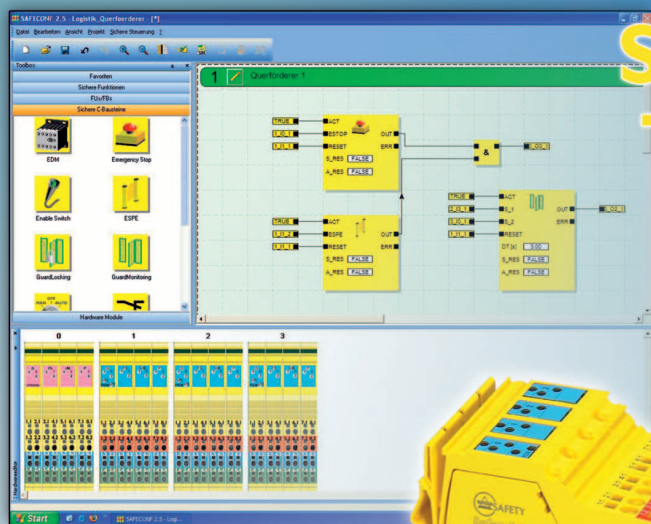


AUTOMATION



SafetyBridge Technology V2



Quick start guide

UM QS EN SAFETYBRIDGE V2 - PC WORX

Order No.: —

Configuring a SafetyBridge V2 system on a
Phoenix Contact controller using PC WORX

AUTOMATION

Quick start guide

Configuring a SafetyBridge V2 system on a Phoenix Contact controller using PC WORX

2011-07-18

Designation: UM QS EN SAFETYBRIDGE V2 - PC WORX

Revision: 00

Order No.: —

This user manual is valid for:

| Designation | Order No. | Revision |
|-------------------------|-----------|------------|
| IB IL 24 LPSDO 8 V2-PAC | 2700606 | 00/100/100 |
| IB IL 24 PSDI 8-PAC | 2985688 | 00/201 |
| IB IL 24 PSDO 8-PAC | 2985631 | 01/200/100 |
| IB IL 24 PSDOR 4-PAC | 2985864 | 00/200/100 |
| IB IL 24 PSDO 4/4-PAC | 2916793 | 01/200/100 |

Please observe the following notes

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 application programmers and software engineers, who are familiar with the safety concepts of automation technology and applicable standards.

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 messages 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, could 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.

Please observe the following notes

General terms and conditions of use for technical documentation

Phoenix Contact reserves the right to alter, correct, and/or improve the technical documentation and the products described in the technical documentation at its own discretion and without giving prior notice, insofar as this is reasonable for the user. The same applies to any technical changes that serve the purpose of technical progress.

The receipt of technical documentation (in particular data sheets, installation instructions, manuals, etc.) does not constitute any further duty on the part of Phoenix Contact to furnish information on alterations to products and/or technical documentation. Any other agreement shall only apply if expressly confirmed in writing by Phoenix Contact. Please note that the supplied documentation is product-specific documentation only and that you are responsible for checking the suitability and intended use of the products in your specific application, in particular with regard to observing the applicable standards and regulations. Although Phoenix Contact makes every effort to ensure that the information content is accurate, up-to-date, and state-of-the-art, technical inaccuracies and/or printing errors in the information cannot be ruled out. Phoenix Contact does not offer any guarantees as to the reliability, accuracy or completeness of the information. All information made available in the technical data is supplied without any accompanying guarantee, whether expressly mentioned, implied or tacitly assumed. This information does not include any guarantees regarding quality, does not describe any fair marketable quality, and does not make any claims as to quality guarantees or guarantees regarding the suitability for a special purpose.

Phoenix Contact accepts no liability or responsibility for errors or omissions in the content of the technical documentation (in particular data sheets, installation instructions, manuals, etc.).

The aforementioned limitations of liability and exemptions from liability do not apply, in so far as liability must be assumed, e.g., according to product liability law, in cases of premeditation, gross negligence, on account of loss of life, physical injury or damage to health or on account of the violation of important contractual obligations. Claims for damages for the violation of important contractual obligations are, however, limited to contract-typical, predictable damages, provided there is no premeditation or gross negligence, or that liability is assumed on account of loss of life, physical injury or damage to health. This ruling does not imply a change in the burden of proof to the detriment of the user.

Please observe the following notes

Statement of legal authority

This manual, including all illustrations contained herein, is copyright protected. Use of this manual by any third party is forbidden. Reproduction, translation, and public disclosure, as well as electronic and photographic archiving or alteration requires the express written consent of Phoenix Contact. Violators are liable for damages.

Phoenix Contact reserves all rights in the case of patent award or listing of a registered design, in as far as this concerns software of Phoenix Contact that meets the criteria of technicality or has technical relevance. Third-party products are always named without reference to patent rights. The existence of such rights shall not be excluded.

Windows 3.x, Windows 95, Windows 98, Windows NT, Windows 2000, Windows XP, and Windows Vista are trademarks of the Microsoft Corporation.

All other product names used are trademarks of the respective organizations.

How to contact us

Internet

Up-to-date information on Phoenix Contact products and our Terms and Conditions can be found on the Internet at:

www.phoenixcontact.com.

Make sure you always use the latest documentation.

It can be downloaded at:

www.phoenixcontact.net/catalog.

Subsidiaries

If there are any problems that cannot be solved using the documentation, please contact your Phoenix Contact subsidiary.

Subsidiary contact information is available at www.phoenixcontact.com.

Published by

PHOENIX CONTACT GmbH & Co. KG
 Flachmarktstraße 8
 32825 Blomberg
 Germany
 Phone +49 - (0) 52 35 - 3-00
 Fax +49 - (0) 52 35 - 3-4 12 00

PHOENIX CONTACT
 P.O. Box 4100
 Harrisburg, PA 17111-0100
 USA
 Phone +1-717-944-1300

Should you have any suggestions or recommendations for improvement of the contents and layout of our manuals, please send your comments to

tecdoc@phoenixcontact.com.

Table of contents

| | | |
|-------|---|------|
| 1 | Introduction..... | 1-1 |
| 1.1 | Purpose of this manual | 1-1 |
| 1.2 | Requirements | 1-1 |
| 1.3 | Additional documentation | 1-2 |
| 1.4 | Safety hotline..... | 1-2 |
| 2 | Integration of a SafetyBridge system in three steps | 2-1 |
| 2.1 | Safety with the SafetyBridge system | 2-1 |
| 2.2 | Integration of a SafetyBridge system | 2-2 |
| 3 | Example..... | 3-1 |
| 3.1 | Example bus configuration | 3-1 |
| 3.2 | Step 1: Configure the safety logic (SAFECONF) | 3-3 |
| 3.2.1 | Creating a project | 3-3 |
| 3.2.2 | Configuring the safety island | 3-6 |
| 3.2.3 | Parameterizing I/O channels of a safety island | 3-8 |
| 3.2.4 | Configuring the safety function | 3-11 |
| 3.2.5 | Exporting the configuration and parameter data record | 3-14 |
| 3.3 | Step 2: Integrate the SafetyBridge modules into the controller (PC WORX)..... | 3-15 |
| 3.3.1 | Creating/opening a project | 3-15 |
| 3.3.2 | Importing FDCML files | 3-15 |
| 3.3.3 | Inserting SafetyBridge modules into the bus configuration | 3-17 |
| 3.3.4 | Importing the library | 3-18 |
| 3.3.5 | Adding SafetyBridge operation to the standard application program | 3-20 |
| 3.3.6 | Copying the configuration and parameter data record in binary file (*.BIN) output format into the standard controller | 3-27 |
| 3.3.7 | Importing the configuration and parameter data record into the PC WORX project in the PCWORX (*.ST) output format | 3-28 |
| 3.3.8 | Loading the standard user program into the standard controller | 3-30 |
| 3.4 | Step 3: Install the SafetyBridge modules | 3-31 |
| 3.5 | Overall safety validation..... | 3-34 |
| A | Appendix | A-1 |

SAFETYBRIDGE V2 - PC WORX

1 Introduction

1.1 Purpose of this manual

This quick start guide uses an example to describe how you integrate SafetyBridge modules in a PROFINET or INTERBUS system into a Phoenix Contact controller.

The document does not describe the complete configuration of a system or how to create a project under PC WORX. 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 (PROFINET or INTERBUS)
- The components used in your application
- The PC WORX software used
- The Microsoft Windows operating system

Hardware

To start up the example system, the following hardware is required:

- Programming device/PC
- Controller (ILC ...) used in the example project (see "Example bus configuration" on page 3-1)
- Bus couplers and I/O devices used in the example project (see "Example bus configuration" on page 3-1)

Software

To start up the example system, the following software is required:

- Microsoft Windows
- PC WORX Version 5 or later (part of the Software-Suite 1.4 Service Pack 3.44)
- Phoenix Contact FDCML files for the bus couplers used
These can be found on the Internet at www.phoenixcontact.net/catalog.
- Phoenix Contact library files for SafetyBridge
These can be found on the Internet at www.phoenixcontact.net/catalog.
- SAFECNF from Phoenix Contact (software for configuration of the safety logic and for parameterization of the channels); Version 2.7.1 or later
This can be found on the Internet at www.phoenixcontact.net/catalog.

SAFETYBRIDGE V2 - PC WORX

1.3 Additional documentation

Comprehensive information about PROFINET is available on the Internet at www.profibus.com.

Please refer to the documentation for the PC WORX 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 for the SafetyBridge modules used must be strictly observed.

| Description | Type | Order no. |
|---|-------------------------------|-----------|
| User manual: Inline module with integrated safety logic and safe digital outputs | UM EN IB IL 24 LPSDO 8 V2-PAC | 2910910 |
| User manual: Inline module with safe digital inputs | UM EN IB IL 24 PSDI 8-PAC | 2910457 |
| User manual: Inline module with safe digital outputs | UM EN IB IL 24 PSDO 8-PAC | 2910538 |
| User manual: Inline module with safe digital relay outputs | UM EN IB IL 24 PSDOR 4-PAC | 2910729 |
| User manual: Inline module with safe digital outputs | UM EN IB IL 24 PSDO 4/4-PAC | 2910554 |

The documentation for Phoenix Contact devices is available on the Internet at 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

2 Integration of a SafetyBridge system in three steps

2.1 Safety with the SafetyBridge system

Within a SafetyBridge system, safety can only be ensured by using the modules of this system (IB IL 24 LPSDO 8 V2-PAC and 1 to 5 satellites). None of the other components of the entire system are safety-related components. Errors on non-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.



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

SAFETYBRIDGE V2 - PC WORX

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 ... |
|----------|--|----------------|--|
| 1 | Configure the safety logic (SAFECONF) | | |
| | <ul style="list-style-type: none"> – Configure the safety island (island number, satellites) – Parameterize I/O channels of a safety island – Configure the safety functions – Export the configuration and parameter data record | Yes | page 3-6 page 3-8 page 3-11 page 3-14 |
| 2 | Integrate the SafetyBridge modules into the controller (PC WORX) | | |
| | <ul style="list-style-type: none"> – Create a project – If necessary, import FDCML files – Insert SafetyBridge modules into the bus configuration – Import library – Add SafetyBridge operation to the standard application program – Integrate configuration and parameter data record <ul style="list-style-type: none"> – Option 1: Load the configuration and parameter data record into the standard controller in binary file (*.BIN) output format – Option 2: Load the configuration and parameter data record into the PC WORX project in PCWORX (*.ST) output format – Load the standard user program into the standard controller | No | Documentation for the controllers and PC WORX page 3-3 page 3-15 page 3-17 page 3-18 page 3-20 page 3-27 page 3-28 page 3-30 |
| 3 | Install SafetyBridge modules | | |
| | Install SafetyBridge modules (hardware) (including island and satellite number settings) | No | page 3-31 and 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.

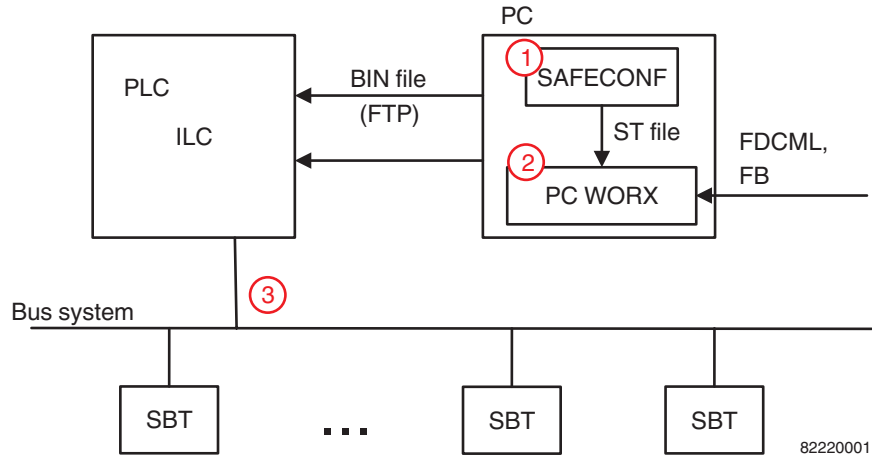


Figure 2-1 Components and steps for integration of a SafetyBridge system

Key:

- 1 Step 1: Configure the safety logic
- 2 Step 2: Integrate the SafetyBridge modules into the controller
- 3 Step 3: Install the SafetyBridge modules

| | |
|------------|---|
| PC | PC with SAFECONF and PC WORX |
| SAFECONF | Software for configuration of the safety logic (configuration of the safety function and parameterization of the channels) |
| PC WORX | Engineering software |
| BIN file | Configuration and parameter data record created with SAFECONF; this must be copied into the standard controller via FTP |
| ST file | Configuration and parameter data record created with SAFECONF; this must be imported into the PC WORX project; Structured Text according to IEC 61131 |
| ILC | ILC controller |
| FDCML | FDCML files of the modules used; If the modules are not contained in the device catalog, the corresponding FDCML files must be imported |
| FB | Phoenix Contact function blocks <ul style="list-style-type: none"> - Download of the configuration and parameter data record from the standard controller to the IB IL 24 LPSDO 8 V2-PAC - Cyclical routing of the SafetyBridge data flow |
| Bus system | PROFINET or INTERBUS |
| SBT | Modules of the SafetyBridge system |

SAFETYBRIDGE V2 - PC WORX

3 Example

This section describes the use of SafetyBridge modules in INTERBUS. Only the safety modules will be considered. You can use standard modules in the Inline station, but these will not be dealt with here.

3.1 Example bus configuration

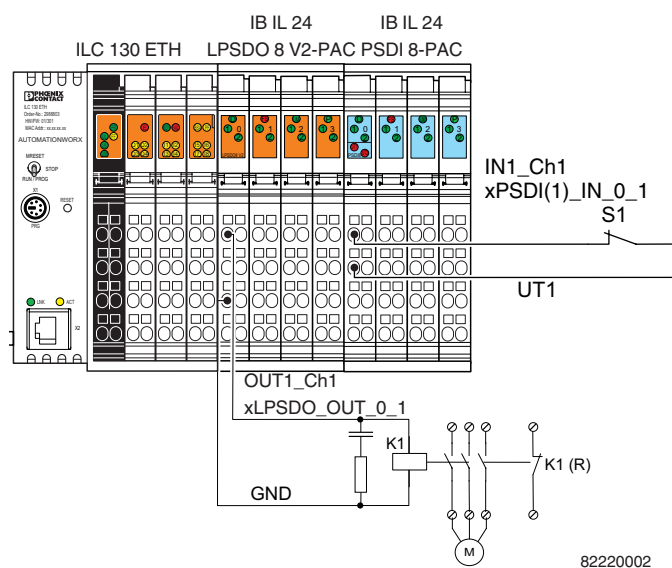


Figure 3-1 Example bus configuration

Key:

- S1 Safety switch; emergency stop (EStop/button S1)
- K1 (R) Forcibly guided 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

Controller

ILC 130 ETH

Controller

Safety modules

IB IL 24 LPSDO 8 V2-PAC

Inline module with integrated safety logic and safe digital outputs

IB IL 24 PSDI 8-PAC

Inline module with safe digital inputs

SAFETYBRIDGE V2 - PC WORX

Devices that can be used as an alternative:**Controllers for PROFINET and INTERBUS**

| | |
|------------------|-------------------------|
| ILC 1xx, ILC 3xx | Inline controller |
| RFC 470 PN 3TX | Remote Field Controller |

Bus couplers for PROFINET and INTERBUS

| | |
|----------------------------|---------------------------------|
| IBS IL 24 BK ... | Inline bus coupler for INTERBUS |
| IL PN BK DI8 DO4-2TX-PAC | Inline bus coupler for PROFINET |
| IL PN BK DI8 DO4-2SCRJ-PAC | Inline bus coupler for PROFINET |

I/O modules

| | |
|-----------------------|---|
| IB IL 24 PSDO 8-PAC | Inline module with safe digital outputs |
| IB IL 24 PSDOR 4-PAC | Inline module with safe digital relay outputs |
| IB IL 24 PSDO 4/4-PAC | Inline module with safe digital outputs |



This and other example projects can be downloaded from the Internet at www.phoenixcontact.net/catalog.

For the file names and details of how to handle the example projects, please consult "Example projects" on page A-1.

3.2 Step 1: Configure the safety logic (SAFECONF)



This section only describes the steps that are essential for the SafetyBridge system. Therefore, you will not find all of the screen views shown here. If you have any questions about SAFECONF, please refer to the online help or software documentation.



If you are using the example project, you can even skip step 1. The configuration and parameter data record which needs to be created as part of this step is contained within the example project as the file PROJECT1.BIN.

3.2.1 Creating a project

Use SAFECONF to configure and parameterize the SafetyBridge system. A configuration and parameter data record is subsequently created and saved as a BIN or ST file for work involving a Phoenix Contact controller.

Table 3-1 Output formats for the configuration and parameter data record for work involving PC WORX

| Output format | Handling the file/Advantages |
|----------------------------|---|
| Binary file (*.BIN) | <p>Copy the binary file (*.BIN) into the controller via FTP.</p> <p>The PC WORX project with the standard user program and the binary file with the safety logic are part of the overall project.</p> <p>If a change is made to the SAFECONF project, a new binary file is created. Copy this file into the controller via FTP again. If the changes only affect the safety logic and hence only the SAFECONF project, the existing PC WORX project does not need to be readjusted.</p> |
| PCWORX (*.ST) | <p>Import the PC WORX file (*.ST) with Structured Text according to IEC 61131 into the PC WORX project.</p> <p>The PC WORX project is the overall project. It contains both the standard user program and the imported safety logic.</p> <p>If a change is made to the SAFECONF project, a new file is created in the PCWORX output format. Once this has been done, reimport this file into PC WORX and generate an overall project. This means that whenever a change is made to your safety logic in SAFECONF, you must also adjust the PC WORX project.</p> |

Both options have their advantages and disadvantages. Select the procedure that is most appropriate for your circumstances.

SAFETYBRIDGE V2 - PC WORX

- Open the SAFECNF software (Version 2.7.1 or later).
- Create a new project with the Project Wizard. To do this, select "File... New Project".
- Specify the name and storage location for the project.

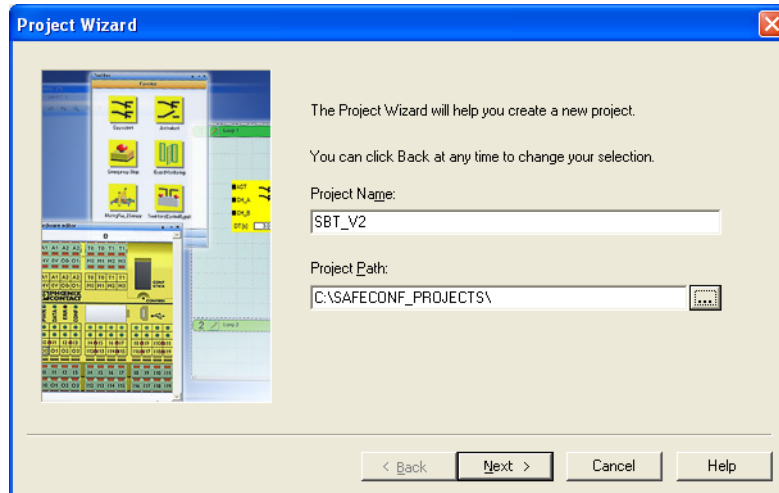


Figure 3-2 Creating the project name and path

- Select the IB IL 24 LPSDO 8 V2-PAC master device for working in the SafetyBridge system.

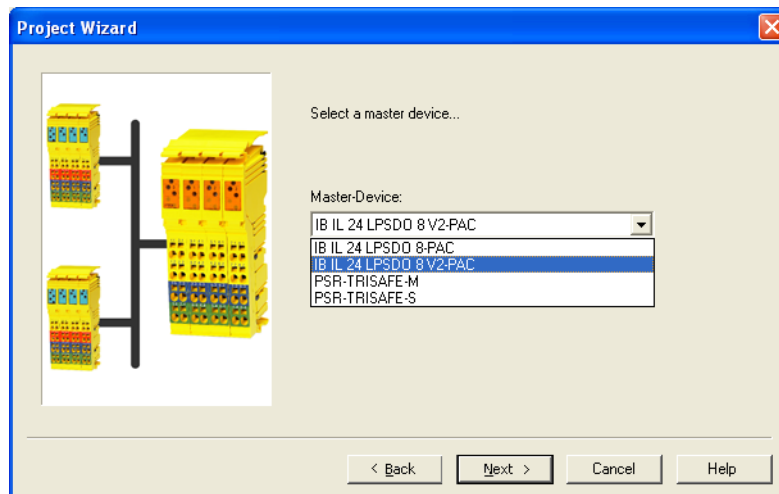


Figure 3-3 Selecting IB IL 24 LPSDO 8 V2-PAC

- Select the file format in which the configuration and parameter data record is to be output (see Table 3-1).
If you are working with PC WORX, you need the binary file or PCWORX output format (for the ST file with Structured Text).

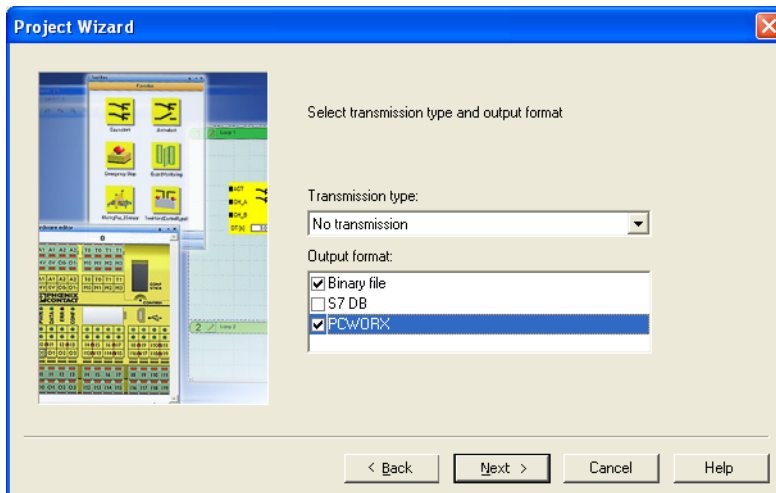


Figure 3-4 Selecting the output format

- Enter a complete description of the project.

Table 3-2 Describing the project

| Field | Contents |
|-------------|-------------------------|
| Description | Maximum of 4 characters |
| Version | Maximum of 4 characters |

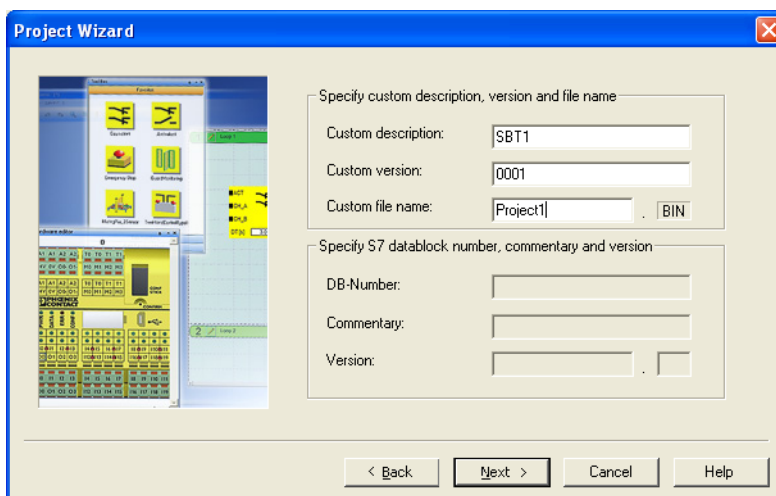


Figure 3-5 Describing the project

SAFETYBRIDGE V2 - PC WORX

- Complete the project creation process.

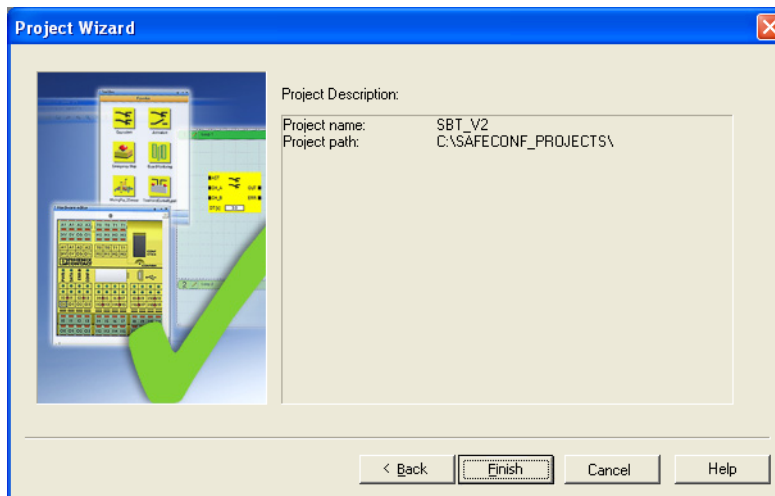


Figure 3-6 Completing the project creation process

3.2.2 Configuring the safety island



In SAFECONF, devices are shown in the form of a safety island view rather than as a network view. Configuration of a safety island is independent of whether it is associated with one Inline station or distributed across several Inline stations.

When the project is completed, a window opens prompting you to enter the island number.

- Enter an island number (1 in the example).

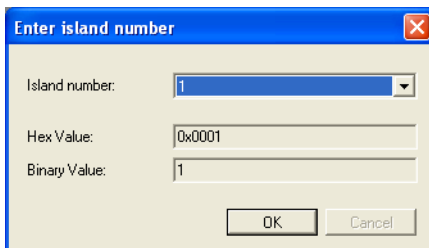


Figure 3-7 Entering an island number

- Specify a password of at least six characters for the project (123456 in the example).

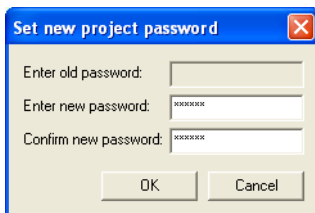


Figure 3-8 Specifying a password

Example

- Configure the hardware structure of the SafetyBridge island. To do this, use drag and drop to move the relevant modules from the "Hardware" toolbox into the hardware editor.
- When you insert (or delete) a device, you receive a corresponding message containing a note about synchronism. Activate the checkbox and acknowledge the window by selecting OK.

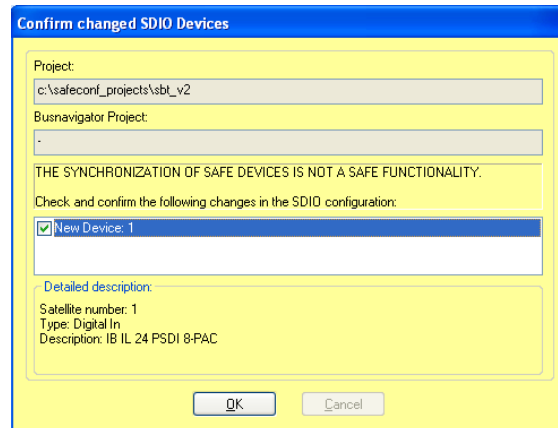


Figure 3-9 Message window for inserting or deleting devices

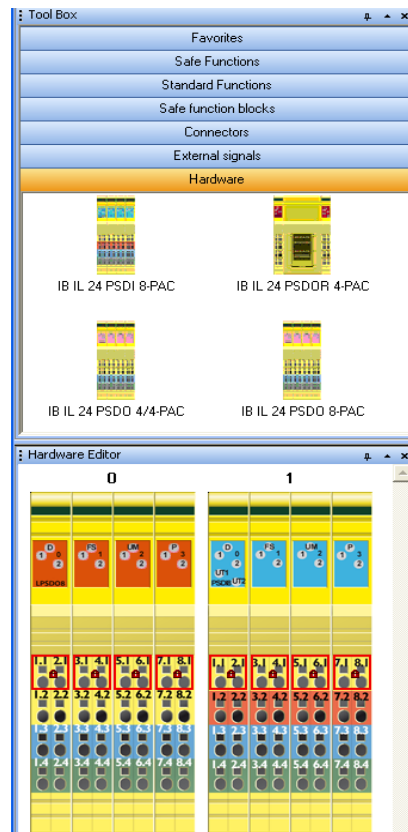


Figure 3-10 Specifying the number of IB IL 24 PSDI 8-PAC

SAFETYBRIDGE V2 - PC WORX

3.2.3 Parameterizing I/O channels of a safety island



NOTE:

With a two-channel assignment, use the same parameterization for both channels.

Parameterize the input and output channels of the SafetyBridge modules. There are two options:

- 1 In the hardware editor, double-click on the module. This opens the window for parameterizing the entire module.
- 2 In the hardware editor, double-click on a terminal point. This opens the window for parameterizing the selected terminal point.

Parameterize the modules in accordance with the information in the user manual. This is available on the Internet at www.phoenixcontact.net/catalog or as online help via the module context menu (right-click on the module in the hardware editor).

- Parameterize the output channels of the IB IL 24 LPSDO 8 V2-PAC.

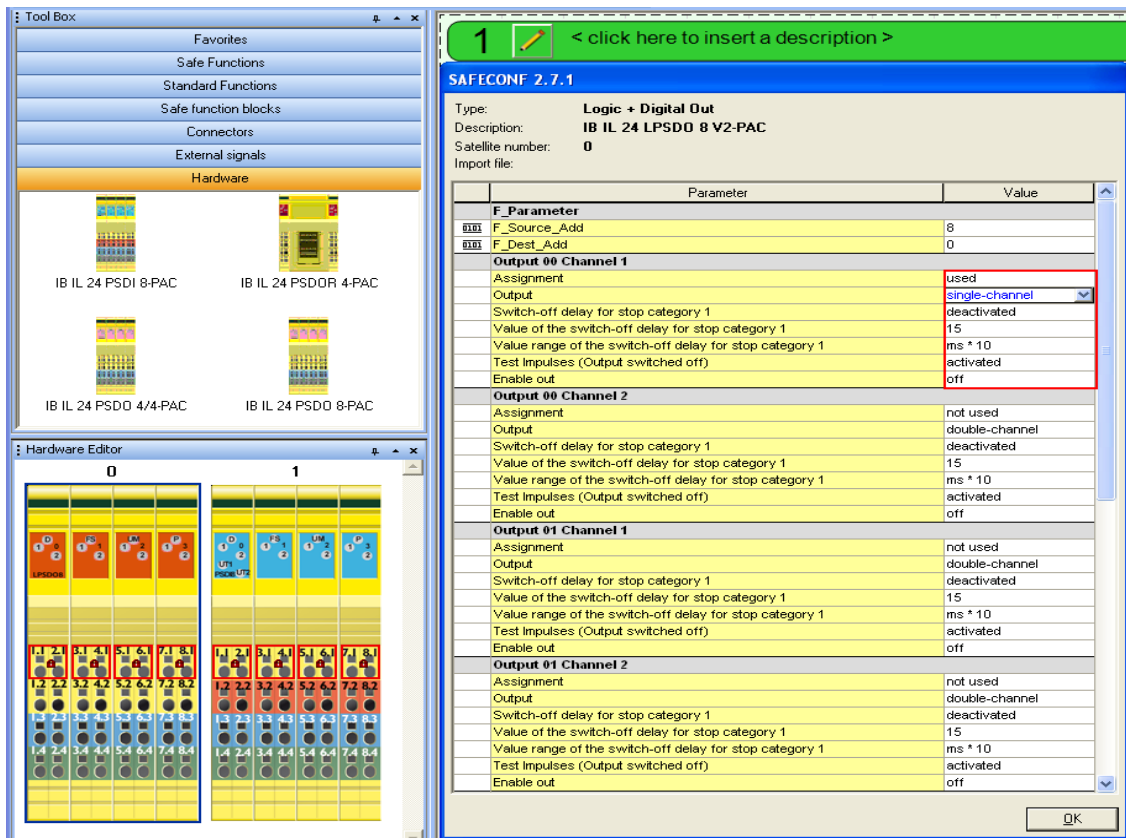


Figure 3-11 Parameterization of IB IL 24 LPSDO 8 V2-PAC: Output 00 channel 1 (here: Parameterization by double-clicking on the module)



The values F_Source_Add and F_Dest_Add are automatically entered. F_Source_Add is derived from the island number, F_Dest_Add is derived from the island and satellite number.

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

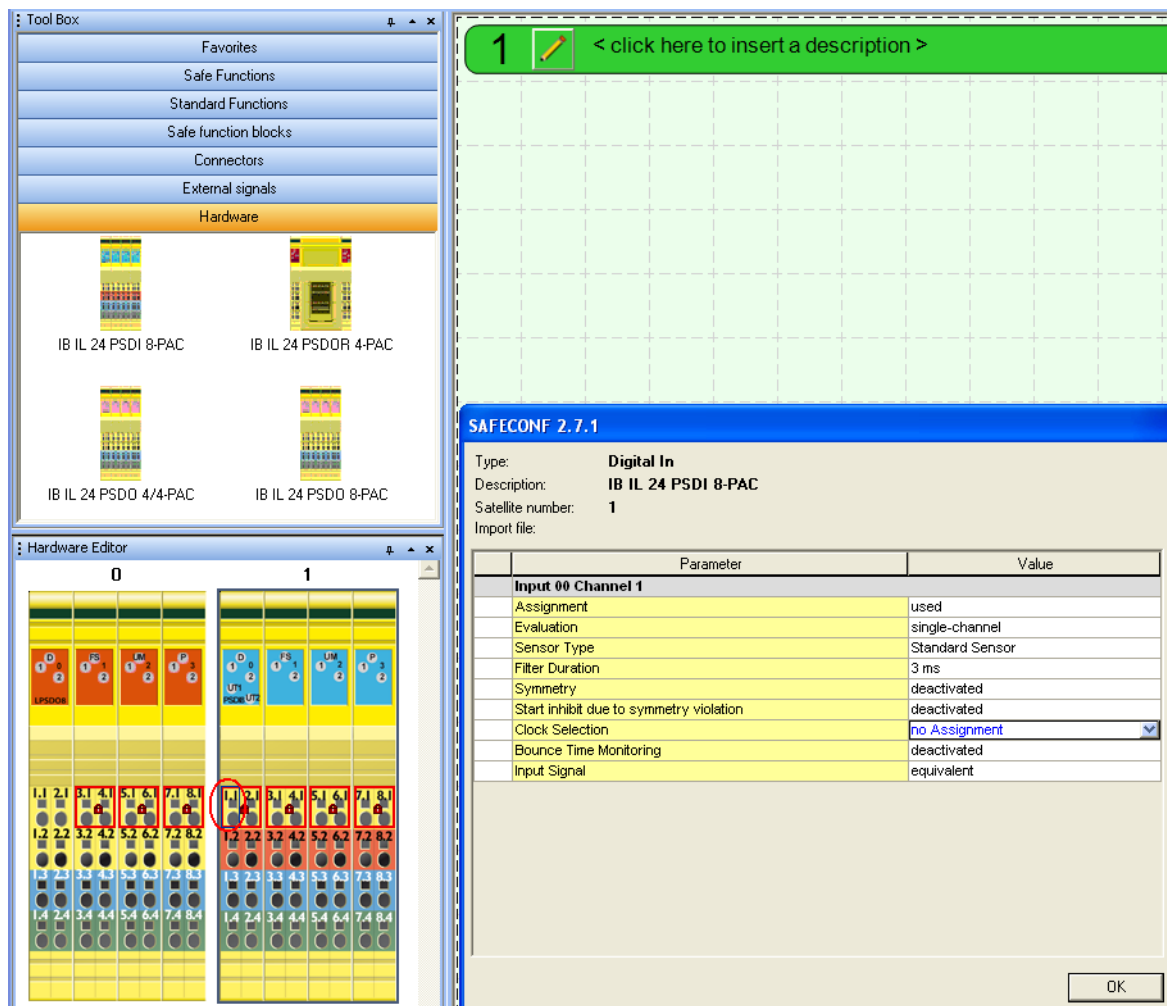


Figure 3-12 Parameterization of IB IL 24 PSDI 8-PAC: Input 00 channel 1 (here: Parameterization by double-clicking on the input at terminal point 1.1)



Inputs or outputs with two-channel parameterization are indicated by a lock.

SAFETYBRIDGE V2 - PC WORX



You can specify the F_WD_Time (in ms) in accordance with your application. The default value is 150 ms. Also refer to "Revision history" on page A-8.

You can only set the clock configuration for the channels by clicking on the module.

SAFECONF 2.7.1

Type: **Digital In**
 Description: **IB IL 24 PSDI 8-PAC**
 Satellite number: **1**
 Import file:

| Parameter | Value |
|---|------------------|
| F_Parameter | |
| F_Source_Add | 8 |
| F_Dest_Add | 9 |
| F_WD_Time | 150 |
| Clock Configuration | |
| Configuration | Clock UT1/UT2 on |
| Input 00 Channel 1 | |
| Assignment | used |
| Evaluation | single-channel |
| Sensor Type | Standard Sensor |
| Filter Duration | 3 ms |
| Symmetry | deactivated |
| Start inhibit due to symmetry violation | deactivated |
| Clock Selection | no Assignment |
| Bounce Time Monitoring | deactivated |
| Input Signal | equivalent |
| Input 00 Channel 2 | |
| Assignment | not used |
| Evaluation | double-channel |
| Sensor Type | Standard Sensor |
| Filter Duration | 3 ms |
| Symmetry | deactivated |
| Start inhibit due to symmetry violation | deactivated |
| Clock Selection | UT2 |

OK

Figure 3-13 Automatically entered data and clock configuration

3.2.4 Configuring the safety function

- Configure the safety function.

Configure the safety function by using drag and drop to move the elements out of the individual areas of the toolbox and into the workspace.

For this purpose, various sources are available for safe and non-safe signals. In the example, this means the following sources:

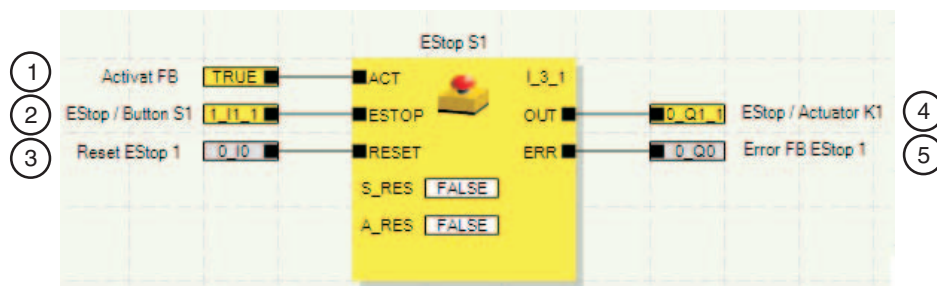


Table 3-3 Sources of the safe signals

- 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 V2-PAC hardware editor
- 5 "External Signals" toolbox; non-safe signals into the standard controller

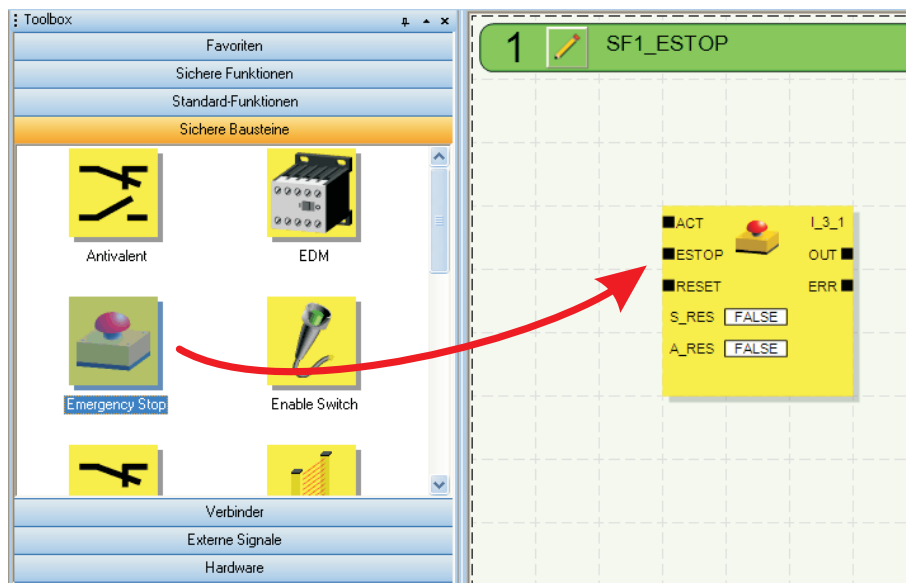


Figure 3-14 Inserting a function block from the "Safe Blocks" toolbox

SAFETYBRIDGE V2 - PC WORX

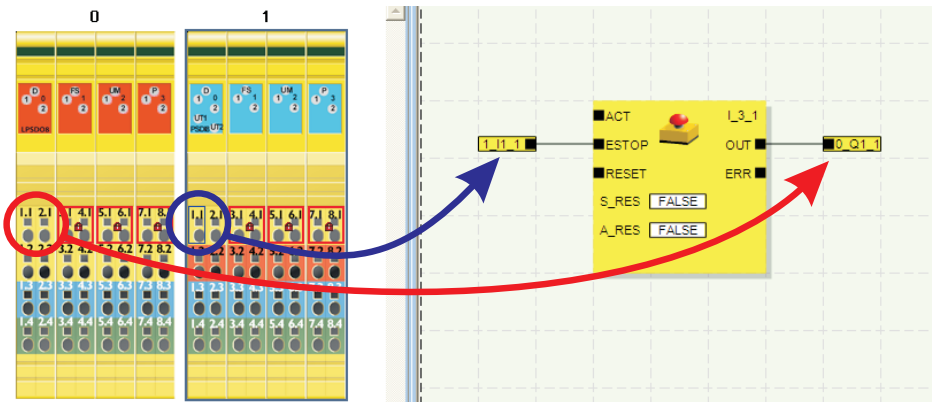


Figure 3-15 Inserting a safe output from the hardware editor using drag and drop



When you use drag and drop to place the safety module terminal point directly onto a function block input or output (as illustrated for an output in Figure 3-15), the connecting line is created automatically.

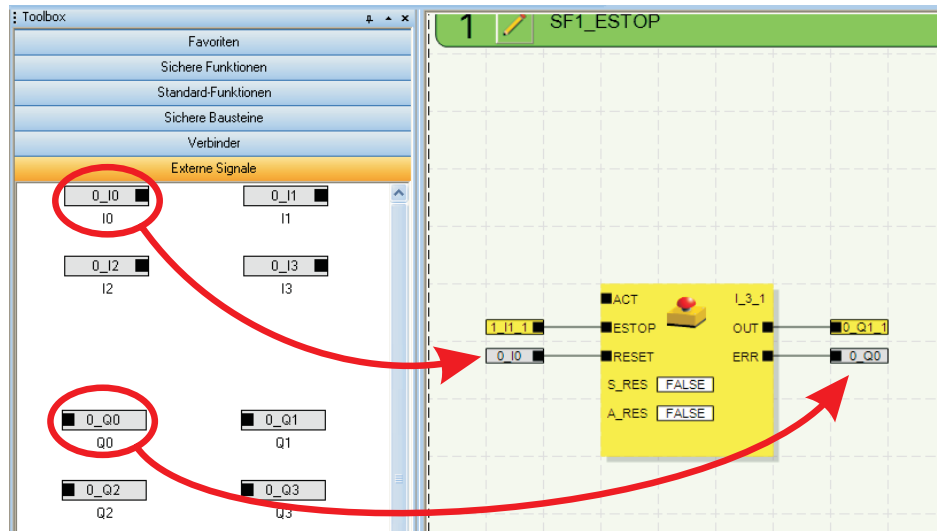


Figure 3-16 Inserting an external signal from the "External Signals" toolbox



Hover the mouse over an external signal to display the corresponding tool tip.



Figure 3-17 Tool tip

Example

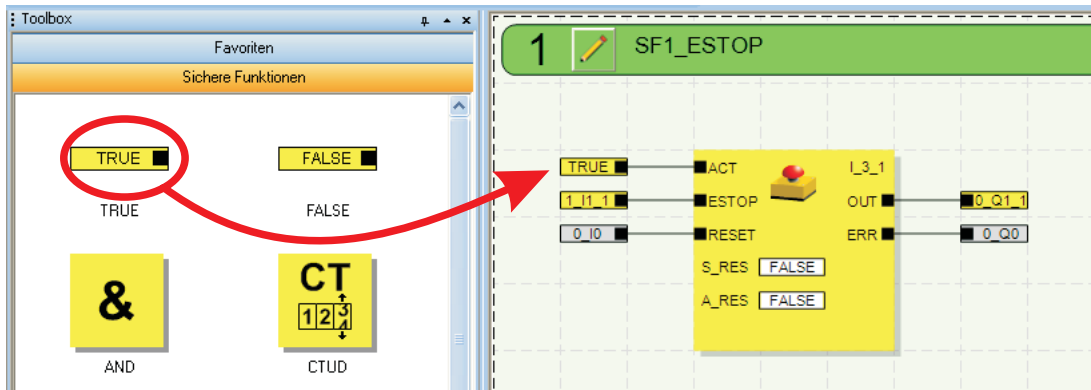


Figure 3-18 Inserting a safe function (TRUE) from the "Safe Function" toolbox

- You can add comments to both the function block and the signals. To do this, select the "Insert Comment" command in the context menu (right mouse button) for the function block or a signal. Once you have done this, move the comment to the desired position.

You can see the full, commented safety function for this example in Figure 3-19

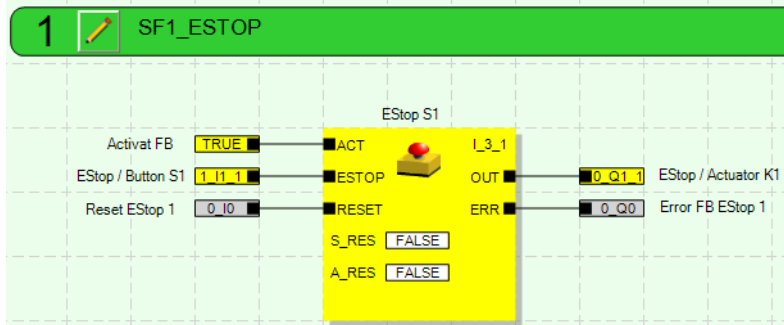


Figure 3-19 Configured safety function with comments

SAFETYBRIDGE V2 - PC WORX

3.2.5 Exporting the configuration and parameter data record

- Check the project. To do this, select "Project... Check Project".

A message window opens to display the progress of the check.

Once the check is complete, the amount of program memory taken up by the program is displayed.

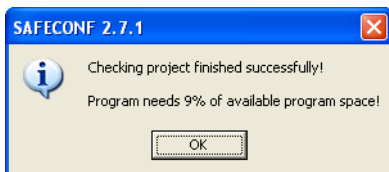


Figure 3-20 Program memory used

If the check is completed without errors, the configuration and parameter data record is created as a *.BIN or *.ST file. These are saved in the path that you have entered for the project (see Figure 3-2 on page 3-4) in the FileOutput folder.

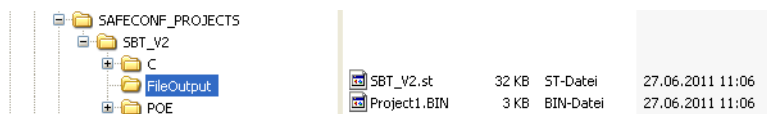


Figure 3-21 BIN file and ST file

Depending on which file you use, the BIN file is subsequently loaded into the standard controller (see "In step 1, the file was created in binary file output format as a *.BIN file and saved under FileOutput in the project path (see Figure 3-21 on page 3-14)." on page 3-27) or alternatively the ST file is imported into the PC WORX project ("Importing the configuration and parameter data record into the PC WORX project in the PCWORX (*.ST) output format" on page 3-28).

This completes step 1 "Configure the safety logic".

3.3 Step 2: Integrate the SafetyBridge modules into the controller (PC WORX)

To integrate the SafetyBridge modules into the network, proceed in accordance with the PC WORX documentation. This section only explains fundamental steps that are relevant to the SafetyBridge system.

3.3.1 Creating/opening a project

- In PC WORX, create a new project or open an existing project.
For the example under consideration, create the project with an ILC 130 ETH.

3.3.2 Importing FDCML files

If the devices that you are using are not visible in the PC WORX device catalog, import the necessary FDCML files.



Make sure you use the latest FDCML file. It can be found on the Internet at www.phoenixcontact.net/download.

- In the case of the standard installation, copy the device-specific FDCML file into the directory C:\Program Files\Common Files\FDCML\xxx\Phoenix Contact.
xxx = System (e.g., INTERBUS, PROFINET).
- In PC WORX, select "Phoenix Contact" in the "Device Catalog" window.
- Open the context menu and select "Import Device...".
- Select the device description file.

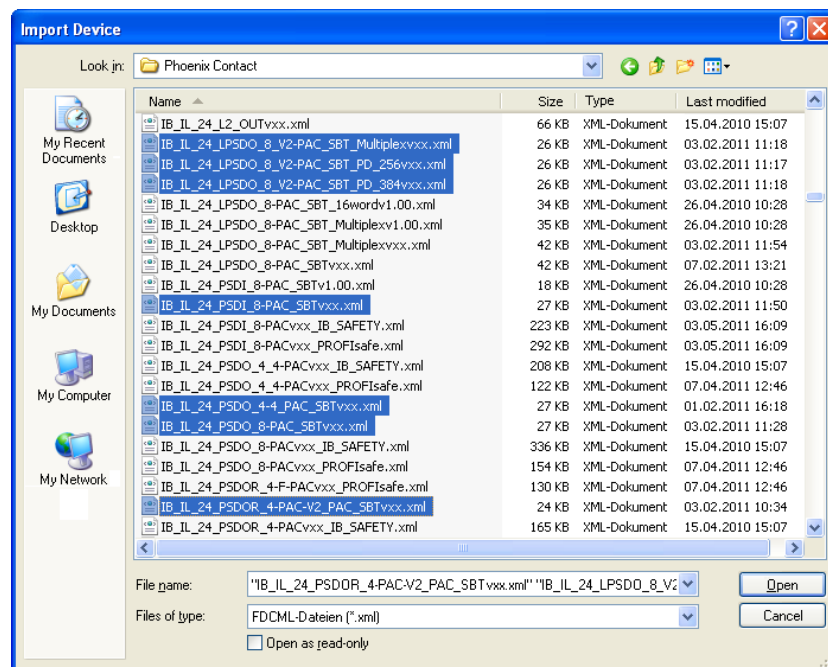


Figure 3-22 Importing the device description file

SAFETYBRIDGE V2 - PC WORX

The message window indicates whether the device has been imported successfully.

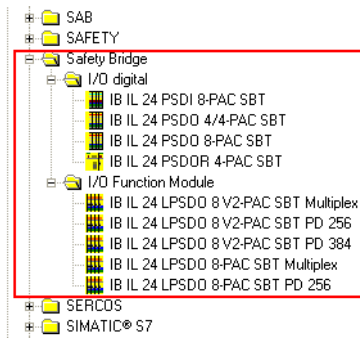


Figure 3-23 Device catalog with the devices required for SafetyBridge

3.3.3 Inserting SafetyBridge modules into the bus configuration

- Insert the required SafetyBridge modules (here: 1 IB IL 24 LPSDO 8 V2-PAC module and 1 IB IL 24 PSDI 8-PAC module) in accordance with the bus configuration (see example station structure in Figure 3-1 on page 3-1). To do this, select the relevant device in the device catalog under "Phoenix Contact/SAFETY/I/O digital" and use drag and drop to move it into the bus configuration under the INTERBUS nodes.

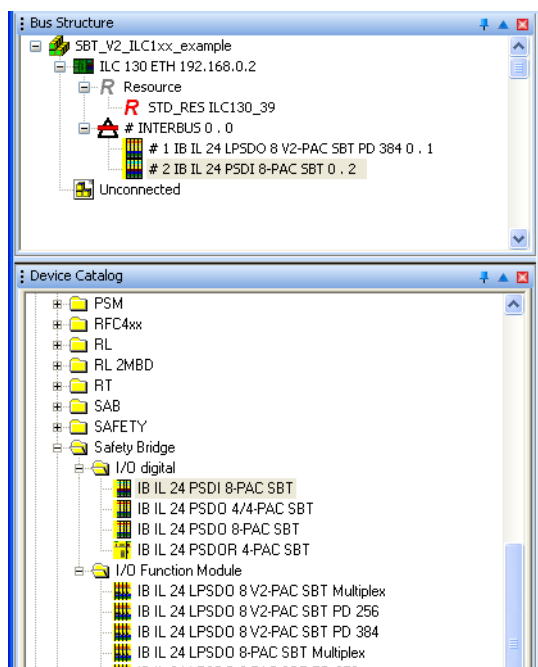


Figure 3-24 Inserting modules into the bus configuration

For the purpose of the example, the complete bus configuration is shown in Figure 3-24.



NOTE: Malfunction caused by incorrectly selected FDCML file

Select the device description for the IB IL 24 LPSDO 8 V2-PAC that corresponds to your application (see Table 3-4).

Table 3-4 FDCML file according to mode

| Operating mode | Maximum number of satellites | Mode | Process data width in bits | FDCML file | Function block SBT_V2_Operate |
|--------------------------|------------------------------|------|--|--|-------------------------------|
| SafetyBridge 16 words | 3 | 1 | 16 words x 16 bits/word = 256 bits | IB IL 24 LPSDO 8 V2-PAC SBT PD 256 | SBT_V2_Operate3 |
| SafetyBridge 24 words | 5 | 2 | 24 words x 16 bits/word = 384 bits | IB IL 24 LPSDO 8 V2-PAC SBT PD 384 | SBT_V2_Operate5 |

SAFETYBRIDGE V2 - PC WORX

- Specify the device properties.

Table 3-5 Required settings for the devices

| Node | Tab | Setting | Example |
|-------------|-------------------|--|---------------|
| Project | Project | First IP address | 192.168.0.2 |
| | | Last IP address | 192.168.0.254 |
| ILC 130 ETH | IP Setting | IP address | 192.168.0.2 |
| INTERBUS | INTERBUS Settings | Baud rate | 2 Mbaud |
| | | Default cycle time (at least 2000 μ s) | 2000 μ s |

3.3.4 Importing the library

You need function blocks in your program to facilitate handling.

- Insert the library in the project tree window under "Libraries". To do this, go to the context menu for "Libraries" and select the command "Insert... User Library".

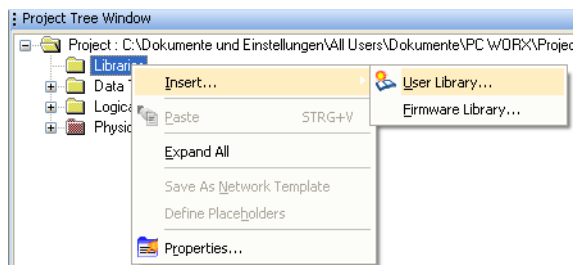


Figure 3-25 Inserting a library

- Select the "SBT_Technology_V1_06.mwt" library.

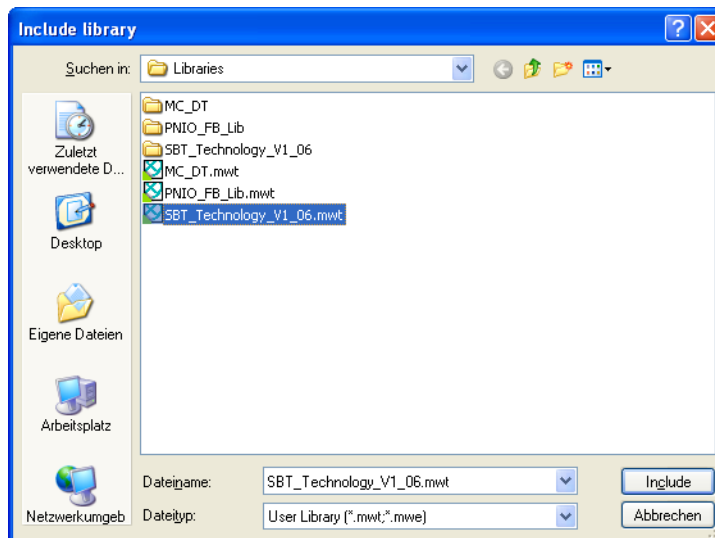


Figure 3-26 Inserting a library

Example

Install this file if it does not already exist. To do this, proceed as follows:

- Download the setup file for the function block library pc_worx_5x_SafetyBridgeTechnology.exe from the Internet at www.phoenixcontact.net/catalog (the the IB IL 24 LPSDO 8 V2-PAC download area).
- Run the setup.
In the case of the standard installation, the library is saved under the path C:\Documents and Settings\All Users\Shared Documents\PCWorx\Libraries.
- Open the installed file SBT_Technology_V1_06.zwt in PC WORX.
- Compile the file by selecting "Make".
- Close the file.
- Now integrate the library as described above.

When the library is integrated, the corresponding function blocks are displayed in the "Editor Wizard" window.

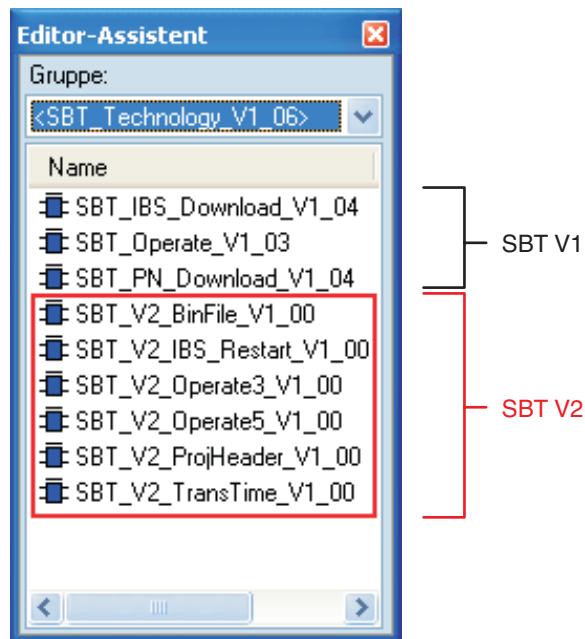


Figure 3-27 Function blocks for SafetyBridge



NOTE: V1 blocks are not compatible

For SafetyBridge V2, only ever use V2 blocks (highlighted in red in Figure 3-27). Never use V1 blocks, since these are not compatible with SafetyBridge V2.

SAFETYBRIDGE V2 - PC WORX

3.3.5 Adding SafetyBridge operation to the standard application program

Add SafetyBridge operation to your standard application program by using the function blocks located in the SBT_Technology_V1_06 library.

- Under "Logical POUs", insert the "SBT_Islands" program.
- Create the cyclic task "SBT_Run" for SafetyBridge operation.
- Add the "SBT_Islands" program instance to the task.

The complete project tree has the following structure.

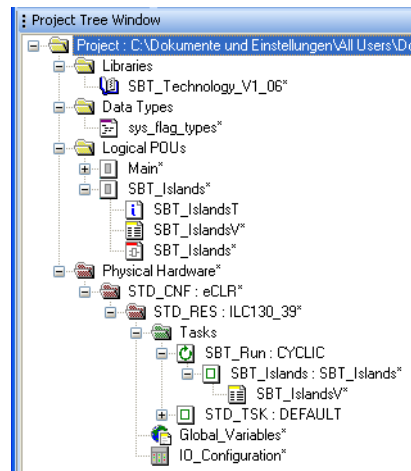


Figure 3-28 Project tree

3.3.5.1 Function block SBT_V2_Operate



Use the function block in accordance with the set mode (see also "Device description files and function block SBT_V2_Operate for mode 1 and mode 2" on page 3-33).

The function block performs the following functions:

- Downloads the configuration and parameter data record from the standard controller to the IB IL 24 LPSDO 8 V2-PAC.
- Performs cyclical routing of the SafetyBridge data flow.

Where there are several SafetyBridge islands, an SBT_V2_Operate block is required for each island.

- Select the "SBT_Islands" program.
- Insert the "SBT_V2_Operate" function block.
- The udtSBT structure variable is used for data exchange between the function blocks of the program.

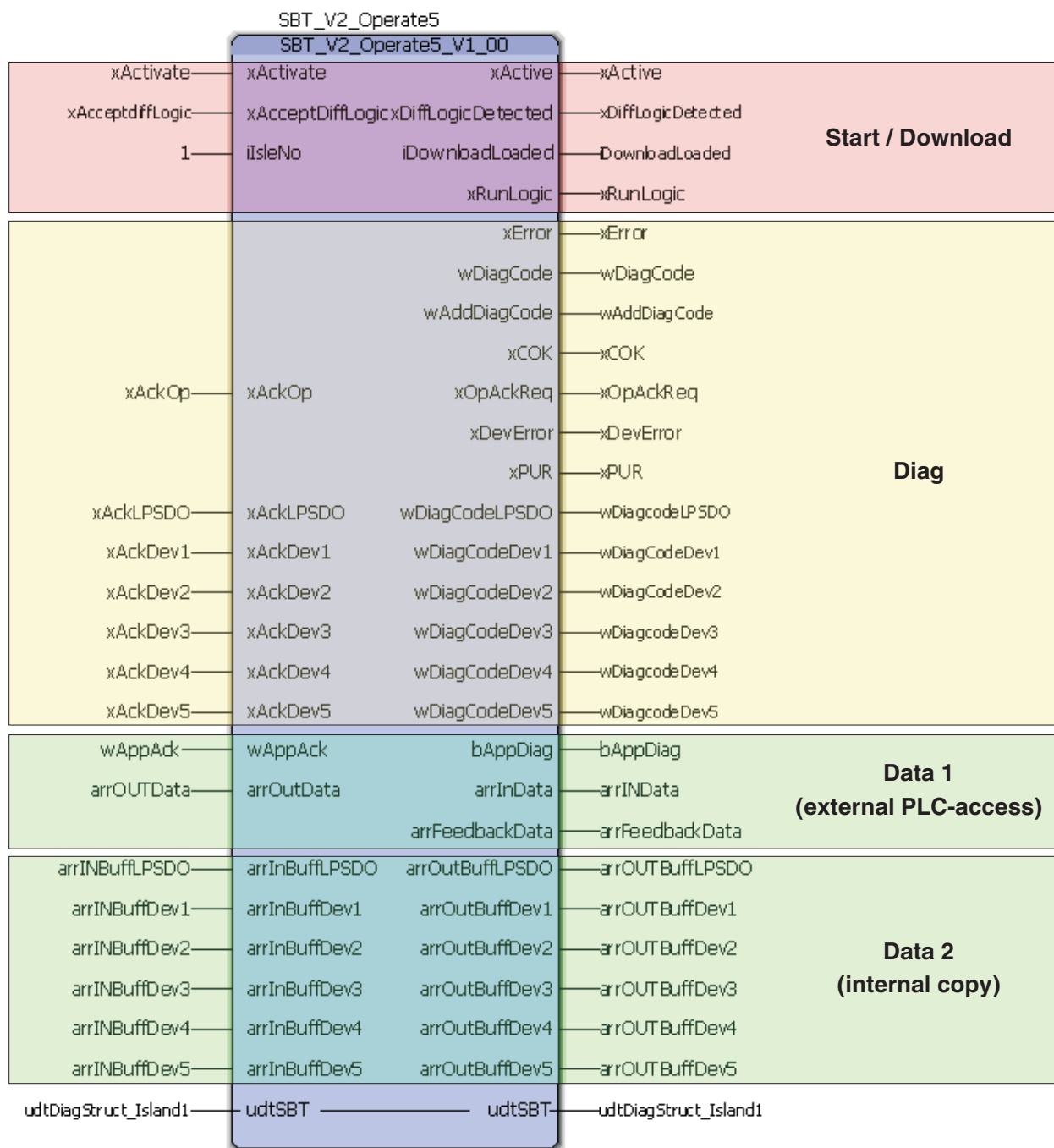


Figure 3-29 Function block SBT_V2_Operate with the area functions and all the variables



For a description of the input and output variables, please consult the online block help in PC WORX.

SAFETYBRIDGE V2 - PC WORX



When the block is inserted, all variables are arranged from top to bottom without any gaps. For a better overview, we recommend moving the variables in accordance with Figure 3-29.

- Create the variables.
 - Select the uSBT variable as a local variable.
 - The inputs and outputs with "arrINBuff..." and "arrOUTBuff..." are process data. VarExternalPG is selected as the use. Select the variable properties in accordance with Figure 3-30.

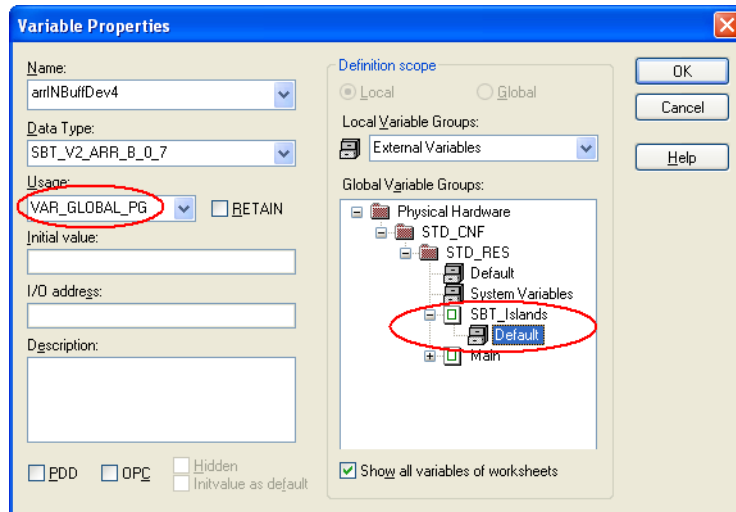


Figure 3-30 Properties of the arr..Buff.. variable

3.3.5.2 Function block SBT_V2_BinFile_V1_00



This function block is only required if you have saved the safety logic from SAFECNF in binary file (*.BIN) output format and wish to load it to the controller via FTP.

The function block performs the following functions:

- Specifies the file for the configuration and parameter data record of the SAFECNF safety project.

Where there are several SafetyBridge islands, a safety project and hence also an SBT_V2_BinFile block are required for each respective island.

- Select the "SBT_Islands" program.
- Insert the function block.
- Link the udtSBT structure variable with the same variables as for the SBT_V2_Operate block.

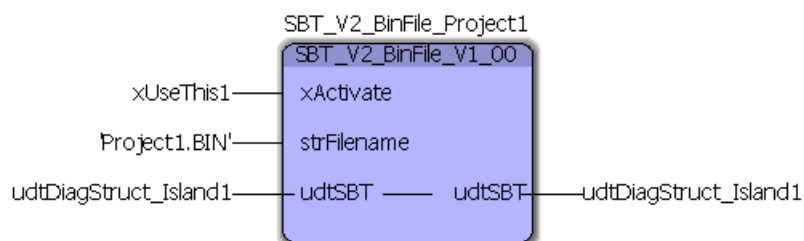


Figure 3-31 Function block SBT_V2_BinFile

SAFETYBRIDGE V2 - PC WORX

3.3.5.3 Function block SBT_V2_IBS_Restart_V1_00



This function block is only required if you are using an ILC 1xx.

If you do not use this block with an ILC 1xx, you will get a bus error once a voltage reset has been performed. A bus restart is required.

The function block performs the following functions:

- Restarts the local bus.

Insert the block once per controller.

- Select the "SBT_Islands" program.
- Insert the function block.
- Set the xAuto input variable to TRUE.
- Set the time for the repeated bus start at the tRepeat input variable to approximately T#2s.
- Link the input variables MASTER_DIAG_STATUS_REG_DTC and MASTER_DIAG_STATUS_REG_RUN with the corresponding system variables.

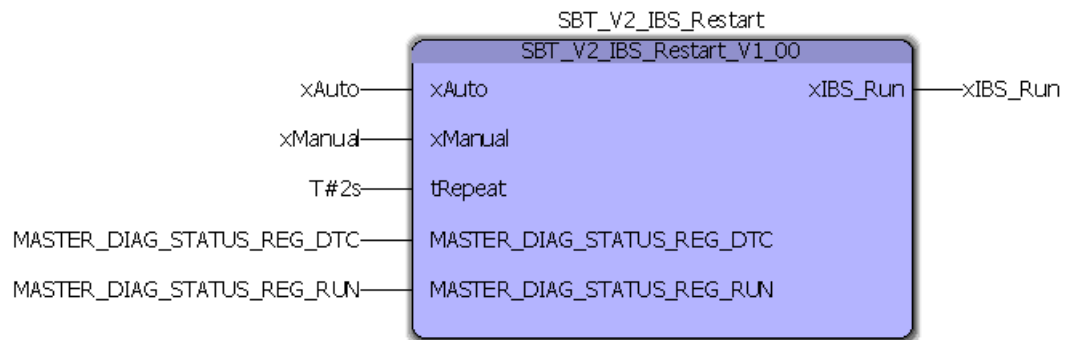


Figure 3-32 Function block SBT_V2_Restart

3.3.5.4 Function block SBT_V2_ProjHeader_V1_00



You can use this function block as an option. It is not required to operate the safety island.

The function block performs the following functions:

- Supplies information about the safety project created in SAFECONF.

Use the block once per island.

- Select the "SBT_Islands" program.
- Insert the function block.
- Link the udtSBT structure variable with the same variables as for the SBT_V2_Operate block.

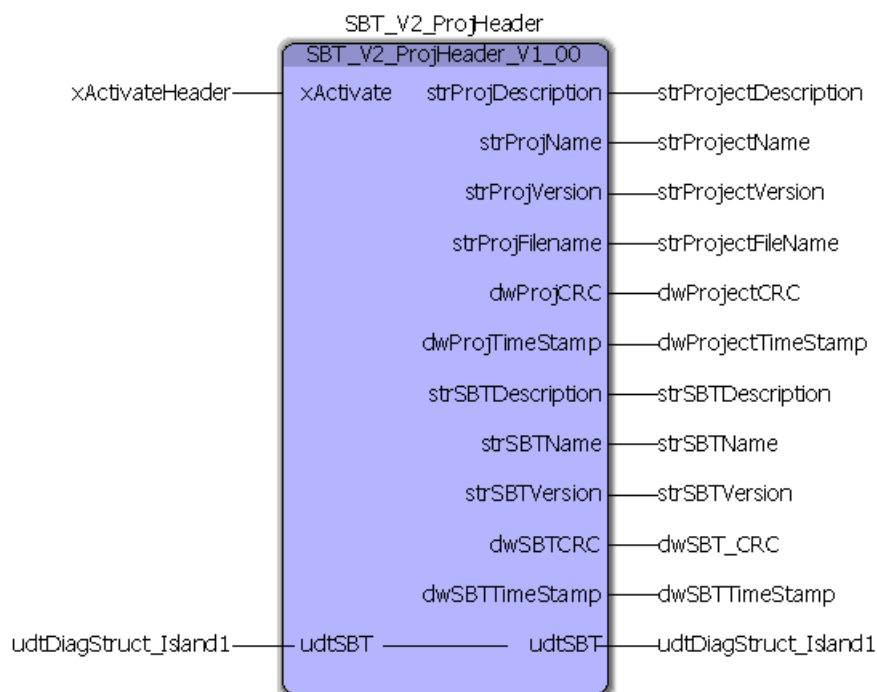


Figure 3-33 Function block SBT_V2_ProjHeader

SAFETYBRIDGE V2 - PC WORX

3.3.5.5 Function block SBT_V2_TransTime_V1_00



You can use this function block as an option. It is not required to operate the safety island.

The function block performs the following functions:

- Measures the transmission time between the SafetyBridge island devices.

Use the block once per island.

- Select the "SBT_Islands" program.
- Insert the function block.
- Link the udtSBT structure variable with the same variables as for the SBT_V2_Operate block.

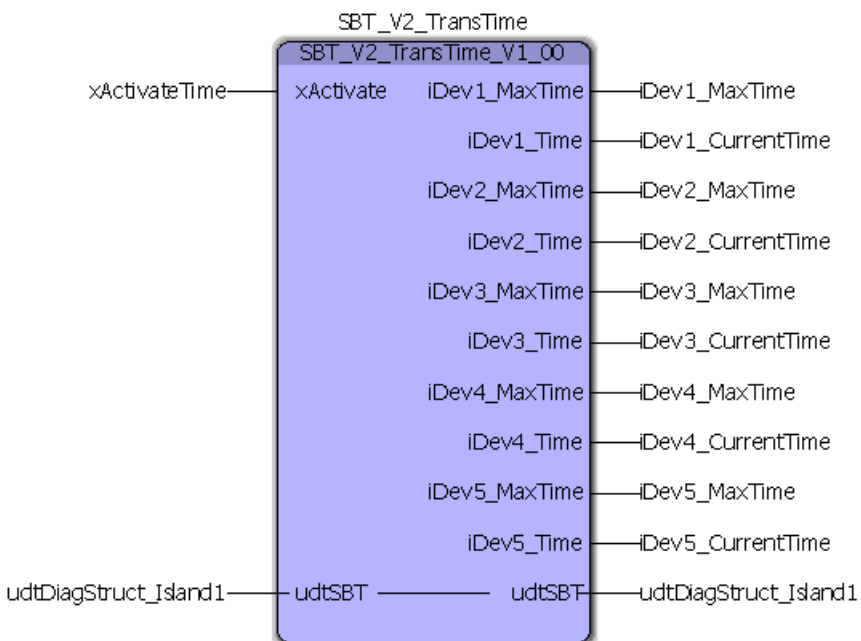


Figure 3-34 Function block SBT_V2_TransTime

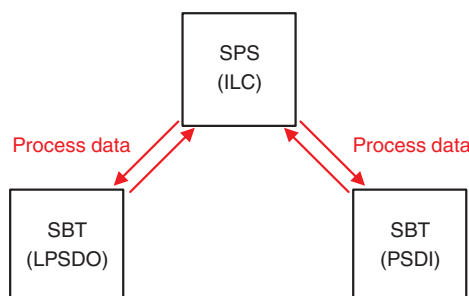


Figure 3-1 Times for exchanging process data between the controller and the bus devices of the SafetyBridge islands

Example

Each SafetyBridge island bus device monitors the process data transmission time to ensure that transmission is not disturbed. For this purpose, the watchdog time (F_WD_Time) is set in SAFECNF on each bus device.

To ensure availability, the watchdog time (F_WD_Time) set in SAFECNF must be greater than the transmission times.

The function block displays the current transmission time (CurrentTime) and the maximum recorded transmission time (MaxTime) for each satellite.

You have now integrated all required and optional function blocks into the project.

3.3.6 Copying the configuration and parameter data record in binary file (*.BIN) output format into the standard controller



This step is only required if you are working with the binary file output format.

Ensure that you have integrated the SBT_V2_BinFile function block into the PC WORX program (see "Function block SBT_V2_BinFile_V1_00" on page 3-23).

In step 1, the file was created in binary file output format as a *.BIN file and saved under FileOutput in the project path (see Figure 3-21 on page 3-14).

- Copy the *.BIN file (PROJECT1.BIN in the example).
- Establish a connection to the controller in Explorer via FTP.
In the example: ftp://192.168.0.2.
- Copy the PROJECT1.BIN file into the root directory of the controller.

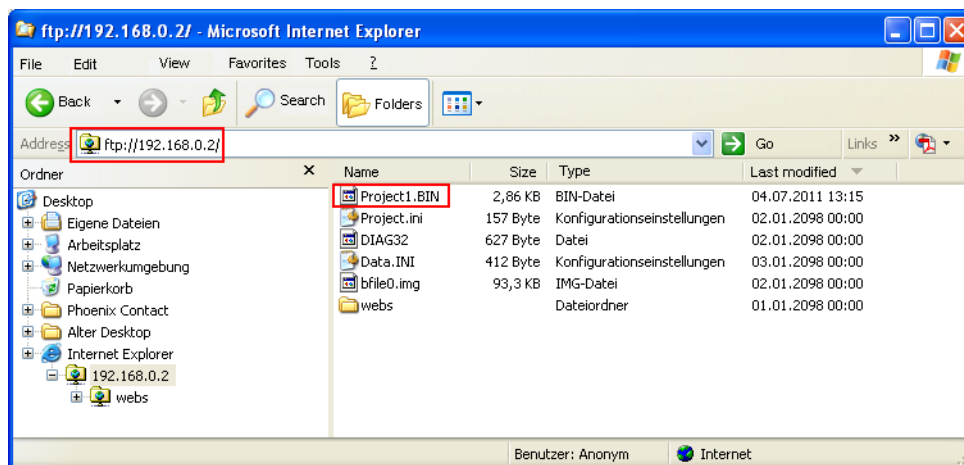


Figure 3-35 PROJECT1.BIN copied to the controller via FTP



Ensure that the file is saved in the folder highlighted in Figure 3-35. If a different folder opens, repeat your selection.

SAFETYBRIDGE V2 - PC WORX

3.3.7 Importing the configuration and parameter data record into the PC WORX project in the PCWORX (*.ST) output format



This step is only required if you are working with the PCWORX output format.

This step enables you to save and manage the safety logic created in SAFECONF as a function block in PC WORX.

In step 1, the *.ST file (e.g., SBT_V2.ST) was created and saved under FileOutput in the project path (see Figure 3-21 on page 3-14).

- Open your project in PC WORX.
- Ensure that you are offline.
- Highlight the "Logical POU" folder.
- Select "File, Import".
- Highlight the entry "Extended IEC 61131-3 Import" and confirm selection with OK.

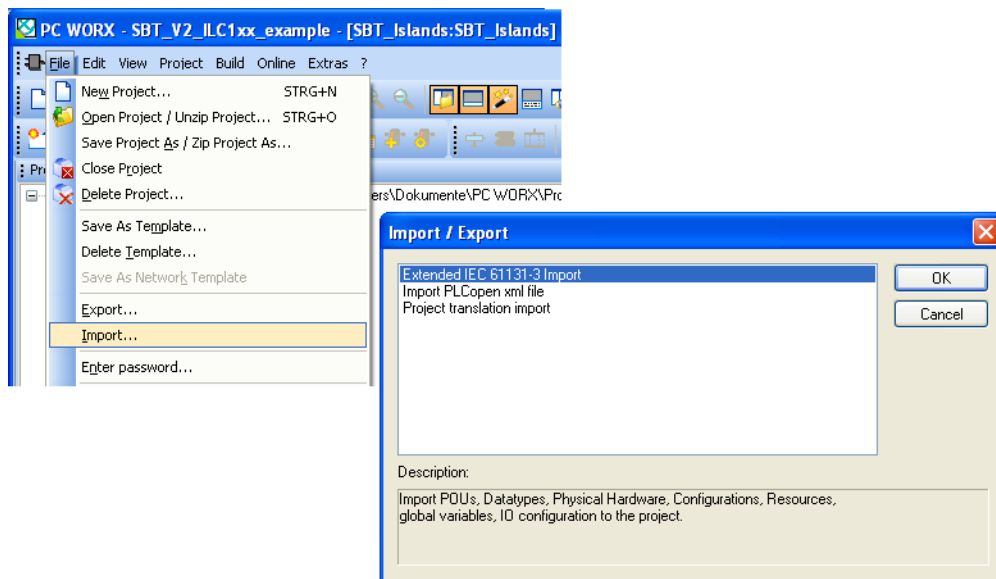


Figure 3-36 "File, Import"

Example

- Select the POU object and confirm your selection with OK.

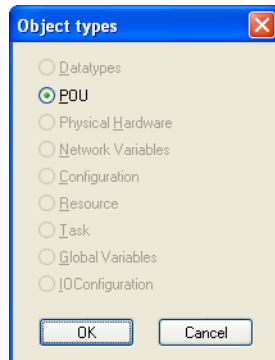


Figure 3-37 POU object

- Highlight the ST file and confirm your selection with OK.

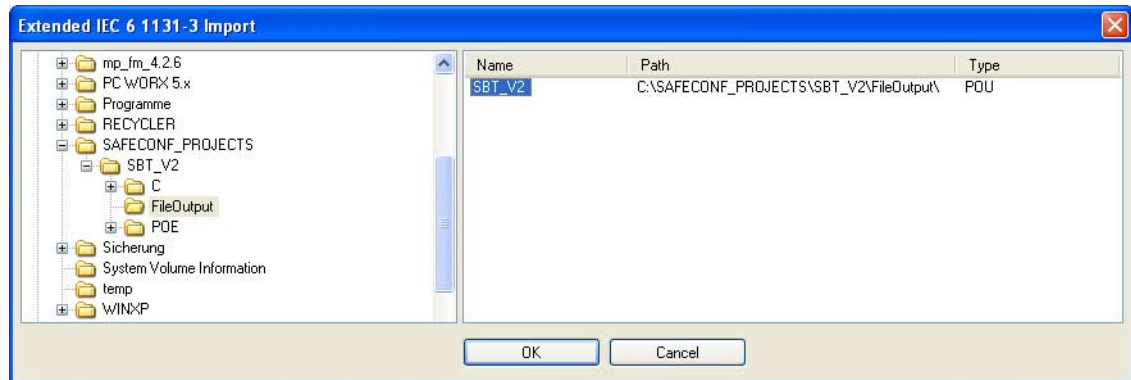


Figure 3-38 Selecting the ST file

If the import is successful, the structure for the SafetyBridge islands (SBTislands) is created under "Logical POUs".

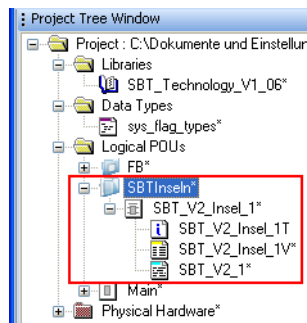


Figure 3-39 POU for SafetyBridge island 1 inserted

Create a safety function and a configuration and parameter data record specific to each SafetyBridge island in SAFECONF. Import each data record in PC WORX. A structure is created for each island.

SAFETYBRIDGE V2 - PC WORX



If an error message appears and the structure is not created, this may be because the name of the file you want to import is too long. If this is the case, give the SAFECNF project a shorter name.

3.3.8 Loading the standard user program into the standard controller

- Select "Make" to compile the project.
- Transmit the project to the controller (Send and Cold Restart in the project control dialog).

This completes step 2 "Integrate the SafetyBridge modules into the controller".

3.4 Step 3: Install the SafetyBridge modules

Install the SafetyBridge modules. To do this, proceed in accordance with the user manuals for the modules used and the Inline Installation Manual (see "Additional documentation" on page 1-2).

Please note the following in particular:



Set the DIP switches **before** assembling the module in the Inline station. The switches cannot be accessed if the safety terminal is built into the Inline station.

The switch numbers correspond to the labeling on the housing and not the numbering on the switch itself.

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

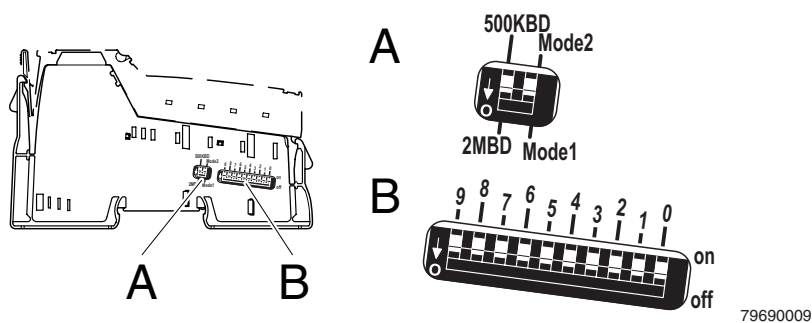


Figure 3-40 DIP switch on the IB IL 24 LPSDO 8 V2-PAC

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



For detailed information on DIP switches, please refer to the documentation for the IB IL 24 LPSDO 8 V2-PAC and IB IL 24 PSDI 8-PAC.

SAFETYBRIDGE V2 - PC WORX

Switch positions of the modules for the example

Table 3-1 Switch positions in the example

| DIP switches | 500 kbaud/ 2 Mbaud | Mode | | | Island number | | | | | Satellite number | | |
|-------------------------|-----------------------|--------|------|------|-----------------------------------|---|---|---|---|------------------|---|---|
| | | | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| IB IL 24 LPSDO 8 V2-PAC | 2 Mbaud | Mode 2 | Res. | Res. | 1 _{dec} | | | | | 0 _{dec} | | |
| | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | | | | | SafetyBridge address: 8dec (8hex) | | | | | | | |
| IB IL 24 PSDI 8-PAC | 2 Mbaud | Mode 2 | Res. | Res. | 1 _{dec} | | | | | 1 _{dec} | | |
| | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| | | | | | SafetyBridge address: 9dec (9hex) | | | | | | | |

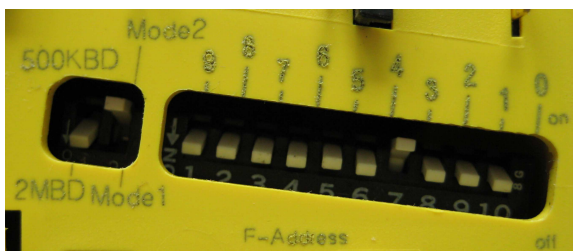


Figure 3-41 Switch position of the IB IL 24 LPSDO 8 V2-PAC



Only use bus devices with a uniform transmission speed within an Inline station (a local bus). It is not possible to operate a mixture of bus devices with different transmission speeds.

Since the SafetyBridge modules of an island can be located in different Inline stations, it may be the case that different transmission speeds (500 kbaud/2 Mbaud) are set for the modules.

Device description files and function block SBT_V2_Operate for mode 1 and mode 2



NOTE: Malfunction caused by incorrectly selected FDCML file or function block
 Ensure that different FDCML files and different SBT_V2_Operate function blocks are available for the different modes.

Table 3-6 FDCML file according to mode

| Operating mode | Maximum number of satellites | Mode | Process data width in bits | FDCML file | Function block SBT_V2_Operate |
|--------------------------|------------------------------|------|--|--|-------------------------------|
| SafetyBridge 16 words | 3 | 1 | 16 words x 16 bits/word = 256 bits | IB IL 24 LPSDO 8 V2-PAC SBT PD 256 | SBT_V2_Operate3 |
| SafetyBridge 24 words | 5 | 2 | 24 words x 16 bits/word = 384 bits | IB IL 24 LPSDO 8 V2-PAC SBT PD 384 | SBT_V2_Operate5 |

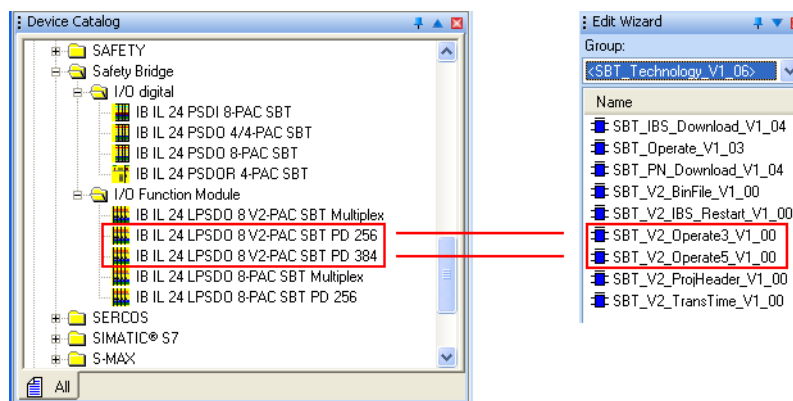


Figure 3-42 Different FDCML files and function blocks according to mode

This completes step 3 "Install the SafetyBridge modules". You have now 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.



For the example test, proceed in accordance with "Flowchart for example test" on page A-3.

A Appendix

A 1 Example projects

Table A-1 Overview of the examples

| Example | Structure | Contents | Network | Example file |
|---------|------------|---|-----------------------|-----------------------------|
| 1 | Figure A-1 | A SafetyBridge island; 1 emergency stop switch (EStop) This example is considered in the present document. | INTERBUS | SBT_V2_STARTERKIT.zwt |
| 2 | Figure A-2 | Two SafetyBridge islands distributed across Inline stations. The IB IL 24 LPSDO 8 V2-PAC are located in various Inline stations; 4 emergency stop switches (EStop); 1 EStop in island 1 | PROFINET/ INTERBUS | SBT_V2_2ISLANDS_EXAMPLE.zwt |
| 3 | Figure A-3 | A SafetyBridge island distributed across two Inline stations. The IB IL 24 LPSDO 8 V2-PAC are located in an Inline station; 1 emergency stop switch (EStop) | Ethernet | SBT_V2_ETH_EXAMPLE.zwt |

The example projects are available for download from the Internet (as setup files) at www.phoenixcontact.net/catalog (in the IB IL 24 LPSDO 8 V2-PAC download area).

Each island is separately configured and parameterized in SAFECONF. If you are only working with island 1, you only need one example file for SAFECONF; if you are working with two islands, you need both.

These are stored in the IB IL 24 LPSDO 8 V2-PAC download center under the following file names.

Table A-2 Example files for SAFECONF

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



The setup files for PC WORX also contain the BIN file, which is created in step 1 (Configuring the safety logic (SAFECONF)). This means that if you are not working with SAFECONF, you only need the example files for PC WORX.

SAFETYBRIDGE V2 - PC WORX

Key for the following figures:

- IL ... BK ... Bus coupler for PROFINET or INTERBUS;
permissible bus couplers, see page 3-1
- I_x Island number x
- S_y Satellite number y

INTERBUS

| | | |
|-------------|-------------------------|------------------------|
| ILC 130 ETH | IB IL 24 LPSDO 8-PAC | IB IL 24 PSDI 8-PAC |
| | I_1 | I_1 S_1 |

Figure A-1 Example 1: One SafetyBridge island

PROFINET/INTERBUS

| | | | |
|-----------------------------|-------------------------|------------------------|------------------------|
| ILC 370 PN 2TX-IB | IB IL 24 LPSDO 8-PAC | IB IL 24 PSDI 8-PAC | IB IL 24 PSDI 8-PAC |
| | I_1 | I_1 S_1 | I_2 S_2 |
| IL PN BK DI8 DO4 2TX-PAC | IB IL 24 LPSDO 8-PAC | IB IL 24 PSDI 8-PAC | IB IL 24 PSDI 8-PAC |
| | I_2 | I_2 S_1 | I_1 S_2 |

Figure A-2 Example 2: Two SafetyBridge islands distributed across two Inline stations;
The IB IL 24 LPSDO 8 V2-PAC are located in an Inline station
(in INTERBUS)

ETHERNET

| | | |
|-------------|-------------------------|------------------------|
| ILC 150 ETH | IB IL 24 LPSDO 8-PAC | IB IL 24 PSDI 8-PAC |
| | I_1 | I_1 S_1 |
| ILC 150 ETH | IB IL 24 PSDI 8-PAC | |
| | I_1 S_2 | |

Figure A-3 Example 3: A SafetyBridge island is distributed across two Inline
controllers; the controllers communicate via ETHERNET (various media
possible: copper, wireless (Bluetooth, WLAN))

A 2 Flowchart for example test

To test the example once the SafetyBridge system has been fully integrated, please proceed in accordance with the following flowchart.

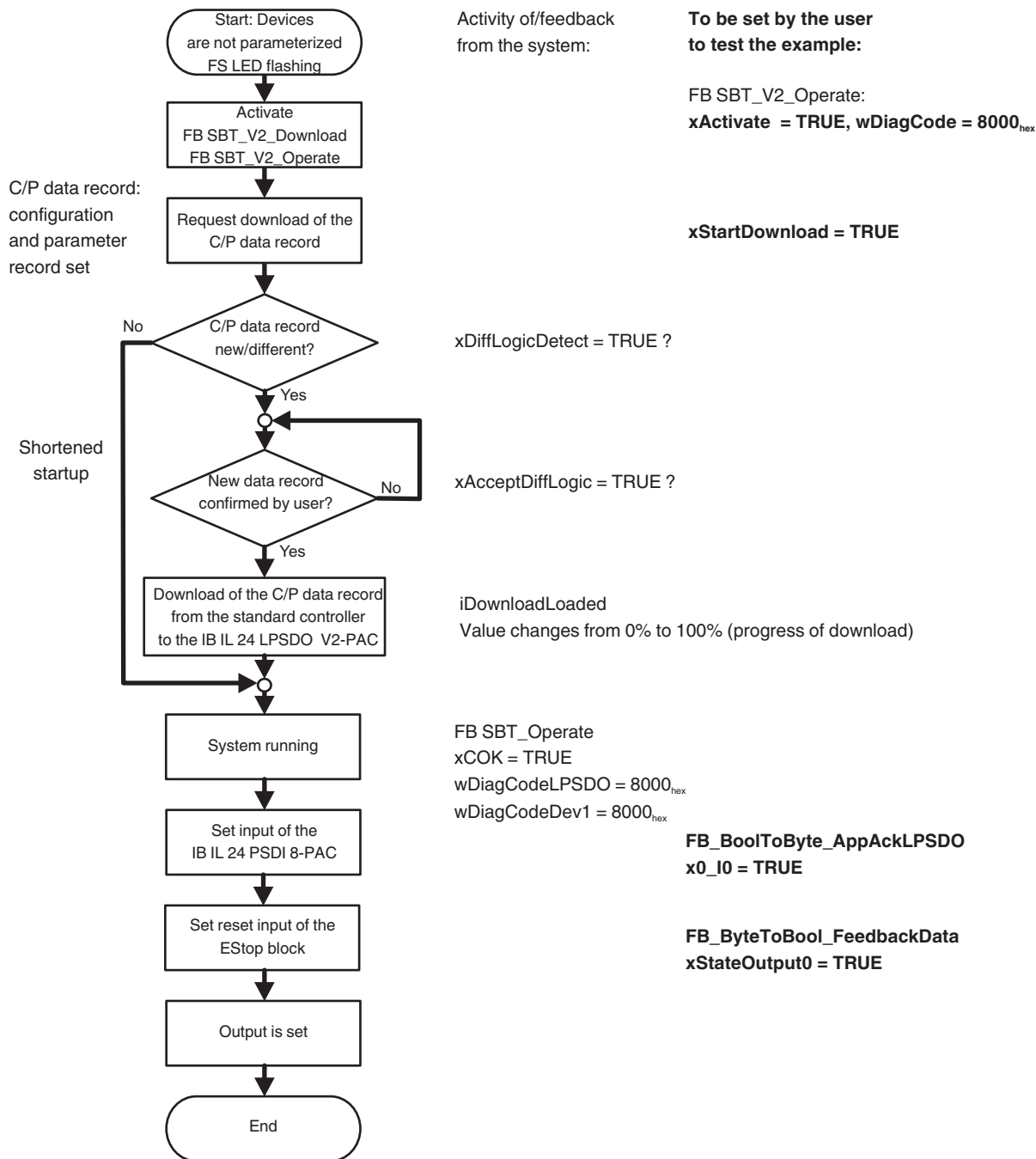


Figure A-4 Flowchart for initial startup and startup following modified configuration and parameter data record

SAFETYBRIDGE V2 - PC WORX

Shortened startup:

If the data record contained on the IB IL 24 LPSDO 8 V2-PAC and the data record for the download are identical, the user does not have to confirm the download.

A 3 External signal variables

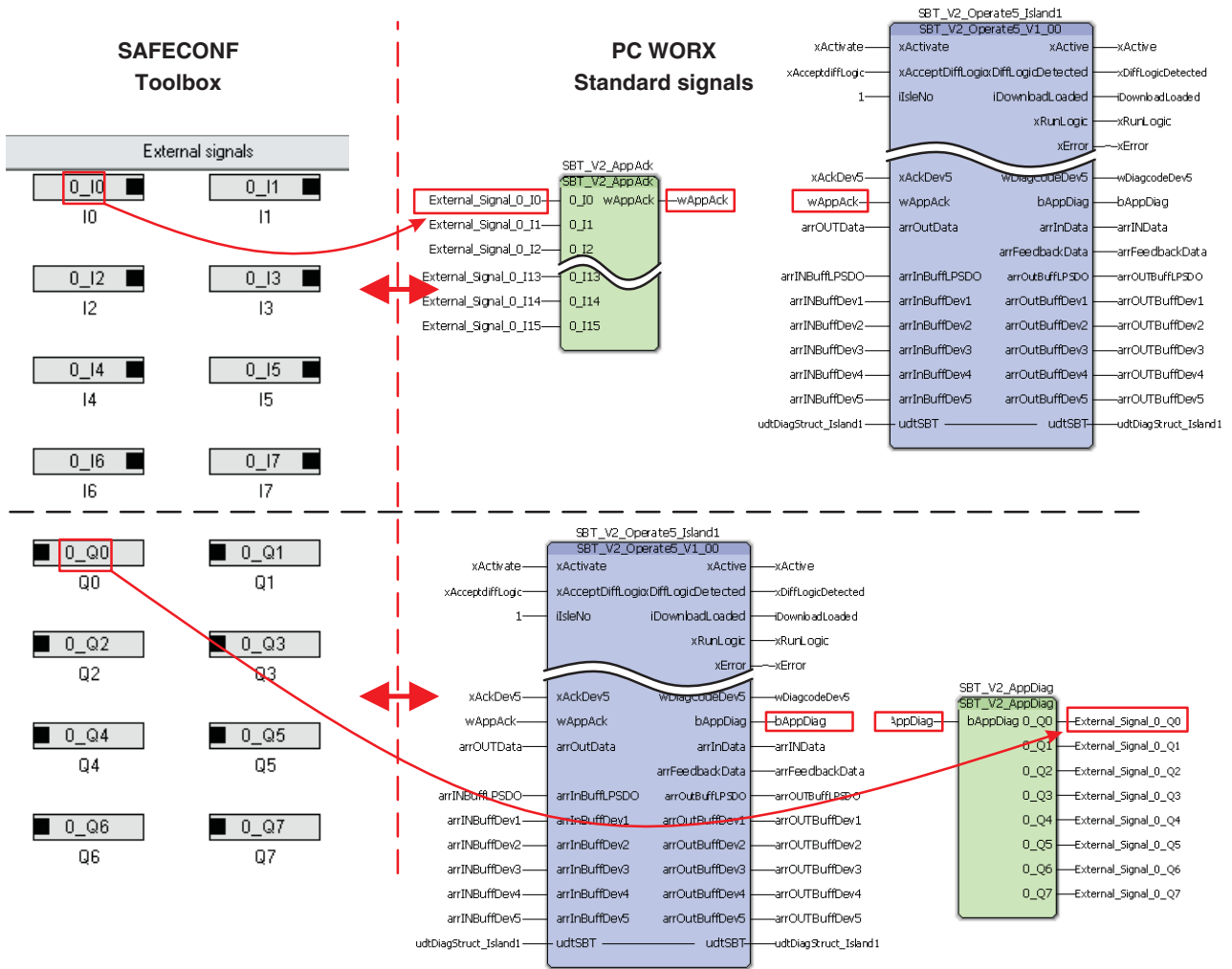


Table A-3 Relationship between the "External Signals" toolbox in SAFECONF and the variables for the non-safe signals in PC WORX

A 4 Variables



The following blocks feature in the examples but are not included in a library. They are used to identify individual variables and provide an improved overview.

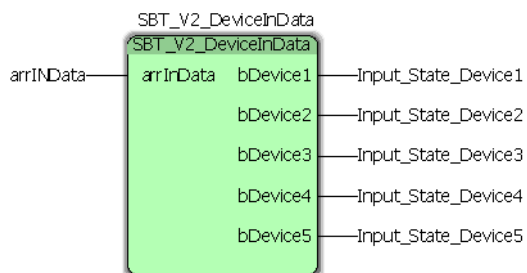


Figure A-5 Variables: Status of the safe inputs when used for extension purposes

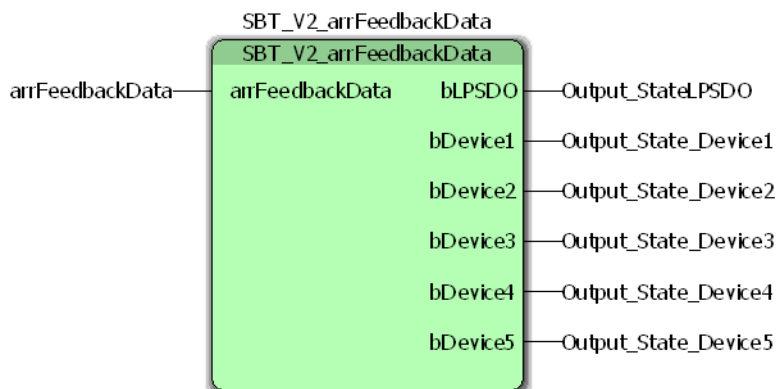


Figure A-6 Variables: Read-back status of the safe outputs on the IB IL 24 LPSDO 8 V2-PAC when used for extension purposes

SAFETYBRIDGE V2 - PC WORX

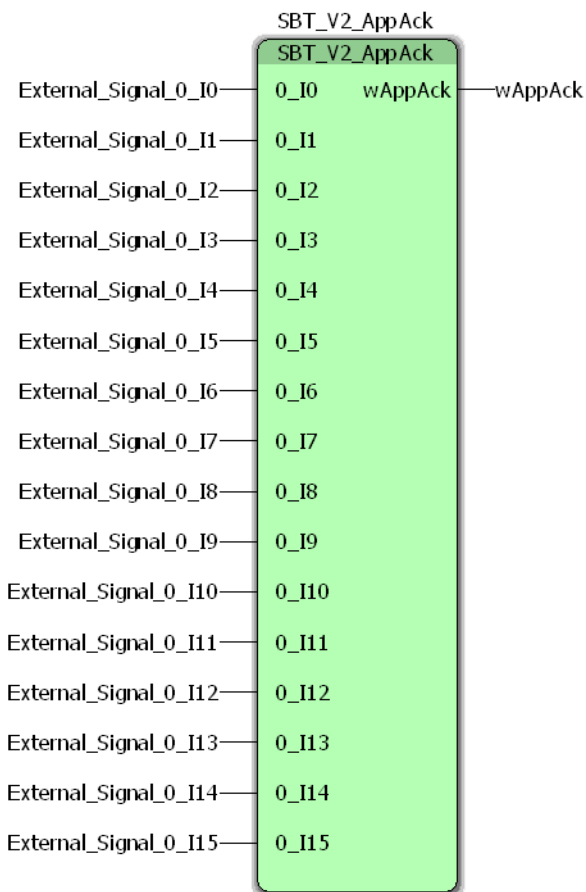


Figure A-7 Variables: Non-safe signals from the PLC to the IB IL 24 LPSDO 8 V2-PAC

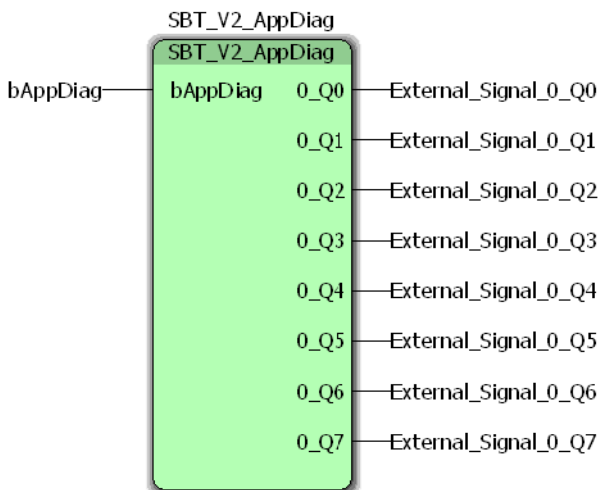


Figure A-8 Variables: Non-safe signals from the IB IL 24 LPSDO 8 V2-PAC to the PLC

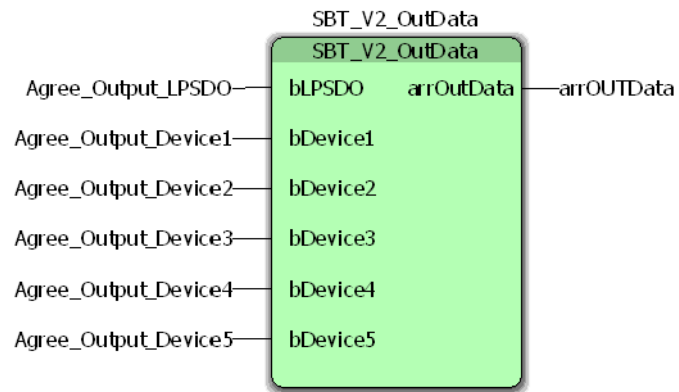


Figure A-9 Variables: Agreement of the safe outputs on the IB IL 24 LPSDO 8 V2-PAC

SAFETYBRIDGE V2 - PC WORX

A 5 Revision history

| Version | Date | Contents |
|----------------|-------------|-------------------|
| 00 | 06/2011 | First publication |



SCATTERGOOD & JOHNSON LTD

ELECTRICAL ENGINEERING & FLUID CONTROL DISTRIBUTORS

Est.1899

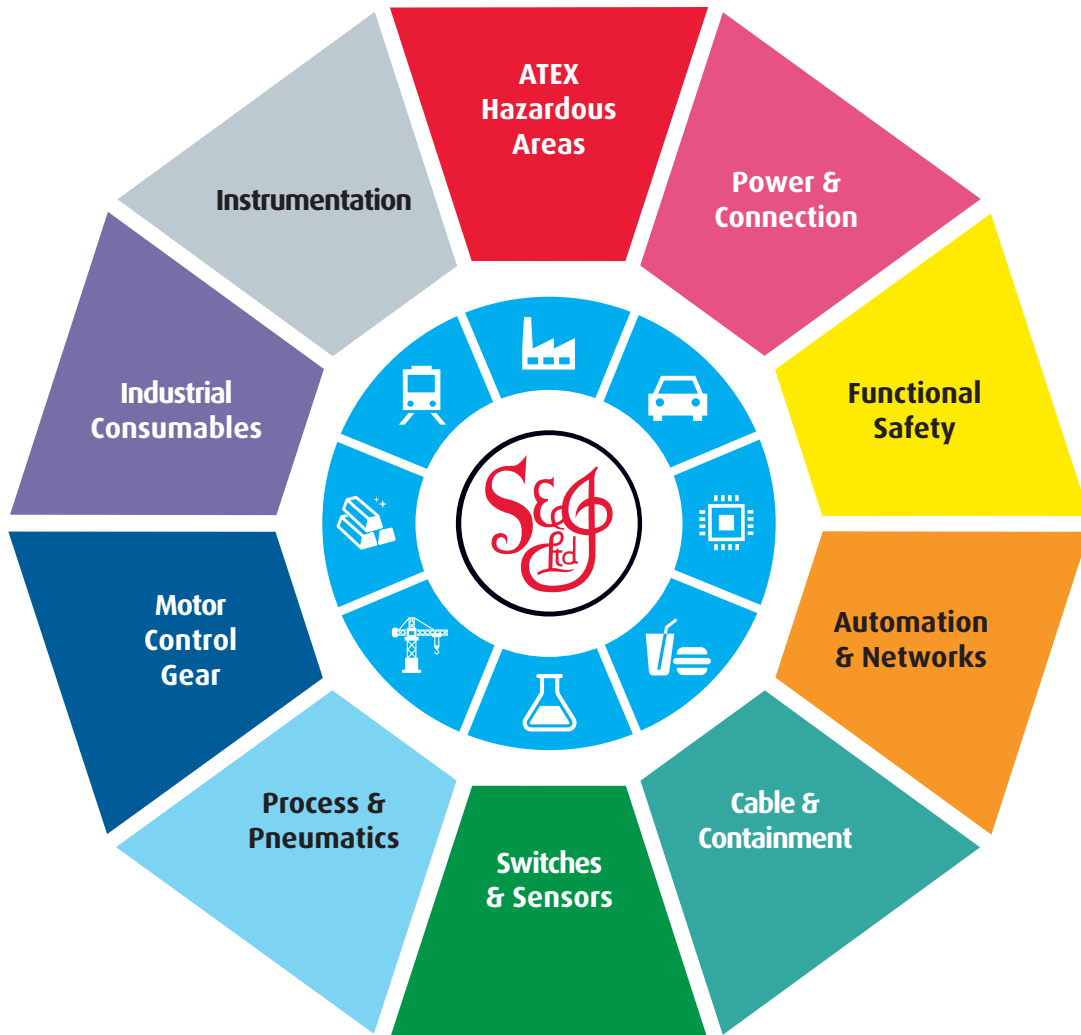
At Scattergood & Johnson Ltd, we pride ourselves on being a technical distributor to specialist industries.

Working with a range of quality product suppliers across a number of specialist markets, we are not your average 'box shifter' - we are your technical and supply chain partner.

We fully support every product we sell - for free! Our internal team and external sales engineers can answer any product or application question, no matter the complexity.

Backing up this technical ability is a range of 50,000+ products available from stock for nationwide next day delivery (same day if required!), or you can collect what you need from any of our trade counters around the UK.

Select your specialist interest below to learn more about how we can help.



Online, In Branch and On the Road - Scattergood & Johnson Ltd, there when you need us.

www.scatts.co.uk