 1 1 0 1 5 0:000 ippn 0 1 1 0 1 6 0:000 ippn 0 1 1 0 1 1 7 0:000 ippn 0 1 <t< td=""></t<>
	interconnected with p1070 main setpoint.	

No.	Action	Remark
31.	Configuration of drive 2 Specify speeds for normal operation and for the SLS safety function. Under the item "Setpoint channel" →, click on "Fixed Setpoints".	 mc_fe_i_006 Inset single drive unit S120xCU320x2xDPxCBE20 Overview Communication Message frame configuration Commiss. interface Topology Control_Unit Infeeds Input/output components Encoder Drives Inset drive SERV0_02 SERV0_03 Inset DCC charts Control logic Setpoint channel Motor potentiometer Speed Setpoint Speed Setpoint Speed limit Penctions Messages and monitoring Commissioning Communication Communication
32.	Configuration of drive 2 The following interconnections have been made: Bit0: Control Unit DI 1 Bit1: Control Unit DI 2 Bit2: 0 Bit3: 0 The following fixed values were entered: Fixed value 1: 33 rpm Fixed value 3: 333 rpm Fixed setpoint active, p1024 is interconnected with p1070 main setpoint.	Field selpoint Field selpoint inteconnection B Control, Unit 1722 1: CD/80: CU d 0 B Control, Unit 1722 2: CD/80: CU d 0 B Control, Unit 1722 2: CD/80: CU d 0 B Control, Unit 1722 2: CD/80: CU d 0 B Control, Unit 1722 2: CD/80: CU d 0 B Control, Unit 1722 2: CD/80: CU d 0 B Control, Unit 1722 2: CD/80: CU d 0 B Control, Unit 1722 2: CD/80: CU d 0 B Control, Unit 1722 2: CD/80: CU d 0 B Control, Unit 1722 2: CD/80: CU d 0 B Control, Unit 1722 2: CD/80: CU d 0 B Control, Unit 1722 2: CD/80: CU d 0 B Control, Unit 1722 2: CD/80: CU d 0 B Control, Unit 1722 2: CD/80: CU d 0 B Control, Unit 1722 2: CD/80: CU d 0 Control, Unit 1722 2: CD/80: CU d 0 B Control, Unit 1722 2: CD/80: CU d 0 Control, Unit 1722 2: CD/80: CU d 0 Control, Unit 1722 2: CD/80: CU d 0 S Control, Unit 172 2: CO/80: CU d 0 S Control, Unit 172 2: CO/80: CU d 0 S Control, Unit 172 2:
33.	Save the project.	

No.	Action	Remark
34.	Go online.	모
35.	Load the project into the target device.	
36.	Copy from RAM to ROM.	•

5.5 Parameterizing the safety functions integrated in the drive

5.5 Parameterizing the safety functions integrated in the drive

Notes

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The safety functions are configured on the drives online.

- Only the windows are described in which parameter changes are required.
- In this example, the following safety functions are used: SS1 and SLS.

No.	Action	Remark
1.	Go online with STARTER.	2 <u>m</u>
2.	Configuration of both drives For the drives, open the "Safety Integrated" window under the item "Functions". In order to change the settings in the Safety screen form, click on "Change settings". A password is now required. The default password for the first commissioning is "0".	Project Edit Target system View Options Window Help Project Edit Target system View Options Window Help Project Edit Target system View Options Window Help Project Edit Target system View Options Safety Integrated Safety In
	Configuration of both drives	Safety Integrated
3.	Switchover the control selection to "Motion monitoring via PROFIsafe".	No Safety Integrated No Safety Integrated ST0/SBC/SS1 via terminal ST0/SBC/SS1 via PROFIsafe Activate settings Motion monitoring via TM54F Motion monitoring via TM54F Motion monitoring via TM54F and terminal Motion monitoring via PR0FIsafe Motion monitoring via PR0FIsafe

No.	Action	Remark
4.	Configuration of both drives Close the message with "Close".	Control selection (ISDRA:20623) Safety consistency Make sure that a PROFIsafe message frame has been created Close
5.	Configuration of both drives	Safety Integrated Safety function selection Motion monitoring via PROFIsafe [0] Safety with encoder
	"Safety Integrated" window The following are configured in the example:	Configuration Motion monitoring
	Select control with "Motion Monitoring via PROFIsafe" and "Safety with encoder"	Safe basic functions (STO, SBC) Safe stop functions (SS1, SS2, SOS, SAM)
	Set "Safety functions" to "Enable".	Safety functions Enable Safety limited speed (SLS)
	Then click on "Configuration".	Safe speed monitoring (SSM)

No.	Action	Remark
		Configuration Image: Configuration clock PR0Flaste address (00:6H Monitoring cycle clock (12:00 ms Actual value acquisition clock (00:000 ms Drive type Safe positioning accuracy 0.00000 mm Safe positioning accuracy 0.00000 mm Drive type Encoder parameterization 0.00000 mm Visco type Forced formant error of the shuddwin paths 0.000 mm/min Fact at stop selection Forced domain error detection of the shuddwin paths Forced domaint error detection required Forced dom error detection of the shuddwin paths Forced domaint error detection required Image: Control Unit: /722.7: CD/80 Remain time till 0 0 0 Test stop: Days Remain time till 0 0 0 Test stop: Days Help
	Configuration of both drives	PROFIsafe properties
	"Configuration" window	Parameter name Value Hex Change value F_SIL SIL2 Change value Exected of the second of
	The following have to be configured in the example:	F_ <u>Gener_Add</u> 2000 F_Dest_Add 198 C6 F_WU_1me 150
6.	PROFIsafe address with C6hex for drive 1 and PROFIsafe address with C5hex for drive 2.	
	The PROFIsafe addresses can read-out from the HW Config under the PROFIsafe properties.	Current F parameter CRC (CRC1) hexadecimat
	Interconnect the signal source of the test stop with DI7 of SINAMICS.	OK Cancel Help PROFIsafe properties X F Parameter
		Parameter name Value Hex Change value F_SIL SIL2 F_CRC_Length 3.Byte-CRC F_Par_Version 1 5 F_Source Add 2000 F_Dest_Add 197 C5 F_WD_Time 130
		Current F parameter CRC (CRC1) hexadecimal:

No.	Action	Remark
7.	Configuration of both drives "Safe stop functions" window The following values were entered for the example: Delay time SS1→ STO active = 500 ms Delay time STOP C/SS2 →SOS active = 500 ms	Stor story functions SST active SST act
8.	Configuration of drive 1 "Safely-Limited Speed (SLS)" window The velocity limit for level 1 is 250 mm/min. When this limit is exceeded, the STOP C stop response configured here is initiated. Within the delay time "Delay Time Delay time between sel. SLS \rightarrow SLS active" (p9551), the drive speed must be below the limit n_max. Entered in the example: Delay time SLS \rightarrow SLS active: 500ms N_max for level 1: 250 mm/min for drive 1	Safely limited speed Safely limited speed Velocity monitoring SLS selection

55	Parameterizing	the safety	, functions	integrated	in the drive
0.0	Farametenzing	line salel	y iuncuons	integrateu	in the unve

No.	Action	Remark
	Configuration of drive 2	
	"Safely-Limited Speed (SLS)" window	
9.	The velocity limit for level 1 is 400 mm/min. When this limit is exceeded, the STOP C stop response configured here is initiated. Within the delay time "Delay Time Delay time between sel. SLS \rightarrow SLS active" (p9551), the drive speed must be below the limit n_max. Entered in the example: Delay time SLS \rightarrow SLS active: 500ms N_max for level 1: 400 mm/min for drive 2	Seldy lawind greed u
10.	Configuration of both drives The parameters must now be copied. To do this, click on the "Copy parameters" button. Then click on "Activate settings".	Safety Integrated Motion monitoring via PROFIsafe [0] Safety with encoder Configuration Motion monitoring Safe basic functions (ST0, SBC) Safe stop functions (SS1, SS2, SOS, SAM) Safety functions Enable Safe speed monitoring (SSM) Safe speed monitoring (SSM) Safe motion direction (SDI) Acceptance Copy parameters Enter license key Activate settings Change password

No.	Action	Remark		
11.	Configuration of both drives You will now be prompted to assign a new password. To do this, e.g. set the password to "1".	Password input ? × Enter the current password: (default password: 0) * Enter the new password: * Repeat your entry: * OK Cancel		
12.	Configuration of both drives The parameters of the drive device are now copied to ROM. Confirm with "Yes".	Activate settings Save parameters After activation of the safety parameterization, this should als to the drive (Copy RAM to ROM). An acceptance test is also Do you want to save the parameters to the ROM now? Parameters of the drive unit Parameters of the drive object		
13.	Go offline	Rail I		
14.	Then perform a power-on reset of the Control Unit.	POWER OFF/ON		
15.	Go online.	Par and a second		
16.	Load the configuration into the PG.	nîn.		
17.	Save the project.			
18.	These messages indicate that a test stop of the safety functions in the drives is required. Here, they involve alarms, i.e. the drives can be switched-on and operated. In this example, the test stop can be executed using switch -S9.	Warning S120xCU320x2xDPxCBE20 : SERVO_02 1697 : SI Motion: Motion monitoring functions must be tested Warning S120xCU320x2xDPxCBE20 : SERVO_03 1697 : SI Motion: Motion monitoring functions must be tested		

5.6 Configuring the F-CPU

In this example, in OB1, the required enable signals (except bit 0 for OFF1/ON enable) are only set in control word 1 for drives 1 and 2.

The safety program was consciously selected to be as simple as possible. In this particular case, the main task of the safety program is to generate the PROFIsafe control words for the drives from the signals at the F-DIs. These are transferred to the drives using the PROFIdrive telegrams where they control the safety functions. The blocks required for the safety program must first be created.

Caution It is not permissible that the program is used for a real application in this form.

You start with the F-Call block. This is required to call the safety program. To do this, a function (in this case, FC1) must be inserted in the block folder using the F-Call programming language. Cyclic interrupt OB35 is required to cyclically call the safety program.

In this example, the actual safety program is executed in a function block (here, FB1); this means that FB 1 must now be inserted with the programming language F-LAD (corresponds to F-KOP (DE)) or F-FBD (corresponds to F-FUP (DE)).

Table 5-5: Configuring the F-CPU

No.	Action		Rem	nark	
	To insert blocks, right-click on "Blocks" → "Insert New Object".	File Edit Insert PL	.C View Options Windo	W Help	🗰 🔁 < No Filter >
		CPU 315F-2 PN Gr S7 Program Source Source	1/DP 1(1) s		
		Cut S120/CU220 Copy Paste Delete Insert Net PLC Rewire Compare Reference Check Bil Print Rename Object Ph Special O	Cut Copy Peste	Ctrl+X Ctrl+C Chrl+V	
			Delete	Del	
1.			Insert New Object PLC	,	Organization Block Function Block
			Rewire Compare Blocks Reference Data Check Block Consistency.		Function Data Block Data Type Variable Table
			Print	•	
			Rename Object Properties Special Object Properties	F2 Alt+Return ▶	

No.	Action	Remark		
2.	Create OB35 using the STL programming language (corresponds to AWL (DE)).	Properties - Organization Block × General - Part 1 General - Part 2 Calls Attributes Name: 0835 Symbolic Name: Symbolic Name: Symbolic Name: Symbolic Name: <		
3.	Create the FC1 using the F- CALL programming language. FC1 is the gateway to the safety program.	Properties - Function × General - Part 1 General - Part 2 Calls Attributes Name: FC1 Symbolic Name: Symbolic Name: Symbolic Name: Symbolic Name: Symbolic Comment: Created in Language: F-CALL Project path: Storage location C:\Program Files\Siemens\Step7\s7proj\MC_FE_L Code Interface Date created: 05/16/2011 01:31:41 PM Comment: OK Cancel Help		
4.	Create FB1 with the programming language F-FBD (corresponds to F-FUP (DE)). The safety program is written to FB1.	Properties - Function Block ▼ General - Part 1 General - Part 2 Calls Attributes Name: FB1 ▼ Mul. Inst. Cap. Symbolic Name: Symbolic Name: Symbolic Name: Created in Language: F-FBD ▼ Project path: Storage location C:\Program Files\Siemens\Step7\s7proj\MC_FE_I_ Ode created: 05/16/2011 01:32:34 PM Last modified: 05/16/2011 01:32:34 PM Comment: ✓ ✓ ØK Cancel Help		

No.	Action	Remark
5.	OB1	OBl : "Main Program Sweep (Cycle)" Comment:
	permanently written to the STW.	Network 1: Assign dummy control word Comment:
	The address of the output word can be seen in Chapter 5.4 for the telegram configuration.	L 1150 // 1150 = 47E T AW 256 T AW 260
6.	OB35 Calls the safety program	OB35 : "Cyclic Interrupt" Comment: Network 1: Open Safety-Program Comment: CALL FC 1
7.	 FB1 Drive 1 Network 1: Acknowledge faults using -S4. Note FB219 can be found in FB1 in the folder "Libraries" → "Distributed Safety" → "F- Application Blocks". Network 2: STO is permanently deselected with a fail-safe VKE1. Network 3: -S1 is interconnected with SS1 on PROFilsafe STW 1 	<pre>FB1 : Safety-Program Comment: Network 1: Reintegration of all components Comment: DB219 F_: Global Acknowledgement of all P-T/0 of a RIG "F_ACK_GL" EN ACK_REI_ E0.3 GLOB EN0 Network 2: PROFIsafe Drive 1 STO Comment: BB818.DBX3 G.4 TRUB "F_ GLOBDB". VKE1 AC4.0 TRUE A64.0 TRUE Network 3: PROFIsafe Drive 1 SS1</pre>
		Comment: A64.1 B0.0

No.	Action	Remark
		Network 4 : PROFIsafe Drive 1 SS2
		Comment:
	FB1 Drive 1	BB818_DBX3 & 6_4 . "F_ A64.2 GLOBDB". = VKE1 =
	Notwork 1:	Network 5 : PROFIsafe Drive 1 SOS
	SS2 is permanently deselected with a fail-safe VKE1.	Comment:
8.	Network 5: SOS is permanently deselected with a fail-safe VKE1. Network 6: -S2 is interconnected with SLS on PROFIsafe STW 1. Inversion is necessary, as -S2 is connected as NO/NC contact. Network 7: -S4 is interconnected with the fail-safe acknowledgment on PROFIsafe STW 1.	DB818.DBX3 6.4 TRUE "F_ GLOBDB". = VKE1 = Network 6: PROFIsafe Drive 1 SLS Comment:
		Network 7: PROFIsafe Acknowledgement Comment: A64.7
		K0.3 -

No.	Action	Remark
		Network 8 : PROFIsafe Drive 1 SLS stage Bit 0
		Comment:
		BB818.DBX3 & 6.3 FALSE "F
		Network 9: PROFIsafe Drive 1 SLS stage Bit 1
	EB1	Comment:
	Drive 1	00000000000000000000000000000000000000
	Networks 8 and 9:	FALSE "F A65.2
9.	The fail-safe VKE0 is interconnected on A65.1 and A65.2; this means that SLS level 1 is permanently selected.	GLOBDB". = VKE0
		Comment:
	Networks 10 and 11:	
	The fail-safe VKE1 is interconnected on A65.4 and A65.5; this means that SDI is permanently deselected in the positive and negative directions.	B818.DEX3 & 6.4 ** TRUE ** GLOBDB". = VKE1 **
		Network 11: PROFIsafe Drive 1 SDI negative
		Comment:
		BB818.DBX3 8 6.4 TRUE "F

No.	Action	Remark
		Network 12 : PROFIsafe Drive 2 STO
		Comment:
		DB818.DEX3
		TRUE "F A70.0
	FB1	GLOBDE".
	Drive 2	Network 13: PROFIsafe Drive 2 SS1
		Comment:
	Network 12: STO is permanently deselected	A70.1
	with a fail-safe VKE1.	E0.0
10.	-S1 is interconnected with SS1	Network 14 : PROFIsafe Drive 2 SS2
	on PROFIsafe STW 2.	Comment:
	Network 14:	8
	SS2 is permanently deselected	DB818.DBX3 6.4
	with a fail-safe VKE1.	TRUE "F
	Network 15 [.]	CLOBDB". =
	SOS is permanently deselected	Network 15 : PROFIsafe Drive 2 SOS
	with a fail-safe VKE1.	Comment:
		DB818.DBX3
		TRUE "F A70.3
		CLOBDB".

No.	Action	Remark
		Network 16 : PROFIsafe Drive 2 SLS Comment: A70.4 E0.2
	FB1	Network 17: PROFIsafe Acknowledgement Comment:
	Drive 2	
	Network 16:	E0.3 - =
	-S3 is interconnected with SLS on PROFIsafe STW 2.	
11.	Network 17: -S4 is interconnected with the fail-safe acknowledgment on PROFIsafe STW 2.	Network 18 : PROFIsafe Drive 2 SLS stage Bit 0
	Networks 18 and 19	BB818.DBX3 6.3
	The fail-safe VKE0 is interconnected on A71.1 and A71.2; this means that SLS level 1 is permanently selected.	FALSE "F
		Network 19: PROFIsafe Drive 2 SLS stage Bit 1
		Comment:
		BB818.DBX3 8 6.3 FALSE "F

No.	Action	Remark
		Network 20: PROFIsafe Drive 2 SDI positive
		Comment:
	FB1 Drive 2	BB818_DBX3 8 6_4 ** "F_ A71.4 GLOBDB". = VKE1 **
	Networks 20 and 21:	Network 21: PROFIsafe Drive 2 SDI negative
	The fail-safe VKE1 is	Comment:
12.	A71.5; this means that SDI is permanently deselected in the positive and negative directions. Network 22: Control of the signal lamp in -S4 for the SSM feedback signal.	BB818_DBX3 8 6_4 4 TRUE *F_ GLOBDB ". = VKE1 =
		Network 22 : SSM active
		Comment:
		B65.7 - A10.7 E71.7 - E71.7
	Generating the safety program	By File Edit Inset PLC View Options Window Help 口 译 智 示 次 印 尼 會 『 『 』 『 『 』 『 注 註 餠 面 「 (No Files > /) 智 @ <mark>開</mark>
13.	Click on this button to generate the safety program.	By mc_le_1006 Object name Type BitMATIC 300(1) GIS7 Program(1) S7 Program GIS7 Program(1) GIS7 Program(1) Connections GIS8 Dacks GIS8 Dacks Connections S120kC1280x2x0PxCBE20 S120kC1280x2x0PxCBE20
	Creating a new F-runtime group	Furtime groups X Furtime group/parameter Value Safety roopan Getrieved FCALL block: Safety mode. Fpogram block: F81
14.	Here, the safety program (FB1) is assigned to FC1 and the associated I-DB is defined.	I-DB for Frongram block: DB1 Max. cycle time of the Fruntime in ms: 200 DB for Fruntime group communication:
	For this purpose, click on the button "F-Runtime groups" → "New" and specify an I-DB.	New

5.7 Acceptance test

No.	Action	Remark
No. 15.	Action Then generate the safety program and load into the F- CPU. In addition, load the standard blocks into the F-CPU	Balely Program - mc_fc_1_006_v121SIMATIC 300(1)/CPU 315F-2 Ph/DPIS7 Program(1) ▼ Office Draine Rack: 0 Slot: 2 Collective signature of the safety program: 13050071 Current mode: Current model: 05/27/201108 09.53 AM 13050071 Current model: 05/27/201108 09.53 AM Safety program is consister. Fabock: Foldock: 10000071 Construction: 13050071 Carent consister. Fabock: 05/27/201108 09.53 AM Envertion on safety program is consister. Fabock: Foldock: Foldock: Foldock: Fabock: FC1 F-CALL 6116 Foldock: F101 Foldock: Foldock: Foldock: Foldock: Foldock: F101 Foldock: Foldock:
		Image: Particular Content of the content of

Note We recommend that blocks OB82 and OB86 are also integrated in order to tolerate the failure of the I/O (e.g. the drives for a power on reset) without the F-CPU going into the STOP operating state.

5.7 Acceptance test

To verify safety-oriented parameters, an acceptance test must be performed after the machine has been commissioned for the first time and also after changes are made to safety-related parameters. The acceptance test must be appropriately documented. The acceptance reports must be adequately stored and archived.

The acceptance test must be carried out after parameterization has been completed and a power on reset.

Information about the acceptance test, the acceptance report and an example of an appropriate acceptance report is provided in the "Function Manual SINAMICS S120 Safety Integrated" (FHS) in the Chapter "Acceptance test and acceptance report".

To simplify the handling of the acceptance test, an application has been created, which can be ordered free of charge by your local SIEMENS partner. This application takes the user step-by-step in a user-friendly fashion through the acceptance test.

6.1 Preconditions

6 Commissioning the application

Up until now, the configuration of the application example was described step-bystep. The following steps should now be followed if the sample project is to be directly downloaded to the hardware.

All of the components (S7-F-CPU and SINAMICS S120) should first be generally reset or reset to factory settings.

6.1 **Preconditions**

Preconditions for operation

- The SIMATIC components have been mounted and connected with one another. The PROFIsafe addresses of the fail-safe input and output modules must be set using the DIL switch; see Chapter 5.4.
- All components have been connected as specified in Chapter 4.
- The DRIVE-CLiQ topology of the SINAMICS components has been maintained.
- The motor is connected to the Motor Module using a power cable.
- The Motor Module is correctly connected with the infeed (DC link and 24 V DC control voltage).
- The infeed is connected to the line supply.
- The components are supplied with 24 V DC.

6.2 Preparation

(see chapter 5.2 Preparation)

6.3 Commissioning

6.3 Commissioning

No.	Action	Remark
	Loading the configuration of the FCPU	
1.	The HW configuration of the S7- F-CPU must first be downloaded. The HW configuration is opened by double-clicking on "Hardware". Depending on the default values and the previous configuration on the F-CPU side, it may be necessary to adapt the PROFIBUS address of the PG in NetPro to download the hardware configuration of the F- CPU.	File Edit Insert PLC View Options Window Help Image: Stress of the str
2.	Note If a Safety program was previously This must be known for the downlo using a suitable device (e.g. a SIE reader, the card will be destroyed.	available on the F-CPU, then this is password-protected. ad. If it is not known, then the memory card must be deleted MENS PG). If the card is deleted or formatted using a card
3.	After the HW configuration has been downloaded, the program blocks must be loaded into the F-CPU. The window to load the safety functions is first opened using the "yellow" button in the function bar. The download is then initiated from this window using the "Download" button. The safety program must have previously been generated ("compiled").	Image: Set of model Processing Symbolic name Symbolic name Symbolic name Symbolic name Symbolic name Image: Set of

6 Commissioning the application

6.3 Commissioning

No.	Action	Remark
4.	The remaining (non-safety- related) blocks are then loaded normally.	Pile Edit Insert PLC View Options Window Help Image: Strain St
5.	Loading the SINAMICS S120 configuration You can download the configuration directly to the SINAMICS S120. To do so, first go online and then perform a download.	Project Edit Target system View Options Window Heip Project Edit Target System View Options Project Edit Project Edit
6.	Now, for each series commissioning, the new serial numbers must be transferred to the Safety configuration. This is carried out using "Acknowledge hardware replacement" in the Safety screen form of both drives.	Safety Integrated Motion monitoring Safe basic functions (ST0, SEC) SBC active Safe basic functions (ST1, SER) SIS active Safety functions SIS active Safety functions SIS active Safety functions SIS active Safety functions Safe stop functions (SS1, SBR) Safety functions Safe speed monitoring (SSM) Safe speed monitoring (SSM) Soft regardle direction Safe speed monitoring (SDI) Safe speed monitoring (SDI) Copy premeters Enter license key Choowledge hardware replacement Change settings

6 Commissioning the application

6.3 Commissioning

No.	Action	Remark
7.	The backup procedure from RAM to ROM must then be initiated for SINAMICS and a restart carried out (power on reset).	•

7.1 Overview

7 Using the application

7.1 Overview

Fig. 7-1: Operator controls of the application example



Switches -S1 to -S4 are located on a switchbox that belongs to the Safety training case. The various safety functions can be selected using the switches.

Switches -S5 to -S12 are located on a switchbox that belongs to the SINAMICS training case. Using these switches, the drives are switched on and switched off, different speed setpoints entered, the test function for the safety functions started and faults acknowledged.

7.2 Description

Reintegration

The drives have to be reintegrated after a power OFF/ON. All of the alarm messages are acknowledged by pressing pushbutton -S4, and the signal lamp in - S4 is lit.

Switching-on/switching-off

The Emergency Stop button S1 must be released in order to be able to operate the drives. Both drives are switched-on (OFF 1) using switch -S5.

Speed steps

Switch -S6 can be used to changeover between speed setpoint 0 and 20 rpm (drive1) or 0 and 33 rpm (drive2). If switch -S7 is also actuated, then the speed increases up to 800 rpm (drive 1) and 333 rpm (drive 2).

Acknowledging alarms

Alarms present on the SINAMICS system can be acknowledged using -S10. The Safety alarms are the exception in this case, as they must be acknowledged in a fail-safe fashion using -S4. Cyclic test stop for the safety functions is activated using -S9.

Protective door 1

When protective door 1 is closed (switch -S2), drive 1 rotates with a maximum of 800 rpm. If the first speed stage is selected, then the motor rotates with 20 rpm. If protective door 1 is now opened, nothing happens, as the speed limit was parameterized with 25 rpm.

Protective door 2

A closed protective door 2 (switch -S3) results in a maximum setpoint speed of 333 rpm for drive 2. If the first speed stage is selected, the motor rotates with 33 rpm. If protective door 2 is now opened, nothing happens, as the speed limit was parameterized with 40 rpm.

Fault simulation

With protective door 1 or 2 open, if the second speed setpoint of 800 rpm (drive 1) or 333 rpm (drive 2) is selected, then this results in an SLS limit value violation and the relevant drive is stopped with an internal SS2 (STOP C); after the delay time has expired, STOP C \rightarrow SOS" (in the example 500 ms) is switched to SOS. The other drive is not affected by this.

7.3 Summary of input signals

7.3 Summary of input signals

Table 7-2: Sinamics digital inputs

Digital input	Switch	Component	Description
DI 0	-S5	Drive 1 / drive 2	Switching-on/switching-off
DI 1	-S6	Drive 1 / drive 2	Changeover speed setpoint (fixed setpoint) bit 0
DI 2	-S7	Drive 1 / drive 2	Changeover speed setpoint (fixed setpoint) bit 1
DI 6	-S10	Drive 1 / drive 2	Acknowledge alarms
DI 7	-S9	Drive 1 / drive 2	Initiate a test stop

Fig. 7-3: Fail-safe inputs on the F-DI module

	Digital input	Switch	Component	Description
ĺ		-\$1	Emergency Stop button	Drive 1: SS1
	1-010	-5		Drive 2: SS1
	F-DI 1	-S2	Protective door 1 (for drive 1)	SLS
	F-DI 2	-S3	Protective door 2 (for drive 2)	SLS
	F-DI 3	-S4	Acknowledgement button	Fail-safe acknowledgement (drives 1 and 2) and depassivation (all F-slaves)

Note

The drives can only be operated when the infeed is activated and the DC link charged.

8 References

8.1 Related documents

This list does not claim to be complete and only provides a selection of suitable references.

Table	8-1:	References
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	Торіс	Title
/1/	SINAMICS S120	Function Manual, Edition 01/2011
/2/	SINAMICS S120	Manual, Edition 01/2011
/3/	SINAMICS S120	List Manual, Edition 01/2011

8.2 Internet links

This list does not claim to be complete and only provides a selection of suitable information.

Table 8-2:	Internet	link	reference
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	Торіс	Title
\1\	Reference to the article	http://support.automation.siemens.com/WW/view/de/29056318
\2\	Siemens I IA/DT Customer Support	http://support.automation.siemens.com

9 History

Table 9-1: History

Version	Date	Revision	
V1.0	05/2008	First edition	
V1.1	07/2009	Revision	
V2.0	07/2011	Revision with SINAMICS V4.4 and STARTER 4.2	