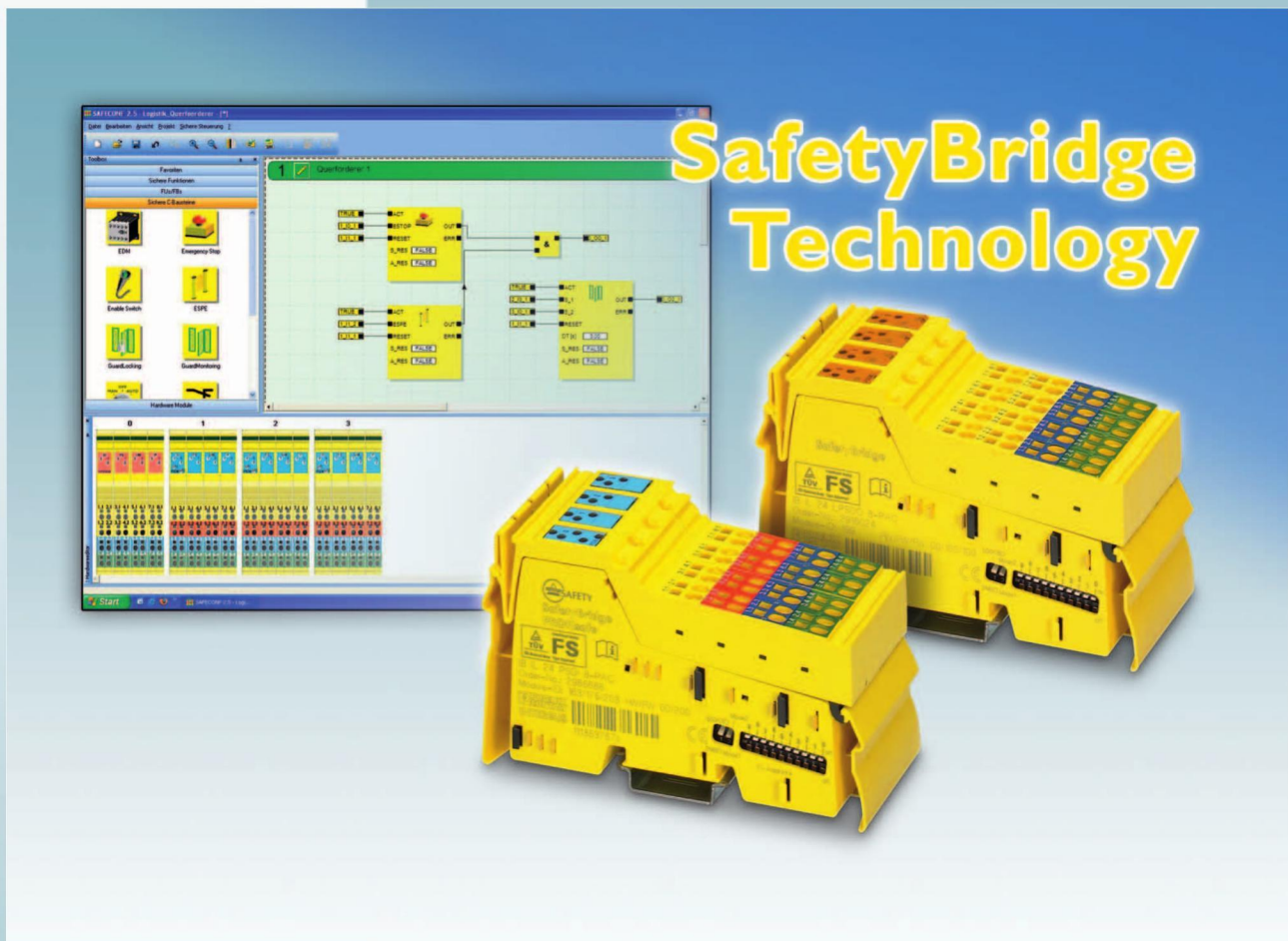


# AUTOMATION



Quick start guide

## UM QS EN SAFETYBRIDGE - S7

Order No.: —

Configuring a SafetyBridge system on a  
SIMATIC® S7 controller



**RSPSupply - 1-888-532-2706 - <https://www.RSPSupply.com>**  
See the product details here

# AUTOMATION

## Quick start guide

### Configuring a SafetyBridge system on a SIMATIC® S7 controller

2010-06-07

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Designation: UM QS EN SAFETYBRIDGE - S7

Revision: 02

Order No.: -

This user manual is valid for:

Designation	Order No.
IB IL 24 LPSDO 8-PAC	2916024
IB IL 24 PSDI 8-PAC	2985688

## Please observe the following notes

In order to ensure the safe use of the product described, you have to read and understand this manual. The following notes provide information on how to use this manual.

### User group of this manual

The use of products described in this manual is oriented exclusively to qualified electricians or persons instructed by them, who are familiar with applicable national standards and other regulations regarding electrical engineering and, in particular, the relevant safety concepts.

Phoenix Contact accepts no liability for erroneous handling or damage to products from Phoenix Contact or third-party products resulting from disregard of information contained in this manual.

### Explanation of symbols used and signal words



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety measures that follow this symbol to avoid possible injury or death.



#### **DANGER**

This indicates a hazardous situation which, if not avoided, will result in death or serious injury.



#### **WARNING**

This indicates a hazardous situation which, if not avoided, will result in death or serious injury.



#### **CAUTION**

This indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

The following types of messages provide information about possible property damage and general information concerning proper operation and ease-of-use.



#### **NOTE**

This symbol and the accompanying text alerts the reader to a situation which may cause damage or malfunction to the device, either hardware or software, or surrounding property.



This symbol and the accompanying text provides additional information to the reader. It is also used as a reference to other sources of information (manuals, data sheets, literature) on the subject matter, product, etc.

---

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# 1 Introduction

## 1.1 Purpose of this manual

This quick start guide uses an example to describe how you integrate SafetyBridge modules in a PROFIBUS system to an S7 controller.

The document does not describe the complete configuration of a system or how to create a project under STEP 7. It only describes what has to be observed with regard to SafetyBridge.

For additional information, please refer to the documents listed in Section 1.3, "Additional documentation".

## 1.2 Requirements

### Knowledge

Knowledge of the following is required:

- The target system (PROFIBUS, PROFINET or INTERBUS)
- The components used in your application
- The Siemens SIMATIC software used
- The Microsoft Windows operating system

In order to start up the example system, the following hardware and software are required:

### Hardware

In order to start up the example system, the following hardware is required:

- Programming device/PC
- The S7 controller used in the example project (S7 3xx or S7 4xx)  
(see Section "Example bus configuration (with PROFIBUS bus coupler)" on page 3-1),
- Bus coupler and I/O devices used in the example project  
(see Section "Example bus configuration (with PROFIBUS bus coupler)" on page 3-1)

### Software

In order to start up the example system, the following software is required:

- Microsoft Windows
- Siemens SIMATIC STEP 7 V5.4 or later (version depends on the S7 CPU used)
- GSD/GSDML files from Phoenix Contact for the bus coupler used.  
It can be found on the Internet at [www.phoenixcontact.net/catalog](http://www.phoenixcontact.net/catalog).
- SAFECONF from Phoenix Contact (software for configuration of the safety logic and for parameterization of the channels)  
It can be found on the Internet at [www.phoenixcontact.net/catalog](http://www.phoenixcontact.net/catalog).

### 1.3 Additional documentation

Comprehensive information about PROFIBUS and PROFINET is available on the Internet at [www.profibus.com](http://www.profibus.com).

Please refer to the documentation provided by Siemens for the STEP 7 software.

Please refer to the documentation for the components used in your application.

Please refer to the documentation of the function blocks used.

The documentation of the SafetyBridge modules must be used.

Description	Type	Order No.
Inline module with integrated safety logic and safe digital outputs	UM EN IB IL 24 LPSDO 8-PAC	2910790
Inline module with safe digital inputs	UM EN IB IL 24 PSDI 8-PAC	2910457

The documentation for Phoenix Contact devices is available on the Internet at [www.phoenixcontact.net/catalog](http://www.phoenixcontact.net/catalog).

### 1.4 Safety hotline

Should you have any technical questions, please contact our 24-hour hotline.

Phone: +49 5281 9462777

E-mail: [safety-service@phoenixcontact.com](mailto:safety-service@phoenixcontact.com)

## 2 Integration of a SafetyBridge system in three steps

### 2.1 Safety with the SafetyBridge system

Within a SafetyBridge system, safety is achieved only through the modules of this system (IB IL 24 LPSDO 8-PAC and 1 to 3 IB IL 24 PSDI 8-PAC). All other components of the entire system are not safety-related components. Errors at not safety-related components or errors during integration of the SafetyBridge system are reliably detected by the SafetyBridge system components. These errors only reduce the system availability but not the system safety.



Please refer to the documentation on the safety modules for information on error messages that occurred.



**No safety controllers are required for the implementation of safety functions.**

## 2.2 Integration of a SafetyBridge system

A SafetyBridge system can be integrated into an existing system in three steps.

Table 2-1 describes the steps for integrating a SafetyBridge island.

Table 2-1 Integration of a SafetyBridge island

Step	Process	Safety-related	See ...
<b>1</b>	<b>Configuring the safety logic (SAFECONF)</b>		
	<ul style="list-style-type: none"> <li>- Configure the safety island (island number, number of PSDI)</li> <li>- Parameterize I/O channels of a safety island</li> <li>- Configure the safety function</li> <li>- Export the configuration and parameter data record</li> </ul>	Yes	Page 3-6  Page 3-8  Page 3-12 Page 3-14
<b>2</b>	<b>Integrating SafetyBridge module into the S7 (STEP 7)</b>		
	<ul style="list-style-type: none"> <li>- Install the device description</li> <li>- Insert the bus coupler in the hardware configurator</li> <li>- Insert SafetyBridge modules in the hardware configurator</li> <li>- Load the configuration and parameter data record into the standard controller</li> <li>- Add SafetyBridge operation to the standard application program</li> </ul>	No	Documentation of the controller manufacturer  Page 3-15 Page 3-16  Page 3-18  Page 3-25  Page 3-20
<b>3</b>	<b>Installing SafetyBridge modules</b>		
	Install SafetyBridge modules (hardware) (including island and satellite number settings)	No	User manuals for the modules used
	Overall safety validation	Yes	

## Integration of a SafetyBridge system in three steps

Figure 2-1 shows the hardware and software components used and the steps for integration of a SafetyBridge system.

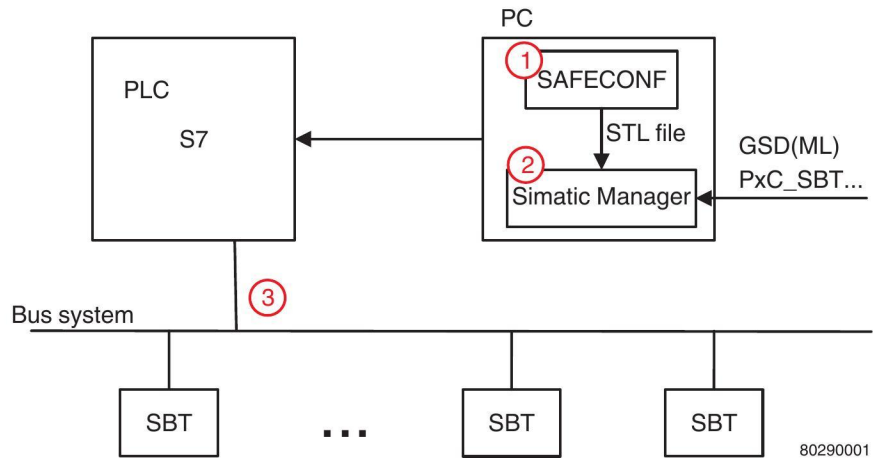


Figure 2-1 Components and steps for integration of a SafetyBridge systems

Key:

<b>1</b>	Step 1: Configuring the safety logic
<b>2</b>	Step 2: Integrating SafetyBridge modules into the S7
<b>3</b>	Step 3: Installing SafetyBridge modules
PC	PC with SAFECONF and Simatic Manager
SAFECONF	Software for configuration of the safety logic (configuration of the safety function and parameterization of the channels)
Simatic Manager	Step 7 engineering software
STL file	Configuration and parameter data record that is generated with SAFECONF; in the S7 it is converted into a data block
S7	S7 3xx or S7 4xx controller
GSD(ML)	GSD or GSDML files to be imported of the modules used
PxC_SBT...	Function and data blocks from Phoenix Contact <ul style="list-style-type: none"> <li>– Download of the configuration and parameter data record from the standard controller to the IB IL 24 LPSDO 8-PAC</li> <li>– Cyclic routing of the SafetyBridge data flow</li> </ul>
Bus system	PROFIBUS, PROFINET or INTERBUS
SBT	Modules of the SafetyBridge system



### 3 Example

This section describes the use of SafetyBridge modules using PROFIBUS. Only the safety modules will be described. You can use standard modules in the Inline station, but these will not be described here.

#### 3.1 Example bus configuration (with PROFIBUS bus coupler)

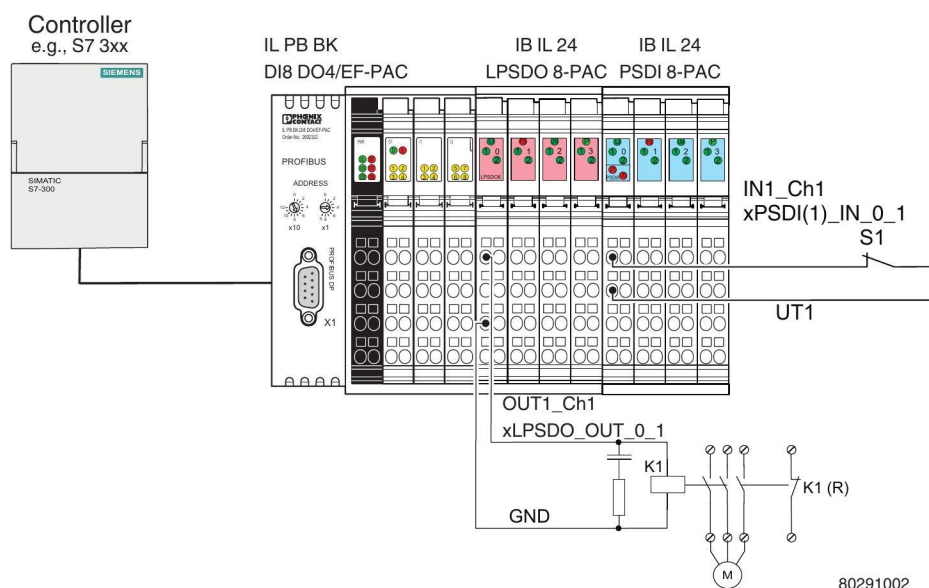


Figure 3-1 Example bus configuration with a PROFIBUS bus coupler

Key:

- S1 Safety switch; emergency stop (EStop/Button S1)
- K1 (R) Positively driven N/C contact for monitoring the state of the relay (readback contact). The example does not describe this readback.

#### Devices used in the example bus configuration or devices that can be used as an alternative

##### Controller

S7 3xx Controller

##### Bus couplers for PROFIBUS

- IL PB BK DP/V1-PAC Inline bus coupler for PROFIBUS firmware version C or later
- IL PB BK DI8 DO4-PAC Inline bus coupler for PROFIBUS firmware version 1.10 or later
- IL PB BK DI8 DO4/EF-PAC Inline bus coupler for PROFIBUS firmware version 2.00 or later (used in the example)

**Safety modules**

IB IL 24 LPSDO 8-PAC      Inline module with integrated safety logic and safe digital outputs  
IB IL 24 PSDI 8-PAC      Inline module with safe digital inputs

**Bus couplers for other bus systems that can be used as an alternative:**

**Bus couplers for PROFINET and INTERBUS**

IL PN BK DI8 DO4-2TX-PAC      Inline bus coupler for PROFINET  
IL PN BK DI8 DO4-2TX/NC      Inline bus coupler for PROFINET  
IBS IL 24 BK-T/U-PAC      Inline bus coupler for INTERBUS



This and other example projects can be downloaded at [www.phoenixcontact.net/catalog](http://www.phoenixcontact.net/catalog).  
Please refer to Section "Example projects" on page A-1 for the file names and how to use the example projects.



## 3.2 Step 1: Configuring the safety logic (SAFECONF)



Only the steps essential for the SafetyBridge system will be shown in the following. Not all screens will be displayed. Should you have any questions regarding SAFECONF, please use the online help or the software documentation.



You can skip step 1 if you use the example project. The configuration and parameter data record to be created with this step is included as xxx.stl file in the example project.

### 3.2.1 Creating a project

SAFECONF is used to configure and parameterize the SafetyBridge system. Finally a configuration and parameter data record is generated that is stored in a data block (DB) for operation with an S7.

- Open the SAFECONF software.
- Create a new project with the help of the Project Wizard. Select "File... New Project".
- Define the name and where the project is to be stored.



#### NOTE: Error during download

Use **at least twelve characters** for the project name, otherwise you will receive an error message (Error Code C002<sub>hex</sub>, Additional Code 0605<sub>hex</sub>) when the configuration and parameter data record is downloaded from the standard controller to the IB IL 24 LPSDO 8-PAC.

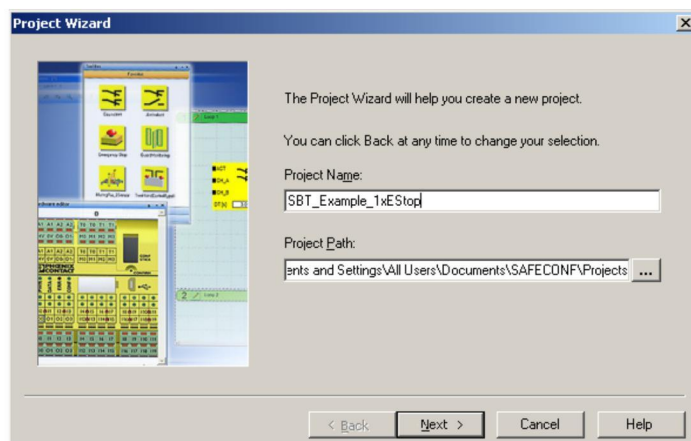


Figure 3-2 Creating project name and project path

- For working with the SafetyBridge system, select the IB IL 24 LPSDO 8-PAC master device.

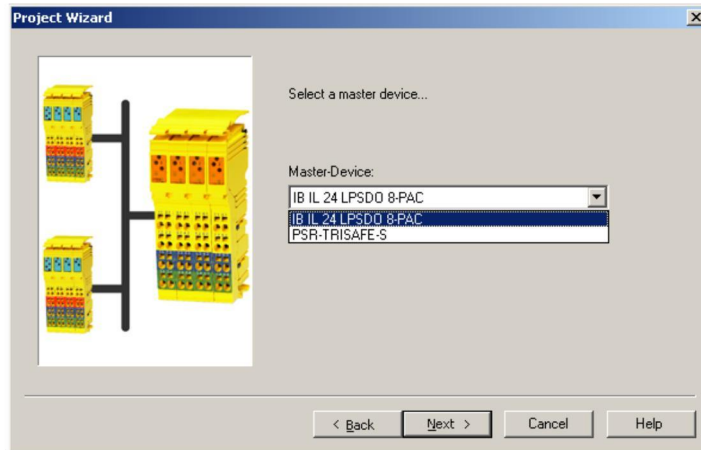


Figure 3-3 Selecting the IB IL 24 LPSDO 8-PAC

- Select the file format with which you will operate. You need the S7 DB output format when working with the S7.

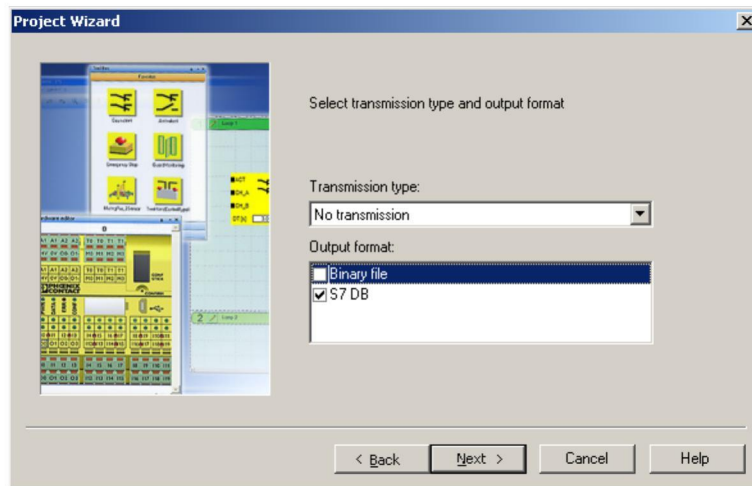


Figure 3-4 Selecting the S7 DB output format

- Describe the project completely.



**NOTE: Error during download**

Please fill out all fields completely. Use the maximum number of characters, otherwise you will receive an error message when the configuration and parameter data record is downloaded from the standard controller to the IB IL 24 LPSDO 8-PAC.

Table 3-1 Describing the project and the data block

Field	Contents
Description	Exactly 4 characters
Version	Exactly 4 characters
DB number	DB number
Title	Exactly 8 characters
Version	Version of the DB

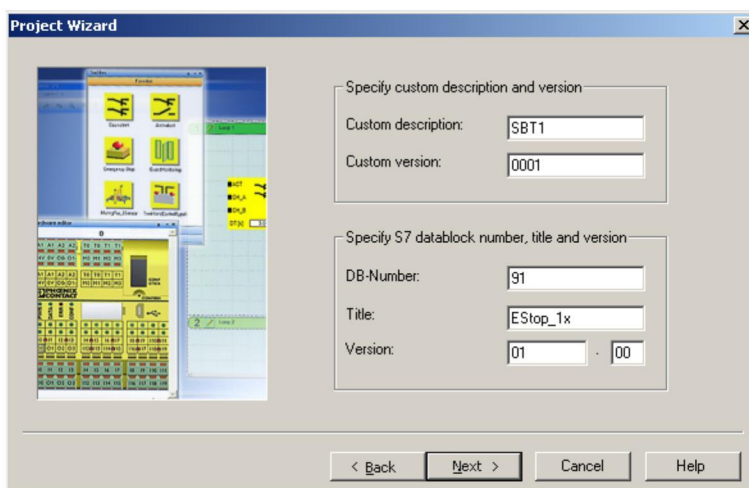


Figure 3-5 Describing the project and the data block

- Complete the project creation.

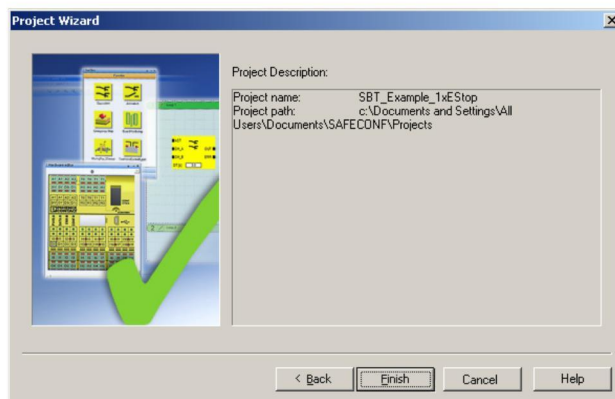


Figure 3-6 Completing the project creation

### 3.2.2 Configuring the safety island



Representation of the devices in SAFECONF is not a network view but a view to a safety island. The safety island configuration is independent of the distribution within an Inline station or in several Inline stations.

When the project has been completed, the window to specify the island number is opened.

- Enter an island number, 1 in the example.

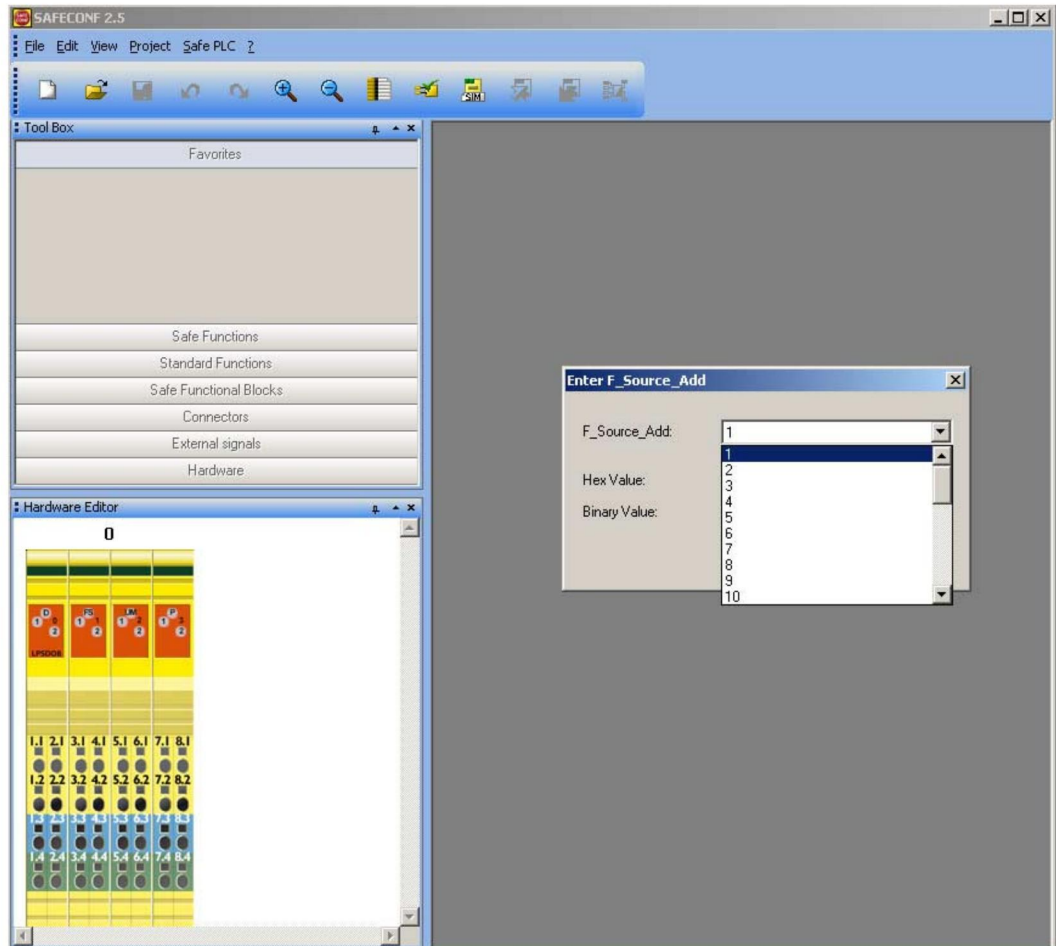


Figure 3-7 Specifying the island number

- Define a password with at least six digits for the project, 123456 in the example.



Figure 3-8 Defining the password

- Define the number of IB IL 24 PSDI 8-PAC modules that belong to the island. To do so, drag and drop the corresponding number of IB IL 24 PSDI 8-PAC modules from the "Hardware" toolbox into the hardware editor.

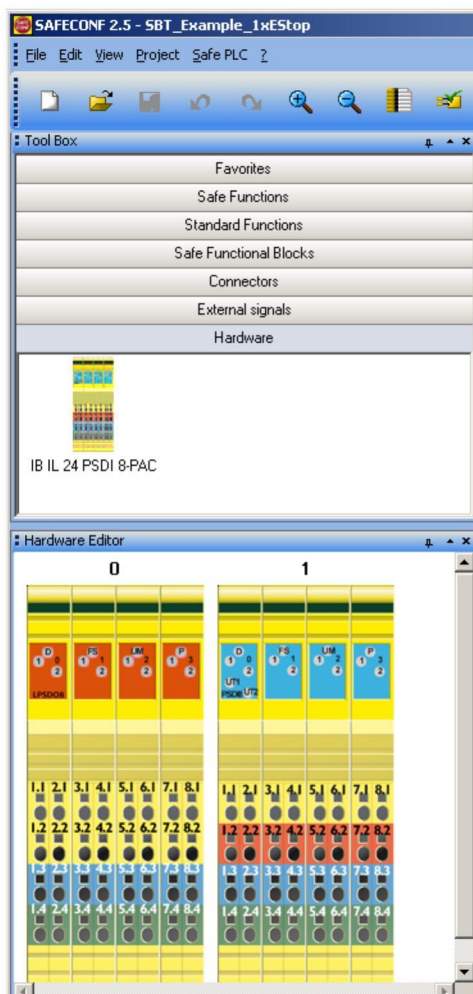


Figure 3-9 Defining the number of IB IL 24 PSDI 8-PAC modules

### 3.2.3 Parameterizing I/O channels of a safety island



**NOTE:**  
With two-channel assignment, parameterize both channels in the same way.

Parameterize the I/O channels of the SafetyBridge modules. There are two options:

- 1 Double-click the module in the hardware editor. The window for parameterization of the entire module opens.
- 2 Double-click a terminal point in the hardware editor. The window for parameterization of the entire terminal point opens.

- Parameterize the output channels of the IB IL 24 LPSDO 8-PAC module.

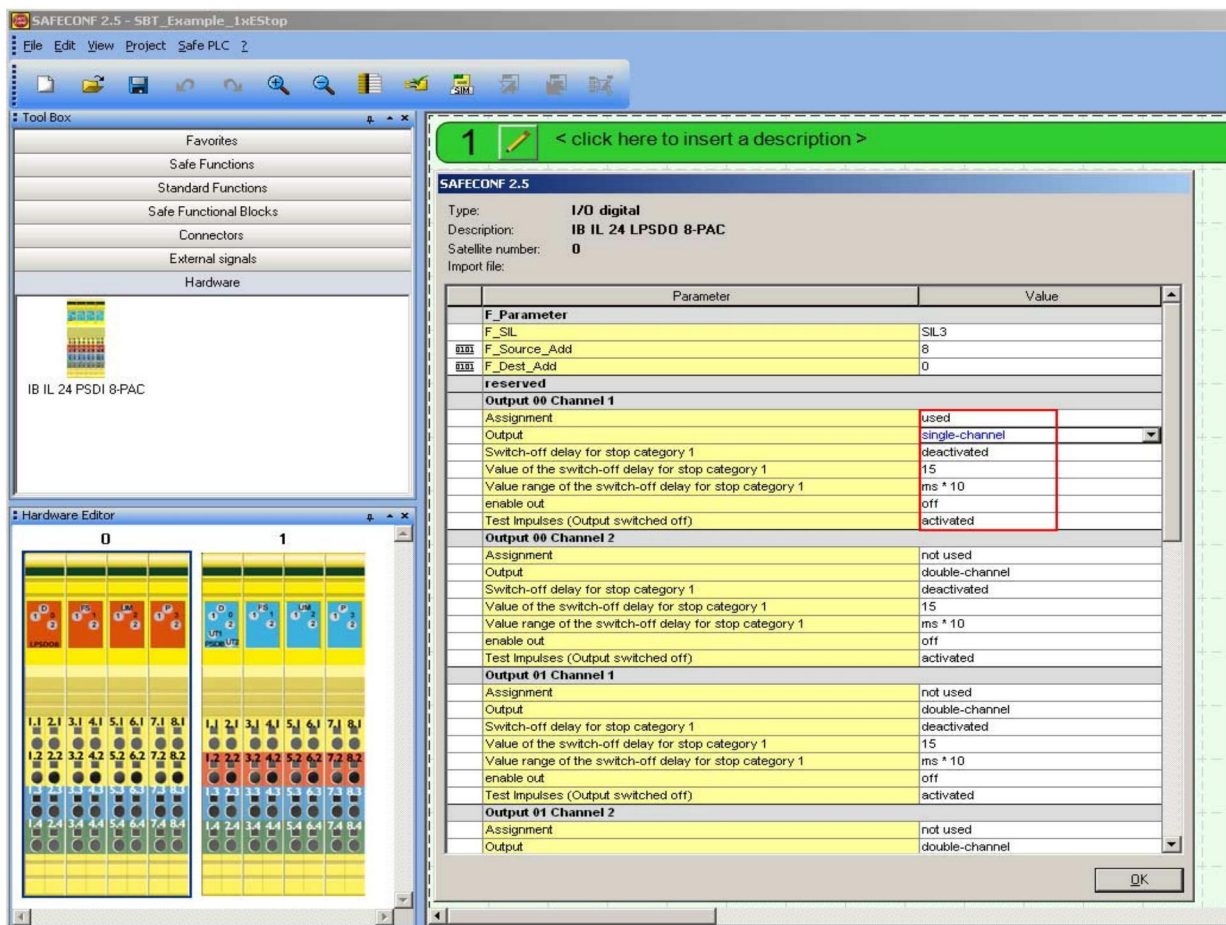


Figure 3-10 IB IL 24 LPSDO 8-PAC parameterization: Output 00 Channel 1 (here: parameterization by double-clicking the module)



The F\_Source\_Add and F\_Dest\_Add values are entered automatically. F\_Source\_Add results from the island number, F\_Dest\_Add from island and satellite number.

- Parameterize the input channels of the IB IL 24 PSDI 8-PAC module.

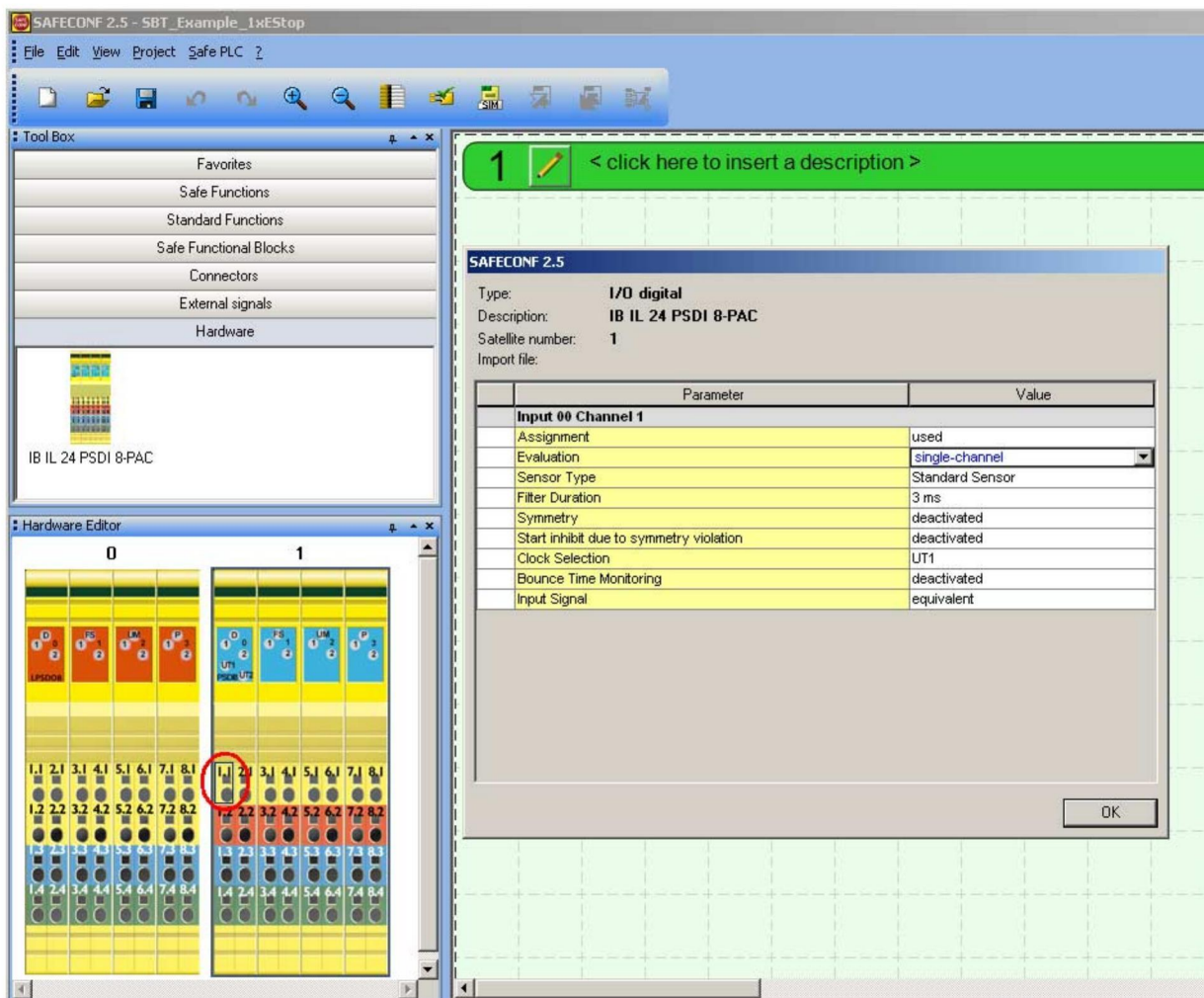


Figure 3-11 IB IL 24 PSDI 8-PAC parameterization: Input 00 Channel 1 (here: parameterization by double-clicking the input at terminal point 1.1)



The F\_Source\_Add and F\_Dest\_Add values are entered automatically. F\_Source\_Add results from the island number, F\_Dest\_Add from island and satellite number. You can define the F\_WD\_Time (in ms) according to your application. The default value is 150 ms. You can configure the clock for the channels only by clicking on the module.

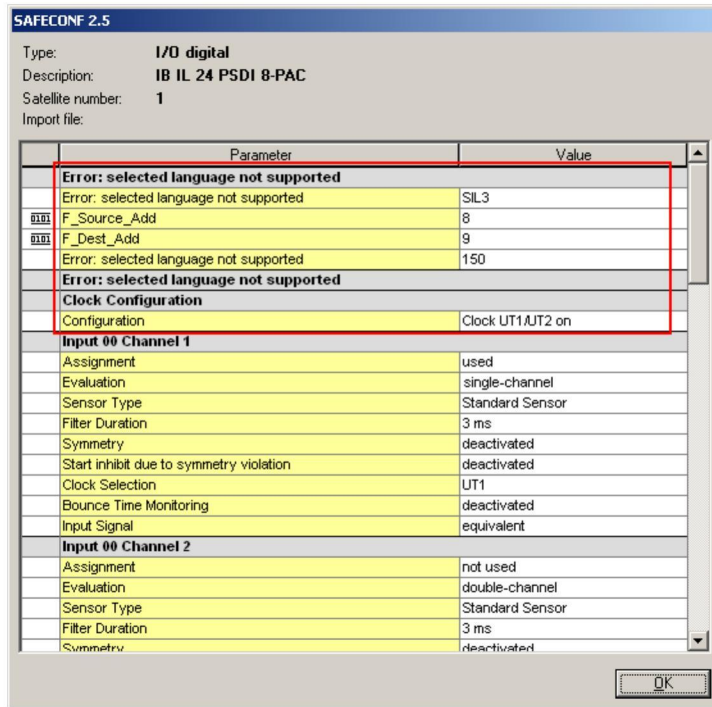


Figure 3-12 Data entered automatically and clock configuration



**Relationship between island and satellite numbers, F\_Source\_Add and F\_Dest\_Add**



Please refer to the documentation for the IB IL 24 LPSDO 8-PAC for additional information about island numbers and satellite numbers.  
 For further information on DIP switches please refer to Section "Step 3: Installing SafetyBridge modules" on page 3-28 or the documentation on the IB IL 24 LPSDO 8-PAC.

Table 3-1 SafetyBridge addresses used and switch positions in the example

DIP switches	500KBD /2MBD	Mode	Island number							Satellite number		
			9	8	7	6	5	4	3	2	1	0
IB IL 24 LPSDO 8-PAC	2 MBD	Mode 1	res.	res.	1 <sub>dec</sub>					0 <sub>dec</sub>		
	1	0	0	0	0	0	0	0	1	0	0	0
	SafetyBridge address: 8 <sub>dec</sub> (8 <sub>hex</sub> )											
IB IL 24 PSDI 8-PAC	2 MBD	Mode 2	res.	res.	1 <sub>dec</sub>					1 <sub>dec</sub>		
	1	1	0	0	0	0	0	0	1	0	0	1
	SafetyBridge address: 9 <sub>dec</sub> (9 <sub>hex</sub> )											

F\_Source\_Add = SafetyBridge address of the IB IL 24 LPSDO 8-PAC = 8

F\_Dest\_Add = F\_Source\_Add + satellite number

F\_Dest\_Add IB IL 24 LPSDO 8-PAC = 0

F\_Dest\_Add IB IL 24 PSDI 8-PAC = 1

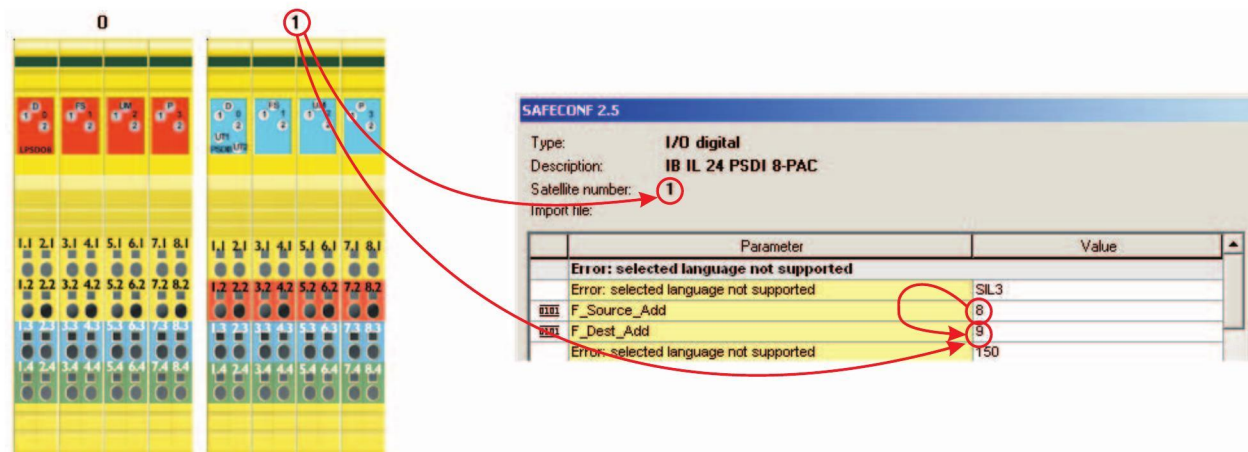


Figure 3-13 Relationship between island and satellite numbers, F\_Source\_Add and F\_Dest\_Add

### 3.2.4 Configuring the safety function

- Configure the safety function.

You configure the safety function by dragging and dropping the elements from the various toolbox areas into the workspace.

Different sources are available for safe and non-safe signals. For the example, these are the following sources:

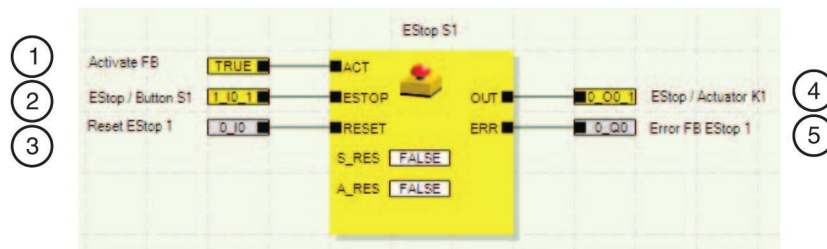


Figure 3-14 Sources for safe signals

- 1 "Safe Functions" toolbox
- 2 IB IL 24 PSDI 8-PAC hardware editor
- 3 "External signals" toolbox; non-safe signals from the standard controller
- 4 IB IL 24 LPSDO 8-PAC hardware editor
- 5 "External signals" toolbox; non-safe signals to the standard controller



Please refer to Section "Variable table of external signals" on page A-5 for the relationship between the external signals in the toolbox and the variables in the S7 program (registers).

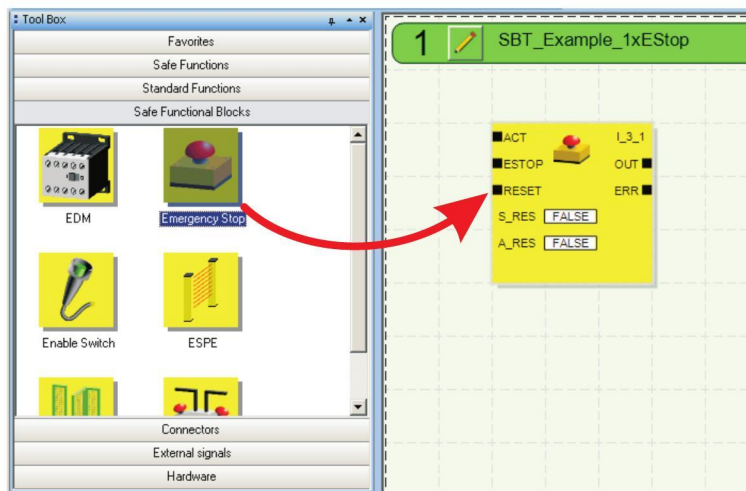


Figure 3-15 Inserting a function block from the "Safe Functional Blocks" toolbox

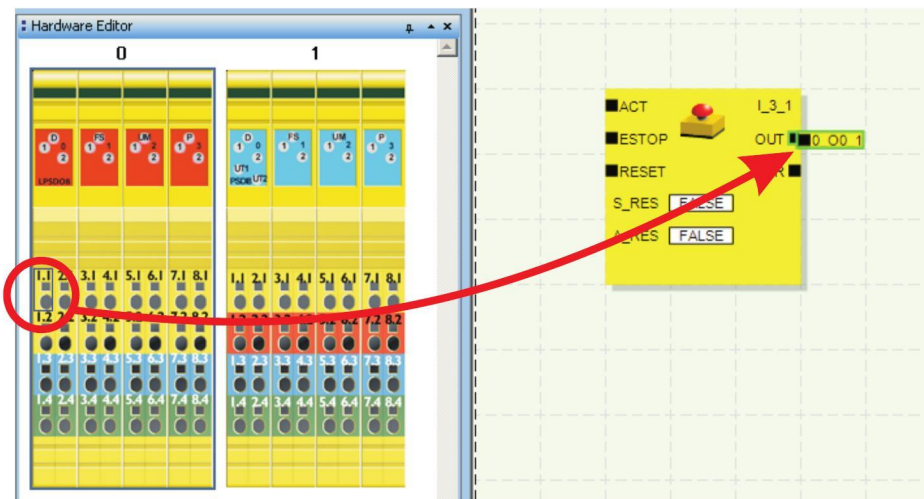


Figure 3-16 Inserting a safe output from the hardware editor using drag and drop



If you drag and drop the terminal point of a safety module directly to an input or output of the function block (as shown in Figure 3-16 for an output), the flow line is created automatically.

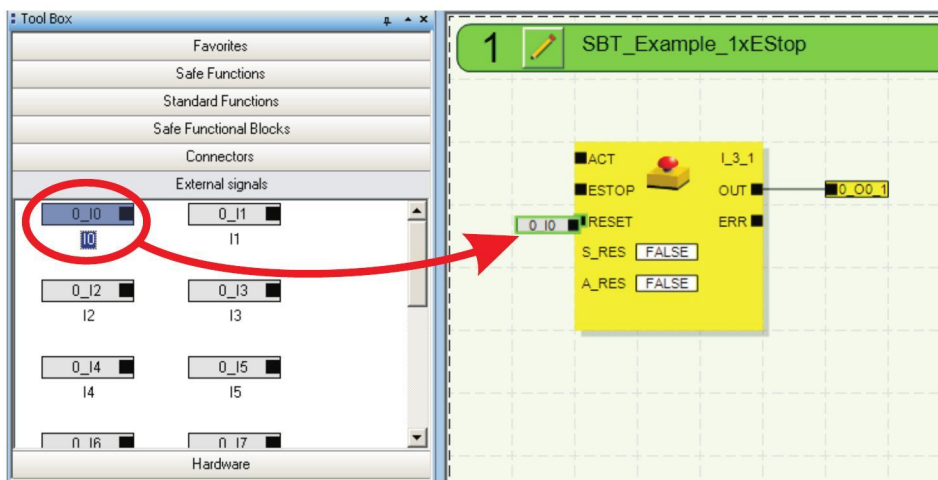


Figure 3-17 Inserting an external signal from the "External signals" toolbox

The complete safety function for this example is shown in Figure 3-18.

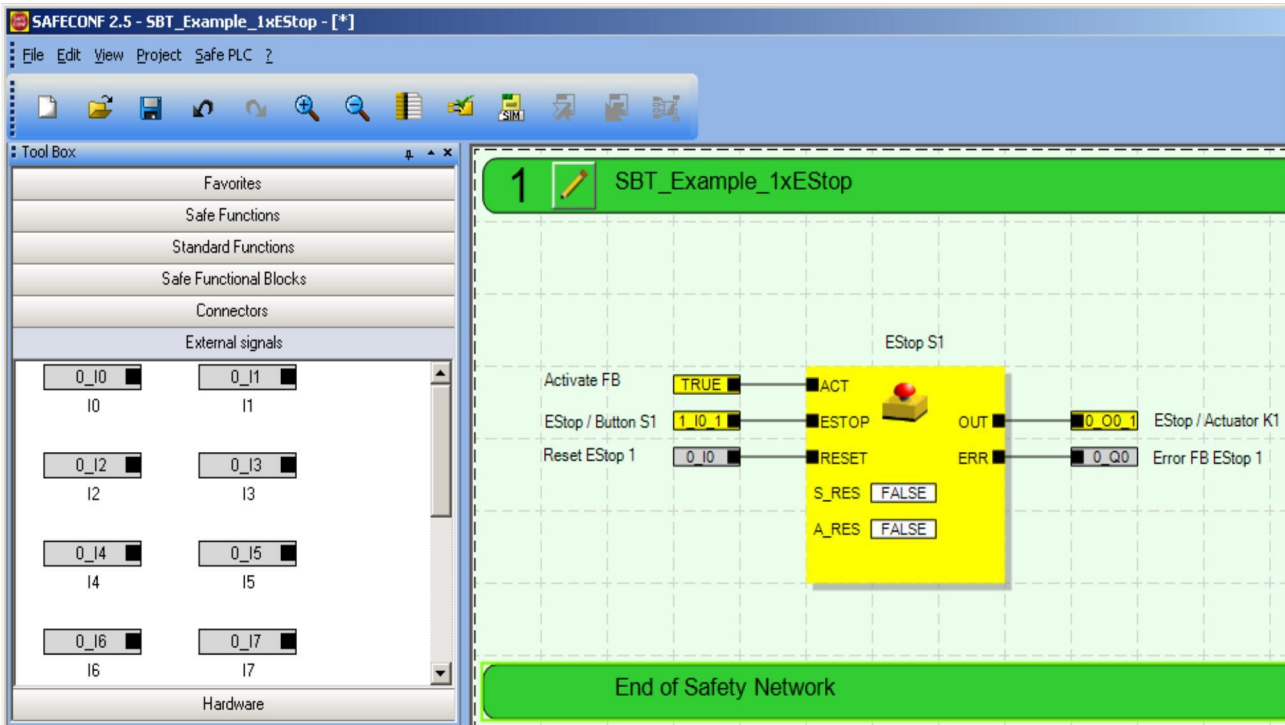


Figure 3-18 Configured safety function

### 3.2.5 Exporting the configuration and parameter data record

- Check the project. Select the "Project...Check project" command.

A message window opens showing the progress of the check. If the check has been completed without errors, the configuration and parameter data record will be created as "*Project name.stl*" file. It is stored in the FileOutput folder in the path that you specified for the project (see Figure 3-2 on page 3-3). This file is loaded into the standard controller later (see Section "Loading the configuration and parameter data record into the standard controller" on page 3-25).

This completes step 1 "Configuring safety logic".

### 3.3 Step 2: Integrating SafetyBridge module into the S7 (STEP 7)

To integrate the SafetyBridge modules into the network, proceed as described in the documentation of your controller manufacturer. This section only describes basic steps that are relevant in association with the SafetyBridge system.

#### 3.3.1 Creating/opening a project

- In the Siemens SIMATIC Manager, create a new project or open an existing project.

#### 3.3.2 Installing GSD/GSDML files

In the following, the term "GSD file" refers to both a GSD file (in the PROFIBUS system) and a GSDML file (in the PROFINET system).



Make sure you use the latest GSD file. It can be found on the Internet at [www.phoenixcontact.net/catalog](http://www.phoenixcontact.net/catalog).

- Copy the device-specific GSD file to a directory of your choice.
- Use the "Options... Install GSD files" menu item to install the relevant GSD file in the hardware configurator.
- In the "Install GSD Files" dialog box, select the "from the directory" option.
- Use "Browse ..." to select the path for the directory, which was used for copying the GSD files.

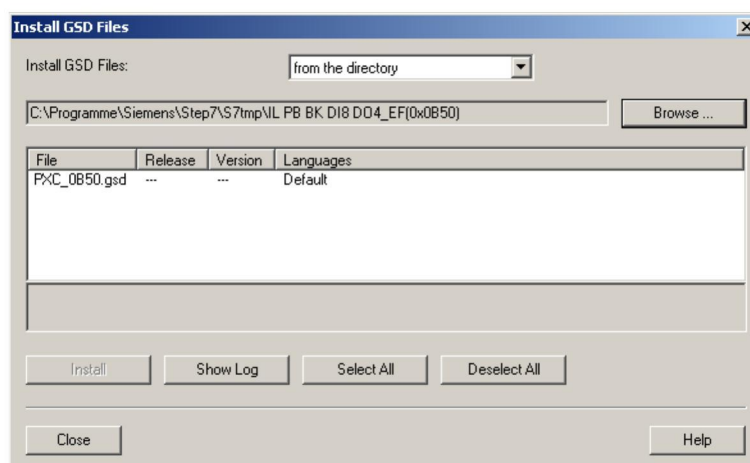


Figure 3-19 "Install GSD files" dialog

- Select the relevant GSD file from the list and confirm with "Install". Close the dialog box.
- Update the hardware catalog. The devices described in the installed GSD file are now available in the hardware catalog.

### 3.3.3 Inserting the bus coupler in the hardware configurator

Once the device-specific GSD file has been installed, the bus coupler is available for selection in the STEP 7 hardware catalog via the path specified in Figure 3-2.

- Select the bus coupler from the hardware catalog and move it into the system using drag and drop.

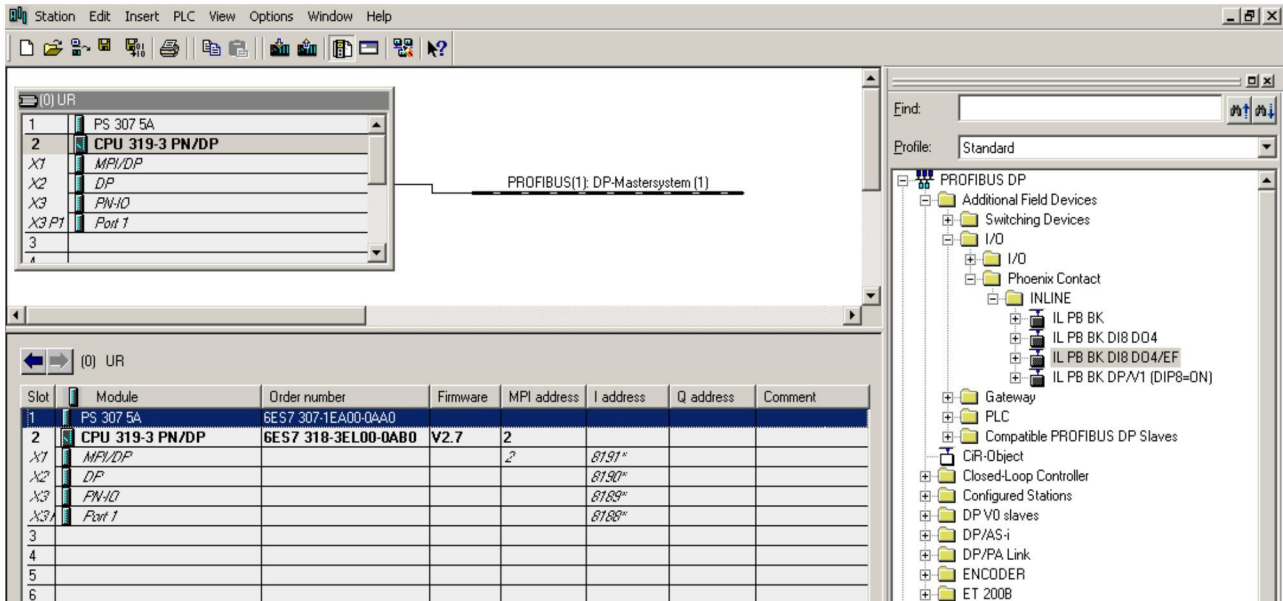


Figure 3-20 Inserting the bus coupler

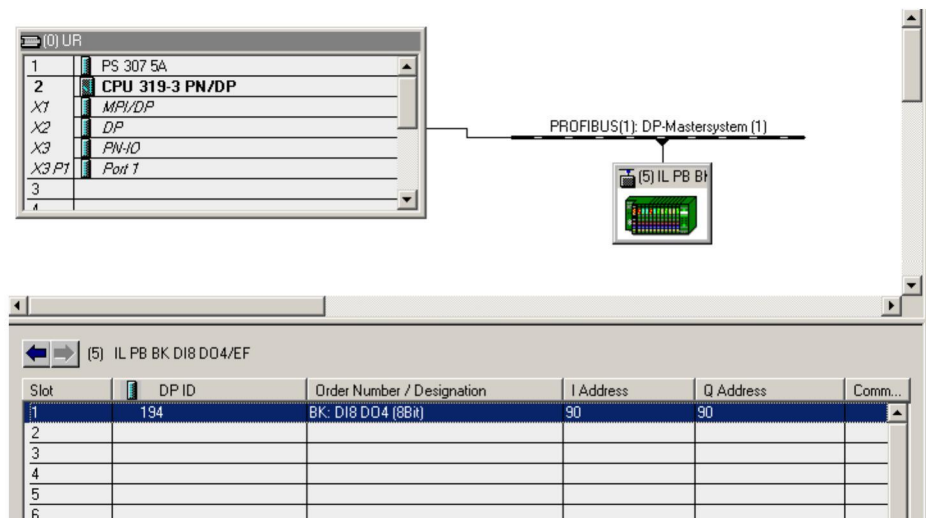


Figure 3-21 Bus coupler inserted

Specify the bus coupler properties (e.g., PROFIBUS address, diagnostic address).

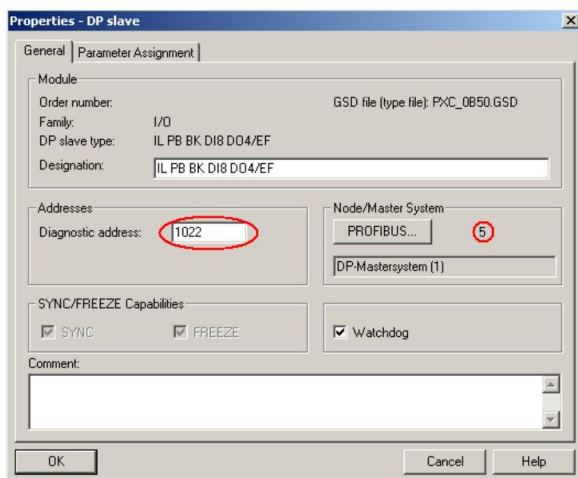


Figure 3-22 Specifying the bus coupler properties



Make sure that the PROFIBUS address matches the address of your bus coupler (in the example: PROFIBUS address 5).

Make sure that the diagnostic address matches the diagnostic address in OB1 (in the example: diagnostics address 1022).

- Add "PCP 4 words" from the hardware catalog.

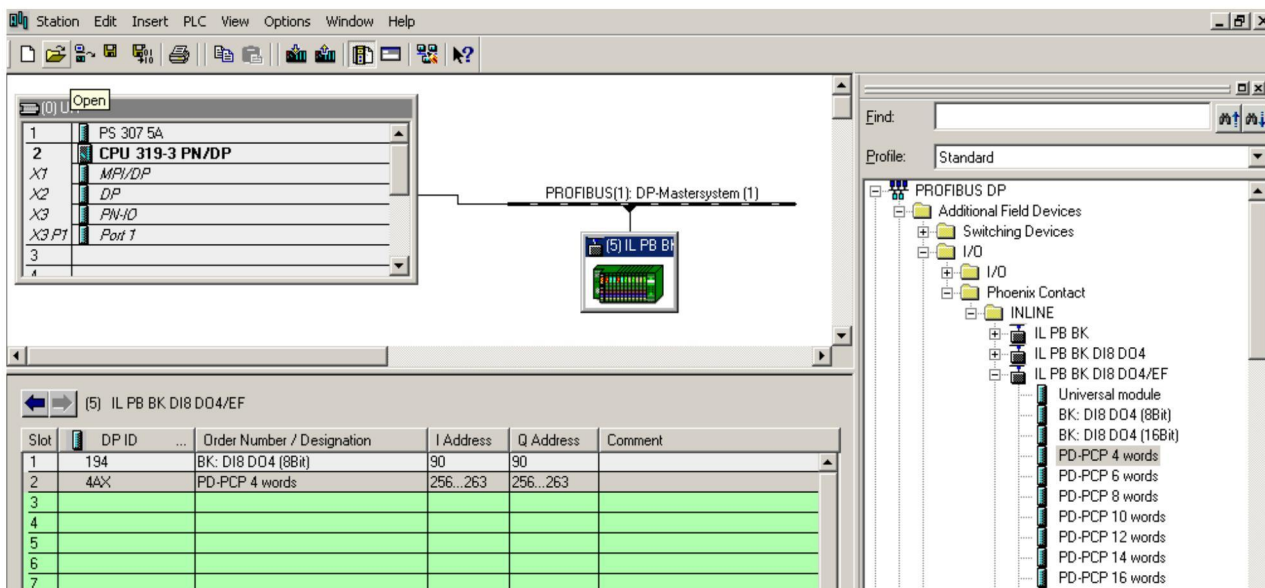


Figure 3-23 Adding "PCP 4 words"

### 3.3.4 Inserting SafetyBridge modules in the hardware configurator

All devices that can be connected to the bus coupler are stored together with a device description in the GSD file.

Now insert the required SafetyBridge modules (here: one IB IL 24 LPSDO 8-PAC module and one IB IL 24 PSDI 8-PAC module) according to the bus structure from the hardware catalog into the configuration (see example station structure in Figure 3-1 on page 3-1).



The IB IL 24 PSDI 8-PAC module for the SafetyBridge system can be found under the IB IL 24 PSDI 8 SBT entry.

All devices that can be connected can be found under PROFIBUS in the path specified in the associated figures.

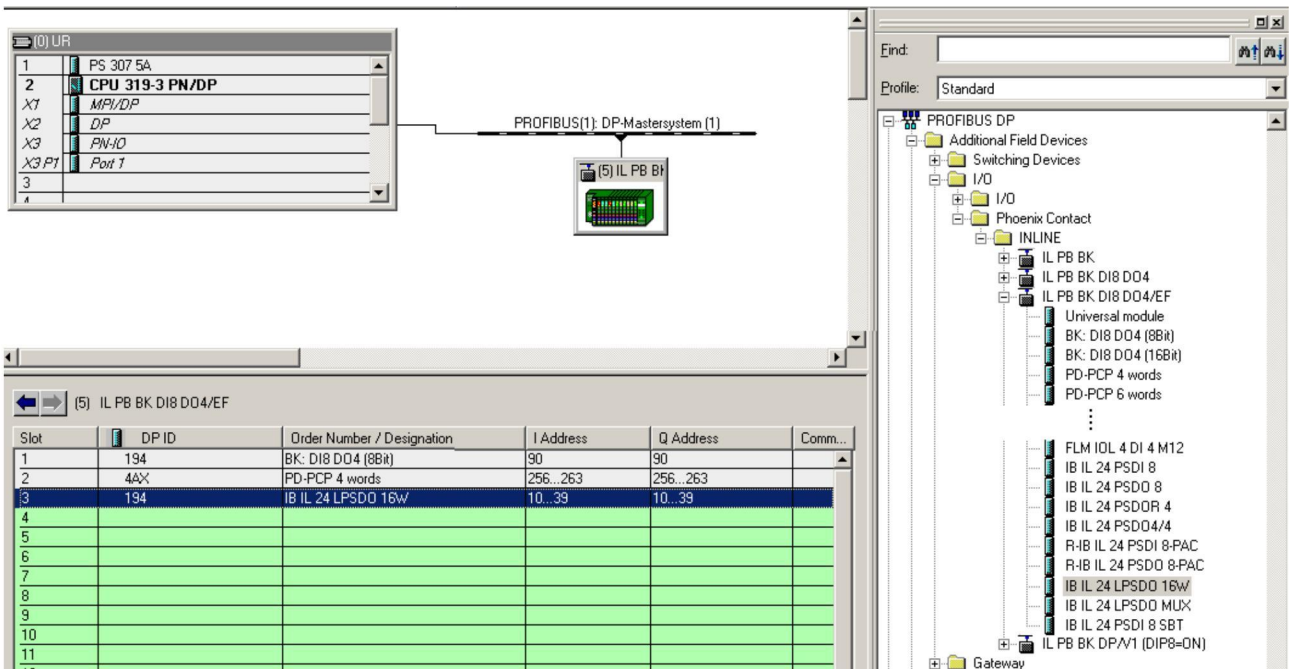


Figure 3-24 Inserting the IB IL 24 LPSDO 8-PAC safety module



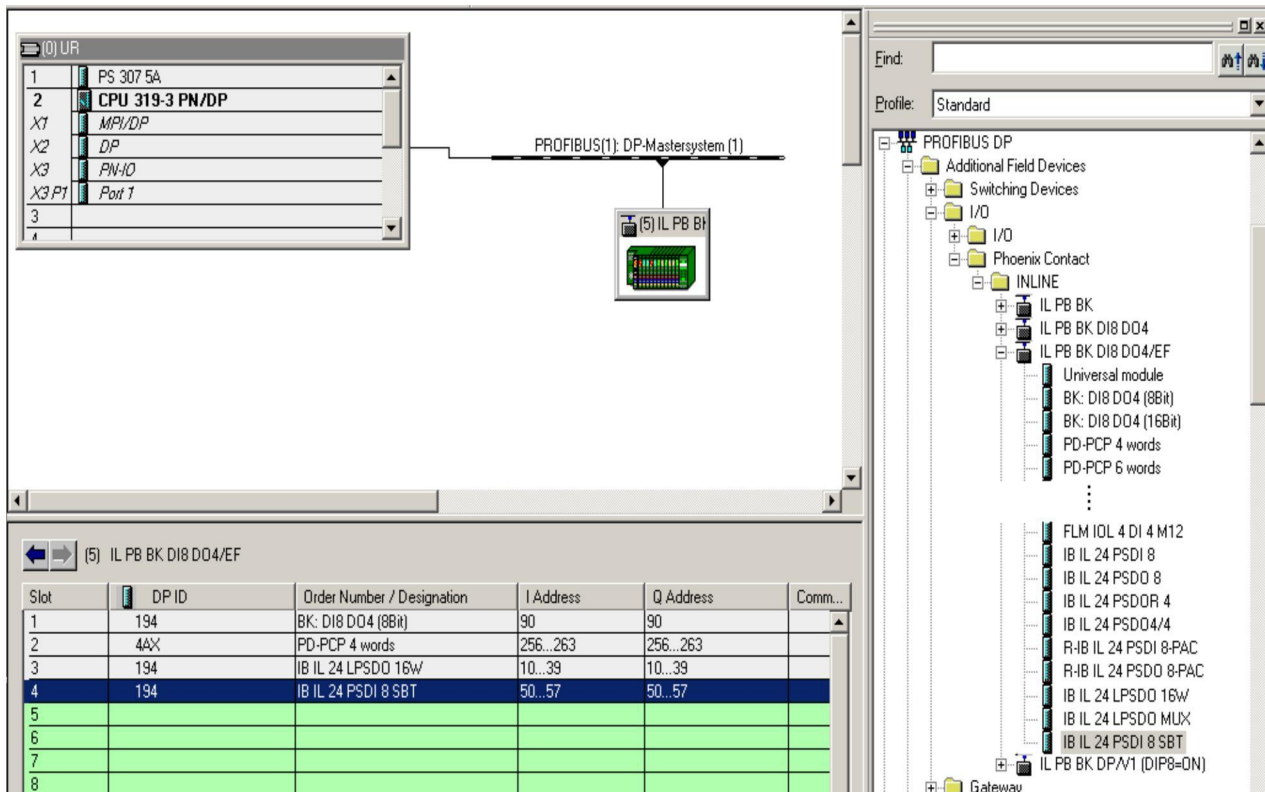


Figure 3-25 Inserting the IB IL 24 PSDI 8-PAC safety module

- Proceed accordingly to insert all the other connected devices. The complete bus configuration is illustrated in the following figure.

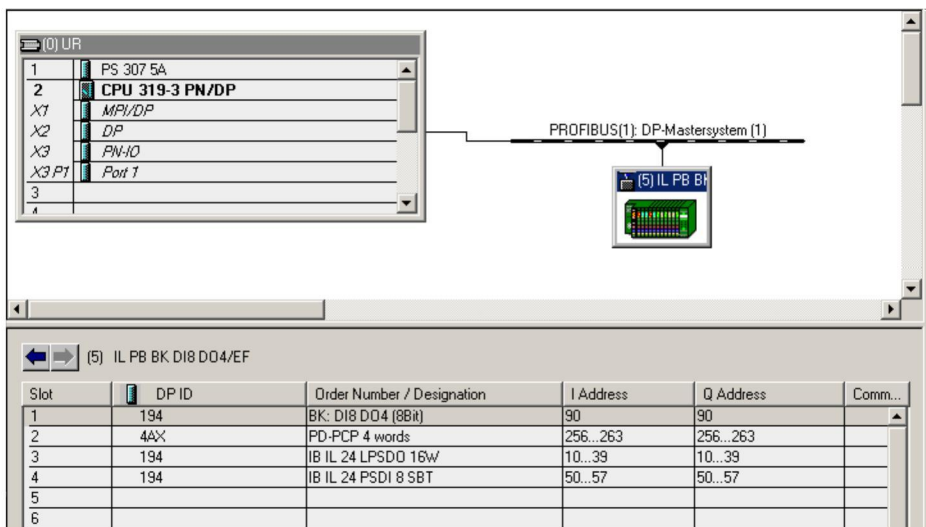
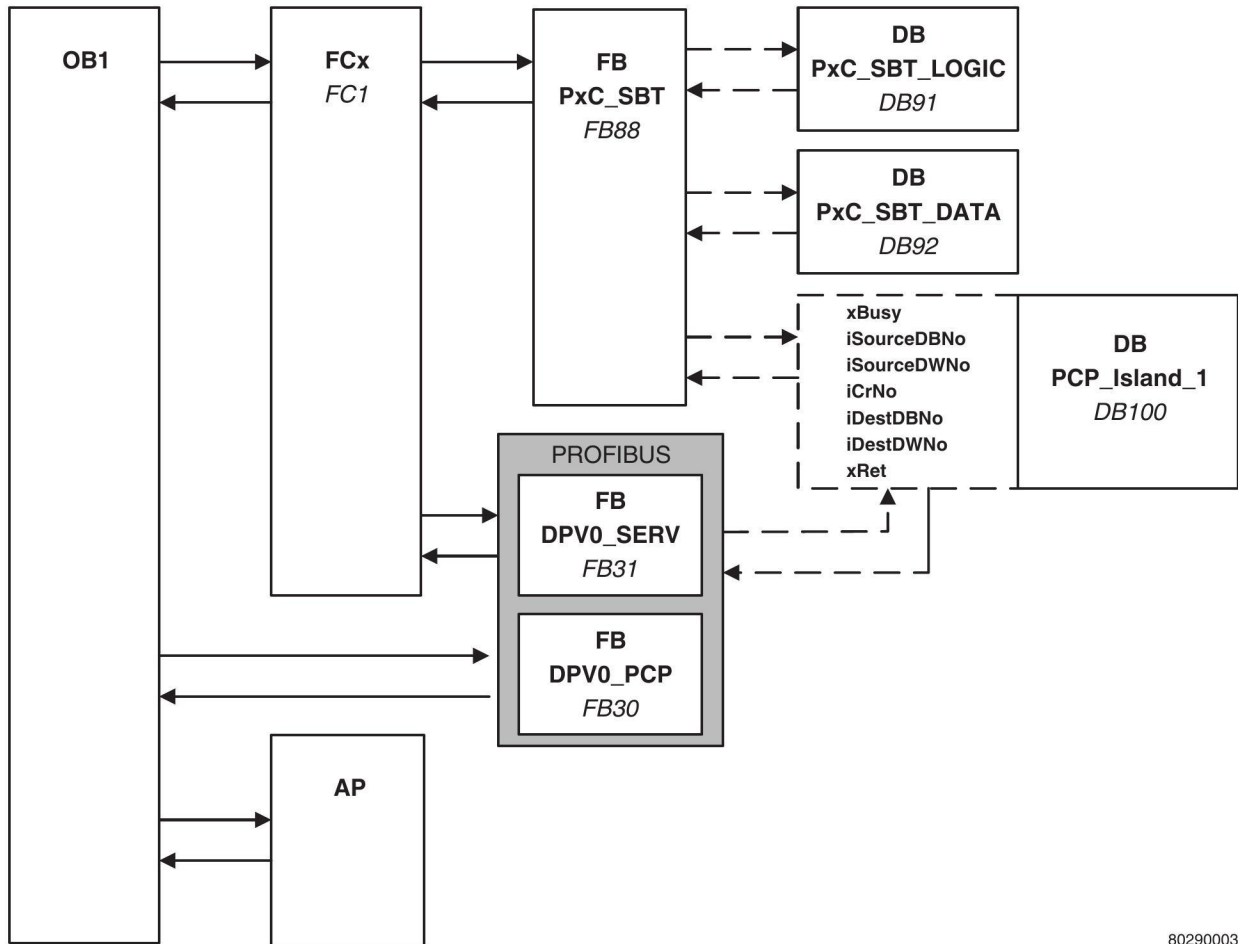


Figure 3-26 Complete bus configuration

### 3.3.5 Adding SafetyBridge operation to the standard application program (PROFIBUS)

Add SafetyBridge operation to your standard application program. The example shows the basic procedure.

Figure 3-27 shows an overview of the program structure in PROFIBUS.



80290003

Figure 3-27 Program structure in PROFIBUS

Key:

<b>Bold</b>	General designation
<i>Italics</i>	Special designation in the example project
AP	Application program
Continuous line	Calls between the blocks
Dashed line	Data exchange over coupling parameters

Table 3-2 Functions of the functional blocks

Functional block	Function
FB PxC_SBT (FB88)	This block has two main tasks: <ul style="list-style-type: none"> <li>– Download of the configuration and parameter data record from the standard controller to the IB IL 24 LPSDO 8-PAC</li> <li>– Cyclic routing of the SafetyBridge data flow</li> </ul>
DB PxC_SBT_LOGIC (DB91)	Data block with the configuration and parameter data record that was generated in SAFECONF and imported into the S7.
DB PxC_SBT_DATA (DB92)	This data block implements: <ul style="list-style-type: none"> <li>– Parameterization of the I/O addresses of an island</li> <li>– Activation of the module</li> <li>– Diagnostic data</li> </ul>
DB PCP_Island_1 (DB100)	Data block for communication
FB DPV0_SERV (FB31)	Function block for PROFIBUS communication
FB DPV0_PCP (FB30)	Function block for PROFIBUS communication



Please refer to the corresponding block documentation for the functions of the function blocks for PROFIBUS communication.

- Link the blocks for PROFIBUS according to Figure 3-28.

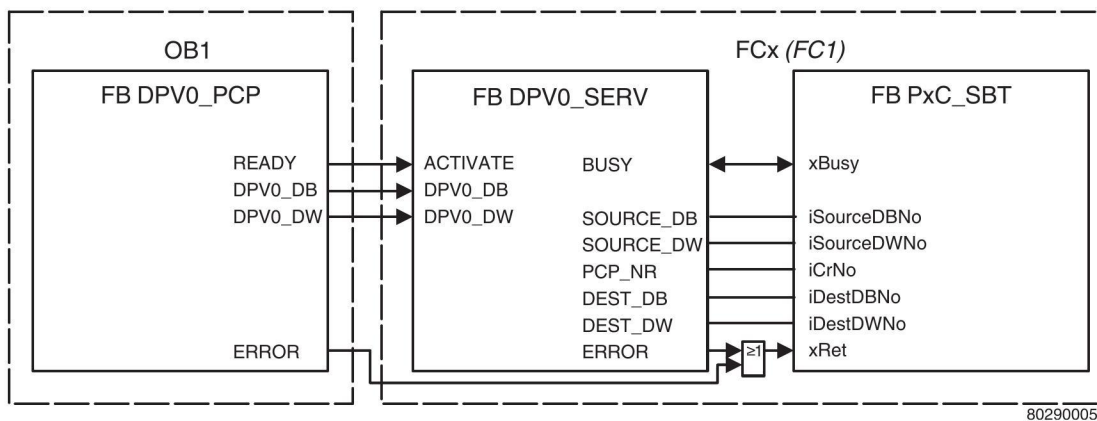


Figure 3-28 Links between the blocks

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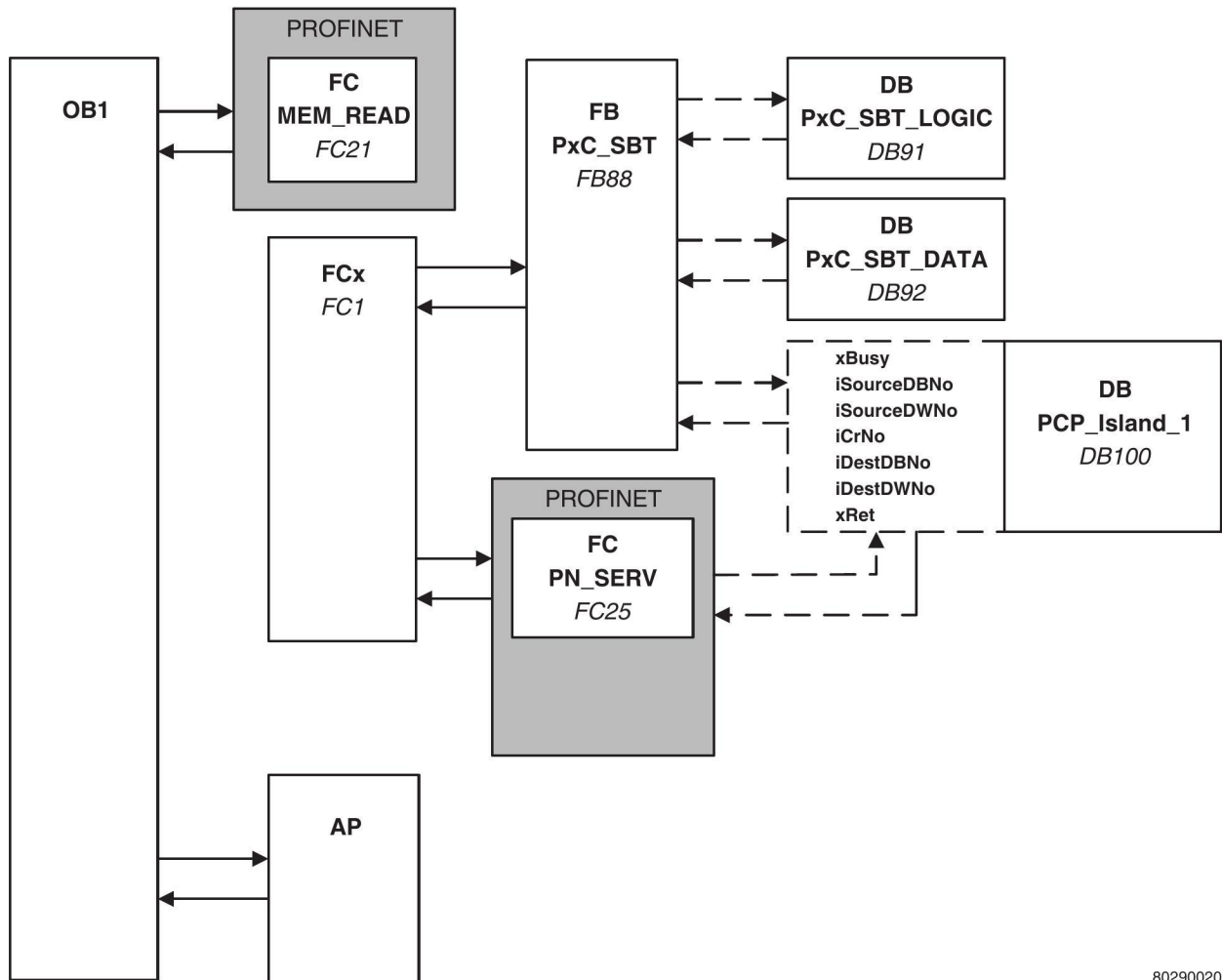
Key:

- Line with arrows      Link with flags
- Line without arrows      Link with constants

### 3.3.6 Adding SafetyBridge operation to the standard application program (PROFINET)

Add SafetyBridge operation to your standard application program. The example shows the basic procedure.

Figure 3-29 shows an overview of the program structure in PROFINET.



80290020

Figure 3-29 Program structure in PROFIBUS

Key:

<b>Bold</b>	General designation
<i>Italics</i>	Special designation in the example project
AP	Application program
Continuous line	Calls between the blocks
Dashed line	Data exchange over coupling parameters

Table 3-3 Block functions

Functional block	Function
FB PxC_SBT (FB88)	This block has two main tasks: <ul style="list-style-type: none"> <li>– Download of the configuration and parameter data record from the standard controller to the IB IL 24 LPSDO 8-PAC</li> <li>– Cyclic routing of the SafetyBridge data flow</li> </ul>
DB PxC_SBT_LOGIC (DB91)	Data block with the configuration and parameter data record that was generated in SAFECONF and imported into the S7.
DB PxC_SBT_DATA (DB92)	This data block implements: <ul style="list-style-type: none"> <li>– Parameterization of the I/O addresses of an island</li> <li>– Activation of the module</li> <li>– Diagnostic data</li> </ul>
DB PCP_Island_1 (DB100)	Data block for communication
FC MEM_READ (FC21)	Function for PROFINET communication
FC PN_SERV (FC25)	Function for PROFINET communication



Please refer to the corresponding block documentation for the function of the function block for PROFINET communication.

- Link the blocks for PROFINET according to Figure 3-30.

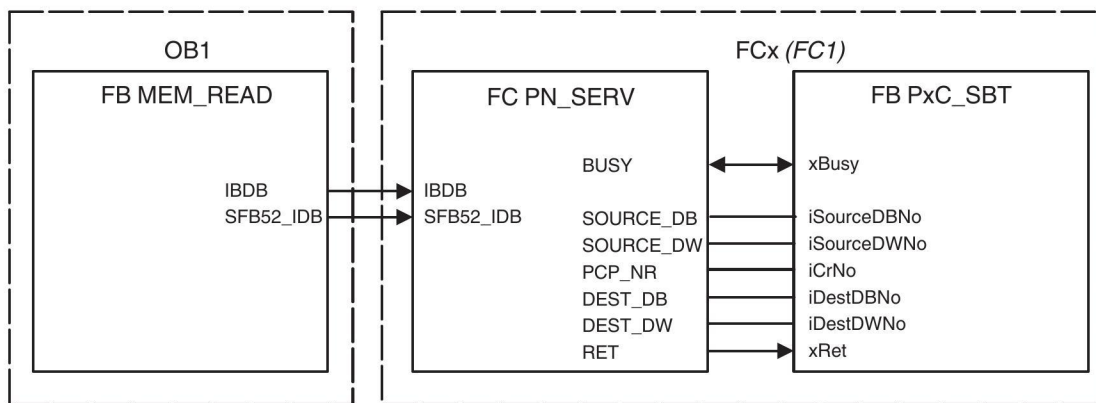


Figure 3-30 Links between the blocks

Key:

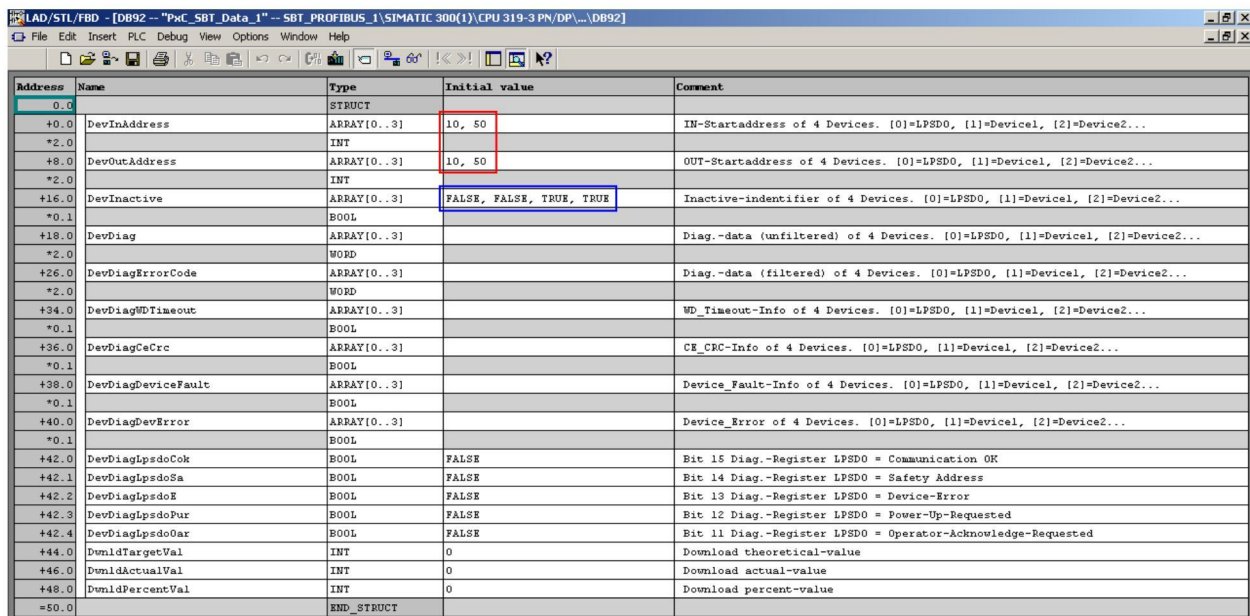
- Line with arrows      Link with flags
- Line without arrows      Link with constants

### 3.3.7 Adding SafetyBridge operation to the standard application program - Example

To integrate the SafetyBridge technology you need to make amendments to your already existing application program. This is implemented using the examples of OB1 and FC1.

FC1 includes the following parts:

- Network 1: Initialization of the DB PxC\_SBT\_DATA (DB92) data block
- Enter the same I/O addresses for DevInAddress and DevOutAddress as in the hardware configuration before.
  - Activate or deactivate the devices for use in the SafetyBridge system.



Address	Name	Type	Initial value	Comment
0.0		STRUCT		
+0.0	DevInAddress	ARRAY[0..3]	10, 50	IN-Startaddress of 4 Devices. [0]=LPSD0, [1]=Device1, [2]=Device2...
+2.0		INT		
+8.0	DevOutAddress	ARRAY[0..3]	10, 50	OUT-Startaddress of 4 Devices. [0]=LPSD0, [1]=Device1, [2]=Device2...
+2.0		INT		
+16.0	DevInactive	ARRAY[0..3]	FALSE, FALSE, TRUE, TRUE	Inactive-identifier of 4 Devices. [0]=LPSD0, [1]=Device1, [2]=Device2...
+0.1		BOOL		
+18.0	DevDiag	ARRAY[0..3]		Diag.-data (unfiltered) of 4 Devices. [0]=LPSD0, [1]=Device1, [2]=Device2...
+2.0		WORD		
+26.0	DevDiagErrorCode	ARRAY[0..3]		Diag.-data (filtered) of 4 Devices. [0]=LPSD0, [1]=Device1, [2]=Device2...
+2.0		WORD		
+34.0	DevDiagWdTimeout	ARRAY[0..3]		Wd_Timeout-Info of 4 Devices. [0]=LPSD0, [1]=Device1, [2]=Device2...
+0.1		BOOL		
+36.0	DevDiagCeCrc	ARRAY[0..3]		CE_CRC-Info of 4 Devices. [0]=LPSD0, [1]=Device1, [2]=Device2...
+0.1		BOOL		
+38.0	DevDiagDeviceFault	ARRAY[0..3]		Device_Fault-Info of 4 Devices. [0]=LPSD0, [1]=Device1, [2]=Device2...
+0.1		BOOL		
+40.0	DevDiagDevError	ARRAY[0..3]		Device_Error of 4 Devices. [0]=LPSD0, [1]=Device1, [2]=Device2...
+0.1		BOOL		
+42.0	DevDiagLpsdoCok	BOOL	FALSE	Bit 15 Diag.-Register LPSD0 = Communication OK
+42.1	DevDiagLpsdoSa	BOOL	FALSE	Bit 14 Diag.-Register LPSD0 = Safety Address
+42.2	DevDiagLpsdoE	BOOL	FALSE	Bit 13 Diag.-Register LPSD0 = Device-Error
+42.3	DevDiagLpsdoPur	BOOL	FALSE	Bit 12 Diag.-Register LPSD0 = Power-Up-Requested
+42.4	DevDiagLpsdoOar	BOOL	FALSE	Bit 11 Diag.-Register LPSD0 = Operator-Acknowledge-Requested
+44.0	DwnldTargetVal	INT	0	Download theoretical-value
+46.0	DwnldActualVal	INT	0	Download actual-value
+48.0	DwnldPercentVal	INT	0	Download percent-value
=50.0		END_STRUCT		

Figure 3-31 Activating/deactivating devices:

- Network 2: Lock communications when using several islands (not used in the example)
- Network 3: Call the FB\_PxC\_SBT(FB88) block for island 1
- Network 4: Call the communication block



Please refer to the program code in the example program for the implementation of the example.



As an alternative, the data block (network 1) can also be initialized directly in the data block with start or default values or in DB100 during the PLC startup.

- Finally transfer the application program to the controller.

This completes step 2 "Integrating SafetyBridge modules in the S7".

### 3.3.8 Loading the configuration and parameter data record into the standard controller

In step 1, the "Project name.stl" file was generated and stored under FileOutput in the project path (see Figure 3-2 on page 3-3).

- Import this file. To do this, select the "Sources...Insert New Object... External Source..." command.

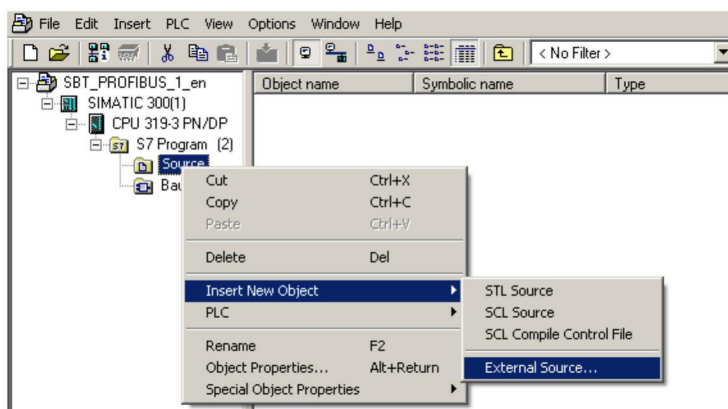


Figure 3-32 Importing the file with configuration and parameter data record

Select the file with the configuration and parameter data record.

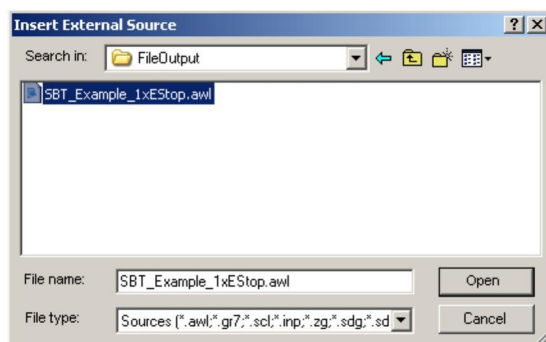


Figure 3-33 Selecting the example file

The imported file will be shown under "Sources".

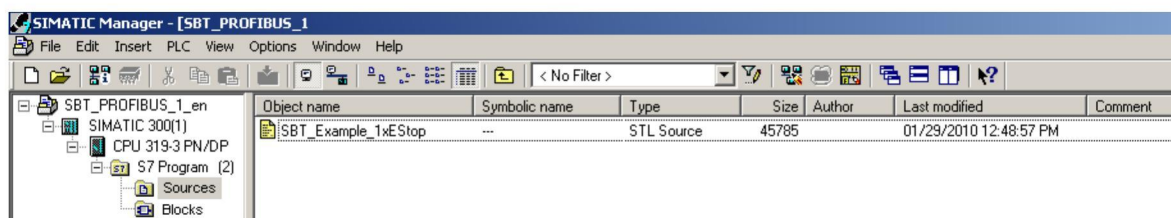


Figure 3-34 Imported configuration and parameter data record

- You have two options for compiling the STL-Source:
  - Select the file, click the right mouse button to open the context menu and select the "Compile" command.

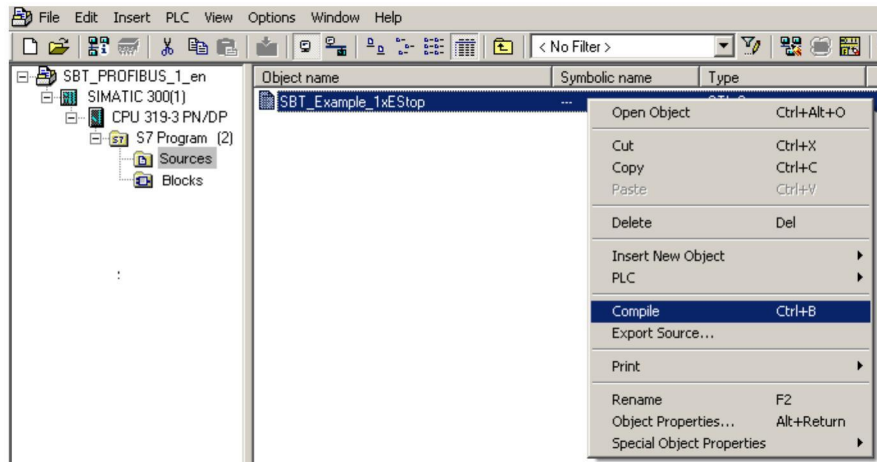


Figure 3-35 Compiling the file (option 1)

Or:

- Open this file by double-clicking on it and compile the STL-Source by clicking the "Compile" button in the command line.

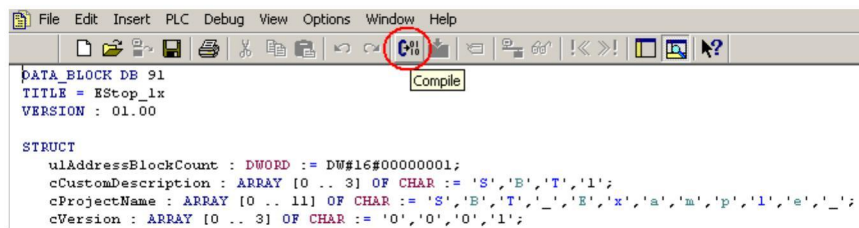


Figure 3-36 Compiling the file (option 2)

The compiling of the STL-Source creates a DB that contains the configuration and parameter data record. In the example this is DB91 as specified in the project description in SAFECNF (see Figure 3-5).



If there is any block with the same number, it will be overwritten.



- Switch to the "Blocks" folder. The created DB91 block will be shown there.
- Select the block and load the DB into the standard controller using the corresponding button.

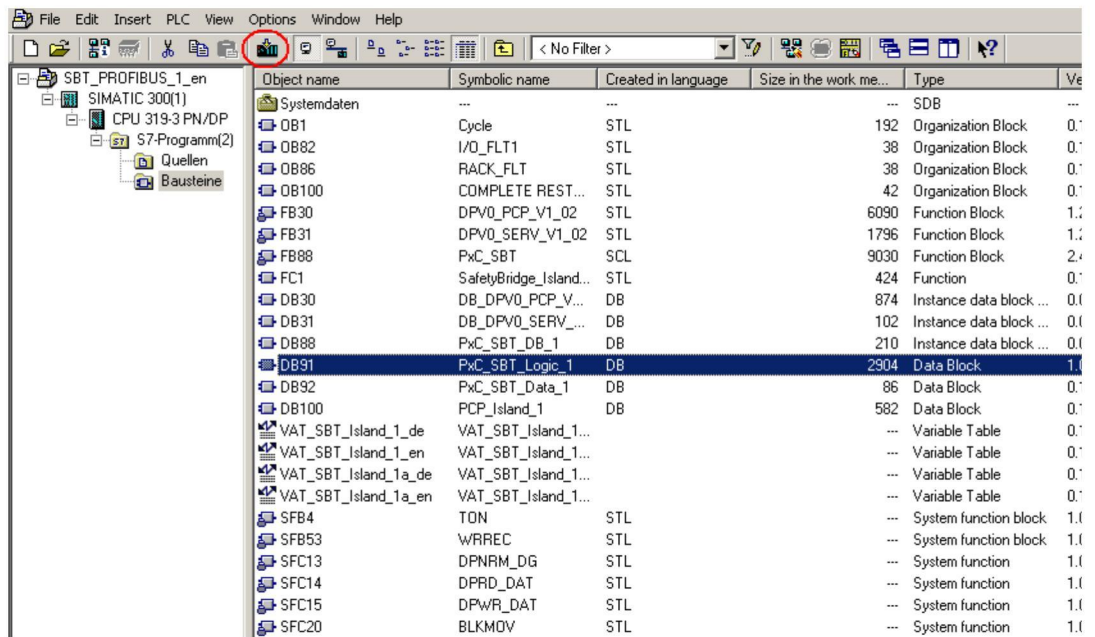


Figure 3-37 The Px\_C\_SBT\_LOGIC block was created as DB91; loading Px\_C\_SBT\_LOGIC into the S7

### 3.4 Step 3: Installing SafetyBridge modules

Install the SafetyBridge modules. Proceed as described in the user manuals for the modules used and the Inline installation manual (see Section "Additional documentation" on page 1-2).

Please note in particular:



Set the DIP switches **before** assembling the module in the Inline station. The switches cannot be accessed when the safety terminal is installed in the Inline station.

The DIP switches are located on the left-hand side of the safety module.

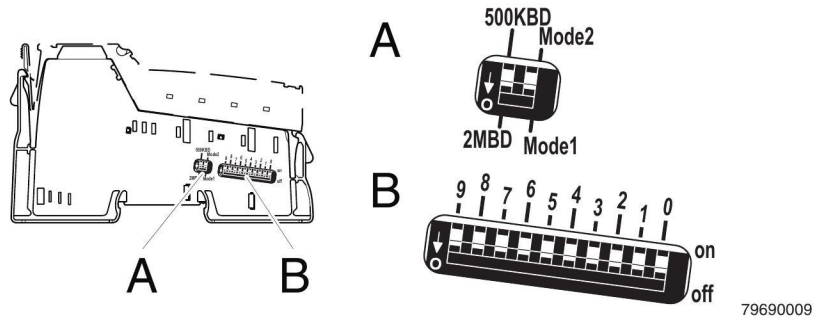


Figure 3-38 DIP switches on the IB IL 24 LPSDO 8-PAC

- A Switch for setting the transmission speed and the operating mode
- B Switch for setting the address



For comprehensive information on DIP switches please refer to the documentation on the IB IL 24 LPSDO 8-PAC and IB IL 24 PSDI 8-PAC.

#### Switch positions of the modules for the example

Table 3-2 Switch positions in the example

DIP switch	500KBD /2MBD	Mode	Island number							Satellite number		
			9	8	7	6	5	4	3	2	1	0
IB IL 24 LPSDO 8-PAC	2 MBD	Mode 1	res.	res.	1 <sub>dec</sub>					0 <sub>dec</sub>		
	1	0	0	0	0	0	0	0	1	0	0	0
	SafetyBridge address: 8 <sub>dec</sub> (8 <sub>hex</sub> )											
IB IL 24 PSDI 8-PAC	2 MBD	Mode 2	res.	res.	1 <sub>dec</sub>					1 <sub>dec</sub>		
	1	1	0	0	0	0	0	0	1	0	0	1
	SafetyBridge address: 9 <sub>dec</sub> (9 <sub>hex</sub> )											



Only use devices with a uniform transmission speed within an Inline station (a local bus). A mixture of devices with different transmission speeds cannot be operated. Since the SafetyBridge modules of an island can be located in different Inline station, it is possible that different transmission speeds (500KBD/2MBD) are set for the modules.

This completes step 3 "Installing SafetyBridge modules" and you have integrated a SafetyBridge system into an existing system in three steps.

### 3.5 Overall safety validation

Perform an overall system validation before you start up your system.



Please proceed as described in Section "Flowchart for testing the example" on page A-3 to test the example.



# A Appendix

## A 1 Example projects

Table A-1 Overview of the examples

Example	Structure	Contents
1	Figure A-1	A SafetyBridge island; 1 emergency stop switch (EStop)  This example is described in this document.
2	Figure A-2	Two SafetyBridge islands distributed in two Inline stations. The IB IL 24 LPSDO 8-PAC are located in different Inline stations. 4 emergency stop switches (EStop); 1 EStop in island 1
3	Figure A-3	Two SafetyBridge islands distributed in two Inline stations. The IB IL 24 LPSDO 8-PAC are located in one Inline station. 4 emergency stop switches (EStop)

The example projects can be downloaded at [www.phoenixcontact.net/catalog](http://www.phoenixcontact.net/catalog).

In SAFECNF each island is configured and parameterized separately. If you are working with island 1 only, you need one example file for SAFECNF, if you are working with two islands, you need both.

They are stored in the Download Center of the IB IL 24 LPSDO 8-PAC under the following file names.

Table A-2 Example files for SAFECNF

Example	Island	Example file
1, 2, 3	1	SBT_EXAMPLE_1xEStop.zcp
2, 3	2	SBT_EXAMPLE_3xEStop.zcp

You need an example file for every example in the S7.

Table A-3 Example files for the S7

Example	Network	Example file
1	PROFIBUS	SBT_PROFIBUS_EXAMPLE_1.zip
2	PROFIBUS	SBT_PROFIBUS_EXAMPLE_2.zip
3	PROFIBUS	SBT_PROFIBUS_EXAMPLE_3.zip



The zip-files for the S7 also include the STL file that is created in step 1 (Configuring the safety logic (SAFECNF)). This means that when you are not working with SAFECNF, you need the example files for the S7 only.

Key for the following diagrams:

- IL ... BK ...            Bus coupler for PROFIBUS, PROFINET or INTERBUS;  
permitted bus couplers see page 3-1
- I\_x                      Island number x
- S\_y                      Satellite number y

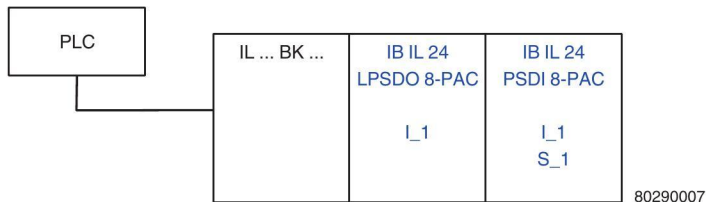


Figure A-1    Example 1: One SafetyBridge island

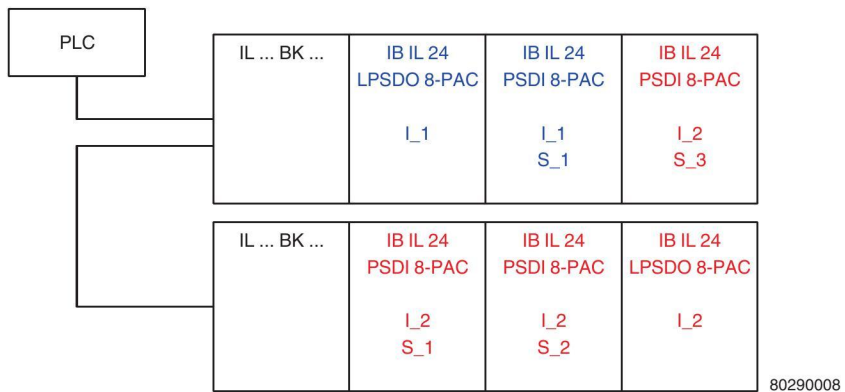


Figure A-2    Example 2: Two SafetyBridge islands distributed in two Inline stations. The IB IL 24 LPSDO 8-PAC are located in different Inline stations.

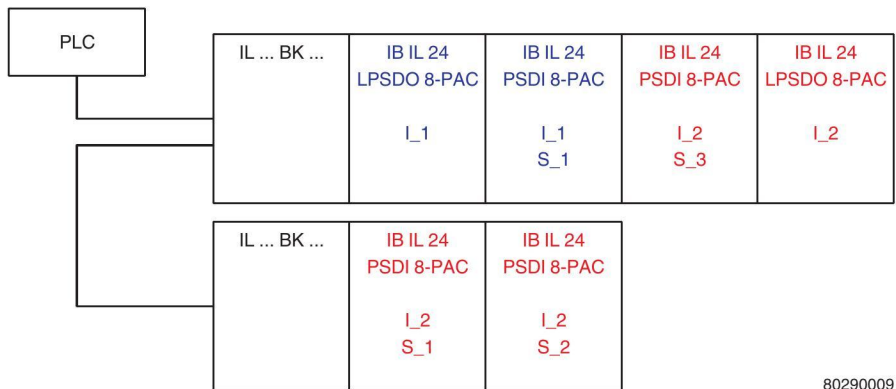


Figure A-3    Example 3: Two SafetyBridge islands distributed in two Inline stations. The IB IL 24 LPSDO 8-PAC are located in one Inline station.

## A 2 Flowchart for testing the example

Please proceed as shown in the following flowchart to test the example after having the SafetyBridge system integrated completely.

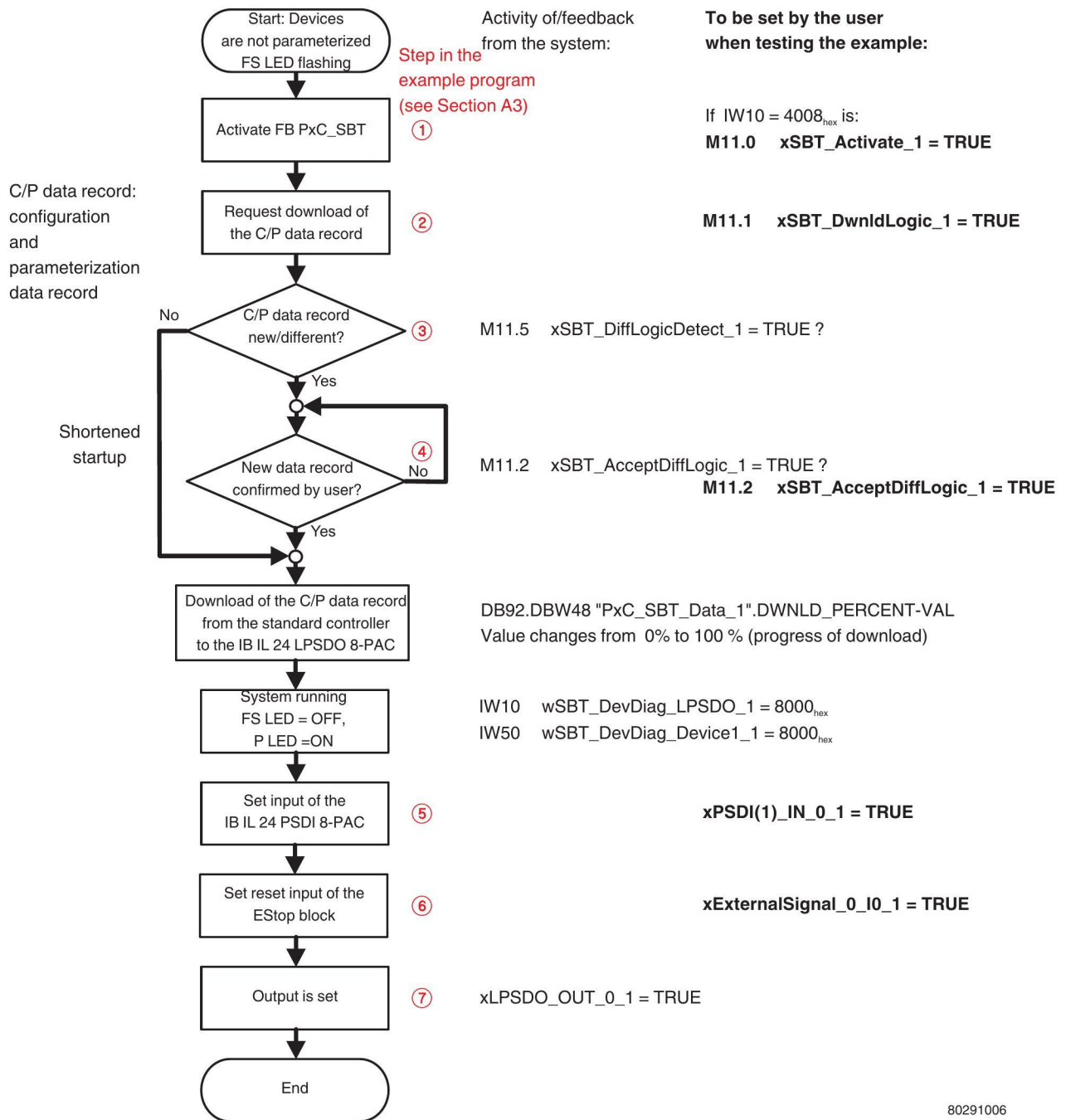


Figure A-4 Flowchart for the initial startup as well as for startup after the configuration and parameter data record was modified

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Shortened startup:

If the data record on the IB IL 24 LPSDO 8-PAC and the data record to be downloaded are identical, you need not to confirm the download.

### A 3 Variable table for testing the example

Address	Symbol	Display format	Status value
1	// Island number 1		
2			
3	// Step 1: Activate function block		
4	M 11.0 "xSBT_Activate_1"	BOOL	false
5			
6	// Step 2: Download the configuration and parameterization data record from the standard PLC (DB91) to the LPSDO		
7	M 11.1 "xSBT_DwnldLogic_1"	BOOL	false
8			
9	// Step 3: Differences between configuration and parameterization data records LSPDO/DB91 have been detected		
10	M 11.5 "xSBT_DiffLogicDetect_1"	BOOL	false
11			
12	// Step 4: The user confirms the download of a different or new configuration and parameterization data record		
13	M 11.2 "xSBT_AcceptDiffLogic_1"	BOOL	false
14			
15	// Download progress bar (configuration and parameterization data record)		
16	DB92.DBW 48 "PxS_SBT_Data_1".DwnldPercentVal	DEC	0
17			
18	// The system is running register entries (Dev-Diag)		
19	IW 10 "wSBT_DevDiag_LPSDO_1"	HEX	W#16#4008
20	IW 50 "wSBT_DevDiagDevice_1"	HEX	W#16#4009
21			
22	// Step 5: Emergency stop circuit is closed		
23	// Safe input PSDI (1)		
24	I 52.0 "xPSDI(1)_IN_0_1"	BOOL	false
25			
26	// Step 6: The emergency stop function or the emergency stop functional block are reset		
27	// Non-safe signals from the PLC to the LPSDO (App-Ack-LPSDO)		
28	Q 11.0 "xExternalSignal_0_I0_1"	BOOL	false
29			
30	// Step 7: The safe output of the LPSDOs is set (is TRUE)		
31	// Status of the safe output/LPSDO (Feedback data)		
32	I 13.0 "xLPSDO_OUT_0_1"	BOOL	false

Table A-4 VAT\_SBT\_Island\_1a\_en variable table



### A 4 Variable table of external signals

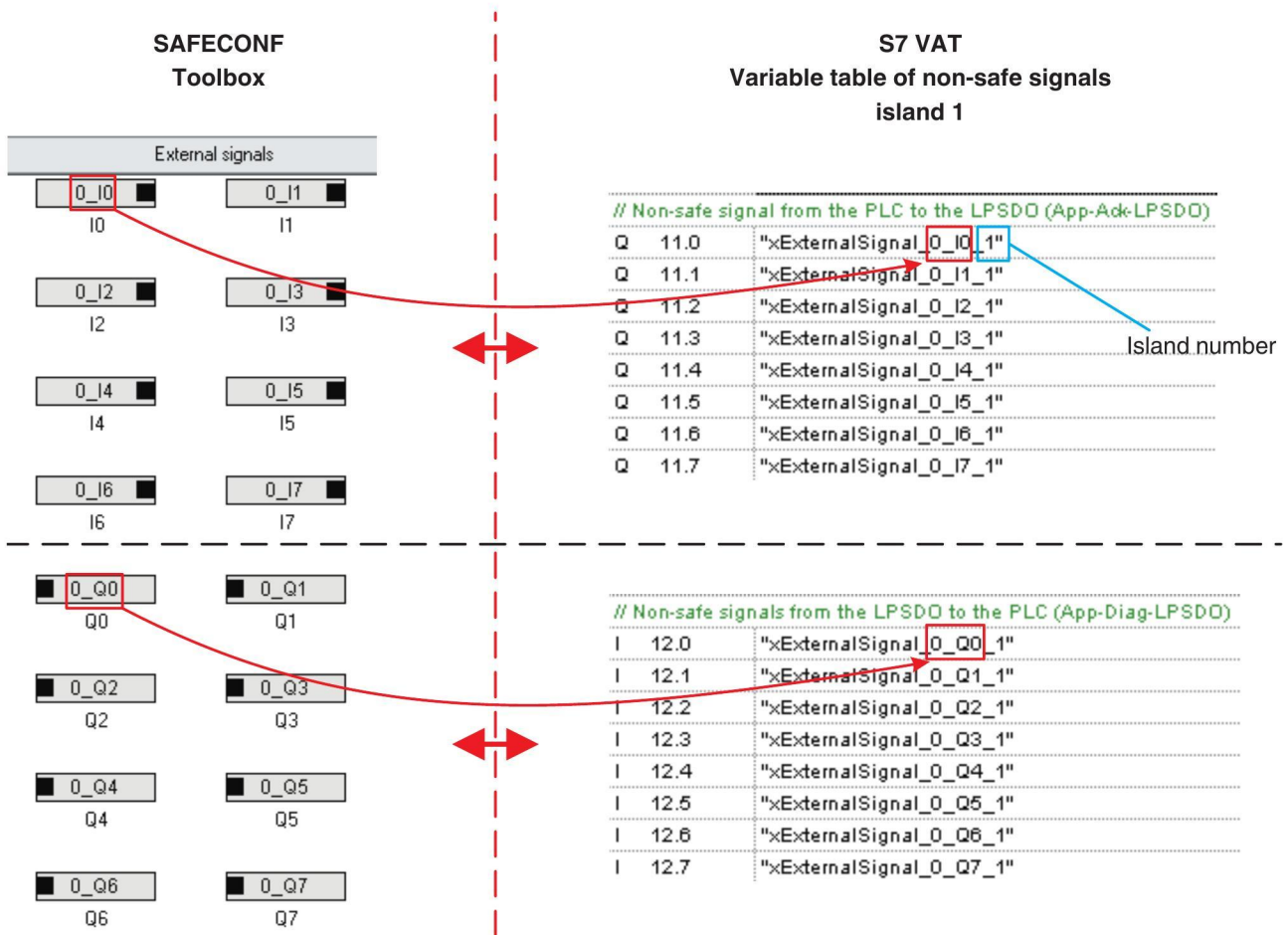


Table A-5 Relationship between the "External signals" toolbox in SAFECONF and the variable table for the non-safe signals in the S7

## A 5 Variable table

// Status of the safe inputs PSDI (1) (Data x)		
I 52.0	"xPSDI(1)_IN_0_1"	BOOL
I 52.1	"xPSDI(1)_IN_1_1"	BOOL
I 52.2	"xPSDI(1)_IN_2_1"	BOOL
I 52.3	"xPSDI(1)_IN_3_1"	BOOL
I 52.4	"xPSDI(1)_IN_4_1"	BOOL
I 52.5	"xPSDI(1)_IN_5_1"	BOOL
I 52.6	"xPSDI(1)_IN_6_1"	BOOL
I 52.7	"xPSDI(1)_IN_7_1"	BOOL
// Status of the safe outputs/LPSDO (Feedback data)		
I 13.0	"xLPSDO_OUT_0_1"	BOOL
I 13.1	"xLPSDO_OUT_1_1"	BOOL
I 13.2	"xLPSDO_OUT_2_1"	BOOL
I 13.3	"xLPSDO_OUT_3_1"	BOOL
I 13.4	"xLPSDO_OUT_4_1"	BOOL
I 13.5	"xLPSDO_OUT_5_1"	BOOL
I 13.6	"xLPSDO_OUT_6_1"	BOOL
I 13.7	"xLPSDO_OUT_7_1"	BOOL
// Non-safe signals from the LPSDO to the PLC (App-Diag-LPSDO)		
I 12.0	"xExternalSignal_0_Q0_1"	BOOL
I 12.1	"xExternalSignal_0_Q1_1"	BOOL
I 12.2	"xExternalSignal_0_Q2_1"	BOOL
I 12.3	"xExternalSignal_0_Q3_1"	BOOL
I 12.4	"xExternalSignal_0_Q4_1"	BOOL
I 12.5	"xExternalSignal_0_Q5_1"	BOOL
I 12.6	"xExternalSignal_0_Q6_1"	BOOL
I 12.7	"xExternalSignal_0_Q7_1"	BOOL
// Non-safe signal from the PLC to the LPSDO (App-Ack-LPSDO)		
Q 11.0	"xExternalSignal_0_I0_1"	BOOL
Q 11.1	"xExternalSignal_0_I1_1"	BOOL
Q 11.2	"xExternalSignal_0_I2_1"	BOOL
Q 11.3	"xExternalSignal_0_I3_1"	BOOL
Q 11.4	"xExternalSignal_0_I4_1"	BOOL
Q 11.5	"xExternalSignal_0_I5_1"	BOOL
Q 11.6	"xExternalSignal_0_I6_1"	BOOL
Q 11.7	"xExternalSignal_0_I7_1"	BOOL
// Enable principle for the individual safe LPSDO outputs (Data-LPSDO)		
Q 12.0	"xEnable_OUT0_Ch1_1"	BOOL
Q 12.1	"xEnable_OUT0_Ch2_1"	BOOL
Q 12.2	"xEnable_OUT1_Ch1_1"	BOOL
Q 12.3	"xEnable_OUT1_Ch2_1"	BOOL
Q 12.4	"xEnable_OUT2_Ch1_1"	BOOL
Q 12.5	"xEnable_OUT2_Ch2_1"	BOOL
Q 12.6	"xEnable_OUT3_Ch1_1"	BOOL
Q 12.7	"xEnable_OUT3_Ch2_1"	BOOL

Table A-6 Variable table for safe, non-safe and acknowledgement variables

## A 6 Revision history

Revision	Date	Contents
00	02/2010	First publication
01		Not published in English
02	06/2010	Revision
		Page 2-1 Note about documentation on the safety modules added.
		Figure 3-1 BK corrected
		Page 3-1 IL PB BK DP/V1-PAC inserted
		Page 3-3 Error code inserted
		Figure 3-11 "Double-channel" under Evaluation replaced with "single-channel"
		Figure 3-12 "Double-channel" under Evaluation replaced with "single-channel"
		Page 3-11 Table 3-1 extended Note on DIP switches extended
		Figure 3-23 New (Figure was missing)
		Figure 3-24 New (Figure was missing)
		Section 3.3.6 Added (PROFINET)
		Section 3.3.7 Network description corrected
		Table 3-2 IB IL 24 LPSDO 8-PAC: res. -> Mode 1
		Figure 3-28 Replaced
		Figure 3-30 Replaced
		Figure 3-33 Replaced
		German text in screenshots replaced with English text

