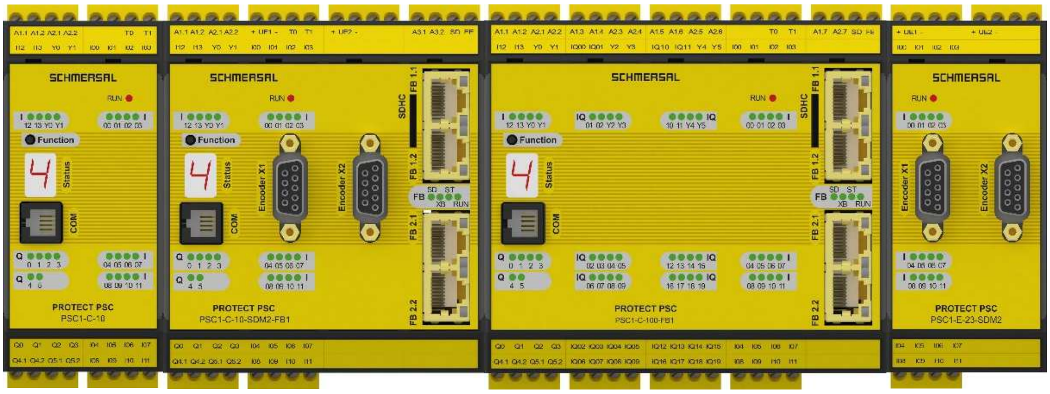
Programming Manual for the

PSC1 Modules



Programming Manual (Version form 1.7.1.78xx)

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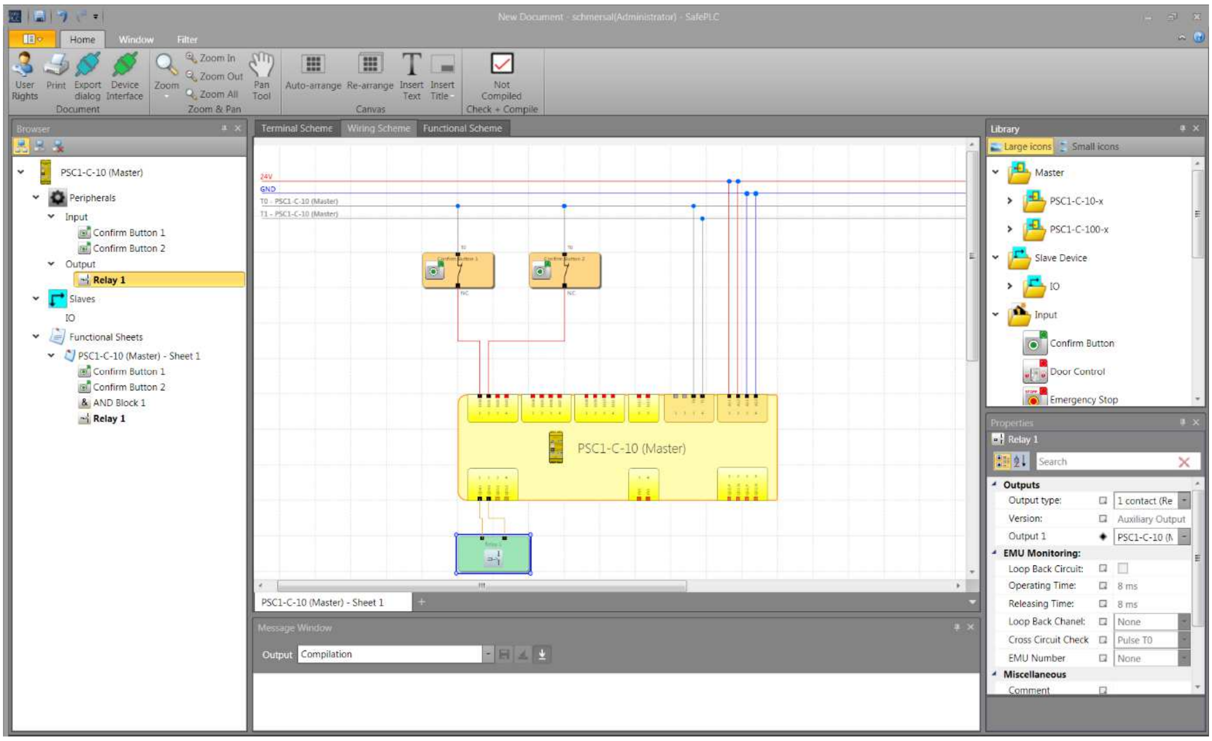
1 SafePLC2

The program SafePLC2 is a graphically oriented editor for the creation of a PLC-based monitoring program for an PSC1-system.

This program editor allows the graphical preparation of sequencing programs using the functional block method, as well as the parameterization of sensors, actuators and other technological functions used.



About This Getting Started Manual

In this manual, you will get to know the basics of SafePLC2. This manual will show you the most important screen dialog boxes and the procedures to follow using practical exercises, which are structured so that you can start with almost any chapter. Previous experience of working with the mouse, window handling, pull-down menus, etc. would be useful, and you should preferably be familiar with the basic principles of programmable logic control.

2 Terms

PLC

Programmable **L**ogic **C**ontroller, equals the German designation for **S**peicher**p**rogrammierbare **S**teuerung (SPS).

SafePLC2

Program editor for the graphical preparation of sequential programs using the function block method, as well as the parameterization of sensors, actuators and other technological functions used.

PSC1

Modular fail-safe control system with integrated technological functions. The behaviour of the PSC1 system is defined by a user configuration and the associated logic operations.

Function block (functional module)

Block in a PLC-control that influences the program sequence of a PLC-program either physically or logically. A physical (hardware) function block is e.g. a push button or an output on the PSC1 block. However, a function block is also the logic operation (e.g. AND or OR) of input and output signals within the PLC.

Function block diagram (function block language)

Graphically oriented, function block based, descriptive “programming language” acc. to IEC 61131-3, serving the purpose of visualizing logic operations of inputs and outputs on function blocks of a PLC control. The function block diagram shows the function blocks and their logic operations in a graphical form (Function Block Diagram FBD).

Input / Output

Location on a function block where a logic operation to other function blocks can be set up.

Logic operation

A named connection between:
a.) a function block output and a function block input.
b.) a PLC input and a function block input.
c.) a function block output and the PLC output.

Connector

Connecting point between the beginning and the end of a logic operation with an input and an output of a function block.

Attribute
Non-graphical feature of a function block. An attribute consists of a designator and a value.

Routes
Horizontal and vertical alignment of logic operations in a function block diagram, so that intersections with function blocks are avoided and logic operations with identical connector are merged at an early stage (related to distance to the target function block).

Signal list
Signal lines into and out of the PLC, represented in a table.

Signal cell
Selectable area within the signal list, which can be provided with a comment.

PLC input signal list
Signal lines entering into the PLC, represented in form of a table. In SafePLC2 the PLC inputs can be designated by the user. They have an unambiguous number and must be assigned to the inputs of a function block.

PLC output signal list
Signal lines leaving the PLC, represented in form of a table. In SafePLC2 these outputs can be designated by the user and, just like the inputs, have an unambiguous identification number.

Instruction list (IL)
Assembler-like programming language that can be loaded into a central PSC1 module. The duty of SafePLC2 is the generation of an instruction list based on defined function blocks, as well as their attributes and linkages.

Compilation
Compilation and verification of the function block diagram created in SafePLC2 and the associated parameters.

Function block group
Classification of function blocks according to their positioning ability in the function block diagram (input, output, logic).

Function block types
More detailed identification of function blocks within a group. (e.g. "Emergency Stop")

message Window

Multi-line output window, embedded in a Windows Toolbar element. This display window is used for the output of errors, warnings and information from the program to the user. The message Window can be switched on and off.

Configuration

Configuration is the generic term for a monitoring program and the associated parameter for permissible deviations or minimum and maximum values. In this context it is important to note that a monitoring program always comes with further data, the program can refer to.

3 Installation

This chapter describes installation procedure and with the installation procedure connected requisites.

3.1 System Requirements

There are the following system requirements in order to install the program:

- Minimum System Requirements
  - OS: Windows XP, Windows Vista, Windows 7, Windows 8 or higher (32 Bit / 64 Bit)
  - Processor: Intel® Pentium® 4 or AMD Athlon™ Dual Core, 3.0 GHz or higher
  - Memory: 2GB
  - HDD: 500MB free space
- Recommended System Requirements
  - Processor: Intel® Core™ i3 or AMD Quad Core, 3.0 GHz or higher
  - Memory: 4GB or more

Program uses DOT Net Frameworks, but the installer will install it if they are missing. DOT Net installation can use local files in „components“ folder or files from Internet. If there is no Internet connection, program will be installed, but installation of DOT Net 3.5, 4.0 and 4.5 and higher will need to be installed by user.

Installer installs VC 2010 redistribution files and also the following drivers:

- Matrix-USB Driver (drivers for hardlock)
- FTDI’s CDM drivers (RS485 - USB) – for connection between PC and PLC to transfer program from SafePLC2 to PLC hardware

Note:

The latest version of SafePLC2 could be found online via

https://products.schmersal.com/de_DE/product/59/psc1-a-91-safeplc2

Please see chapter 4.11.4 for further details

3.2 Installation Procedure

Administrative privileges are requested only for installing. Normal user can use the installed program.

Program installation starts by double mouse left click on file SetupSafePLC2.exe.

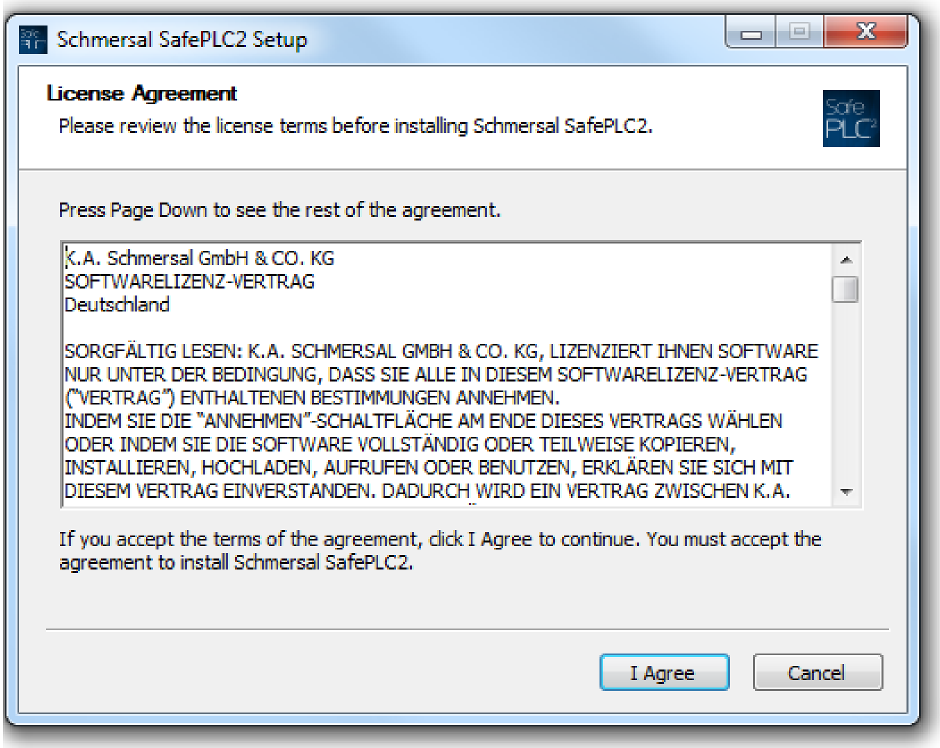
Then appears the following window:

By rolling down the menu you can choose installation language (English or German).

Note:

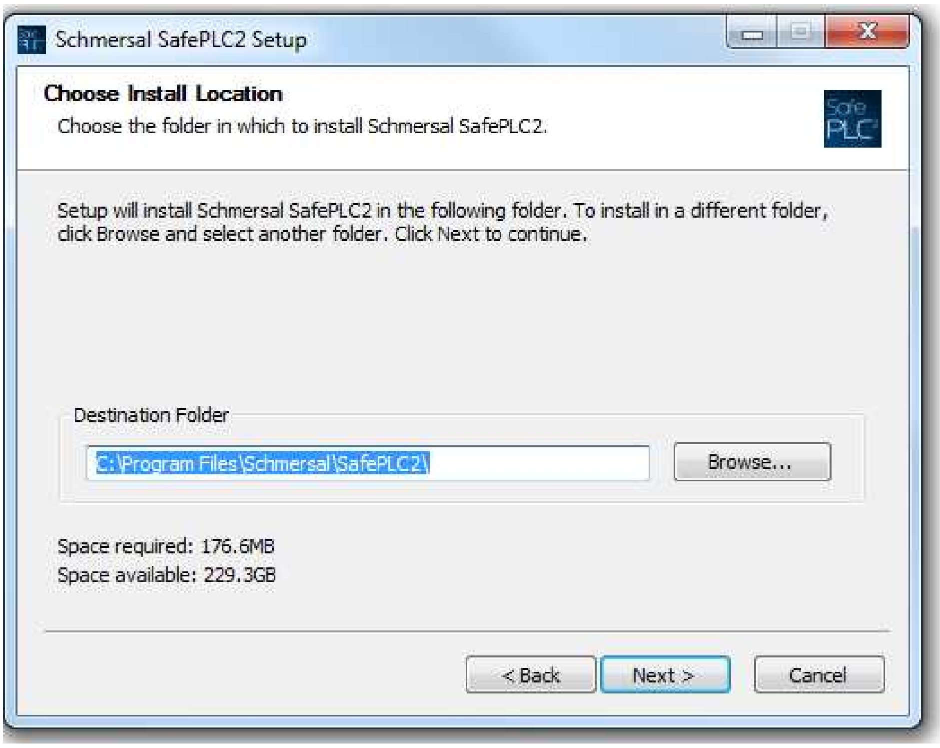
This window appears only for the first installation procedure. For the next time, the chosen language will be remembered, and License Agreement window will appear as first. This Installer language window sets up just the installation language and not language for SafePLC2 user interface.

After language choice press button “OK” to continue the installation. If you click button “Cancel”, installation will finish without program installing. After pressing button “OK” there will appear next window with license agreement.

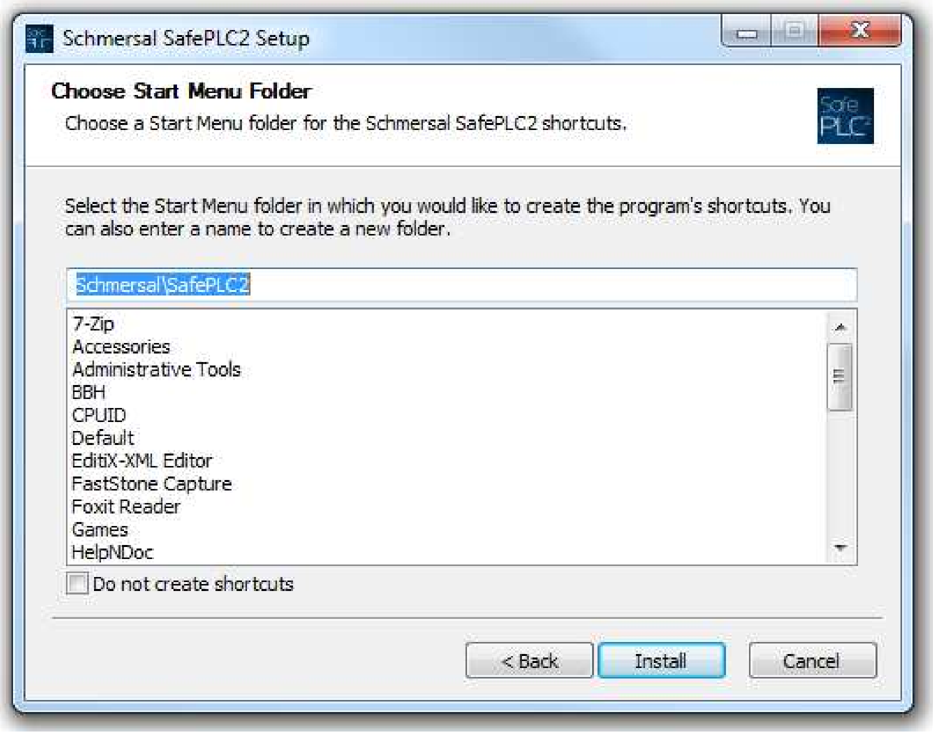


To continue in program installation press button “I Agree”. If you do not agree with License Agreement press button “Cancel”. Installation will finish without program installing.

After pressing button “I Agree” there will appear a window with possibility to set the destination folder where program will be installed.

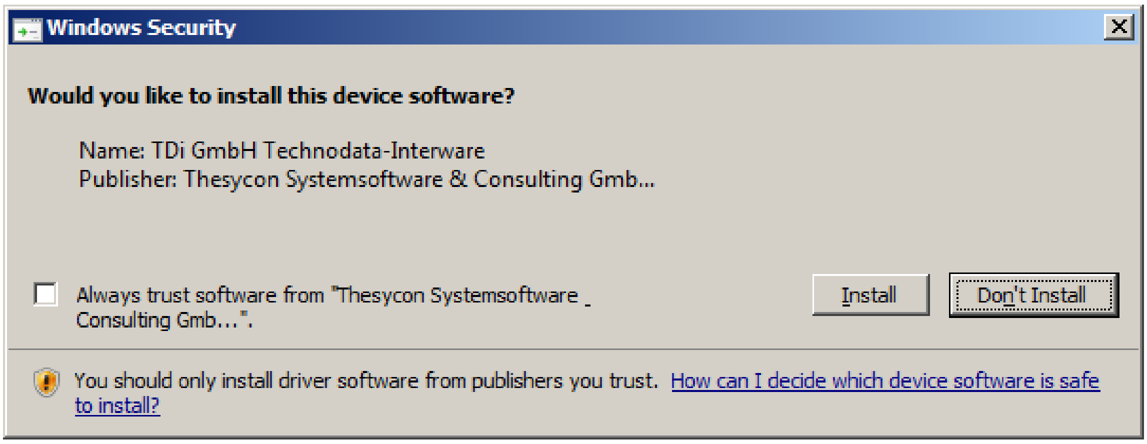


After pressing button “Next” there will appear window to choose Start Menu Folder for Schmersal SafePLC2 program’s shortcut. There is also a possibility to create shortcut in Start Menu Folder. If you choose this possibility, there will be created an icon for starting program only at computer’s desktop.



After pressing button “Install”, installation will start.

If during installation there appear “Windows Security” alert, click “Install” to install Matrix-USB Driver (drivers for hardlock) and FTDI’s CDM drivers (RS485 - USB) – for connection between PC and PLC to transfer program from SafePLC2 to PLC hardware.



Tip:

During installation of USB drivers, click on "Skip searching for Windows updates" for a faster installation.
After finishing installation there will appear window:

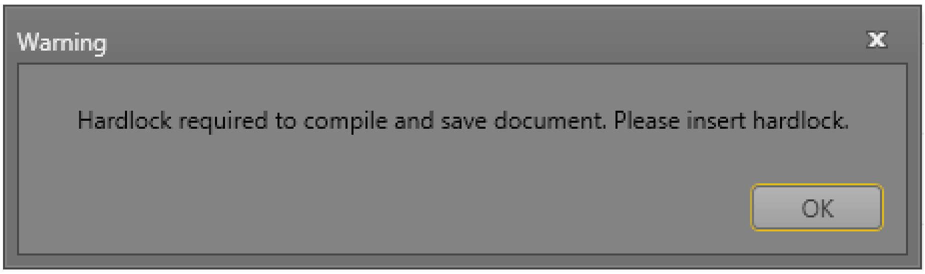
,

By clicking check box it is possible to choose if you want run program immediately or not. When check box is marked after click on button “Finish”, the dialog window will be closed and the program will start.

During the installation the desktop icon for starting the program will be created. You can use this icon to start the program any time. If during installation there was created shortcut in Start Menu Folder it is possible to start program from shortcut created in this folder.

3.3 Hardlock

For a proper functionality of SafePLC2 you need Hardlock. If you start program without Hardlock there will appear the following message:



Press button “OK” and insert Hardlock to USB port. Hardlock will be detected and SafePLC2 will be fully functioned. If you remove Hardlock during working with SafePLC2, there will be lost of full functionality and you will be not able to compile and save created program. Insert Hardlock to USB port and full functionality will be recovered.

3.4 Uninstall

To uninstall SafePLC2 you can use shortcut in Start Menu Folder or function Uninstall Program in Windows Control Panel.

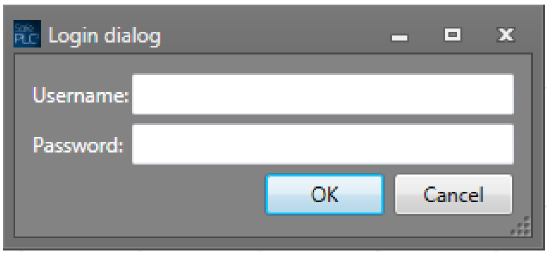
If you want to install program again with possibility to change Installation Language, it is necessary to delete registry key "Installer Language" in branch: HKEY_CURRENT_USER\Software\ Schmersal\SafePLC2.

3.5 Running Application

To Run application double-click on icon on desktop or choose program from Start Menu.

Note:

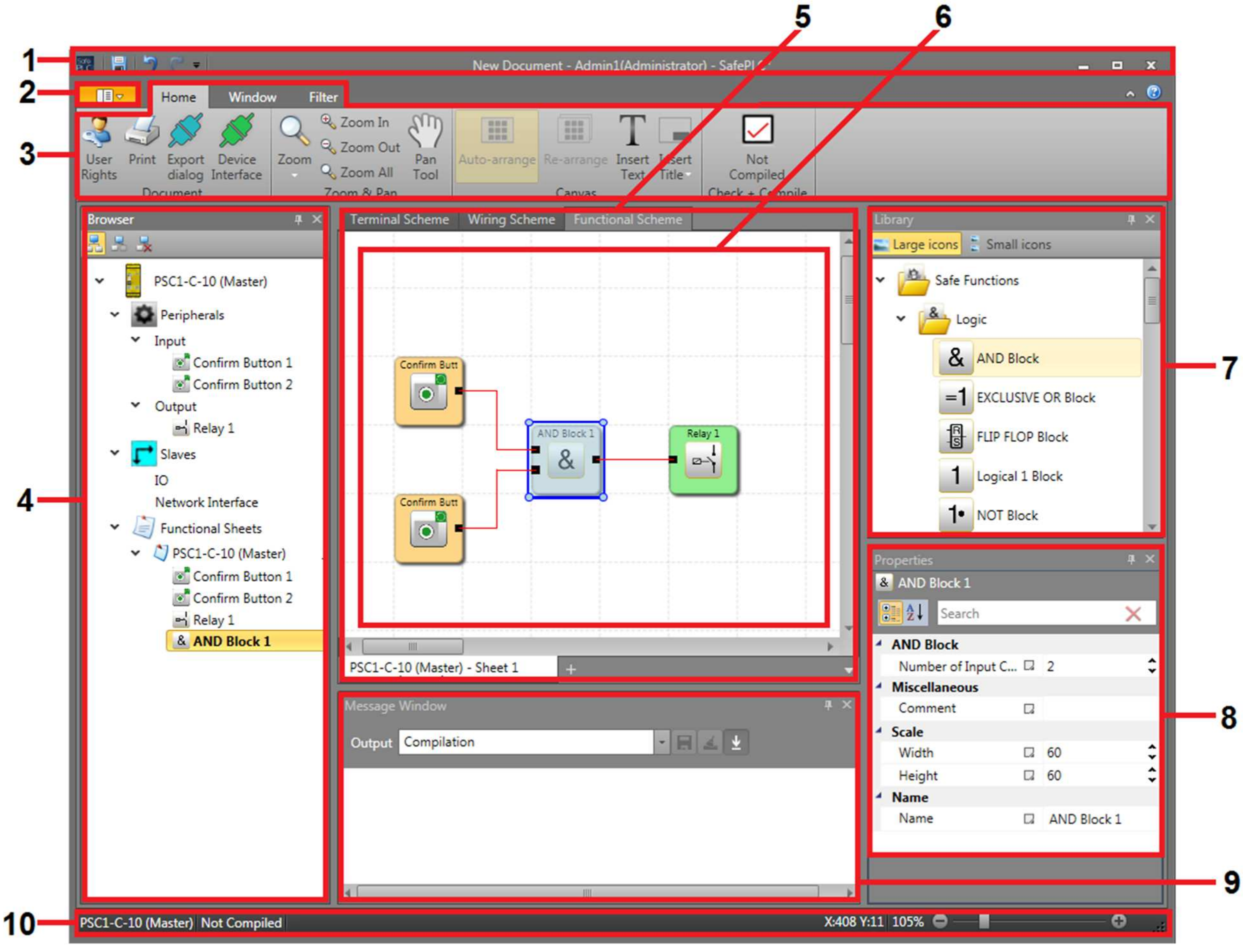
After application start there appears “Login dialog” and you can work with application after inserting “Username” and “Password”.



	Username	Default-password
Administrator	schmersal	schmersal
Standard	guest-user	123

4 User Interface

4.1 Main Window



Application window is the root window of SafePLC2 application. Window can be resized, minimized, maximized or closed through window mode handling buttons.

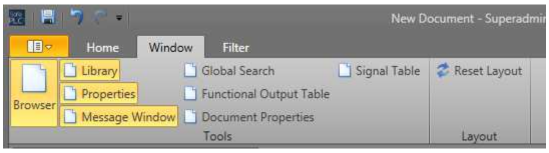
It is divided in the following elements:

1. Title bar with Quick Access Toolbar
2. Start menu
3. Ribbon menu (Tabs with Groups)
4. Browser
5. Document tab control with Scheme tabs placed on top and Sheet tabs placed bottom
6. Canvas
7. Library window
8. Property Grid
9. message Window
10. Status bar

4.1.1 Adjusting the Main Window

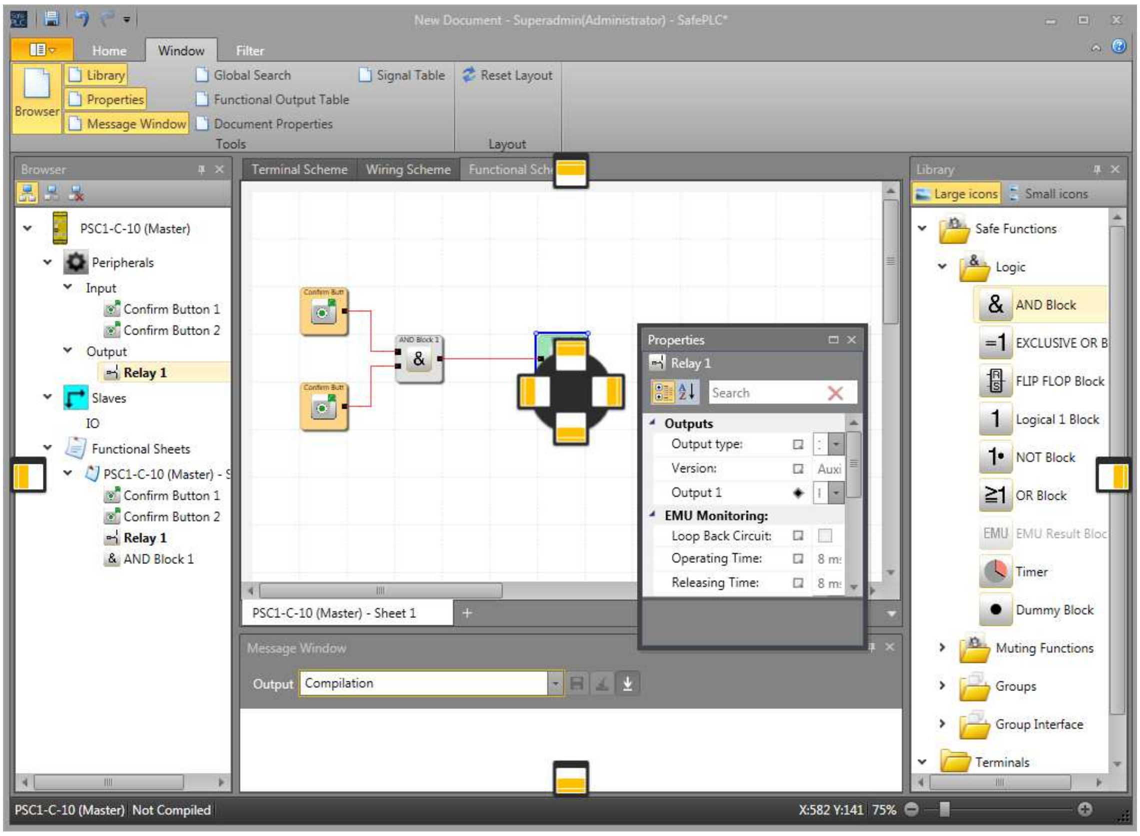
4.1.1.1 Reset Layout

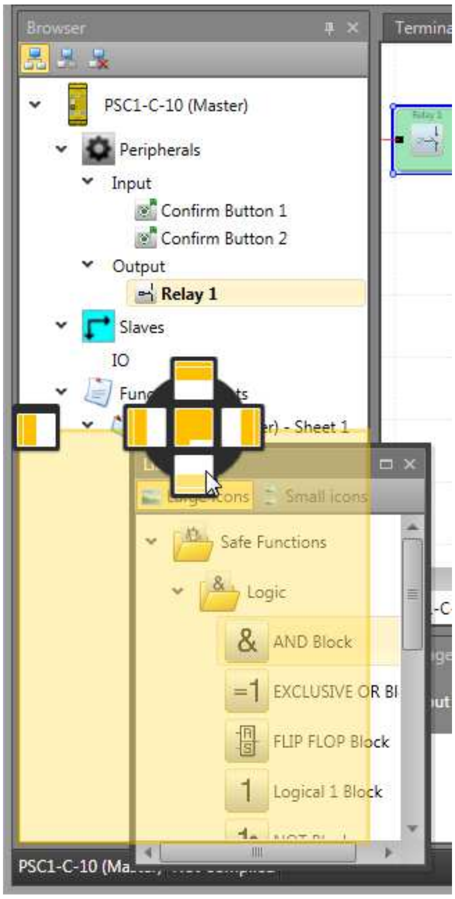
User can reset application layout to defaults by clicking on “Reset Layout” button located in Window Ribbon page. Note that this operation will erase user layout and there is no option to restore user layout.

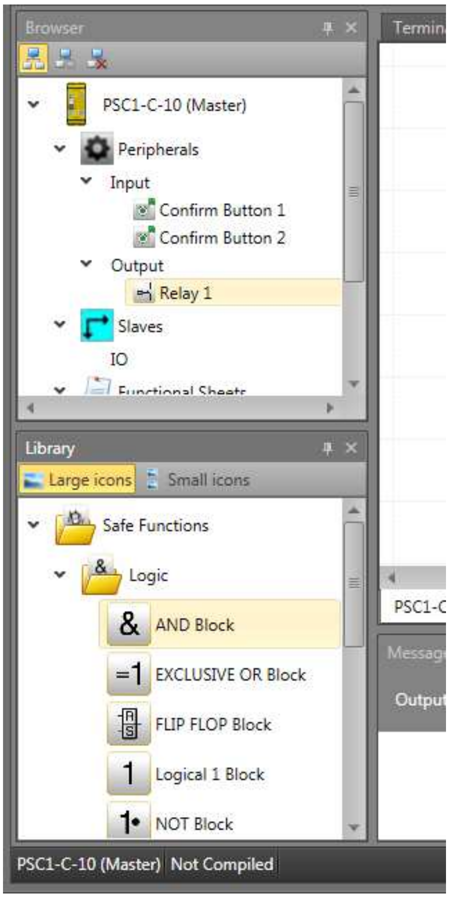


4.1.1.2 Docking

Docking provides useful way to customize application layout. Every panel (except Schemes and Sheets) can be dragged out of application window or can be dropped onto other panel or tabbed group.

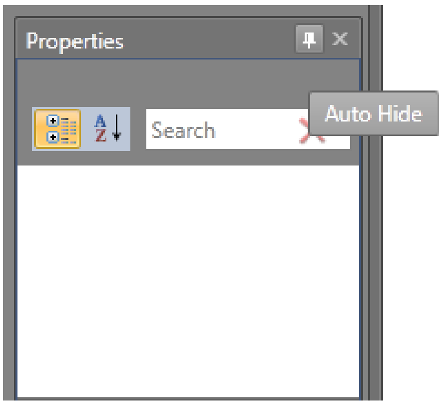




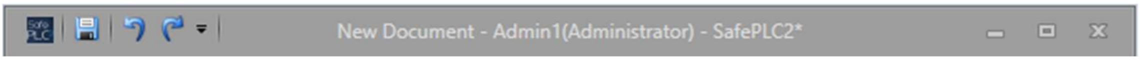


4.1.1.3 Automatic Hiding

Every panel with “Auto Hide” icon can be switched to auto hide mode. User can disable auto hide mode and restore panel to its previous position by clicking again on the “Auto Hide” icon .

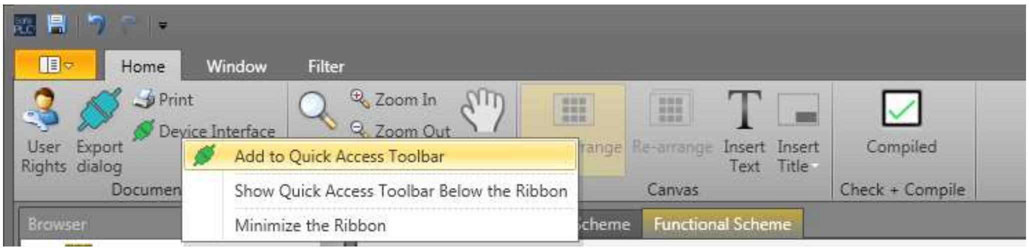


4.1.2 Title bar

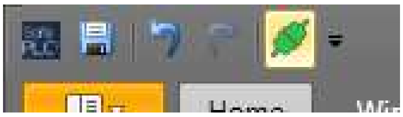


Title bar located on top of application window contains application icon, quick access buttons and application title. Quick access buttons consist of Save button  (also available through keyboard shortcut Ctrl+S), Undo button  (Ctrl+Z) and Redo button  (Ctrl+Y).

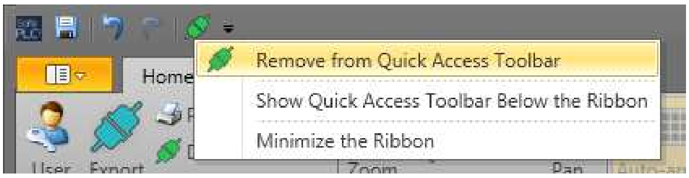
It is possible to add more elements in the Quick Access Toolbar by right clicking in any element in the Ribbon menu and selecting “Add to Quick Access Toolbar”.



A new quick access button will be shown in the Quick Access Toolbar.

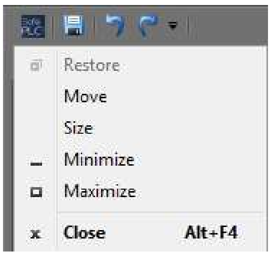


To remove it, right click on the new button in the Quick Access Toolbar and select “Remove from Quick Access Toolbar”

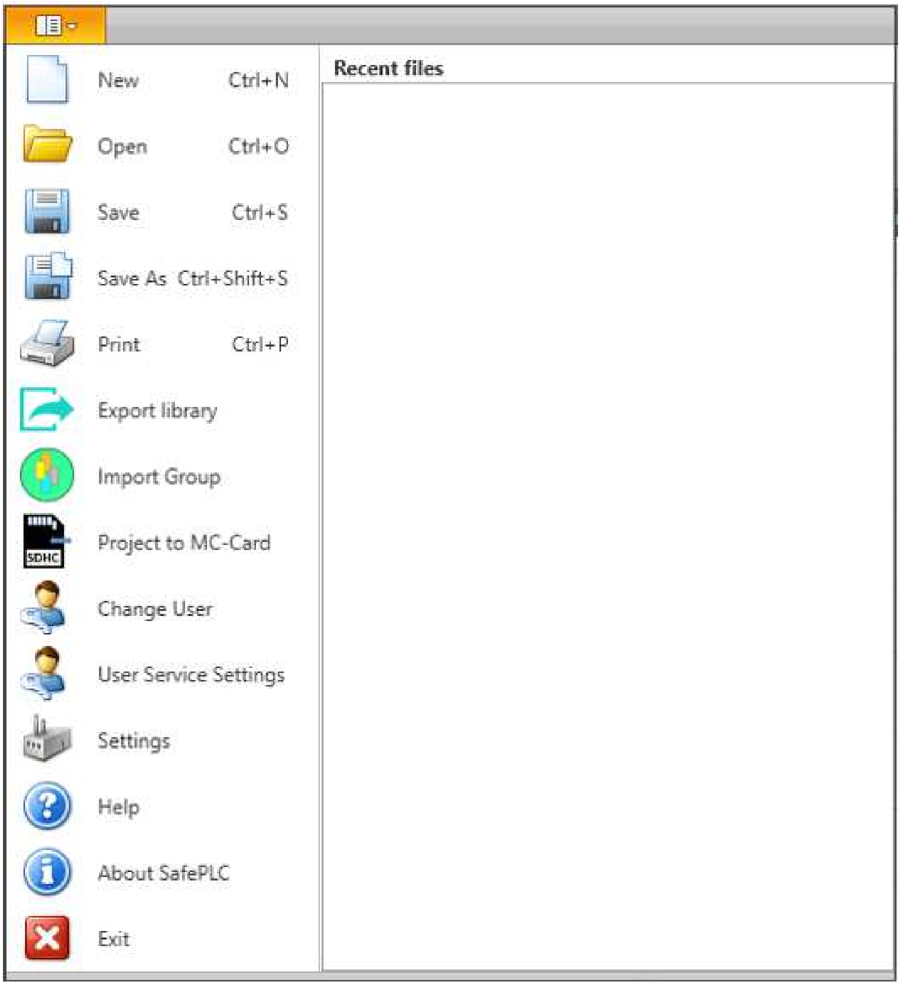


Application title  consists of current document name, name of user currently logged in and application name with asterisk indicating there is at least one unsaved change.

User can display application Window context menu by clicking on application icon. Context menu provides well known windows functionality.



4.1.3 Start menu



Start menu provides basic document and application functionality, such as New document, Save document, Print, User management, Settings etc.

Recent files list contains documents recently opened (latest first).

New

Create blank new project. If the current project is opened, program will ask if user want save changes to old document.

Open

Opens existing SafePLC2 document or document with entire library. If a project is opened, program will ask if user want to save changes.

Note:

When an existing SafePLC2 program is opened with a later version of SafePLC2, this program will be migrated.

Save

Save document to selected location. In the case of new project, the extended save functions windows appear (like a Save as).

Save as

Save document and select name, type and location of document. If the folder contains the document with the same parameters, the program will ask user if want to replace it.

Print

Shows the print menu. For description of function see chapter 0

Print

Export library
Export SafePLC2 library to *.splib file.

Import Group
Here existing groups can be imported. See also section 0

Project to MC-Card
The binary files generated during compilation are written to a memory card in the PC.
See section 5.8

Change user
Change user allows user to log in or log off. See chapter 4.13 Change User.

User service settings
Allow changing user permissions.

Settings
Settings window allows user to change application settings. See chapter 0

Settings.

Help

Opens SafePLC2 help window.

About SafePLC2

About SafePLC2 show brief information about the Windows system, application build and compilation information.

Exit

Close the whole program.

4.1.4 Ribbon menu

Ribbon menu is part of main window and consists of several Ribbon pages. User can toggle ribbon mode (Expanded-Compact) by clicking on  button in top-right corner of menu. When Ribbon menu is in Compact mode user has to click on Ribbon page name to expand page and page gets automatically collapsed when it loses focus.

User can access any Ribbon page by pressing “Alt key” and then “desired key” regarding the tooltips appeared in ribbon. Afterwards additional tooltips appear next to each operation in Ribbon menu. Next to “Toggle ribbon mode” button is Help button  that will show help dialog.

4.1.4.1 Home

Document group

- **User Rights** button - shows dialog where user can define rights for users.
- **Device Interface** button - shows device dialog.
- **Export dialog** button - shows export dialog.
- **Print** button - shows print menu.

Zoom & Pan group

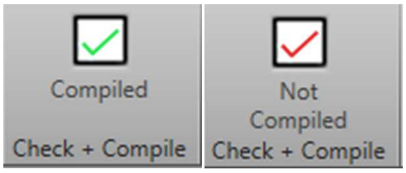
- **Zoom** dropdown list - provides quick access to specific zoom values.
- **Zoom In** button - increases current zoom value by 25%.
- **Zoom Out** button - decreases current zoom value by 25%.
- **Zoom All** button - scales Canvas so that it fits entire Canvas container.
- **Pan Tool** toggle button - toggles Pan mode. When enabled user is able to pan the Canvas by either left mouse button or middle mouse button.

Canvas group

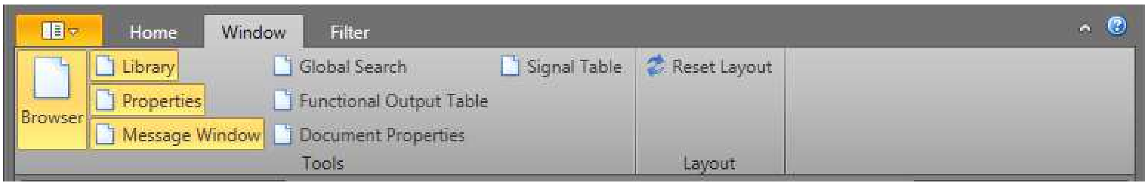
- **Auto-arrange** toggle button - toggles auto-arrange mode. When enabled elements are automatically arranged. Not all scheme types support arranging.
- **Re-arrange** button - arranges elements instantly. Not all scheme types support arranging.
- **Insert Text** toggle button - switches on Text dropping. When enabled user can drop text to Canvas by clicking left mouse button.
- **Insert Title** dropdown menu - lists available titles. After clicking on one of titles selected title is immediately inserted to all sheets across whole document.

Check + Compile group

- **Compile** button - compiles current document. When compilation is successful button shows „Compiled“ text with green check mark . Otherwise „Not Compiled“ text and red check mark are showed.



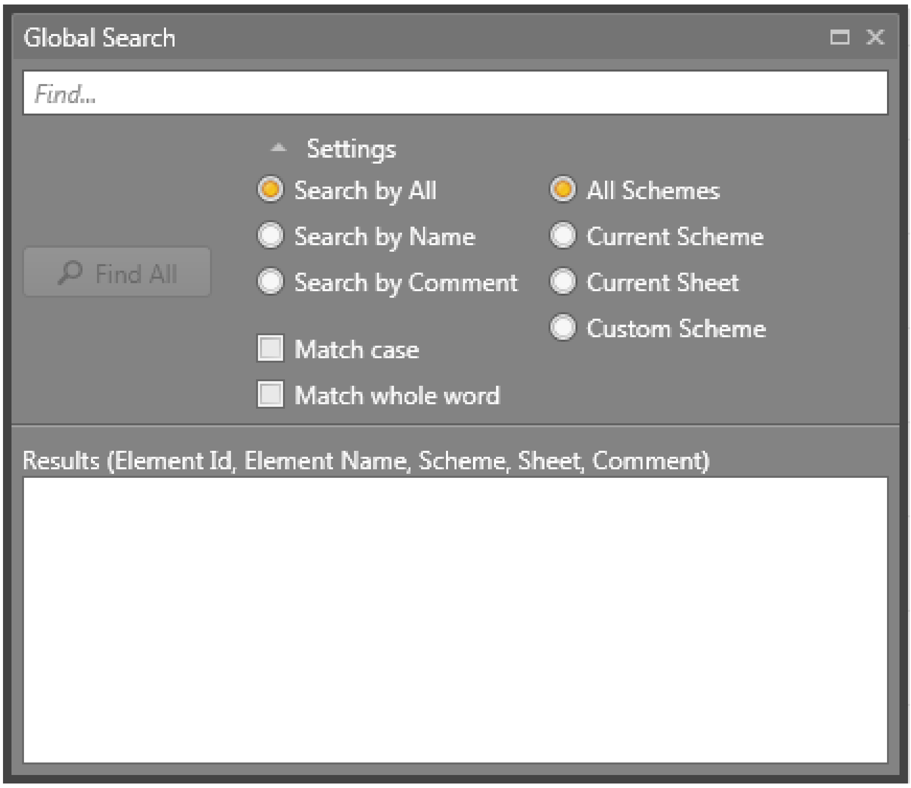
4.1.4.2 Window



User can show or hide windows by toggling the following toggle buttons:

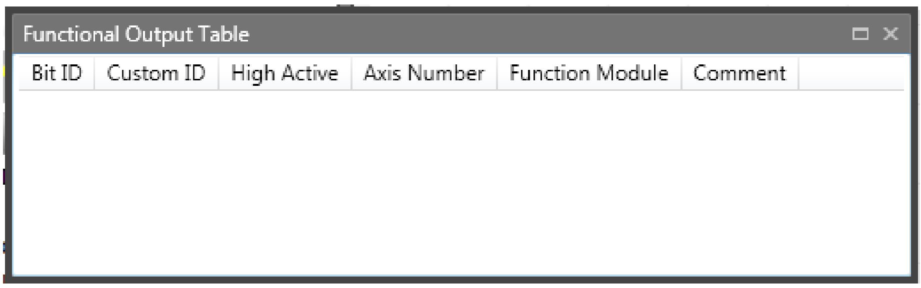
- **Browser** toggle button - turns on and off Browser window in user interface.
- **Library** toggle button - turns on and off Library window in user interface.
- **Properties** toggle button - turn on and off Properties grid.
- **message Window** toggle button - turns on and off message Window in user interface. For more information see chapter 4.8 message Window.

- **Global Search** toggle button - turn on window for Global Search. More information about this function is in chapter 4.9 Global Search.

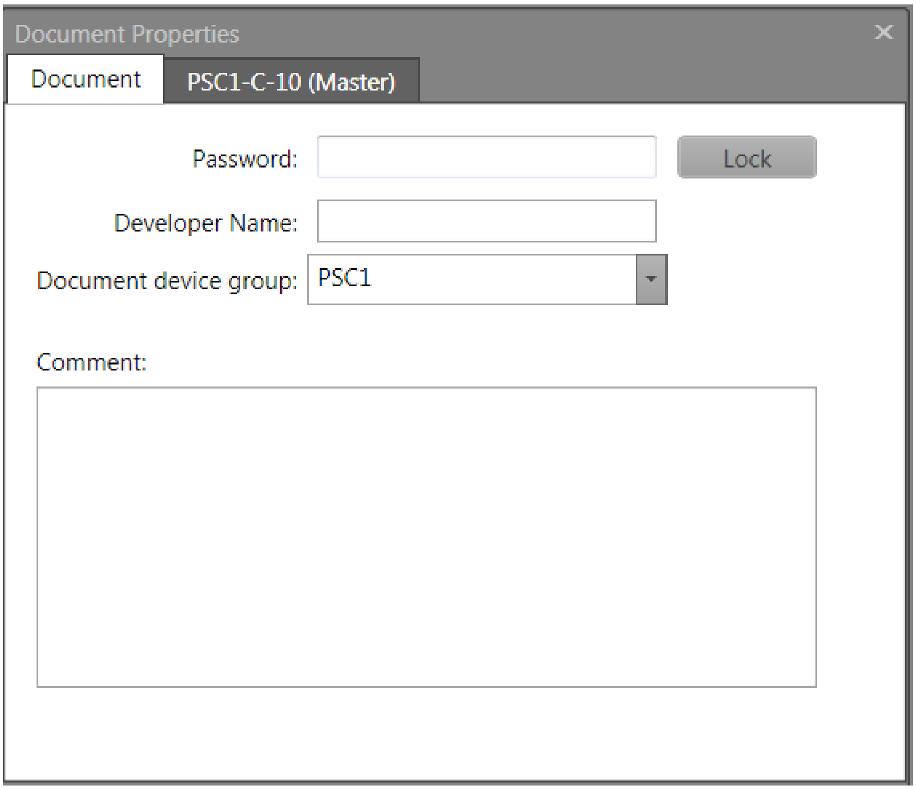


Global Search: Results (Element Id, Element Name, Scheme, Sheet, Comment)

- **Functional Output Table** button - shows corresponding table (see next figure).



- **Document Properties** toggle button – document management information window. This window contains Document tab and Device tab.



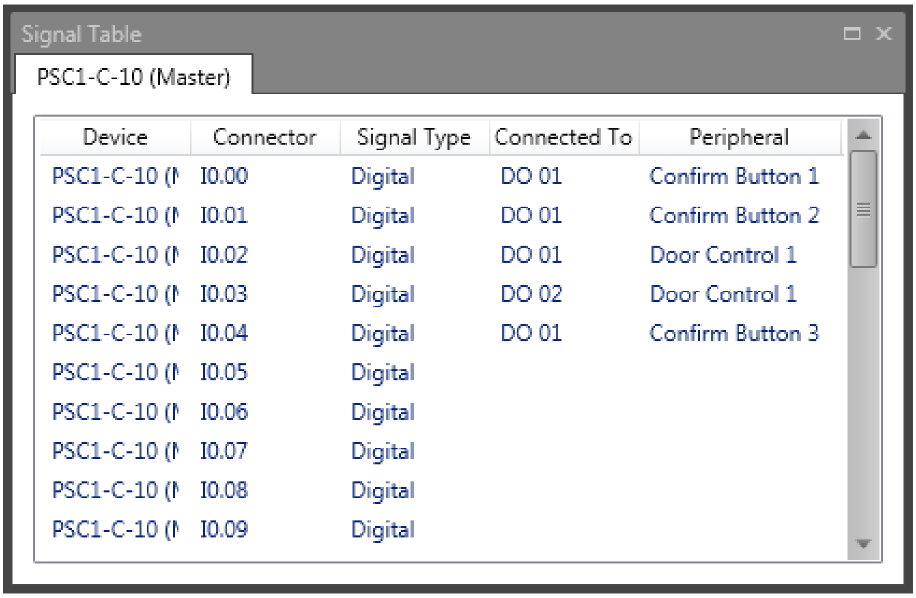
Document Properties window

The Document tab consist of:

- **Password** - password for lock function. For more information see chapter 7. User Management.
- **Developer Name** - Name of the responsible programmer/developer.
- **Document device group** – Selection of device group for document.
- **Comment** - This input field provides a descriptive field for the input of any text. Here one can document e.g. program or parameter changes during the life cycle of the currently used device.

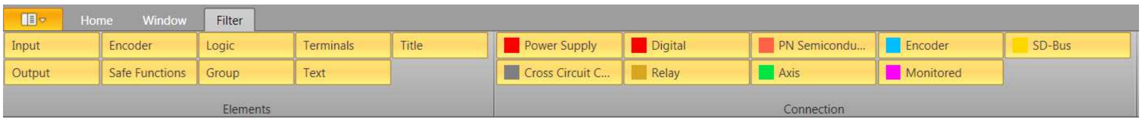
The Device tab consist of information fields and connection settings:

- **Device information** – For more information about edited fields see chapter 6. Configuration report.
- **Connection settings** – For more information see chapter 5.7 Transferring the Program on the Device.
- **Signal Table** button – this table show connections and signal types of all device connectors.



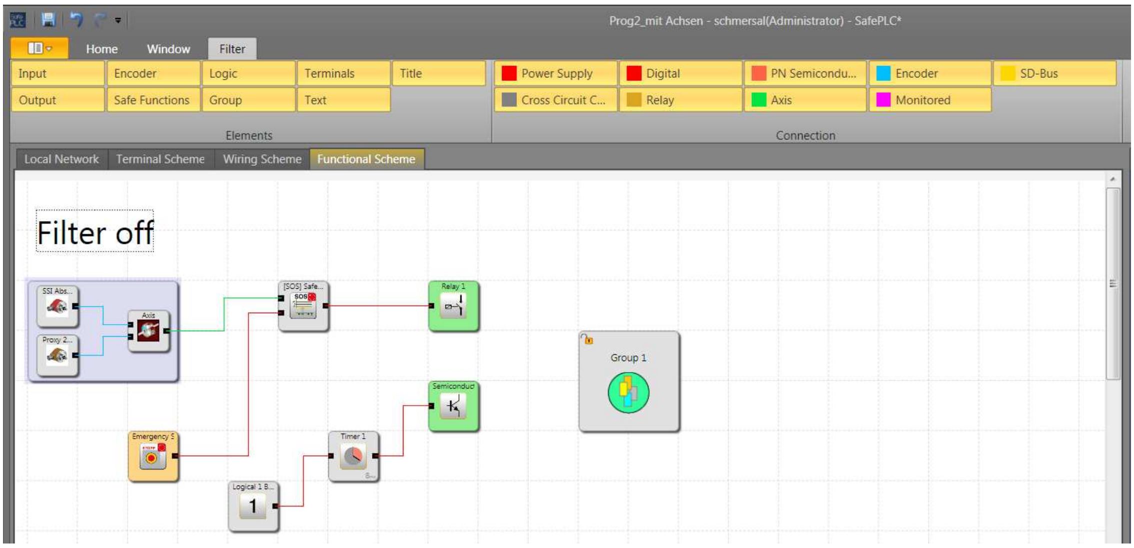
Device	Connector	Signal Type	Connected To	Peripheral
PSC1-C-10 (I	I0.00	Digital	DO 01	Confirm Button 1
PSC1-C-10 (I	I0.01	Digital	DO 01	Confirm Button 2
PSC1-C-10 (I	I0.02	Digital	DO 01	Door Control 1
PSC1-C-10 (I	I0.03	Digital	DO 02	Door Control 1
PSC1-C-10 (I	I0.04	Digital	DO 01	Confirm Button 3
PSC1-C-10 (I	I0.05	Digital		
PSC1-C-10 (I	I0.06	Digital		
PSC1-C-10 (I	I0.07	Digital		
PSC1-C-10 (I	I0.08	Digital		
PSC1-C-10 (I	I0.09	Digital		

4.1.4.3 Filter

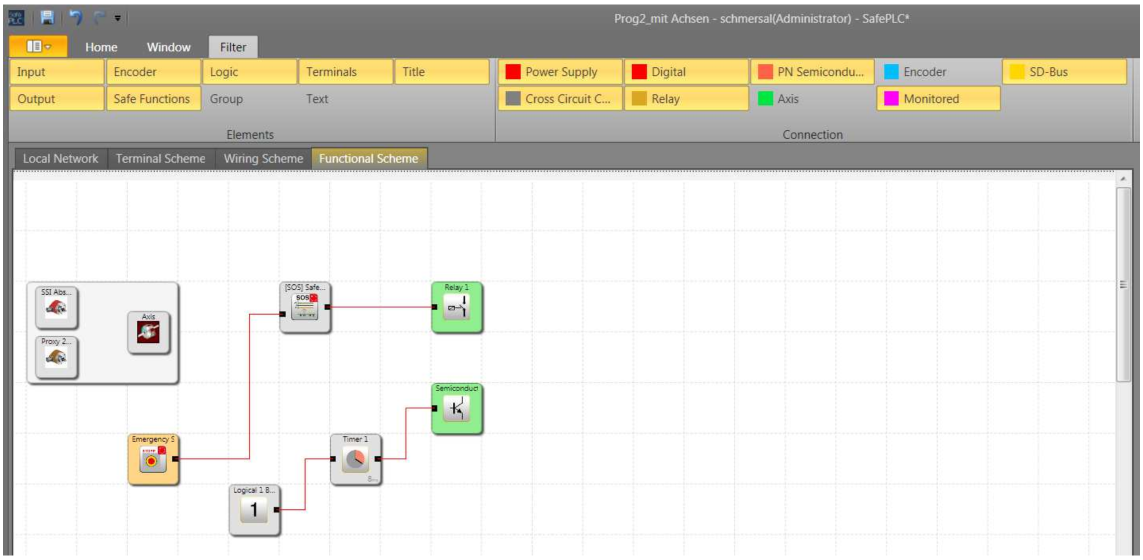


Filter provides great tool to maintain Canvas readability by hiding desired element type or connection type. Filter consists of two filter categories: Elements and Connection. Each group contains several filters. By disabling, the elements (or connections) that belong to given filter are hidden from Canvas.

All elements and connections are shown:



Group elements, Text elements and Encoder connections are not shown:



4.1.5 Status Bar

Status bar belongs to main window and is composed of current master device name and action mode aligned to the left side and cursor position in Canvas, Canvas zoom slider and resizing icon aligned to the right side. Resizing icon symbolizes that user can change size of main window. Action mode will show current action that user is performing in Canvas.

4.2 Mouse and Keyboard Commands

4.2.1 Mouse Dependent Actions

- Left mouse button-click on a function block (de)select given block.

Note:

Multiple selection can be achieved by holding Shift key (adds block to selection) or Ctrl key (inverts selection on block)

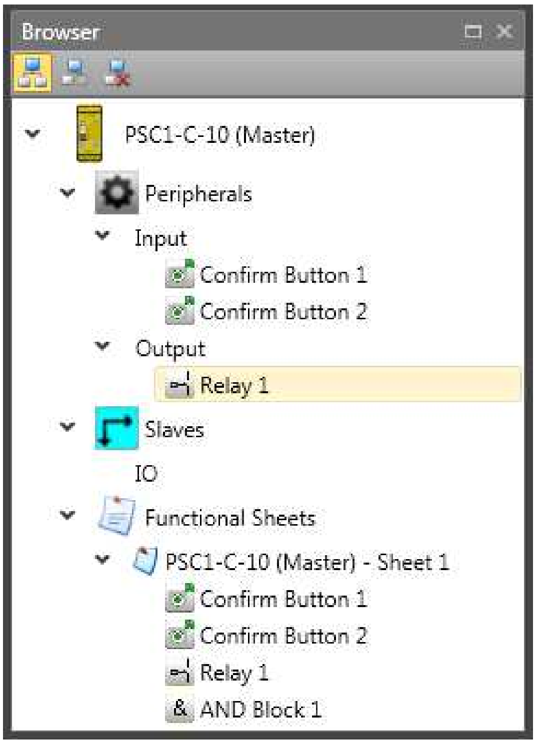
- Cursor hover over the block or connection: Highlights the block or connection
- Shift + Left mouse button on function block: Adds block to selection
- Ctrl + Left mouse button on function block: Inverts selection of given block
- Delete key: Deletes the elements in current selection including connections
- Right mouse button on object: Displays context menu
- Left mouse button on connection: Highlights the existing connection wire
- Scrolling the scroll wheel on the mouse: Scrolls Canvas up/down
- Middle mouse button and mouse move: Pans the Canvas
- Shift + Scrolling the scroll wheel on the mouse: Scrolls Canvas left/right
- Ctrl + Scrolling the scroll wheel on the mouse: Dynamic zooming of the Canvas
- Clicking left mouse button, holding the button and moving mouse pointer: move element on the Canvas

4.2.2 Keyboard Commands

- Ctrl + N: New document command
- Ctrl + O: Open document command
- Ctrl + S: Save document command
- Ctrl + Shift + S: Save As document command
- Ctrl + P: Print command
- Ctrl + R: Open most recent document command
- Ctrl + Z: Undo command
- Ctrl + Y: Redo command
- Ctrl + A: Select All command
- Ctrl + Del: Delete command
- Ctrl + C: Copy selected item(s) command
- Ctrl + X: Cut selected item(s) command
- Ctrl + V: Paste selected item(s) command

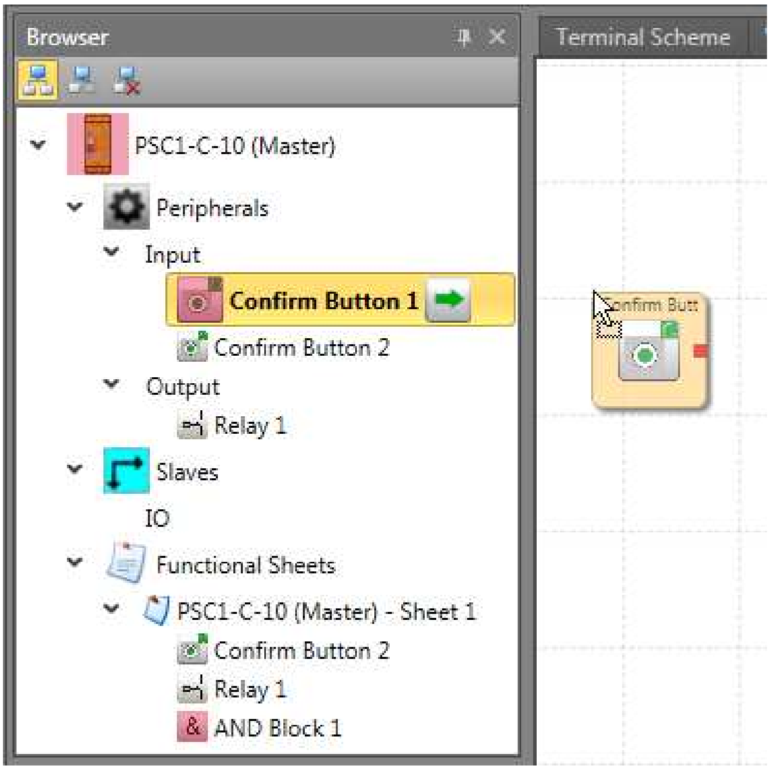
- Esc: Cancel command
- Backspace: Remove previous connection point command during drawing connection
- Ctrl + F: Show Global Search command
- Ctrl + F: Show Find dialog command (only when message Window has focus)
- Shift + F11: Create new sheet command
- Ctrl + Tab: Toggle between schemes
- F1: Show the SafePLC2 Help (on specific window the Help opens on an appropriate chapter).

4.3 Browser

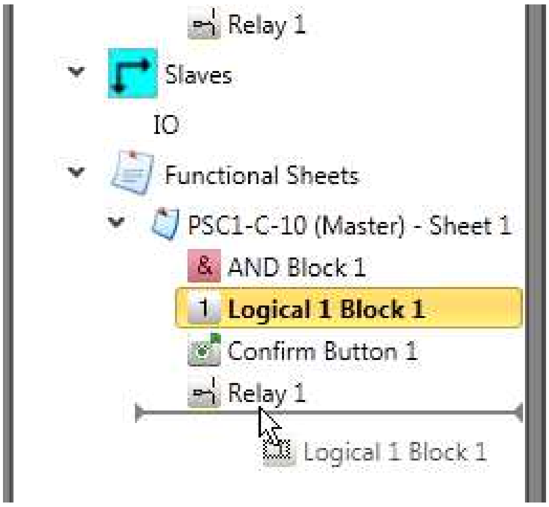


Browser panel provides overview of entire document. Devices, Elements and Functional sheets are represented as nodes within a tree view. Library panel adjusts its content automatically regarding the currently selected item in Browser. Each node in Browser can be expanded or collapsed. User can rename any node either by 2nd click on node or by context menu. Multiselecting is supported and can be achieved by holding Ctrl or Shift key. Selection in Browser is synchronized with selection in Canvas.

When Functional Scheme is selected and there is any Input or Output or Sensor element that has not yet been inserted into Functional Scheme then such items contains green arrow indicating these items can be dragged and dropped to Functional Scheme.

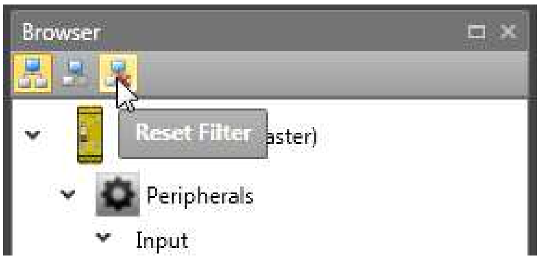


Order of children items within parent node typically can be adjusted by user by dragging and dropping element on desired place.



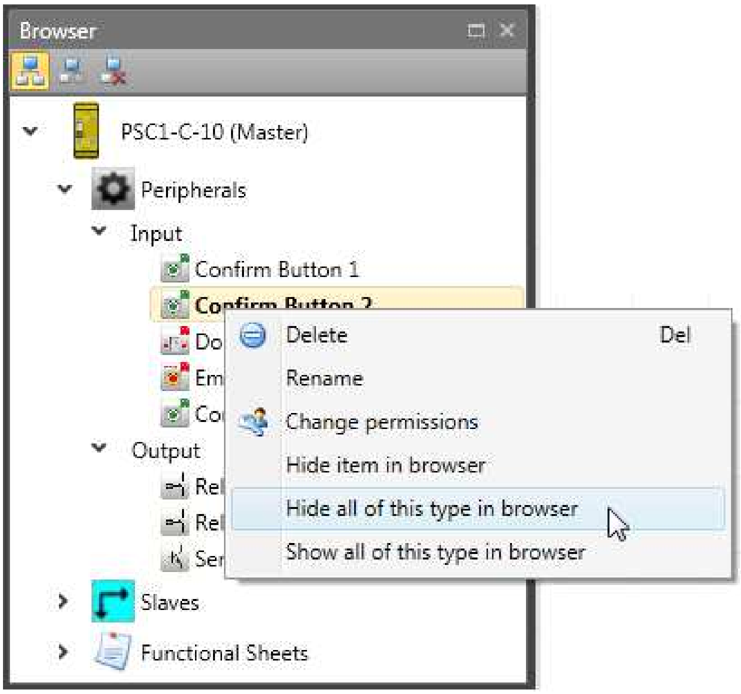
4.3.1 Filter options

This function allow clarify Browser tree with hide options. Right mouse button on element show filter options such as Hide/Show item in Browser, Hide/Show all of this type in Browser.



There are three buttons on top of the window that allow user to use filter options in Browser. First two buttons toggle between show all or show filtered elements in Browsers tree. Third button is Reset filter to default (show all).

4.3.2 Browser context menu



4.4 Document tab control

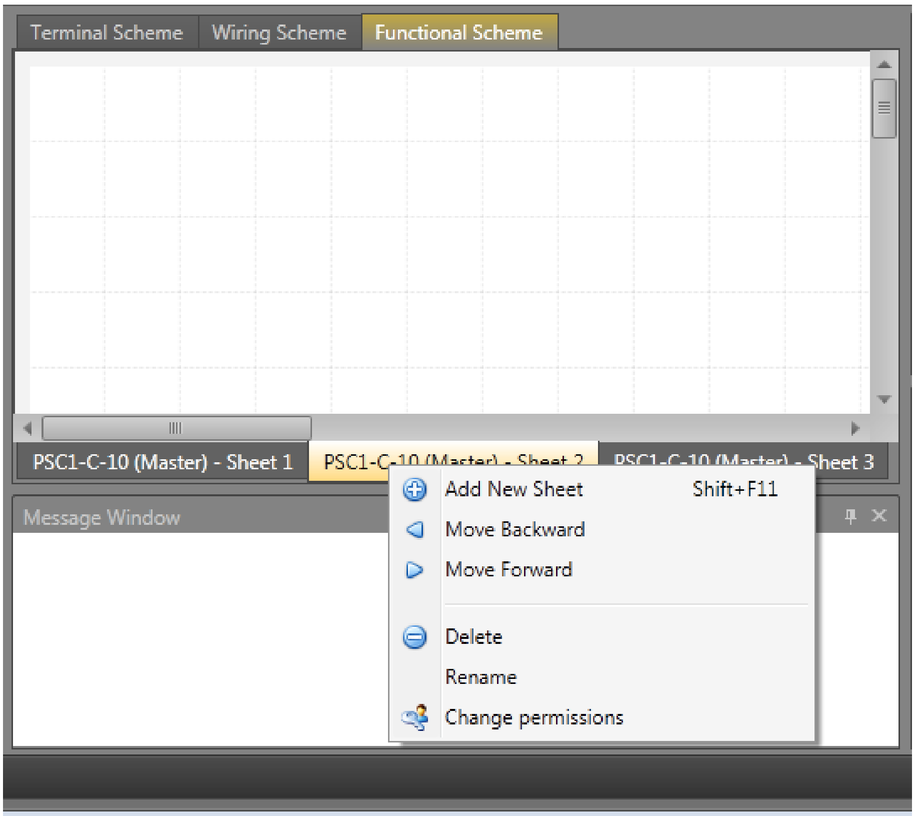
Following schemes are known within SafePLC2:

- Terminal Scheme
- Wiring Scheme
- Functional Scheme
- Groups
- Global Network
- Local Network
- SD Bus Groups

Each scheme and sheet are represented by single tab within document tab control. Document tab control allows user to switch amongst scheme types and sheets. Schemes tabs are placed on top of panel and Sheet tabs are placed to the bottom of panel. Note that by default only Terminal, Wiring and Functional Scheme tabs are visible. Rest of types (Networks, Groups, SD Bus Groups) will be shown only in certain circumstances. Each sheet belongs to one device. In case Slave device is selected in Browser then only schemes and sheets belonging to this slave device are visible. In order to show sheets of another device user has to select desired device in Browser.

Note:

Keyboard command “Crtl + Tab” toggle between schemes.



Sheet context menu shows:

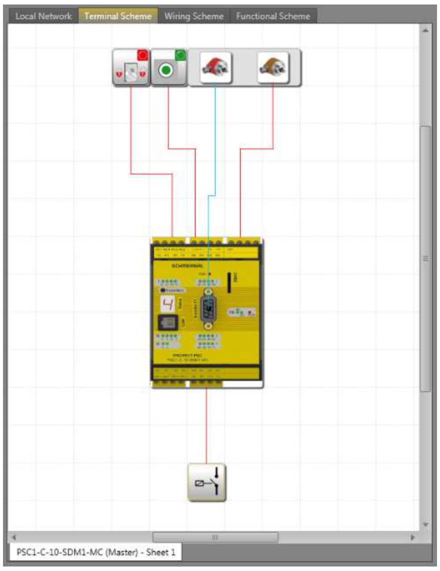
- **Add New Sheet** - adds new sheet to current scheme.
- **Move Backward** - moves current sheet one position to the left.
- **Move Forward** - moves current sheet one position to the right.
- **Delete** - removes current sheet. This command is not available when there is only one sheet left.
- **Rename** - renames current sheet.
- **Change permissions** - shows permissions dialog.

4.4.1 Scheme types

Each scheme and sheet is represented by single tab within Document tab control.

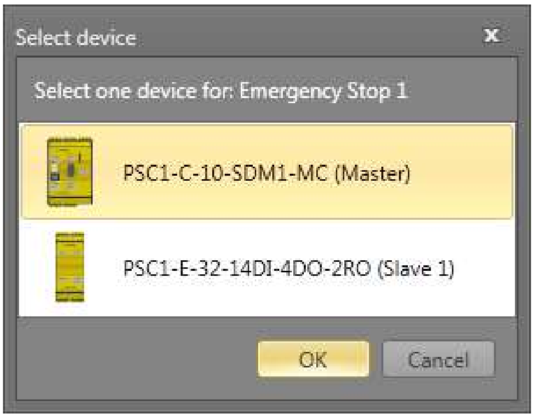
4.4.1.1 Terminal Scheme

The Terminal Scheme represents the simplified scheme with selected devices and peripherals of the PSC1-system.



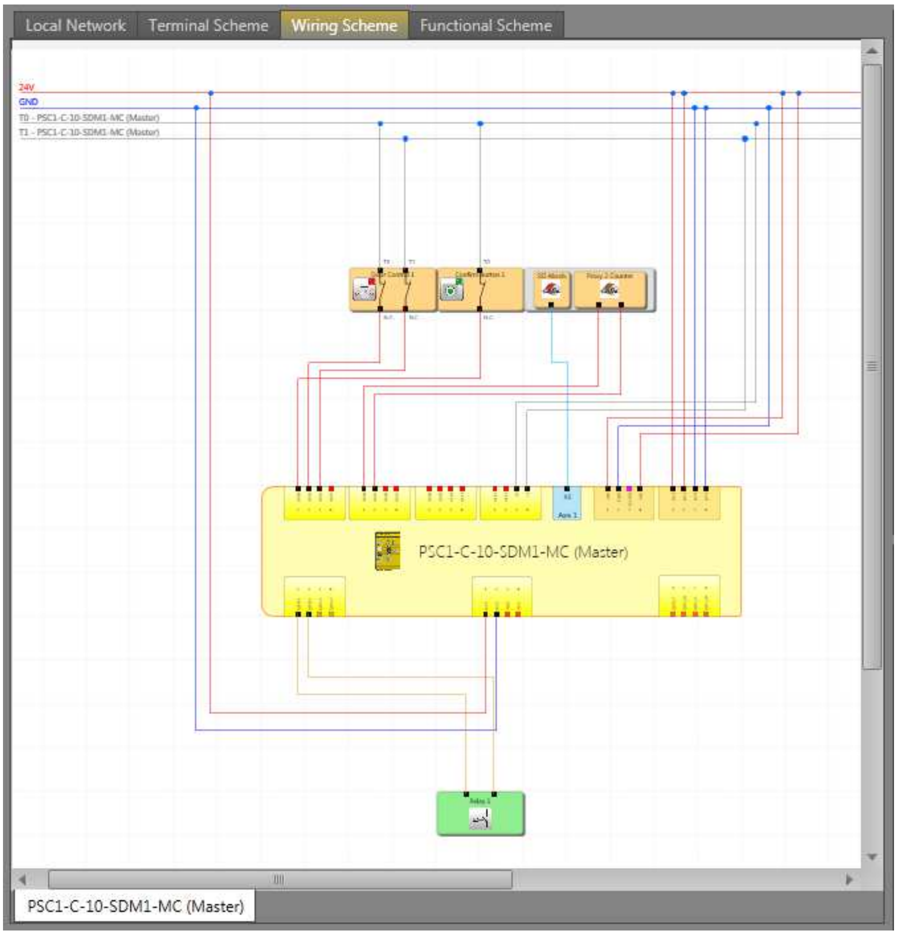
Terminal Scheme

If function blocks are inserted into the terminal diagram, the elements will be automatically paired with device. In the case of several devices in Terminal Scheme, user must add peripherals to appropriate device. Otherwise the selection device dialog appears.



4.4.1.2 Wiring Scheme

The Wiring Scheme describes the external port assignments in a PSC1-system to the chosen sensors and actuators. When creating a new project (Menu>New...) the scheme shows all available inputs and outputs, as well as further sensor interfaces (encoders, analogue sensors).
Even though auto-arrange is enabled, in some instances it may happen, that the connections are unfavorably displayed. However, this does not affect the function! When moving the corresponding block, the connecting wiring will be redrawn and may appear more distinctly.



Wiring Scheme

Potentials

- **24V** - This wire represents permanently 24 voltage power. PSC1 module requires 24VDC power supply.
- **GND** - This wire represents permanently ground serves as a (reasonably) constant potential reference against which other potentials can be measured.
- **CrossCircuitCheckT0/T1** - Wiring with T0/T1 test pulses.

Note:

No logic elements must be defined in this view, the corresponding commands are accessible in the Functional Scheme.

4.4.1.3 Functional Scheme

In the function block diagram linkages take place between input, monitoring, output and logic blocks.

In this respect the output connectors on the input elements correspond with the input data of the function block diagram. In the same way the input connectors of the output elements must be viewed as output data of the function block diagram.

In order to be able to create a clearly structured function block diagram, one can define so-called terminals. These represent a named connection between input and output connectors of function blocks (see chapter Terminal).

4.4.1.4 Group Scheme

Group Scheme includes one group sheet for each group block from Functional Scheme. This scheme is available after creating group block in Functional Scheme. For more information about creating Groups see chapter: “10.3.5 Groups“.

4.4.1.5 Global Network

All networks are shown in this scheme. Master connections and also connections with slaves, Fieldbus and SD-Bus Groups are shown there. For more information see chapter: ”10. Networks”.

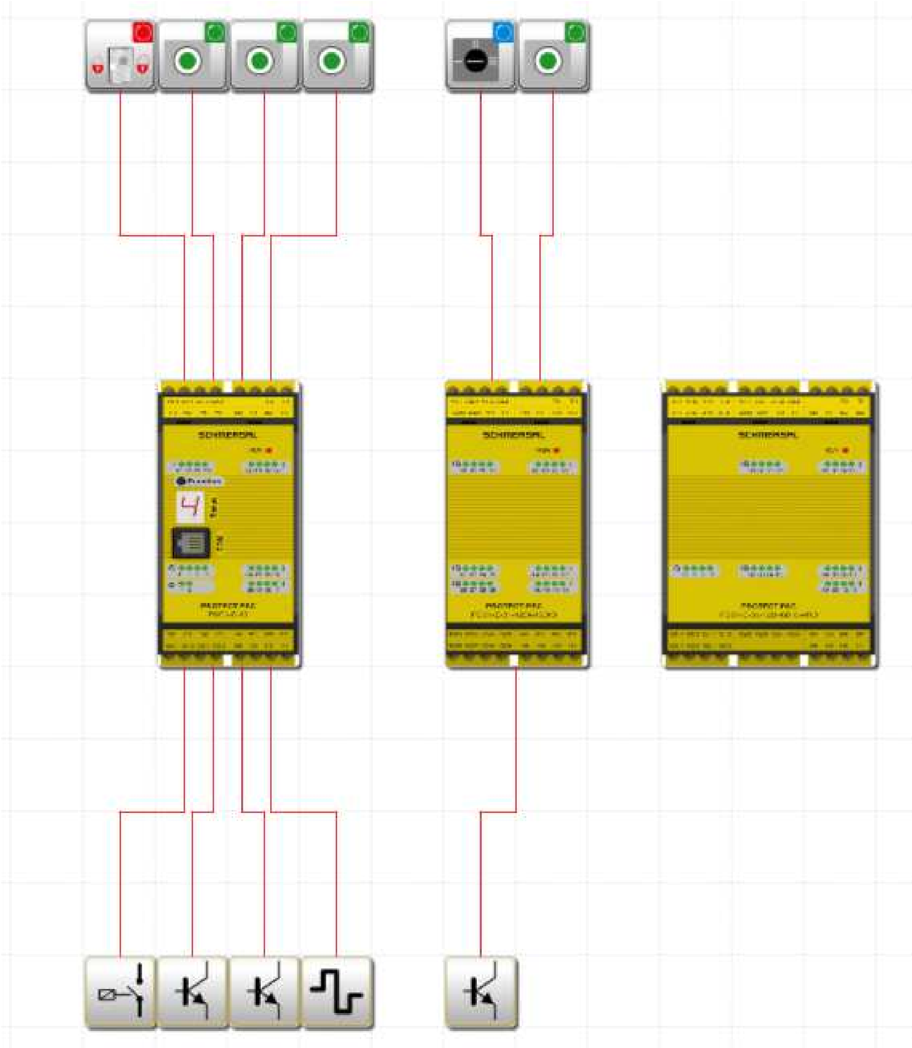
4.4.1.6 Local Network

In Local network type are the same elements shown as in Global Network without the Master to Master communication.

4.4.1.7 SD-Bus Group

By using a device which supports SD-Bus and activating that the SD-Bus Groups can be assigned to that device. A SD-Bus Group acting like an input element with two outputs (like light curtain element). It is possible to assign up to 31 groups for a SD-Bus supporting device.

4.5 Canvas



Canvas represents the base drawing tool. Each sheet is represented by its Canvas.

Useful tips:

- User can pan the Canvas by pressing middle mouse button regardless Pan mode is enabled or not.
- Zoom level can be changed by scrolling the mouse wheel while Ctrl key is pressed.
- User can scroll Canvas vertically by scrolling mouse wheel.
- User can scroll Canvas horizontally by scrolling mouse wheel while Shift key is pressed.
- Each Canvas stores its own Zoom level.

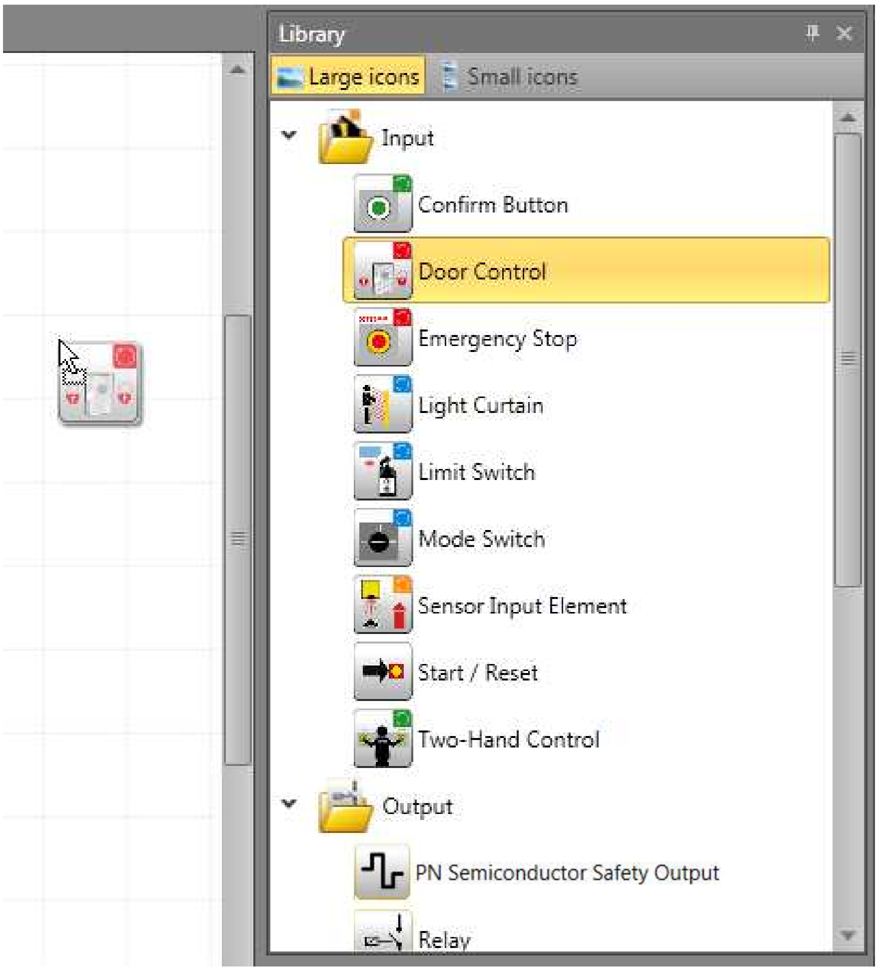
Canvas context menu shows:

- **Select All** selects all elements and connections within Canvas.
- **Paste** pastes elements and connections from clipboard (if present).
- **Pan Tool** toggles Pan Tool mode.
- **Insert Text** inserts texts to current mouse pointer position on Canvas.

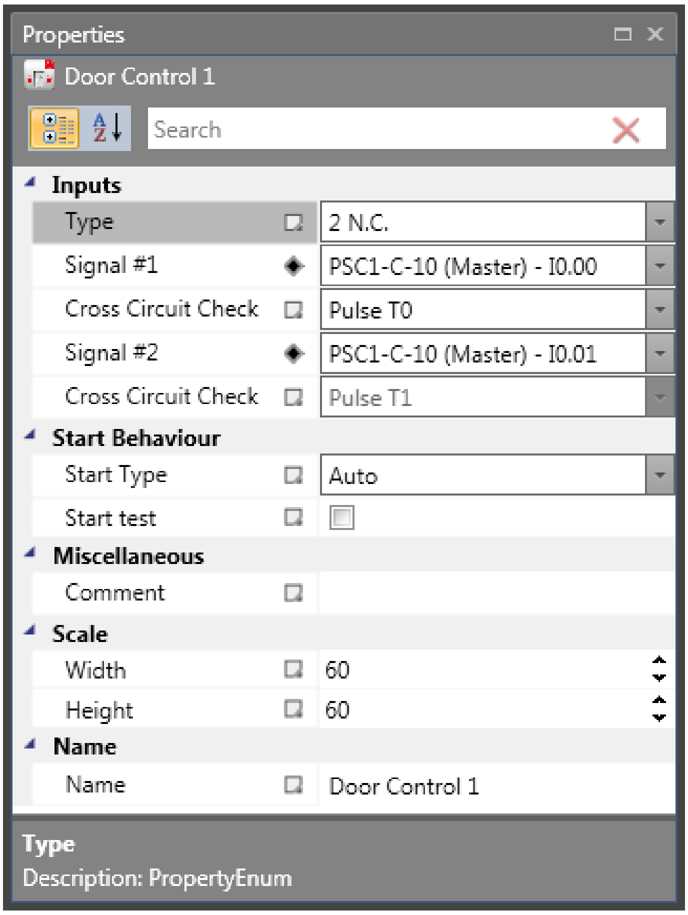
4.6 Library Window

Library window represents main tool for user to insert elements to document. Library window consists of collapsible folders. Each folder contains one or more elements. Folders and elements are filtered regarding to current scheme, current sheet and currently selected element in Browser or Canvas. There are two buttons on top of window that allow user to toggle between element size views.

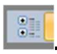
In order to insert element to document user must drag element from Library window and drop it onto Canvas.



4.7 Property Grid

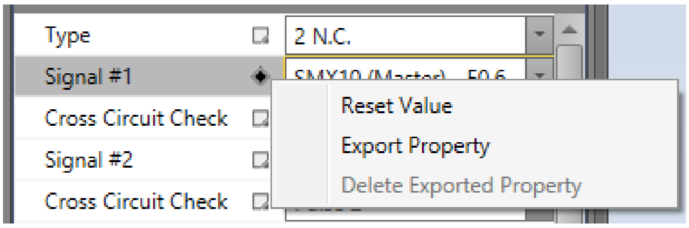


Property Grid allows user to change property values of elements. Content of Property Grid is automatically refreshed and reflects currently selected element.

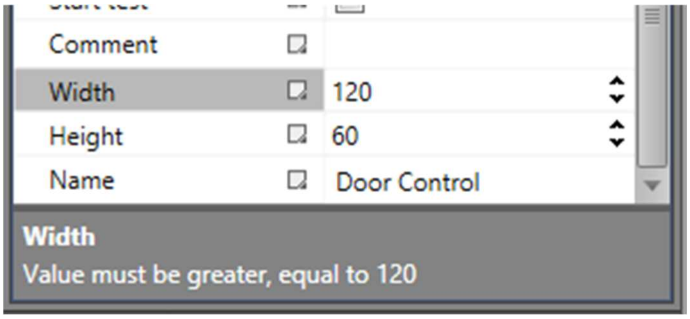
By default, properties are grouped into categories. By clicking on Alphabetical button  properties can be sorted alphabetically. To switch back user has to click on Categorized button .

Search block  provides fast and easy tool to find desired properties.

When property value is set to its default then there is white icon next to property name. When value is set to value other than its default then icon becomes black. After clicking on this icon user can reset value to its default.



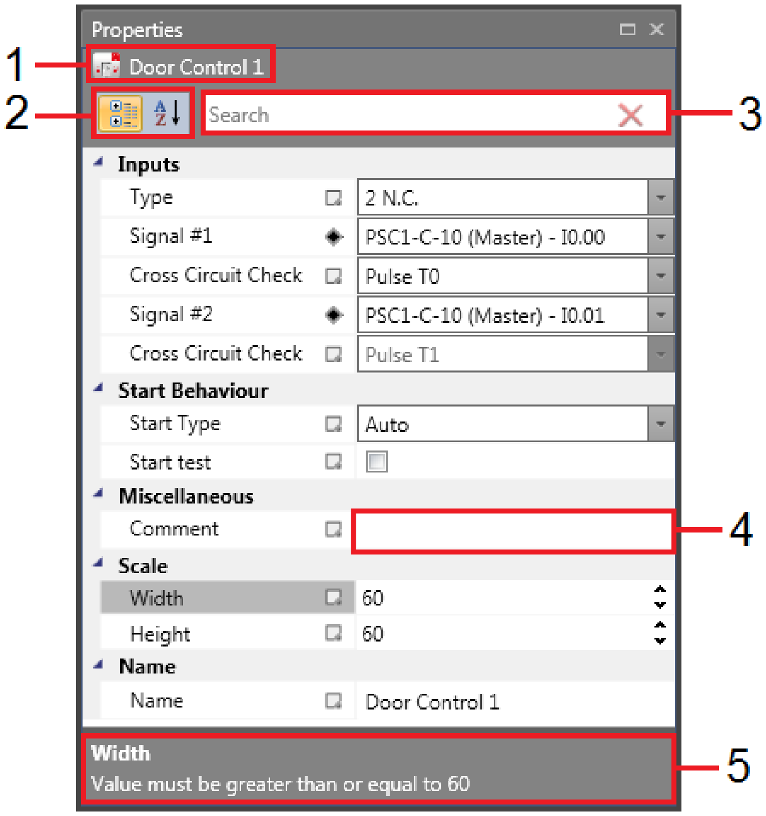
Bottom bar of Property Grid shows additional information about currently selected properties.



The Property Grid is where you can view and modify the properties of a selected object. The panel displays different types of editing fields, depending on the needs of a particular property. These Edit fields include Edit boxes, Drop-down lists, and links to custom editor dialog boxes. You can open Property Grid by pressing the Properties button in the Window tab of the Ribbon menu.

Tip:

The Comment field can be in more lines. User can switch to next line by pressing Enter on keyboard.

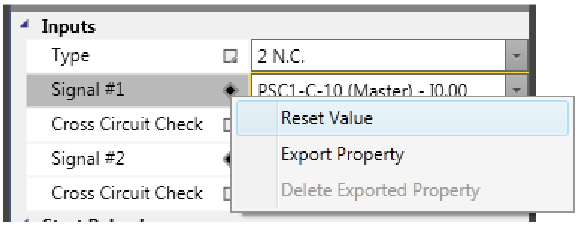


Property Grid contains:

1. The name of the selected object.
2. Toggle buttons for changing arrangement of the property list:
   - Categorized - Lists all properties and property values for the selected object by category. You can collapse a category to reduce the number of visible properties. Categories are listed alphabetically.
   - Alphabetical - Alphabetically sorts all properties for selected objects.
3. The Search box for filtering the properties that are displayed by the text that is entered.
4. The Edit field for the comment.
5. The description of the selected property.

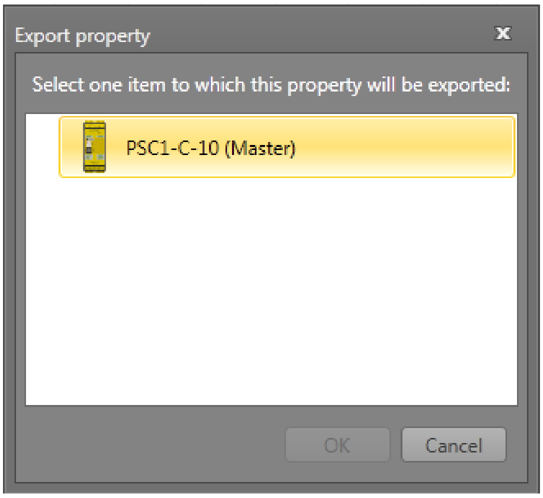
4.7.1 Advanced options menu

The advanced options menu allows users to invoke property-specific commands.

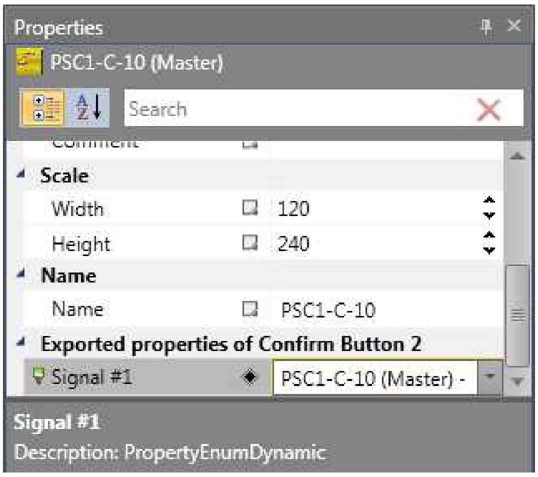


Advanced options menu allows to:

- Reset value – Allows user to reset the property to a default value.
- Export property – Allows user to export the property to any element, that is higher in hierarchy.
- Delete Exported Property – Removes exported property from the element.



Export property dialog:

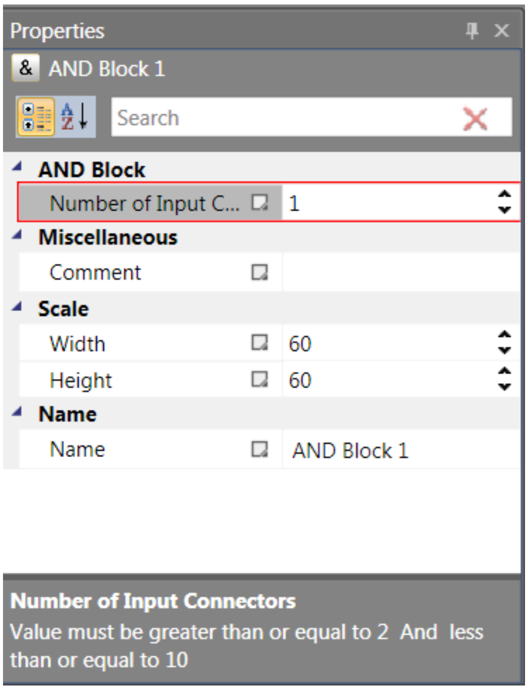


Exported property on a master device

4.7.2 Property validation

4.7.2.1 Input validation

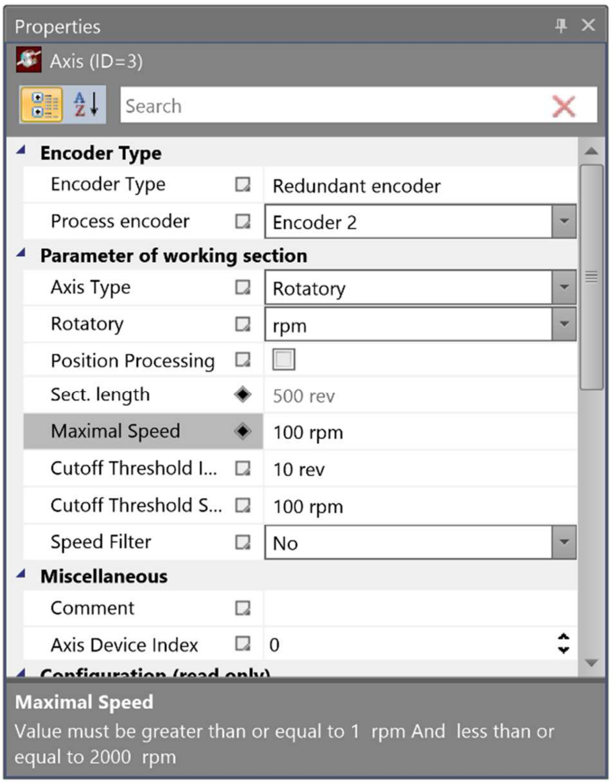
Input validation checks if an editor value is within a range specified by the property and if the value does not contain any illegal characters. If the value is invalid, a red rectangle is drawn around the editor.

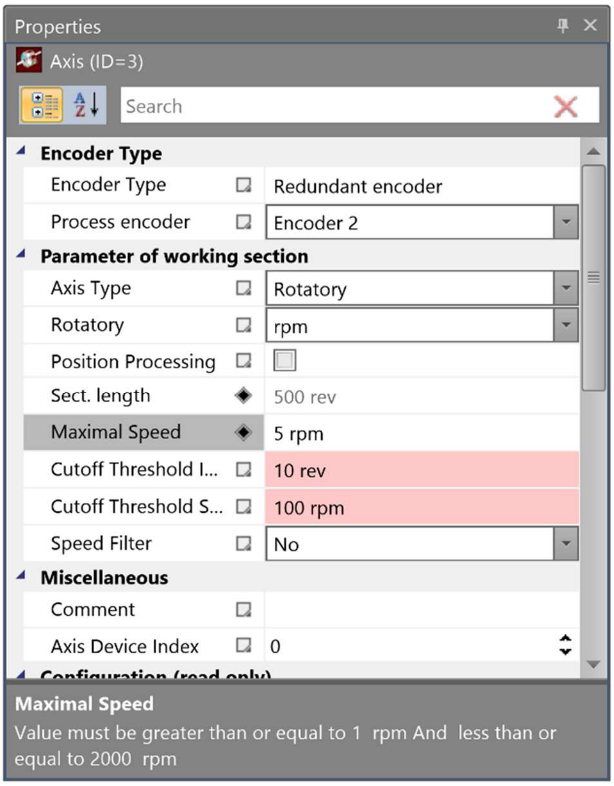


Value of the Number of Input Connectors property is out of range

4.7.2.2 Value validation

Value validation checks if an editor value meets the constraints defined by other properties. If the value will become invalid, the background of the editor will turn red.

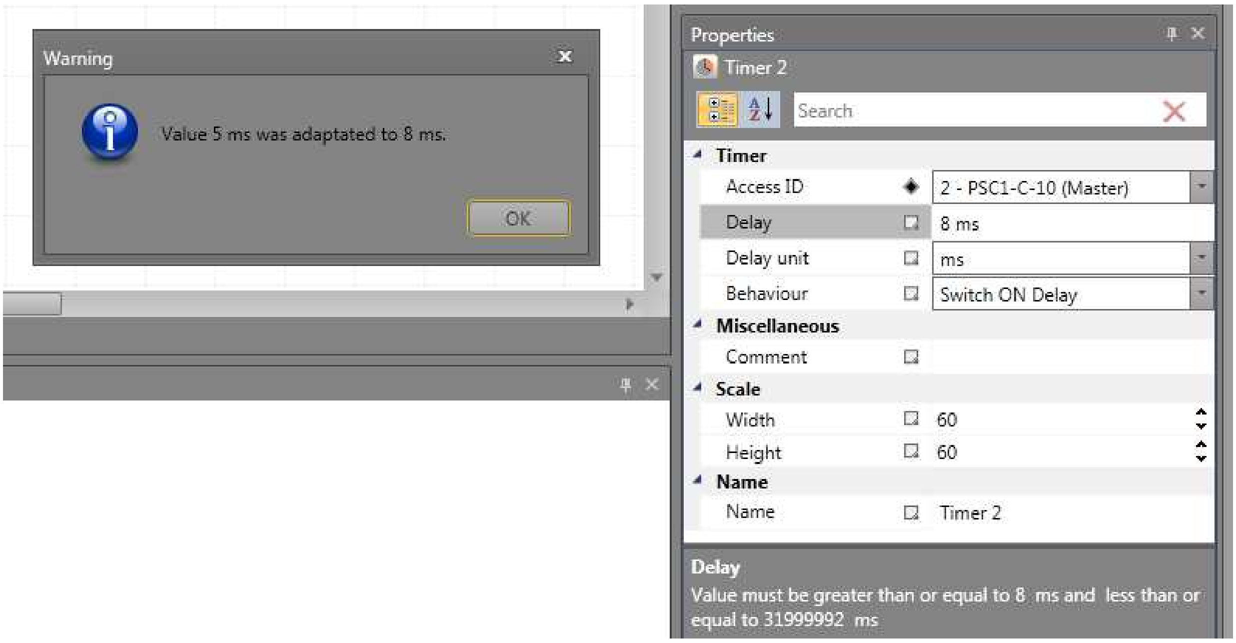




Example of value validation. After changing value of Maximal Speed property to 5, Cutoff Threshold properties became invalid.

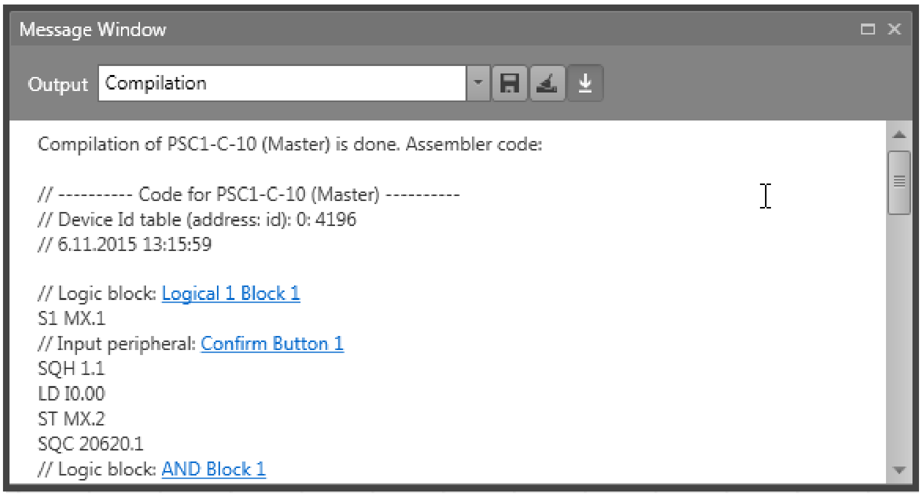
4.7.2.3 Adaptation function

If a value does not meet constraints defined in the function, the function will update the value and display a message box with a description about why the value was invalid.



Example of adaptation function. After changing the value of the Delay property to 5, the value was evaluated by adaptation function and was changed to 8.

4.8 message Window



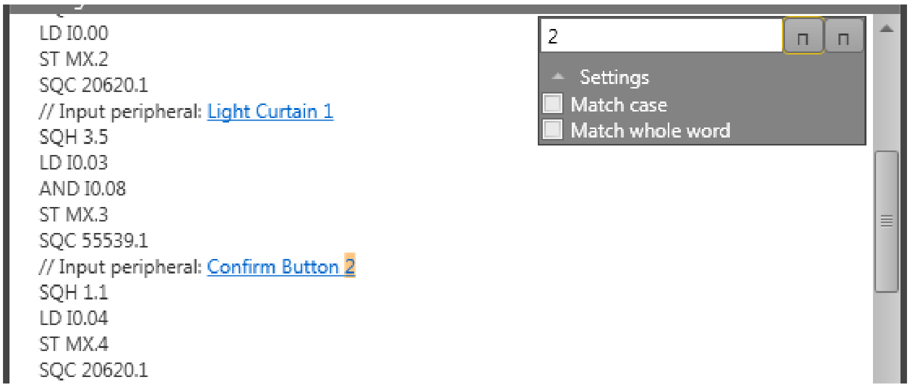
Besides the output of status and error messages as well as the display of results from the examination of the Functional Scheme, the message Window also is a useful tool for checking function block data within their context.

Quick Jump

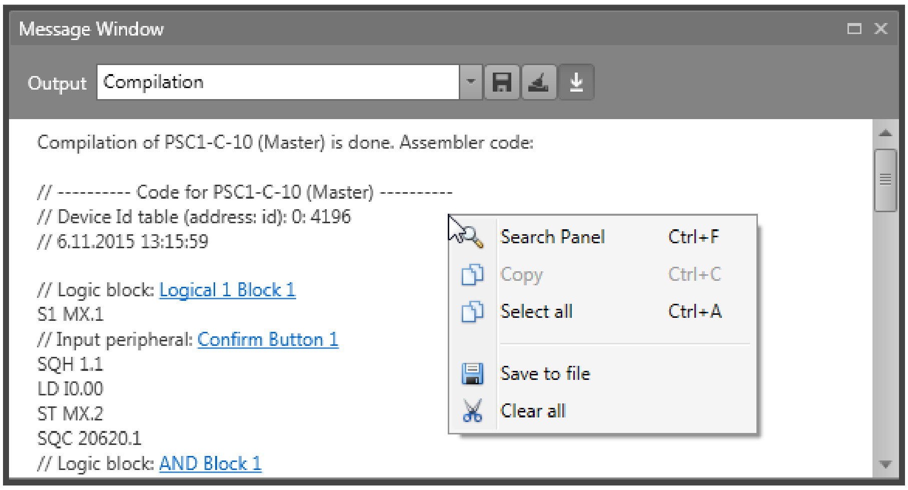
By clicking on the colored BlockIDs (Block name) in the message Window one can navigate to given element so that Canvas scrolls to proper position to ensure element is visible.

Search Panel

Search Panel is available through keyboard shortcut Ctrl+F. Take into account that this shortcut works only when message Window is focused. Second way to show Search Panel is via context menu.



Search Panel allows user to search through compiled code. To find next occurrence one has to click on Find next button  also available through F3 key. By clicking on Settings one can expand or collapse additional settings. By checking the checkboxes user can determine the search method.



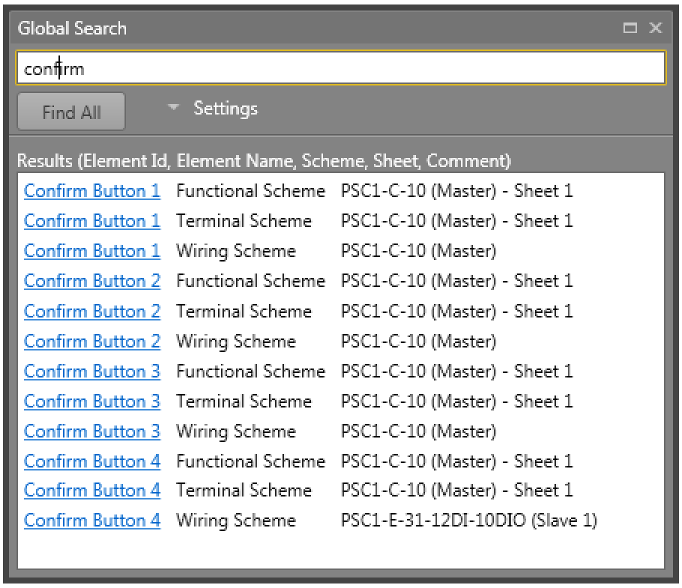
Options in message Window

- Output:
    - Application – show other application errors
    - Compilation – show compilation output. In the case compilation failed, window shows failure error and information.
    - Device interface – show process information (compilation, communication etc.)
- Save to file button – Save output as *.txt file.
- Clear all button - deletes whole text.
- Auto scroll to bottom toggle button - Scroll output text to bottom after compilation

Context menu

- **Search Panel** - toggles search panel visibility.
- **Copy** - currently selected text into clipboard, making the text available for pasting.
- **Select all** - selects whole text.
- **Safe to file** - save output as *.txt file.
- **Clear all** - deletes whole text.

4.9 Global Search

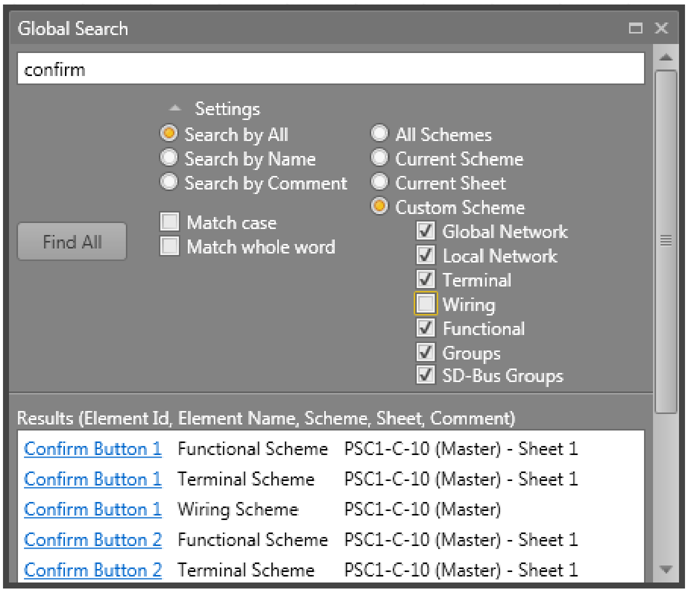


Global Search is a powerful search tool. Text entered into the Search box will be searched based on settings. To find all occurrences of given text one has to click on “Find All“ button or press Enter key.

Search Settings

By default, the search settings section is collapsed, and one has to click on Settings expander

.



Besides well-known settings such as “Match case” or “Match whole word”, “Global Search” also provides user to search by Name or by Comment. In addition, one can determine from which schemes results should be displayed.

Quick Jump

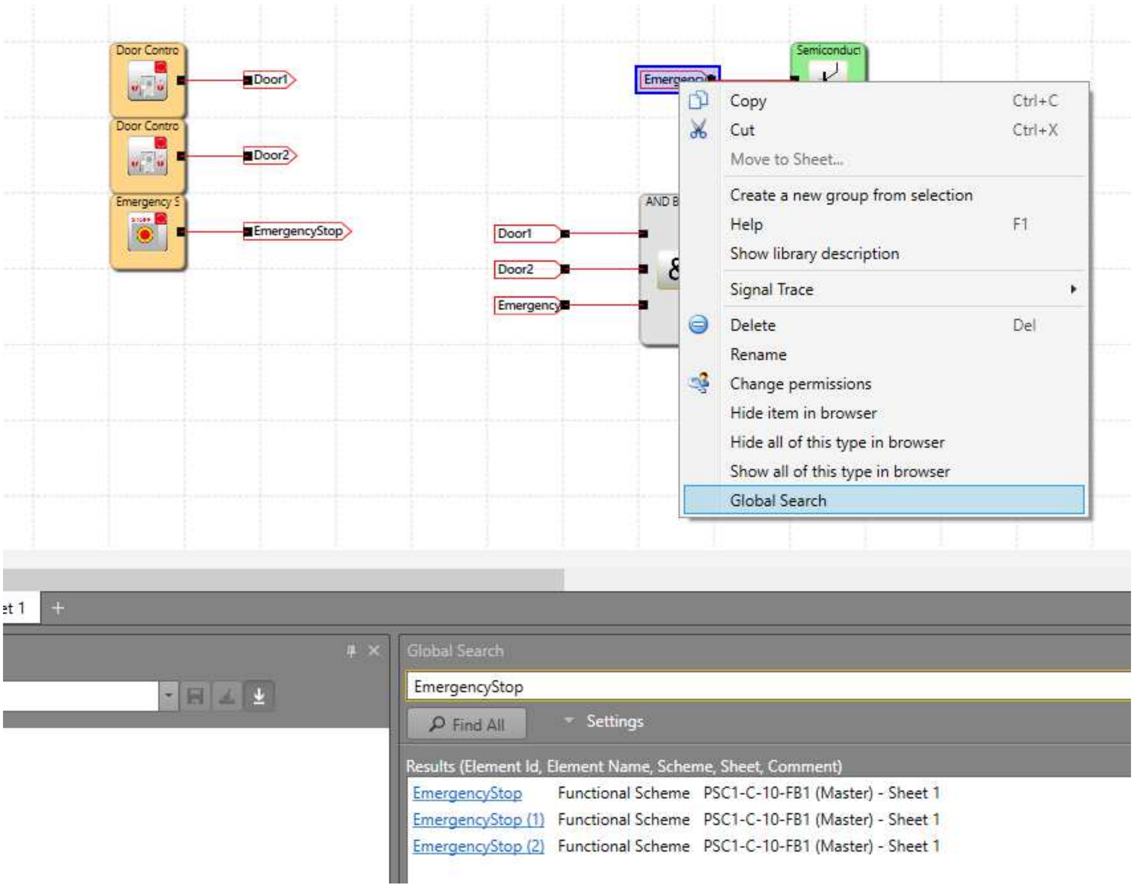
By clicking on Block name user gets immediately navigated to block.

Tip:

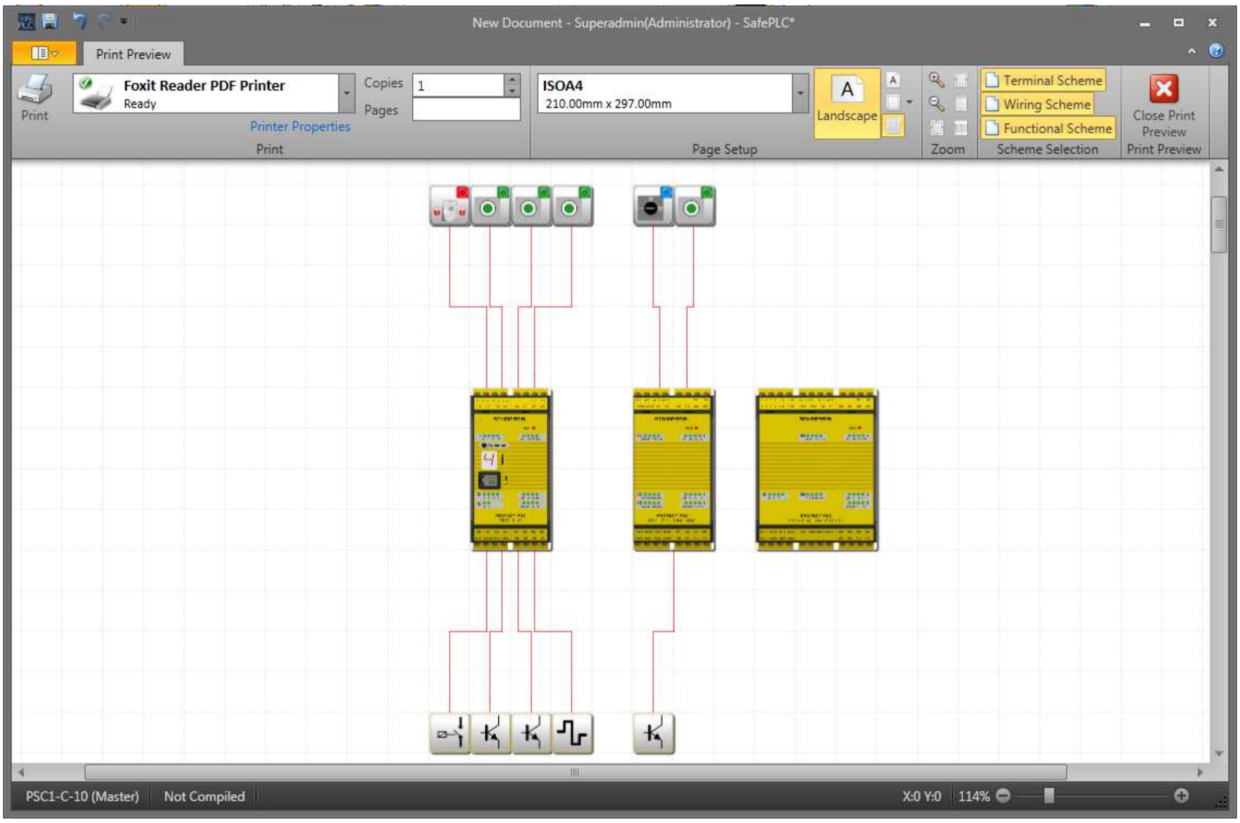
In the context menu (right click) of the individual elements you will find the entry *Global Search*. This transfers the name of the element directly into the search window and executes the search.

Note:

For terminals, the numbering is resolved so that these elements, which are usually used several times, can be found very easily.



4.10 Print



Print group

Print allows to print created scheme on paper. It is possible to select printer and set printer properties. You can set how many copies should be printed and set range of pages which should be printed.

Page Setup group

There it is possible to set paper size, orientation (Landscape, Portrait), paper margins (Left, Right, Top, Bottom) and it is possible by using Print Grid toggle button turn off and on grid on the paper.

Zoom menu group

- **Zoom In** – Zoom in content in preview window (+10%).
- **Zoom Out** – Zoom out content in preview window (-10%).
- **Actual Size** – Zoom content to 100% size.
- **Page Width** – Shows page full width.
- **Whole page** – Shows whole page in preview window.
- **Two pages** – shows two pages at the same time.

Scheme selection menu group

- **Terminal Scheme** toggle button – sets whether the Terminal Scheme will be printed or not.
- **Wiring Scheme** – sets whether the Wiring Scheme will be printed or not.
- **Functional Scheme** – sets whether the Functional Scheme will be printed or not.

Print preview

- **Close Print Preview** – close window for print preview.

To print scheme from document:

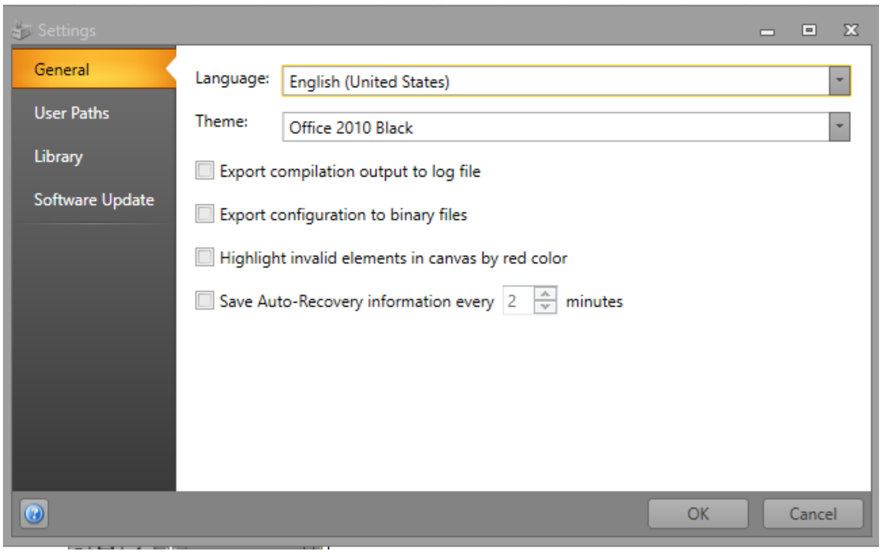
1. Click on “Print” button via “Home” group tab (or click on Print on the Quick Access Toolbar or use keyboard combination Ctrl+P).
2. Check the printing preview for Terminal Wiring and/or Functional Schemes before printing.
3. Select the printer from list with ready status.
4. Set the number of copies and pages.
5. Set page setup properties such as paper size, orientation, margins and you can switch on or off “Print Grid”. For Advanced printer properties click on “Printer properties”.
6. Click on “Print” button. When you want to edit scheme or continue work click on “Close Print Preview”.

In “Zoom” group it is possible to set Zoom for print preview.

4.11 Settings

Settings window allows user to change application settings. To switch the category, click on desired tab on the left of the program.

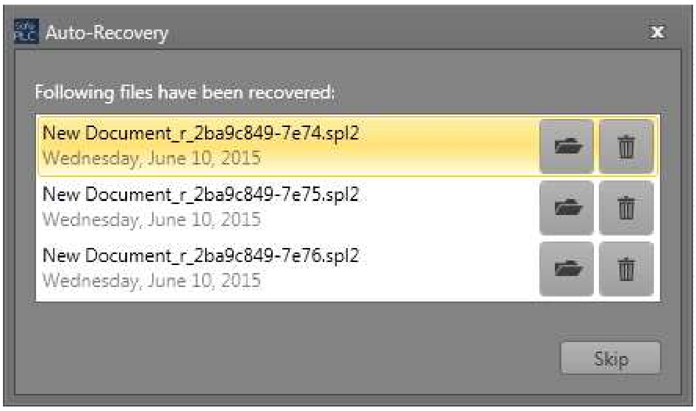
4.11.1 General:



Allow language selection, theme and check on or off possibility to save compilation output to log file and save configuration to binary files, “Highlight invalid elements and setting Auto-Recovery function.

4.11.1.1 Auto-Recovery function

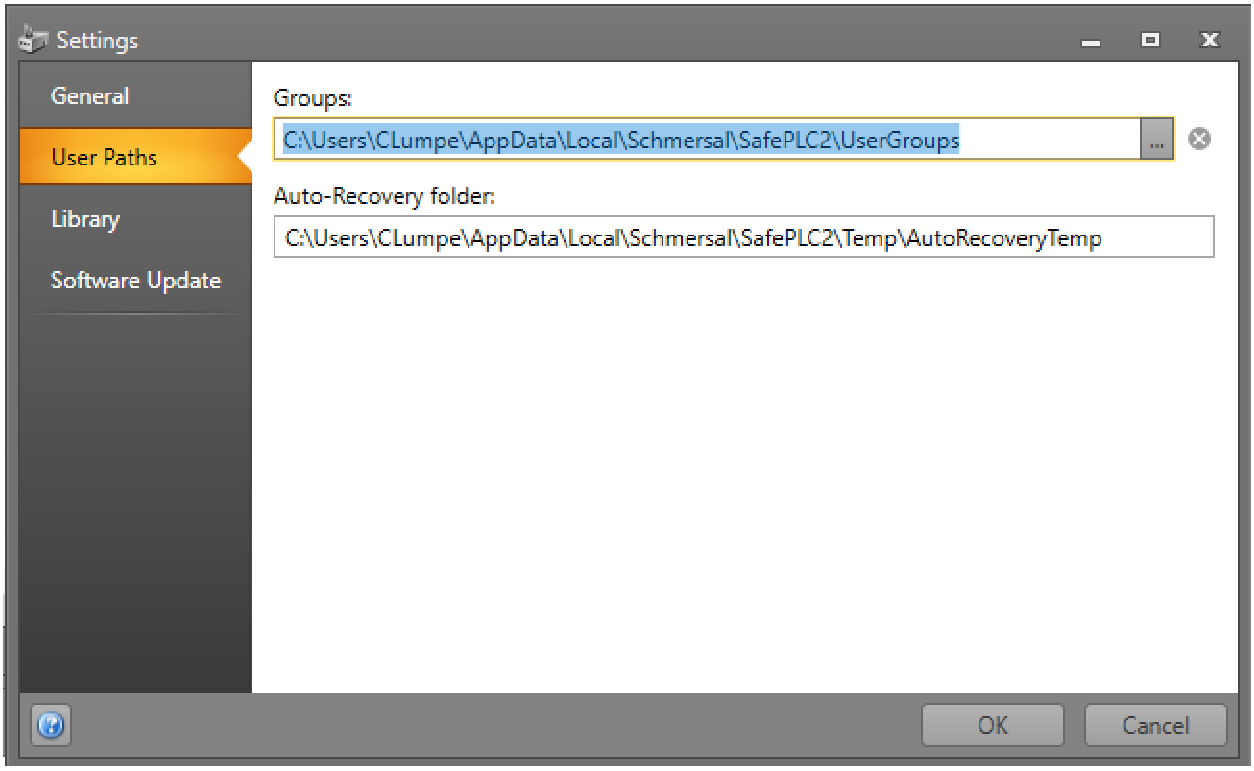
SafePLC2 has a built-in Auto-Recovery function. This feature saves document process of opened file at a user-definable fixed interval (1 to 60 minutes). The files can be recovered if program closes unexpectedly, for example, during a power failure or unexpected crashing. This SafePLC2 function saves the document process in the temporary file directory which path is in User Paths tab. Restarting SafePLC2 after crashing allow user to select Auto-Recovery files, delete these files or click skip to pass the selection to the next start of SafePLC2. However, this does not save project data when SafePLC2 closes normally.



Auto-Recovery options are:

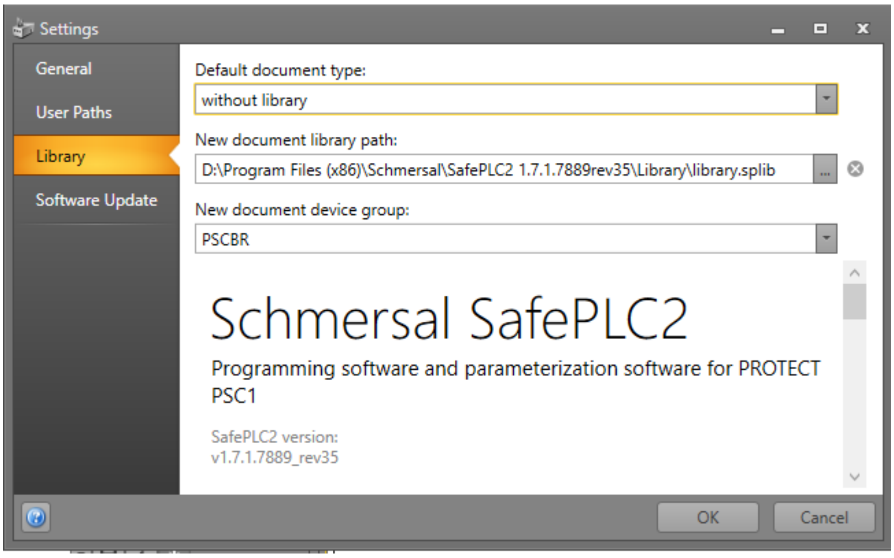
- **Open file** – This will allow to continue process with selected recovery file. Other saved recovery files remain to next restarting SafePLC2.
- **Delete file** – Delete recovery file and program continue with blank document. If only one recovery file is available, next selection is not necessary.
- **Skip** – Skips the recovery selection and continue program with blank document. Recovery selection keeps files to next restart SafePLC2

4.11.2 User Paths:



Allow the definition of the paths where “Groups” and the “Auto-Recovery” data is stored.

4.11.3 Library:

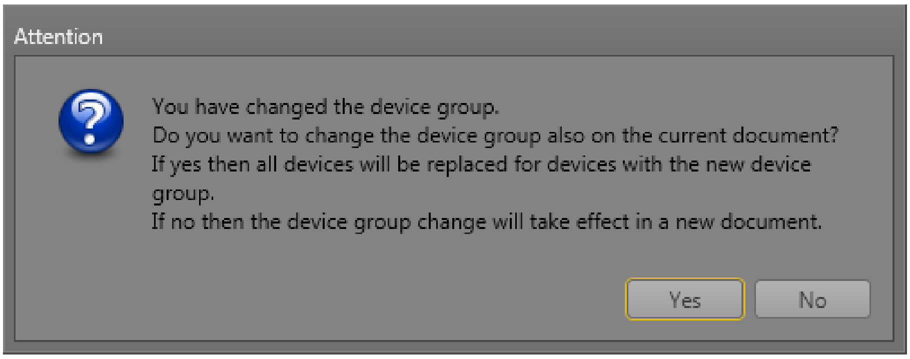


Library options

- **Default document type:** Allow to define whether the project is stored with or without library
- **New document library path:** Allow to set the path to the Library *.splib file.
- **New document device group:** Allow device group selection.

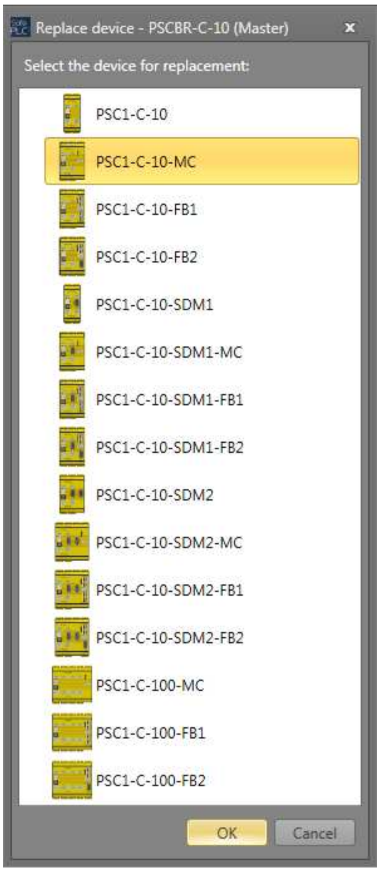
4.11.3.1 Changing device group

After changing the device group, you have to confirm the following



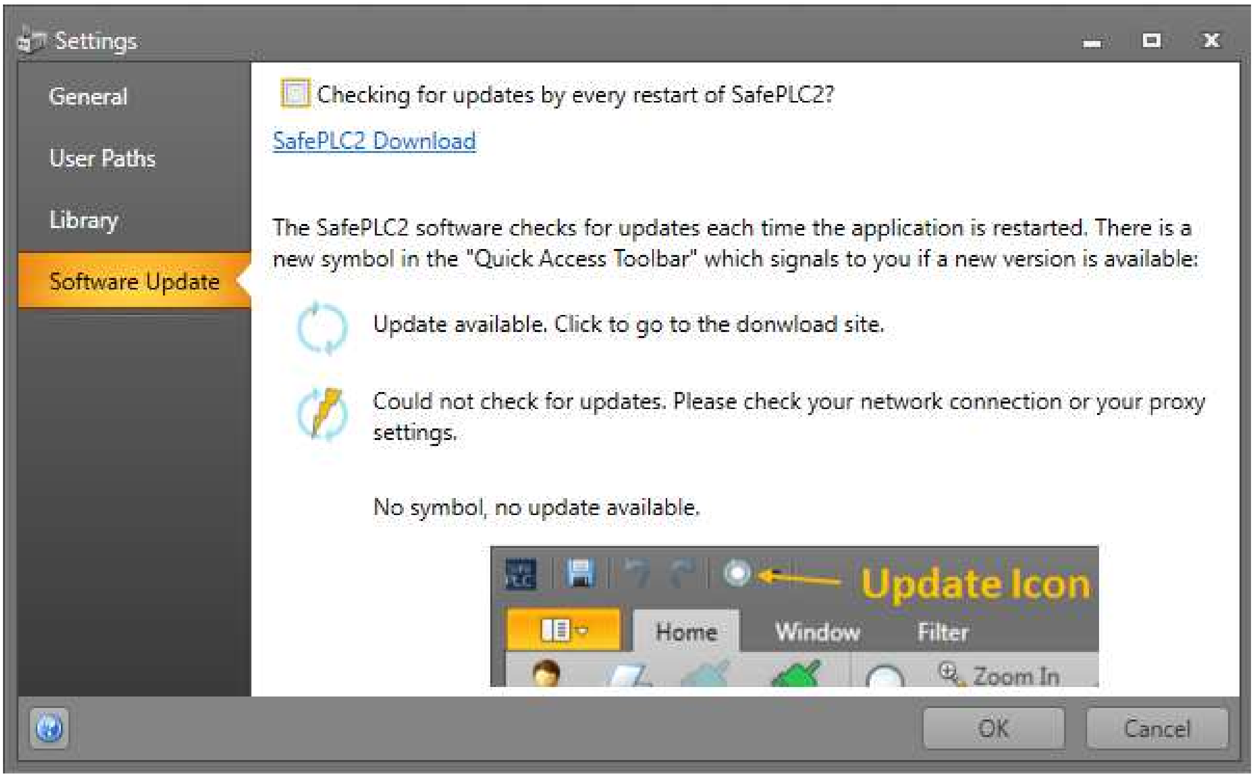
Changing the device group while creating a scheme is possible. After changing, above shown attention window appears. If user wants to keep created scheme in current document, select "Yes". Otherwise change will only take effect in a new document.

After changing in a current scheme, the device must be replaced. A dialog shows all available devices:



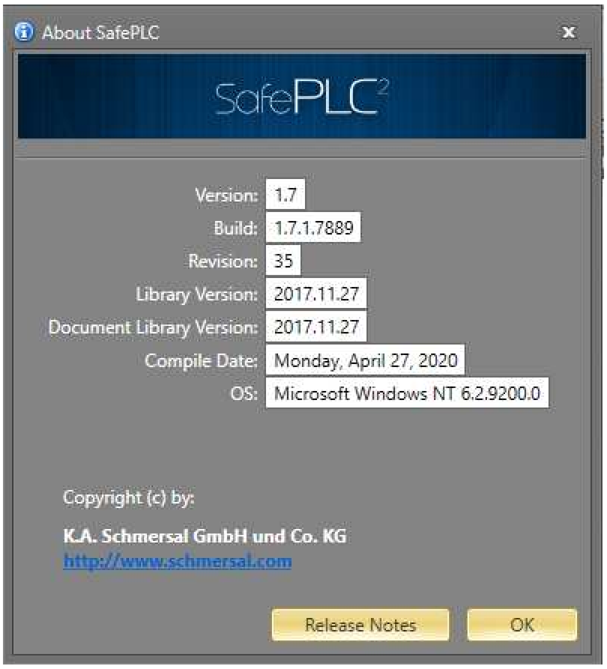
Selecting device for replacement after device group change

4.11.4 Software Update



If the function *Checking for updates on restart* is activated, SafePLC2 checks whether a new version is available in the Schmersal online catalogue (products.schmersal.com). The result is then displayed in the program bar as shown. A click on this symbol or by means of the link SafePLC2 Download, the corresponding page in the online catalogue is opened directly.

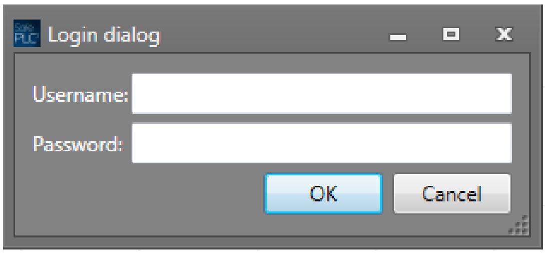
4.12 About the Program



The About SafePLC2 window displays information about the Windows system, application version and compilation information.
Release Notes displays the changes compared to the previous version.

4.13 Change User

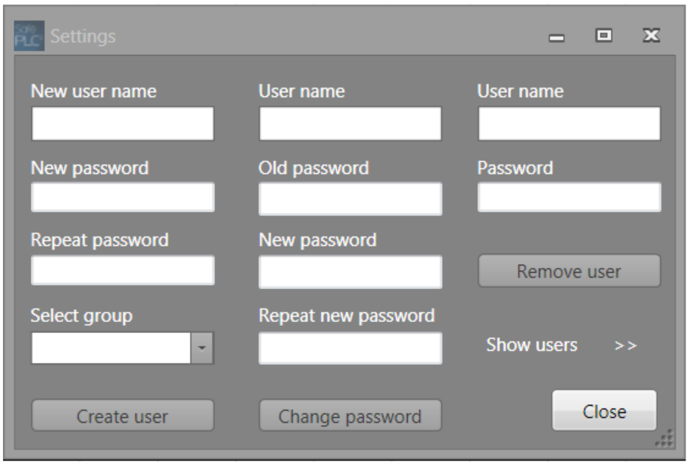
“Change User” window allows user to log in or log off:



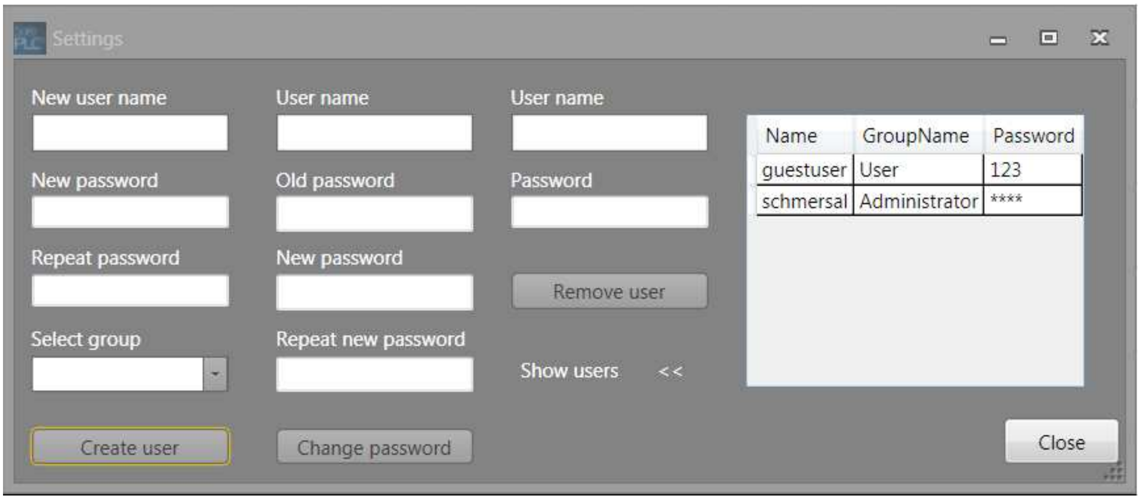
	Username	Default-password
Administrator	schmersal	schmersal
Standard	guest-user	123

4.14 User Service Setting

Via this dialog it is possible to manage users (create new users, change password for existing users and remove users).



First column is used to create new user, second column to change password for existing user and third for remove user. To look for defined users click on „Show users".



Note

The update of the changes of user database only take place after restarting the application.

4.15 User Rights Dialog

The User Rights Dialog allows an administrator to change user permissions for every object in a scheme.

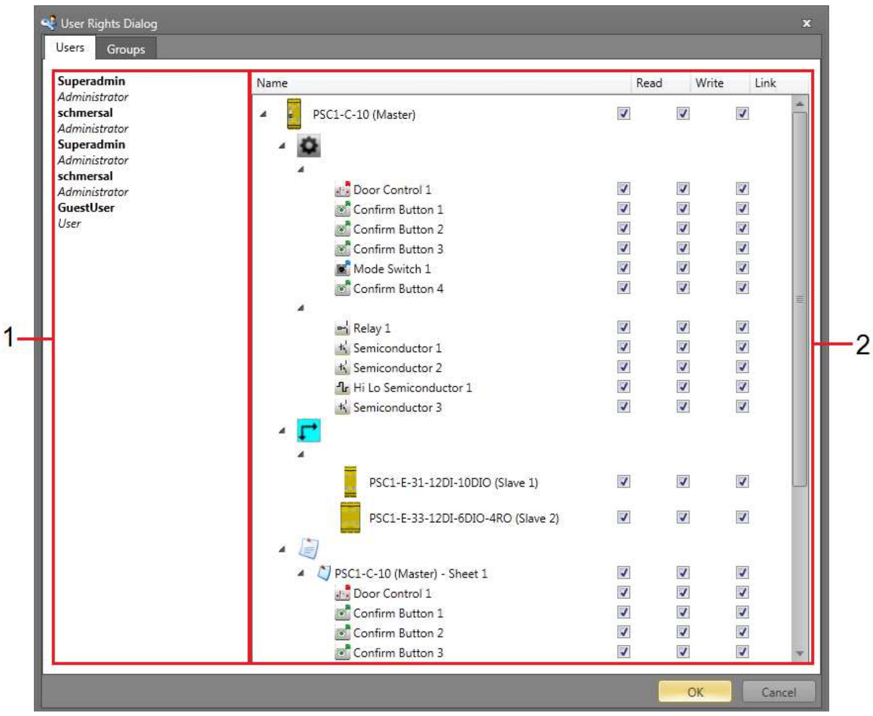
The application implements three specific permissions that apply to each object:

1. The Read permission grants the ability to read the properties of an object.
2. The Write permission grants the ability to modify the properties of an object.
3. The Link permission grants the ability to link an object with another objects.

The dialog is accessible only to administrators. The dialog can be opened by pressing the User Rights button on the Home tab. The dialog consists of Users and Groups tabs.

4.15.1 Users Tab

On the “Users” tab an administrator is able to modify permissions for every other user:

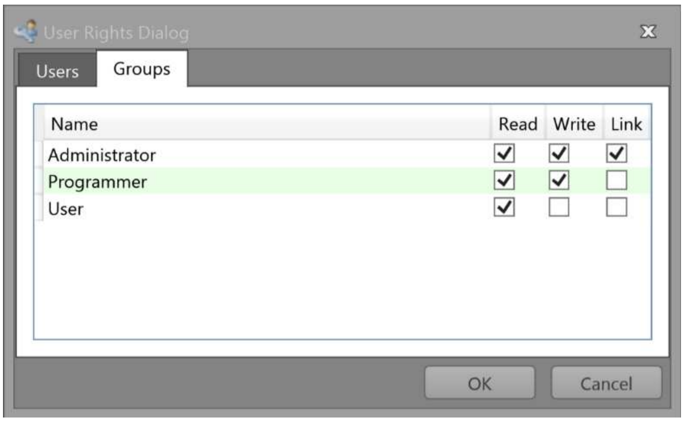


- List of users along with the name of the user group to which they belong (e.g. Administrator). Each user employs a default set of permissions, unless overridden, which he inherits from the user group
- The list of elements along with the permissions of the currently selected user.

Note:

User can change permission for every block or group independently by right mouse button and selecting change permission option.

4.15.2 Groups Tab



The "Groups" tab allows an administrator to change the default permissions of individual user groups.

5 Creating a program

The program SafePLC2 is a graphically oriented software for creating a PLC-based monitoring program for the PSC1 module. The procedure described hereafter has been found most effective for the programming of the PSC1 devices, whereby it is not strictly prescribed.

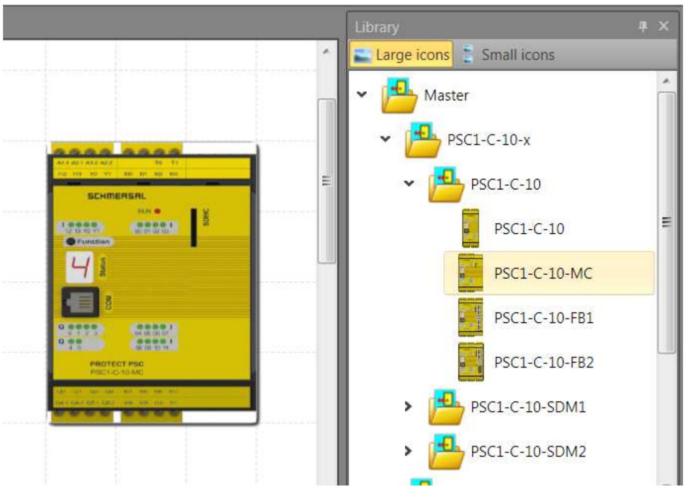
General note:

The program requires write and read rights of the user logged in to the PC that is used for programming. Missing access rights can lead to side effects in Functional Scheme debugging or cause problems when saving logic diagrams to directories with limited rights.

5.1 General Workflow

Drag an icon in the library or a menu option and Drop it to the Canvas to insert in selected scheme. If it is possible the item will automatically add a block in Canvas. The proposed process steps correspond with the considerations, which should be executed when planning a safety related monitoring of a drive axis.

Drag & Drop



To add a block or device simply use “Drag & Drop”.

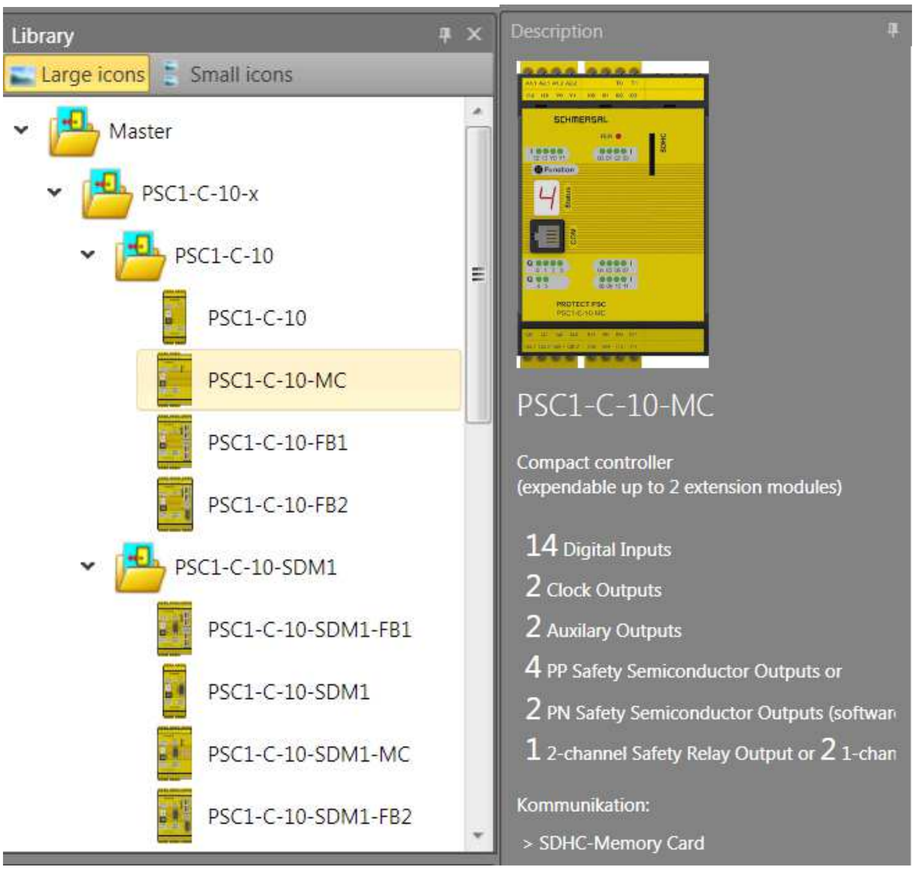
The basic sequence involved in drag and drop is:

- Move the pointer to the object
- Press, and hold down, the button on the mouse or other pointing device, to "grab" the object. The “Esc”-key cancels this mode.
- "Drag" the object to the desired location by moving the pointer to this one
- "Drop" the object by releasing the button

Please proceed as follows to create an application:

1. **Selection of the device type to be programmed**

Once SafePLC2 has been started, or if a new logic plan is to be created, the blank Canvas will appear. All available devices are in library. Clicking on appropriate module the description window shows the module preview and data such as: programming interface, safe monitoring or number of sensor interfaces, digital I/O's, outputs, inputs etc. The desired module can be added via Drag &Drop.

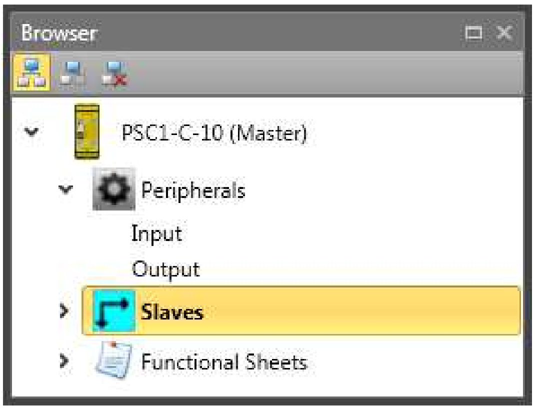


Device preview description

The system device must be selected first to continue procedure.

Adding slave device

Once the master device is added to Terminal Scheme, the secondary device must be a slave device. Otherwise the master device will be replaced. But the program will show a replace alert message.

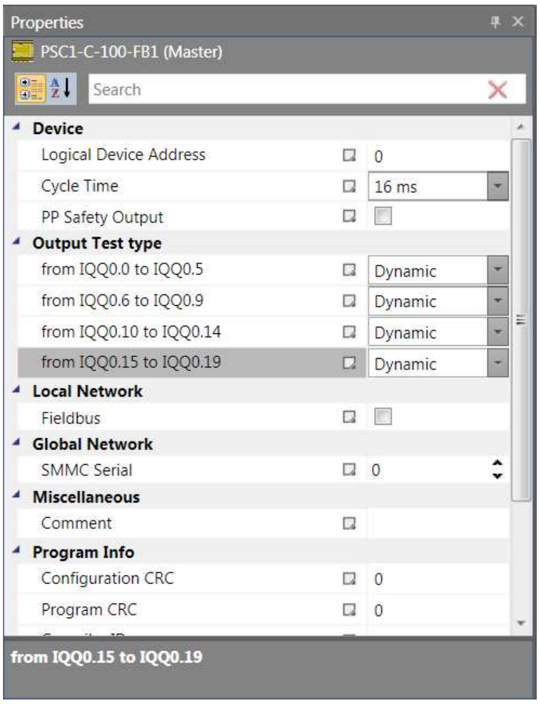


Note:

Due to the associated resources and their management in the programming environment changing the equipment type at later date is not recommended.

The following device Property Grid can be used to assign a name and to choose the parameters e.g. “Cycle Time”, etc.

The setting of “Cycle Time” is only changeable for the PSC1-C-100 to 16ms, 24ms and 32ms.



Device Property Grid

2. Determination of peripheries in Terminal Scheme

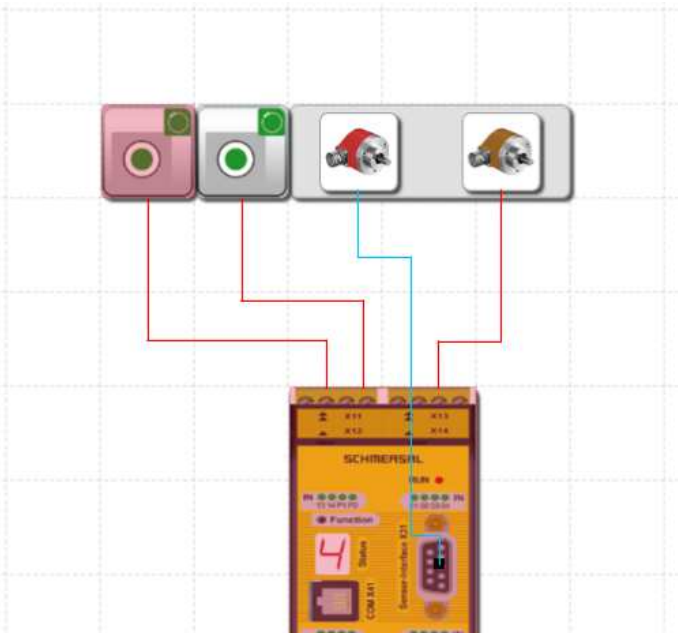
The Terminal Scheme represents the simplified scheme with selected devices, encoders, inputs and outputs of the PSC1-system. The required modules are automatically linked after inserting.

The following procedure is recommended:

- Select appropriate peripheral types in Browser tree.
- Choose module from library.
- For modules with speed and position monitoring the definitions of encoders used and their parameters are required.

Note:

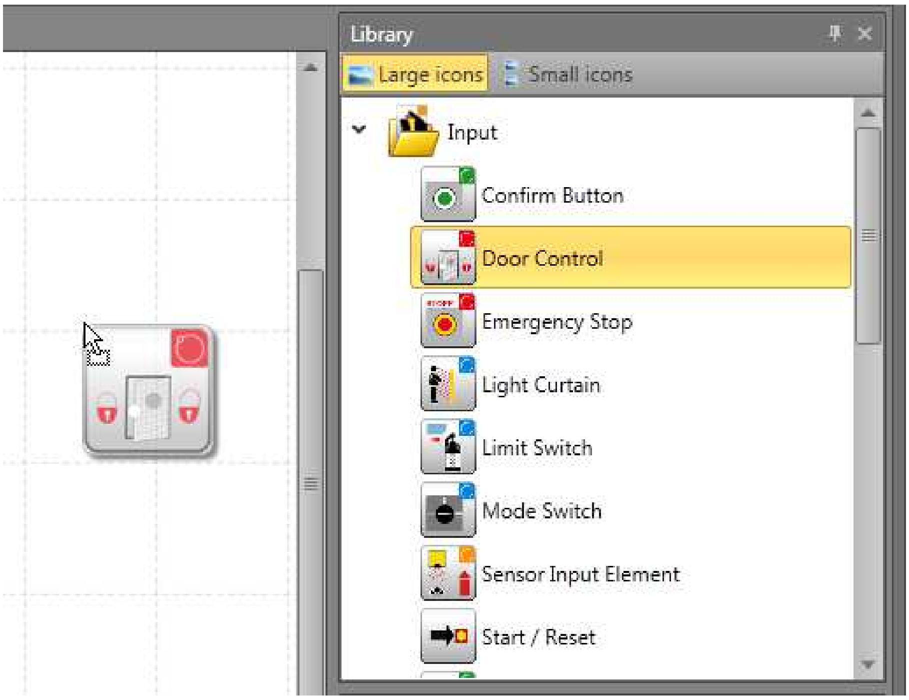
A red icon indicates that it is not used in Functional Scheme.



"Confirm button" with missing parametrization (red)

For a module with analog processing (only on request) the used interfaces must be parameterized.

Selection of input and peripheral modules (Confirm Button, Door Control, Emergency Stop, Light Curtain, etc.) via the library "Input elements":



In the same way add required output modules (Semiconductor, Relay, etc.)

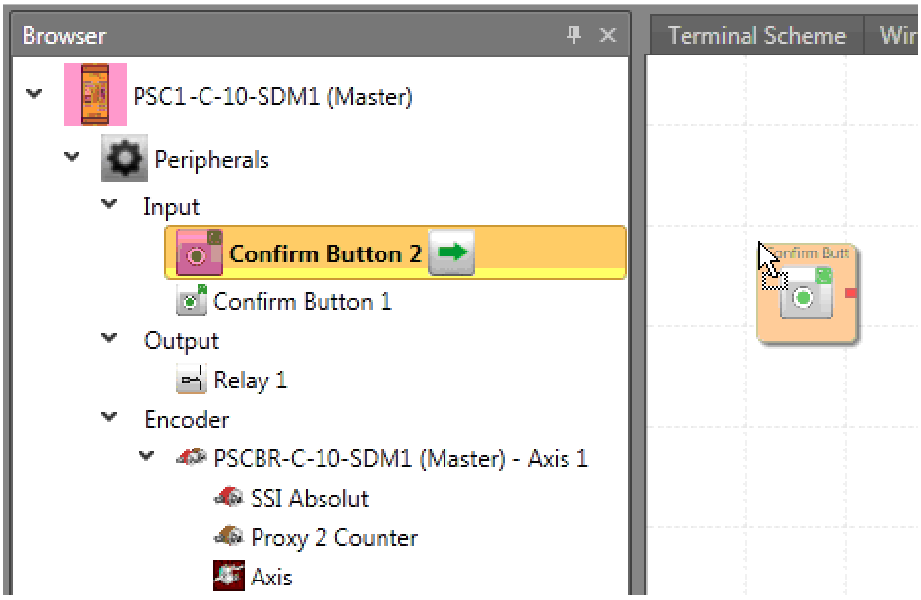
Note:

The Wiring Scheme represents the connections to sensors and actuators of the PSC1 system with displayed connectors. After choosing the required peripherals, these are subsequently linked with each other.

.

3. Definition of peripherals in the Functional Scheme

The Functional Scheme shows the logic modules and their internal linkage.
Peripherals that has not yet been inserted into Functional Scheme are marked with a green arrow indicating that they can be dragged and dropped to Functional Scheme.



Inserting the Input block

Big markups indicate that this element isn't used in Functional Scheme, small markups indicate that the element isn't yet connected.

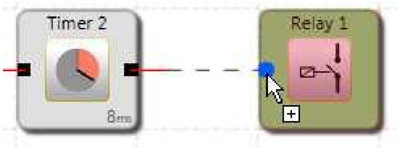
4. Definition of monitoring functions and logic modules in the Functional Scheme

The Functional Scheme shows the logic modules and their internal linkage.

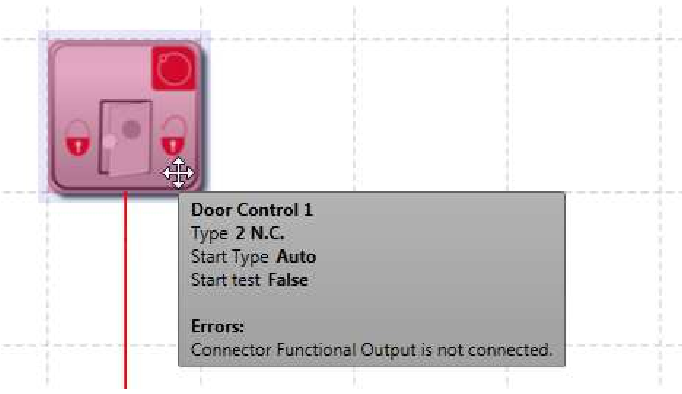
Programming of the Functional Scheme by using:

- Logical and processing elements.
- Timers, flip-flops (trigger elements) and terminal blocks.
- Monitoring modules for drive monitoring (this is only possible, if the associated sensors had been defined).

After choosing the required modules, these can be subsequently linked with each other.



For this purpose, drag the mouse pointer across a "start connector". First press the left mouse button in start connector, and then by second clicking connect a "target connector" For more info see chapter „Wiring".



Info display

5. Compilation of monitoring program

After completion of the programming process the Functional Scheme is compiled and transformed into a machine-readable format.

This process consists of:

- Examination for open connectors in the logic diagram
- Examination of boundary conditions for the monitoring functions
- Examination of the correct distribution of pulses for cross-wire detection
- Generation of a transferable OP programming code for the PSC1 module

6. Program transfer to PSC1 by clicking on Device Interface

After opening Device Interface dialog window, the program automatically compiles the program.

Process of transferring program consist of:

- Setting the COM output
- Transfer of the machine program
- Transfer the network configuration whenever a network is used
- Testing the program on the PSC1 module
- Preparation of the configuration report and validation of the configuration
- Lock the logic plan after approval

5.2 Adding Input elements

The input elements create the digital connection between one or several connected sensors and/or further lower-level switching devices in the ***PSC1 System***. Each input element, except the mode selector switch, provides one logic output signal "0" or "1" for further processing in the PLC.

The input elements are automatically added and edited in the "Terminal Scheme" or "Wiring Scheme" view. In the "Terminal Scheme" the Input Blocks are inserted from Browser.

The resource control of the function block elements for the PSC1-system manages the available elements, the number of which may be limited.

If no further elements are available when programming the Terminal Scheme, blocks for adding the corresponding modules or function blocks are not available. The available blocks are shown in library. These resources can be released again by deleting the corresponding function blocks. To delete a block, select the block from Browser or Canvas and by right mouse button select Delete or press Del.

5.3 Inserting Output elements

The output elements create the digital connection between one or several connected external switching circuits in the ***PSC1 System***. Moreover, one can also specify how external switchgear is to be monitored. Each output element is triggered by a logic input signal "0" or "1" via the Functional Scheme.

The output elements are added in the "Terminal Scheme" or "Wiring Scheme" view. Edit the Output elements in "Functional Scheme". In the "Terminal Scheme" the Output blocks are dragged and dropped from Browser.

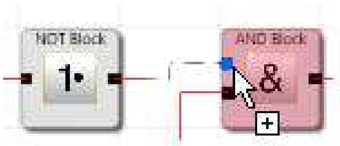
The automatic monitoring of resources of the function block elements for the PSC1-module has the effect, that only the available elements are enabled in the program. If there are no resources available for the monitoring program in the PSC1-module, the commands for inserting the corresponding components or function blocks will be disabled (library options is not available). This is e.g. the case when all digital outputs of the PSC1-module are occupied. These resources can be released again by deleting the corresponding function blocks.

5.4 The Logic Modules

These modules form the basis for creating a program for the safety application. They enable the logic linkage of the input with monitoring functions and with the outputs. Inserting logic modules is only possible in the "Functional Scheme" view, otherwise the associated menu commands are disabled. This is the case when the resources for a module are already used up, e.g. after all timer modules have been inserted.

For description of each Logic module see chapter „Logic functions“

5.5 Wiring

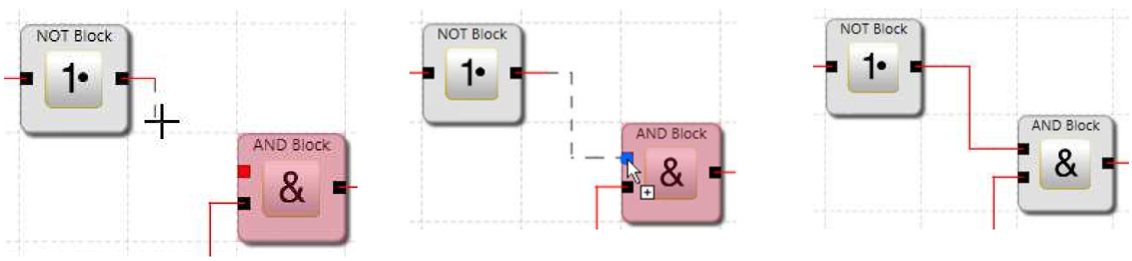


The assignments in the Functional Scheme are created by linking the input and output connectors of the functional modules. An output of a module may, if necessary, be multiply connected with inputs on other modules, whereby any input must only be assigned once. Apart from this, certain module groups cannot be interconnected for technical reasons. In case of an invalid connection the program will display a corresponding message.

Only orthogonal control points can be generated, i.e. the connecting lines will always run horizontally or vertically.

Connection set-up

1. First press left mouse button to select a start connector.
2. User can define rout by simply clicking the clear area to define breakpoints.
3. Second click to select target connector.
4. If Auto-arrange is enabled the connection and block will be automatically arranged.



<u>Note:</u>

Connections can only be selected with a mouse and deleted by Del button.

Tip:

If all connections of a module are to be deleted, one should delete the associated function block. The connected connections will in this case be automatically deleted.

The program routes a new connection in “Terminal or Wiring Scheme” automatically. The program draws the connection by inserting additional control points (breakpoints) based on a bisecting algorithm.

The graphics display can be varied, and the overall presentation optimized by simply moving the function blocks (if auto arrange is disabled). In complex diagrams it may happen that a connecting line will intersect with a function block. This behavior has no influence on the internal function of the linkage.

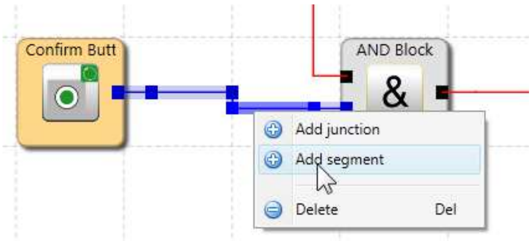
Note:

Not all scheme types create connection automatically.

Support of drawing of user defined connecting lines is additionally available. These will remain existent, until the dislocation of an associated function block forces the recalculation of the control points (see arrange buttons).

Add segment

To adding segment in the connection line, press the right mouse button and select add segment.



Add junction

To add a junction, double-click on connection line or press the right mouse button and select Add segment.

Note:

If segments of a connection run in a line, they are automatically merged.

Input of corner points

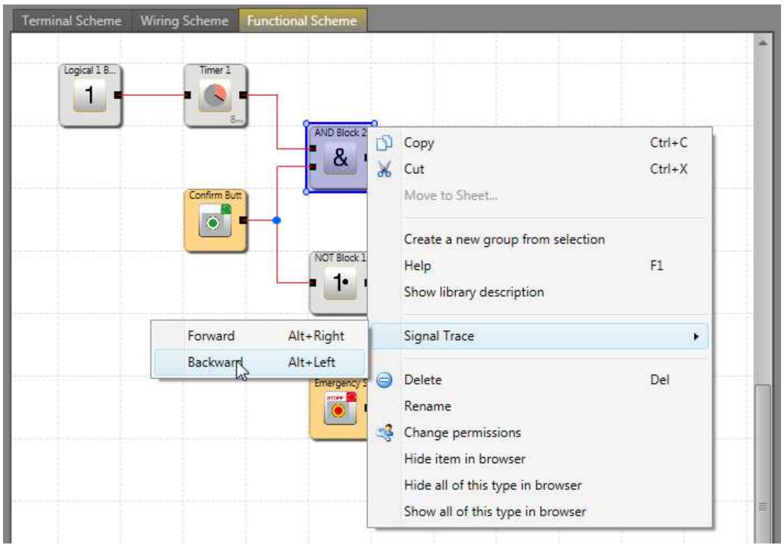
Connecting lines always run horizontally and vertically. Corner points are inserted with every left-click. The program connects the entered points until the drawing command is terminated (abort with Escape).

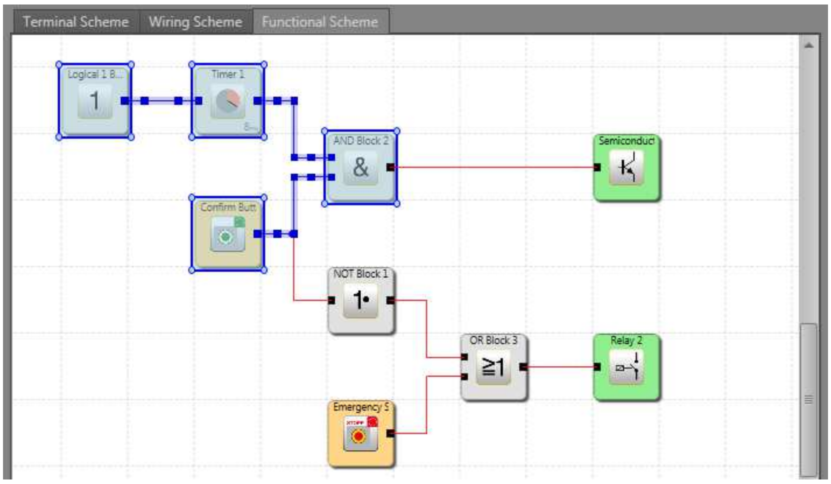
Tip:

Visual corrections to the logic diagram should only be made just before the logic diagram is blocked. Only then the layout is complete, and the blocks do not need to be displaced any more.

5.5.1 Signal Trace

For clarify wirings and connections user can use Signal Trace function for visualization signal route. For visualization press right mouse button on block and select Signal Trace from context menu. There is forward direction from Functional Output and backward from Functional Input. It is possible to use keyboard shortcut Alt+Left or Alt+Right on selected block.

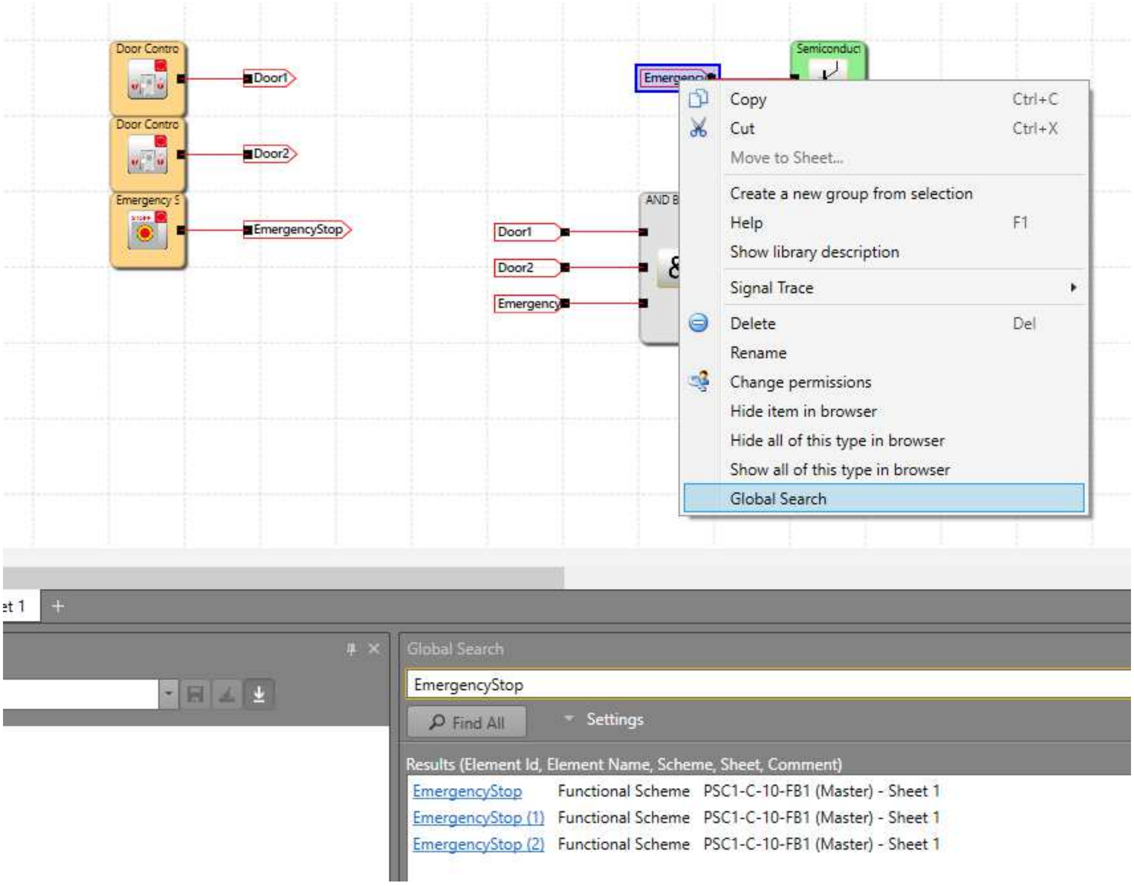




Visualized signal trace backward

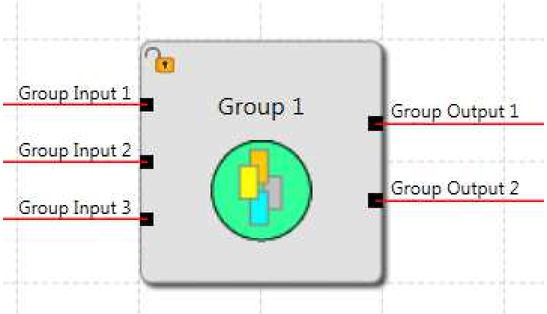
Tip:

Another way to track signals, e.g. to find the use of connection points in branched programs, is to use the Global Search (see also chapter 4.9 *Global Search* window). In the context menu (right click) of the individual elements you will find the entry *Global Search*. This transfers the name of the element directly into the search window and the search is executed.
For connection points, the numbering is resolved so that these elements, which are usually used several times, can be followed very easily.



5.6 Using Groups

Function groups combine several function modules into an encapsulated logic structure (see Ch. 11.3.9).



This grouping gives the function block diagram a much clearer structure and, with the export / import functionality, enables the creation of an own function library.

5.7 Program Creation

After the program has been finished, the compilation process can be started by invoking the compiler ☑. The results are displayed in the message Window which is automatically switched on when compilation is created. After starting the compiler, the compilation process will run in the stages described below. The results are displayed in the message Window, which is automatically switched on when the compiler is started.

1. Verifying for open connectors

SafePLC2 makes sure that all connections between function blocks can be opened. Unconnected connectors are recognized as faults.

2. Verifying for unreferenced "Terminal In" and „Terminal Out“

SafePLC2 makes sure that all terminal blocks inserted in the logic diagram are used. Unsolved references are recognized as faults.

3. Verifying the value ranges of the monitoring functions

Before creating the IL, SafePLC2 checks whether the parameters of the monitoring functions are inside the value ranges of the current encoder configuration. In case of a modification of the encoder settings with a monitoring functionality that had already been determined, an unnoticed area overflow may otherwise occur.

4. Creation of the instruction list (IL)

The IL-code created on basis of the function blocks is output in the message Window, where it can also be verified, the code segments associated with the function blocks are identified by a corresponding subheading.

5. Creating the OP code

Generation of a machine-readable code for the PSC1-system, which is then transferred together with the parameter data.

Generated OP Code commands count contains extra 3 initialization OP codes for compact devices. These initialization OP codes are automatically added at beginning.

6. Message Window

All results of the compilation process are reported in the message Window. Should faults be found, the message Window will automatically pop up.

Tip:

Use the "Quick Jump" feature to be able to jump directly to the associated block in the diagram by simply double-clicking on a displayed subheading in the message Window. This way one can easily identify the corresponding function block in case of fault messages.

7. Program signature

After a successful compiler run a total of three CRC-signatures is made.

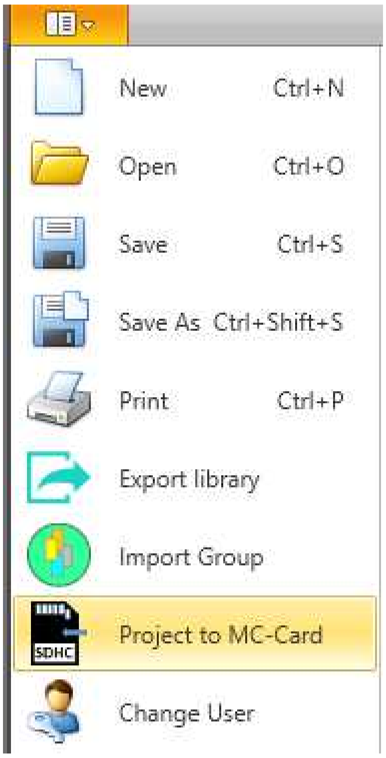
PSC1-C-10	PSC1-C-100
• Device configuration CRC: Signature concerning program and parameter data • Parameter CRC: Signature concerning parameter data • Program CRC: Signature concerning the program	• Configuration CRC: Signature concerning parameter data • Program CRC: Signature concerning the program

Important:

The CRCs displayed in the Property Grid are only informative and must not be used for the safety related documentation!
For validation of all implemented safety function refer to the respective chapters of the installation manuals.

5.8 Backup copy on MC card

Most PSC1 master modules offer the possibility to load a security program stored on an SD card. This makes it easier to replace a defective module, for example. To do this, the necessary files must be provided in a special form on this SD card. Via the button *Project to MC-Card*



the currently compiled version is written to a memory card **in the PC**.

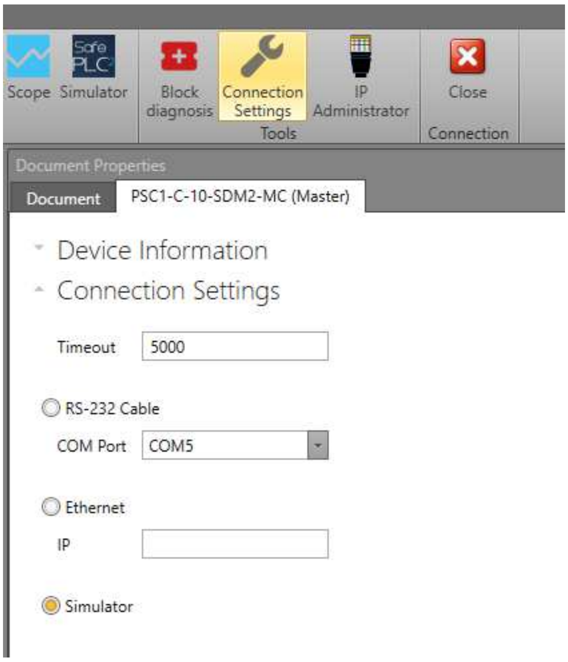
Note:
It is possible to keep further documents belonging to the project on the memory card.

5.9 Transferring the Program on the Device

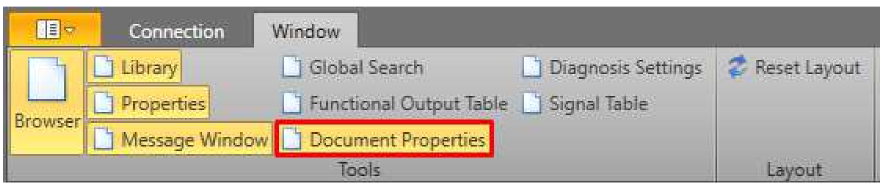
This paragraph describes the data and program transfer to a basic PSC1 module. Via the *device dialog* button,

the respective toolbar will appear. It contains connection and transfer tools for the communication with the device. Please refer to chapter *8 Device interface* for further information.

The button Connection Settings opens the *Document Properties* window with *Document* and device tab.



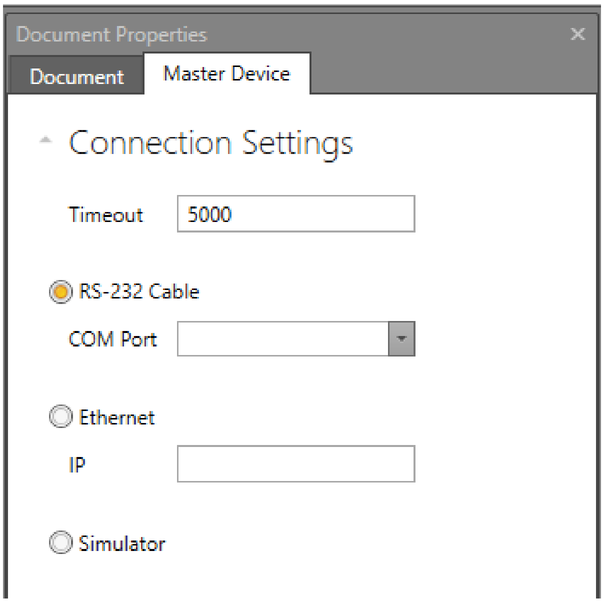
The *Document* tab allows the user to add the developer name and notes. The device tab consists of *Device Information* and *Connection settings*. This window is available also via *Document Properties* switch in *Window* ribbon.



The exact current transmission status and any errors that may occur are displayed in the "Message Window".

Note:

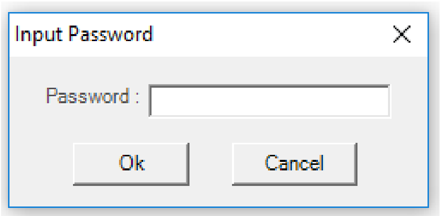
The connection between the PC and the PSC1 system is usually established via a USB/RS485 interface. The correct driver must be installed without errors and set up during installation. In case of problems the driver can also be found in the directory of the SafePLC2 programming environment for manual installation. (Directory `...\RS485_USB_Driver`).



Connection settings

Connection settings

- **Timeout** - the time in millisecond for communication timeout can be set.
- **RS-232 Cable** - the COM interface used by the Windows driver must be set.
- **Ethernet** - set the IP-Address of the respective device (refer fieldbus manual for details). The following requested password is the serial number of the device which can be found on the side plate.



- **Simulator** – see chapter 5.10 Offline simulation

Disconnecting on the PC-side

At the latest after 5s the system will detect that the connection no longer exists and will also not be re-established automatically, if the connection is to be set up again.

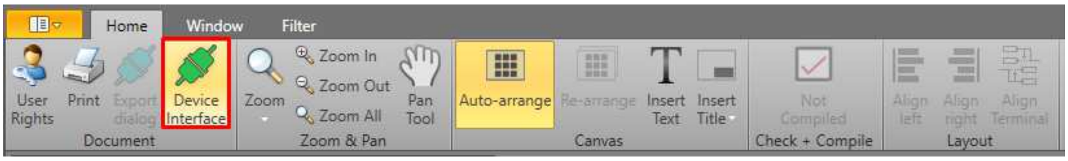
Disconnecting on the PSC1-side

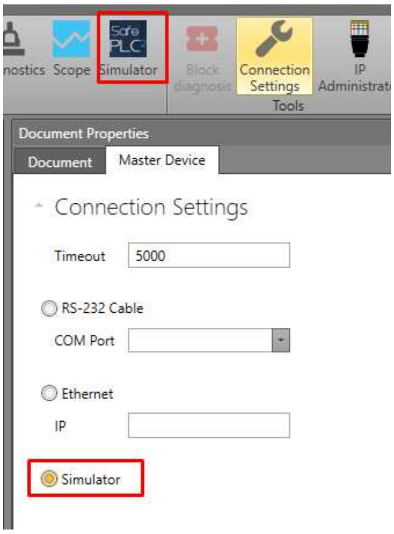
At the latest after 10s the system will detect that there is no connection. However, the connection will be automatically set up again if the physical connection is re-established.

5.10 Offline simulation

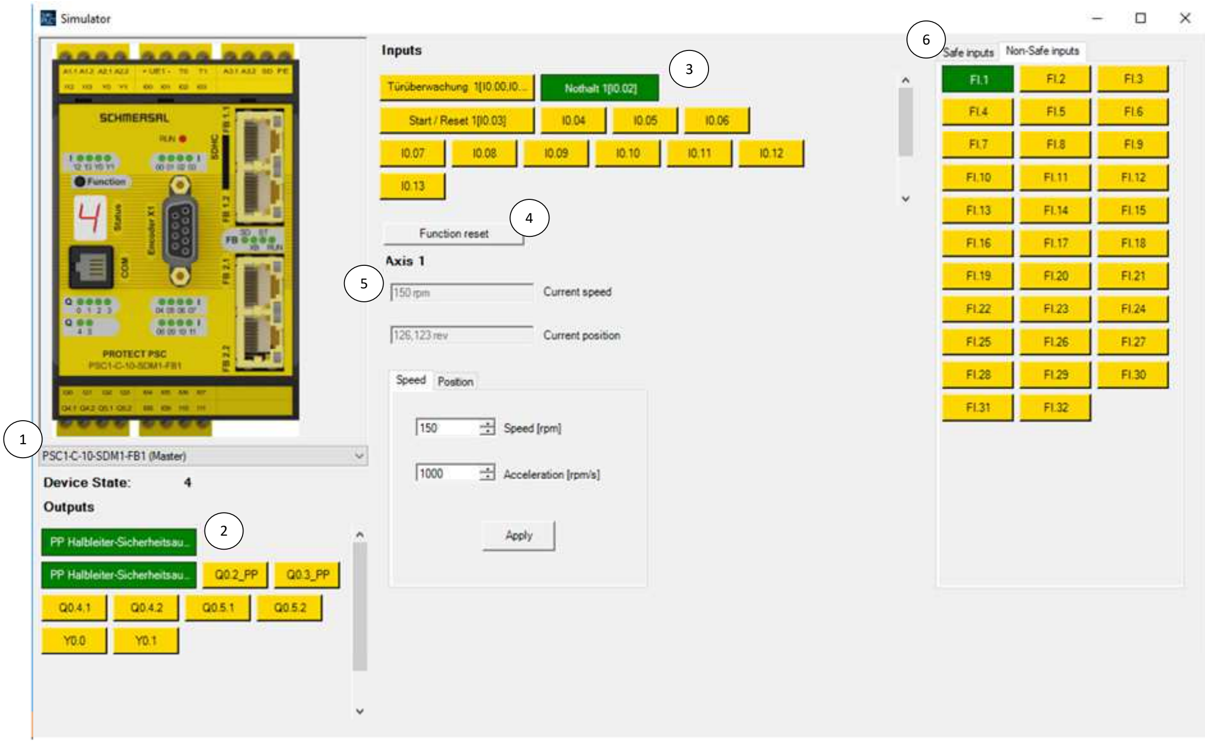
The simulator makes it possible to test the created logic even without a physical device and peripherals.

As described in chapter 5.8 the simulator is selected in the connection settings.





With this selection the Simulator button is activated, and a virtual device is displayed →



1 Via this selection you may switch between the parameterized modules, i.e. master and extension or axis modules.

2 The status of the outputs of the selected module is displayed in this area. Active elements are shown in green, elements that are not activated are shown in yellow

3 The input elements are grouped in this area. Logical units are displayed, i.e. the simulation does not take place at IO level. Active input elements are displayed in green, inactive elements in yellow.

4 The button allows the reset of errors, e.g. for axis monitoring functions

5 A connected axis can be simulated in this area. Adjustable parameters are speed and acceleration (positive and negative acceleration use the same value). The current values for speed and position are displayed. This also allows functions such as the safely monitored speed (SLS) to be verified via the simulator

6 The elements for safe and non-safe inputs allow the simulation of static signals from a higher-level PLC, for example, an additional, functional release by the process sequence control

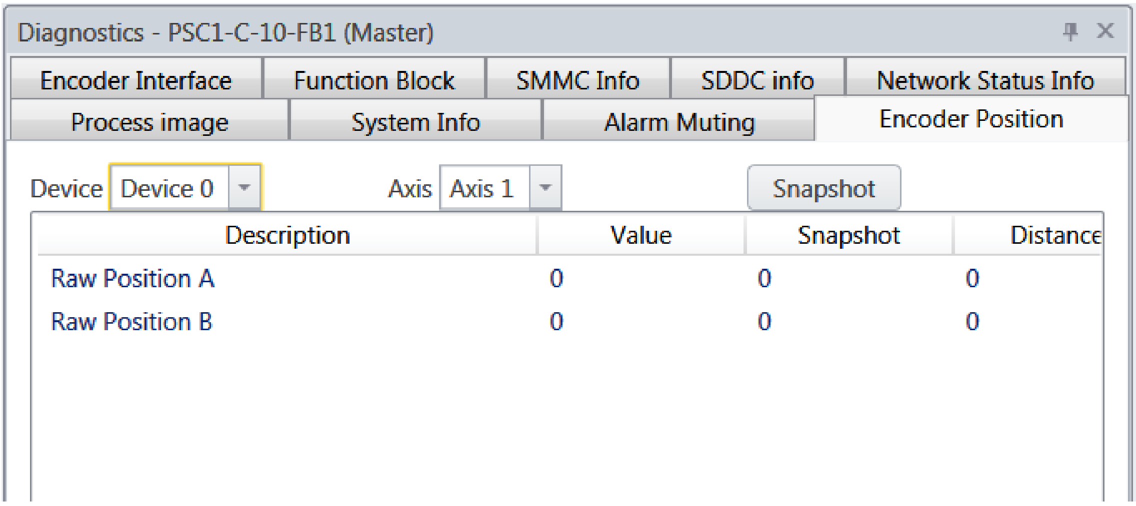
The diagnosis by means of the offline simulation is carried out analogously to a real device. The procedure is described in the following chapter (5.11 Diagnostics).

5.11 Diagnostics

After activating the Device Interface there is available Diagnostics button tool. When clicking on the Diagnostics button the Diagnostics window will appear. Diagnostic functions cannot be running simultaneously with Scope function window.

Note:

A correct diagnose requires the adjustment of data between Functional Scheme and equipment configuration. A missing logic diagram or a discrepancy between the available logic scheme and the equipment configuration only permits a limited diagnose. The functionality "Diagnose function modules" is in this case not available.



Diagnostics window consist of following sheets:

Process Image

Display of the states of all addresses of the input and output image in the PSC1 module.

System Info

System information about the PSC1-module. The CRC of the active configuration is displayed together with the status of an internal transfer counter. This counter is incremented during each transfer action to the PSC1 module and can be used as reference for the purpose of documentation. As follows:

Parameters	Description
Overall – CRC	CRC signature concerning program and parameter data
Configuration - CRC	CRC signature concerning the parameters
Program CRC	CRC concerning the program
Transfer counter	Status of an internal transfer counter This counter is incremented during each transfer action to the PSC1-system and can be used as reference for the purpose of documentation.
Serial number	Current serial number of the equipment
Version number	Firmware version number

Alarm Muting

Show active alarm muting functions.

Encoder Position

Shows the position values for encoder A and encoder B which have actually been transferred by the encoders. User can mark the actual position via snapshot button. The program will show the distance parameter from the registered position.

Encoder Interface

Shows the voltage differential of the driver modules and the status of the input jumpers in the encoder interface. If one of the values for the voltage condition is 0, the encoder is defective or not connected. The value for the input jumper must be interpreted differently.

In case of incremental encoders:
0 := Jumper OK
1 := Fault

In case of SSI encoders:
0 := Listener operation
1 := SSI encoder operation

Function Block

Enables selective monitoring of memory states of pre-selected function blocks. To select function blocks for diagnostics from Canvas use button Block diagnosis. This tab allows to see logic condition "0" or "1" in the Functional Scheme.

SMMC Info

Shows information about SMMC communication.

SDDC Info

Shows information about SDDC communication.

Network Status Info

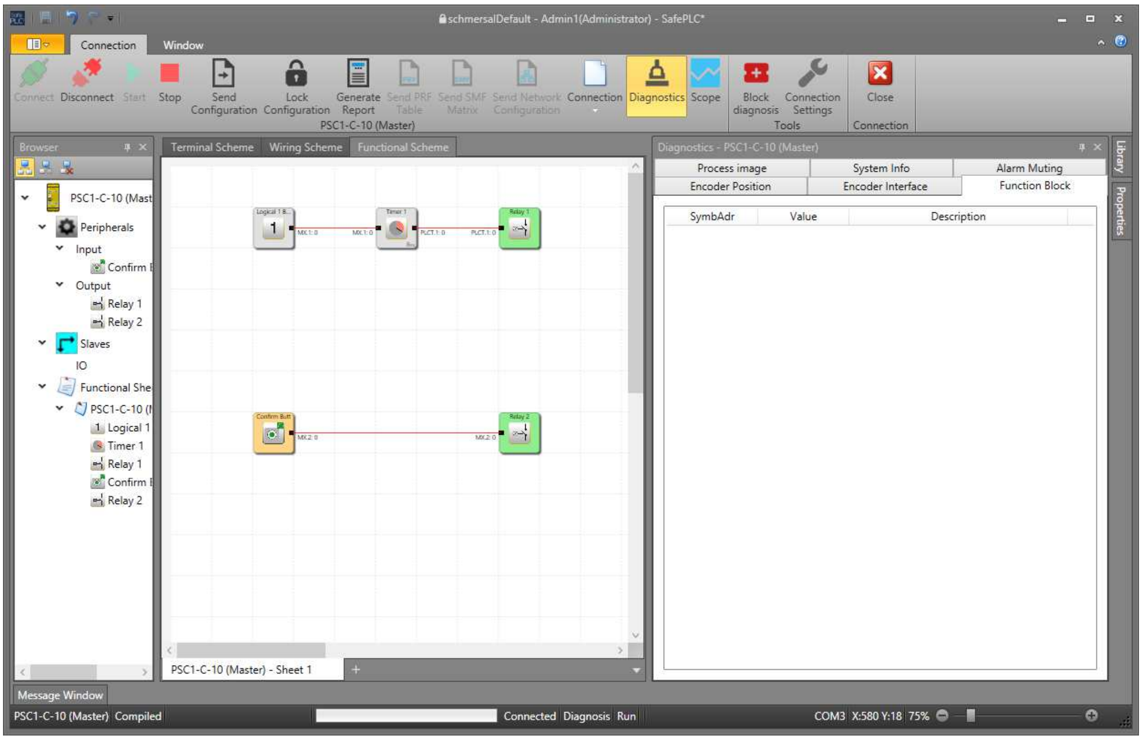
Shows information about Network communication.

5.11.1 Procedure for function block diagram diagnose

The main condition to run diagnostics is that program is Started i.e. Start button in Connection toolbar is gray shaded.

5.11.1.1 Diagnostics in Canvas

Diagnostics in Canvas works only when user select in Diagnostics window Function Block Tab. After selecting Functional Block Tab diagnostics start automatically.



Running diagnostics in Canvas

When running a Canvas diagnose, the current input and output states are displayed in scheme according to their logic condition "0" (red color line) or "1" (yellow color line). The logic condition is also showed in Canvas next to Connector ID.

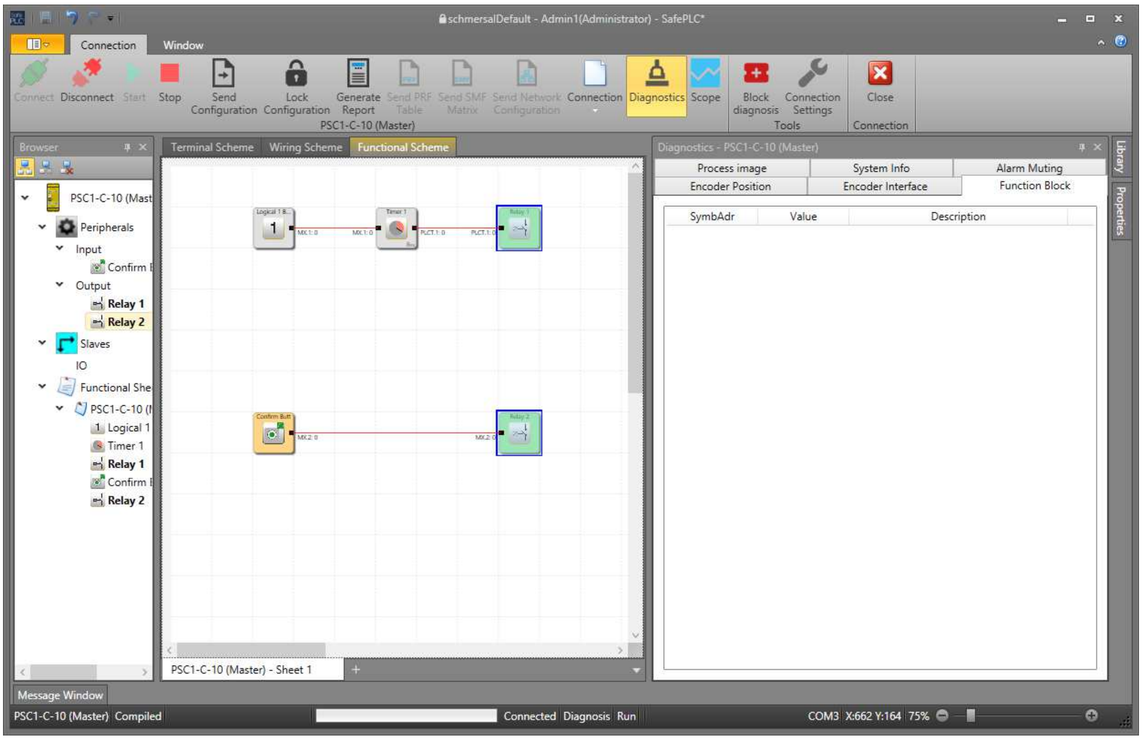
If the "Tab" of the Diagnostics window is changed from "Functional Block" to another diagnose mode i.e. another Tab (e.g. "Encoder Position"), the diagnostics information disappears from Canvas.

5.11.1.2 Diagnostics in Function Block Tab

It is possible to run diagnostics for selected blocks.

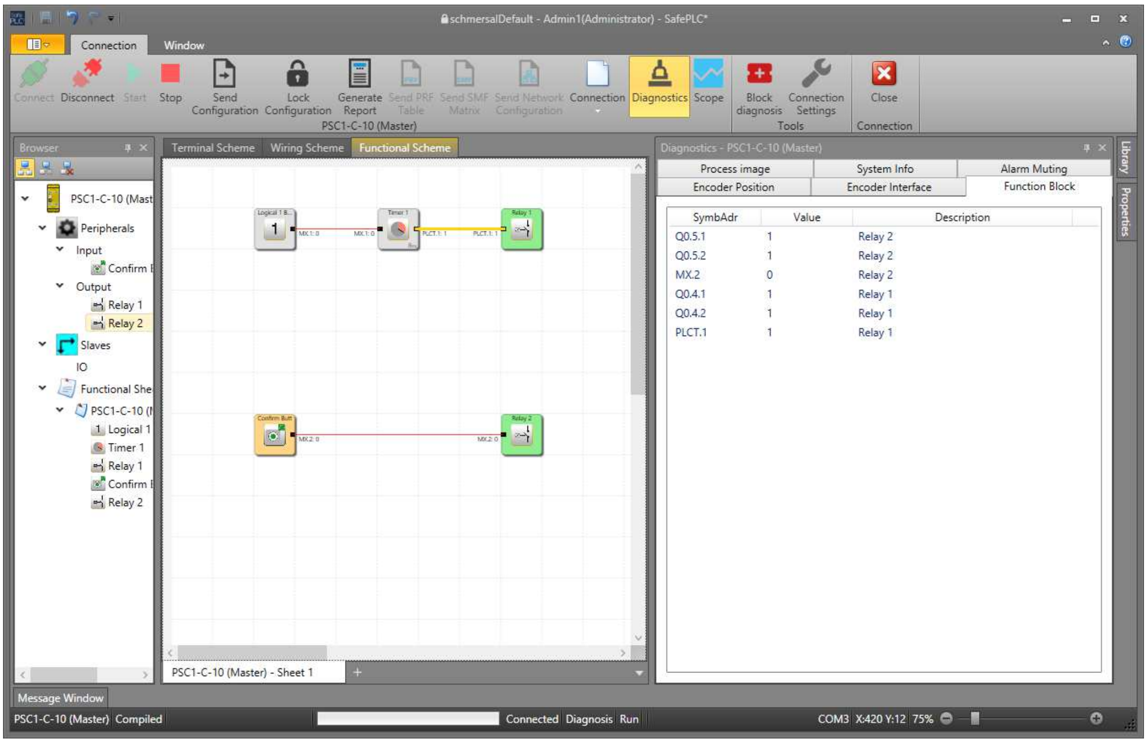
Selecting the data to be displayed

If one has changed to the Functional Block Tab it is possible to select function blocks, the status of which is to be monitored. Functions blocks can be selected in Canvas and after selection press "Block diagnosis"  button. By pressing this button, the blocks are taken over into the monitoring list.



Selected blocks in Canvas

In monitoring list, there appear Symbol Address, Logic Value and Description for each added block. When running a Functional Block diagnosis, the current input and output states of the function blocks are displayed according to their logic condition "0" or "1" on the selected block.



To remove block from monitoring list it is possible by marking block and pressing „Del“ button.

Double-clicking on a list entry shows the associated Function block in scheme.

Note:

The symbol addresses shown in the list are also used in the compilation and in the validation report.

Tip:

The "Select all" command from the context menu (right mouse button) can be used to select all data from the Functional Scheme.

The selected data can only be diagnosed if the information in the Functional Scheme corresponds with the information in the actively connected PSC1-system.

Note:

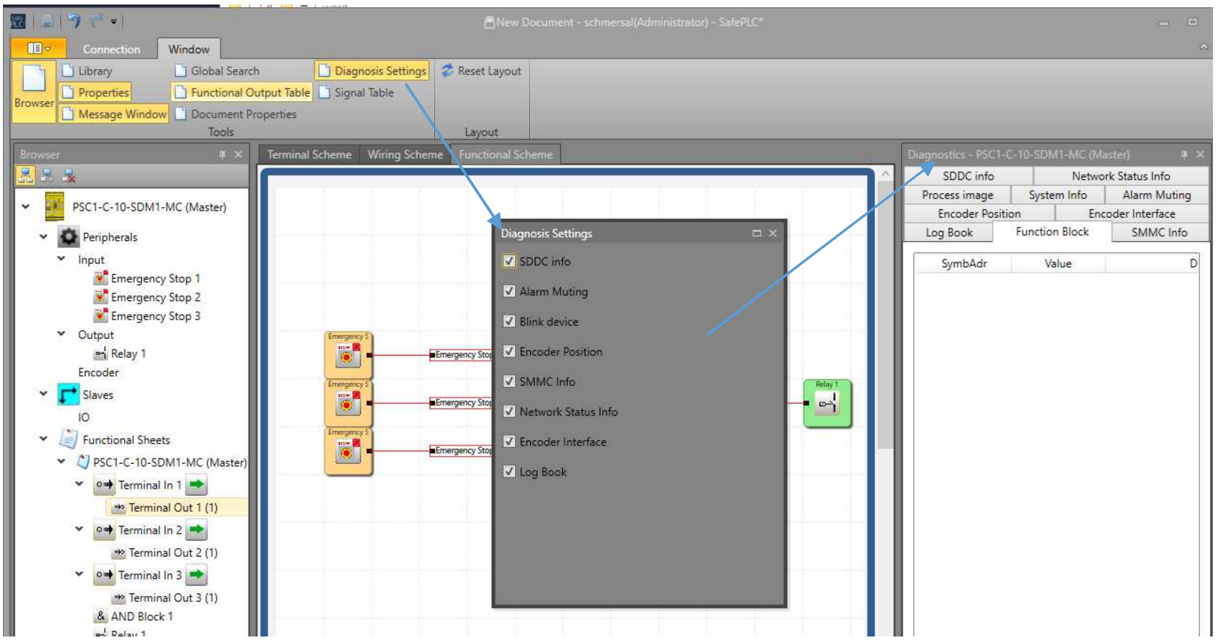
The implemented debugging function requires intensive data transfer between PSC1-system and SafePLC2**.** This results in a temporally delayed display of data. Quick status changes on module outputs may therefore not be detectable.

ATTENTION:

If the PSC1 module changes to a state of alarm, the process representation is no longer updated. Changing input levels no longer have any effect and will also no longer be shown in the diagnose.

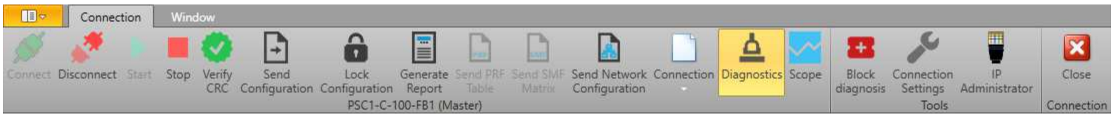
5.11.2 Hiding Tabs in Diagnostics

To get a better overview using the Diagnostics the tabs can be customized via *Diagnosis Settings* in the *Window* tab. Per default all tabs are visible, but tabs can be hidden by un-checking the respective box. Changes will only be valid by the next opening of the connection dialogue.

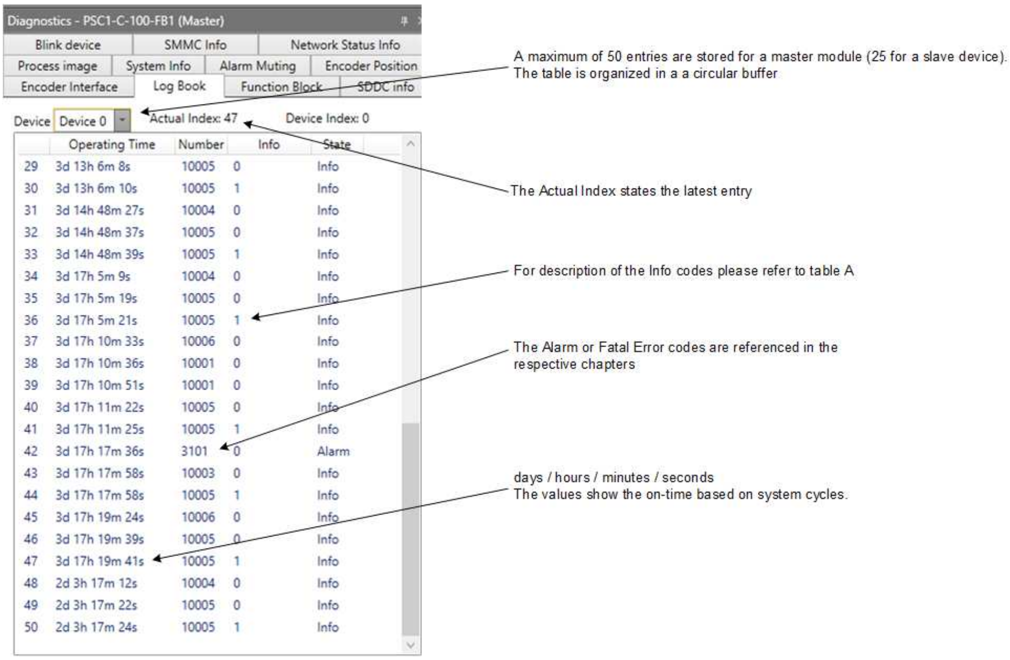


5.11.3 Log Book

The Log Book can be accessed via the Connection Tab.



Here go to diagnostics and then select the Log Book Tab



Number	Info	Description
10001	0	Download configuration
10002	0	Configuration locked
10003	0	Alarm-Reset
10004	0	System switched from STOP to RUN
10005	0	POR
	1	Module switched to run
10006	0	System in STOP state
10007	Slave No.	SDDC Timeout
10008	Slave No.	SDDC CRC error

table A

The logbook function is possible for the following modules starting with the specified FW version

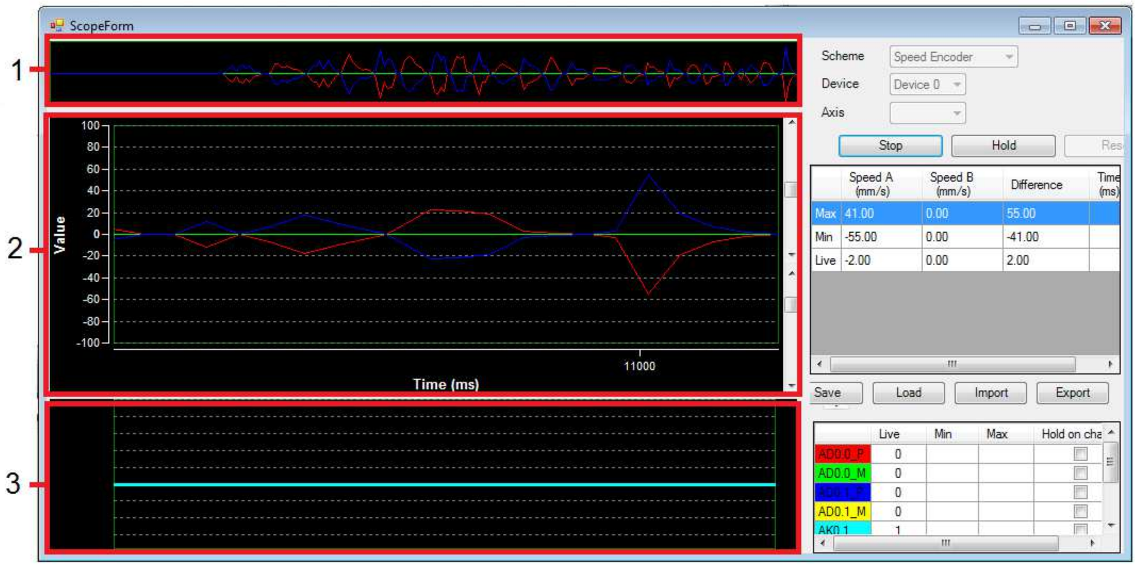
PSC1-C-10x	05-00-00-17
PSC1-C-100x	04-00-00-11
PSC1-E-2x	04-00-00-6A
PSC1-E-13x	04-00-00-6A
PSC1-E-37	01-00-00-08

References:
Chapter 14.7: Alarm list
Chapter 14.8: Fatal fault list

5.12 The Scope monitoring

Parameterization of drive monitoring requires exact knowledge of process data from the point of view of the PSC1-system. Knowledge about the temporal course of speed, acceleration and position is of outmost importance. Only this enables the setting of correct threshold values and limiting parameters.

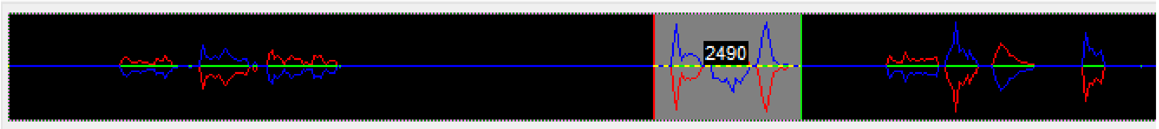
Scope function is available in Device Interface dialog. Select the scope monitor function by activating the „Scope“ button. If diagnostics button is enabled clicking on Scope button is not possible.



Device interface Scope view

1. Overview scroll bar
2. Main diagram window
3. Signal output window

All available graphics functions read the required process data ONLINE from the active basic PSC1-group through the communication interface for time-based representation. Up-to-date values are inserted at the right border of the Scope Monitor, moved further to the left during recording, until they finally disappear at the left border of the screen. Although these data have disappeared from the visible window, they are still maintained in a buffer memory and can still be moved back into the visible area by sliding the scroll bar beyond the main diagram window.



Overview scroll bar for main diagram

Scheme

The “Scheme” function is used to select the current context for the desired visualization. Depending on the „scheme“ selection from the selection list, the context of the displayed graphs will change. These are assigned via the color specified in the legend.

The following schemes are available:

- Encoder data
- Speed Encoder
- Data SSX1 Block
- Data SSX2 Block
- Data SSX3 Block
- Data SSX4 Block
- SEL (Time Based)
- SLS Filter
- SCA Filter
- Sensor Pass
- Encoder Position
- SLA
- Analog filter (on request)
- Analog Adder (on request)

Depending on whether the scheme shows time or position dependent values, the X-axis is used to show the progressing Tick Time, or the measuring length configured in the encoder. The Y-values refer to the selected scheme.

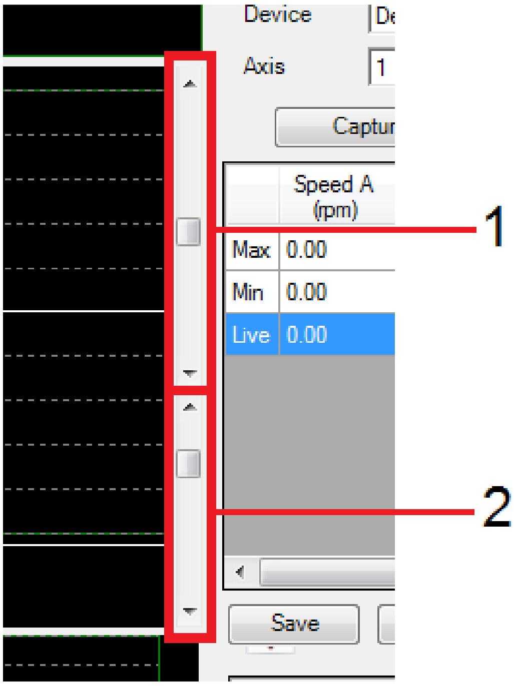
Changing the scheme during a progressing measurement is blocked.

Device

Selection of device.

Axis

Axis can be selected. When using several identical functions, these can be selected and displayed separately via this selection. The values of these measuring data are displayed for each relevant cursor position



Scaling diagram using Slide bars

Scaling the displayed diagram function enables the adaptation of the Y-values in the individual graphs by Slide bar1/2:

1. **Slide bar1 -** Change the Y-values visible area on diagram.
2. **Slide bar2 -** Change the maximum displayed Y- value range of the diagram.

Capture / Stop

Start or stop recording.

Hold

Press the Hold button to stop displayed values in main diagram with data still maintained in a buffer memory.

Reset

Reset the diagram values and process data.

<u>Tip:</u>

If you double-click on the main chart, a pointer is inserted at this position. This displays the cursor in the value table to display additional readings.

Hold on change

If the switch "Hold on change" is set, recording will stop 2 seconds after an edge change of the specified output (see above). This function enables long-term recording and fault analysis with no operator present.

Save

Once the Scope has stopped, there is a possibility to save the current recording in a file. The Scope data are written in a file as ASCII values. The individual values have XML - tags assigned, so that the recording can be used for the purpose of documentation of for the analysis associated with the encoder configuration. The data can also be viewed with the current Microsoft Explorer or with any other XML-viewer.

Load

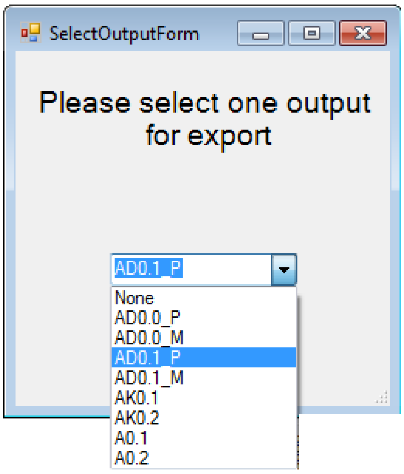
With this control button one can load a measurement saved in a Scope XML-file into the Scope. The Scope dialog will in this case change to viewer mode. Due to the possible difference of the encoder configuration of the viewed measurement to the current program and the deviations in the scaling of position and speed values resulting from this, the “Start” button and the scheme selection list are disabled, after data have been loaded for display. Measurements remain disabled, until the Scope is restarted.

Import

Import measurement from ScpXml files.

Export

Export the measurement of one selected output to ScpXml file.



Selecting output for export

5.12.1 Procedure when measuring with the scope

After the Scope dialog has been opened it is still in "Stop" mode, i.e. no cyclic process data are read-in from the PSC1-system. In order to be able to perform a measurement, you should proceed as described below.

Note:

All Internet or LAN based applications (e.g. mail program), which run in the background, should be closed before the measurement.

5.12.2 Preparing the measurement

Choose the desired measuring scheme: In case of a speed-oriented measurement the running tick time of the PSC1 module is displayed on the X-axis. It must be considered as a continuously incrementing counter for the system ticks of the PSC1 module. The measurement data for the graph are continuously updated and maintained in the buffer memory. The recording memory is approx. 15 minutes.

The measuring process is automatically stopped when the buffer memory is full. The previous measurement is automatically saved under "ScopeTempData.ScpXml".

With position-oriented measurement the configured measuring range of the set axis is displayed on the X-axis.

Note:

When changing the scheme, any recorded data from previous measurements will be lost. When changing the dialog size, the display data must be rescaled.

5.12.3 "Start" measurement

The control button "Capture" for starting measurement is only available in case of an active connection to the PSC1-system. After clicking on this control button, the data will be cyclically transferred to the buffer memory and displayed in the diagram from left to right. Active recording can be stopped with the "Stop" control button.

5.12.4 "Stopping" a measurement and viewing data

After completion of the measurement the data can be analyzed by moving the slide controllers accordingly.

5.12.5 Measuring schemes

Encoder data:

Functionality	• Recording of scaled position values of system A and system B over the course of time. • Recording of process values for speed and acceleration over the course of time. **<u>Note:</u>** After reciprocal comparison of the two channel values, the process value of the velocity is generated from one channel.
Application	• Scaling of the encoder systems A and B in case of position monitoring. In case of a correctly scaled encoder system there should be no significant deviation between positions A and B, or the deviation should not exceed the “permissible deviation” set in the encoder dialog. • Analysis and course of encoder signal for diagnostic purposes (e.g. trouble shooting, etc.) • Acceleration and speed behavior of the drive. • Detection of thresholds.
Output	• Acceleration in [rev/min/s] in red • Position A in [rev] in green • Position B in [rev] in yellow • Speed in [rev/min] in blue • Selectable output on PSC1 in grey • Two cursor values positioned freely **<u>Note:</u>** The assigned colors can be optionally adapted.

Speed Encoder

Functionality	• Recording the current speed of system A and system B over the course of time. • Recording the difference of speed signals from system A and system B over the course of time.

	<u>Note:</u> After reciprocal comparison of the two channel values, the process value of the position is internally generated from one channel.
Application	• Scaling of the encoder systems A and B in case of speed monitoring. In case of a correctly scaled encoder system there should be no significant deviation between speeds A and B, or the deviation should not exceed the permissible “speed threshold” set in the encoder dialog. • Analysis and course of encoder signal for diagnostic purposes (e.g. trouble shooting, etc.).
Output	• Speed A in [rev/min] in red • Speed B in [rev/min] in green • Speed difference in [rev/min] yellow • Selectable output on PSC1 in grey • Two cursor values positioned freely **<u>Note:</u>** The assigned colors can be optionally adapted

Data SSX1 – SSX4 Block

Functionality	• Recording of process data for speed and acceleration over the course of time. • Recording of upper and lower speed limits for the monitoring function over the course of time.
Application	• The diagram shows the dynamic behavior of the drive via the visualization of speed and acceleration. • With the SSX not activated, the limiting speed remains zero. • When activating the SSX-function, the limiting speeds and the current speed are taken on and represented over the course of time. • If the drive with its current speed remains below the limiting speed, the system will not be shut down.

Output	• Acceleration in [rev/min/s] in red • Lower limiting speed in [rev/min] in green • Upper limiting speed in [rev/min] in yellow • Current speed in [rev/min] in blue • Selectable output on PSC1 in grey • Two cursor values positioned freely **Note:** The assigned colors can be optionally adapted

SEL (Time Based)

Functionality	• Recording of process data for speed and acceleration over the position or the course of time. • Visualization of current position in form of the parallel moving cursor. • Visualization of the current stopping distance in form of a trailing pointer.
Application	• The diagram shows the dynamic stopping distance value as minimum value for the braking distance. • Examination of the set parameter values in the SEL-function, examination of the available reserve for shut-down.
Output	• Current position in [rev] in red • Speed in [rev/min] in green • Acceleration in [rev/min/s] in yellow • Stop distance in [rev] in blue • Selectable output on PSC1 in grey • Two cursor values positioned freely **Note:** The assigned colors can be optionally adapted

SLS Filter

Functionality	• Monitoring the maximum speed or rotational speed of a drive • Recording of process data for speed and over position or course of time. • Visualization of current position in form of the parallel moving cursor. • Visualization of the integrated measurands over speed as position value approximation
Application	• The graph shows the current speed with reference to the set limiting speed. • Checking the shut-down when exceeding the limiting speed. • Display of the integrated speed • Control of functions, which work in dependence on the limiting speed
Output	• Current speed in [rev/min] in red • Limiting speed in [rev/min] in green • Integral in yellow • Status of function in blue • Selectable output on PSC1 in grey • Two cursor values positioned freely

(The limit indicates the limiting speed)

SCA Filter

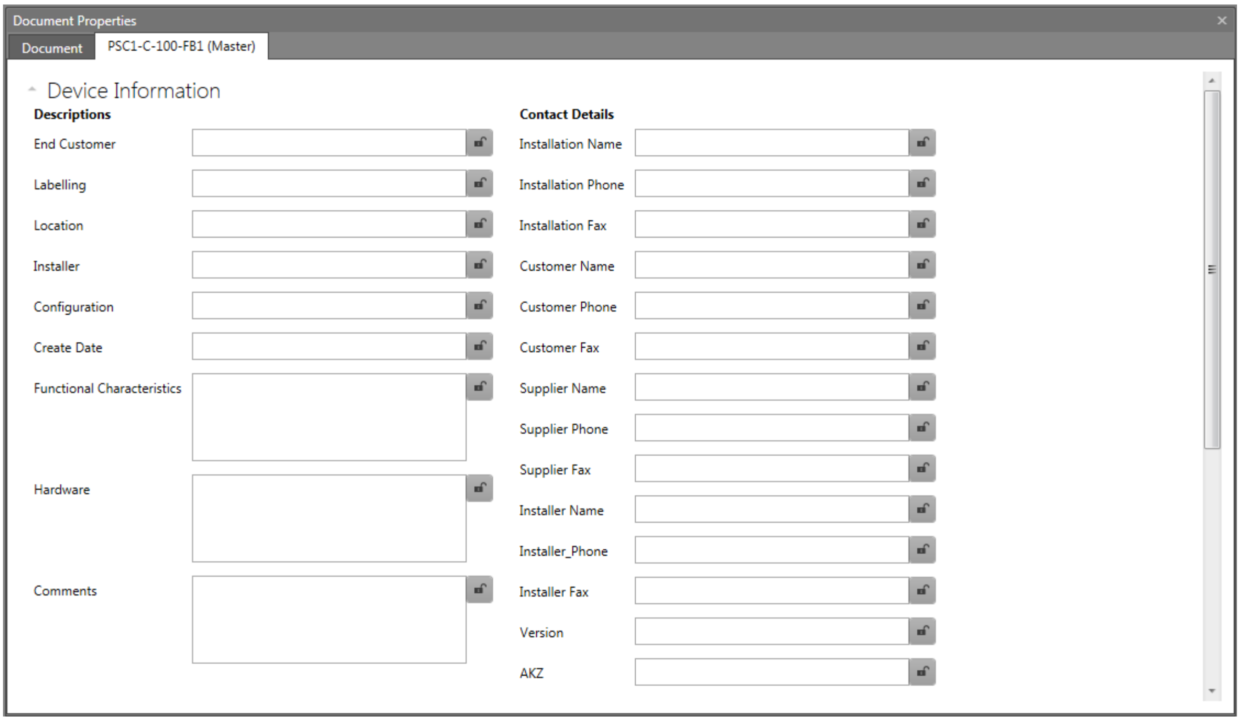
Functionality	• Monitoring a parameterizable position range with assigned minimum and maximum values and maximum rotary speed / speed • Recording of process data for speed and over position or course of time. • Visualization of current position in form of the parallel moving cursor.
Application	• The graph shows the current speed with reference to the set limiting speed – as well as the determined position by integrating the speed.

	• Checking the shut-down when exceeding the limiting speed or when leaving the permitted range between minimum and maximum value • Control of functions, which work in dependence on the position range and a limiting speed
Output	• Current speed in [rev/min] in red • Limiting speed in [rev/min] in green • Integral in yellow • Status of function in blue • Selectable output on PSC1 in grey • Two cursor values positioned freely

6 Configuration Report

SafePLC2 uses the validation function (Device Interface->Generate Report) to create a configuration report for the equipment configuration. This function is only available in case of an active connection to a PSC1 system.

Write or edit information and description for generated report in Document Properties window:



Device information fields for Configuration Report

Each field has a lock function.

<u>ATTENTION:</u>
The printed file serves as <u>model</u> for the <u>safety related examination</u>!

<u>Note:</u>

The report can only be created after the logic diagram has been saved.

The generated file (*.pdf`, *.xlsx) has the same name and is located in the same directory as the associated logic diagram.

Filling the report can be done in the following steps:

Step: Editing the report header

The following fields can be edited in the header:

- End customer: The name of customer
- Labelling: The project label
- Configuration: The configuration name
- Comments: Any comments which can be useful e.g. file name of logic diagram

Step: Filling Acceptance

- Inspector 1: Inspector's name
- Date: Date of inspection
- Sign: Place for inspector's sign
- Inspector 2: Inspector's name
- Date: Date of inspection
- Sign: Place for inspector's sign

Step: Filling Contact Details

- Version: Document version
- Installation: Installation place description
- Customer: Operator of equipment
- Supplier: Manufacturer of machine / equipment
- Installer: Information about commissioning of equipment

For fields Installation, Customer, Supplier and Installer there can be filled also Phone number and Fax number.

Step: Filling Description

- Installer: Person who installed devices
- Labelling: Identification of hardware
- Location: describes the exact location of the equipment
- End customer: Operator of equipment
- Configuration: safety related equipment features to be monitored by the safety module
- Create Date: Date when report was created
- Functional characteristics: describes the functionality or field of application of the equipment
- Comments: safety related equipment features

- Hardware: Code designation of equipment

Step: Individual check of each system component

In this area there are check boxes, which should be checked if information given is correct.

Visual inspection for mechanical damage and correct mounting.

Component documentation is present.

Visual inspection for deviation from installation guidelines.

- Device type: Write device type here e.g. PSC1-C-10, PSC1-C-100-MC, etc.
- Serial number: Serial-number of the safety module (sticker)
- CRC Device Config: Signature concerning program and parameter data
- CRC Parameter: Signature concerning parameter data
- CRC Program: Signature concerning the program
- Extension Devices: Description of extension devices
- Transfer Counter: This field can be also edited.
- Number of axes: Number of all axes

Checking of the correct function can be done as follows:

1. The correct program and parameter data must be loaded to be able to generate the validation report!
2. The test engineer must once again validate all configured data in the printed report by confirming the programmed functions on the equipment / machine.
3. All parameterized limiting values of the monitoring functions used must be checked for correctness. Attention must be paid to the response times mentioned in the installation manual

A successfully executed validation should be completed by clicking on the control button "Lock validation".

Note:

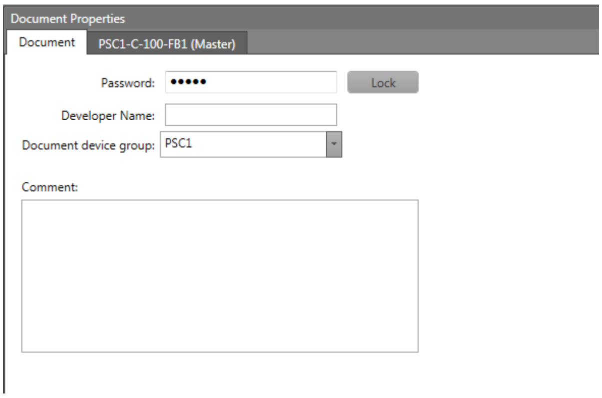
If a new configuration is loaded to the PSC1-system, the system LED will, in case of fault-free operation, subsequently light *YELLOW*. This signalizes a non-validated application! When actuating the control button "Lock validation" while actively connected with the module, the LED will subsequently flash *GREEN*.

7 Document Properties

With the User Management the logic diagrams can be disabled against unintended or unauthorized modifications. Here one can disable or enable access to the function blocks in the current logic diagram. This means, that in a disabled logic diagram all menu options and toolbars for adding function blocks appear in light grey (= disabled). Moreover, parameters in function blocks, that had already been added, cannot be changed.

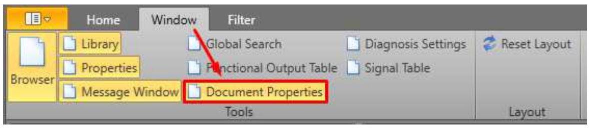
Please note:

A disabled logic diagram can no longer be compiled! However, access to the PSC1 module is still possible.

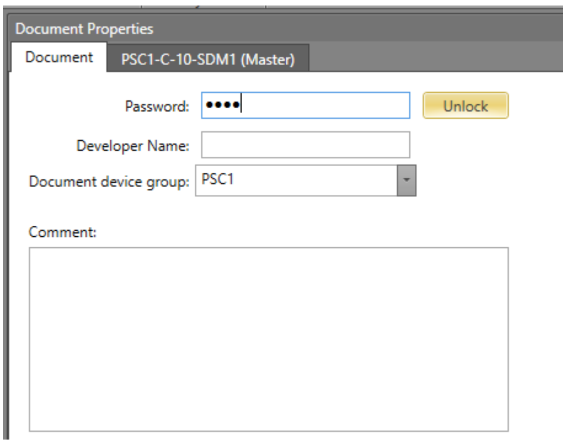


This lock function is located in the Document Properties window and must be protected with a password of at least 5 characters.

Note:
The Document Properties window can be displayed at any time using the window manager.



➢ Unlocking is done in the same way



8 Device interface

Device interface is Device dialog window. This window allows the extended communication dialog such as program transfer, Diagnosis and Scope monitoring with connected PSC1 devices. If Device interface dialog is opened, program automatically start the compilation process.

Icon tools for Device dialog:

Icon tools in the Device Interface – disconnected

Icon tools – connected

Connect

Starts the connection to the PSC1-system.

Disconnect

Cancels an active connection.

Start

Starts the sequencing program.

Stop

Stops the sequencing program

Send configuration

Transmits the configuration of the function block diagram to the PSC1-system. This is only possible in “Stop” mode.

Lock configuration

After each transfer of configuration data to a PSC1-system, the data is marked as “not validated”. The basic group signalizes this by means of yellow flashing of the status RUN LED on the PSC1. The command “Disable configuration” disables access to the configuration data in the basic block. This is indicated by a green flashing status LED.

Generate report

Creates a PDF of the current PSC1 configuration for the connected device. The text file lists the parameters of the configured modules and the Instruction List (IL) program. The printout must be confirmed and released in accordance with the demanded regulations.

Send Network Configuration

Transmitting the network configuration to the PSC1 module.

Online/Connection

Transfer a configuration from a file or to a file for reading from the PSC1. This function is not available when the Diagnostic or Scope window is open.

- **PSC1-C-10**

Send	Configuration (binary)	Transferring a compiled file to the PSC1. The file is created during compilation in the working directory of the SafePLC2 project, if the corresponding item is activated in the settings.
Read	Configuration (binary)	A program image is read from the PSC1, which is then available in a binary format. **Note:** The file cannot be opened in SafePLC2.

- **PSC1-C-100**

<table>
<tr><td rowspan="2">Send</td><td>Configuration (binary)</td><td rowspan="2">Transferring a compiled file to the PSC1.
The file is created during compilation in the working directory of the SafePLC2 project, if the corresponding item is activated in the settings.</td></tr>
<tr><td>Program (binary)</td></tr>
<tr><td rowspan="2">Read</td><td>Configuration (binary)</td><td rowspan="2">A program image is read from the PSC1, which is then available in a binary format.
Note: The file cannot be opened in SafePLC2.</td></tr>
<tr><td>Program (binary)</td></tr>
</table>

Diagnostics

Open diagnostics window. See chapter „Diagnostics“

Scope

Opens the „Scope“ monitor dialog. This enables the representation of various process data.

Block diagnosis

This button adds selected elements to Function block tab within Diagnostics window Device dialog. This button is enabled only when Device dialog is showed.

Connection settings

Open Document Properties window with connection settings. In order to be able to set up a connection with a PSC1-system, the transfer parameters must be set accordingly.

Close

Close Device Interface dialog.

Device interface status bar:

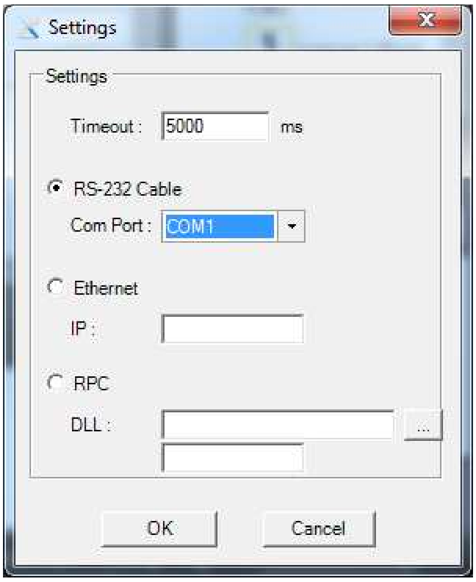
1. Compilation indicator
    - **Compiled** – compiled current file
    - **Not compiled** – current file is not compiled
2. Progress status
    - **None** – gray shaded indicates no configuration sequence
    - **Sending configuration** – transmitting the configuration of the logic diagram to the PSC1 module.
    - **Reading configuration** – reads out the current PSC1 device configuration
3. Connection status with indicator bar
    - **Connected** – active connection to the COM interface of a PSC1 monitoring unit
    - **Disconnected** – no active connection
4. Program status
    - **Idle** – program has completed all tasks in Control tab
    - **Upload** – program is uploading to PSC1 system
    - **DownloadBinary** – program is downloading Configuration from device
    - **Diagnosis** – program uses diagnostic tools in Diagnosis tab.
    - **Scope** – program monitoring the time dependent courses of speed, acceleration and position in Scope tab.
5. Device status
    - **Stop** – stops the transferred program
    - **Run** – starts transferred program
    - **Init** – device in initializing state
    - **None** – no connected device (only disconnected status
6. Alarm status: Only in case of alarm
    - **Alarm** – Case of alarm with number of errors
7. Connected COM port

Note:

Diagnostic function is described in chapter „Diagnostics“. For more information about Scope see chapter „The Scope monitor“.

9 Export dialog

Export dialog function serve to export parameters and configurations. After pressing button there appear dialog window to set connection among PC and PSC1 unit.



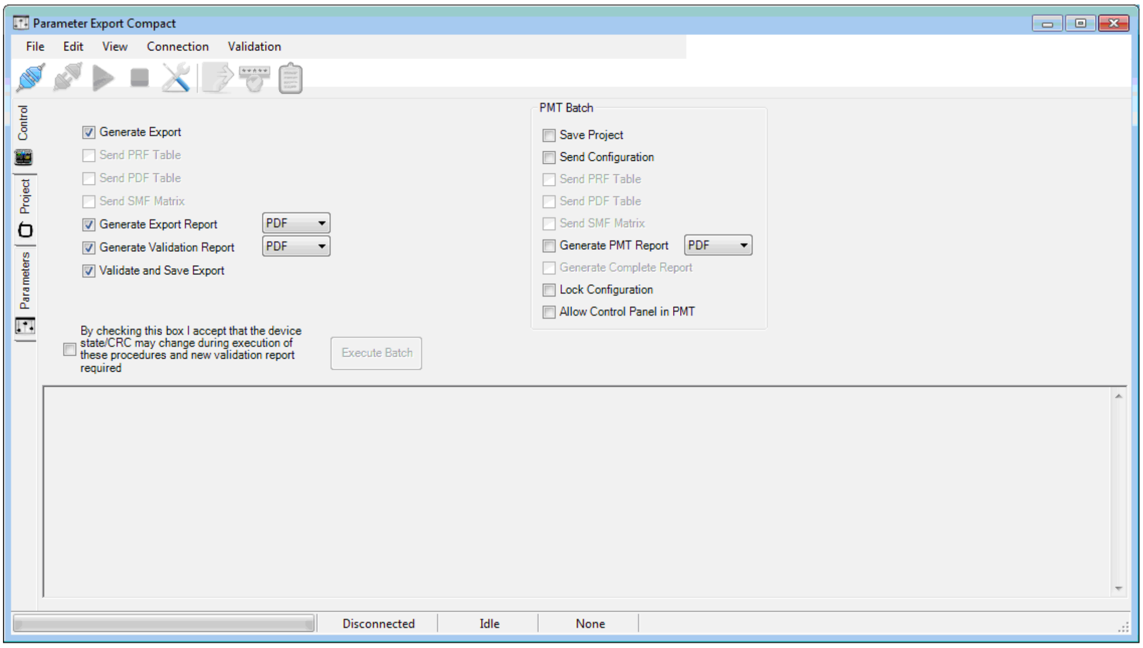
Note:

Connection settings are described in chapter 0

.

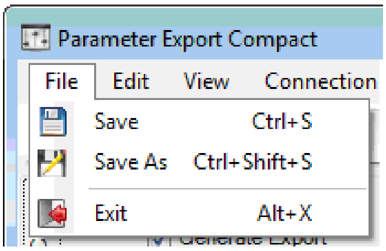
After connection set a pressing button OK there appear the main window for parameters export – Control Tab

.



There are following menus: **File**, **Edit**, **View**, **Connection** and **Validation**.

File menu commands:



Save

Save export parameters.

Save As

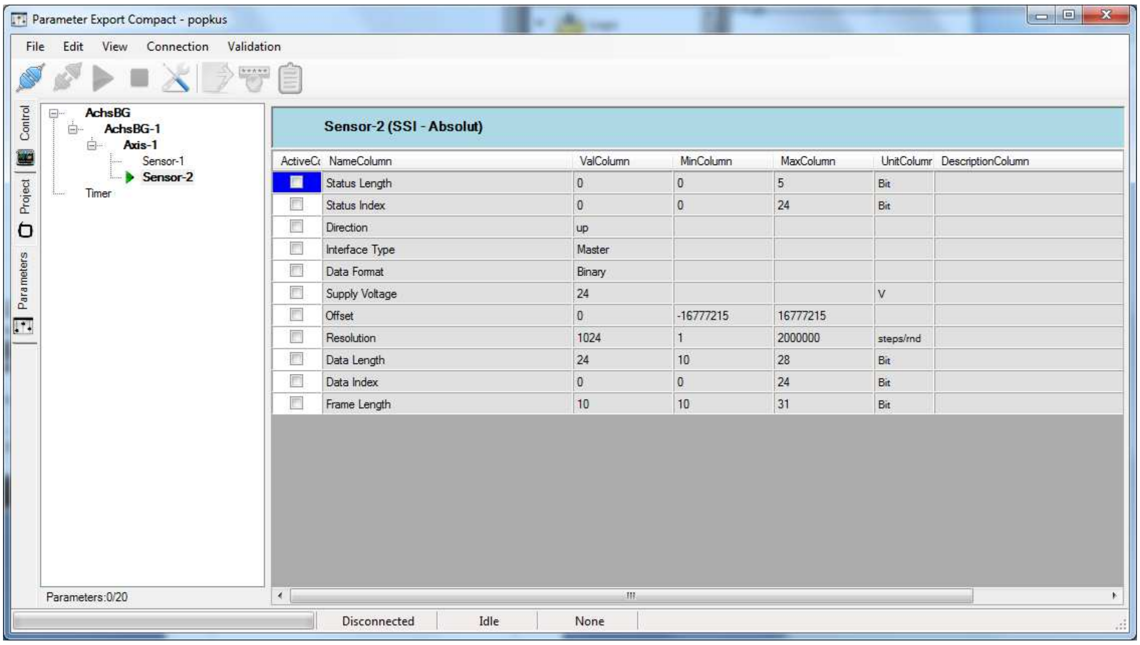
It sets the way how are data exported. They can be exported as separate files, or as a project container (PMT Package file). Project container can be protected by password.

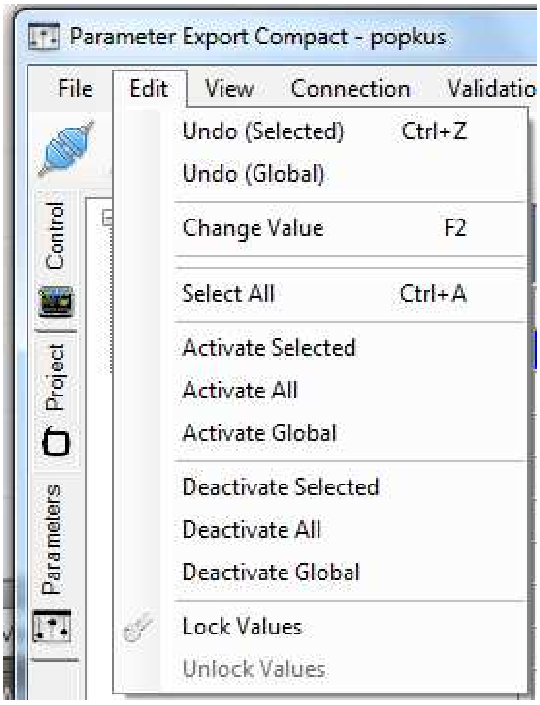
Exit

Close Parameter Export window

Edit menu commands:

Commands in this menu are designated for working in „Parameters“ Tab.



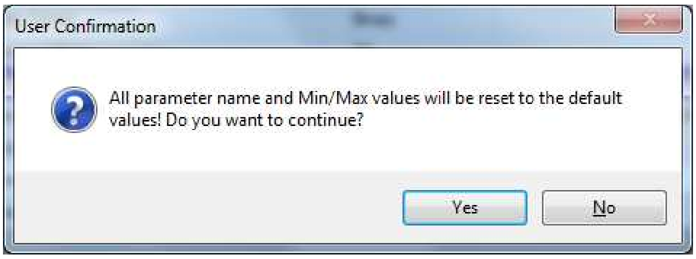


Undo (Selected)

Returns the selected value to the default value.

Undo (Global)

Returns all changes in all parameters to the default values.



Change Value

It allows to change selected value. The same action can be activated by double left button mouse click on value.

Select All

Selects all parameters in Parameters Tab for chosen element e.g. Encoder.

Activate Selected

Activates selected parameter (row) in Parameters Tab.

Activate all

Activates all parameters (rows) for selected element e.g. Encoder.

Activate Global

Deactivates all parameters (rows) for all used elements.

Deactivate Selected

Deactivates selected parameter (row) in Parameters Tab.

Deactivate all

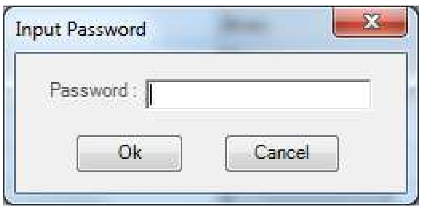
Deactivates all parameters (rows) for selected element e.g. Encoder.

Deactivate Global

Activates all parameters (rows) for all used elements.

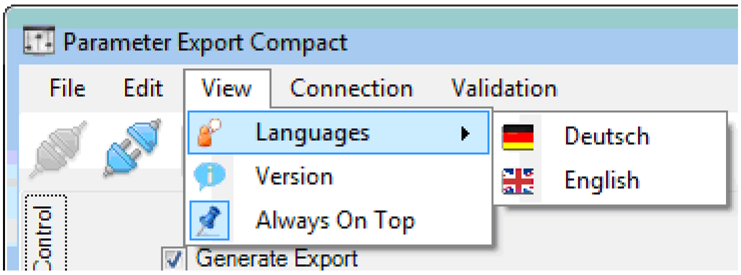
Lock values

Locks the selected value. A dialog box for setting a password is displayed for this purpose. The locked values cannot be used in another separate program (SafePMT) without this password.



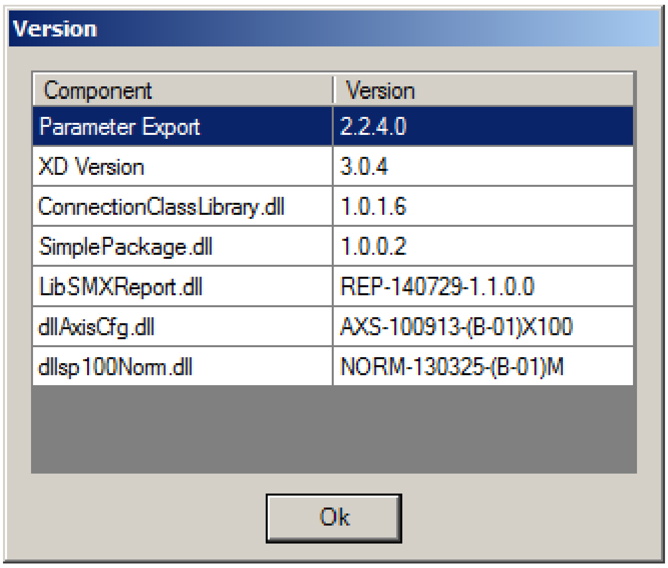
Unlock values
Unlocks values, which were locked before by command Lock. It does not ask password, because in this environment you are administrator who set password.

View menu commands:



Languages
Changes language used for user interface and parameters names in Parameters Tab. (English/German).

Version
Shows information about Parameters export version.



Version

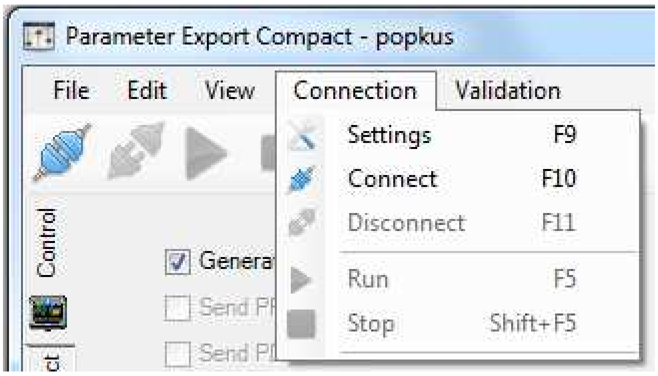
Component	Version
Parameter Export	2.2.4.0
XD Version	3.0.4
ConnectionClassLibrary.dll	1.0.1.6
SimplePackage.dll	1.0.0.2
LibSMXReport.dll	REP-140729-1.1.0.0
dllAxisCfg.dll	AXS-100913-(B-01)X100
dllsp100Norm.dll	NORM-130325-(B-01)M

Ok

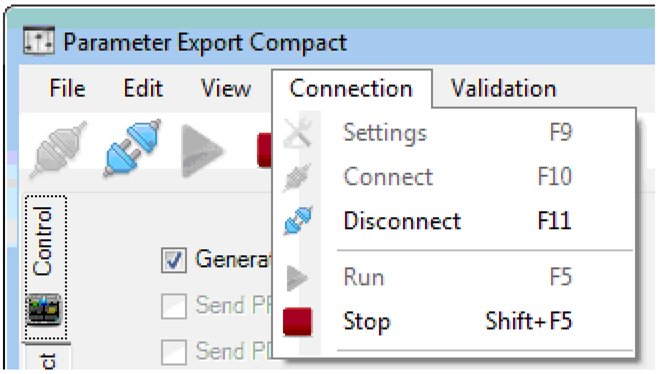
Always On Top
Pins Export dialog window on top.

Connection menu commands:

Appearance of this menu depends on whether PSC1 is connected or not.



Appearance if PSC1 is disconnected.



Appearance if PSC1 is connected and running.

Settings

Opens connection settings window. In order to be able to set up a connection with a PSC1-system, the transfer parameters must be set accordingly.

Connect

Starts the connection to the PSC1-system.

Disconnect

Cancels an active connection.

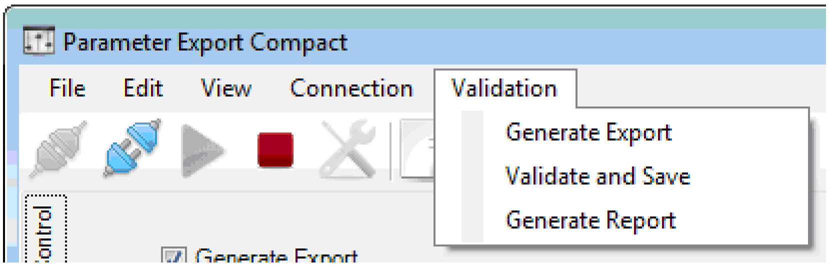
Run

Starts the sequencing program.

Stop

Stops the sequencing program.

Validation menu commands:



Generate Export

This function joins two functions together - Generate export and Generate Export Report.

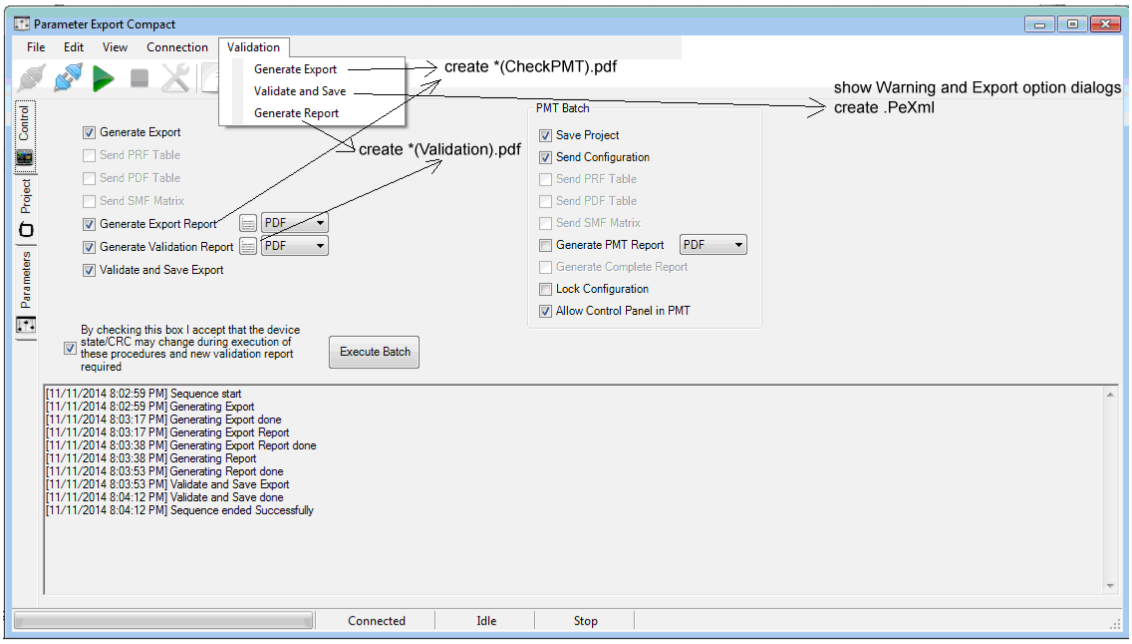
Validate and Save

Validates parameters and saves them.

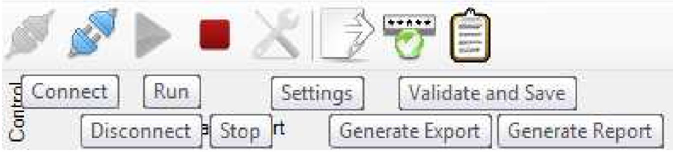
Generate Report

Create a PDF or Excel file with the current PSC1 configuration for the connected device. The text file lists the parameters of the configured modules and the instruction list. The printout must be confirmed and released in accordance with the required guidelines..

The same functions can be activated via the appropriate check box:



Icon tools for Parameter Export dialog:



Icon tools in the Device Interface – in status connected

Icon tools – in status disconnected

Connect
Starts the connection to the PSC1-system.

Disconnect
Cancels an active connection.

Run
Starts the sequencing program.

Stop
Stops the sequencing program.

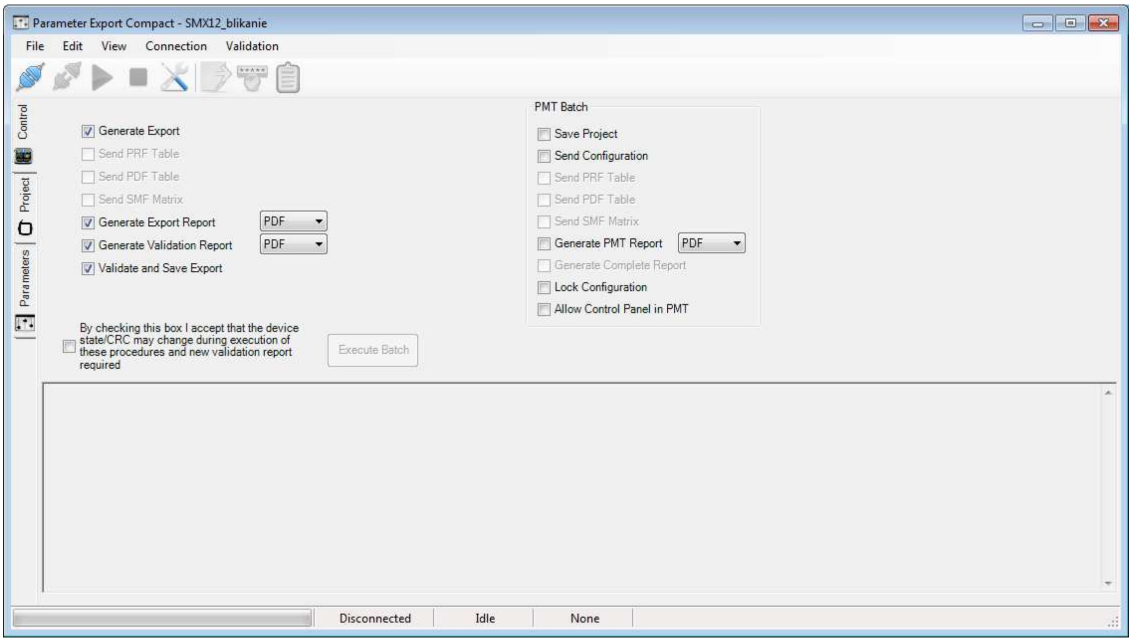
Settings
Opens connection settings window. In order to be able to set up a connection with a PSC1-system, the transfer parameters must be set accordingly.

Generate Export
Generates export.

Validate and Save
Validates parameters and saves them.

Generate report
Create a PDF or Excel file with the current PSC1 configuration for the connected device. The text file lists the parameters of the configured modules and the instruction list. The printout must be confirmed and released in accordance with the required guidelines.

Control Tab:



Send PRF (Position Reference Function) Table (on request)

Transfers all data required when using the PRF-function, e.g. the position table.

Send SMF (Safe Matrix Function) Matrix (on request)

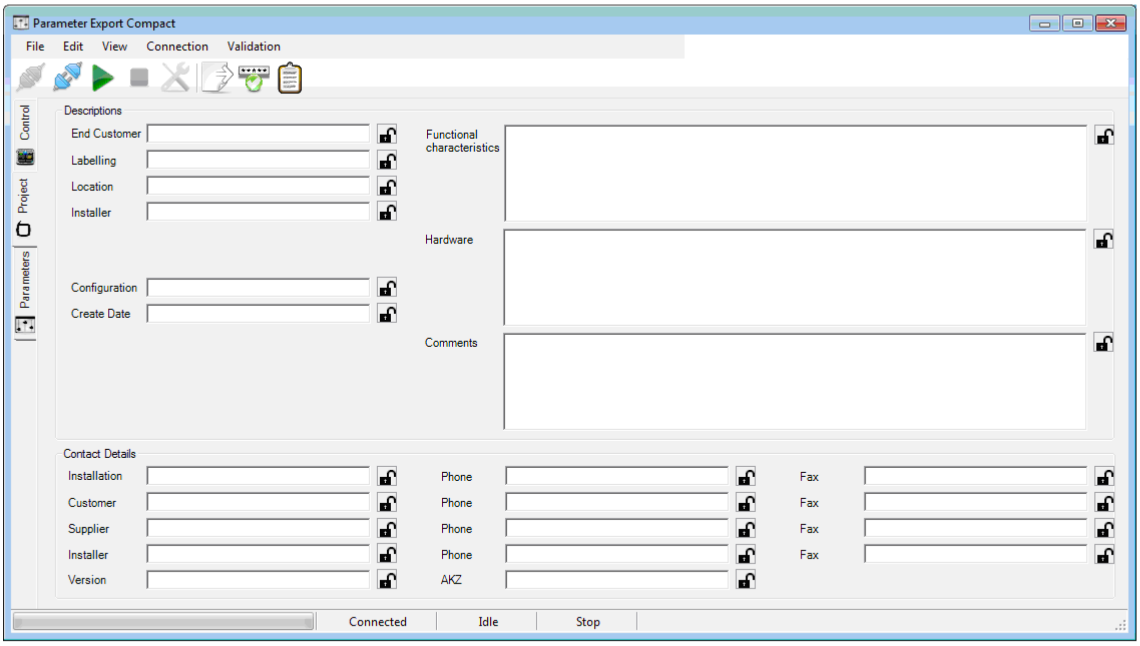
Transfers position data of the coordinate matrix.

Safe PMT

Separate parameterizing tool

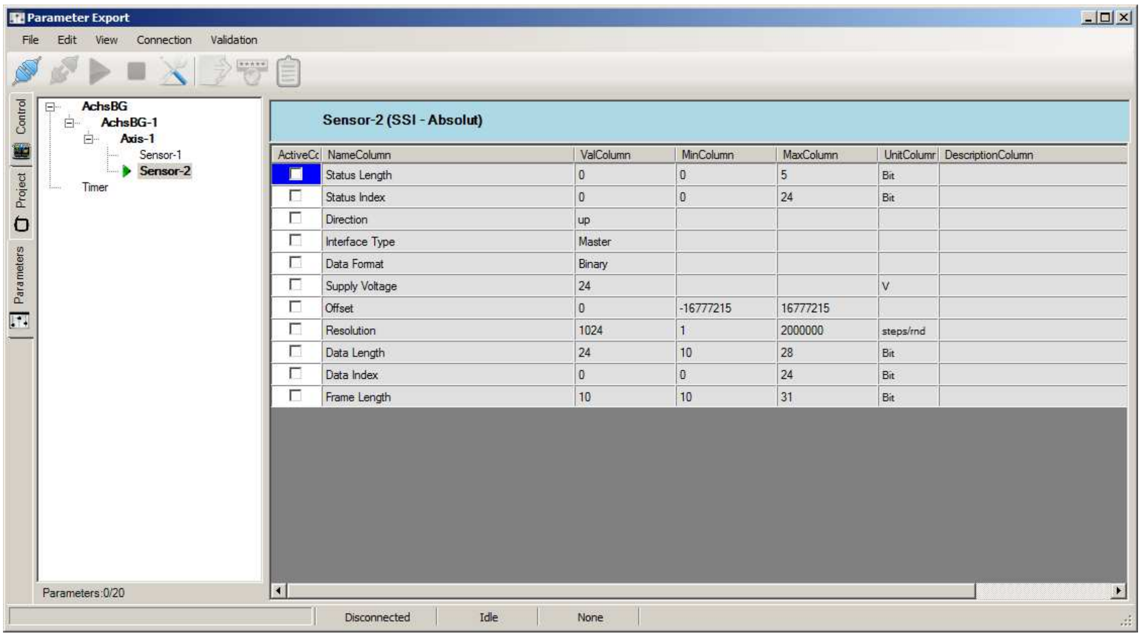
Project Tab:

In this tab it is possible to fill text fields and export this information together with exported parameters. It is also possible to lock these fields. Locked fields are after exporting and opening in another separate program impossible to edit.



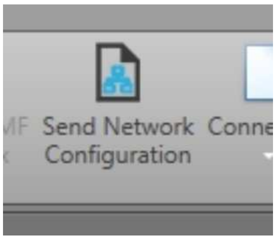
Parameters Tab:

There it is possible to see all Parameter, their values and after activating parameters it is possible to change them. Working with parameters uses commands in menu Edit.



10 Networks

Note:
When using the PSC1 for the first time or changing any of the networks described below, the final network configuration must be transferred to the PSC1 separately from the actual configuration.
For this purpose, after SafePLC2 has been connected to the PSC1 with the "Connect" command in the "Device Interface" menu, the network configuration is transferred with the "Send Network Configuration" command.



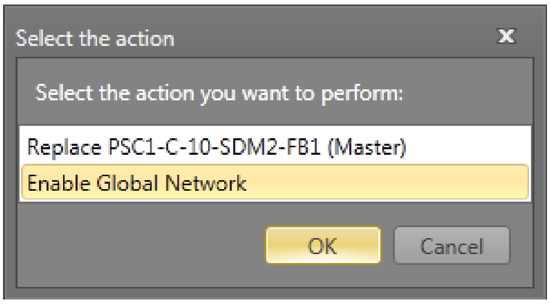
10.1 Master to Master (SMMC)

10.1.1 Description

It is a global network for master to master communication. Minimum is 2 masters, maximum is 4.

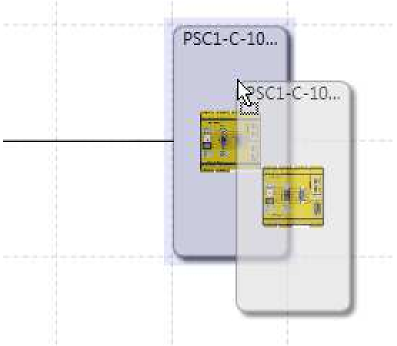
10.1.2 Creating

1. The user needs to insert a master which supports SMMC
2. If the user inserts a second master which supports SMMC, he gets the following dialog:



Choosing Enable Global Network and press button OK. Second master is added, and Global Network scheme tab appears.

After creating SMMC network with minimum 2 master devices, if there will be added next master device with SMMC support the dialog above does not appear, and device is automatically added to Global Network (up to max. 4 devices). If you want replace master device with another, you have to drag new device from Library and pull it exactly at icon of device which you want to replace. The mouse cursor must point at icon of device which you want to replace (see picture below).



Deactivating

automatically, if other master is deleted and there left only one master.

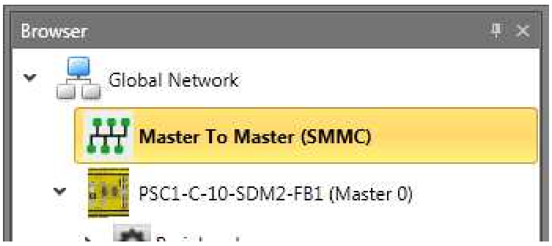
Appearance

10.1.3 Configuration

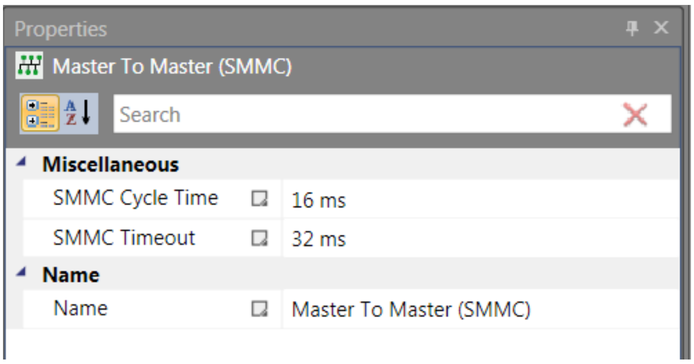
10.1.3.1 Shared configuration

If user click at SMMC line in Global Network scheme,

or select SMMC in Browser



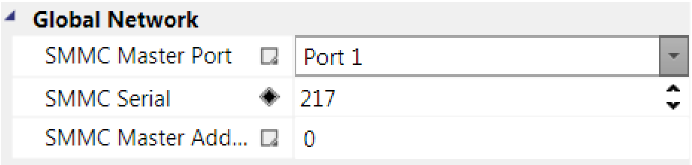
then there appear properties for SMMC in Property Grid.



There it is possible to set SMMC Cycle Time and allowed Timeout Time in ms.

10.1.3.2 Individual configuration of masters

After clicking at each master device in SMMC network, in Property Grid appear properties which allow to configure these devices individually.



SMMC Master Port

Select port which will be used for SMMC communication.

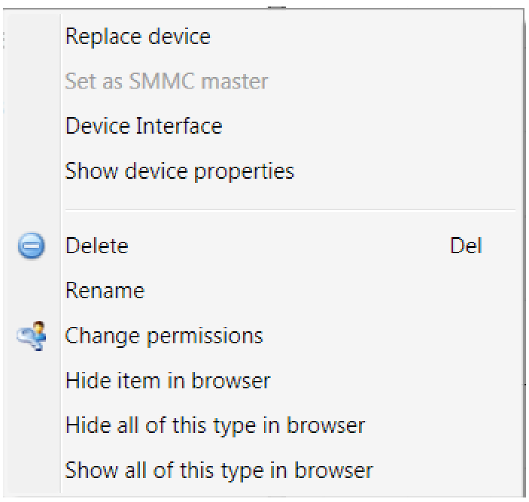
SMMC Serial

Device serial number – need to be read from device label and write to program.

SMMC Master Address

It is address of device in SMMC network. SMMC Master device has address 0. Order in scheme and Master address are connected. First device (in top-down direction) is Master and has address 0. Second device has address 1, third has address 2 and last one has address 3. If in Global Network scheme user change order of devices by drag&drop function, Master address will be changed according to above mentioned principle (First device = Master address 0, etc.).

After right mouse click button at Master device in Browser there is possibility to set selected device as a master. After setting selected device as a master, in Global Network scheme this device will be moved at first place and other devices will be moved down and their Master address will be changed.

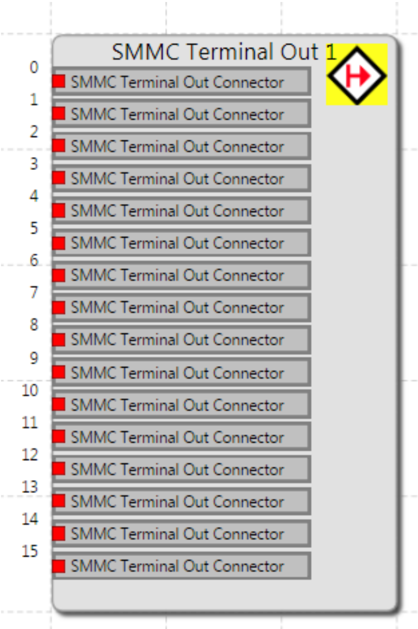


10.1.4 Using SMMC

Note:
The SMMC address used in the IL code (e.g. LD SMMC0.3 / ST SMMC_EN.3) is always by "+1" higher than the SMMC output or input connector used.

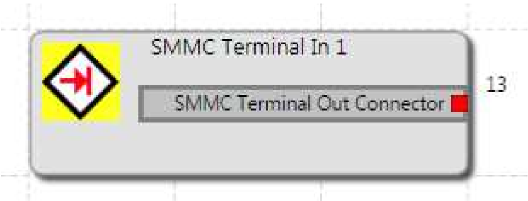
10.1.4.1 SMMC Terminal Out

Each device can write 16 bits as output to the SMMC image. These bits are defined by connection to SMMC Terminal Out connectors.
Depending on the number of available masters, each master receives:
(number of masters - 1) * 16 bits of data; with 4 masters max. 48 bits



10.1.4.2 SMMC Terminal In

Each device can read bits from all other devices and also own bits (each bit can only be read once).



There are limited numbers of configurable shared bits for each device between these master devices that can be assigned to the logic as a “SMMC Terminal Out”.

This SMMC Terminal In will be available after the user configured the related “SMMC Terminal Out” in the functional schema libraries of any master.

10.2 SD-Bus

10.2.1 Description

The SD-Bus is a proprietary **S**erial **D**iagnostic **B**us (in the following: SD-Bus).

10.2.1.1 Physical perspective

SD-Bus is a single-line bus system which is connected to a master device (universal communication board) or in future to a decentralized device (in the following: only master devices are mentioned).

Because of this single-line character, SD-Bus compatible safety switching devices have an SD-Bus in- and output contact. The master device output contact is connected to the input of the first device, from the first's output to the input of the next device and so on. All these devices must always be electrically connected in series.

From safety perspective each device has additionally 2 safety input and 2 safety output contacts. Groups of devices can be built. A group contains a number (minimum one) of devices which are connected in series within this group (from output to input contacts and so on). The safety output contacts of the first device of each group can be connected to two safety inputs of a master device or of extension modules. The 2 safety input contacts of the last device in each group are connected to 24V.

10.2.1.2 SafePLC2 (logical) perspective

SD-Bus allows transferring diagnostic information from the SD-Bus compatible safety switching devices to a higher-level process control system. In the other direction it's possible to affect the behavior of the switching devices sending commands from this PLC.

SD-Bus elements allow handling SD-Bus compatible safety switching devices inside SafePLC2. The graphical presentation within SafePLC2 is almost identical with the electrical installation. Therefore SD-Bus elements are divided into SD-Bus Group and SD-Bus Device elements.

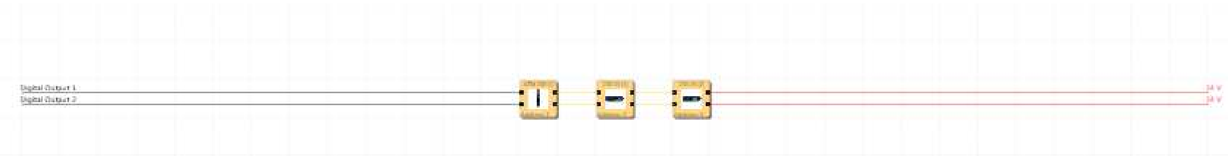
SD-Bus Group elements act similar as the other input elements (like a light curtain). In SafePLC2 schemes multiple SD-Bus Group elements can be connected to a master device or to extension modules.

Because these Group elements are the counterparts of the above mentioned electrical groups they also contain a number (minimum one) of SD-Bus Device elements.

These SD-Bus Device elements act as the counterparts of the real SD-Bus safety switching devices. Therefrom these elements are also connected in series within such a SD-Bus Group. The two outputs of the first SD-Bus Device element are the group outputs, the inputs of the last SD-Bus Device element are the group inputs which are connected to a logical 24V level (which means that this device generates their own test pulses like a light curtain or a sensor input element).

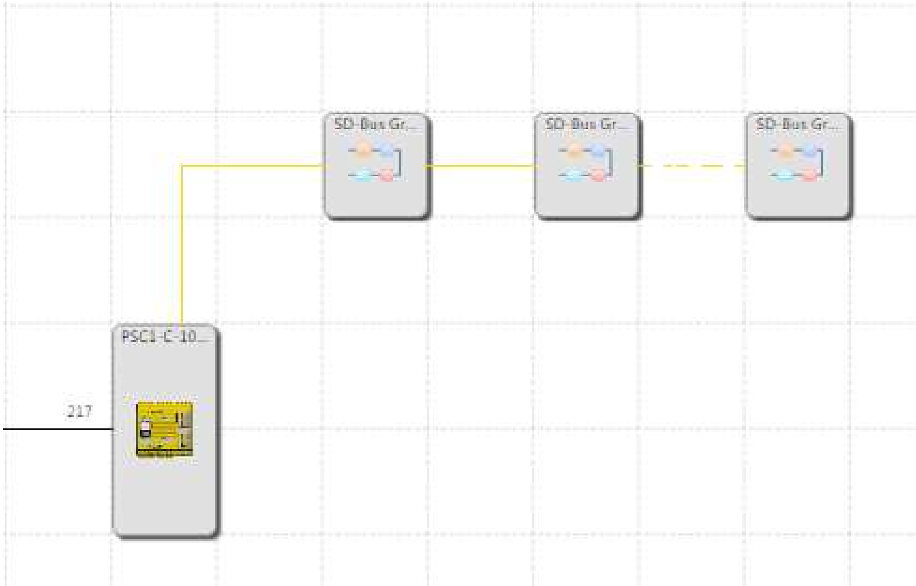
10.2.2 Creating

1. Insert SD-Bus Group is possible from library. If in scheme is inserted at least one SD-Bus Group, it is possible to use Copy&Paste function to insert other SD-Bus Groups.
2. By using a device which supports SD-Bus, SD-Bus Groups can be assigned to that device. A SD-Bus Group acting likes an input element with two outputs (like light curtain element). It is possible to assign up to 31 groups for a SD-Bus supporting device.
3. SD-Bus for a device can be in more than one group and each of them represents an element in wiring scheme. Each group has 2 safe outputs, 24 Volt input and a diagnosis channel input (yellow color in scheme means that device is connected to SD-Bus Device connector).
4. Each group can contain SD-Bus elements inside and a bus can contain up to 31 elements. It means it is possible to have at minimum one group with 31 elements inside or maximum 31 groups with one element for each group. Each group can be configured like in the picture bellow.

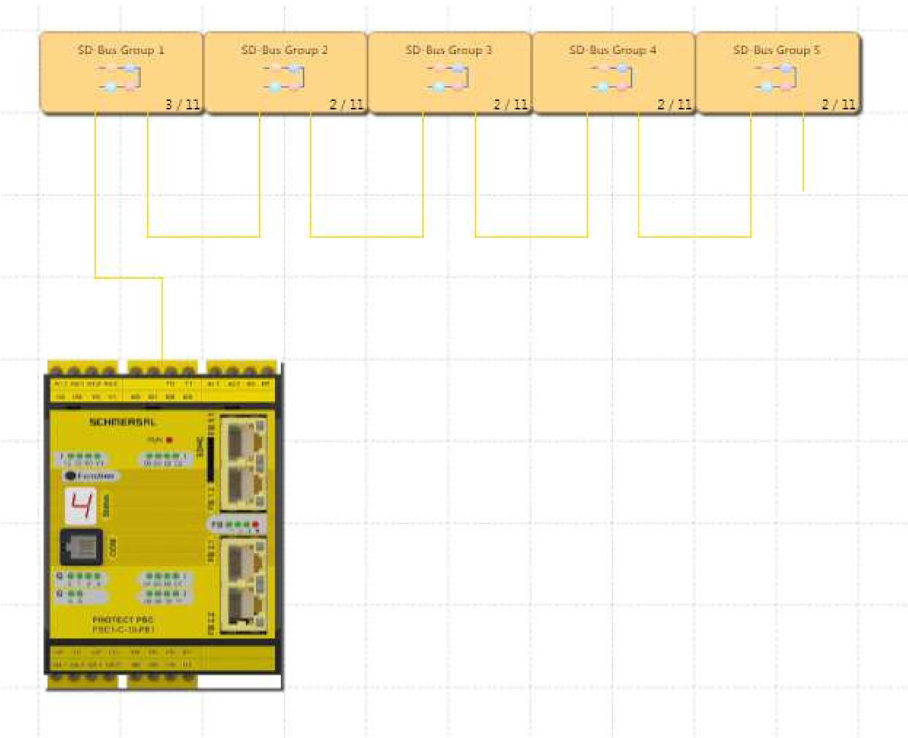


Appearance

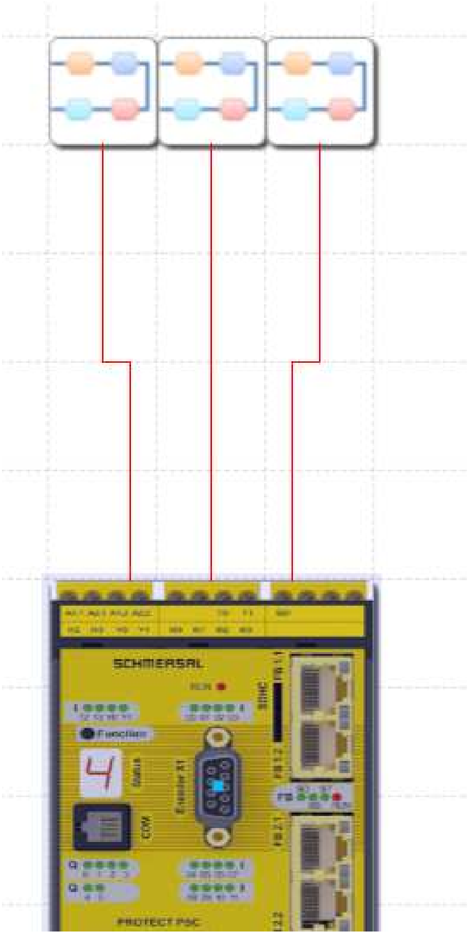
In Global Network scheme the maximum of 3 icons are showed. If there are more than 3 SD-Bus Groups, the connection line among second and the last icon is represented by dashed line.



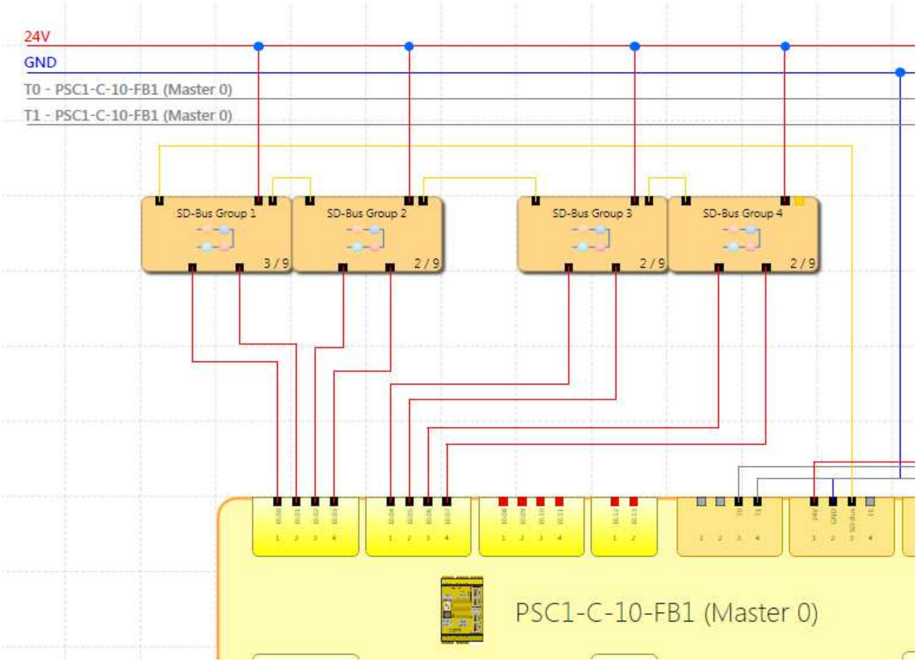
In Local Network scheme there are all SD-Bus Groups visible.



SD-Bus appearance in Terminal Scheme



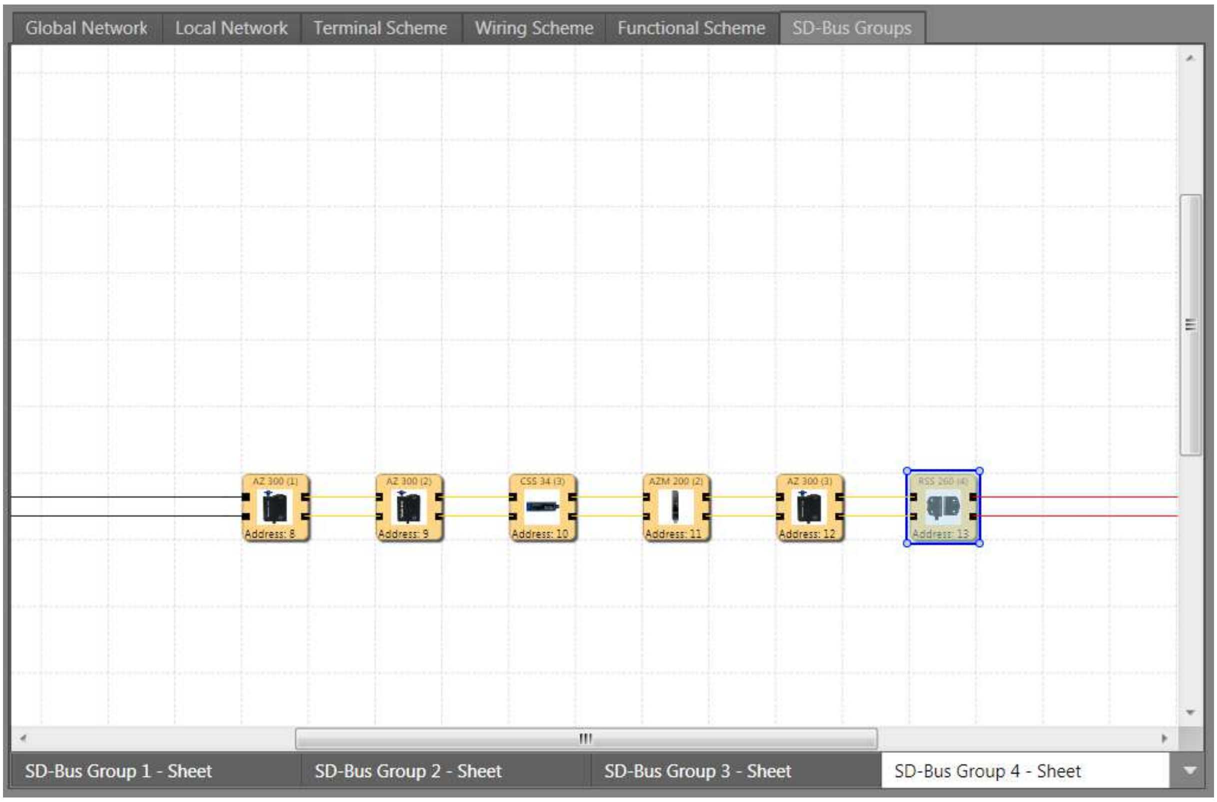
SD-Bus appearance in Wiring Scheme



Inserting SD-Bus elements to SD-Bus Group

To insert SD-Bus elements to SD-Bus Group it is necessary to open SD-Bus Groups Tab in main window. After opening this tab, library shows SD-Bus elements which can be inserted to scheme by Drag&Drop function. If you select some SD-Bus elements, it is also possible to use Copy&Paste function.

SD-Bus Group scheme

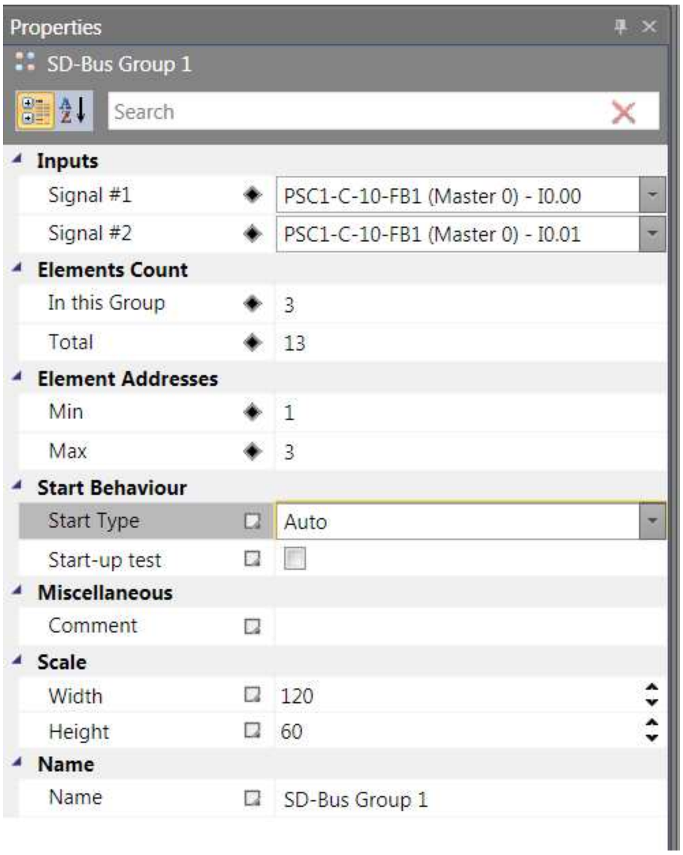


If there is more than one SD-Bus Group at the bottom of window are Tabs, which allow to switch among individual SD-Bus Groups. After switching to desired SD-Bus Group scheme it is possible insert SD-Bus element to this group.

SD-Bus elements are connected in one row from left to right. Address of SD-Bus element is given by order of element in row. By changing order of elements in row is also changed its address (from 1 to 31). Numbering of elements is going through groups i.e. if you have in first SD-Bus Group six elements, they will have addresses from 1 to 6 and in next group will have first element address 7, second 8 etc. Changing order of elements is possible by Drag&Drop function. If you will insert SD-Bus element between existing elements in scheme, all elements on right from place of inserting will be renumbered i.e. their addresses will be changed. If number of SD-Bus elements across the SD-Bus Groups for one master will reach number 31, the Library window become empty and there is no possibility to insert next SD-Bus element.

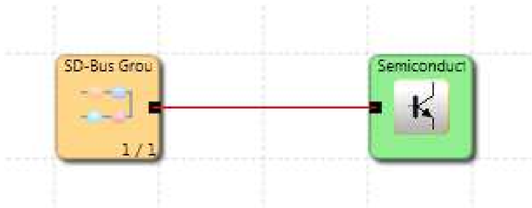
10.2.3 Configuration

To configure SD-Bus Group is possible in Property Grid. To see properties for SD-Bus Group is necessary to select SD-Bus Group in Browser or select it in Local Network scheme, Terminal Scheme or Wiring Scheme. The order of SD-Bus Groups it is possible to change in Local Network scheme, Terminal Scheme or Wiring Scheme by Drag&Drop function or in Browser window. Remember that, changing order of SD-Bus Groups will change also addresses of SD-Bus elements in these groups.



10.2.4 Using SD-Bus

SD-Bus Group can be inserted from Browser to Functional Scheme. Every SD-Bus Group will act as like as an input element in Functional Scheme and the output connector can be connected to safe logics inside Functional Scheme. Connection can be created by drawing connection line between output connector and desired element as it is showed on picture below, or by setting in Property Grid.



10.3 Fieldbus

10.3.1 Description

Fieldbus is the name of a family of industrial computer network protocols used for real-time distributed control, standardized as IEC 61158.

Fieldbus network protocols:

- Non-Safe networks
  - PROFINET
  - PROFINET
  - EtherCAT
  - CANopen
  - EtherNet/IP

- Safe networks
  - PROFIsafe
  - FSoE

Only on Request:

- Non-Safe networks
  - DeviceNet
  - CC-Link
  - CC-Link IE

- Safe networks
  - CIP Safety

10.3.2 Creating

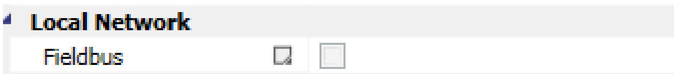
10.3.2.1 Device has own Fieldbus connector

If device has own Fieldbus connector, in Property Grid one can find the entry Fieldbus. By checking this property box, it is possible to turn on or off Fieldbus.

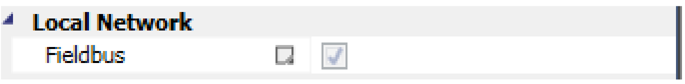
By activating Fieldbus for each device, a network line will be created.

10.3.2.2 Device support Fieldbus connector through network interface slave (PSCBR)

After inserting such device to scheme, in Property Grid for this device item Fieldbus is gray shaded and disabled.



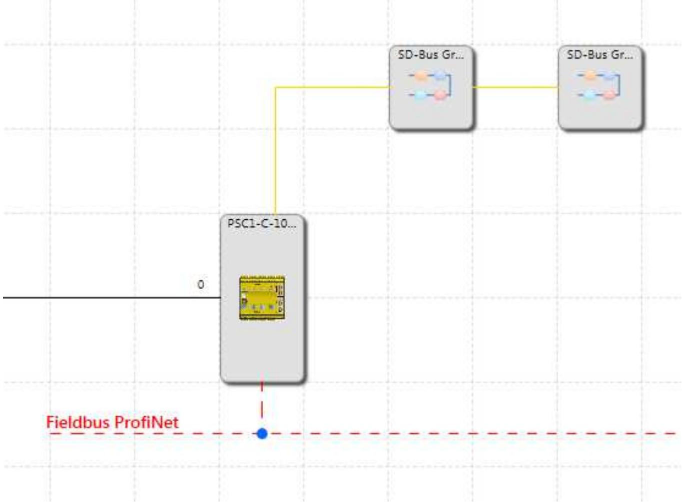
If is additionally inserted network interface slave, Fieldbus is automatically turned on, but it is not possible to turn it off by using checkbox in Property Grid for master device.



To turn of Fieldbus, it is necessary to delete network interface slave.

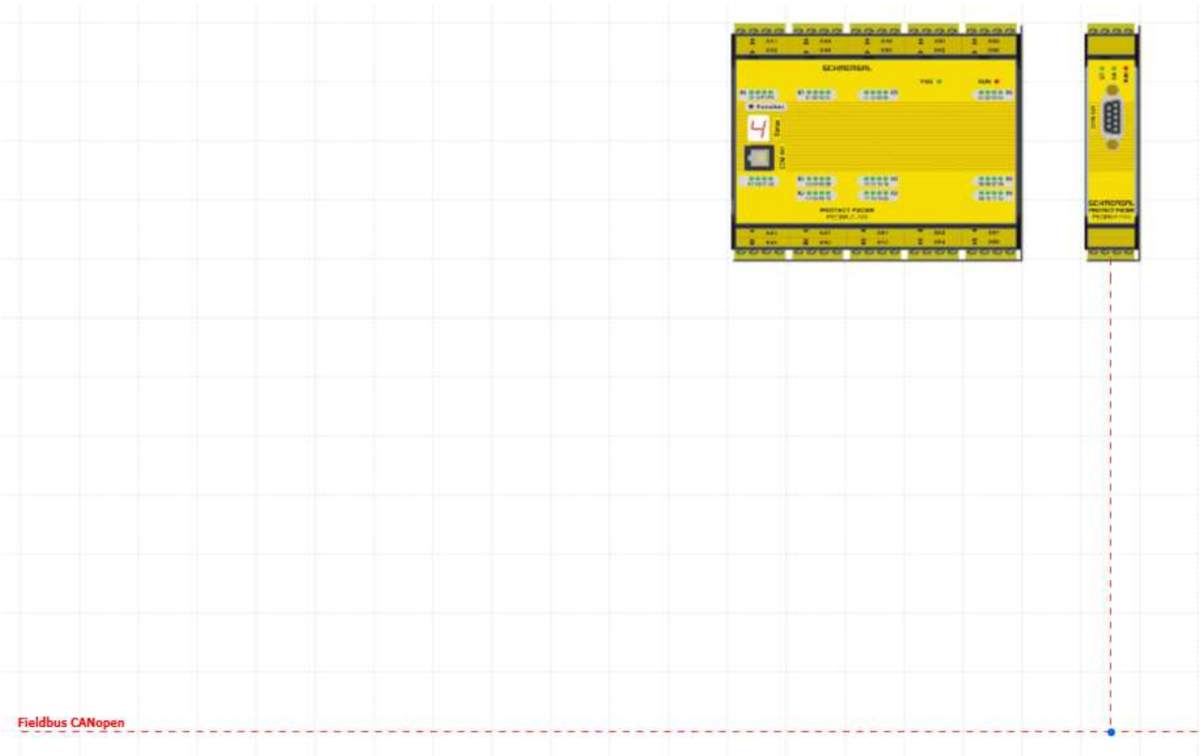
Appearance

In Global Network scheme:

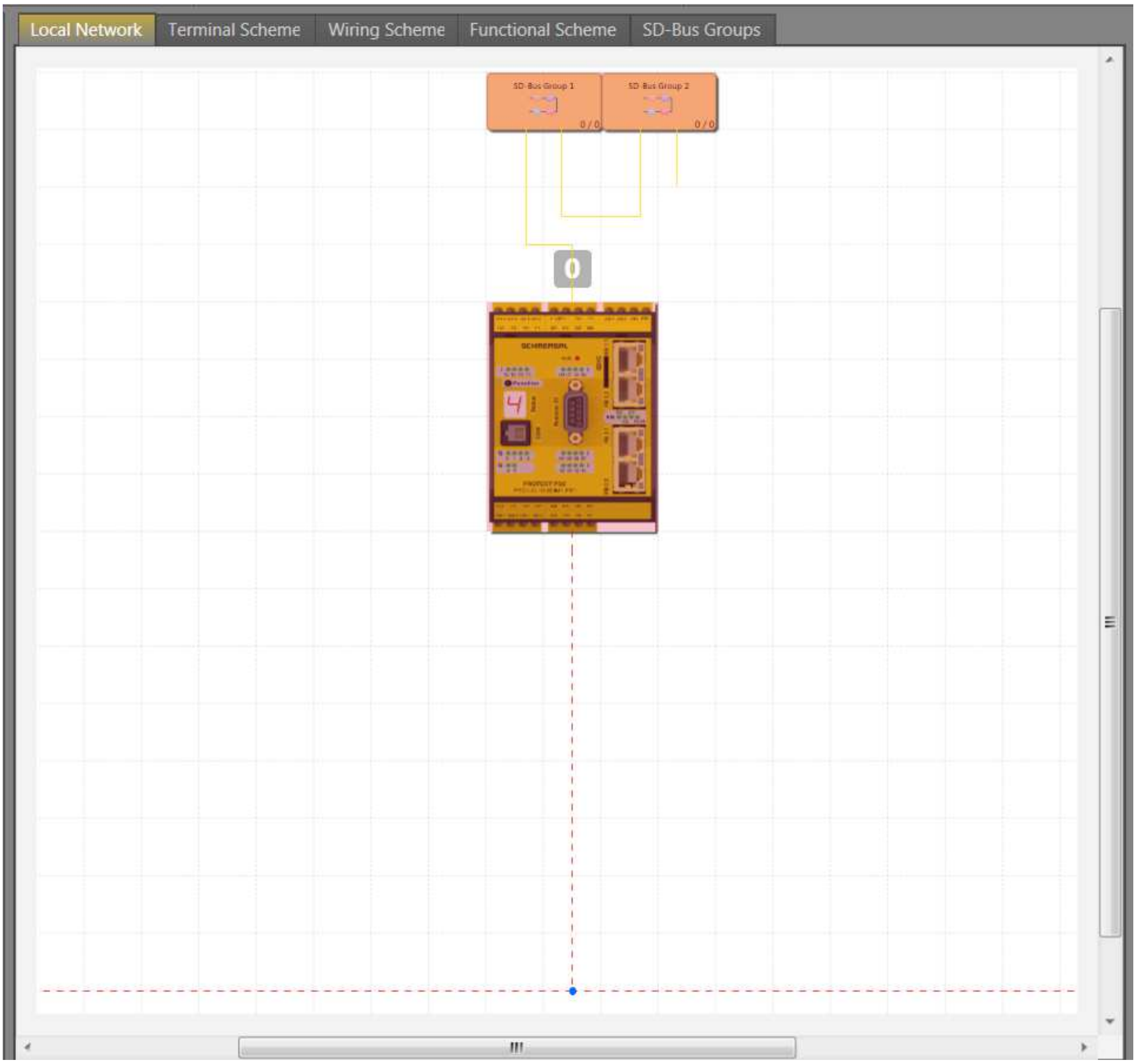


In Local Network scheme:

For devices that support the fieldbus connection via the network interface slave, a line is drawn from the network interface slave.



Line is drawn directly from master device for devices which have own Fieldbus connector.

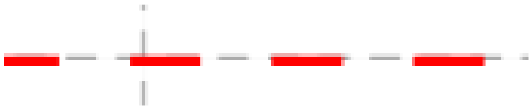


This scheme represents the connection of the device to a higher-level PLC. The fieldbus is activated separately for each device in the "Local Network" scheme.

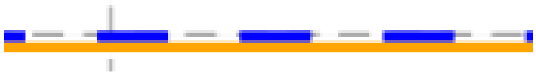
The parameter "Usage" (network pattern) can be set to "Safe" (safety-related), "Non-Safe" (not safe) and "Both" (mixed). The setting is made in the "Properties" window. The fieldbus line is displayed according to the selection for the "Usage" parameter.

The safe usage is represented by red continuous line:

Non-Safe is represented by red dashed line:



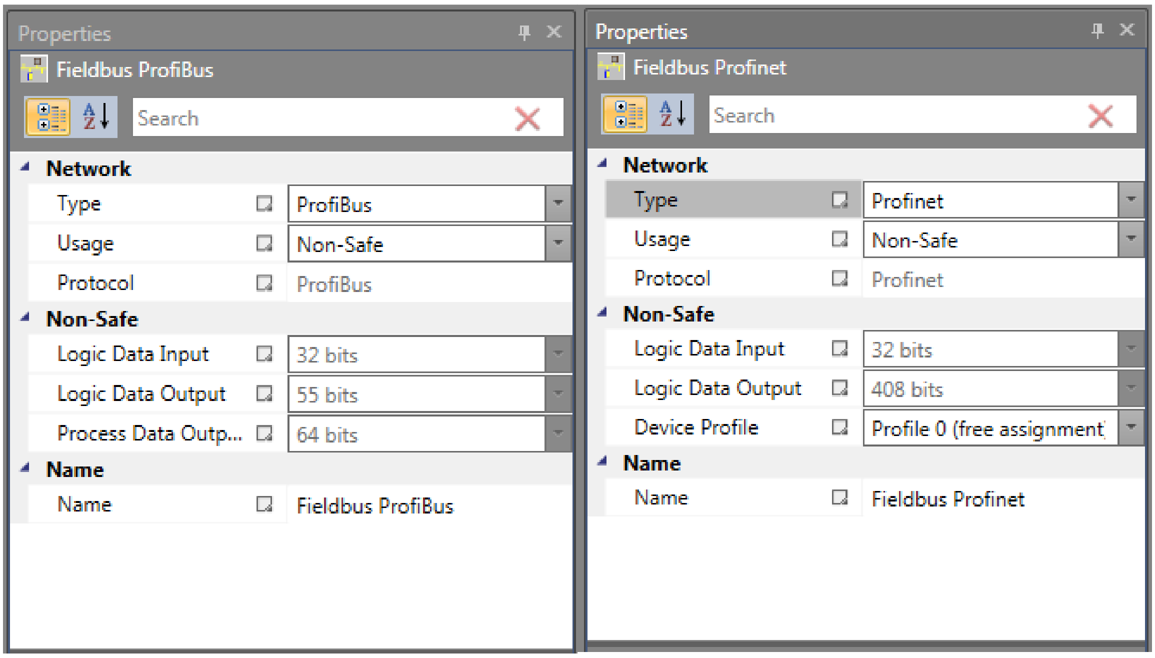
The Both usage is represented by double orange blue line:



10.3.3 Configuration

The properties of this network are configurable when user clicks on the Fieldbus line or selecting Fieldbus in Browser through the Property Grid. The information over this bus has a fixed size for transmission. These are divided between "process data", such as velocity or position (each of which can be defined as a byte, int16, int24 or int32, or as a user-defined type) and logical information. The way that this network is configured is dependent of the pre-defined profiles.

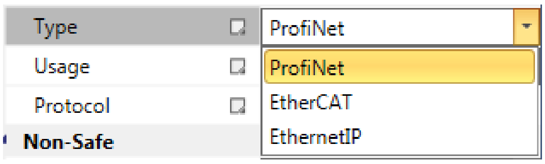
There are different properties for PSC1-C-10 and PSC1-C-100devices in Fieldbus Property Grid as shown below:



For both series it is possible to set following properties:

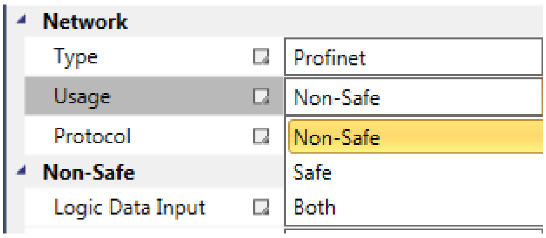
Network Type

PROFINET, EtherCAT and Ethernet/IP can be selected for some devices and PROFIBUS for others. Displayed Type depends on chosen device.



Network Usage

Safe, Non-Safe and Both can be selected.



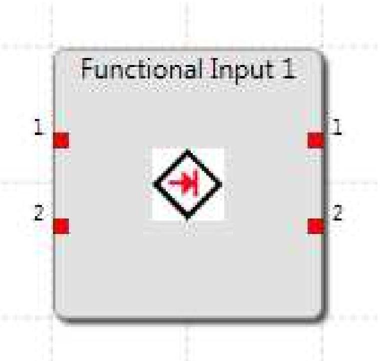
10.3.3.1 Non-Safe Usage

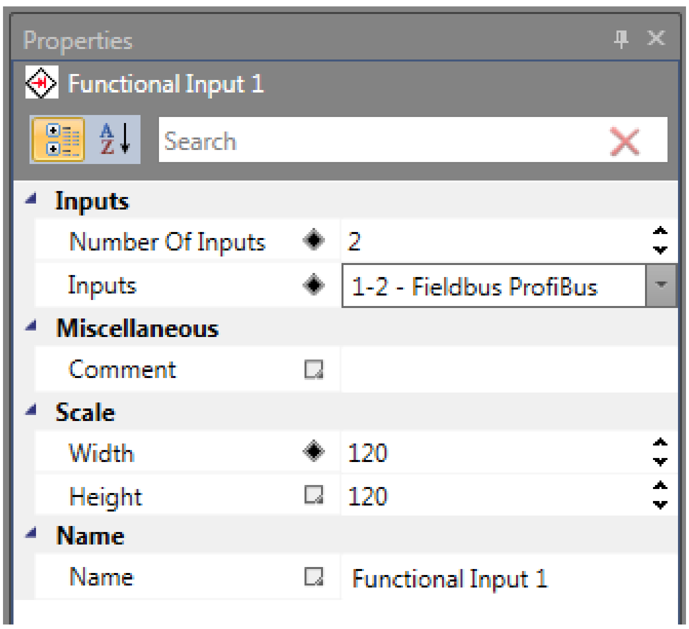
Logic Input and Output Data:

For Non-Safe usage both series have Logic Input and Output Data with fixed bits. Difference is in number of bits for Logic Output Data (55 bits in PSC1-C-10 versus 408 bits for PSC1-C-100). These values define the number of bits usable by Functional Input and Functional Output.

10.3.3.1.1 Functional Inputs

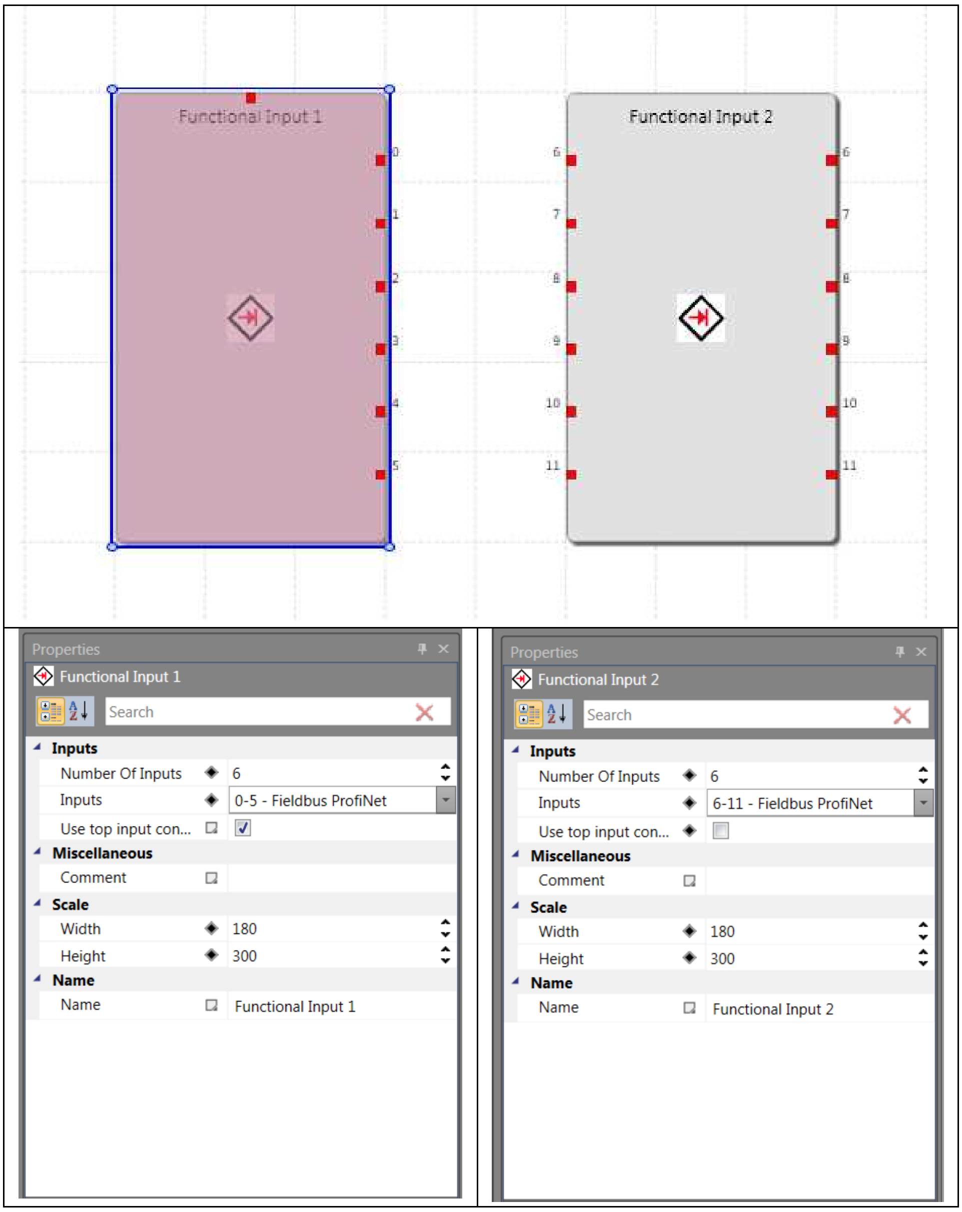
A functional input can only be used once. For each device, the property "Number of Inputs" can be set in the range 1 - 32. Functional inputs provide a non-safety-related input, and it is not permitted to use a non-safety-related input directly. Instead, it may only be activated via another safety-related input. Therefore, the Functional Input block has an additional input connector for each non-safety-related input. An internal check is integrated to ensure that this additional input connector is connected to a safety-related input module. A connection to a logic 1 or another logic device is not permitted.





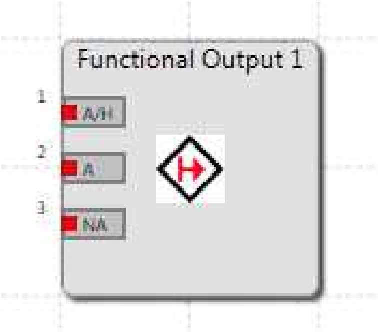
Property Grid for a Functional Input.

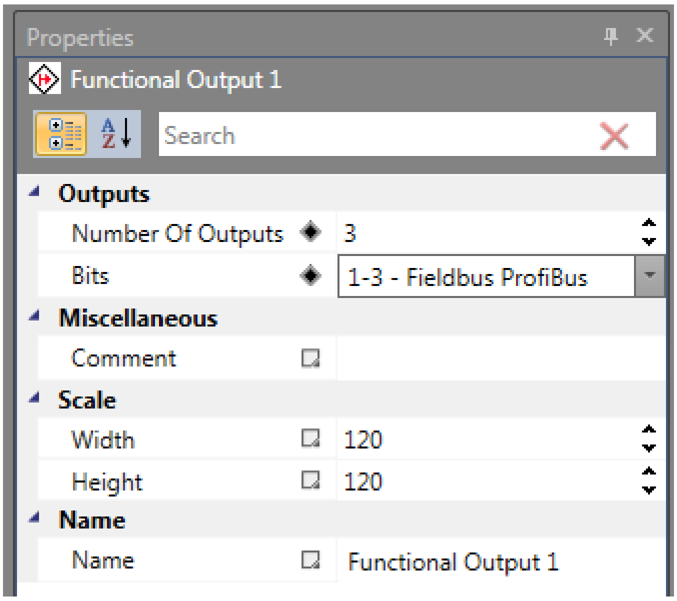
The property "Use top input connector" in the properties window of the functional input module defines whether a common safe input is to be assigned to all functional inputs or whether each input is to be assigned to its own safe input.



10.3.3.1.2 Functional Outputs

A Functional Output can be used only once. For each block the Number of Outputs can be configured in the range of 1 – 55 for PSC1-C-10 series and 1 – 408 for PSC1-C-100 series. The picture below shows Functional Output Block with 3 connectors. Each connector can be configured separately.



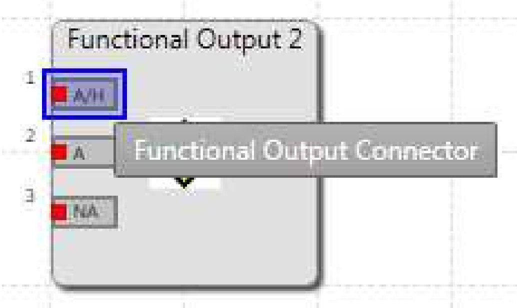


Property Grid for Functional Output.

After selecting a Functional Output Connector, Property Grid shows properties for selected connector.

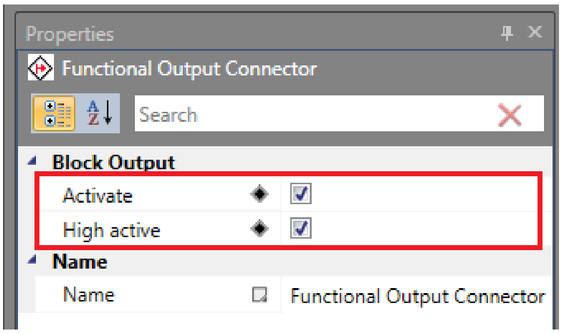
It is possible to set Block Output as:

- NA – Non activated (both check boxes are not checked)
- A – with Low active
- A/H – with High active



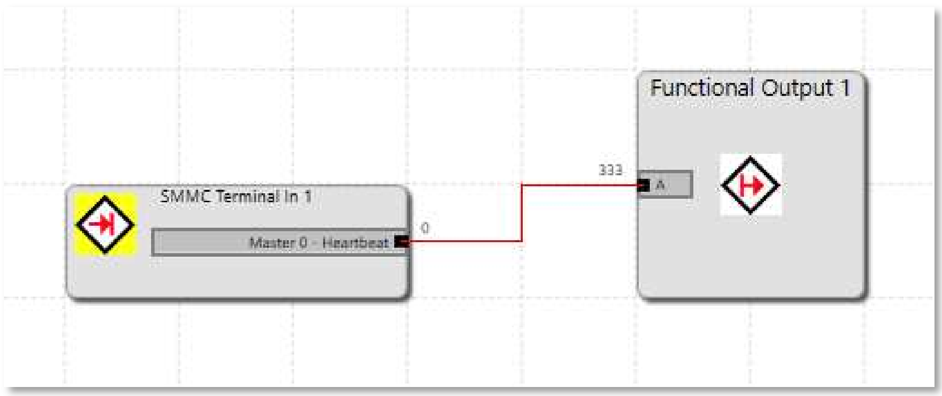
Note:

- Regardless of the configuration (A, A/H; NA) of the Functional Output Connector, the state of the element connected there is always transmitted over the chosen fieldbus.
- “A” and “A/H” are used to write a customer-specific message on the 7-segment display in addition to the transmission on the fieldbus:
  - This message is shown with a <C> and the number of the configured output bit.
  - “A” is used to trigger the message with a low input signal at the Functional Output Connector
  - “A/H” to trigger it with a high input signal.

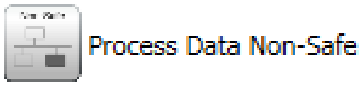


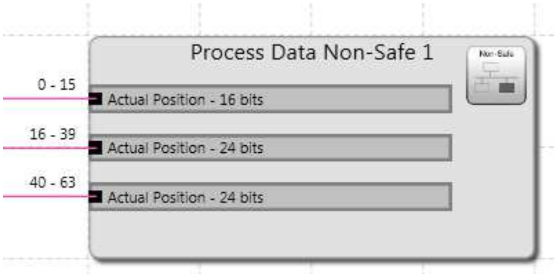
Example: Multi-Master Application

A missing heartbeat signal from master 0 would be indicated by a 0 in bit 333 of the fieldbus transmission. At the same time, code c333 is issued on the front display of the controller, thus simplifying troubleshooting directly in the control cabinet.

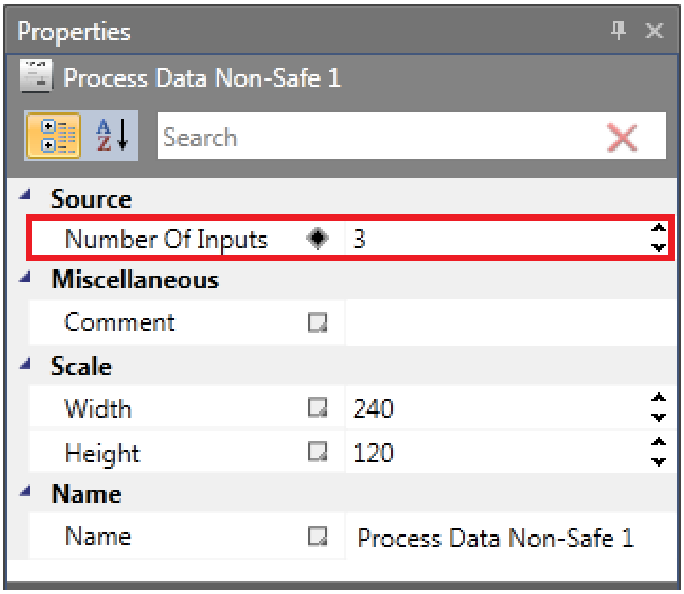


10.3.3.1.3 Process Data for PSC1-C-10:

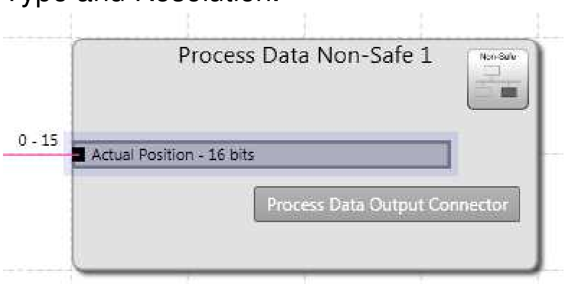


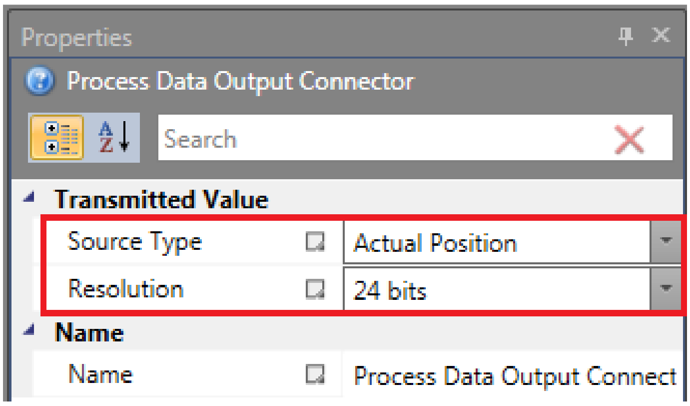


For Process Data Output it is possible to set Number of Inputs.

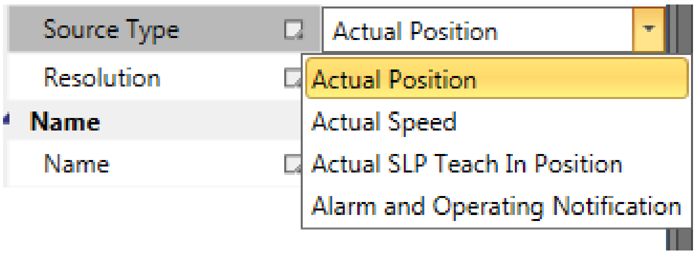


After selecting Process Data Output Connector in Property Grid it is possible to set Source Type and Resolution.

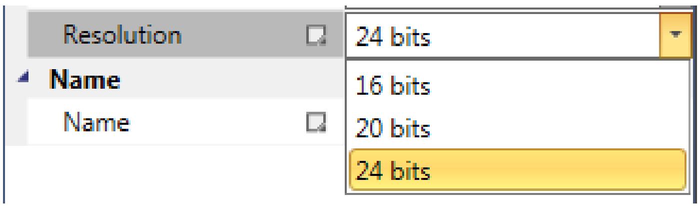




Source Type can be Actual Position, Actual Speed, Actual SLP Teach In Position and Alarm and Operating Notification; Analog Value, Analog Value Filter and Analog Value Adder are also shown (but only available on request).

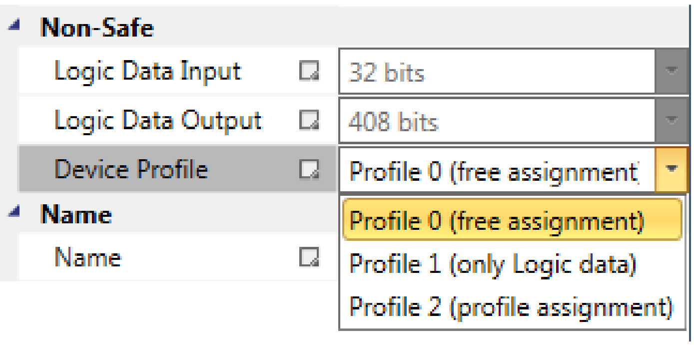


Resolution can be set in different range and it depends on selected Source Type e.g. for Actual Position it can be 16, 20 or 24 bits.



10.3.3.1.4 Process Data for PSC1-C-100:

Here it is possible to choose between 3 Device Profile.



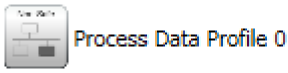
- **Profile 0 (free assignment)** - User can insert one Process Data Profile 0 block and can freely configure inputs and connect sources to inputs.
- **Profile 1 (only Logic data)** – No process data.
- **Profile 2 (profile assignment)** – User can choose from predefined profiles showed in library. Some can be configurable other totally fixed.

Process data are configured separately for each axis slave device. Master, IO and Decentral IO slaves don’t have process data.

Chosen profile effects which Process Data Profile blocks are shown in Library.

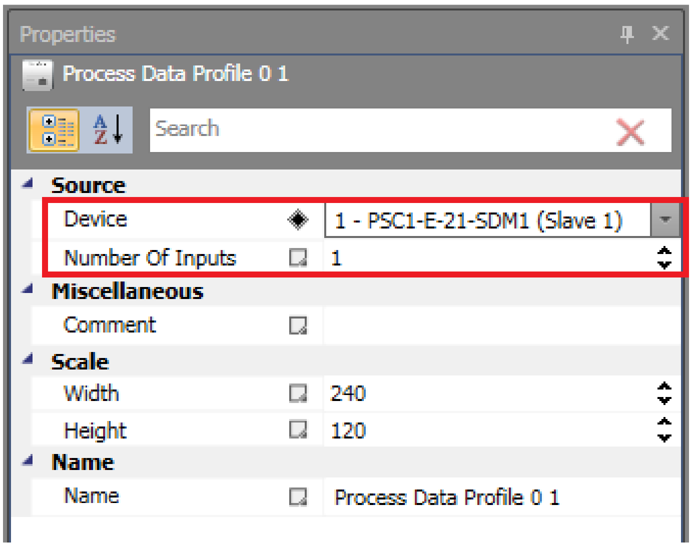
Important note:

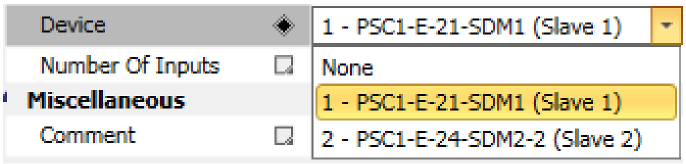
To be able to display the process data profile blocks in the "Library" window for all PSC100 variants, at least one axis slave must be added.

If **Profile 0** is selected in library appears 

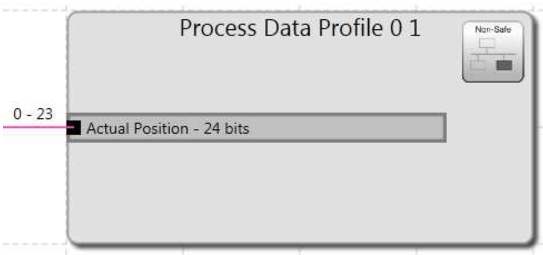
and following configurations are possible:

Here it is possible to set Device and Number of Inputs.

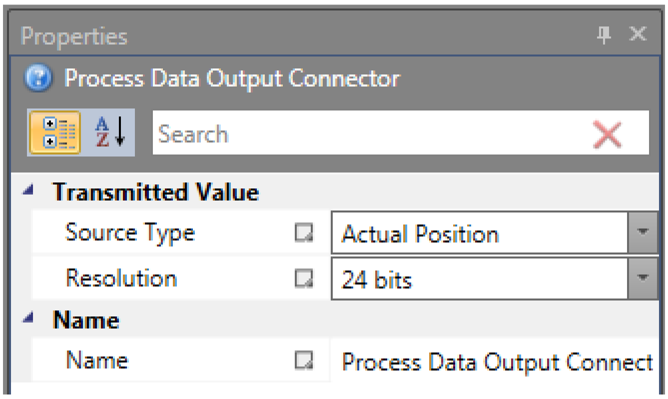


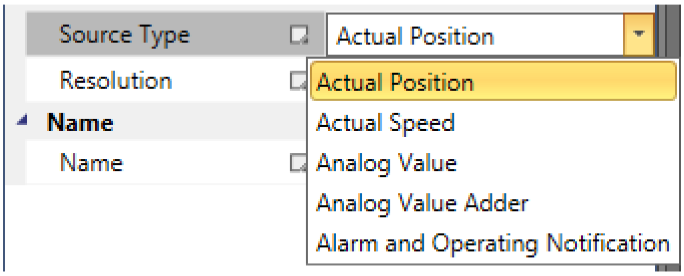


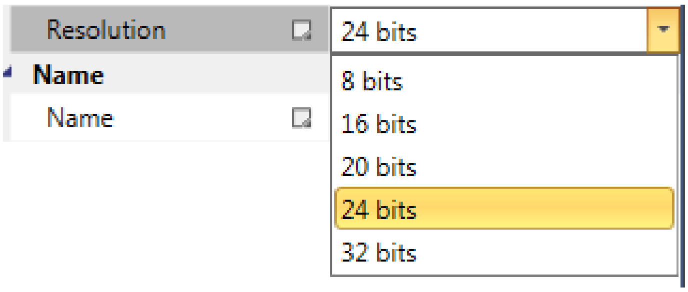
If one of the inputs is selected it is possible to set its properties in Property Grid.



It is possible to set Source Type (Actual Position, Actual Speed, (Analog Value, Analog Value Adder; only on request), Alarm and Operating Notification) and Resolution. For Analog Value, Analog Value Adder, Alarm and Operating Notification it is not possible to set Resolution.



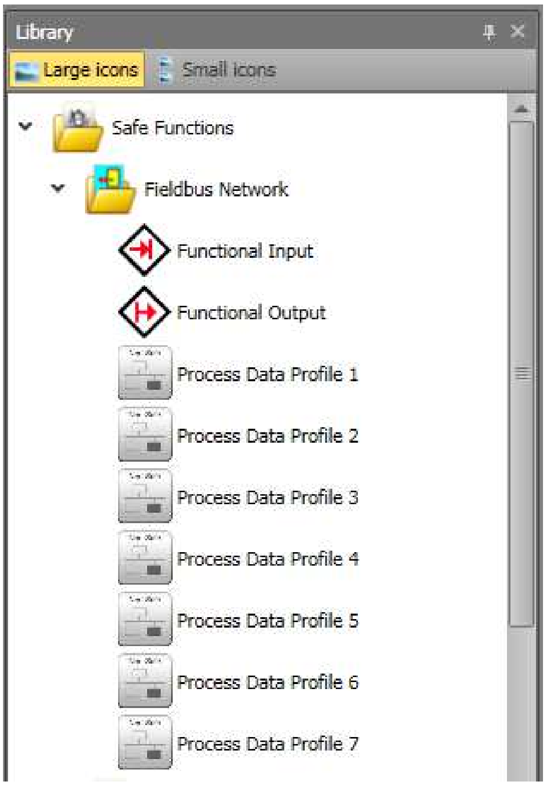




If **Profile 1** is selected, there is no Process Data Profile in Library.

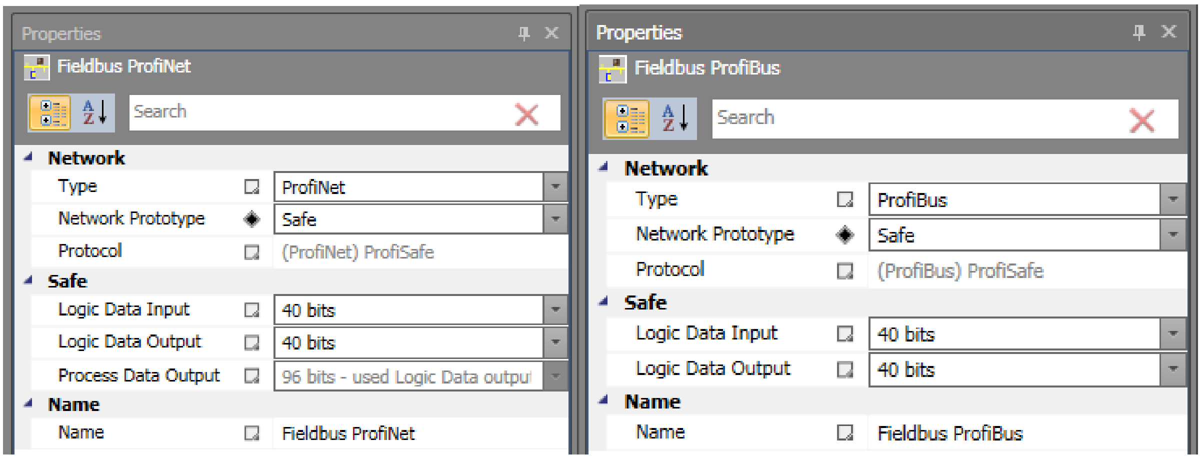
If **Profile 2** is selected, in Library appear predefined profiles. Some predefined functions and values is not possible to change, but for some values changes are allowed.

For every axis device it is possible to insert one Process Data Profile block.



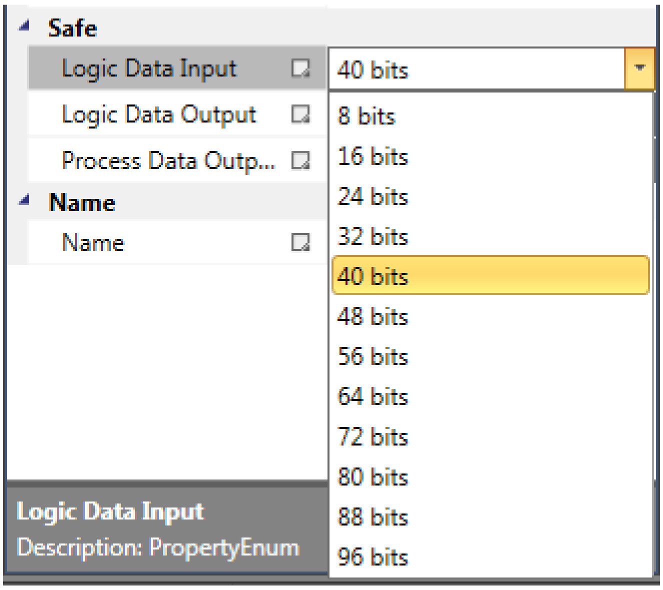
10.3.3.2 Safe Usage

For Safe usage Property Grid looks like it is shown on pictures below (PSC1-C-10 series – left, PSC1-C-100 series – right):

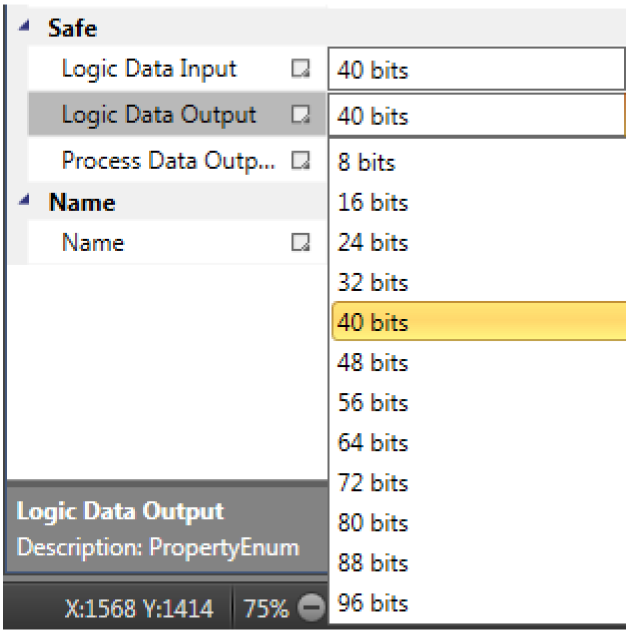


Here it is possible to set:

Logic Data Input – it is possible to set from 8 bits to 96 bits.

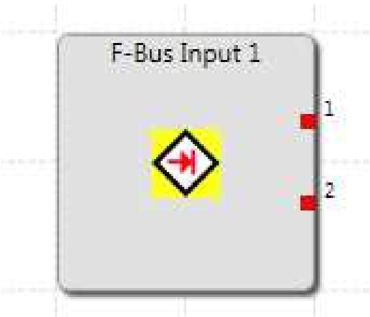


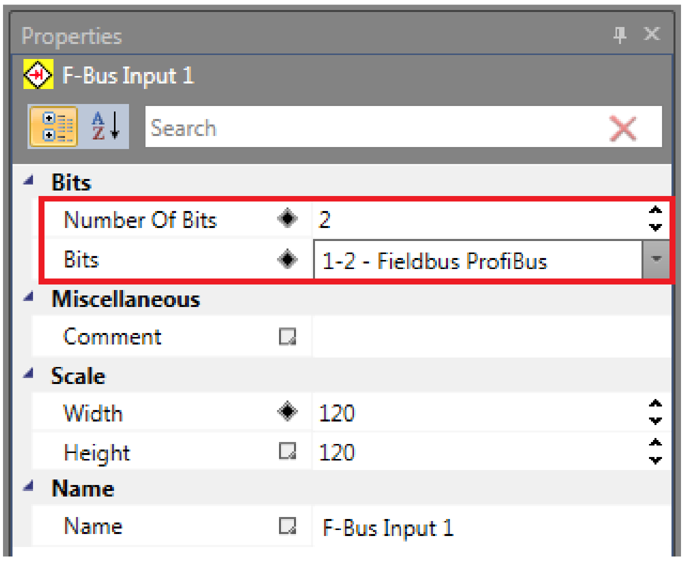
Logic Data Output – it has the same range as input (from 8 bits to 96 bits).

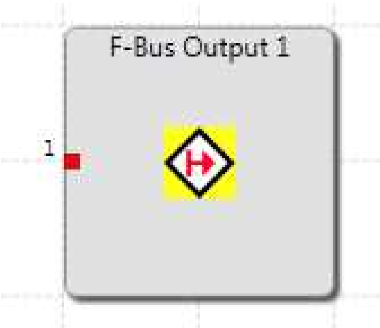


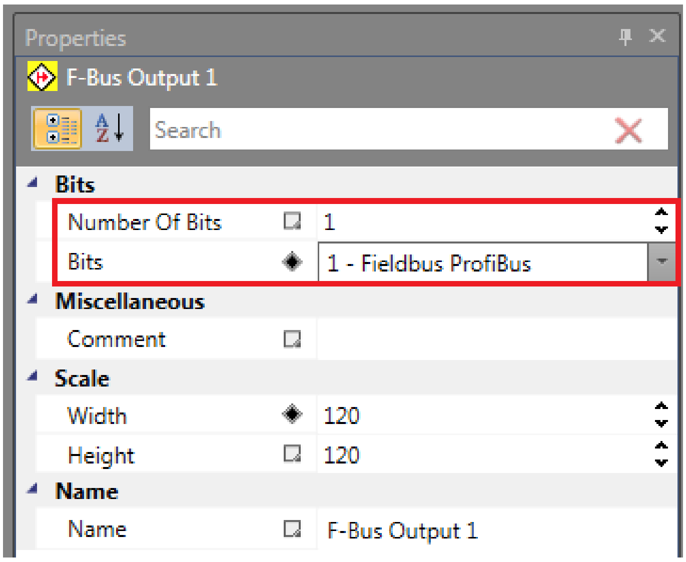
These values define the number of bits used by safe terminals: F-Bus Input and F-Bus Output.

Safe functions F-Bus Input, F-Bus Output – each block can be used only once. For each block the Number Of Bits can be configured in range 1 – 32 and also which bit or bits will be used.



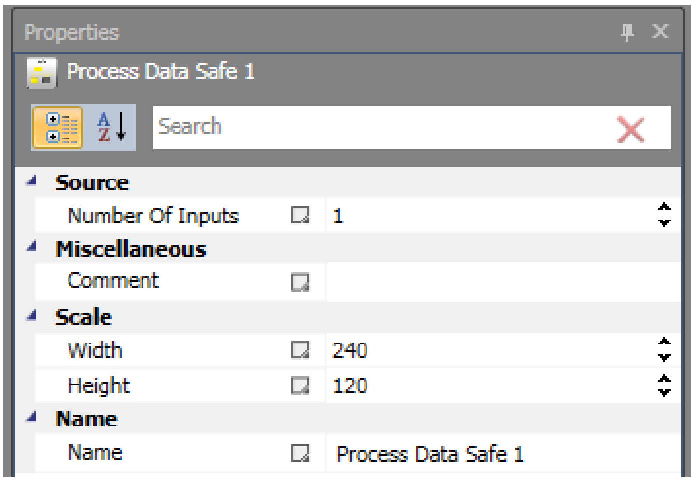

Properties
F-Bus Input 1
Search
Bits
Number Of Bits
2
Bits
1-2 - Fieldbus ProfiBus
Miscellaneous
Comment
Scale
Width
120
Height
120
Name
Name
F-Bus Input 1


F-Bus Output 1
1

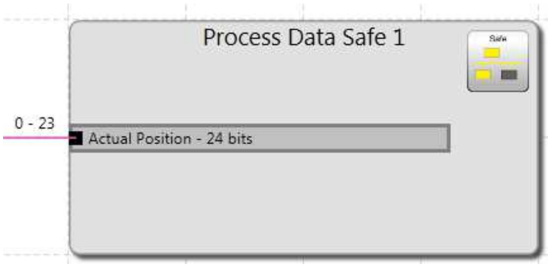

Properties
F-Bus Output 1
Search
Bits
Number Of Bits
1
Bits
1 - Fieldbus ProfiBus
Miscellaneous
Comment
Scale
Width
120
Height
120
Name
Name
F-Bus Output 1

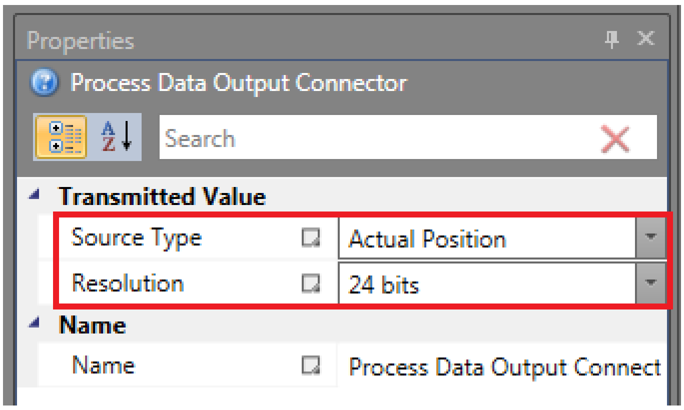
Process Data Output for PSC1-C-10:

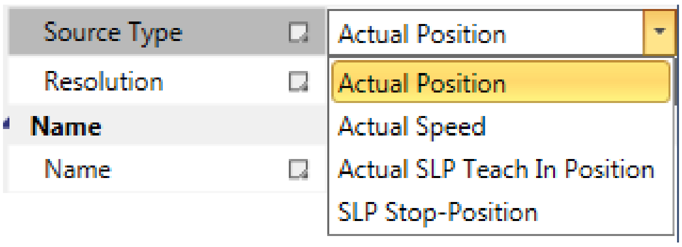
It is possible to set the Number of Inputs in range from 1 to 7.

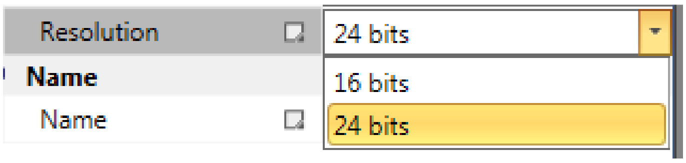


After selecting Input Connector, it is possible to set Source Type (Actual Position, Actual Speed, Actual SLP Teach In Position and Alarm and Operating Notification) and Resolution in Property Grid.





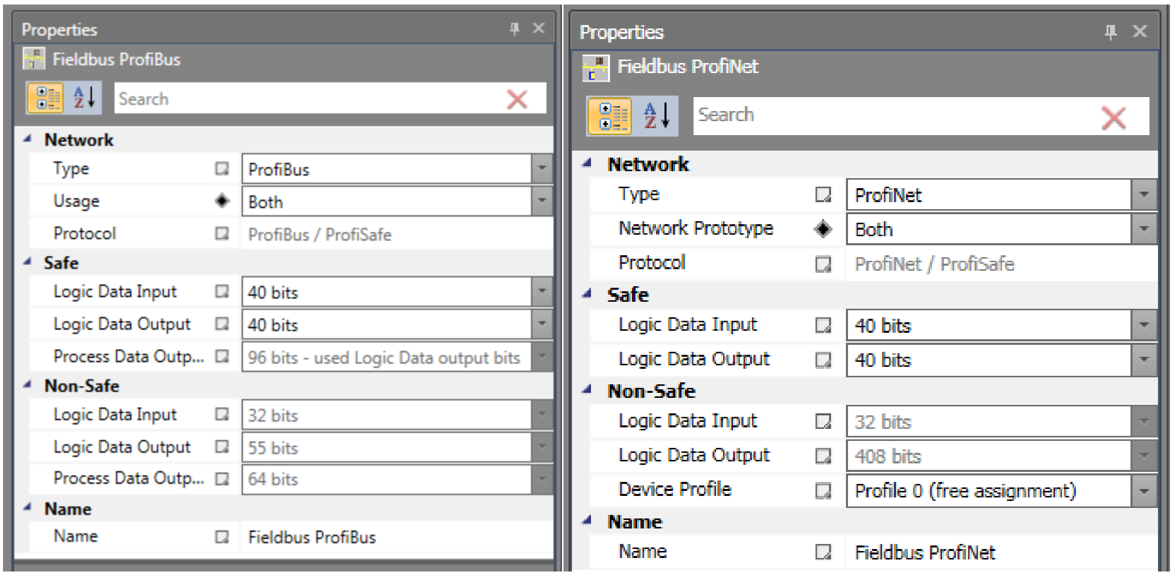




10.3.3.3 Both Usage

Non safe usage (settings are the same as it is described in chapter 0) and safe usage (the same settings as it is described in chapter 10.3.3.2).

Property Grid for PSC1-C-10 and PSC1-C-100 series:



10.3.4 Using Standard and Safety fieldbus network

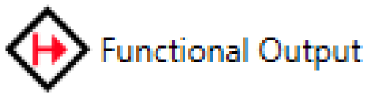
In the library of the Functional Scheme there is a Fieldbus Network folder. Therein are functions to handle Standard and Safety Fieldbus communication.

Shown functions depend on chosen devices and usage:

Functional Input

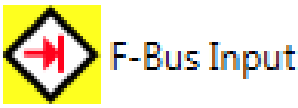
Described in chapter 10.3.3.1.1.

Functional Output



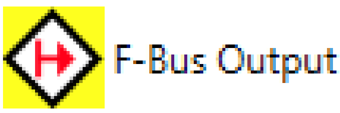
Described in chapter 10.3.3.1.2.

F-Bus Input



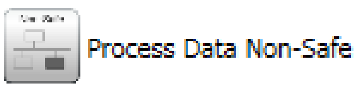
Described in chapter 10.3.3.2.

F-Bus Output



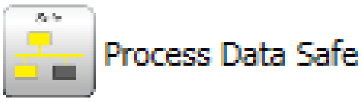
Described in chapter 10.3.3.2.

Process Data Non-Safe



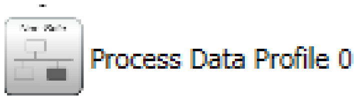
Described in chapter 10.3.3.1.3 and 10.3.3.1.4.

Process Data Safe



Described in chapter 10.3.3.2.

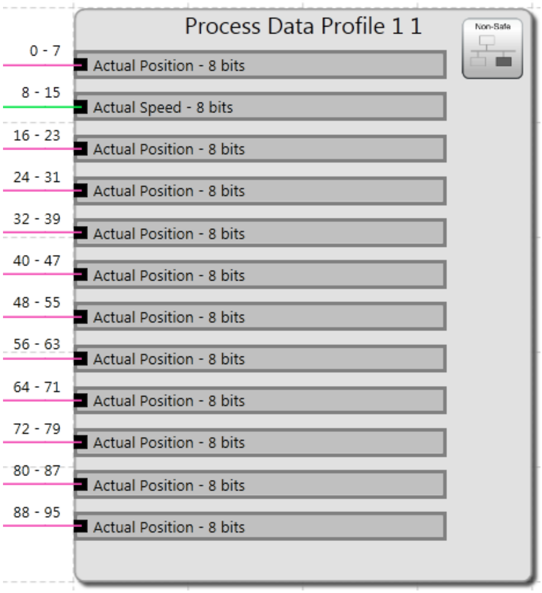
Process Data Profile 0



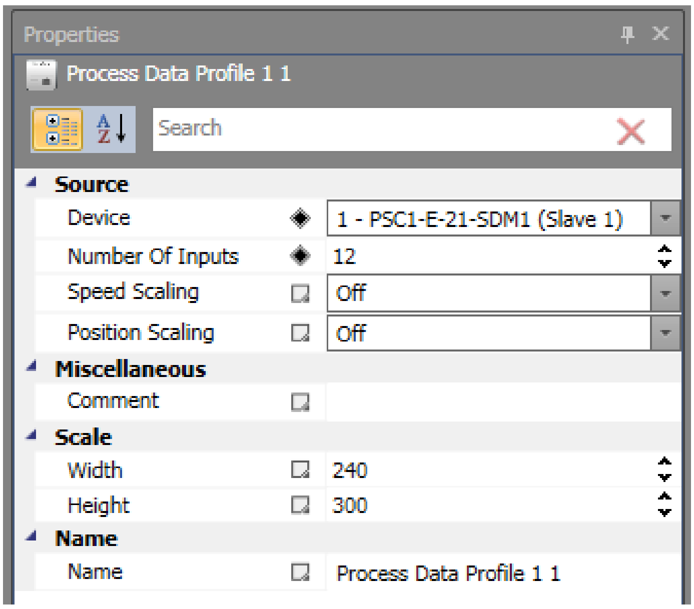
Described in chapter 10.3.3.1.4.

Process Data Profile 1

It offers 1 to 12 inputs. It is possible to set Source Type: Actual Position, Actual Speed, Analog Value, Analog Value Adder, Alarm and Operating Notification. For Actual Position and Actual Speed it is possible to set resolution.



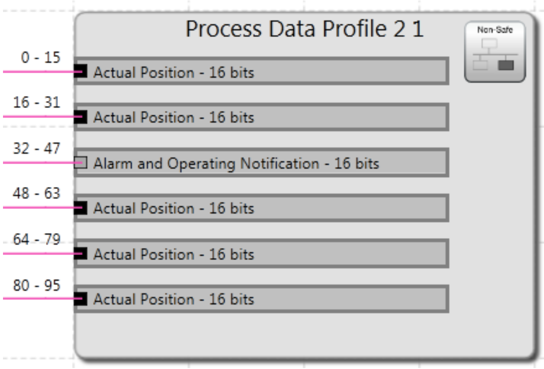
Property Grid for Process Data Profile 1:



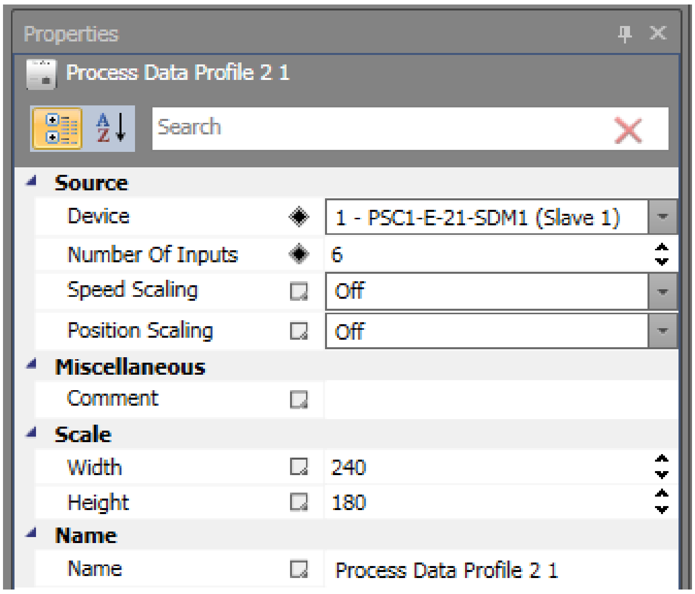
Process Data Profile 2


Process Data Profile 2

It offers from 1 to 6 inputs. It is possible to set Source Type: Actual Position, Actual Speed, Analog Value, Analog Value Adder, Alarm and Operating Notification. It is possible set resolution only for Actual Position.



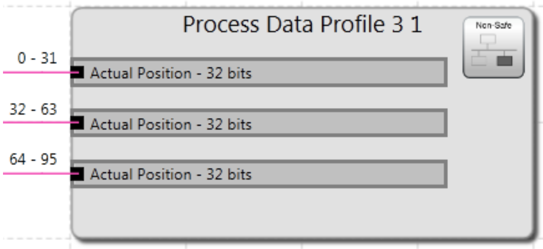
Property Grid for Process Data Profile 2:



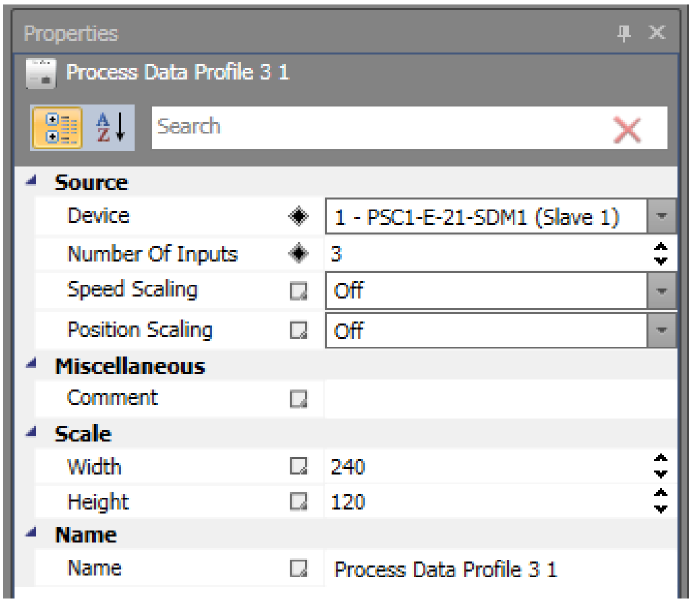
Process Data Profile 3


Process Data Profile 3

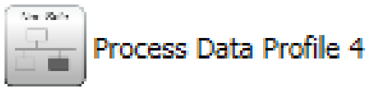
From one to three Actual Position (32 bit) inputs only. It is not possible to change resolution.



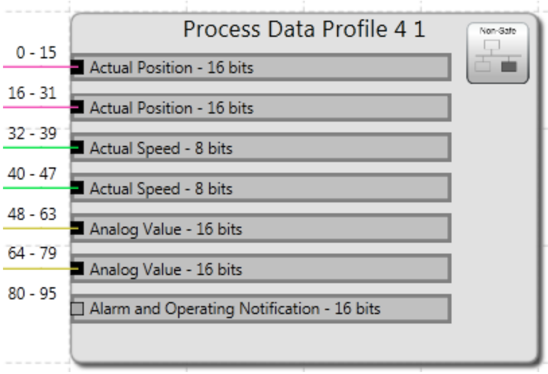
Property Grid for Process Data Profile 3:



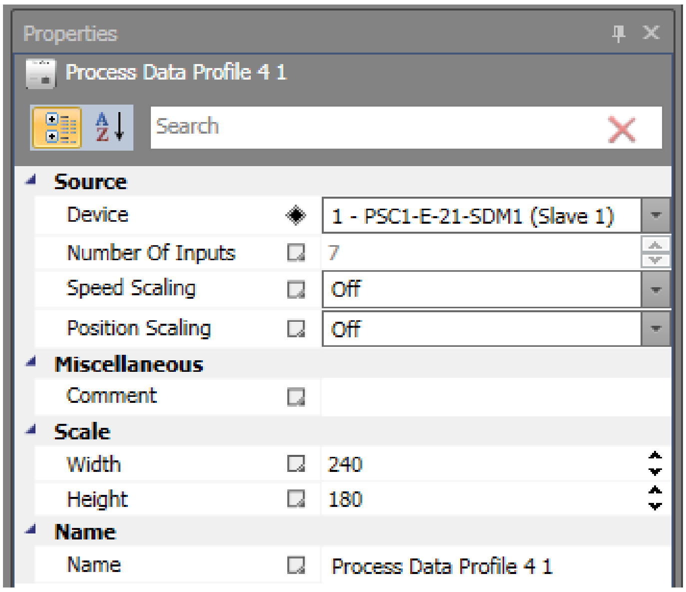
Process Data Profile 4



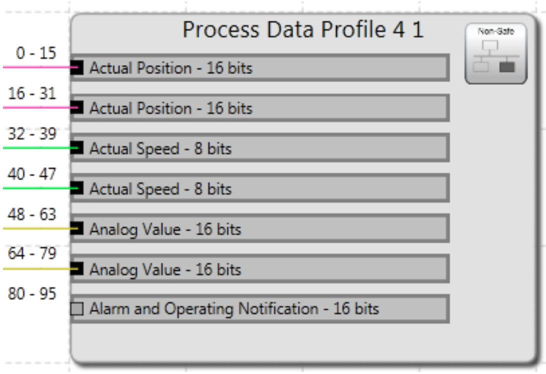
Fixed 7 inputs with predefined resolution.

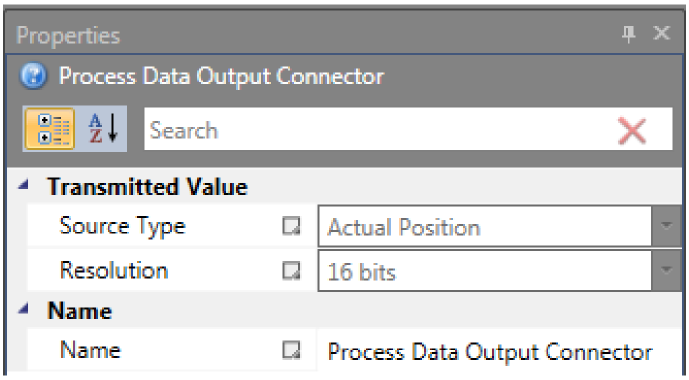


Property Grid for Process Data Profile 4:

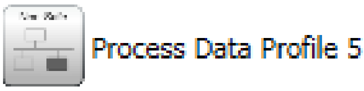


Source Type and Resolution is not possible to change.

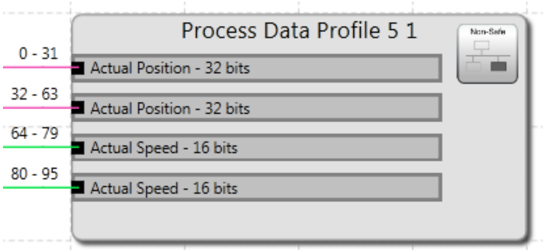

Process Data Profile 4 1
0 - 15
Actual Position - 16 bits
16 - 31
Actual Position - 16 bits
32 - 39
Actual Speed - 8 bits
40 - 47
Actual Speed - 8 bits
48 - 63
Analog Value - 16 bits
64 - 79
Analog Value - 16 bits
80 - 95
Alarm and Operating Notification - 16 bits


Properties
Process Data Output Connector
Search
Transmitted Value
Source Type
Actual Position
Resolution
16 bits
Name
Name
Process Data Output Connector

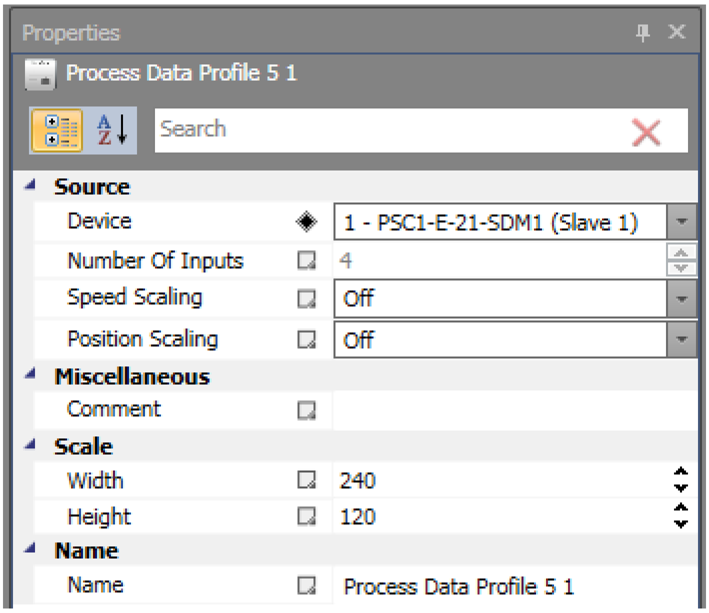
Process Data Profile 5



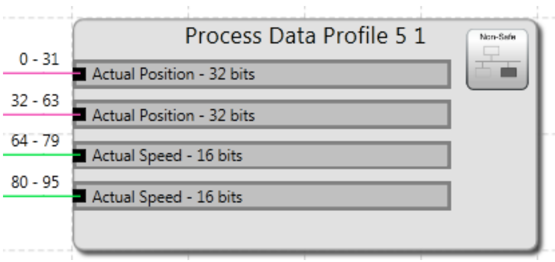
Fixed 4 inputs with predefined resolution.

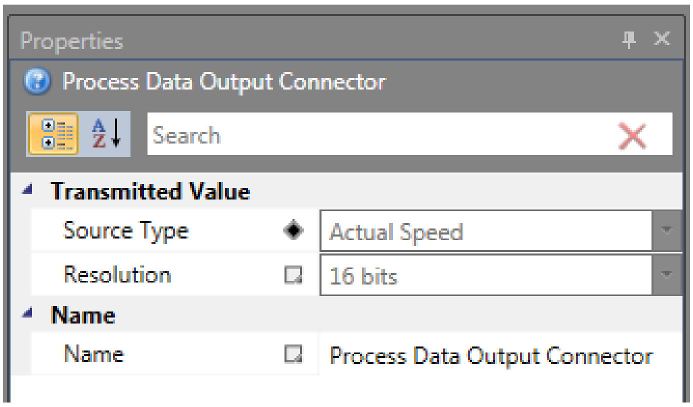


Property Grid for Process Data Profile 5:

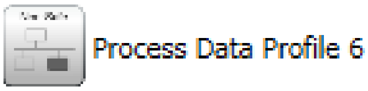


Source Type and Resolution is not possible to change.

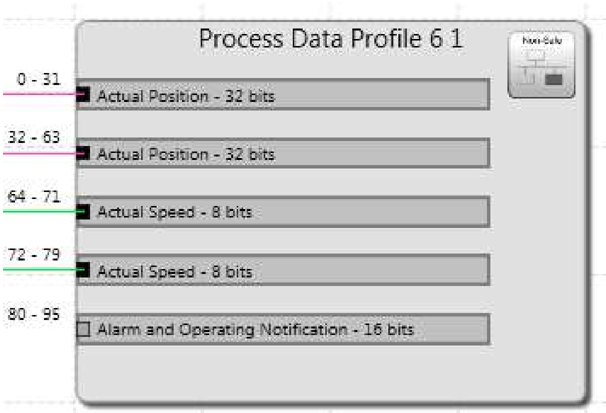



Properties
Process Data Output Connector
Search
Transmitted Value
Source Type
Actual Speed
Resolution
16 bits
Name
Name
Process Data Output Connector

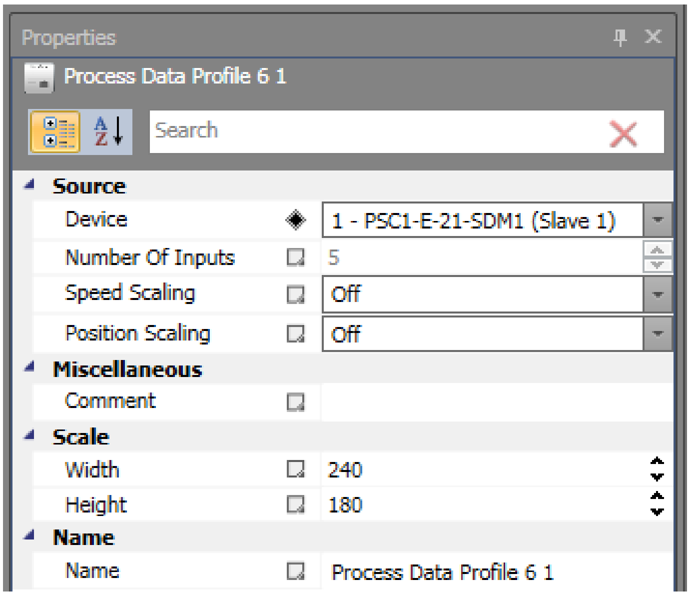
Process Data Profile 6



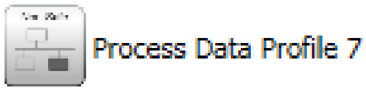
Fixed 5 inputs with predefined resolution. Source Type and Resolution is not possible to change.



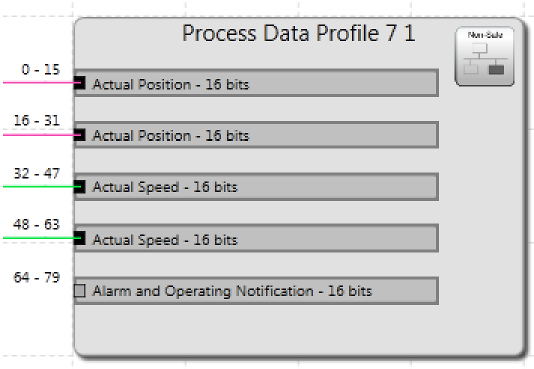
Property Grid for Process Data Profile 6:



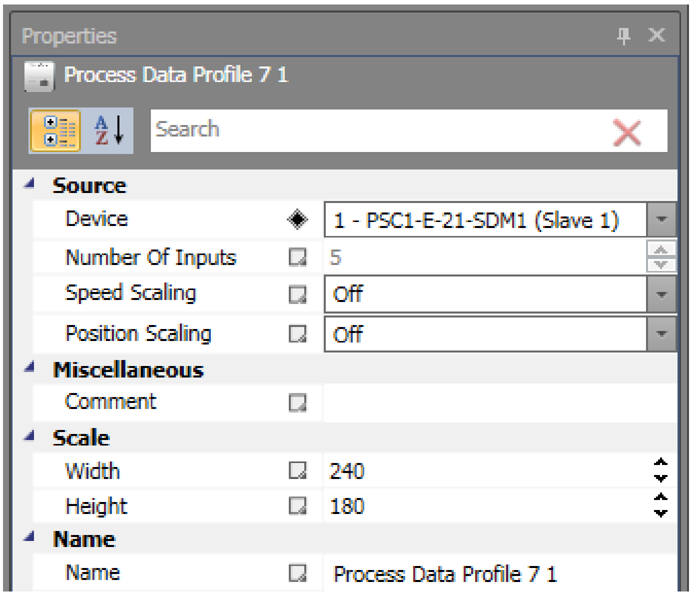
Process Data Profile 7



Fixed 5 inputs with predefined resolution. Source Type and Resolution is not possible to change.

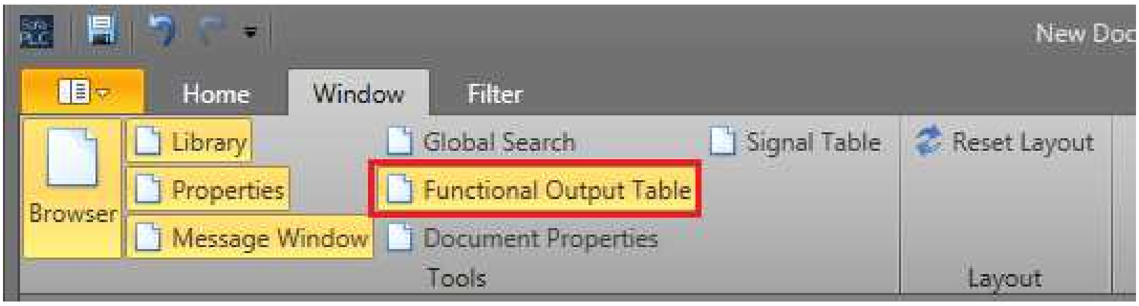


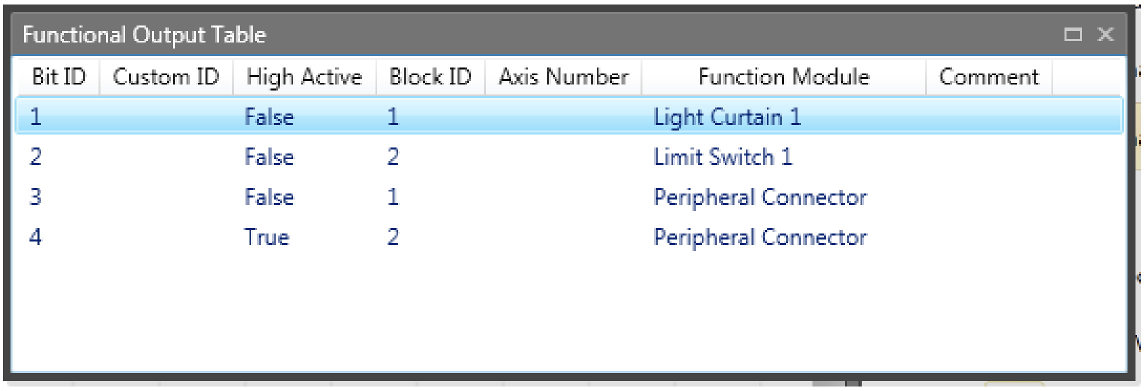
Property Grid for Process Data Profile 7:



Functional Output Table

In Tab Window there is a table which contain all connected Functional Output Connectors




Functional Output Table

Bit ID	Custom ID	High Active	Block ID	Axis Number	Function Module	Comment
1		False	1		Light Curtain 1	
2		False	2		Limit Switch 1	
3		False	1		Peripheral Connector	
4		True	2		Peripheral Connector	

10.4 Decentral

10.4.1 Creating

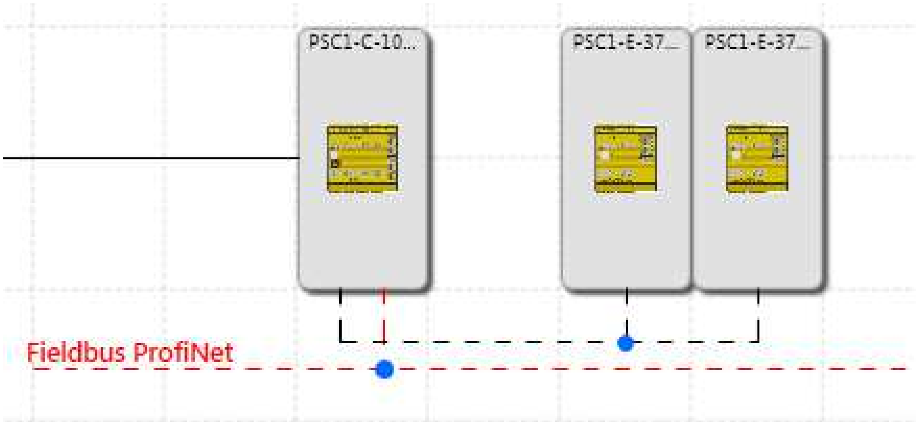
If the device supports decentral devices, then these so called “decentral slave devices” are shown in the library and if used they are also shown in the project Browser tree

Note:

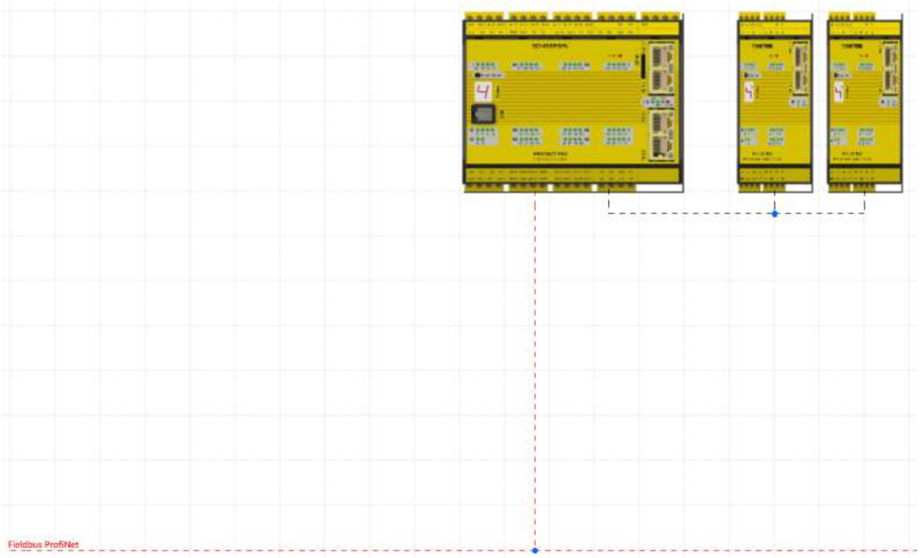
The device serial number must be filled in the respective Property Grid.

Appearance

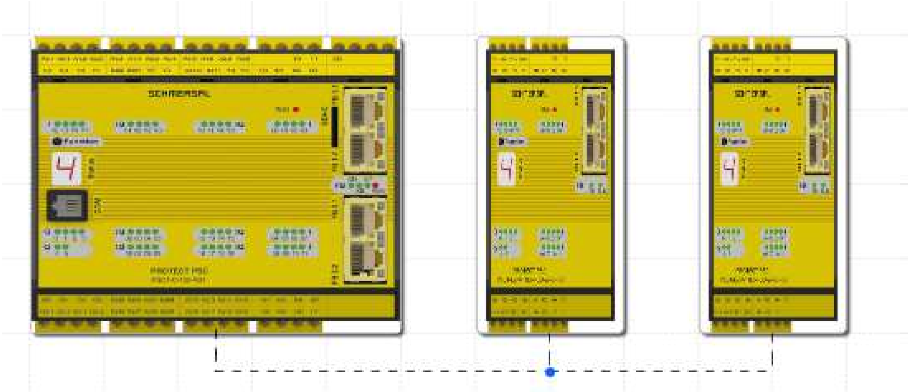
In Global Network scheme:



Local Network scheme:



Terminal Scheme:

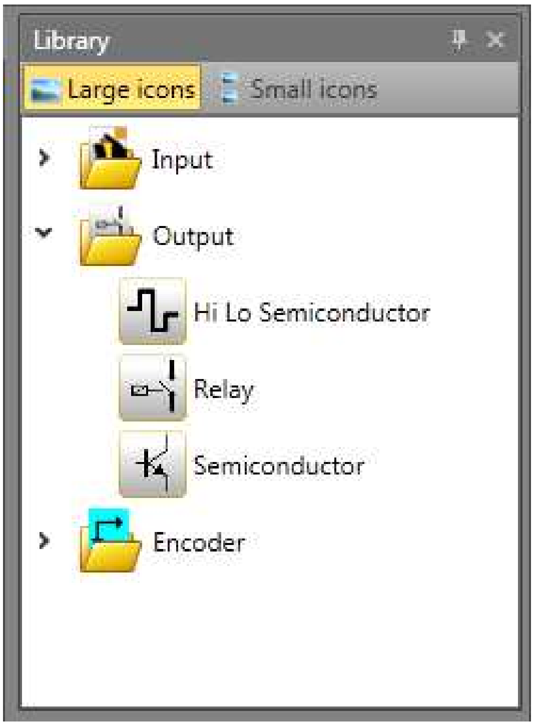


11 Library Content

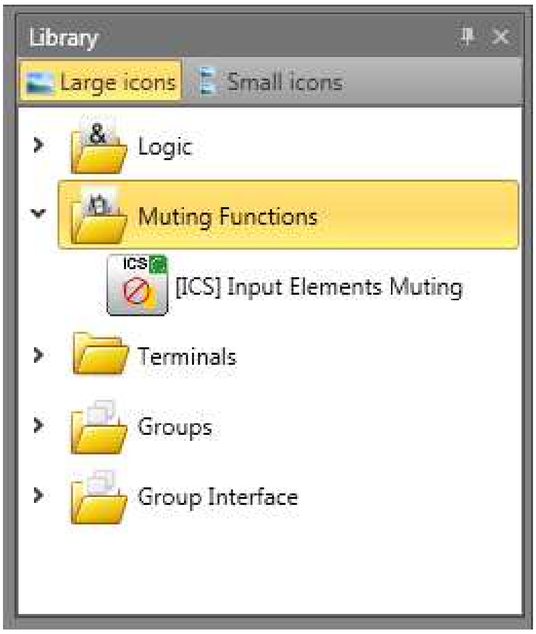
The Library window contains all available elements for creating the desired application.

It shows only the elements which can be used in the selected scheme.

The elements can be added to the respective scheme by drag & drop and can be edited in Properties window.



Library view – Terminal Scheme selected



Library view – Functional Scheme selected

The number of available elements might be limited, which is controlled by the PSC1 – resource-checker.

The automatic monitoring of resources of the block elements for the PSC1 module has the effect, that only the available elements are enabled in the program. This, above all, concerns the time-monitored peripheral devices.

Some of them are dependent on other blocks, so they are available only when these blocks are already present in the scheme.

If there are no resources (memory) available for the monitoring program in the PSC1 module, the components or function blocks are no longer listed in the Library view, e.g. when all digital ports of an PSC1 module or all timer modules have been used.

These resources can be released again by deleting the corresponding function blocks.

11.1 Device modules

11.1.1 Master devices

Master device is the base module for programming.

Dependent on the master device different slave (extension) modules can be used:

- for the PSC1-C-10 series only IO-extensions can be configured,
- for the PSC1-C-100 series IO- or Axis extensions up to maximum number of slave devices allowed by the master device can be used.

One SafePLC2 document can contain programs for more master devices of different kinds. The master devices which have this ability can communicate to each other using SMMC network.

11.1.2 Slave devices

A slave device is an expansion module that provides more I/O connectors or allows monitoring of additional axes.

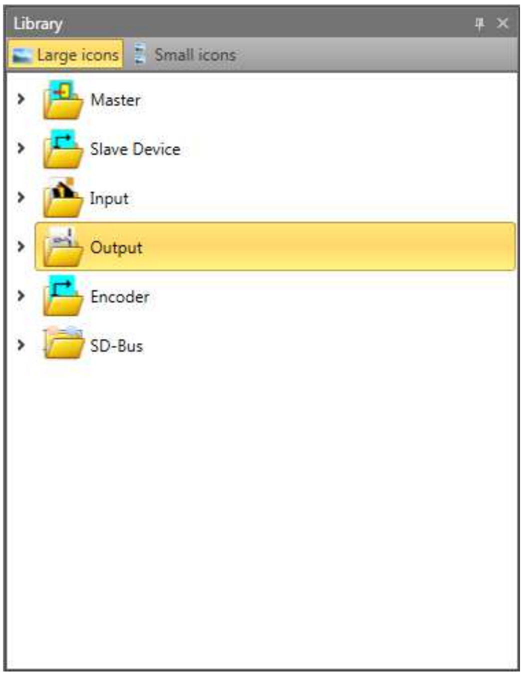
There are two kinds of slave devices:

- IO-extensions extend the number of inputs and outputs.
- Axis extension modules can be used to control additional axes. The axes extension modules provide also additional inputs and outputs.

If the IO or Axis extensions are connected with their master via SMMC network, they are listed in the Document Browser in Decentral IO or Decentral axis folder.

11.1.3 SD-Bus Group

SD-Bus Groups connect several SD-Bus elements for transferring diagnostic information to a master device. If device supports SD-Bus, it is possible to insert SD-Bus Groups from the library. User can add multiple SD-Bus Groups. Each group must contain at least one SD-Bus element. The number of SD-Bus Groups is limited by the maximum of 31 used SD-Bus elements. Every SD-Bus Group will act like an input element in Functional Scheme and the output connector can be connected to safety logics inside Functional Scheme. For more information see chapter 10.2 SD-Bus .

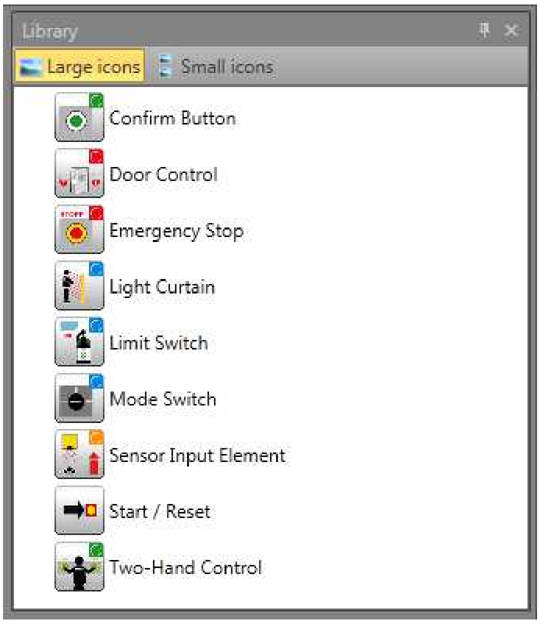


11.2 Peripherals

Input and output signals can be added to connection or wiring diagrams. These will automatically be connected to the appropriate available ports on PSC1 devices.

When added, a corresponding functional block is created, which can be used in the Functional Scheme in conjunction with other Functional blocks to configure desired behavior of the system.

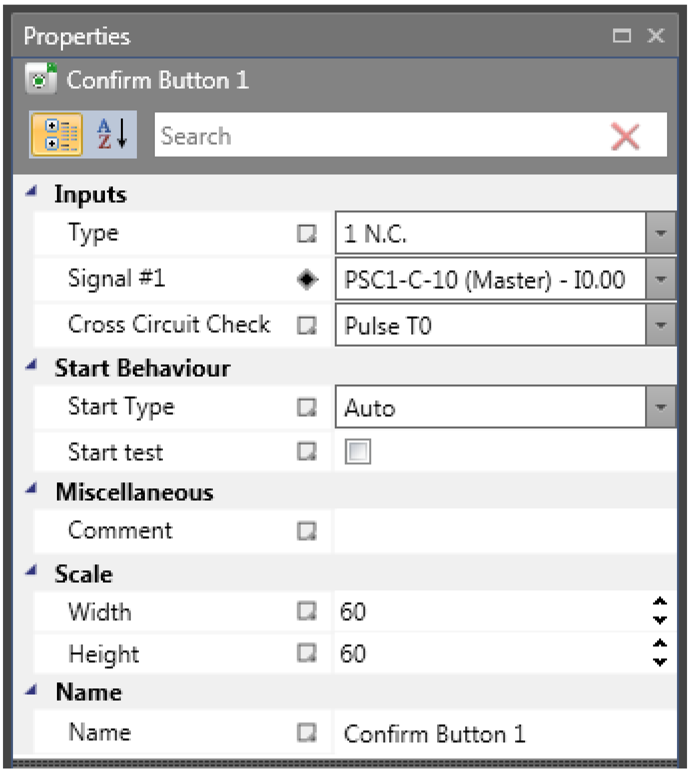
11.2.1 Input blocks



List of Input blocks

The input elements create the digital connection between one or several connected sensors and/or further lower level switching devices in the PSC1 System. They deliver the data about operating status of the peripherals monitored by the PSC1 module. These components, which, from the point of view of the PSC1 module, are outside the device, can only be inserted and configured in the Terminal or Wiring Scheme. Each Input element, except the Mode Switch, provides <u>one</u> logic output signal "0" or "1" for further processing in the PLC1. The elements are structured according to use and input signal type, enabling targeted resource monitoring of the PSC1 module. The input elements are structured according to their application.

The following paragraphs list details to this type (by way of the Confirm button as an example).



Confirm button properties view.

Notes:

- The configuration of the Input block has a significant effect to the performance level. See installation manual.
- Not used inputs are always assigned to pulse T0 (default configuration)
- Not used inputs are listed into the configuration report anyway with the "default configuration".

The configuration of the digital inputs is always based on the same process:

Switch type

The number of associated input signals and the monitoring behavior of the PSC1 module changes in dependence on the selection.

With time monitored switch elements another signal change must take place within t=3s after the first signal, otherwise a malfunction is recognized.

Signal-No.

Assignment number of the external signal at the digital input of the PSC1 module. This selection list shows the still unused input signal designators (e.g. “I0.01”) of the PSC1 module. These could be assigned by the user. A double assignment of input signals is not permitted. If the resources of the PSC1 module are almost used up and the selection of the switch type would use up too many input signals, the selection list will remain empty. Here a switch type with less connections must be used.

Cross-circuit check

Source of the input signal used. Two signal pulses, Pulse T0 and T1, are available. The "OFF" option can be alternatively selected.

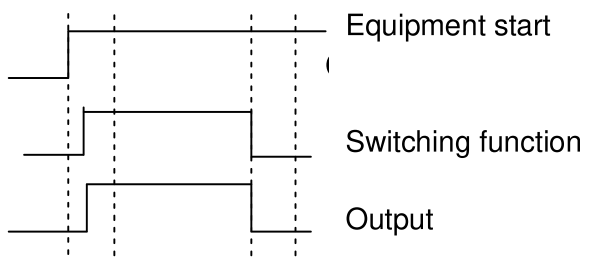
In order to ensure reliable monitoring for short-circuit or line breakage, inputs next to each other on the PSC1 module, should have different pulse numbers assigned.

Start behavior:

With this setting you specify the way the peripheral devices should behave when switching on or resetting the system.

Automatic

This preset start type allows the PSC1 module to be enabled without the need for user acknowledgement.

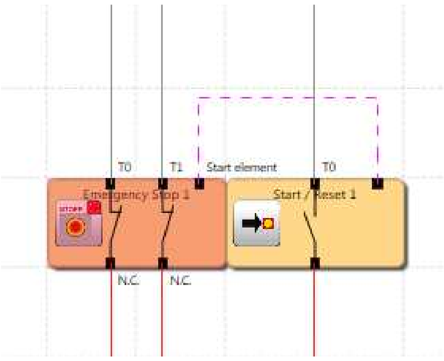
Start type	Function	Scheme
Automatic start	Automatic start after equipment reset. Output of the input element becomes “1” when the safety circuit is closed/active acc. to the definition of the switch type	

Monitored

Release of the monitored input element in case of trailing edge of the specified monitoring input. This is required at any time when the monitored input element is to be switched.

Example:

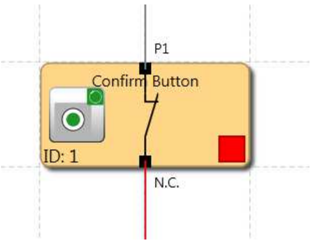
Start of a drive only after confirmation of the operating personnel.
With monitored starting mode an additional connector for linking with the Start element is provided (referred to chapter 11.2.1.10); look to the following Wiring Scheme.



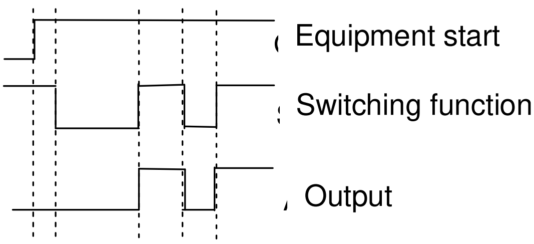
Start-up test

Manual start after resetting a system or after an alarm condition. The monitored switchgear must be triggered once in the monitoring direction and then switched on again. Normal operation then follows. This one-time triggering of the input element when starting (or resetting) the monitored component ensures the function of the input element at the time of starting. With the exception of the operating mode selector switch, a startup test can be performed for all input elements.

An activated Start-up test is indicated by a red rectangle on an added function block.



Altogether two switch elements can be configured with start-up test.

Start type	Function	Scheme
Start-up test	**Manual staring after a new start or an alarm reset, including testing of the connected monitoring equipment. The monitored equipment must be triggered once in monitoring direction and then switched back on again, followed by normal operation.**	

<u>Comment:</u>

A text to be displayed in hovering hint. You can enter your own comment.

11.2.1.1 Confirm Button

Switch type	Designation	Comment
1 (1 N.C.)	1 normally closed	Enable switch standard
2 (1 N.O.)	1 normally open	Enable switch standard
3 (2 N.C.)	2 normally closed	Enable switch higher requirements
4 (2 N.C. Time Monitored)	2 normally closed time monitored	Enable switch time monitored

11.2.1.2 Emergency Stop

Switch type	Designation	Comment
1 (1 N.C.)	1 normally closed	Emergency stop standard
2 (2 N.C.)	2 normally closed	Emergency stop higher requirements
3 (2 N.C. Time Monitored)	2 normally closed time monitored	Emergency stop time monitored

11.2.1.3 OSSD

Switch type	Designation	Comment
1 (2 N.C.)	2 normally closed	Input element with OSSD outputs for higher requirements. **Note:** The cross-short monitoring in the PSC1 is deactivated

11.2.1.4 Door Control

Switch type	Designation	Comment
1 (2 N.C.)	2 normally closed	Door monitoring higher requirements
2 (2 N.C. Time Monitored)	2 normally closed time monitored	Door monitoring time monitored
3 (1 N.O. 1 N.C.)	1 normally open + 1 normally closed	Door monitoring higher requirements
4 (1 N.O. 1 N.C. Time Monitored)	1 normally open + 1 normally closed time monitored	Door monitoring time monitored
5 (2 N.O. 2 N.C.)	2 normally open + 2 normally closed	Door monitoring higher requirements
6 (2 N.O. 2 N.C. Time Monitored)	2 normally open + 2 normally closed time monitored	Door monitoring time monitored
7 (3 N.C.)	3 normally closed	Door monitoring higher requirements
8 (3 N.C. Time Monitored)	3 normally closed time monitored	Door monitoring time monitored

11.2.1.5 Two-Hand Control

Switch type	Designation	Comment
1 (2 Toggle Switches)	2x (normally open +normally closed)	Two-hand button higher requirements type III C
2 (2 N.O.)	2x normally open	Two-hand button monitored type IIIA

Note:

With these input elements a fixed pulse assignment takes place, which cannot be influenced by the user!

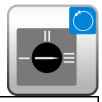
11.2.1.6 Limit Switch

Switch type	Designation	Comment
1 (1 N.C.)	1 normally closed	Limit switch standard
2 (1 N.O)	1 normally open	Limit switch standard
3 (2 N.C.)	2 normally closed	Limit switch higher requirements
4 (2 N.C. Time Monitored)	2 normally closed time monitored	Limit switch time monitored

11.2.1.7 Light Curtain

Switch type	Designation	Comment
1 (2 N.C.)	2 normally closed	Light curtain higher requirements
2 (2 N.C. Time Monitored)	2 normally closed time monitored	Light curtain time monitored
3 (1 N.O. 1 N.C.)	1 normally open + 1 normally closed	Light curtain higher requirements
4 (1 N.O. 1 N.C. Time Monitored)	1 normally open + 1 normally closed time monitored	Light curtain time monitored

11.2.1.8 Mode Switch

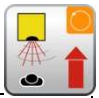


Switch type	Designation	Comment
1 (N.C. N.O.)	Selector switch normally closed/normally open	Mode selector switch monitored
2 (3 Phase)	Selector switch 3 steps	Mode selector switch monitored
3 (4 Phase)	Selector switch 4 steps	Mode selector switch monitored

Note:

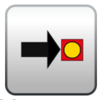
When changing the status of the switch, the SafePLC2 program to be created must ensure that the outputs of the module are deactivated (note: Standard IEC 60204-1).

11.2.1.9 Sensor

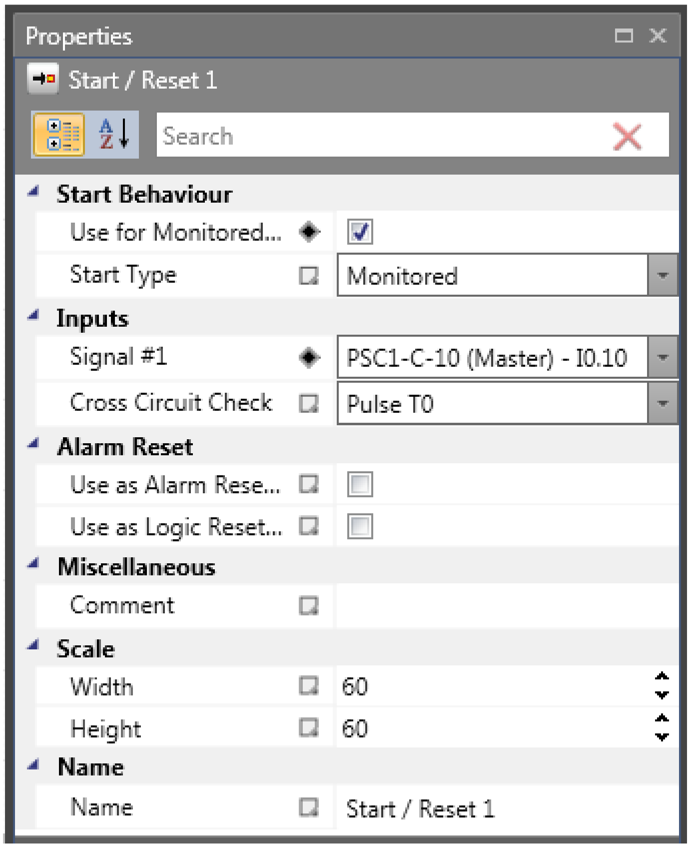


Switch type	Designation	Comment
1 (1 N.C.)	1 normally closed	Sensor Input standard
2 (1 N.O.)	1 normally open	Sensor Input standard
3 (2 N.C.)	2 normally closed	Sensor Input higher requirements
4 (2 N.C. Time Monitored)	2 normally closed time monitored	Sensor Input time monitored
5 (1 N.O. 1 N.C. Time Monitored)	1 normally open + 1 normally closed time monitored	Sensor Input time monitored

11.2.1.10 Start / Reset Element



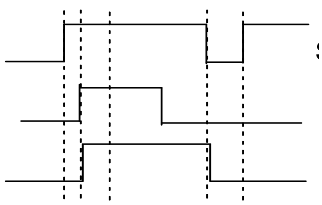
This input element offers both extended monitoring functionality, as well as the possibility to reset an occurring alarm.

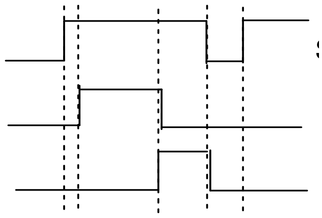


Start / Reset properties view

Use for Monitored Start Up

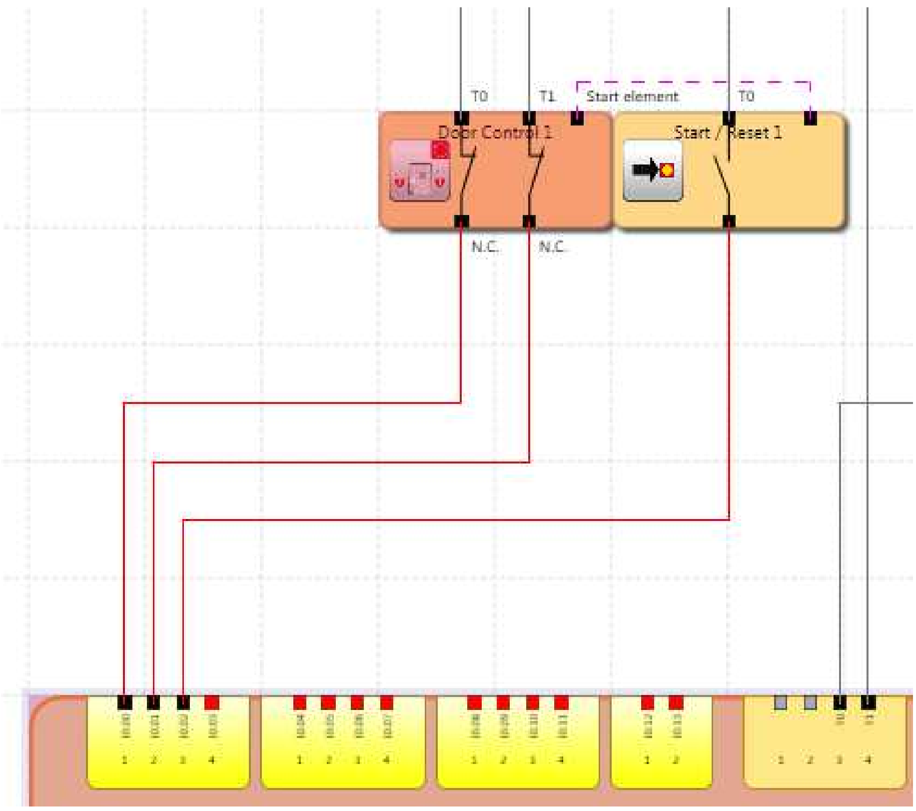
With start monitoring activated, special IL code segment for monitoring an assigned Input segment during a restart or an alarm reset of the equipment/machine to be monitored is automatically generated.

Start type	Function	Scheme
Manual start (by hand)	Manual start after equipment reset. Output of the Input element becomes 1 when the safety circuit is closed/active acc. to the definition of the switch type and the start button has been pressed 1x. Output becomes 0 after safety circuit is open.	 Switching function Start button Output

Start monitored	Manual start after equipment reset with monitoring of start circuit for static 1-signal. Output of the Input element becomes 1 when the safety circuit is closed/active acc. to the definition of the switch type and the start button has been pressed 1x and released again. Output becomes 0 after safety circuit is open.	 Switching Function Start button Output

List of starting types by means of a enable button

The monitoring input of the start element must be connected to the output of the input elements labelled "Start element". Several elements can be monitored.



Start/Reset block connected with Monitored start type

Note:

When editing the associated input element, the connection with the start element is deleted and cannot be restored automatically. It must subsequently be supplemented manually.

Input: Signal No. 1

As with the input elements, this selection list is used to determine the input on the PSC1 module to which the button for the start element is to be connected. This input is internally limited to the assignment to a basic module (I0.00 to I0.13).

Use as Alarm Reset (normally open)

If this option is set, the associated button can be used to reset (acknowledge) a fault that may occur during operation. The user is thus not forced to reset an occurring fault with the “Func” button on the PSC1 module. No special program code is generated, but this input is directly processed by the PSC1 module in case of an alarm. Only one Alarm reset can be used.

Note:

f a reset element is used, no cross-circuit monitoring can be processed for this input. The cross-circuit check, in this case, is set to “OFF”

The following table shows an overview of all monitoring functions and their acknowledgement in triggered state:

Safety modules	Reset necessary
SEL	yes
SLP	yes
SCA	no
SSX	yes
SLI	yes
SDI	yes
SLS	yes
SOS	yes
ECS	yes

Resettable safety modules

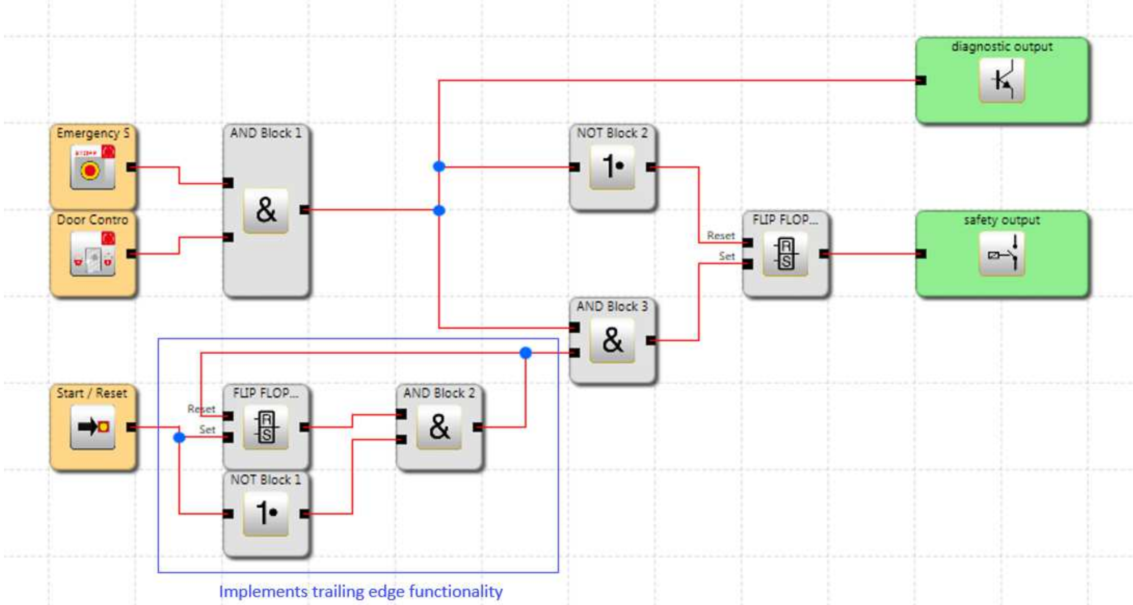
Note:

- The same functionality is achieved when using the "Function" button of the basic PSC1 module.
- Error messages of type "FatalError" require a restart of the basic PSC1 module.
- The alarm reset input can be operated with 24V continuous voltage and is raising edge triggered.

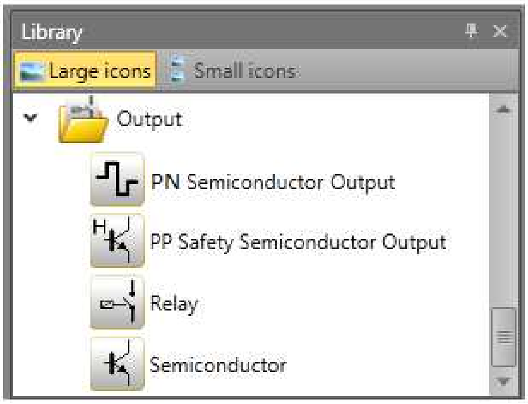
Use as Logic Reset (normally open)

This option makes the reset-acknowledgement functionality in the logic diagram available for further processing. In this case, the output of the function block is automatically generated, and can be used for linkage with a logic functionality.

For example, for building up custom reset logic functionality for safety release:



11.2.2 Output blocks



The Output blocks create the digital connection between one or several connected external switching circuits in the PSC1 System. Each block is triggered by a logic input signal "0" or "1" via the Functional Scheme.

EMU Monitoring

The multiplication of contacts and power normally requires additional switching devices, which are triggered through the shut-down circuits of the PSC1-system. EMU monitoring implements the "Safety relay" function by processing an external feedback circuit.

Applications with higher safety requirements (category 4 of DIN EN ISO 13849 among others) require functional monitoring for these types of switching devices. For this purpose the switching devices must be equipped with positively driven auxiliary contacts.

Auxiliary contacts to be monitored are switched in series and are closed when in idle state. It is verified whether all contacts are closed in idle state and open in active state. Time related expectations can be parameterized. The same sources as for the inputs are also used to supply the contacts to be monitored. The contacts to monitor must be supplied through the assigned test pulses.

Note:

Details to this subject can be found in the circuitry examples of the installation manual.

Loop Back Circuit

Switch to activate EMU monitoring:

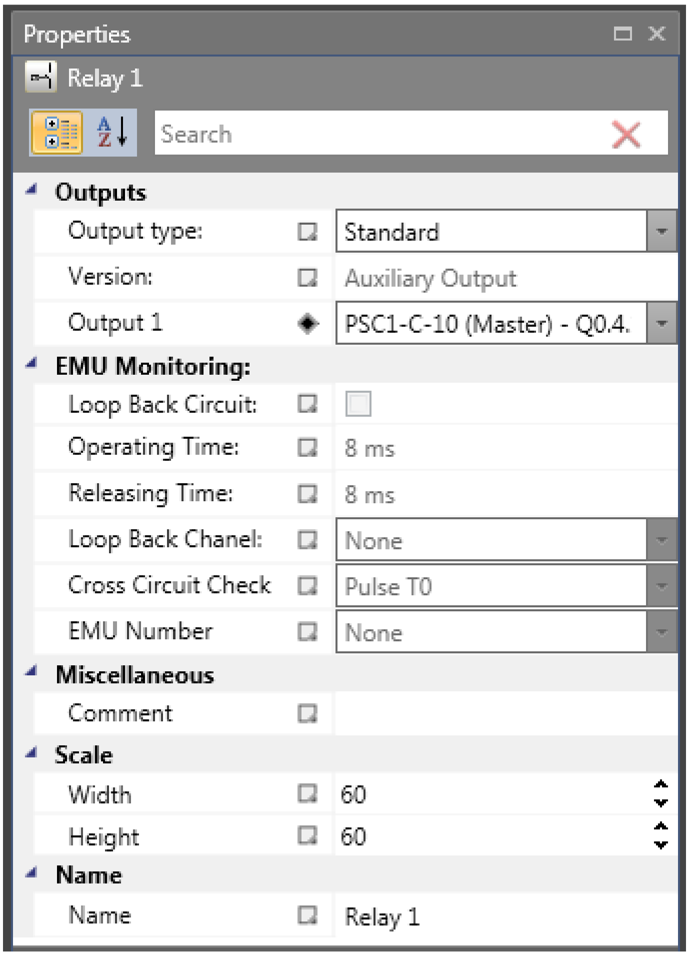
- Operating Time
    - Variable time slot (closing delay) for testing the safety contacts
        - $Min\{T_{EMU}\}$ = 8 msec
        - $Max\{T_{EMU}\}$ = 3000 msec
- Releasing Time
    - Variable time slot (release delay) for testing the safety contacts
        - $Min\{T_{EMU}\}$ = 8 msec
        - $Max\{T_{EMU}\}$ = 3000 msec
- Loop Back Channel
    - Digital input of the feedback circuit. The outputs for activation of the external switching function and the feedback circuit must be located on the same PSC1-system module (basic module or expansion module).

Note:

The result of EMU function of the master device is routed in the PLC code to the configured output. EMU function in a slave device generates an alarm event on the master device in case of an error.

Number of Blocks	PSC1-C-10	PSC1-C-100
EMU – Emergency Monitoring Unit	2	16

11.2.2.1 Relay



Output type

- **Standard:** 2 single relays (Q4 to Q5) can be selected independently from each other.
- **Redundant:** Two relay outputs are combined and always switched together.

Version

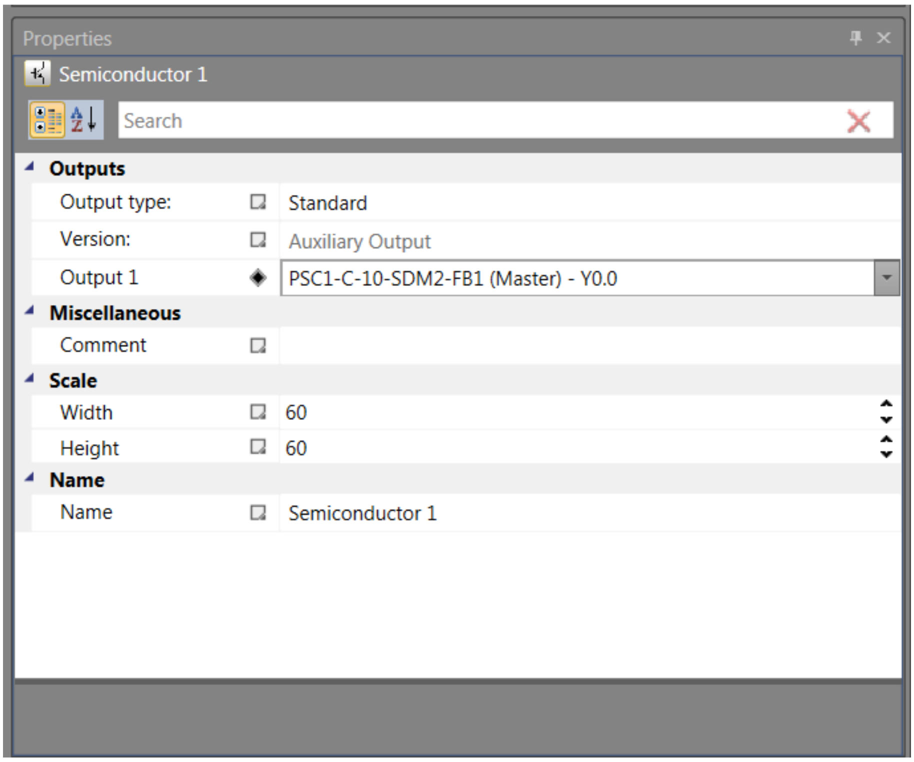
- Output as Auxiliary- or Safe Output

Relay outputs can be used individually as Auxiliary Outputs and grouped as Safe Outputs (refer to the installation manual for details).

Note:

Follow the explanations in the installation manual when using relay in safety applications.

11.2.2.2 Semiconductor



Output type

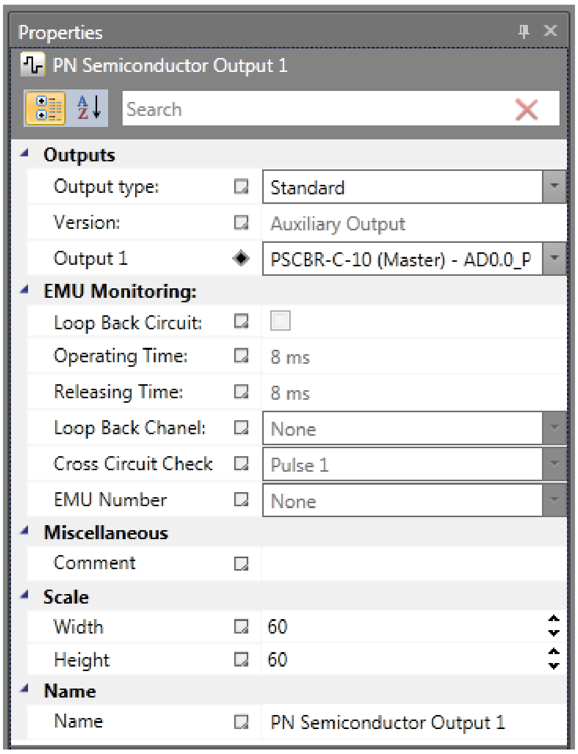
- **Standard:** non-adjustable

Version

- Output only as Auxiliary Output

Certain semi-conductor outputs can solely be used as Auxiliary Outputs and are thus not suitable for safety applications (refer to the installation manual for details).

11.2.2.3 PN semiconductor output



Output type

- **Standard:** "HISIDE" (= P-switching) or "LOSIDE" (= N-switching) can be selected as standard output (depending on used output). The use of single standard outputs is not suitable for safety reasons.
- **Redundant:** This option compellingly specifies a combination of "HISIDE" (= P-switching) and "LOSIDE" (= N-switching) outputs.

Version

- Output as Auxiliary- or Safe Output

PN semiconductor outputs can be used individually as Standard Outputs and grouped as Safe Outputs (refer to the installation manual for details).

Fast Channel (applies only for PSC1-C-100)

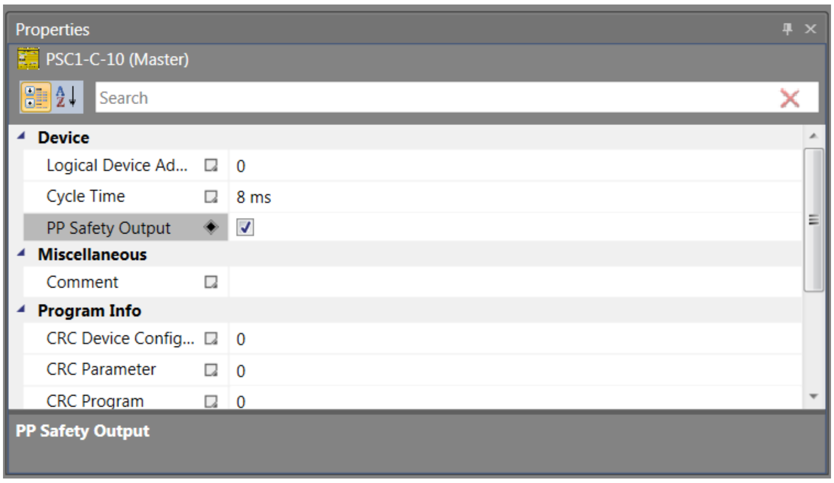
Only “Redundant” output type can be configured to a Fast Channel.
A master device output can use “External” or/and “Internal” Fast Channel of an axis slave device.
The safety functions SLS and SOS can trigger a Fast Channel event.

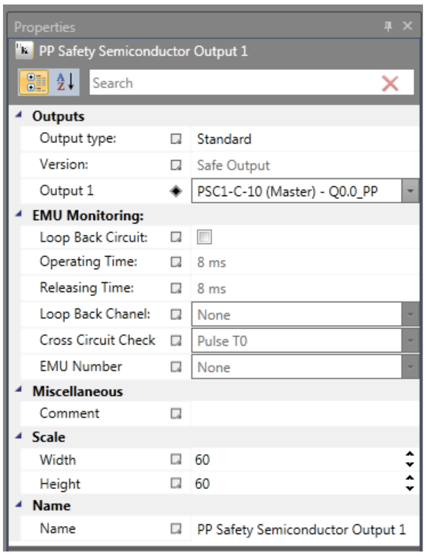
Note:

Only one Fast Channel event can be created, i.e. all outputs configured with Fast Channel will be switched off. For reaction time see installation manual.

11.2.2.4 PP safety semiconductor output

To activate PP safety semiconductor, you have to enable PP safety semiconductor in the Property Grid of the base module:





Output type

- **Standard:** internally two p-switching semiconductors in series;

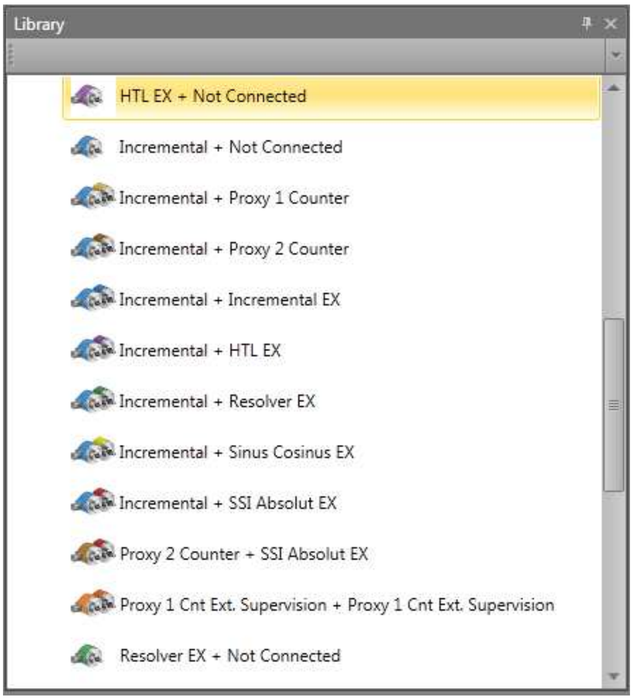
Version

- Output as Safe Output

PP semiconductor outputs can only be used as Safe Outputs (refer to the installation manual for details).

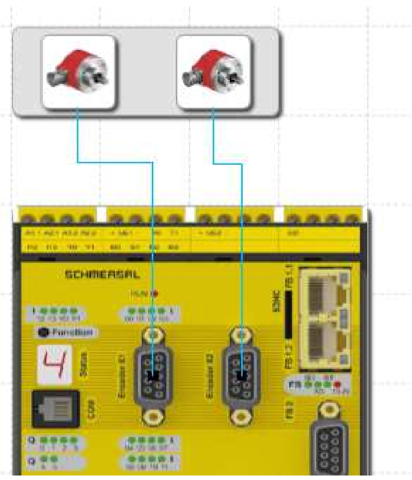
11.2.3 Encoder combinations

Encoder combinations are listed in Library window and selection is available in library by drag&drop to Terminal Scheme. It shows only combinations which can be used with selected PSC1 devices. Each encoder combination has two encoder types.



Note:

The parameterization of encoders must always be related to one common axis. If the two encoders are connected to different mechanical positions, and these positions are linked e.g. by an intermediate gear, the measuring section must be fixed to one of the two encoder positions and for the other encoder the transmission ratio in between must be taken into account.



Encoder combination view in Terminal Scheme

11.2.3.1 Encoder type

Adding encoder by drag&drop

Selection of function type of encoder

- Incremental
  - Position and speed are detected via pulses / distance.
- SIN / COS
  - Position and speed are detected via Sine and Cosine / distance.
- SSI / Absolute encoder
  - The position is detected absolute and remanent. By activating the position processing in the Axis area, the Input field "Offset" can be additionally enabled.
- Proxy 1 Counter
  - Position and speed are recorded by one pulse counter.
- Proxy 2 Counter
  - Position and speed are recorded by two pulse counters**.**
- Analog (on request)
  - Absolute encoder enables scaling of the applied analogue sensor signals.
- Not connected
  - No second encoder
- None
  - No encoder connected

<u>Note:</u>

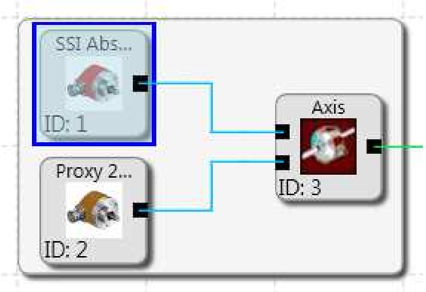
For position monitoring at least one of the two encoders must be designed as absolute encoder. If none of the two sensors is of the "Absolute" type, the position Input fields in all other Input masks of the monitoring function are inactive.

If an absolute encoder has been selected, the system will show the data format area in Property Grid for further selection.

With the "Incremental" type an impulse multiplication takes place inside the device.
The physical resolution must be entered as pulses per revolution (PPR).

11.2.3.2 Encoder parameterization

Parameterization of both encoders for position and speed detection can be defined in properties window by clicking on appropriate encoder icon in Functional Scheme or Browser.



Encoder combination – Functional Scheme

The configuration only affects the software evaluation of the encoder.. For correct functioning an extended hardware parameterization of the encoder interface is required. Details to this subject can be found in the PSC1 module “Installation Manual”.

Encoder area properties:

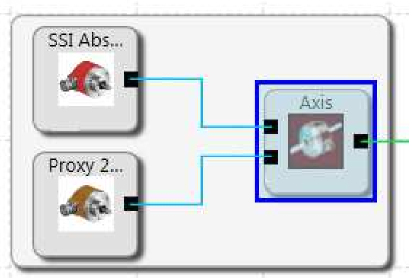
Parameters depends on encoder type.

Parameter	Description	Value
Direction	Selection of sensor counting direction	Up / Down
Supply Voltage	Encoder power supply	5V, 8V, 10V, 12V, 20V, 24V
Resolution	Encoder resolution referring to the measuring axis in the pre-defined context (linear or rotational)	1 – 2 000 000 inkr/1000 or inkr/U
Offset	Offset value for position encoder. Usable if “Position Processing” is activated	-268435455 – 268435455 Inkr
Encoder type (SinCos EX)	Activation high resolution mode for slow counting SinCos Encoder.	Simple -> no high resolution HighRes -> high resolution

SSI-Interface (Absolut encoder)		
Interface Type	SSI	SSI-Masterclock, SSI-Listener
Data Format	Format of position data	Binary, Graycode
Frame Length	Length of whole SSI frame	10 – 31 Bits
Data Length	Length SSI-Data starting with MSB. In this data field no other (e.g. status) bits are allowed (only SSI data).	10 – 28 Bits
Data Index	Start-index for bit information encoder data.	Integer value: Bit position starting at LSB
Status Length	Length status information (e.g.: error bit, status bits)	Integer value: Length starting at LSB
Status Index	Index, where a status information (bit index) is listed	Integer value: Bit position starting at LSB
Status Mask Err (Status mask Error)	Definition of error bits	
Status Mask Def (Status mask Definition)	Default value for active error bits	
Resolver type (Resolver)		
Formfactor	Formfactor des Resolvers	Off, Sinus, Triangle
Resolver Ratio	Resolver ratio	2:1, 3:2, 4:1, Pattern1 (Amplitude Check), Pattern2 (Frequency Check), Pattern3 (Frequency&Amplitude Check)
Pole pair	Number of pole pairs	1 – 8 Pole pairs
Interface Type	Resolver type	Master, Listener
Listener Frequency	Frequency listener mode	4 kHz – 12 kHz, 14 kHz, 16 kHz

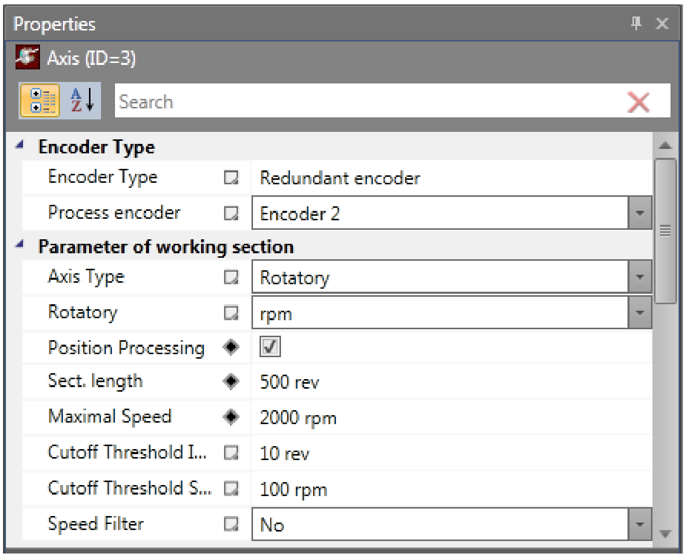
Configuration (read only, shown in light grey) - Display of the resulting data related to the currently used encoder	
Column name	Meaning
Class-ID	Unambiguous ID of encoder configuration
General flags	BIT-coded assignment D0: 1= shows that this encoder input is activated
Modes	BIT-coded assignment for SSI-Interface, data format and sense of rotation D0: 1= SSI-Listener 0= SSI-Standard D1: 1= SSI-Binary 0= SSI-GrayCode D2: 1= Rising 0= Falling D3: not used D4: 1= WCS
EXT-Modes	BIT-coded assignment for Encoder voltages D0: 1= 5V D1: 1= 12 V D2: 1= 24 V
V_Standardization	Standardization value for speed (internal calculation value)
PosStandardization	Standardization value for position (internal calculation value)
ShiftvalPos	Integer exponent for basis 2. Internal calculation value for position standardization.
ShiftvalSpeed	Interger exponent for basis 2. Internal calculation value for speed standardization.
Offset	Offset between the encoder value and the position in the measuring section.
Resolution	Resolution of the encoder related to the measuring axis in steps/m or steps/rev.
FilterTime	Not used
Data width	Field with data width in encoder interface
Cycle time	Specifies the cycle time of the PSC1 module
V_max	The maximum speed that can be entered for the parameterization of the monitoring dialogs. Is defined via "Encoder dialog maximum speed" * Factor 1.5
V_minused	Internal minimum speed for standardization calculation
V_min	The minimum speed that can be entered for then parameterization of the monitoring dialogs.
Measuring length	Entered measuring length.
Pos_Minused	Internal minimum position for standardization calculation
Pos_min	The maximum position that can be entered for the parameterization of the monitoring dialogs.

11.2.3.3 Parameterization Axis properties



Axis area in Encoder combination – Functional Scheme

Parametrization of the following options is possible on Property Grid by selecting Axis area in Encoder combination.



Parameterization of the working section

Linear

The measuring section has a linear characteristic. The unit for the position in this case is "mm" and the speed can be given either in "mm/s" or in "m/s".

Rotatory

The measuring section has a rotational characteristic, i.e. the movement is a rotation. The position is processed in "degrees" or in "revolutions", the speed in "degr/s", "rev/s" or in "rpm".

Position processing

Processing of an absolute measuring section. This functionality is only available for selection if an absolute encoder has been parameterized beforehand. With position processing activated all position related monitoring functions are enabled.

Sect. Length

Specification of the max. measuring length for the position in mm, m or degr, rev. With position processing activated, the application must always maintain within the limits of the set measuring length. Each actual position outside the defined measuring length causes an alarm of the PSC1 axis.

Maximal Speed

Specification of the max. speed of the reference axis given in the currently selected unit. The permissible maximum speed describes the highest speed that can possibly be reached with the current technological system configuration. Here one should enter the max. value that may possibly be reached by the axis to be monitored. This may, under certain circumstances, only refer to a theoretical maximum speed of the actual application. The parameterized value does not refer to the safety-related shut-down (e.g. shut-down via SLS), but to the reliability, i.e. consistency of encoders or consistency of the mechanics. Exceeding this value triggers an alarm with shut-down and error / alarm status. This is no planned shut-down because of safety-relevant speeding, but the reliability of the encoders or the mechanical situation is in doubt (encoder fault, electric power converter fault, ...), because this speed can normally not be achieved under drive technological aspects.

Should this occur, the PSC1 module will change into alarm state and switch off all outputs. This means, that the "Maximal Speed" must always be higher than the shut-down speed of a safety function. It serves the purpose of detecting a fault on the safe axis by means of measuring systems.
The value that is entered into this field, at the same time changes the dimensioning of the encoder consistency in regard to the "Cutoff Threshold Increment " and the " Cutoff Threshold Speed". A higher maximal speed permits higher cutoff threshold between the encoders. The maximum value should therefore not be chosen too high, as otherwise the cutoff thresholds could be too high for the reliability of the encoders amongst each other.

Cutoff Thresholds

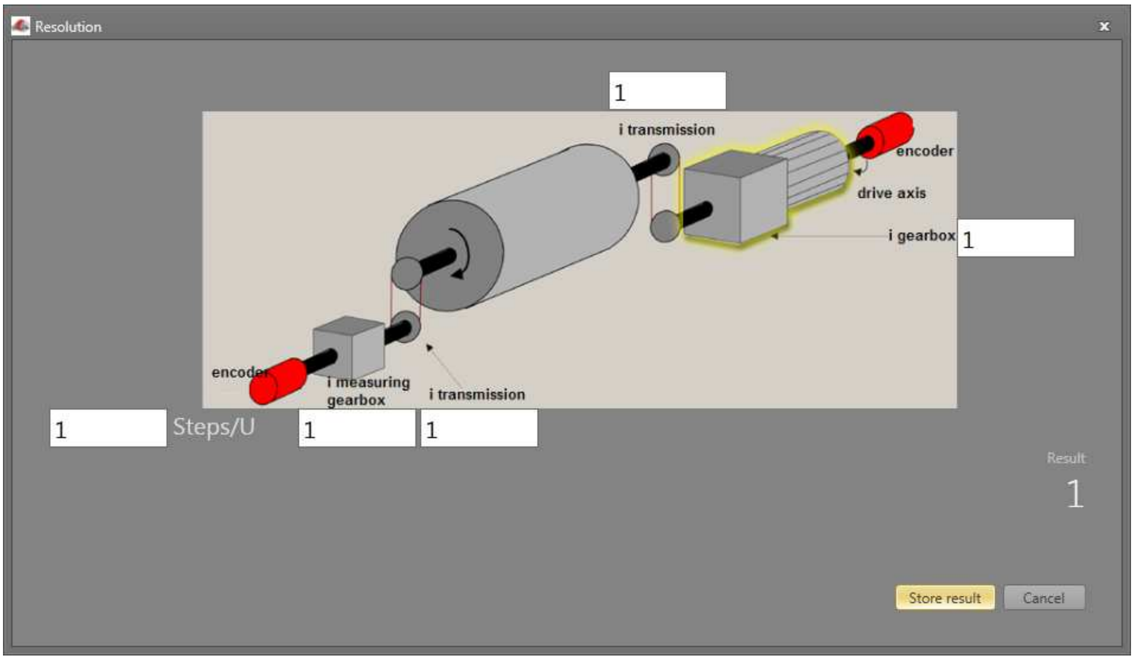
The Cutoff Threshold defines the tolerable speed/position deviation between the two detection channels / encoder channels. It may be dependent on the arrangement of the sensors and the maximum mechanical play (e.g. gearbox and spring rate) between the two detection locations. The lowest possible value, at which monitoring is not yet triggered in normal operation, should be chosen, under consideration of the dynamic processes (e.g. load/play in gearbox).

Speed filter:
Average filter covering the detected speed values of the encoder to dampen peak speeds in case of low resolution or variance of the connected sensor. With the filter switched on, the specified response time of the overall system will increase by the set time. The filter has an effect on the speed related parameters of the monitoring modules.

11.2.4 Determination of the Resolution

Determination of the resolution with regard to different characterized measuring lengths. Determination could be optionally entered by Calculate button in Encoder area properties.

11.2.4.1 Rotational measuring lengths:



Reference axis	Input values		Resolution related to measuring length
Feed axis (process axis)	Encoder 1: Resolution Gb1 i measuring gearbox i layshaft assembly	A_Gb1 in [steps/rev] I_MG I_VG	$Gb1 = I\_MG \cdot I\_VG \cdot A\_Gb1$
	Encoder 2: Resolution Gb2 i gearbox i layshaft assembly for drive	A_Gb2 in [steps/rev] I_G I_VA	$Gb2 = I\_G \cdot I\_VA \cdot A\_Gb2$

Motor axis	Encoder 1: Resolution Gb1 i measuring gearbox i layshaft assembly ∅ measuring gear i gearbox i layshaft assembly	A_Gb1 in [steps/rev] I_MG I_VG D_MR in [mm] I_G I_VA	$Gb1 = \frac{I\_MG \cdot I\_VG \cdot A\_Gb1}{I\_G \cdot I\_VA}$

Input example 1:

In a manufacturing device the speed of certain manual processes is to be monitored for a safe reduced value, as well as standstill and movement direction. The movement to be actively monitored is a rotary movement. The drive works with an electric motor with integrated motor feedback system and intermediate gear.

Selecting the block or module

Selecting the encoder type: No monitoring of positions requested -> Absolute encoders are not required, speed detection by means of incremental encoders is quite sufficient.

Determination of the measuring length: The axis of rotation of the manufacturing device is selected as reference axis. The following parameters are selected:

- Rotational
- Measuring length unknown
- Reference axis is rotational axis => selection = degr

Determination of parameters for Encoder 1: Encoder 1 is directly connected with the output axis of the gearbox = load axis. A encoder with the data: Pulse generator A/B-track, 5000 pulses/revolution is used.

The following parameters are selected:

- Encoder type incremental
- Resolution:

Encoder 1:	
Resolution Gb1	5000 [steps/rev]
i measuring gearbox	1
i layshaft assembly	1

Gb1 = I_MG · I_VG · A_Gb1 = 1 · 1 · 5000 = 5000;

Determination of parameters for Encoder 2: The existing motor feedback system is used as encoder 2. The motor is connected to the rotational axis of the manufacturing device by means of an intermediate gear.

The encoder interface is connected to the pulse outputs of the power converter. The sensor data are as follows: According to the data sheet of the power converter manufacturer the sin/cos tracks of the encoder are outputs in the form of pulses -> emulated encoder on the pulse outputs of the power converter = pulse generator, A/B-track, 1024 I/rev. The following parameters are selected:

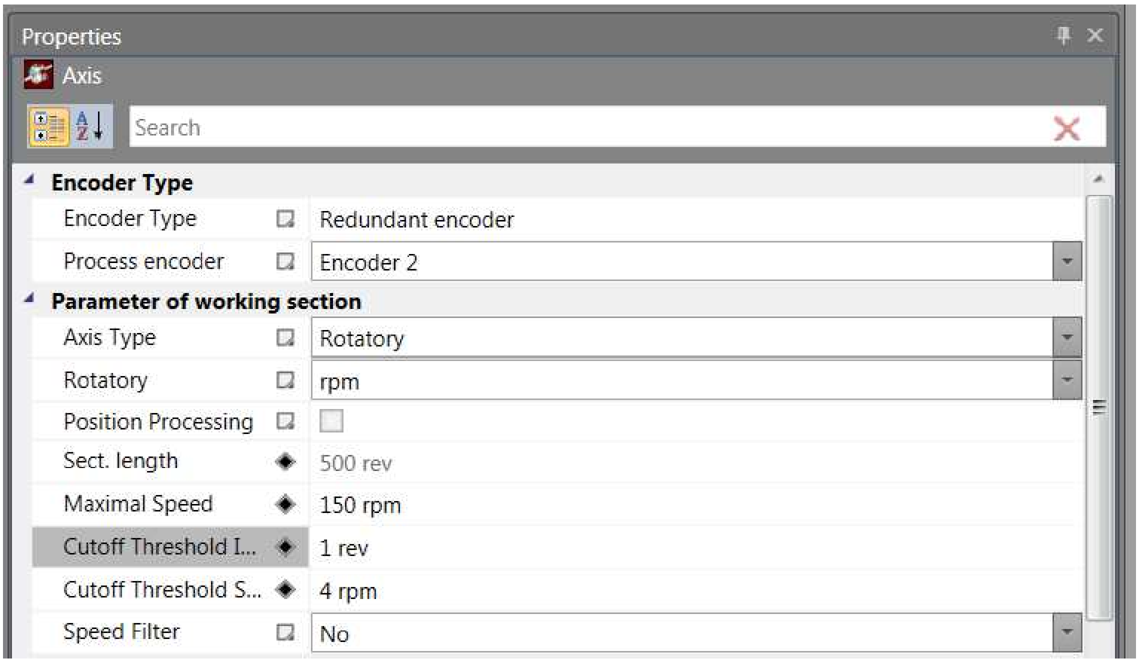
- Encoder type incremental
- Resolution:

Encoder2:	
Resolution Gb2	1024[steps\rev]
i gearbox	10
I layshaft assembly for drive	1

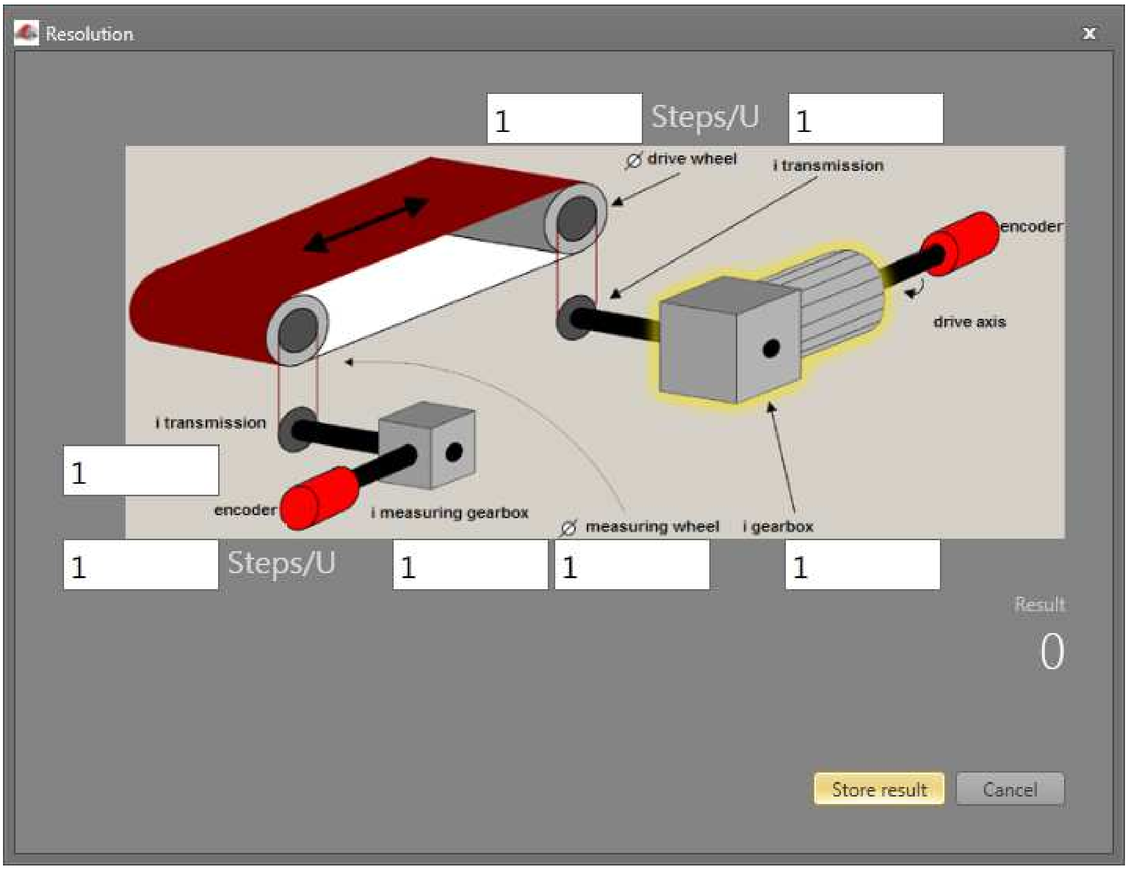
$Gb2 = I\_G \cdot I\_VA \cdot A\_Gb2 = 1024 \cdot 10 \cdot 1 = 10240$;

Specification of max. speed: The max. speed of the output axis is derived from the max. motor speed. In rev./min related to the load axis and with Nmax = 1500 rev./min it is 1500 / 10 = 150 [rpm]

Input of max. deviation: The empirical measurement reveals a maximum difference between both detection tracks of 3,2 rpm. A value of 4 rpm is chosen.



11.2.4.2 Linear measuring length



Reference axis	Input values		Resolution related to measuring length
Feed axis (process axis)	Encoder1: Resolution Gb1 i measuring gearbox i layshaft assembly ∅ measuring gear	A_Gb1 in [steps/rev] I_MG I_VG D_MR in [mm]	$Gb1 = \frac{1000}{D\_MR \cdot \pi} \cdot I\_MG \cdot I\_VG \cdot A\_Gb1$
	Encoder 2: Resolution Gb2 i gearbox i layshaft assembly for drive ∅ drive gear	A_Gb2 in [steps/rev] I_G, I_VA, D_AR in [mm]	$Gb2 = \frac{1000}{D\_AR \cdot \pi} \cdot I\_G \cdot I\_VA \cdot A\_Gb2$

Motor axis	Encoder 1: Resolution Gb 1 i measuring gearbox i layshaft assembly ∅ measuring gear i gearbox i layshaft assembly for drive ∅ drive gear	A_Gb1 in [steps/rev] I_MG I_VG D_MR in [mm] I_G I_VA D_AR in [mm]	$Gb1 = \dfrac{\dfrac{1000}{D\_MR \cdot \pi} \cdot I\_MG \cdot I\_VG \cdot A\_Gb1}{\dfrac{1000}{D\_AR \cdot \pi} \cdot I\_G \cdot I\_VA \cdot A}$

Input example 2

On a manufacturing machine access to the working area is to be enabled at certain positions of the main feed axis for manual feeding or setup work. The drive remains active in this position and is only monitored for standstill. The limits of the working stroke are variable and are to be monitored electronically in safety-relevant mode, as a replacement of the mechanical safety limit switch. The movement to be actively monitored is a linear movement. An absolute encoder is positively connected with this main drive axis of the linear length measuring system. The drive works with an electric motor with integrated motor feedback system and one intermediate gear. The output shaft of the intermediate gear is connected with a drive gear ∅ 31.83 mm (= 100 mm circumference).

Selecting the module

Selecting the encoder type: Monitoring of positions is requested -> Absolute encoder required, for the second encoder an incremental detection + reference switch is sufficient.

Determination of the measuring length parameters: The main axis of the machine is selected as reference axis. The following parameters are selected:

- Linear
- Measuring length = 600 mm
- Reference axis is rotational axis => selection = mm

Determination of parameters for encoder 1: Encoder 1 is directly connected to the drive axis. Absolute encoder SSI, 4096 steps/rev. is used.

The following parameters are selected:

- Encoder type absolute
- Data format SSI
- Resolution:

Encoder 1:	
Resolution Gb1	4096 [steps/rev]
i measuring gearbox	1
i layshaft assembly	1
∅ drive gear	31.83

$$Gb1 = \frac{1000}{D\_MR \cdot \pi} \cdot I\_MG \cdot I\_VG \cdot A\_Gb1 = \frac{1000}{31{,}83 \cdot \pi} \cdot 1 \cdot 1 \cdot 4096 = 40960$$

Determination of parameters for encoder 2: The existing motor feedback system is used as encoder 2. The motor is connected with the drive gear via an intermediate gearbox. The ratio of the gearbox is 4.51 times the Ø of the drive gear 31.831 mm.

The encoder interface is connected to the pulse outputs of the power converter. The encoder data are as follows: Hiperface, 1024 I/rev. According to the data sheet of the power converter manufacturer the sine/cosine tracks of the Hiperface encoder are output in the form of pulses -> emulated encoder on the pulse output of the power converter = pulse generator, A/B-track, 1024 I/rev.

The following parameters are selected:

- Encoder type incremental
- Resolution:

Encoder 1:	
Resolution Gb2	1024 [steps/rev]
i gearbox	4.51
i layshaft assembly	1
∅ drive gear	31.83

$$Gb2 = \frac{1000}{D\_AR \cdot \pi} \cdot I\_G \cdot I\_AV \cdot A\_Gb2 = \frac{1000}{31{,}83 \cdot \pi} \cdot 4{,}51 \cdot 1 \cdot 1024 = 46182$$

Specification of max. speed: The max. speed of the output axis is derived from the max. motor speed. In mm/s related to the load axis and with Nmax = 1500 rev./min it is (1500 [rev/min] / 60 [s]) * 0.012 [m] = 0.3 [m/s] = 300 [mm/s].

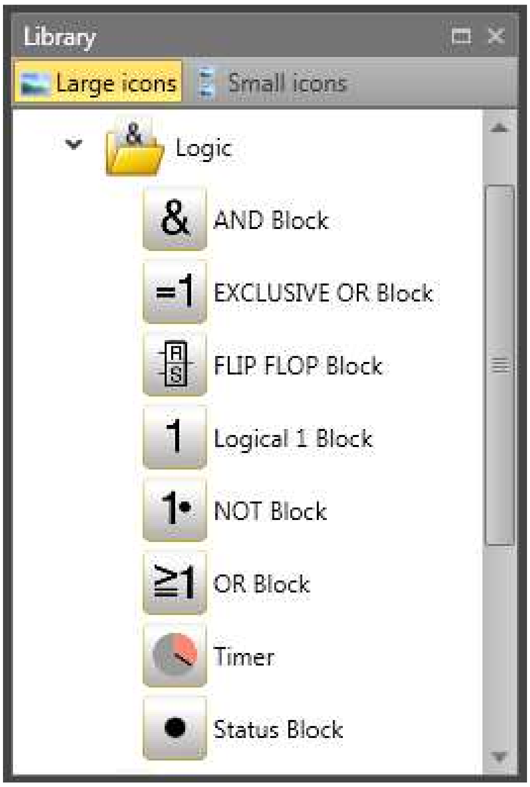
Input of max. deviation: The empirical measurement reveals a maximum difference of <1 mm between both sensing points on motor axis and movement axis. The value chosen is 1 mm.

The encoder configuration info obtains:

Configuration (read only)	
General Flags	1
Class ID	3300
Modes	6
ExtModes	4
Resolution	1024
Offset	0
ShiftPos	12
NormPos	4194
ShiftSpeed	21
NormSpeed	286331
FilterTime	1
DataLength	24
FrameLength	10
StatusLength	0
DataIdx	0
StatusIdx	0
StatusMaskErr	0
StatusMaskDef	0
ResolvParam	0

11.3 Functional blocks

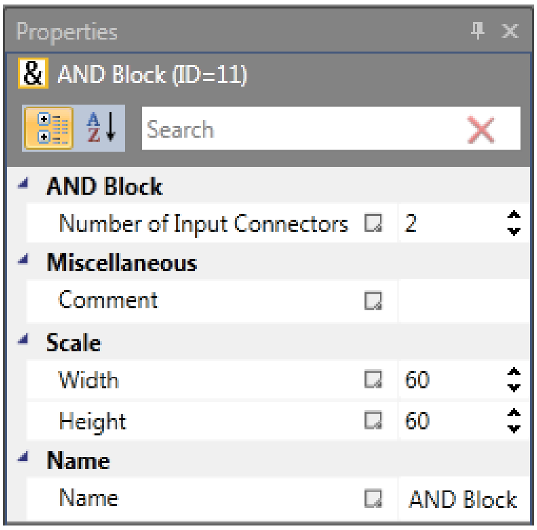
11.3.1 Logic functions



These blocks form the basis for creating a program for the safety application. They enable the logic linkage of the inputs with monitoring functions and the outputs. Inserting logic blocks is only possible in the "Functional Scheme" view, otherwise the associated menu commands are disabled. This is the case when the resources for a module are already exhausted, e.g. after all timer modules have been inserted.

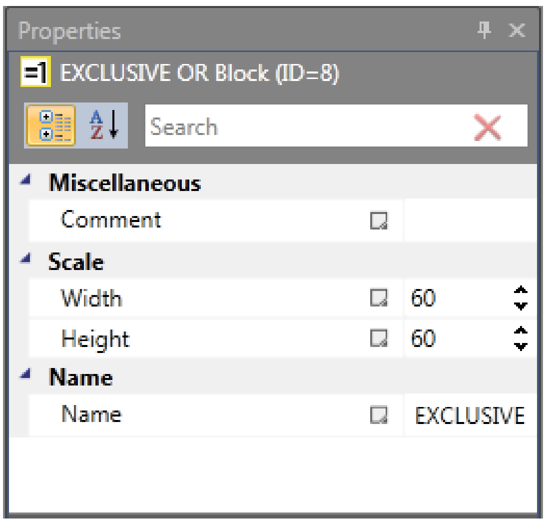
11.3.1.1 AND Block

"AND"-operation of maximum 10 output signals from other function blocks. The AND-operation provides the signal state "1" if all input signals are "1" as logical result, otherwise "0".



11.3.1.2 EXCLUSIVE OR Block

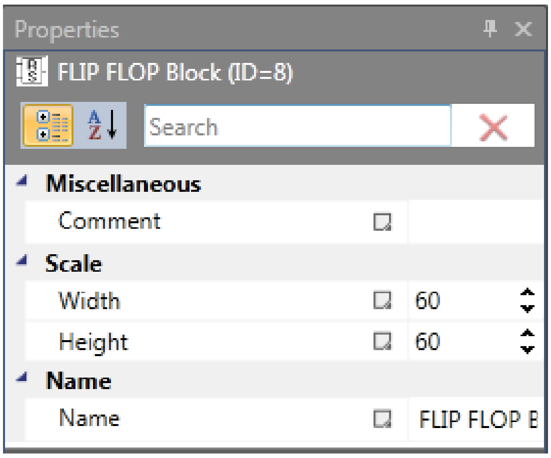
"EXCLUSIVE OR"-operation of 2 output signals from other function blocks. The XOR-module provides "1" as logic result, if one input has the input signal "1" and the other input has the input signal "0", otherwise "0".

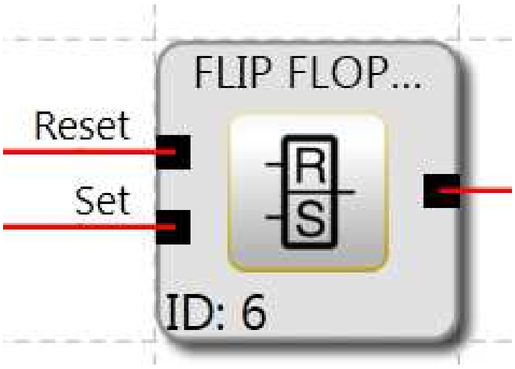


11.3.1.3 FLIP FLOP Block

This switching element shows the following characteristics:

- The logic result during initialization of the element is "0".
- The logic result becomes "1", if an edge change from "0" to "1" takes place at the "Set" input. The output remains at "1", even if the state of the "Set" input changes back to "0".
- The logic result becomes "0", if an edge change from "0" to "1" takes place at the "Set" input.
- With both inputs set to "1", the result is "0"!



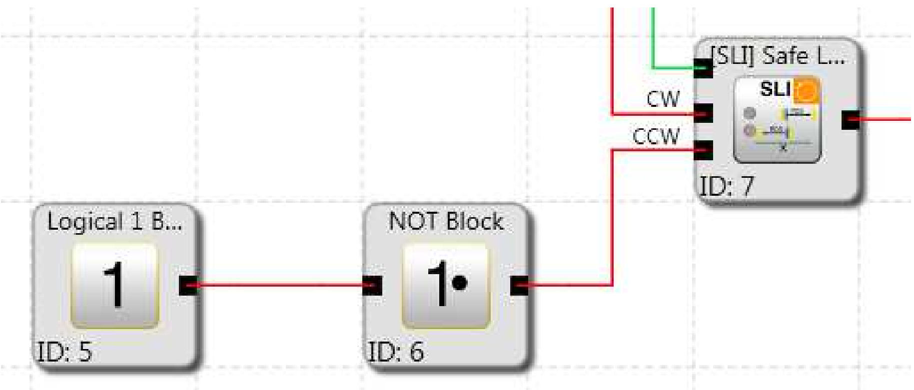


11.3.1.4 Logical 1 Block

This module constantly provides the value "1". This function can be used to program static states in the Functional Scheme.

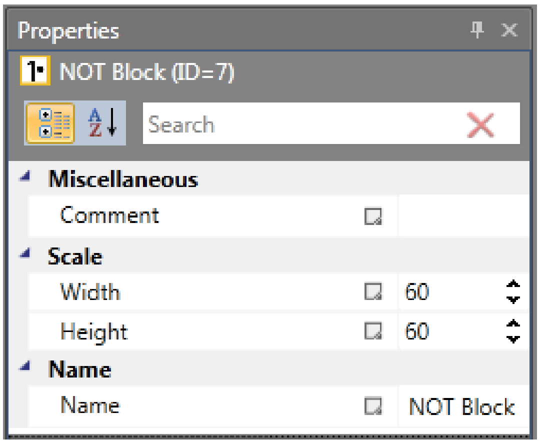
Example:

Assignment of an unused input on a direction dependent SDI



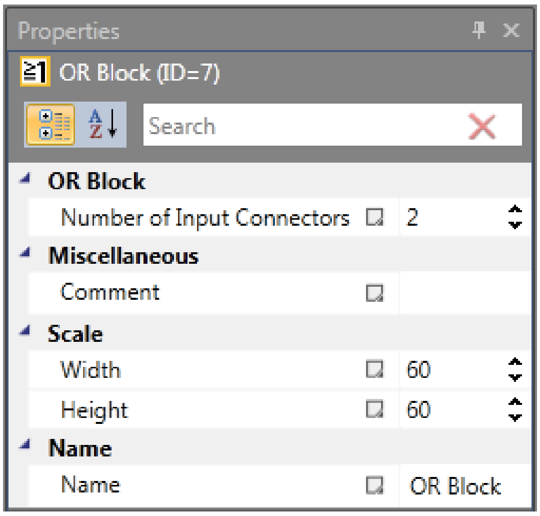
11.3.1.5 NOT Block

The logic result of this function block is the negation of the input signal. The term negation means that the logic result is inversed (negated).



11.3.1.6 OR Block

"OR"-operation of maximum 10 output signals from other function blocks. The OR-operation provides the signal state "1" for at least one input with signal state "1", otherwise "0".

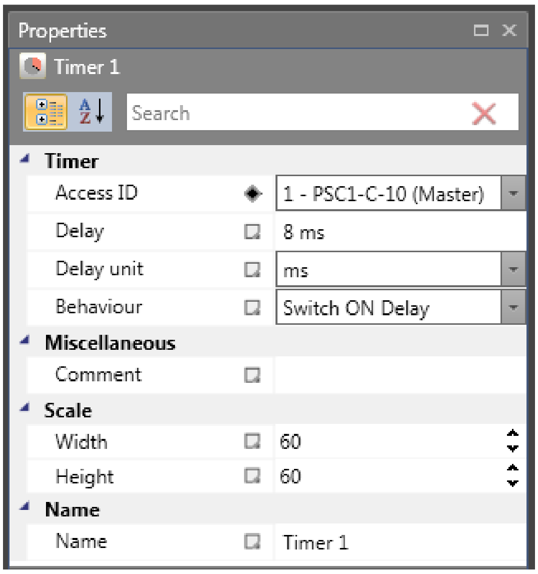


11.3.1.7 Dummy Block

This block does not have any effect on the functionality of the device and running program and normally should be used temporarily for debugging.

11.3.1.8 Timer

Function block that starts a counter in the event of an edge change. After the specified temporal delay the logic result will become "1" or "0".



Access ID

Number of timer. This can be set when inserting. Once all timers are used up, the timer command will be disabled in the menu.

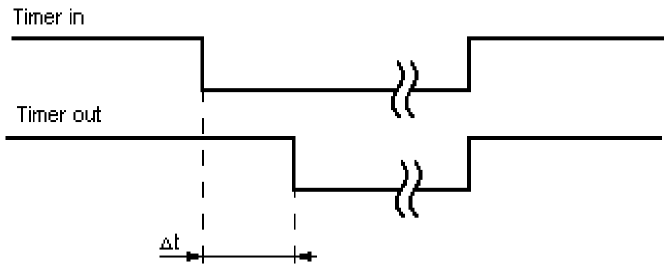
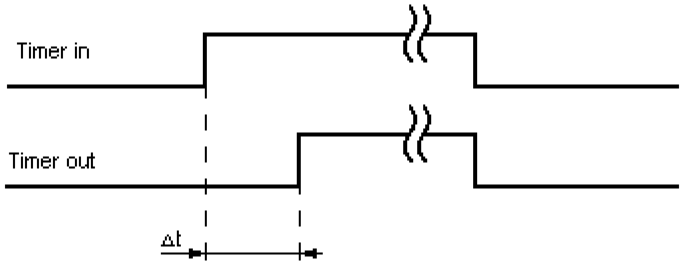
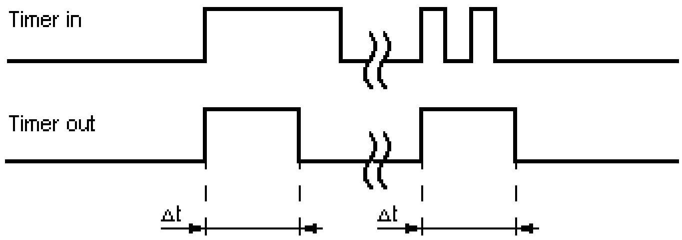
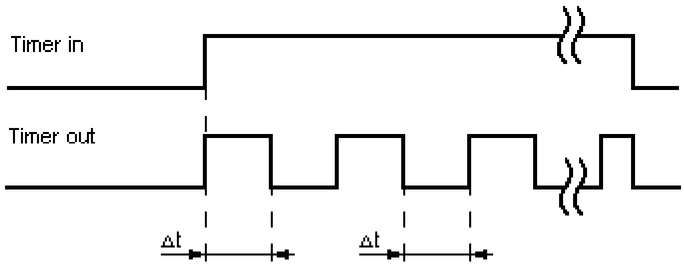
Delay

Desired period of time the timer should run.
T min = Cycle time
T max = 533 min (31999992 ms)

<u>Note:</u>

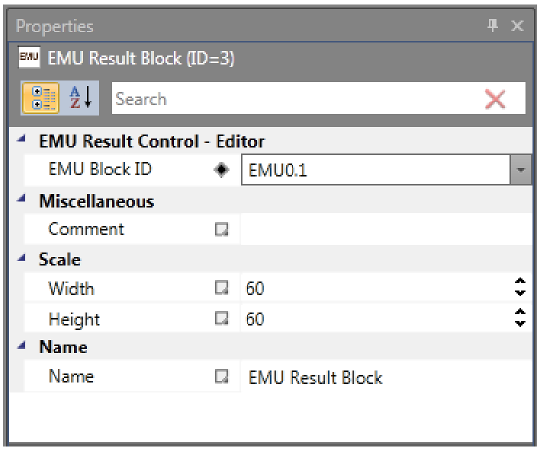
Due to the fixed cycle times of the PSC1-C-10 module the timer specification must be a multiple of 8ms and for PSC1-C-100 a multiple of 16ms [24ms, 32ms].

Characteristics

Function	Activation timer	Timing diagram
Switch OFF Delay	Trailing edge	
Switch ON Delay	Rising edge	
Impulse	Rising edge	
Intermitted	Rising edge	

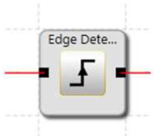
11.3.1.9 EMU Result Block

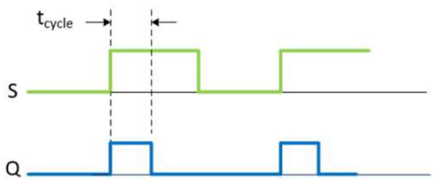
This module delivers the result of the EMU-function that has been parameterized in the output module. In OK-condition this value is “1”. The module can be used for e.g. visualizing the EMU condition through an signaling output.



11.3.1.10 Edge detection

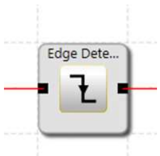
Rising edge triggered

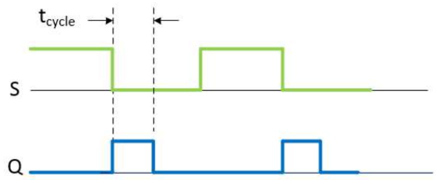




On the rising edge of the input signal, the device outputs a high pulse of the duration of one cycle, independent of the duration of the applied high signal. The falling edge is ignored, only a new change of the input signal from low to high leads to a new high pulse.

Trailing edge triggered





On the falling edge of the input signal, the device outputs a high pulse of the duration of one cycle, independent of the duration of the applied low signal. The rising edge is ignored, only a new change of the input signal from high to low leads to a new high pulse.

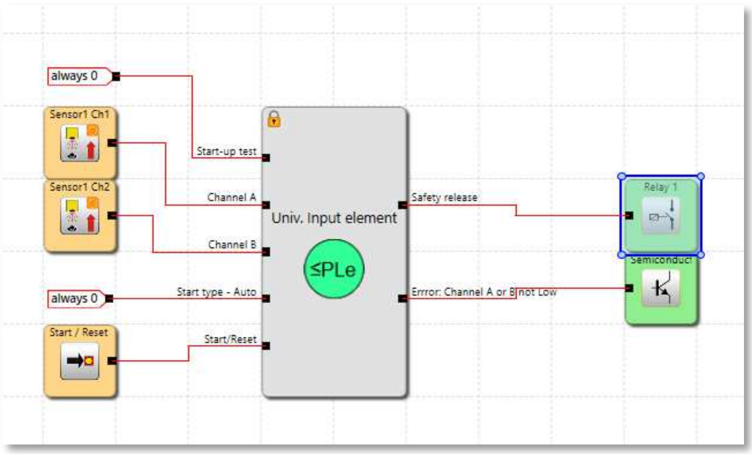
11.3.2 Universal Input Element

When using sensors with non-positive break contacts or two independent sensors with independent actuation, the "Universal input module" macro (group) must be used in SafePLC2.

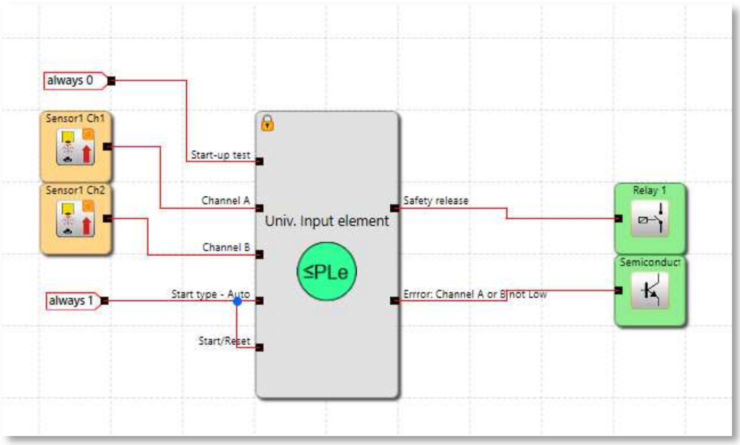
Two 1-channel elements must be used as inputs. It is important to ensure correct assignment of the test pulses for cross-wire short detection. The behaviour of the group can be adapted via logic input signals.

- **Start-up Test** True - The monitored switchgear must be triggered once in the monitoring direction and then switched on again
- **Starttype – Auto** True - Autostart

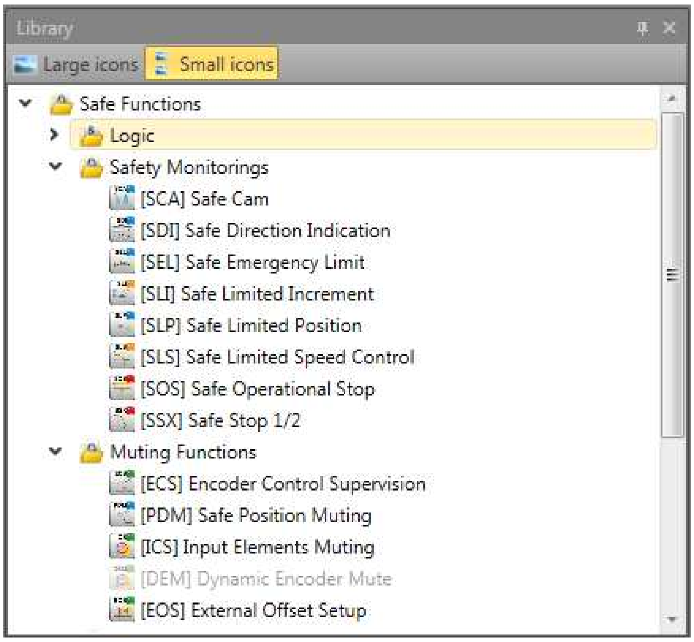
The following figure shows an exemplary configuration for operation with manual reset without start-up test



For operation in Autostart configuration, the above example must be wired as follows



11.3.3 Safety functions



The safety drive monitoring functions are an essential functionality of the PSC1-system.

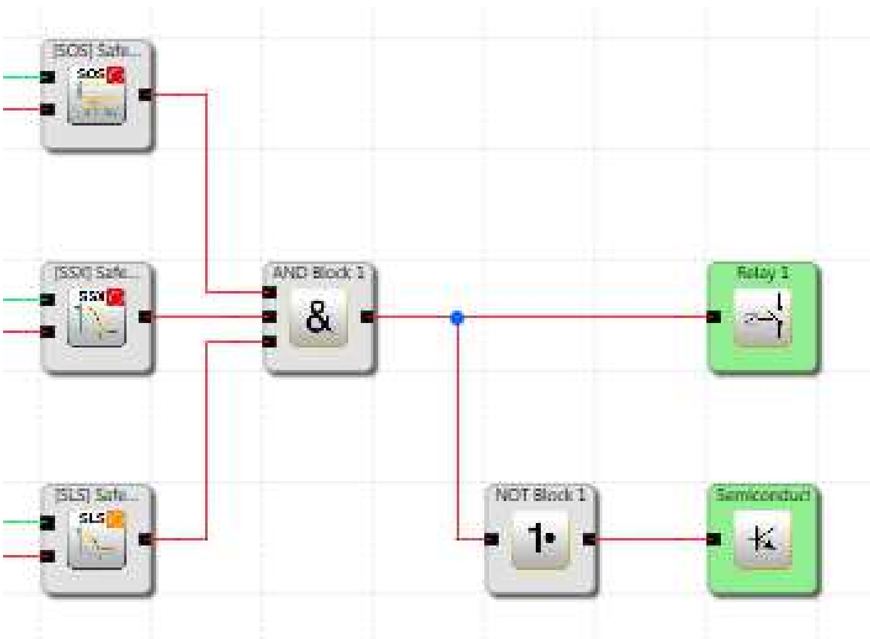
Pre-defined functions for:

- speed monitoring
- position detection
- monitoring of limits and target positions
- standstill monitoring
- direction monitoring
- muting

The functionality for monitoring position, speed and shut-down is only activated after successful encoder configuration. Once this has been done, the corresponding functions can be inserted as long as there are resources available in the PSC1 module for this purpose. Once these have all been used, the menu option for the corresponding function block is disabled.

Function named in EN 61800–5–2	Number of blocks for PSC1-10 series	Number of blocks for PSC1-100 series
SLS - Safe Limited Speed	8	48
SOS - Safe Operational Stop	1 (per axis)	12 (1 per axis)
SDI - Safe Direction Indication	1 (per axis)	12 (1 per axis)
SSX - Safe Stop 1/2	4	24 (4 per device)
SLI - Safe Limited Increment	1 (per axis)	12 (1 per axis)
SCA - Safe Cam	16	64
SEL - Safe Emergency Limit	1 (per axis)	12 (1 per axis)
SLP - Safe Limited Position	2	12 (2 per device)
DEM - Dynamic Encoder Muting	1	12 (1 per axis)
ECS – Encoder Control Supervisor	1 (per axis)	1 (per slave device)
ICS – Input Elements Muting	1	1 (per slave device)
EOS – External Offset Setup	1	1 (per axis)
PDM – Safe Position Muting	1 (per axis)	1 (per axis)

If switching off by a monitoring function is to be signalized to the outside, e.g. to a control unit, an auxiliary output may be used for this purpose. Once a 1 is applied to the outputs of the monitoring functions in OK condition, the result is to be negated as per following example for the feedback.



Example for a logic linkage of monitoring functions

11.3.3.1 SEL (Safe Emergency Limit)

Monitoring of the maximum movement range

Function:	Monitoring of the permissible speed related to the relative distance to the maximum limit of the movement or adjustment range. This function replaces the conventional safety limit switches!
Input:	Standardized position signal X from the encoder interface.
RESET-function:	The violation of the permissible monitoring range is saved and requires a RESET acknowledgement.

This occurs alternatively via:

- RESET function in the group of Input elements
- Function key on the front side of a basic module
- FBus reset element

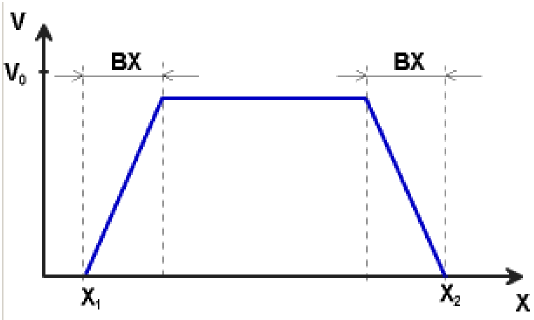
Description of function:

- Calculation of actual speed V using position signal X
- Determination of the stopping distance related to the current status of acceleration and speed

  => Cyclic determination of the Stop_Distanz$_{Akt.}$ = f (V, a) with a = acceleration
- Comparison: Pos$_{Akt.}$ + Stop_Distanz$_{Akt.}$ < Ziel_Pos + Overtravel

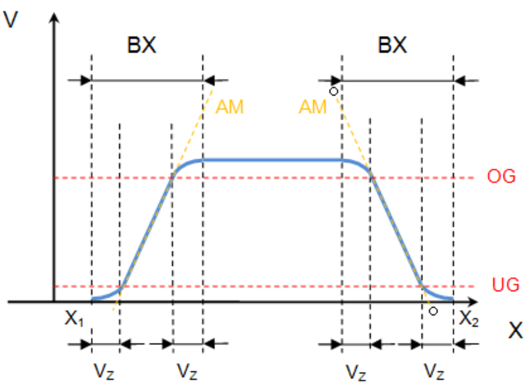
A trapezoidal or S-shaped speed profile serves as basis for the calculation. For a trapezoidal speed profile the limit curve is the result of the parameterized acceleration, whereas an S-shaped speed profile additionally uses the change in acceleration for the calculation.

Trapezoidal speed profile:



X1 = Min. position
X2 = Max. position
V0 = Maximum speed for (X1 + BX) < X < (X2 – BX)
BX = Braking/approaching range

S-shaped speed profile



BX	= Braking/approaching range
X1	= Min. position
X2	= Max. position
V_Z	= S-Ramp time
AM	= Max. Acceleration
UG/OG	= area of max. acceleration

Correlation between Position, Speed, Accelaration and S-Ramp time (Vz):

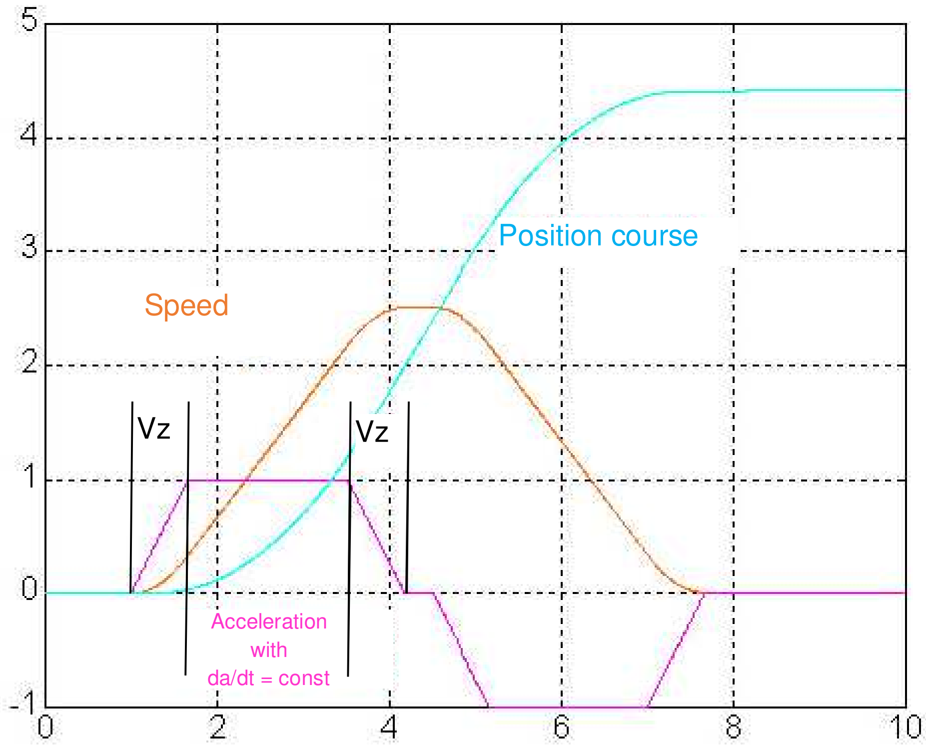
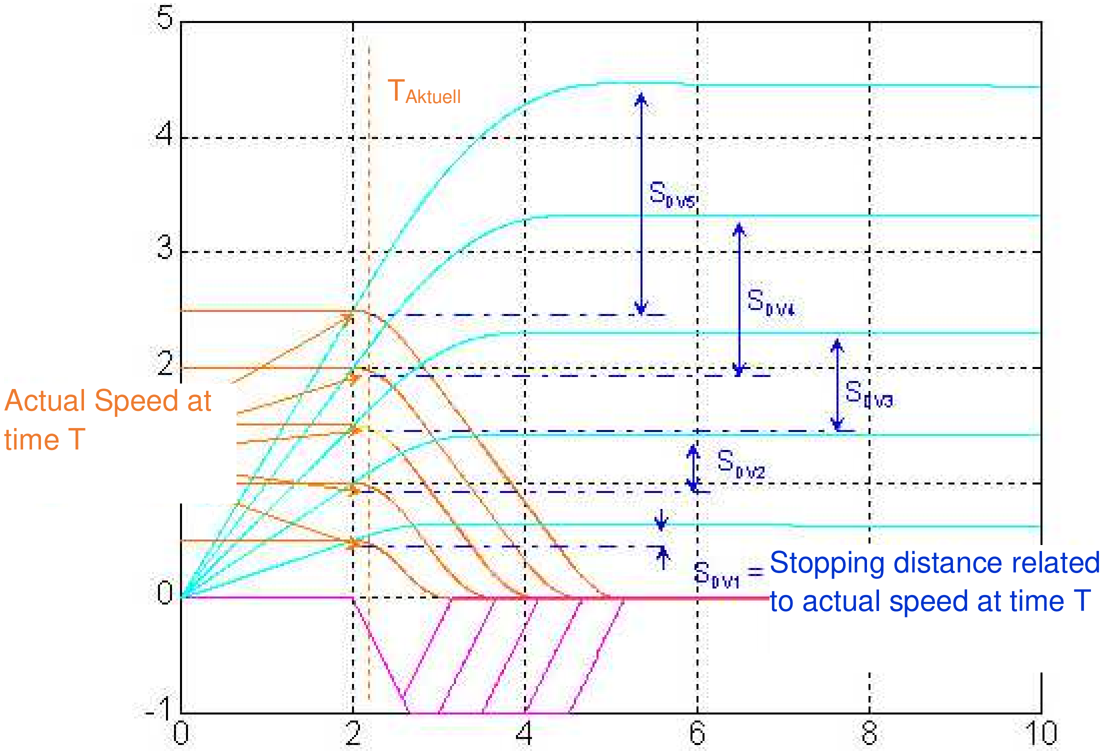


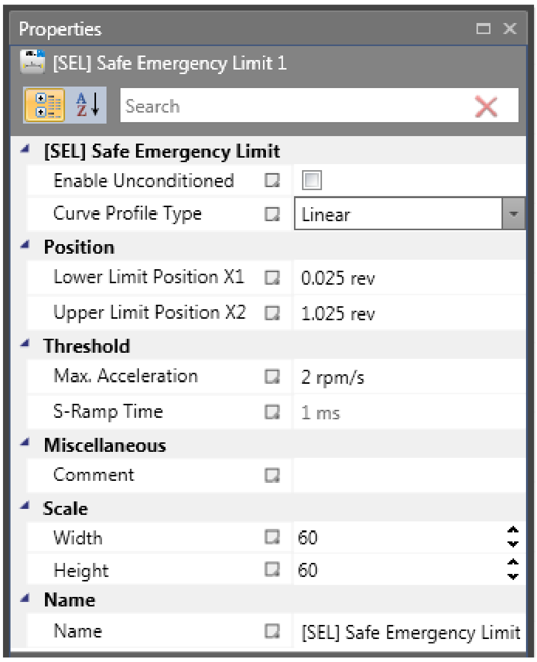
Illustration of Stopping distance in relation to actual speed:



Output function:

Range	HI	LO
X < X1 OR X > X2		X
X >= X1 AND X <= (X1 + BX) AND V < Limit curve	X	
X >= (X2 – BX) AND X <= X2 AND V < Limit curve	X	
X >= X1 AND X <= (X1 + BX) AND V >= Limit curve		X
X >= (X2 – BX) AND X <= X2 AND V >= Limit curve(1)		X

(1) Limit curve = Speed profile derived from the actual parameterization



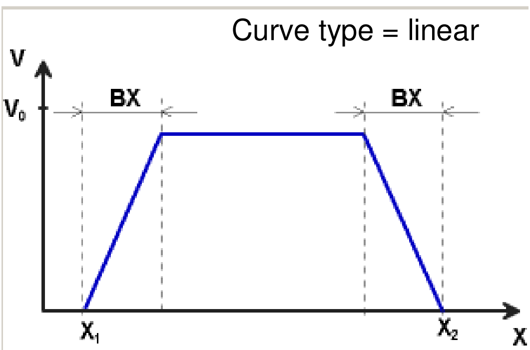
Parameters:

Enable Unconditioned

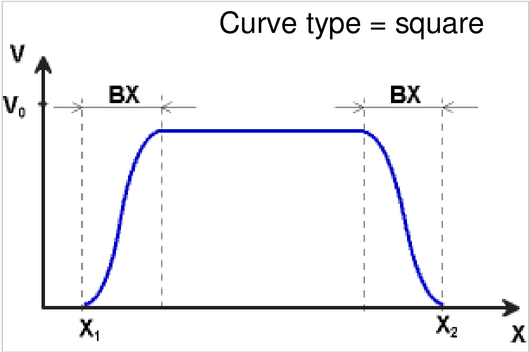
If this option is set, the monitoring function has no Input connector. The function is active right from the start of the device.

Curve Profile Type

- linear
  Linear calculation method for the stopping distance with respect to the limit position



- type S-shaped
  Square calculation method for the stopping distance with respect to the limit position



Lower limit position X1

Lower limit position

Upper limit position X2

Upper limit position

Max. acceleration

Max. acceleration value within BX

S-Ramp time

Slope time of the acceleration => time from acceleration = 0 until max. acceleration

Input example:

On a manufacturing machine access to the working area is to be enabled at certain positions of the main feed axis for manual feeding or setup work. The drive remains active in this position and is only monitored for standstill. The limits of the working stroke are to be monitored electronically in safety-relevant mode, as a replacement of the mechanical safety limit switch. The movement to be actively monitored is a linear movement. An absolute encoder is positively connected with this main drive axis of the linear length measuring system. The drive works with an electric motor with integrated motor feedback system and intermediate gear.

1. **Limit position**

The reference zero point of the main drive axis is located in the top dead center.
The mechanical trailing distance subordinate is: X1 = - 5mm.

The lower end position is at 600mm + 5 mm safety limit: X2 = 605mm

2. **Form of speed selection**

The drive/position controller uses a ramp limitation (jerk limitation) for the acceleration with resultant S-slip of the speed, in order to minimize deviations and processing marks => Select S-form option

3. **Limit value selection**

All other limit values are taken from the machine parameterization.

Maximum acceleration = 1000 mm/s²

Maximum change of acceleration Vz = 10 ms (empirically determined)

11.3.3.2 SLP (Safe Limited Position)

Monitoring of the pre-defined movement range

Access-ID: Identification of function element

Function: Monitoring of the permissible speed related to the relative distance to a parameterized Teach-In target position.

Input: Standardized position signal X from the encoder interface

RESET-function: The violation of the permissible monitoring range is saved and requires a RESET acknowledgement.

This occurs alternatively via:

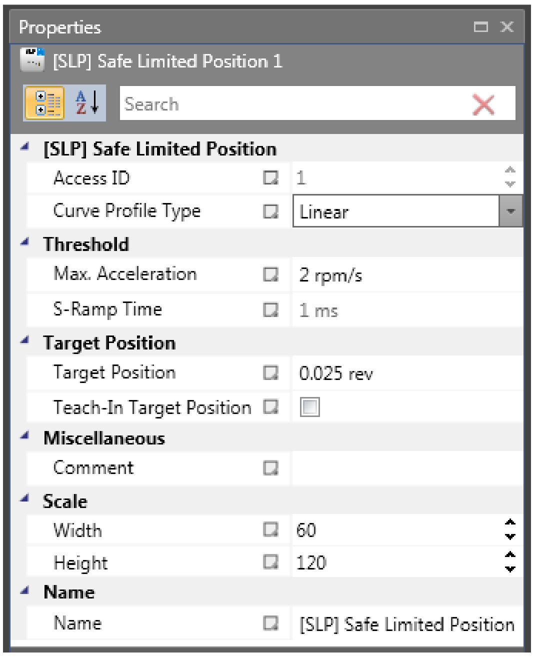
- RESET function in the group of Input elements
- Function key on the front side of a basic module
- FBus reset element

Description of function:

- Calculation of actual speed V using position signal X
- Determination of the stopping distance related to the current status of acceleration and speed=> Cyclic determination of the Stop_Distanz$_{Akt.}$ = f (V, a) with a = acceleration
- Comparison: Pos$_{Akt.}$ + Stop_Distanz$_{Akt.}$ < Ziel_Pos + Overtravel
- Comparison: Pos$_{Akt.}$ - Stop_Distanz$_{Akt.}$ > Ziel_Pos + Overtravel
- Direction control cw = clockwise, ccw = counter-clockwise

Note:

If the function is activated, both input signals "cw" and "ccw" must not be activated at the same time. If both input signals are activated, an alarm is generated.



Parameters:

Curve profile type

- Linear:
  Linear calculation method for the stopping distance with respect to the target position
- S-shaped:
  Square calculation method for the stopping distance with respect to the target position

Max. acceleration

Max. acceleration value within BX

S-Ramp time

Slope time of the acceleration => time from acceleration = 0 until max. acceleration

Target position

Absolute position value of target position

Teach in target position

The "Teach-In" option can be used to have the target position recorded by the PSC1-system without the need of manual parameterization.

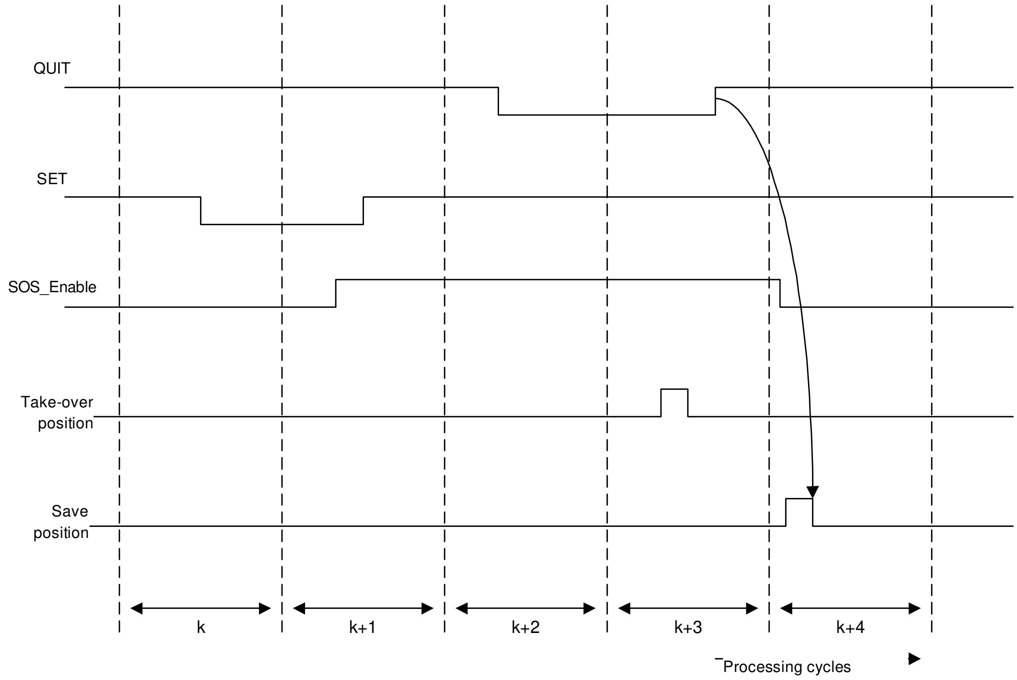
This requires the following steps:

- Activating the switch "Teach-In" changes the Input field "Target position" to "Position tolerance". At same time the Input dialog increases by the SOS-functionality.
- Recording a position using the "Teach-In" option can only take place at standstill, with the SOS-function activated and SLP deactivated.
- Recording a position requires the two signals "SET" and "QUIT". These appear when activating the TEACH-IN option as Input connector of the functional module.
- The „TeachIN“ mode activates automatically the SOS-function and evaluates the result of this function. Non-triggering of the SOS-function is pre-condition for an active teach-in cycle.
- Position will only be recorder if the present position is within the defined position range.
- The successfully recorded TeachIN position appears in the process Input image on index 37(SLP 1) respective index 38 (SLP 2).
- The TeachIn position is securely stored even in case of a power loss.
- The TeachIn position is reset after every configuration upload.

Note:

In case of bus versions of the PSC1 module, parameterization of the SLP-function partly takes place directly via the safety bus. The target position is transferred to the PSC1 module under SLP-position (from bit 32 in PAA). The selection of the SLP-range also takes place with bit 6 or bit 7 of the PAA for ranges 1 or 2. The settings for target position and range in the parameterizing mask have no effect in case of bus versions of the PSC1 module!

Time characteristic of the SET/QUIT process



The sequence is time monitored and triggers an ALARM if the expectations are exceeded.

ATTENTION:
The maximum time slot is 3 seconds !

Position Tolerance
Tolerance value for Teach-In position.

- cw (enabled) = $Pos_{Akt.}$ + $Stop\_Distanz_{Akt.}$ < Ziel_Pos + Position Tolerance
- ccw (enabled) = $Pos_{Akt.}$ - $Stop\_Distanz_{Akt.}$ > Ziel_Pos - Position Tolerance

Note:

When using the Teach-In function, the monitoring threshold is extended by the value of the position tolerance. Without the Teach-In functionality the value of the position tolerance is zero.

If indicated by the risk assessment, a key switch should be used for the "SET" input or the input should be activated, for example, by means of two AND-linked position switches.

When determining the position tolerance, one must consider the permissible maximum position: => maximum value of position tolerance = max. position in travel direction – Teach-In position

11.3.3.3 SCA (Safe Cam)

Monitoring of position range with or without speed monitoring

<u>Access-ID:</u> Identification of function element

<u>Function:</u> Monitoring of a parameterizable position range with allocated minimum and maximum limits. Additional monitoring of the maximum speed in the permissible range.

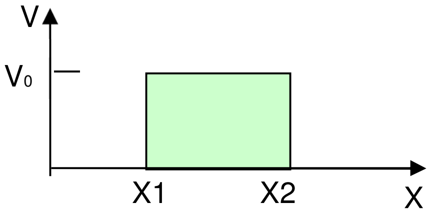
<u>Input:</u> Standardized speed signal V from encoder interface

<u>RESET-function:</u> Violation of the permissible monitoring range is not saved. No RESET acknowledgement required.

<u>Description of function:</u>

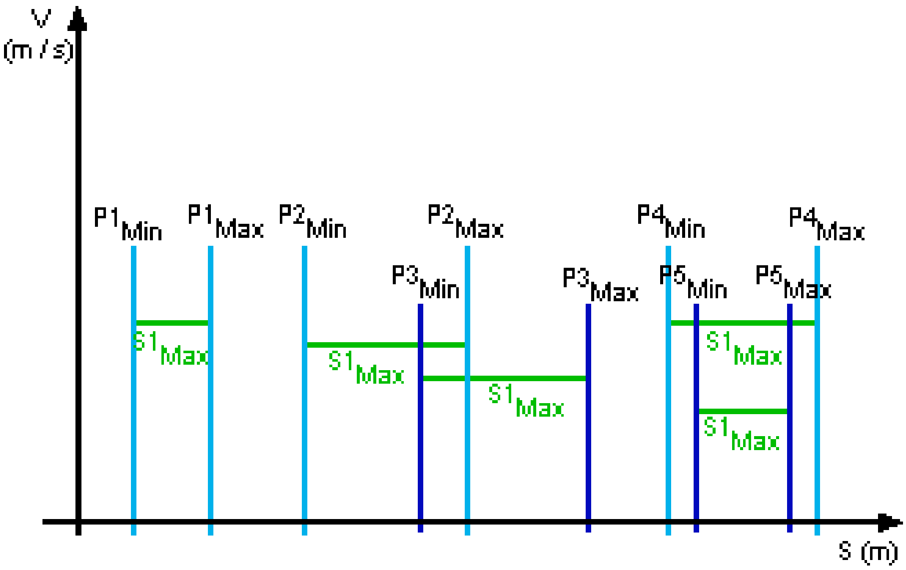
- Comparison of actual position with the parameterized range limits
- Comparison of actual speed with the parameterized maximum speed range
- Comparison of actual acceleration with the parameterized acceleration range
- Monitoring position limit with speed profile supervision
- Count direction control
- Overspeed distance monitoring

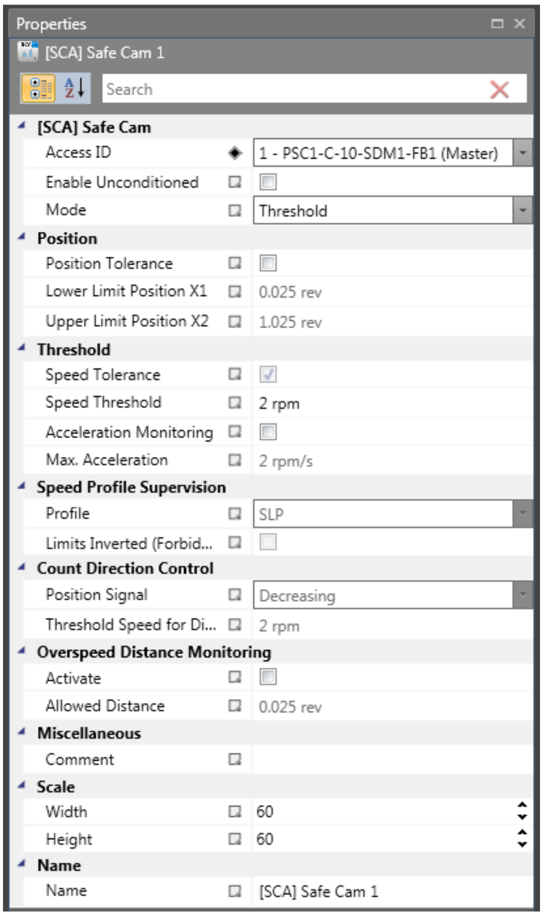
Output function:



Range		HI	LO
X < X1 X > X2	OR		X
X >= X1 X <= X2 V < V0	AND AND	X	
X >= X1 X <= X2 V >= V0	AND AND		X

Ranges can be defined as overlapping and nested.





Parameters:

Enable unconditioned

If this option is set, the monitoring function has no Input connector. The function is active right from the start of the device.

Lower limit position X1

Lower limit position

Upper limit position X2

Upper limit position

Speed threshold

Maximum permissible speed in the parameterized position range

Max. acceleration

Maximum permissible acceleration in the parameterized position range

Mode: Speed Profile Supervision

Monitoring of speed at the limits using the monitoring characteristics parameterized in SEL or SLP. This switch can only be activated with the SLP or SEL function block inserted.

Limits Inverted (forbidden area):
This parameter determines the type of area information.

- Standard (without inverted limits):
  The indication of minimum and maximum value represents the limits for the permissible area, which is located between these limits.

  -----[MIN====MAX]---- (- forbidden area, = permissible area)

- "Inverted limits" inverts the permissible area
  The permissible area is outside the area between minimum and maximum value. Minimum and maximum value now specify the Forbidden area between the values.

  ====]MIN-----MAX[====

Mode: Overspeed distance monitoring

This additional functionality enables filtering of peak speeds in case of irregular travel operation (speed peaks in signal). The path integral is calculated on basis of the difference between the current speed and the parameterized speed monitoring value and compared with the entered value. If the entered value is exceeded the monitoring function is triggered. The function can only be activated if the acceleration monitoring function is switched off.

ATTENTION:

If this functionality is used, the response time of the monitoring function used will be increased.

Mode: Count direction control

This dialog element enables a direction dependent activation of other function modules. If this option is selected, the speed and acceleration monitoring functions of this monitoring module are no longer available.

Position Signal:

- with position signal increasing:
  Result of function block is set to "1" for clockwise speed
- with position signal decreasing
  Result of function block is set to "1" for counterclockwise speed

Threshold Speed for Direction:
Threshold value to activate the module if it is exceeded and then direction is appropriate. If speed is less than this value the result is "0".

Input example:

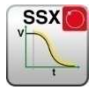
On a manufacturing machine access to the working area is to be enabled at certain positions of the main feed axis for manual feeding or setup work. The drive remains active in this position and is only monitored for standstill. The limits of the working stroke are to be monitored electronically in safety-relevant mode, as a replacement of the mechanical safety limit switch. The movement to be actively monitored is a linear movement. An absolute encoder is positively connected with this main drive axis of the linear length measuring system. The main axis serves as reference axis for the PSC1-module.

1. Selecting the range

Position monitoring is to be used to monitor the position of the main axis in top zero position. Top zero position also serves as reference zero position in the length measurement of the feed axis. If the range is recognized, a protective device is released for opening.

- Range limit X1 = top position = 0mm
- Range limit X2 = lower tolerance limit for position = 2 mm
- Speed = tolerated speed to maintain position= 3 mm/s
- Acceleration = tolerated acceleration to maintain position= 5 mm/s

11.3.3.4 SSX (Safe Stop 1/2)



Controlled Stop of a motor according to Stop category 1/2

Access-ID: Identification of function element

Function: Controlled Stop of a motor according to Stop category 1/2

Input: Standardized speed signal V from the encoder interface

RESET-function: The violation of the permissible monitoring range is saved and requires a RESET acknowledgement.

This occurs alternatively via:

- RESET function in the group of Input elements
- Function key on the front side of a basic module
- FBus reset element

Description of function:
Monitoring the sequence of a controlled EMERGENCY STOP by comparing the speed drop with a parameterizable monitoring curve over the course of time. The monitoring curve is a result of latency, max. speed distance to the limit curve, as well as their characteristic, calculated on the basis of acceleration and acceleration change. After activating the monitoring function, the course of the limit curve is calculated on the basis of the current speed.

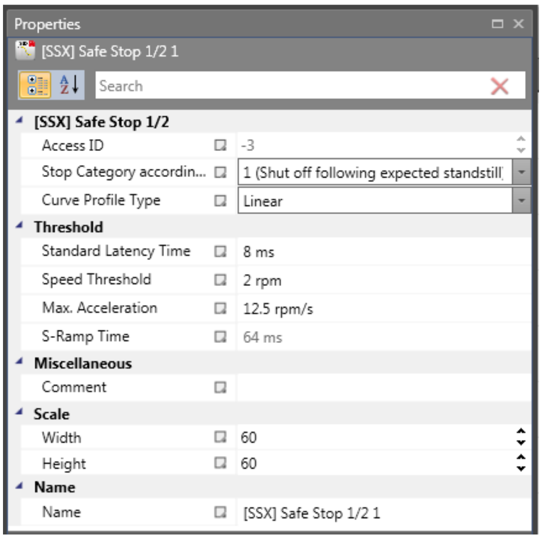
Output function:

Range	HI	LO
$T < T_{Latency}$	X	
$T > T_{Latency}$ AND $V < V_{Limit\ curve}$	X	
$T > T_{Latency}$ AND $V > V_{Limit\ curve}$		X

Each function block can be parameterized to stop category 1 or 2. In stop category 2 the SOS-function is automatically activated after the expected standstill.

Reset characteristic:
The violation of the permissible monitoring range is saved and requires a RESET functionality. This occurs alternatively via:

- "Alarm Reset" module
- Function key on the front side of a basic module



Parameters:

Stop category 1

This option realizes monitoring of the controlled EMERGENCY STOP acc. to EN 60204. According to the normative definition the energy supply should here be disconnected after the drive has come to a halt. This is supported by a transition of the SSX-function Output value from "1" to "0".

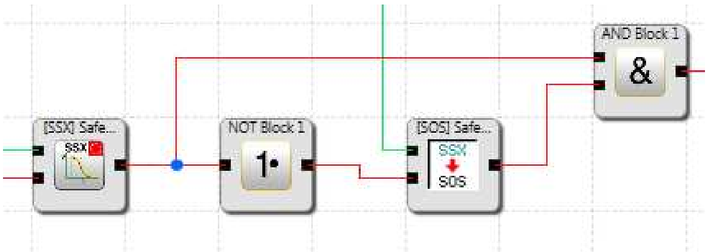
Stop category 2 (SOS after expected standstill)

This option realizes monitoring of the controlled EMERGENCY STOP acc. to EN 60204. After the ramp monitoring has expired, the drive is stopped without disconnection from the energy supply (Safe Operational Stop = Standstill). For this reason, the Output value remains art "1" after the SSX-limit curve has expired.

If no SOS-module has yet been defined in the Functional Scheme, the SSX must be extended by this function. All parameters required for the SOS-function, must be entered at the SOS Property Grid.

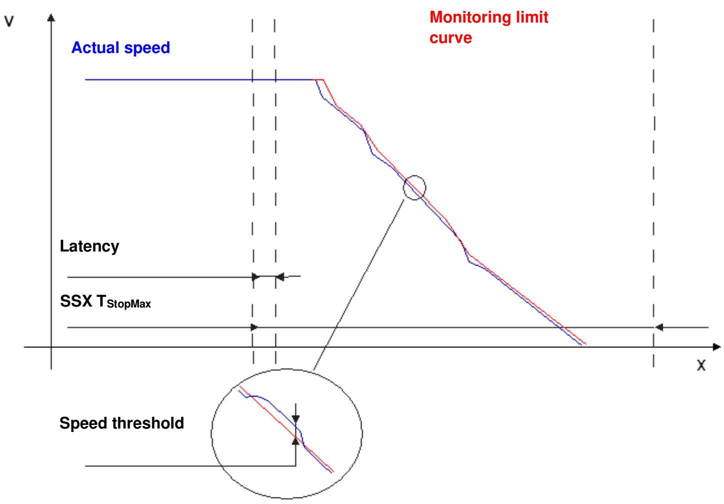
Note:

If the SSX-function is used in connection with SOS, the following circuitry must be used. If standstill is detected, the operating system will automatically activate the SOS-monitoring.

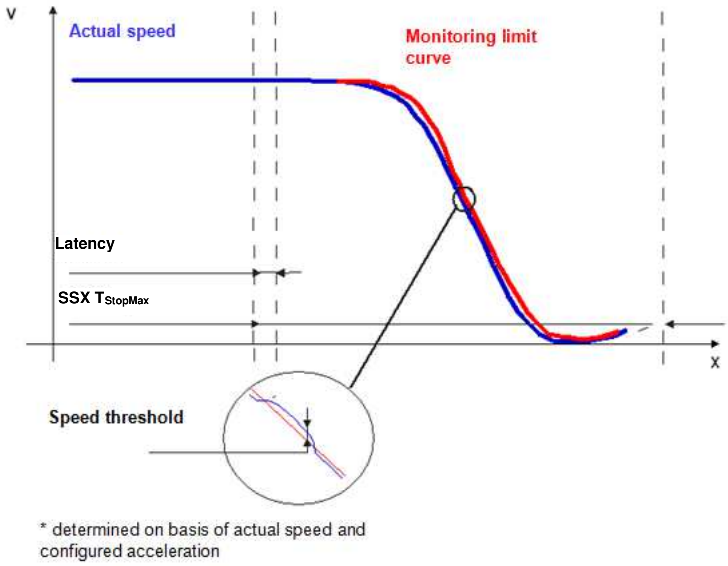


Curve Profile Type

- Linear
  Linear speed and constant acceleration curve for the stop sequence



- S-shape
  S-shape speed and linear acceleration curve for the stop sequence



Standard Latency Time

Latency until the occurrence of active deceleration

Speed Threshold

Speed threshold that must not be exceeded during the stopping process, as otherwise the energy supply will be disconnected.

Max. Acceleration

Default acceleration value to calculate the limit curve.

S-Ramp Time

Designates the period of time in which the speed changes in a non-linear fashion, or the time period for changing the acceleration from a=0 to $a=a_{max}$ or vice-versa

Input example:

On a manufacturing machine access to the working area is to be enabled at certain positions of the main feed axis for manual feeding or setup work. The drive remains active in this position and is only monitored for standstill. The limits of the working stroke are to be monitored electronically in safety-relevant mode, as a replacement of the mechanical safety limit switch. The movement to be actively monitored is a linear movement. An absolute encoder is positively connected with this main drive axis of the linear length measuring system. The drive works with an electric motor with integrated motor feedback system and intermediate gear.

1. **Selecting the stop category**

In order to keep times of standstill and restart as short as possible, the stop category 2 acc. to EN 60204 (controlled stop with drive subsequently actively controlled to V=0) is to be used => Select stop category 2

2. **Form of speed selection**

The drive/position controller uses a ramp limitation (jolt limitation) for the acceleration with resultant S-slip of the speed, in order to minimize deviations and processing marks => Select S-slip option

3. **Limit value selection**

For the purpose of monitoring one must enter the worst-case latency starting with the occurrence of the Emergency Stop event, until the start of the braking process, which is executed with the standard control. The program sequence time of the standard control results in: Latency = cycle time*2 = 50 ms

All other limit values are taken from the machine parameterization:

- Maximum feed speed = 300 mm/s²
- Maximum acceleration = 1000 mm/s²
- S-Ramp time 10 ms (empirically determined)

11.3.3.5 SLI (Safe Limited Increment)

Monitoring of the max. step size

Function: Monitoring of the max. permitted step size

Input: Standardized speed signal from encoder interface. Direction indication CW/CCW

RESET-function: The violation of the permissible monitoring range is saved and requires a RESET acknowledgement.

This occurs alternatively via:

- RESET function in the group of Input elements
- Function key on the front side of a basic module
- FBus reset element

Description of function:

- Monitoring of the max. permitted step measurement = relative travel range for uninterrupted travelling in jog mode.
- Calculation of the current sense of rotation on basis of speed signal
- Determination of the relative travel after the start of the movement.
- Monitoring for compliance with the predetermined direction and the max. relative travel

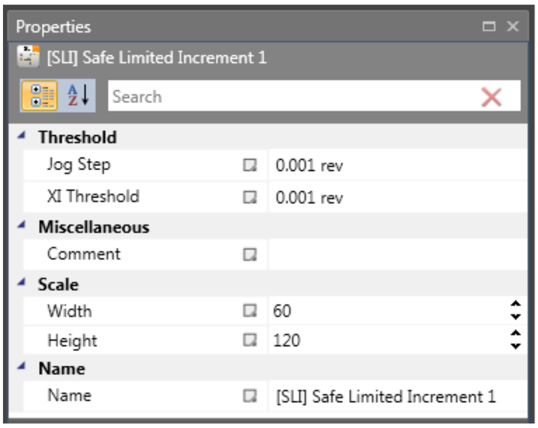
Note:

Inputs of SLI block have to be set to „0“ in case of a reset event. Otherwise the function could not be reset.

If the function is enabled, it’s not allowed that the input signals cw and ccw are enabled at the same time. If both are enabled an alarm will be generated.

Output function:

Range	HI	LO
V <= 0 AND DIRECTIONMARKER = ccw AND relative travel < max. step measurement	X	
V >= 0 AND DIRECTION MARKER = cw AND relative travel < max. step measurement	X	
V < 0 AND DIRECTION MARKER = cw OR relative travel > max. step measurement		X
V > 0 AND DIRECTIONMARKER = ccw OR relative travel > max. step measurement		X



Parameters:

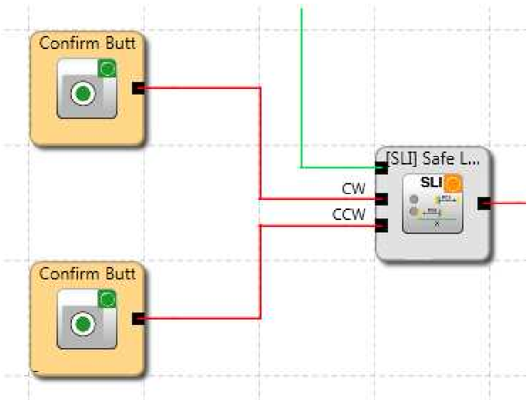
Jog Step

Step size - Maximum relative travel after activating the monitoring function

XI threshold

Tolerance threshold for monitoring the travel in opposite direction

Activation example:



Input example:

The max. travel in the material feed system of a manufacturing facility is to be safely monitored in jog mode. According to the risk analysis this travel is max. 50 mm. A faulty travel in opposite direction is to be monitored.

1. **Jog Step**

   The relative travel (only incremental encoder present) is monitored => Input of the max. permissible travel acc. to risk analysis with tolerance = 55 mm

2. **Travel direction monitoring**

   Tolerable travel in opposite direction (=creeping motion of drive) = 1 mm/s

3. Monitoring Input

The monitoring module has two inputs to specify the direction. An active direction signal activates the monitoring function.

11.3.3.6 SDI (Safe Direction)

Monitoring the pre-defined sense of rotation / direction of movement

Function: Monitoring the pre-defined sense of rotation / direction of movement

Input: Standardized speed signal from encoder interface. Direction marker CW/CCW

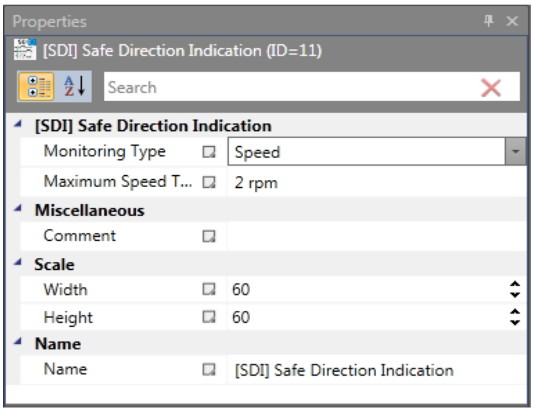
RESET-function: The violation of the permissible monitoring range is saved and requires a RESET acknowledgement.

This occurs alternatively via:

- RESET function in the group of Input elements
- Function key on the front side of a basic module
- FBus reset element

Output function:

Range	HI	LO
V <= 0 AND DIRECTIONMARKER = ccw	X	
V >= 0 AND DIRECTION MARKER = cw	X	
V < 0 AND DIRECTION MARKER = cw		X
V > 0 AND DIRECTION MARKER = ccw		X



Parameters:

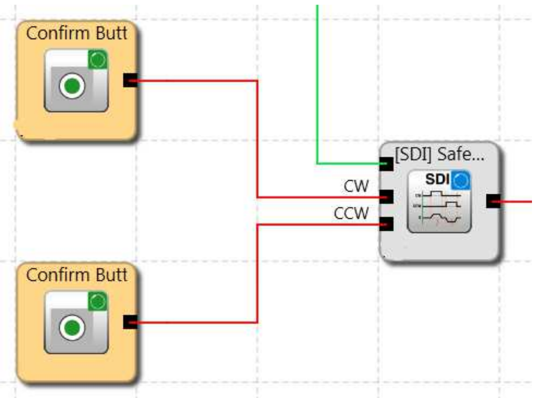
Monitoring Type

Select speed or position monitoring

Maximum Speed/Position Tolerance

Tolerance threshold for position or speed in opposite direction

Activation example:



Input example:

In a manufacturing device the speed of certain manual processes is to be monitored for a safe reduced value, as well as standstill and movement direction. The movement to be actively monitored is a rotary movement. The drive works with an electric motor with integrated motor feedback system and intermediate gear.

1. Input for monitoring function

Monitoring of speed (only incremental encoder present)
=> Speed

2. Speed monitoring

Tolerable speed in opposite direction (=Creeping of drive) from machine parameter = 1 mm/s

Monitoring Input:

The monitoring module has two inputs to specify the direction. An active direction signal activates the monitoring function.

Note:

Both input signals "1" are detected as non-permitted condition, causing an alarm message.

11.3.3.7 SLS (Safe Limited Speed)

Monitoring of a pre-defined minimum speed

Access-ID: Identification of function element

Function: Monitoring of a pre-defined minimum speed

Input: Standardized speed signal from the encoder interface

RESET-function: The violation of the permissible monitoring range is saved and requires a RESET acknowledgement.

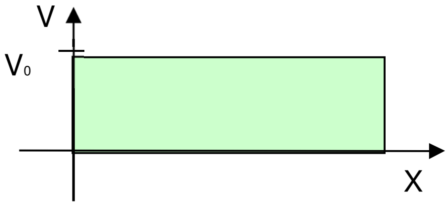
This occurs alternatively via:

- RESET function in the group of Input elements
- Function key on the front side of a basic module
- F-Bus reset element

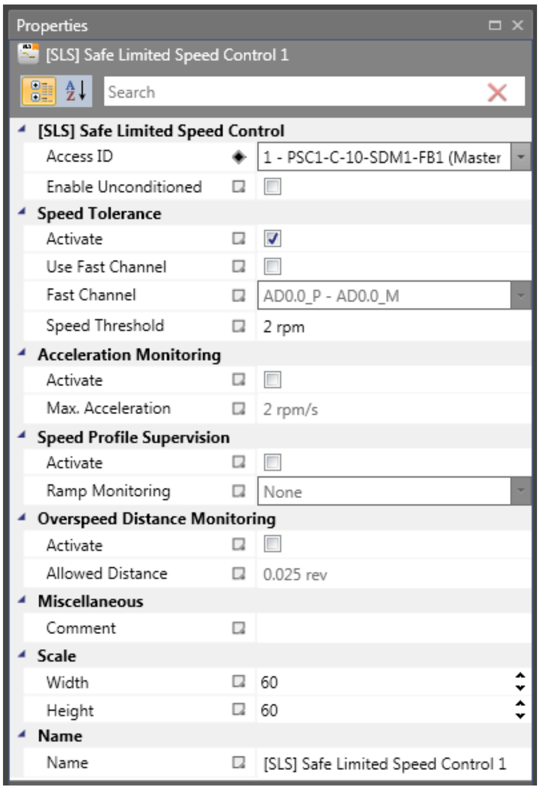
Description of function:

- Monitoring the pre-defined maximum speed of a drive.
- Comparison of the current speed with the parameterized speed threshold
- Monitoring of a speed transition from fast to slow.
- Overspeed distance monitoring

Output function:



Range	HI	LO
V < V0	X	
V >= V0		X



Parameters:

Enable unconditioned

If this option is set, the monitoring function has no Input connector. The function is active right from the start of the device.

Speed Tolerance - Activate

To activate speed monitoring

Use fast channel

The "Fast Channel" option can be used to achieve a shorter response time of the system. The respective semi-conductor outputs can alternatively be chosen in combination as cut-off channel.

ATTENTION:

Response time see installation manual !

Speed Threshold

Specification of maximum speed, alternatively max. rotational speed.

Max. Acceleration

Specification of the max. acceleration

Ramp Monitoring

This option monitors the transition of speed from fast to slow by using an SSX-functionality. The selected SSX-element must be available in the Functional Scheme.

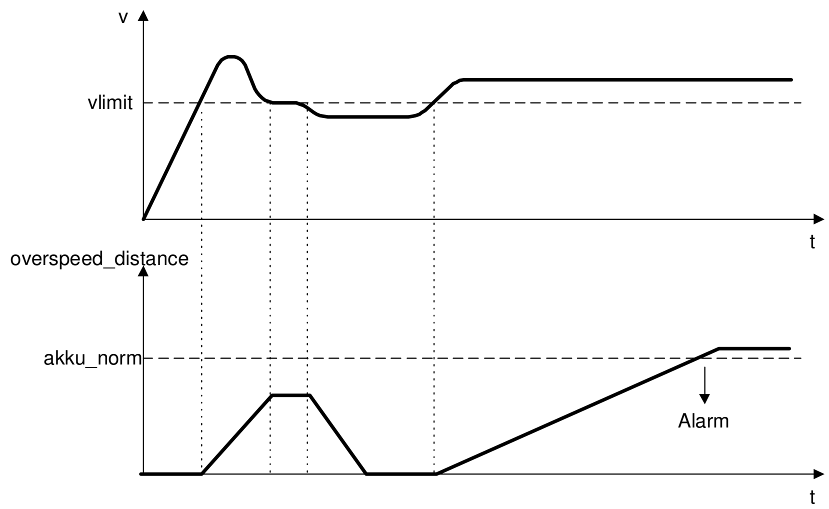
Overspeed Distance Monitoring

This additional functionality enables filtering of peak speeds in case of irregular travel operation (speed peaks in signal).

The path integral is calculated on basis of the difference between the current speed and the parameterized speed monitoring value and compared with the entered value. If the entered value is exceeded the monitoring function is triggered.
The function can only be activated if the acceleration monitoring function is switched off.

Example of Overspeed Distance Monitoring:

The graph shows an example for overspeed distance monitoring. A drive exceeds the threshold "vlimit", which is parameterized in the SLS-function. By exceeding this value, the speed above the threshold is integrated (= akku_norm). If the current speed drops below the threshold, the integral will also decrease down below the limitation. During the continuing process the speed will rise again and remain above the parameterized threshold. Therefore, the integral will also increase again, triggering an alarm when it exceeds the fault distance (=integrated speed proportion). The course of the fault integration can be visualized with the SCOPE-function.



ATTENTION:

When using this function, the response behavior of the application will change.

Reaction time:

The filter function extends the reaction time to the violation of the velocity limit v0 by the value T_{filter}. For the respective application, the total value of the reaction time $T_{react} = T_{dcs} + T_{filter}$ must be taken into account.

Parameter	Calculation method	Remark
Tdcs	Output reaction time	Refer to reaction time in installation manual
Tfilter	$\sqrt{2 \cdot \frac{XF}{a0}}$	Filter reaction time

Treact	Tfilter + Tdcs	Total reaction time
delta_v_filter	$\sqrt{2 \cdot XF \cdot a0}$	
v1(k2)	$\sqrt{2 \cdot XF \cdot a0} + v0 + a0 \cdot Tdcs$	Speed at the reaction set point

Note:

- Speed limit in SLS — v0 = constant
- Allowed distance (look to properties) — XF = constant
- Max. acceleration value of the application — a0 = constant

Input example:

In a manufacturing device the speed of certain manual processes is to be monitored for a safe reduced value, as well as standstill and movement direction. The movement to be actively monitored is a rotary movement. The drive works with an electric motor with integrated motor feedback system and intermediate gear.

1. **Speed monitoring**

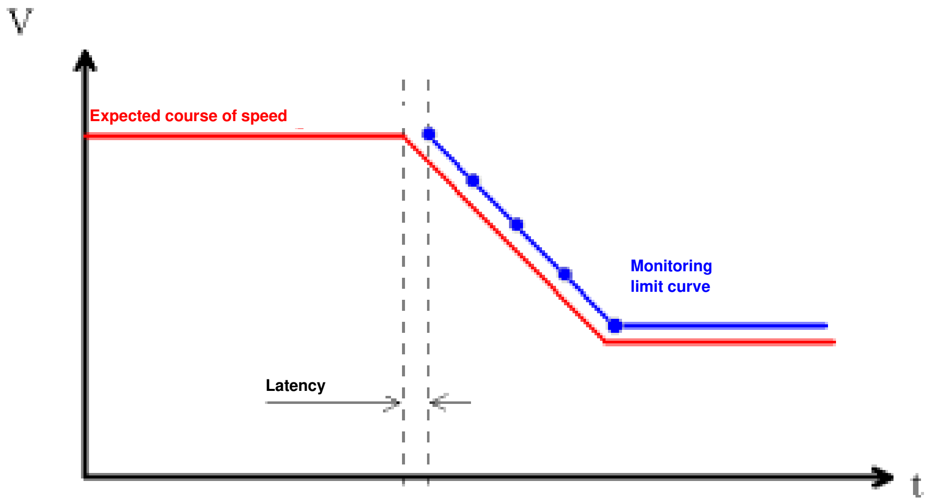
The safely reduced speed in manual mode is to be monitored => speed monitoring active with max. value from machine parameter = 50 rpm

2. **Acceleration monitoring**

The safely reduced acceleration in manual mode is to be monitored => acceleration monitoring active with max. value from machine parameter = 100 rpm/s

3. **Ramp monitoring**

For speed and ramp monitoring SSX must already be inserted and configured in the project. The transition from a fast to a slower (= parameter max. speed) speed can now be monitored (see graph).



When activating the SLS, the parameterized SSX is automatically activated via the SLS. The SSX monitors the ramp course of the speed. If the actual speed is lower than the SLS threshold, the SLS will take over the further monitoring, until the SLS is deactivated again.

The ramp course can be diagnosed with the SCOPE function.

Notes:

- If the used SSX is activated during "SLS ramp monitoring" i.e. by a normal EMERGENCY STOP function, the parameterized SSX-connection is always prioritized.
- The SSX-function is always activated by the SLS, if the current speed is higher than the SLS-threshold.
- If the calculated speed profile is exceeded when changing the speed from fast to slow, this is saved in both monitoring functions SLS and SSX.
- If several SLS-functions with ramp monitoring are activated, the lowest parameterized SLS-threshold value is used as threshold value for the SSX-ramp.

11.3.3.8 SOS (Safe Operational Stop)

Standstill monitoring

Function: Standstill monitoring

Input: Standardized speed signal from encoder interface.

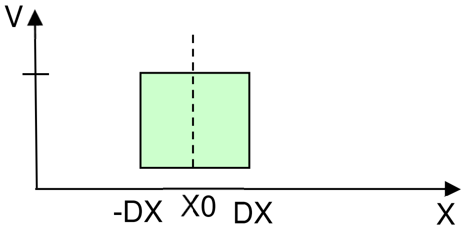
RESET-function: The violation of the permissible monitoring range is saved and requires a RESET acknowledgement.

This occurs alternatively via:

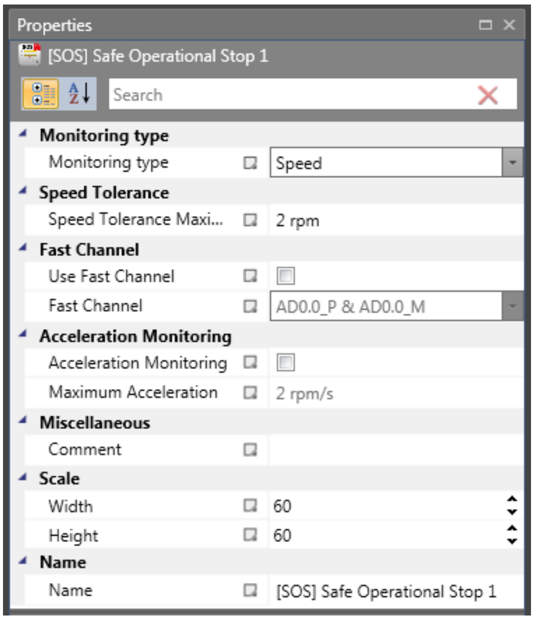
- RESET function in the group of Input elements
- Function key on the front side of a basic module
- FBus reset element

Description of function:
Standstill monitoring of drive at the current position Comparison of the current speed with the parameterized monitoring slot

<u>Output function:</u>



Range	HI	LO
X > (X0 – DX) AND X < (X0 + DX)	X	
X <= (X0 - DX)		X
X >= (X0 + DX)		X



Parameters:

Monitoring type

Determination of the monitoring type for standstill to a minimum speed threshold or a position slot

Speed Tolerance Maximum

Permissible speed or a relative deviation from the actual position at the time when the SOS-functionality is activated.

Use fast channel

The "Fast Channel" option can be used to achieve a shorter response time of the system. The respective semi-conductor outputs can alternatively be chosen in combination as cut-off channel.

ATTENTION:

Response time see installation manual !

Maximum Acceleration

Optional maximum value for acceleration monitoring during an active SOS-function.

Input example 1:

In a manufacturing device the speed of certain manual processes is to be monitored for a safe reduced value, as well as standstill and movement direction. The movement to be actively monitored is a rotary movement. The drive works with an electric motor with integrated motor feedback system and intermediate gear.

1. **Selecting the type**

Only the speed is monitored (e.g. by means of incremental encoder) => speed monitoring

2. **Speed monitoring**

Specification of the tolerable speed monitoring value

Input example 2:

On a manufacturing machine access to the working area is to be enabled at certain positions of the main feed axis for manual feeding or setup work. The drive remains active in this position and is only monitored for standstill. The limits of the working stroke are variable and are to be monitored electronically in safety-relevant mode, as a replacement of the mechanical safety limit switch. The movement to be actively monitored is a linear movement. An absolute encoder is positively connected with this main drive axis of the linear length measuring system. The drive works with an electric motor with integrated motor feedback system and intermediate gear.

1. **Selecting the type**

The position is monitored (absolute encoder available) => position monitoring

2. **Position monitoring**

Specification of the tolerable position monitoring value

11.3.4 Muting Functions

11.3.4.1 PDM (Safe Position Muting)

Temporal hiding of the 2-channel encoder evaluation in case of encoder position deviation or an encoder "RESET"

Function: Hiding (muting) the encoder diagnostics

Note:

This function may have a considerable effect on the safety of an application. One must make absolutely sure that the use of the PDM-function will not cause any situations that may adversely affect safety!

Description of function:

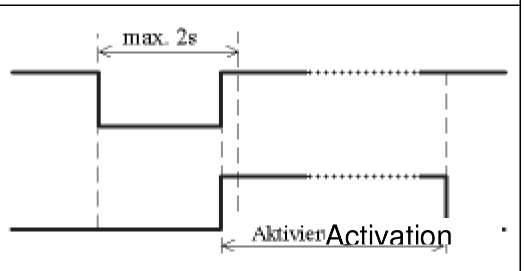
- Automatic activation in case of an alarm
  Switching off the encoder diagnostics for an existing A3303/A3304
- Auto compare of encoder data (in case of Incr./SSI is configured)
  The encoder diagnostics is suppressed over the parameterized activation period

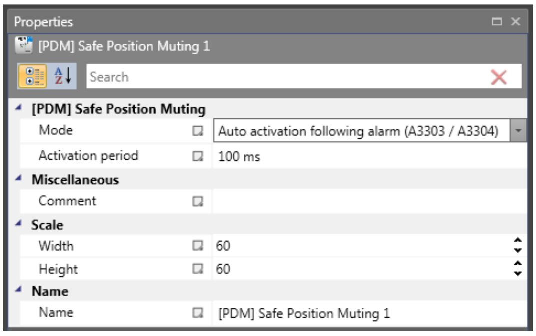
Input:

The PDM-function should be activated by means of e.g. a safety directed key-switch or a similar installation. In normal condition the activation signal for the PDM-function is "1". The Input is time monitored and needs to execute an edge change from "1" to "0" and from "0" to "1" within two seconds. Only then is the PDM-function available.

Output:

In deactivated condition this function sends the result "0" and in activated condition a "1" to the process image.

Switching behavior	
Input	
Output	



Parameters :

Mode

- **Automatic activation in case of alarm A3303/A3304**
  Suppression of the plausibility test for speed and position over the duration of the activation time from a fault A3303/A3304.

  Application example: e.g. lifting platform with 2 encoder systems

  A lifting platform is equipped with two drive systems and assigned encoder systems (both SSI-encoders). The encoders are connected with the PSC1-module and monitor the horizontal position of the platform. If the platforms drifts to a slanted position (position deviation of encoders) the alarm triggered by this condition cannot be reset. By activating this PDM-function the user is able to bring the platform back to horizontal position.

Notes:

- Perhaps a speed fault (A3301/A3302) is first detected in case of an encoder deviation. After resetting the fault with the drive at standstill the position deviation fault A3303/A3304 is then displayed.
- When activating this function, the encoder monitoring is switched off for the configured period of time. In this case the user must ensure that the moved drive does not pose any danger to persons or properties.

Mode

- **Auto compare of encoder data**
  Suppression of the plausibility test for speed and position over the duration of the activation time without any further pre-conditions.

  Application example:
  Compensation of position drifting in a friction wheel application.
  A drive system is equipped with a position encoder with friction wheel drive. After several operation cycles a difference occurs between absolute encoder and second channel. The absolute encoder needs to be reset at a defined position, but the drive system is to remain active (= RUN) during that time. Resetting the encoder during operation would possibly result in high speed or acceleration values, which would cause a shut-down, even though the drive is already in standstill.

Notes:

- The user needs to ensure that the drive is at standstill when the encoder is preset.
- In a "Preset" the encoder can only be set to a value range 0 < x < measuring length!

Activation period

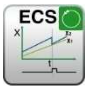
Time in milli-seconds after which the suppression is automatically removed.

Input range: 100ms … 25s

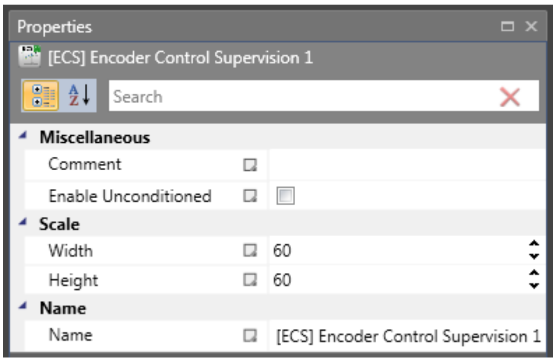
Note:

Once the monitoring function can be temporarily deactivated with the help of this function, particular attention must be paid when it is used!

11.3.4.2 ECS (Encoder Control Supervision)



User defined evaluation of encoder status.



Note:

Since this function is critical with respect to safety, the user must check when and how the individual functionalities may be used. He must additionally make sure that the reliability is independent from the application and needs to be individually approved.

Function: Evaluation of the encoder error status in the logic diagram.

Reset characteristic: This function does not trigger an alarm. The correct behavior for cases of shut-down and release of the affected outputs must be assured by the user program.

Input: The function can be permanently activated or activated through an input.

RESET-function: not applicable

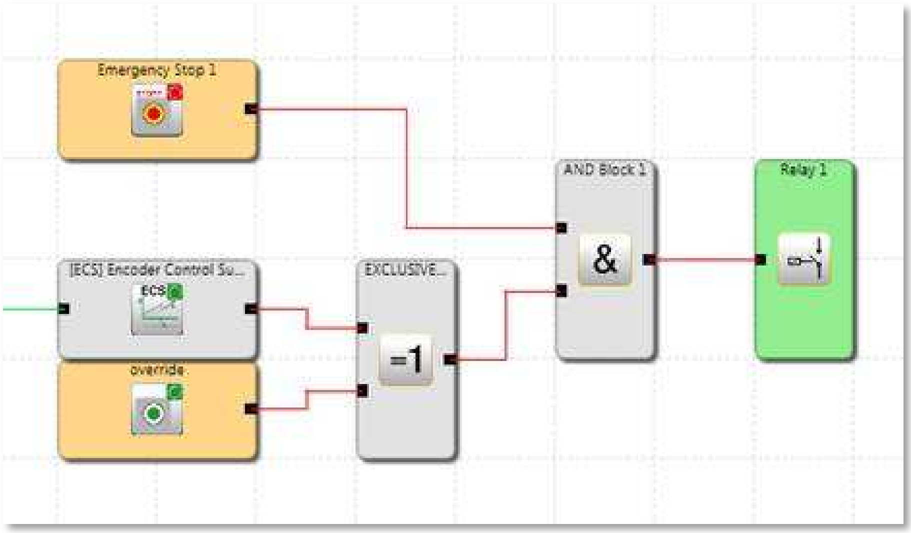
Description of function:
The detection of safe speed and position is based on a multitude of measures and various fault reactions in the form of alarm messages. Without the use of an ECS–element the operating system will switch the PSC1-system to status **RUN → ALARM** when a speed/position fault is detected. All outputs will be passivated immediately.

Inserting an ECS-element into the function block diagram suppresses this state change and the operating system remains in **RUN** condition. The PLC-program now needs to use the status of the ECS-element to trigger the required measures to avoid dangerous conditions in the application. Alarm messages of the encoder interface with identical reference number are identified with the prefix “E”.

Application:

As long as the ECS block is not used, the monitoring unit will change to alarm or fault mode in case of encoder errors and switches the outputs automatically off. When using the ECS function block, the user takes over the treatment of errors for any cases in which encoder errors are detected. This enables e.g. monitored travel movements by an operator, in order to move the application to a suitable position for fault rectification.

The output of the function block has been set (High), if **no** encoder related error is present.



Example for the use of the ECS-function

The ECS-function mutes encoder alarm functions listed below:

System A	System B	Diagnostics function
3209	3210	Monitoring the encoder voltage X1
3213	3214	Monitoring the encoder voltage X2
3229	3230	Plausibility test for encoder voltage (Dynamic test)
3237	3238	Test of the analogue encoder AIN1 (on request)
3239	3240	Test of the analogue encoder AIN2 (on request)
3309	3310	Diagnose speed test of maximum speed (axis 1)
3329	3330	Diagnose speed test of maximum speed (axis 2)
3301	3302	Speed test (comparison) of the two encoders (axis 1)
3321	3322	Speed test (comparison) of the two encoders (axis 2)
3303	3304	Position test (comparison) of the two encoders (axis 1)
3323	3324	Position test (comparison) of the two encoders (axis 2)

System A	System B	Diagnostics function
3307	3308	Inspection of the measuring length for permissible range (axis 1)
3327	3328	Inspection of the measuring length for permissible range (axis 2)
3317	3318	Monitoring of the counting signal for track A X1
3337	3338	Monitoring of the counting signal for track A X2
3313	3314	Monitoring of the SSI encoder value for impermissible jump (axis 1)
3333	3334	Monitoring of the SSI encoder value for impermissible jump (axis 2)
3407	3408	Difference level monitoring (axis 1)
3409	3410	Difference level monitoring (axis 2)
3411	3412	SIN/COS plausibility monitoring (axis 1)
3413	3414	SIN/COS plausibility monitoring (axis 2)
3415	3416	Level monitoring proxy
3451	3452	Frequency monitoring of the reference signal
3453	3454	Monitoring of the transfer ratio reference signal / measured signal
3457	3458	Monitoring the Uref on the Extended Board
3459	3460	Diagnose of amplitude monitoring
3461	3462	General diagnostic status PIC faulty
3463	3464	Diagnose of signal level
3465	3466	Form factor analysis of the measured signal
3469	3470	Monitoring of the permissible quadrant
3471	3472	Supply voltage monitoring
3473	3474	Signal level Input monitoring
3475	3476	Monitoring of the counting signal separated for track A/B
3551	3552	Fault in 1. status bit of the SSI_Ext encoder(axis 1)
3553	3554	Fault in 2. status bit of the SSI_Ext encoder (axis 1)
3555	3556	Fault in 3. status bit of the SSI_Ext encoder (axis 1)
3557	3558	Fault in 4. status bit of the SSI_Ext encoder (axis 1)
3559	3560	Fault in 5. status bit of the SSI_Ext encoder (axis 1)
3561	3562	Fault in 1. status bit of the SSI_Ext encoder (axis 2)
3563	3564	Fault in 2. status bit of the SSI_Ext encoder (axis 2)

System A	System B	Diagnostics function
3565	3566	Fault in 3. status bit of the SSI_Ext encoder (axis 2)
3567	3568	Fault in 4. status bit of the SSI_Ext encoder (axis 2)
3569	3570	Fault in 5. status bit of the SSI_Ext encoder (axis 2)
3571	3572	Fault in 1. status bit of the SSI encoder
3573	3574	Fault in 2. status bit of the SSI encoder
3575	3576	Fault in 3. status bit of the SSI encoder
3577	3578	Fault in 4. status bit of the SSI encoder
3579	3580	Fault in 5. status bit of the SSI encoder

Only one ECS can be used per axis.

11.3.4.3 ICS (Input Elements Muting)

Muting of the monitoring of the digital inputs

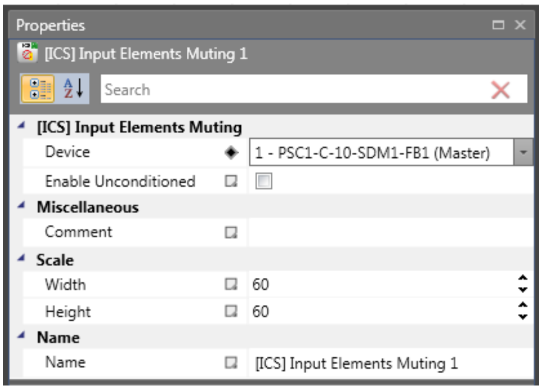
Number: see chapter “The Safety Functions”

Function: Muting of the monitoring of the digital inputs for correct test pulse sequence (if configured) and input function

RESET-Function: not applicable

Note:

This function has important influence on the safety level of an application. It has to be analyzed that the use of this function will not reduce the required safety level within the complete operational range of the application!



Description of the function:
By activation of this ICS-element all possible alarms on the monitoring of the digital inputs such as:

- Monitoring of the correct pulse (if configured) on the input lines
- Monitoring of the correct function on the input lines

are muted. The system remains in the RUN-state if such an alarm status occurs.

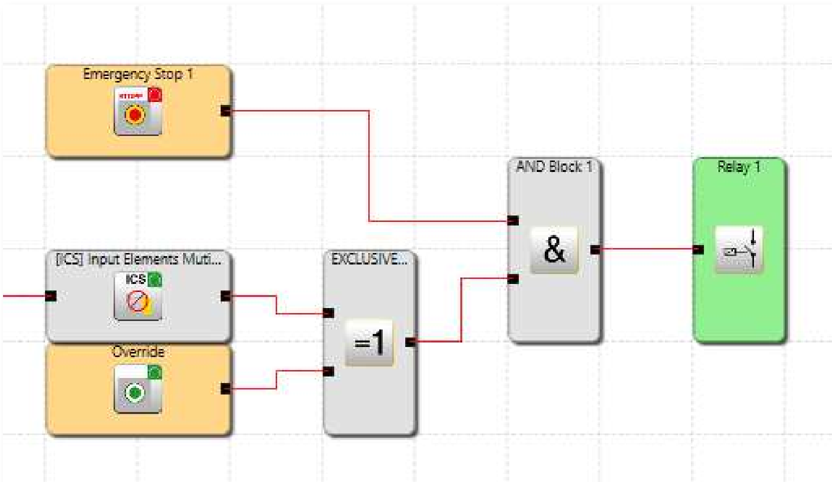
The automatic monitoring of the digital inputs has to be substitute by an adequate method within the PLC-program by using the output status of this function block.

Detected alarms are shown with the prefix E and the same reference as under normal conditions.

Application:

As long as the ICS block is not used, the monitoring unit will change to alarm or fault mode in case of encoder errors and switches the outputs automatically off. When using the ECS function block, the user takes over the treatment of errors for any cases in which encoder errors are detected. This enables e.g. monitored travel movements by an operator, in order to move the application to a suitable position for fault rectification.

The output of the function block has been set (High), if **no** input related error is present.



11.3.4.4 DEM (Dynamic Encoder Mute)

Function: Muting of alarm from encoder diagnostics, starting from a parameterizable limiting speed.

RESET- Function: not applicable

Note:

DEM-function can only be used for axis parametrized without position processing.

Description of function / Operation:

- Alarm muting of encoder diagnostic functions if a parametrizable speed tolerance is exceeded and function is enabled.
- If a safety function with the same axis will be enabled the DEM-function will be disabled.
- The alarm status of encoder diagnostics will be internally saved. Status FALSE (encoder alarm) will be cleared if the speed muting gets inactive.
- The saved alarm status will generate an alarm if another safety function will be enabled during muting.

Output:
The output signalized the status (only diagnostic) of this function and will be cleared depending of the muting function if the muting gets inactive.

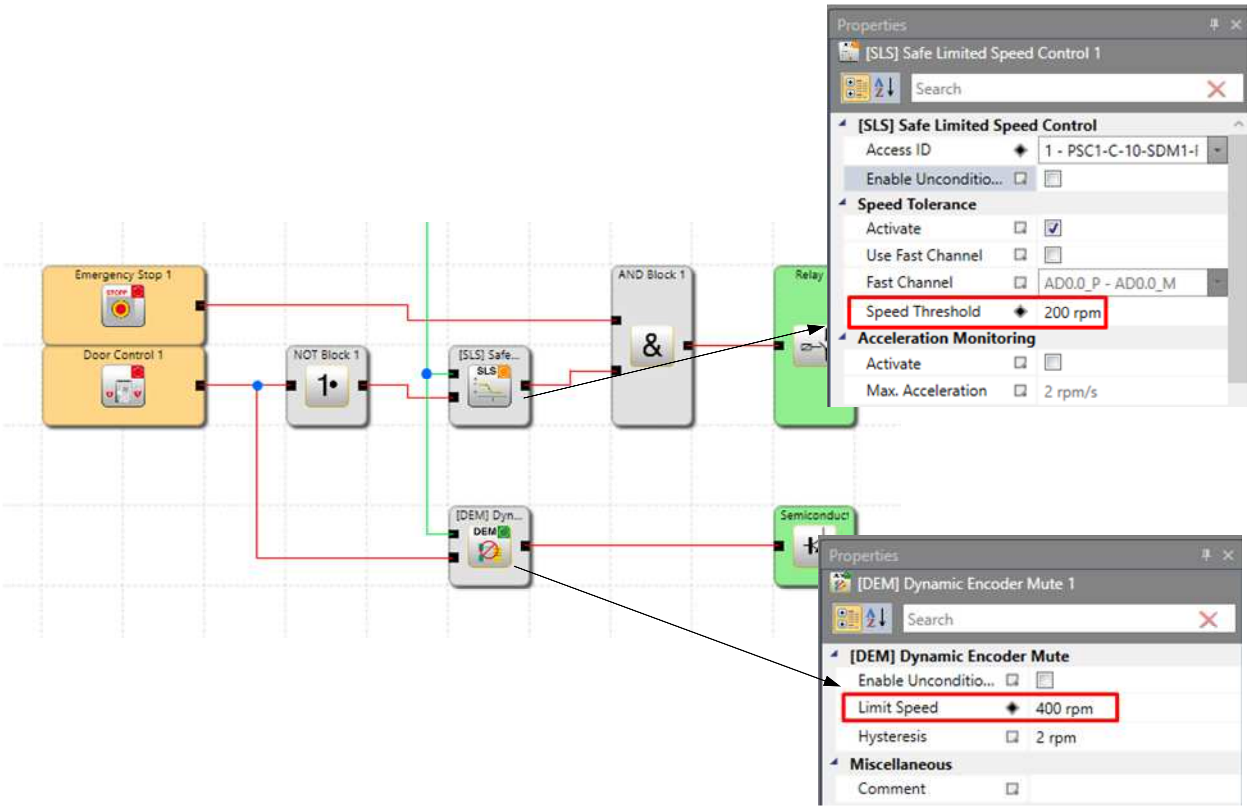
Safety advice:

- The speed threshold should be always much greater than the speed threshold in other safety functions used the axis number.
- The output of DEM should be evaluated. The evaluation is not safety related and can be done in a non safe controller.
- The signal used for enable the DEM-function has to be the highest SIL or PL level as the other safety functions on the same axis.

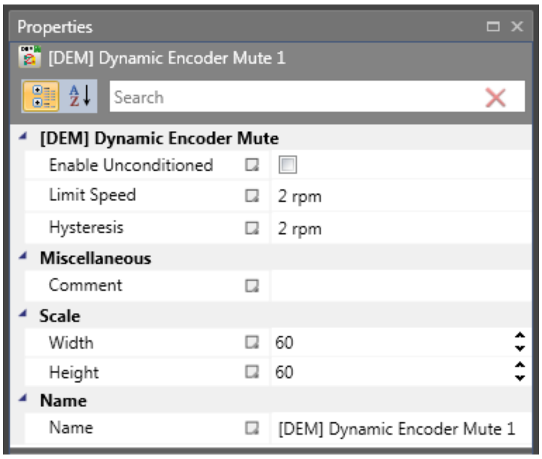
Example:

DEM function axis1 with SLS according to PI_d and SOS according to PI_e. The activation of DEM will be if door is closed. Closed state will be controlled with a door – monitoring block.

- Highest level PI = PI_e, Input signal has to be PI_e
- Door- monitoring signal has to be PI_e
- Example:
  2-pole positively driven door contact in electrical and mechanical design according to Ple, connected to PSC1 with activated short circuit monitoring.



Parameters:



Enable unconditioned

If this option is set, the monitoring function has no Input connector. The function is active right from the start of the device.

Limit speed

If this value will be exceeded the muting function will be enabled.

Note:

"Limit Speed" also defines the max. input values for the speed limits in the functions SLS, SOS, SDI and SCA. Their input values must always be smaller than the muting speed limit.

Hysteresis

To avoid a toggle in the enable of the function a hysteresis value can be set:

- Enable function: Speed threshold + Hysteresis
- Disable function: Speed threshold

11.3.4.5 EOS (External offset setup)

Sets encoder position to configured position value

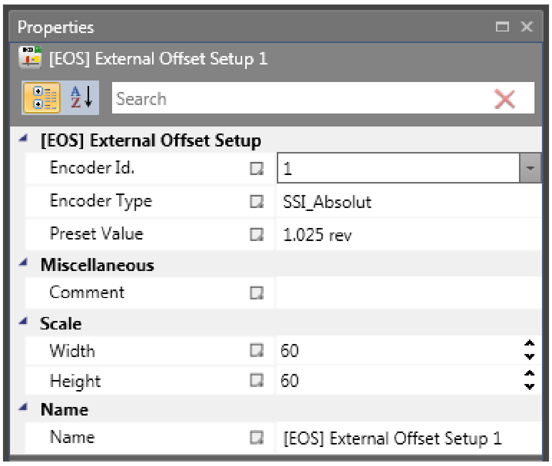
Note:

EOS can only be used with multiturn-encoders; singleturn-encoders are not allowed.

Function:	Calculation of an offset value for position encoders based on a parametrizable Set position derived from the current encoder position. By activating the EOS-function the current position value is adapted to a parametrizable preset value by recalculating and setting of the offset value. The offset value is in this case permanently saved.
Input:	Position signal X from the encoder interface.
Reset function:	not applicable

Description of function / Operation:
Activation of this function starts with a rising edge at the input of the function.

The EOS-function can only be used after position processing has been activated and absolute encoder (e.g. SSI-encoder) has been parameterized on the selected encoder channel.



Parameters:

This module can subsequently be parameterized in the Functional Scheme. For this purpose the sensor channel is chosen by selecting the respective encoder number. The specification of the preset value takes place in the physical unit chosen for the measuring distance.

Encoder Id.

Choice of sensor connected to Encoder A (= 1) or Encoder B (= 2).

Encoder Type
Choice of encoder type.

Preset Value
Preset value (set position) for selected encoder.

Notes:

- Max. one EOS-function can be used for an absolute encoder.
- Any operational activation of the EOS-function must be ruled out. The function serves the purpose of service and maintenance. This must be assured by choosing suitable operating means for triggering this function. Suitable operating means are e.g. key switch, only accessible for qualified service and maintenance personnel.
- Suitable organizational measures must be applied to ensure compliance between the physical position of the axis and the Set position.
- The calculated offset value is permanently stored in the device.
- ECS-function has to be enabled during the use of EOS-function for correct working.

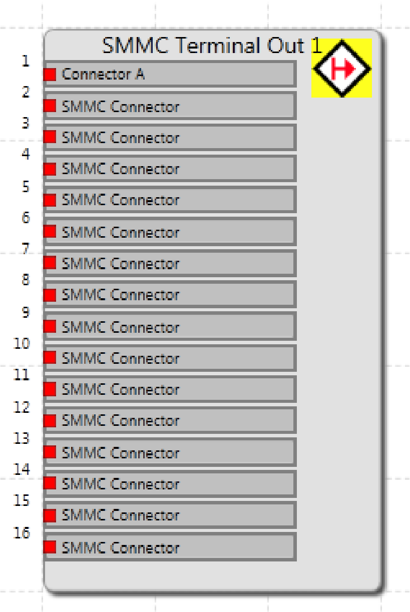
11.3.5 Global Network Elements

Global Network elements include one SMMC terminal Out and adequate Terminal In blocks

.

11.3.5.1 SMMC Terminal Out

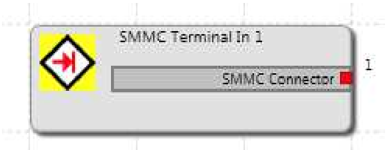
This block represents Terminal Out for SMMC. Each device can write 16 bits as output to SMMC. These bits are defined by connection to SMMC Terminal Out connectors.

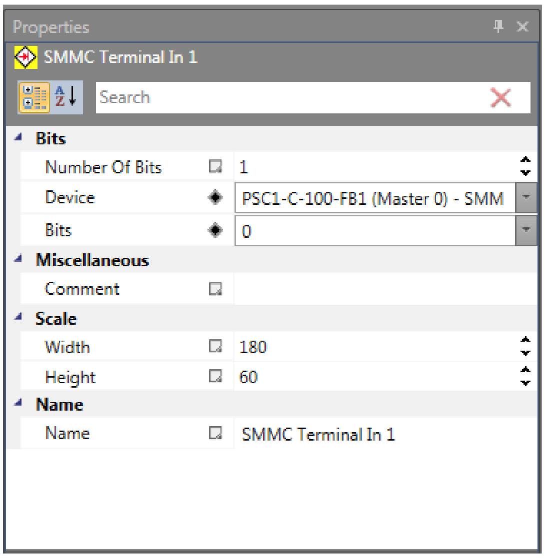


User can change the name of each used Terminal Out connector.

11.3.5.2 SMMC Terminal In

This block represents Terminal In for SMMC and will be available after the user configured the related “SMMC Terminal Out” in any Functional Scheme.





Parameters:

Number Of Bits

Number of bits available for Terminal In. Number must be greater or equal to 1 and less or equal to 16.

Device

Selection of SMMC device.

Bits

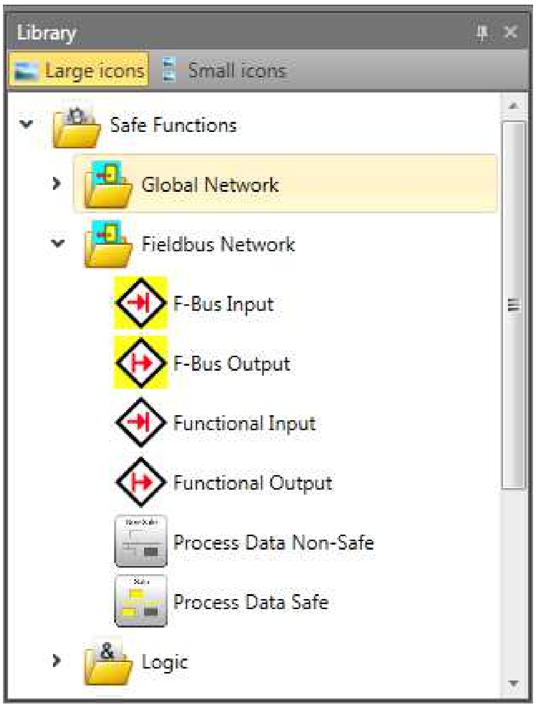
Range of available bits depends of selected number of bits.

Name

User can define name of SMMC terminal.

11.3.6 Fieldbus Network Elements

Fieldbus Network Elements are shown in Library under Fieldbus Network folder if Functional Scheme Tab is selected. These elements are shown on picture below. Shown functions depend on chosen device and Usage. For description of elements refer to chapter 10.3.

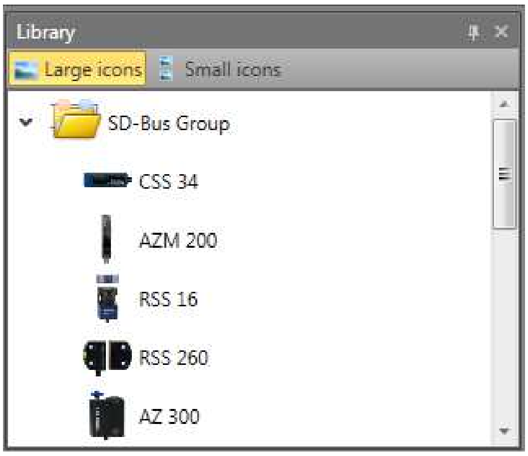


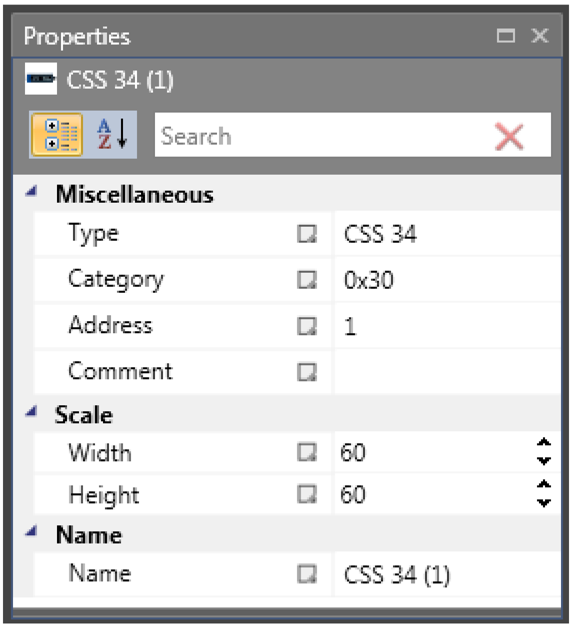
11.3.7 SD-Bus Group Elements

SD-Bus Device elements are the logical representation of the real SD-Bus compatible safety switching devices.

For this reason, each SD-Bus Device element is generally identified in the respective scheme by an icon with the associated device type name.

Up to 31 components (SD-Bus compatible safety devices) can be wired in series:





Properties of SD-Bus Device elements

Parameters

Type

Type of the SD-Bus element. The type cannot be edited.

Category

The device category identifies the type of switching device. The category is described by a hexadecimal number which is equivalent to the following types. The category cannot be edited.

Address

The address is a value between 1 and 31 and cannot be edited in Property Grid. This address depends on SD-Bus chain scheme.

Comment

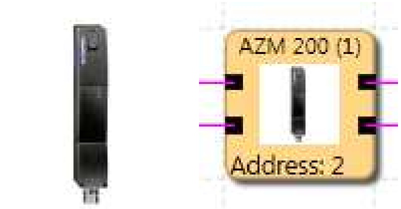
A text to be displayed on the block. It is possible to enter own comment text.

11.3.7.1 CSS 34

Safety sensor

11.3.7.2 AZM 200

Solenoid safety interlock



11.3.7.3 RSS 16

Safety sensor

11.3.7.4 RSS 260

Safety sensor

11.3.7.5 AZ 300

Safety switch.

11.3.7.6 MZM 120B

Safety interlock, „B“-type.


11.3.7.7 MZM 120BM

Safety interlock, „BM“-type.


11.3.7.8 MZM 120-1BM

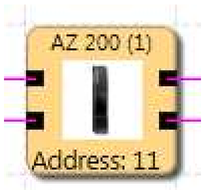
Safety interlock, „BM“-type.


11.3.7.9 MZM 100

Safety interlock, „Z“-type.

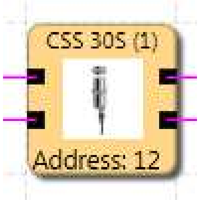

11.3.7.10 AZ 200

Safety switch.

11.3.7.11 CSS 30S

Safety sensor

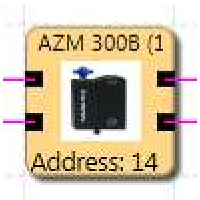



11.3.7.12 MZM 100B

Safety interlock, „B“-type.

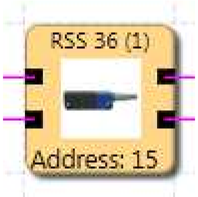

11.3.7.13 AZM 300B

Safety interlock, „B“-type.

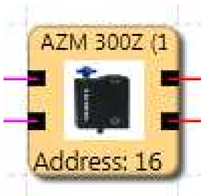
11.3.7.14 RSS 36

Safety sensor

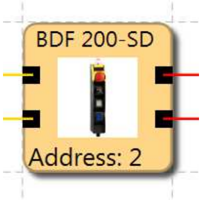
11.3.7.15 AZM 300Z

Safety interlock, „Z“-type.

11.3.7.16 BDF 200-SD

Control panel with integrated E-Stop

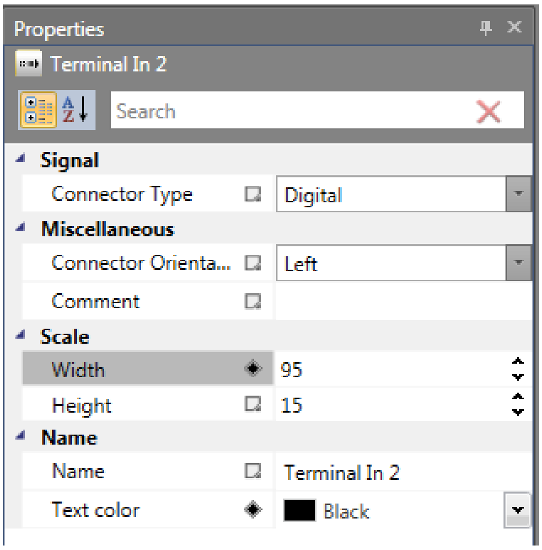


11.3.8 Terminals

These elements serve the clear representation of Functional Schemes. They can also be used to make signals available on other sheets. These elements provide “Output/Input connecting point” elements.

11.3.8.1 Terminal In

These elements provide Output connecting point elements.



Terminal In properties grid

Parameters:

Connector Type

Type of the signal.

Connector orientation

Selecting orientation of connecting point in Canvas.

<u>Note:</u>

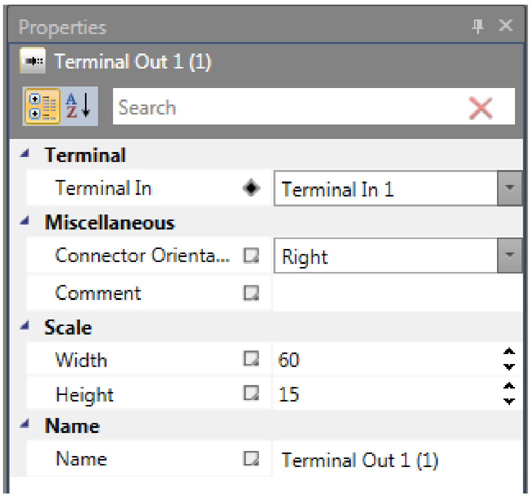
When deleting “Connecting point” elements, which are referenced by “Output” blocks, the user will receive a warning. When confirmed, the dependent function blocks will be deleted. If no associated “Terminal Out” block has been defined, this will result in a compiler error: “Not assigned Terminal Out”.

Tip:

Use the comment line. The entered comment will simplify the assignment of elements.

11.3.8.2 Terminal Out

This element enables the continuation of a signal, which leads to a “Terminal In” function block. According to this, these elements can only be inserted after a “Terminal In” element has been defined.



Parameters:

Connector orientation

Selecting orientation of connecting point in Canvas.

Terminal In

Identification of the “Terminal In” connecting point.

Note:

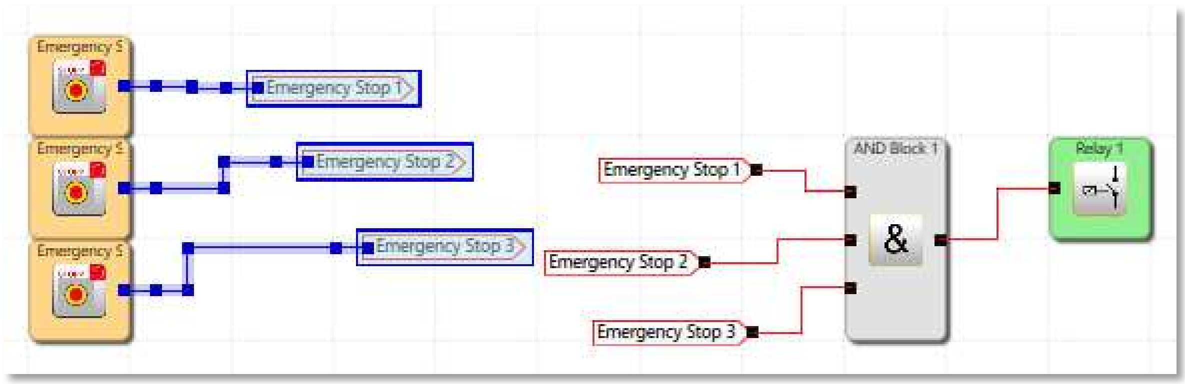
Since this element refers to the set “Terminal In” element, the comment for this element is displayed.

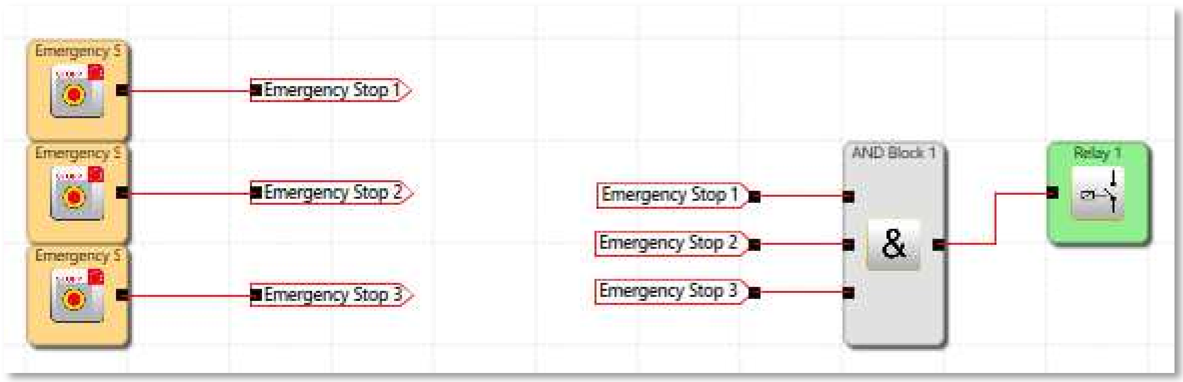
11.3.8.3 Alignment of terminals

Via the buttons in the Layout tab terminals can be aligned.

	Align left	The terminals will be aligned at the terminal being furthest to the left.
	Align right	The terminals will be aligned at the terminal being furthest to the right.
	Align Terminal	The terminals are centered to their corresponding function block connector.

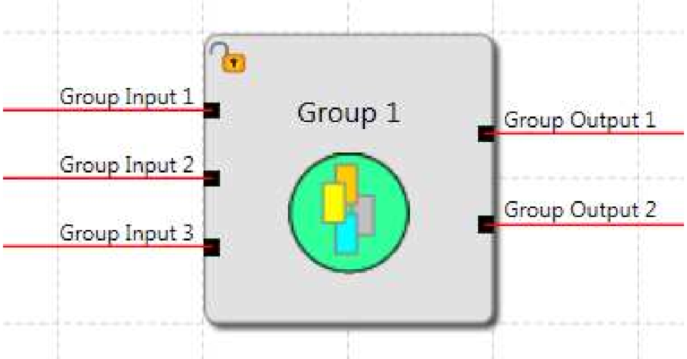
Example





11.3.9 Groups

Function groups connect several functional blocks to a capsulated logic structure.



This grouping gives the function chart a much clearer structure - and makes it easier to read and maintain. The function for exporting and importing group elements can also be used to create a separate function library.

Note:

A group is not the same as a function block. The group is rather to be understood as a graphical simplification and is processed accordingly during compilation.

11.3.9.1 Creating the Group:

1. Create Group Block

1.1. Creating an empty Function Group

Library window contain New Group element. To adding new group, drag a “New Group “ element from Library window and drop it in Functional Scheme Canvas. Created group has no in-and output interface.

1.2. Creating a function group from selection

The size of the group elements is determined with the mouse pointer:

1. First position the mouse pointer with the left mouse button in the left upper corner of the group frame <u>and hold the mouse button pressed</u>.
2. Then drag the mouse pointer while holding the left mouse button pressed and determine the right bottom corner of the group area.
3. Click right mouse button on selection and create a new group that will insert the group frame and allow to open group tab for editing.
4. Blocks that cannot be transferred to the group are listed in an info box.

2. Adding function blocks to the group

The group drawing area can be opened either by double-clicking on the group box or via the group sheet in the tree view of the "Browser" area. As long as the group is not locked, function modules can be inserted, moved or deleted.

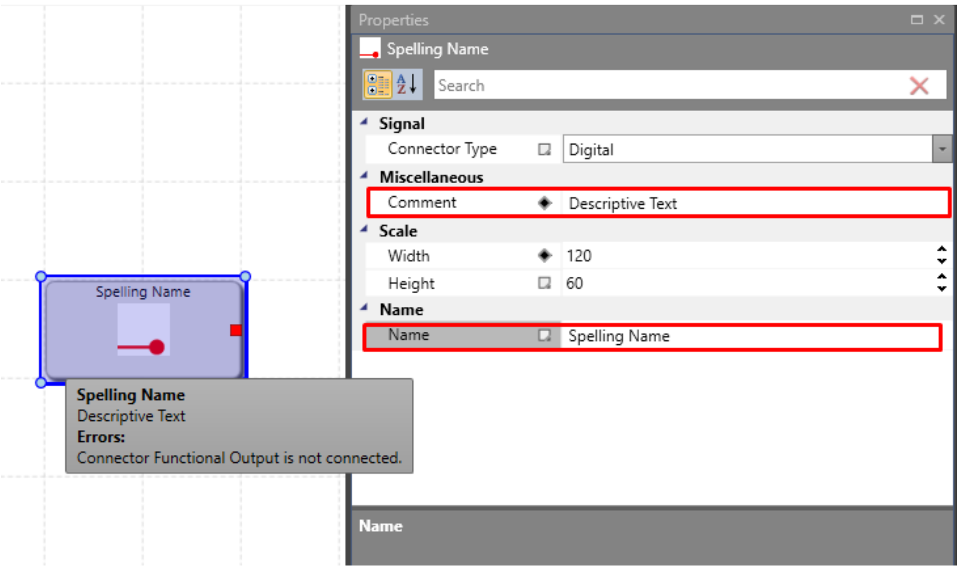
Note:

- You cannot include function blocks by simply placing them on the group block. Instead, the modules must be moved into the group sheet.
- Only logic modules and monitoring functions (e.g. SLS) are permitted for the group. Input and output modules as well as predefined elements, such as encoder modules, are not permitted.
- The group is limited to one drawing sheet.

3. Adding interface Input/Output

Insert a group interface block by dragging and dropping a group input/output from the Group Interface folder in the Library window to the appropriate group. The function modules contained in a group can only be linked to the function elements outside the group box using these interface modules. The connector type must be set in this interface. When using the group, only one input/output signal of the same type is accepted.

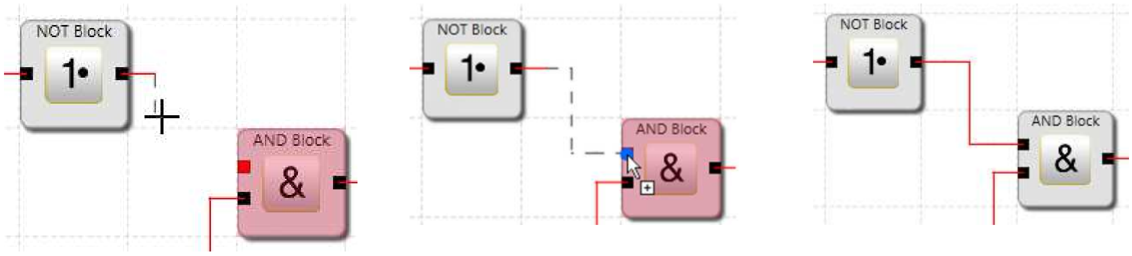
The inputs/outputs should be named via the respective input dialog. Further information can also be entered in the Comment field.



- ➢ Please see chapter 11.3.9 for further details

.

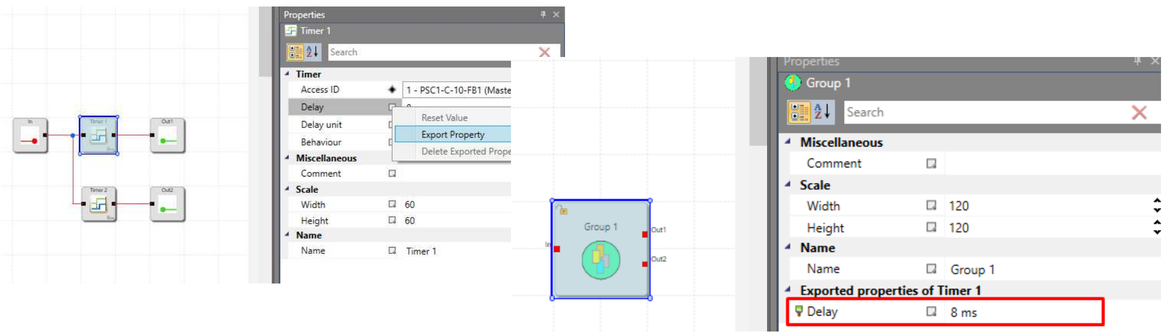
4. Create connections



The logic elements are connected according to the description in section 5.5 Wiring.

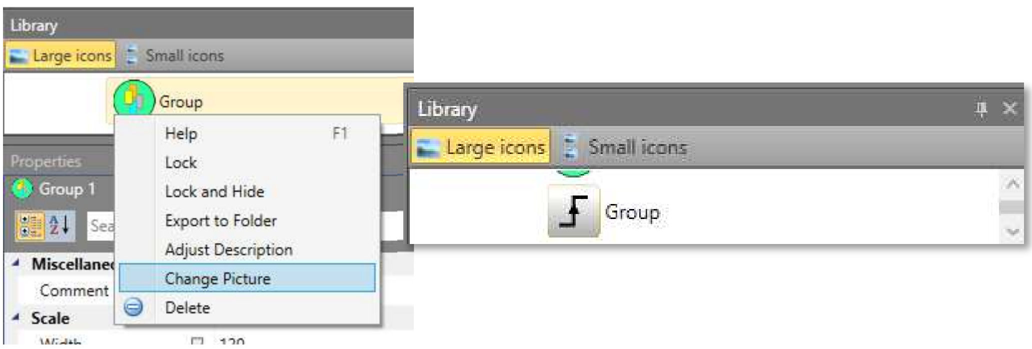
11.3.9.2 Exporting properties

Parameters of elements within a group can also be made accessible from outside the group. This simplifies the reusability of the groups and further improves the maintainability of the application as changeable values can be better highlighted.

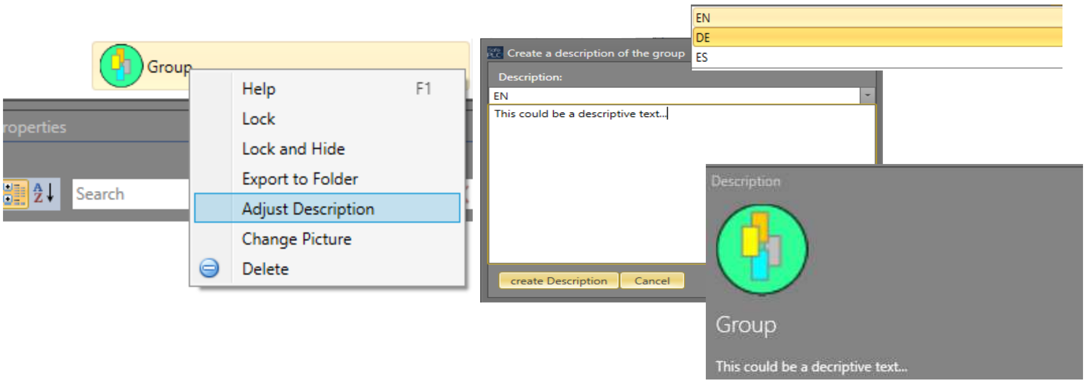


11.3.9.3 Change picture

An image can be assigned to a group to further improve the readability of the application. The image must be in png format and ideally have a square aspect ratio.



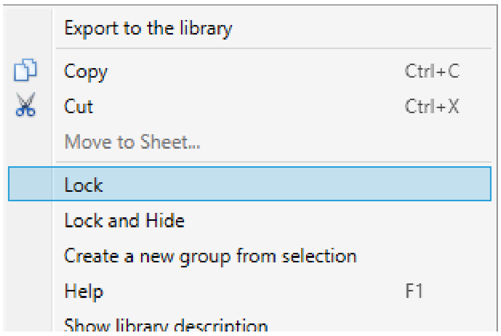
11.3.9.4 Adjust description



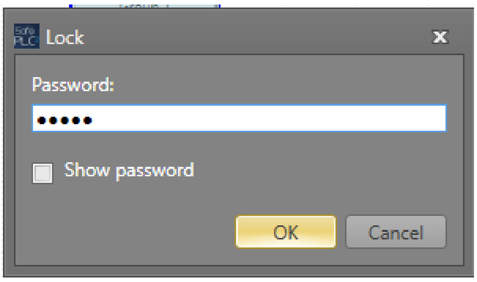
A description can be added to groups to make it easier to reuse them. Independent of the set language in SafePLC2 the description text can be entered for all supported languages.

11.3.9.5 Locking a group

When you right-click on a group, the context menu with the *Lock* option is displayed.



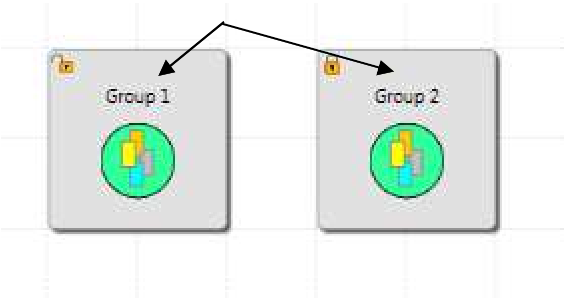
A password must be specified for the locked group. The password must be at least 5 characters long.



This option locks editing and links the function blocks to the group:

- Modules can no longer be removed from the group, whereby the configuration of parameters is still permitted.
- Deleting a group frame also deletes all group blocks.
- No new blocks can be added to the group.

The group status "locked" is indicated by the padlock symbol in the group block at the top left.

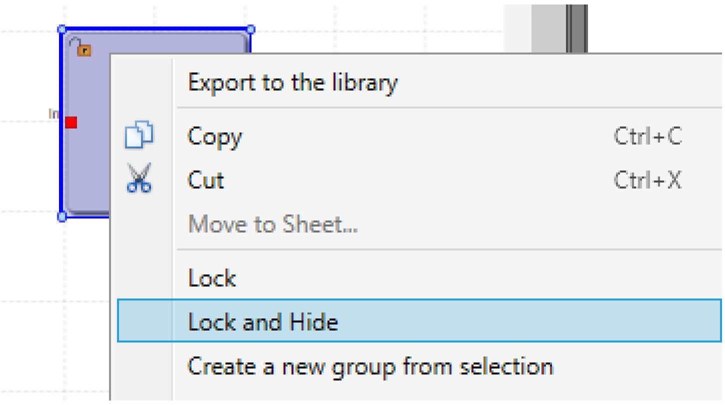


Group locked / unlocked

When inserting a New Group block the Lock function is initially not set.

11.3.9.6 Lock and hide

If you right-click on a group, the context menu with the option *Lock&Hide* is displayed.

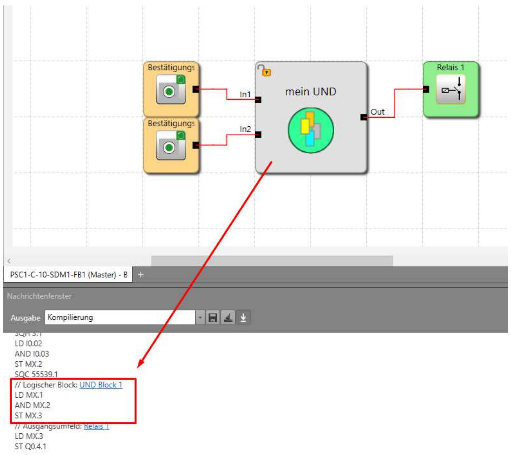


A hidden group is indicated by an additional symbol:

<u>Note:</u> The change is only valid after a restart

In addition to the locking of the group described in 11.3.8.5, it is no longer possible to display the contents. If this is desired, the following points must be observed.

- It is no longer possible to diagnose the signals within a group. A possible error search is thus limited to the periphery of the group
- For later validation of the application, the corresponding IL snippets for the group must be available. Please note that depending on the complexity of a group, it is not necessarily compiled as a block.



<u>Note</u>: *Lock&Hide* is only available for unlocked groups.

11.3.9.7 Reusing groups

11.3.9.7.1 Exporting/Importing a function group

If you right-click the group, the Export to library option is displayed.

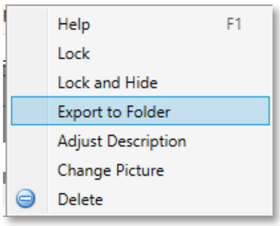
Note:
The group cannot be renamed in the Library window.

An exported group can be imported into another group sheet. This allows you to create a library of predefined function groups that can be imported into new projects. The import process includes checking the encoder configuration and the resources still available in the function block diagram. The group can only be imported if the resources are available for all modules. Especially for position-dependent monitoring modules, the necessary encoder settings must be checked. If a resource is no longer available, a corresponding error message is displayed.

Note:
In case of resource errors, make sure that the encoder settings meet the requirements of the group. This is especially true if position-dependent modules (SEL, SLP, SCA) were used in the function groups.

11.3.9.7.2 Exporting groups to a storage device

Right-clicking on a group in the library opens the following dialog:



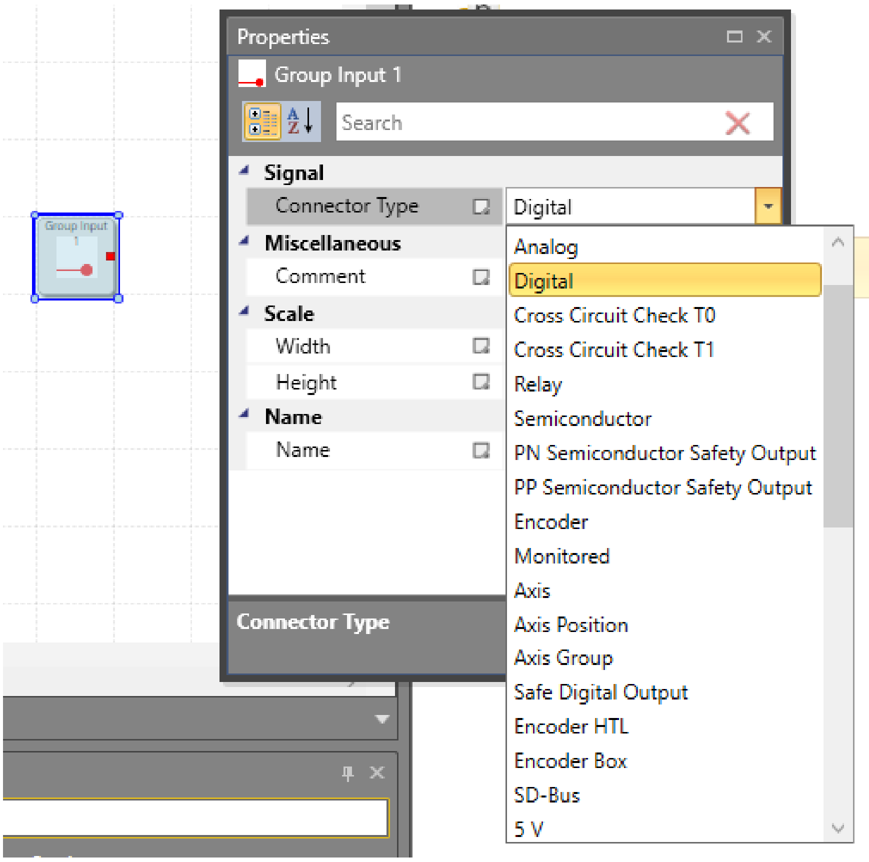
With the function Export to Folder the group can be saved on any storage device and thus be made available to other users.

11.3.9.7.3 Importing groups from a storage device

The Import Group function can be used to load previously exported groups into the library where they are available for further use.

11.3.10 Group interface

The function modules contained in a group can only be linked to the function elements outside the group box via these interface modules. To insert a group interface block, drag and drop a group input/output from the Group Interface folder in the Library window into the corresponding group. The connection type must be set in this interface. When using the group, only one input/output signal of the same type is accepted.



Group Input

This element represents the connection of function blocks outside the group to the group elements. The block should be positioned on the left side of the group area, if this is possible. The Output connector must be further wired inside the group.

Group Output

This icon transfers a result from the group to externally located function block diagram elements.

Note:

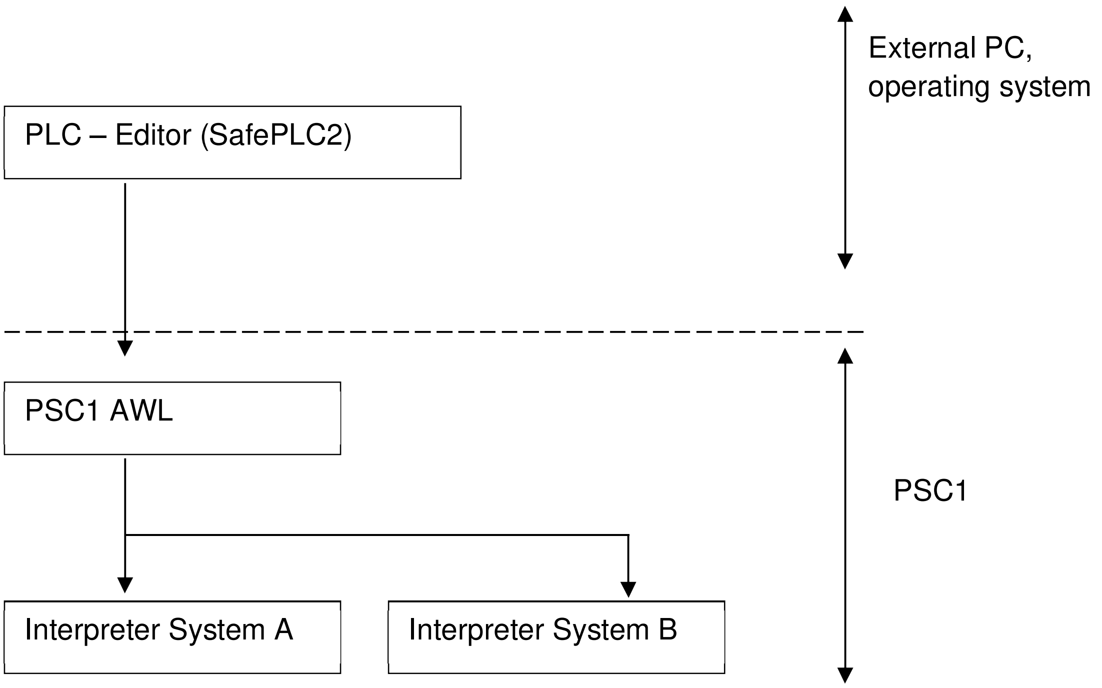
Input/Output blocks can be deleted only in Group sheet

12 Appendix - Process Image

12.1 Introduction

The PSC1-system is able to execute interpreter code in real-time.

With an external, not safety related PLC-editor (SafePLC2) a program can be created in function block representation as specified in IEC 61131, compiled and saved in the format **PSCAWL**. The same program adds the **PSCAWL -** instructions to the configuration data and transmits the data to the PSC1.



Evidence of the correct assignment of inputs and outputs must be provided by the user within the scope of a safety documentation (validation report).

The PSC1 AWL-CODE is executed by both systems in each cycle. For this purpose, the input variables used in the program are linked in compliance with the interpreter code.

The result of the interpreter run is obtained by:

- Setting/re-setting one or several variables in the initial process image
- enabling/disabling monitoring functions
- setting/ re-setting outputs
- setting/ re-setting terminals / marker
- starting and stopping timers

The AWL-code generated by the compiler must be verified within the validation process. Exceptions are the so-called MACRO-functions, which are internally 2-channel tested by the PSC1-system. In the MACRO-function only the connection of inputs must be verified. MACRO-functions refer e.g. to two-hand operation.

12.2 Description of Function Elements

The following description is required for executing the application validation.

12.2.1 PLC – Commands

The following list contains all commands used within the PSC1-system:

Operator	Operand	Description
LD	all input and output operands	Equates current result with operand
LD NOT	all input and output operands	Equates current result with operand and inverts the operand
ST	only output operands	Saves current result to operand address
AND	all input and output operands	Boolean AND
AND NOT	all input and output operands	Negated Boolean AND
OR	all input and output operands	Boolean OR
OR NOT	all input and output operands	Negated Boolean OR
XOR	all input and output operands	Boolean Exclusive OR
NOT	all input and output operands	Inverts the accumulator value
SET MARKER	PLC_MARKER in output image	Sets marker
RESET MARKER	PLC_MARKER in output image	Resets marker

Operator	Operand	Description
SET	all input and output operands	Sets operand to 1
RESET	all input and output operands	Sets operand to 0
MACRO_INFO	Description of macro element	Operand field: 2 byte for macro identification
MACRO_CRC	CRC the previous macro field	Operand field: 1. Operand: CRC_LO (8 Bit) 2. Operand: CRC_HI (8 Bit)
INFO	Info field	Operand field: 1. Operand: reserved 2. Operand: reserved

12.2.2 Designation of safety functions

The designations of safety functions are as follows:

Function	Function name acc. to EN 61800–5–2 or PSC1 - designation
SLS	Safe Limited Speed
SOS	Safe Operational Stop
SDI	Safe Direction
SSX	Safe Stop 1 or 2
SLI	Safe Limited Increment
SCA	Safe Cam
SEL	Safe Emergency Limit
SLP	Safe Limited Position
PDM	Position Deviation Muting (PSC1-function)
ECS	Encoder Control Supervision (PSC1-function)

12.2.3 Input variables in function block diagram for PSC1-C-10 devices

Note:

The output values of the monitoring functions must be considered as inputs in the process image!

Index	PAE-variable	Bit Pos.	Bit variable	Description
1	Config_ID			0x3001 fixed
2	DriveBASE	0 1 2 3 4 5		0 .. 2 always “1” 3 Reset monitoring functions 4 ECS result axis 1 5 ECS result axis 2
3	DriveSLI	0 1	SLI.0 SLI.1	Results SLI
4	EA2_In8	0 .. 7	I2.0 .. I2.7	Extension inputs
5	DriveEMU	0 1	EMU.1 EMU.2	Results EMU
6	DriveSCA	0 .. 7 0 .. 7	SCA.1 .. SCA.8 SCA.9 .. SCA.16	Results SCA
7	DriveSSX	0 1 2 3	SSX.1 SSX.2 SSX.3 SSX.4	Results SSX
8	DriveSOS	0 1	SOS.1 SOS.2	Results SOS
9	DriveSLP	0 1	SLP.1 SLP.2	Results SLP
10	DriveSEL	0 1	SEL.1 SEL.2	Results SEL
11	DriveSLS	0 .. 7	SLS.1 .. SLS.8	Results SLS
12	DriveSDI	0 1	SDI.1 SDI.2	Results SDI
13	DriveSAC	0 .. 7	SAC.1 .. SAC.8	Results SAC
14	DriveSF	0 1	PDM_EN.1 PDM_EN.2	Results PDM
15	DI8	0 .. 7	I0.0 .. I0.7	Hardware inputs basic block 1 .. 8
16	DI16	0 .. 7	I0.8 .. I0.15	Hardware inputs basic block 9..16
17	DI24	0 .. 7	I1.0 .. I1.7	Hardware inputs PSC31 Extension with log. address 1 inputs 1 – 8

Index	PAE-variable	Bit Pos.	Bit variable	Description
18	DI32	0 .. 7	I1.8 .. I1.11	Hardware inputs PSC31 Extension with log. address 1 inputs 9 – 12 and extension with log. address 2 inputs 9 – 12
19	PLCTimer16	0 .. 7	PLCT.9 .. PLCT.16	Results PLC Timer
20	Reserve1			Reserve
21	StartTimer	0 .. 1 2 .. 3 4 .. 5 6 .. 7	MET.1 MET.2 MET.3 MET.4	Output start element with time
22	Outp2HandTimer	0	MEZ.1	Output two-hand with time
23	Start element	0	MES.1	Output start element
24	Start-up Test	0 1	MEA.1 MEA.2	Output start-up test
25	PLC Timer	0 .. 7	PLCT.1 .. PLCT.8	Results PLC_Timer
26	DriveTTS	0 1 2 3	IQI2.7 IQI2.8 IQI2.9 IQI2.10	
27	AIn1			Analogue input 1
28	AIn2			Analogue input 2
29	AIn3			Analogue input 3
30	AIn4			Analogue input 4
31	SysACC Axis1		SysAcc[0]	current system acceleration axis 1
32	SysACC Axis2		SysAcc[1]	current system acceleration axis 2
33	Limit20Axis1		Limit20[0]	Limit for GOTO monitoring axis 1
34	Limit20Axcis2		Limit20[1]	Limit for GOTO monitoring axis 2
35	Pos20Axis1		Position20[0]	Current position axis 1
36	Pos20Axis2		Position20[1]	Current position axis 2
37	BG20Axis1		BG20[0]	Range limit axis 1
38	BG20Axis2		BG20[1]	Range limit axis 2
39	StopDistAxis1		StopDistanz20[0]	Current stop distance axis 1
40	StopDistAxis2		StopDistanz20[1]	Current stop distance axis 2
41	SysSpeed Axis1		SysSpeed[0]	Current speed axis 1
42	SysSpeed Axis2		SysSpeed[1]	Current speed axis 2

Index	PAE-variable	Bit Pos.	Bit variable	Description
43	AnalogAdder			Analogue adder
44	EA_IN8	0 .. 7	IQI1.0 .. IQI1.7	Extension inputs PSC31 with log. address 1
45	EA_IN16	0 .. 7	IQI1.8 .. IQI1.9 IQI2.0 .. IQI2.5	Log. address 1 Log. address 1 Log. address 2 Log. address 2
46	Start element Timer2	0 1 2 3	MET.5 MET.6 MET.7 MET.8	Output start element with time
47	EMU 31 1 1	0 1 2 3 4 5 6 7	EMU31_1.1 EMU31_1.2 EMU31_1.3 EMU31_1.4 EMU31_1.5 EMU31_1.6 EMU31_1.7 EMU31_1.8	EMU results PSC31 with log. address 1
48	EMU 31 1 1	0 1	EMU31_1.9 EMU31_1.10	EMU results PSC31 with log. address 1
49	EMU 31 1 2	0 1 2 3 4 5 6 7	EMU31_2.1 EMU31_2.2 EMU31_2.3 EMU31_2.4 EMU31_2.5 EMU31_2.6 EMU31_2.7 EMU31_2.8	EMU results PSC31 with log. address 2
50	EMU 31 1 2	0 1	EMU31_2.9 EMU31_2.10	EMU results PSC31 with log. address 2
51	Reserve3 PAE			Reserve
52	Reserve			Reserve
53	Reserve			Reserve
54	Reserve 2_0 PAE			Reserve
55	Reserve 2_1 PAE			Reserve
56	Reserve 2_2 PAE			Reserve
57	Reserve 2_3 PAE			Reserve

Index	PAE-variable	Bit Pos.	Bit variable	Description
58	Reserve 2_4 PAE			Reserve
59	Reserve 2_5 PAE			Reserve

12.2.4 Input variables in function block diagram for PSC1-C-100 devices

Input variables for the PLC-system are marked by:

- affiliation to the system image of the PSC1-C-100 system
- the unambiguously determined address (byte index in system image, bit index in entry of system image)
- by the 1-bit value of the input variable (TRUE or FALSE)
  Type of input variables: HW-inputs, RESULT of the monitoring function, RESULT of markers, RESULT of timers
- access to the input variables always takes place bitwise

Syntax and addressing:

Idx	PAE name	Description
1	Drive SAC 1-8	Result SAC function 1…48
2	Drive SAC 9-16	
3	Drive SAC 17-24	
4	Drive SAC 25-32	
5	Drive SAC 33-40	
6	Drive SAC 41-48	
7	Drive SDI 1-8	Result SDI Function 1-12
8	Drive SDI 9-16	Bit 13-16 not used
9	Drive SLI 1-8	Result SLI Function 1-12
10	Drive SLI 9-16	Bit 13-16 not used
11	Drive SEL 1-8	Result SEL Function 1-12
12	Drive SEL 9-16	Bit 13-16 not used
13	Drive SSX 1-8	Result SSX Function 1-24
14	Drive SSX 9-16	
15	Drive SSX 17-24	
16	Drive Base	DRB_STAT.1 = ESTOP external DRB_STAT.2 = RUNNING DRB_STAT.3 = LOCK DRB_STAT.4 = RESET
17	Drive SLP 1-8	Result SLP Function 1-12
18	Drive SLP 9-16	Bit 13-16 not used

Idx	PAE name	Description
19	Drive SLS 1-8	Result SLS Function 1-48
20	Drive SLS 9-16	
21	Drive SLS 17-24	
22	Drive SLS 25-32	
23	Drive SLS 33-40	
24	Drive SLS 41-48	
25	Drive SCA 1-8	Result SCA Function 1-64
26	Drive SCA 9-16	
27	Drive SCA 17-24	
28	Drive SCA 25-32	
29	Drive SCA 33-40	
30	Drive SCA 41-48	
31	Drive SCA 49-56	
32	Drive SCA 57-64	
33	Drive SF 1-8	Not used
34	Drive SF 9-16	
35	Drive SOS 1-8	Result SOS Function 1-12
36	Drive SOS 9-16	Bit 13-16 not used
37	Drive PDM 1-8	Not used
38	Drive PDM 9-16	
39	Drive ECS 1-8	Result ECS Function 1-12
40	Drive ECS 9-16	Bit 13-16 not used
41	Drive ACS 1-8	Result ACS Function 1-12
42	Drive ACS 9-16	Bit 13-16 not used
43	Drive EMU 1-8	Result EMU Function 1-16
44	Drive EMU 9-16	
45	PLC Timer 1-8	Result PLC Timer 1 -64
46	PLC Timer 9-16	
47	PLC Timer 17-24	
48	PLC Timer 25-32	
49	PLC Timer 33-40	
50	PLC Timer 41-48	
51	PLC Timer 49-56	
52	PLC Timer 57-64	
53	FunctionalInp 1-8	Functional inPorts 1-32
54	FunctionalInp 9-16	
55	FunctionalInp 17-24	
56	FunctionalInp 25-32	

Idx	PAE name	Description
57	StartElement Timer 1-8	Results for inPort time monitored 1…64
58	StartElement Timer 9-16	
59	StartElement Timer 17-24	
60	StartElement Timer 25-32	
61	StartElement Timer 33-40	
62	StartElement Timer 41-48	
63	StartElement Timer 49-56	
64	StartElement Timer 57-64	
65	Start-up Test 1-8	Result of start behavior monitored
66	Start-up Test 8-16	
67	Start-up Test 17-24	
68	Start-up Test 25-32	
69	Start-up Test 33-40	
70	Start-up Test 41-48	
71	Start-up Test 49-56	
72	Start-up Test 57-64	
73	Outp2HandTimer 1-8	Result of Two-hand button
74	Outp2HandTimer 9-16	
75	Digital Inp 1-8	InPort Master E0.1 bis E0.12
76	Digital Inp 9-16	
77	Digital Inp 17-24	InPort Master IQI0.1 bis E0.8
78	Digital Inp 25-32	InPort Master IQI0.9 bis E0.16
79	Digital Inp 33-40	InPort Master IQI0.17 bis E0.24
80	Digital Inp 41-48	InPort Master IQI0.25 bis E0.32
81	Digital Inp 49-56	InPort Master IQI0.33 bis E0.40
82	Digital Inp 57-64	Not used
83	Digital Inp 65-72	InPort Slave Address 1
84	Digital Inp 73-80	InPort Slave Address 1
85	Digital Inp 81-88	InPort Slave Address 1
86	Digital Inp 89-96	InPort Slave Address 2
87	Digital Inp 97-104	InPort Slave Address 2
88	Digital Inp 105-112	InPort Slave Address 2
89	Digital Inp 113-120	InPort Slave Address 3
90	Digital Inp 121-128	InPort Slave Address 3
91	Digital Inp 129-136	InPort Slave Address 3
92	Digital Inp 137-144	InPort Slave Address 4
93	Digital Inp 145-152	InPort Slave Address 4
94	Digital Inp 153-160	InPort Slave Address 4
95	Digital Inp 161-168	InPort Slave Address 5
96	Digital Inp 169-176	InPort Slave Address 5
97	Digital Inp 177-184	InPort Slave Address 5
98	Digital Inp 185-192	InPort Slave Address 6
99	Digital Inp 193-200	InPort Slave Address 6

Idx	PAE name	Description
100	Digital Inp 201-208	InPort Slave Address 6
101	Digital Inp 209-216	InPort Slave Address 7
102	Digital Inp 217-224	InPort Slave Address 7
103	Digital Inp 225-232	InPort Slave Address 7
104	Digital Inp 233-240	InPort Slave Address 8
105	Digital Inp 241-248	InPort Slave Address 8
106	Digital Inp 249-256	InPort Slave Address 8
107	Digital Inp 257-264	Not used
108	Digital Inp 265-272	Not used
109	Digital Inp 273-280	Not used
110	Digital Inp 281-288	Not used
111	Digital Inp 289-296	Not used
112	Digital Inp 297-304	Not used
113	Digital Inp 305-312	Not used
114	Digital Inp 313-320	Not used
115	Digital Inp 321-328	Not used
116	Digital Inp 329-336	Not used
117	Digital Inp 337-344	Not used
118	Digital Inp 345-352	Not used
119	Digital Inp 353-360	Not used
120	Digital Inp 361-368	Not used
121	Digital Inp 369-376	Not used
122	Digital Inp 377-384	Not used
123	Digital Inp 385-392	Not used
124	Digital Inp 393-400	Not used
125	Digital Inp 401-408	Not used
126	Digital Inp 409-416	Not used
127	Digital Inp 417-424	Not used
128	Digital Inp 425-432	Not used
129	Digital Inp 433-440	Not used
130	Digital Inp 441-448	Not used
131	SOC Status 1-8	Status information from Slave Adresse1
132	SOC Status 9-16	
133	SOC Status 17-24	
134	SOC Status 25-32	
135	SOC Status 33-40	Status information from Slave Adresse2
136	SOC Status 41-48	
137	SOC Status 49-56	
138	SOC Status 57-64	
139	SOC Status 65-72	Status information from Slave Adresse3
140	SOC Status 73-80	
141	SOC Status 81-88	
142	SOC Status 89-96	

Idx	PAE name	Description
143	SOC Status 97-104	Status information from Slave Adresse4
144	SOC Status 105-112	
145	SOC Status 113-120	
146	SOC Status 121-128	
147	SOC Status 129-136	Status information from Slave Adresse5
148	SOC Status 137-144	
149	SOC Status 145-152	
150	SOC Status 153-160	
151	SOC Status 161-168	Status information from Slave Adresse6
152	SOC Status 169-176	
153	SOC Status 177-184	
154	SOC Status 185-192	
155	SOC Status 193-200	Status information from Slave Adresse7
156	SOC Status 201-208	
157	SOC Status 209-216	
158	SOC Status 217-224	
159	SOC Status 225-232	Status information from Slave Adresse8
160	SOC Status 233-240	
161	SOC Status 241-248	
162	SOC Status 249-256	
163	Master switch Input 1-8	Result Master switch
164	Master switch Input 9-16	
165	Master switch Input 17-24	
166	Master switch Input 25-32	
167	DriveDEM 1-8	Result DEM Function 1-12 Bit 13-16 not used
168	DriveDEM 9-16	

Note:

Digital inPort Slave x:

- Bit 0…11: Ix.0 ……………Ix.11
- Bit12…21: IQIx.0..…………IQIx.9

12.3 PLC Processing

12.3.1 PLC - Syntax

The PLC-program is CRC-protected and part of the PSC1 configuration data. Each PLC-command is identically structured as follows:

Syntax of list entry:

Size of list entry = 4 byte

Byte index	**0**	**1**	**2**	**3**
Assignment	PLC – Command	Byte-Address Operand	Bit-Address	Downcount 0..255

Comment

- Downcount = (number of IL-commands) – (line number of list entries - 1)
- At 256 the counter jumps back to 0.

12.3.2 PLC – Commands

Operator	Operand	OPCODE	Description
LD	all input and output operands	02	Equates current result with operand
LD NOT	all input and output operands	04	Equates current result with operand and inverts the operand
ST	only output operands	06	Saves current result to operand address
AND	all input and output operands	08	Boolean AND
AND NOT	all input and output operands	10	Negated Boolean AND
OR	all input and output operands	12	Boolean OR
OR NOT	all input and output operands	14	Negated Boolean OR
XOR	all input and output operands	16	Boolean Exclusive OR
NOT	all input and output operands	18	Inverts the accumulator value
SET MARKER	PLC_MARKER in output image	20	Sets marker
RESET MARKER	PLC_MARKER in output image	22	Resets marker
SET	all input and output operands	24	Sets operand to 1
RESET	all input and output operands	26	Sets operand to 0
MACRO_INFO	Description of macro element	28	Operand field: 2 byte for macro identification
MACRO_CRC	CRC the previous macro field	30	Operand field: 1. Operand: CRC_LO (8 Bit) 2. Operand: CRC_HI (8 Bit)
INFO	Info field	32	Operand field: 1. Operand: reserved 2. Operand: reserved

12.3.3 PLC – Elements (I/O)

The PLC input and output elements are defined in the document “TS-37350-340-02 Switch Types PLC”!

12.3.3.1 Input elements

I/O	Type
ESwitch_1O	1
ESwitch_1S	2
ESwitch_2O	3
ESwitch_2OT	4
ESwitch_1S1O	5
ESwitch_1S1OT	6
ESwitch_2S2O	7
ESwitch_2S2OT	8
ESwitch_3O	9
ESwitch_3OT	10
TwoHand_2O	11
TwoHand_2S	12
Mode_1S1O	13
Mode_3Switch	14

12.3.3.2 Output elements

I/O	Type
DO.0_P	1
DO.0_M	1
DO.1_P	1
DO.1_M	1
DO.2_P	1
DO.2_M	1

12.3.4 Process Data for PSC1-C-100

Idx	PAE name	Description
1	Limit20 Axis:1	Not used
2	Limit20 Axis:2	
3	Limit20 Axis:3	
4	Limit20 Axis:4	
5	Limit20 Axis:5	
6	Limit20 Axis:6	
7	Limit20 Axis:7	
8	Limit20 Axis:8	
9	Limit20 Axis:9	
10	Limit20 Axis:10	

Idx	PAE name	Description
11	Limit20 Axis:11	
12	Limit20 Axis:12	
13	Position20 Axis: 1	Position value axis 1 ... 12
14	Position20 Axis: 2	
15	Position20 Axis: 3	
16	Position20 Axis: 4	
17	Position20 Axis: 5	
18	Position20 Axis: 6	
19	Position20 Axis: 7	
20	Position20 Axis: 8	
21	Position20 Axis: 9	
22	Position20 Axis: 10	
23	Position20 Axis: 11	
24	Position20 Axis: 12	
25	BG20 Axis: 1	TeachIn position value axis 1 ... 12
26	BG20 Axis: 2	
27	BG20 Axis: 3	
28	BG20 Axis: 4	
29	BG20 Axis: 5	
30	BG20 Axis: 6	
31	BG20 Axis: 7	
32	BG20 Axis: 8	
33	BG20 Axis: 9	
34	BG20 Axis: 10	
35	BG20 Axis: 11	
36	BG20 Axis: 12	
37	StopDistanz20 Axis: 1	Not used
38	StopDistanz20 Axis: 2	
39	StopDistanz20 Axis: 3	
40	StopDistanz20 Axis: 4	
41	StopDistanz20 Axis: 5	
42	StopDistanz20 Axis: 6	
43	StopDistanz20 Axis: 7	
44	StopDistanz20 Axis: 8	
45	StopDistanz20 Axis: 9	
46	StopDistanz20 Axis: 10	
47	StopDistanz20 Axis: 11	
48	StopDistanz20 Axis: 12	
49	SysSpeed Axis: 1	Speed value axis 1 ... 12
50	SysSpeed Axis: 2	
51	SysSpeed Axis: 3	
52	SysSpeed Axis: 4	
53	SysSpeed Axis: 5	

Idx	PAE name	Description
54	SysSpeed Axis: 6	
55	SysSpeed Axis: 7	
56	SysSpeed Axis: 8	
57	SysSpeed Axis: 9	
58	SysSpeed Axis: 10	
59	SysSpeed Axis: 11	
60	SysSpeed Axis: 12	
61	SysAcc Axis: 1	Acceleration value axis 1 ... 12
62	SysAcc Axis: 2	
63	SysAcc Axis: 3	
64	SysAcc Axis: 4	
65	SysAcc Axis: 5	
66	SysAcc Axis: 6	
67	SysAcc Axis: 7	
68	SysAcc Axis: 8	
69	SysAcc Axis: 9	
70	SysAcc Axis: 10	
71	SysAcc Axis: 11	
72	SysAcc Axis: 12	
73	AIn Input: 1	Analog inPort Ain 1 ... 16
74	AIn Input: 2	
75	AIn Input: 3	
76	AIn Input: 4	
77	AIn Input: 5	
78	AIn Input: 6	
79	AIn Input: 7	
80	AIn Input: 8	
81	AIn Input: 9	
82	AIn Input: 10	
83	AIn Input: 11	
84	AIn Input: 12	
85	AIn Input: 13	
86	AIn Input: 14	
87	AIn Input: 15	
88	AIn Input: 16	
89	AnalogAdder Id: 1	Analog adder 1 … 8
90	AnalogAdder Id: 2	
91	AnalogAdder Id: 3	
92	AnalogAdder Id: 4	
93	AnalogAdder Id: 5	
94	AnalogAdder Id: 6	
95	AnalogAdder Id: 7	
96	AnalogAdder Id: 8	

12.3.5 PLC - Output variables for PSC1-C-10 devices

Output variables for the PLC-system are identified by:

- Affiliation to the system image of the PSC1-system
- the unambiguously determined address (byte index in system image, bit index in entry of system image).
- PAEOFFS = Size of segment PAE = 96
- by the 1-bit value of the input variable (TRUE or FALSE)

Syntax and addressing:

Index	PAE-variable	Bit Pos.	Bit variable	Description
1	Config_ID			0x3002 fixed
2	DriveBASE	0 1 2 3 4 5		DRB_STAT.1 = ESTOP external DRB_STAT.2 = RUNNING DRB_STAT.3 = LOCK DRB_STAT.4 = RESET
3	DriveSLI	0 1	SLI_EN.1 SLI_EN.2	Activation SLI
4	DriveEMU	0 1	EMU_EN.1 EMU_EN.2	Activation EMU
5	DriveSCA	0 .. 7 0 .. 7	SCA_EN.1 .. SCA_EN.8 SCA_EN.9 .. SCA_EN.16	Activation SCA
6	DriveSSX	0 1 2 3	SSX_EN.1 SSX_EN.2 SSX_EN.3 SSX_EN.4	Activation SSX
7	DriveSOS	0 1	SOS_EN.1 SOS_EN.2	Activation SOS
8	DriveSLP	0 1	SLP_EN.1 SLP_EN.2	Activation SLP
9	DriveSEL	0 1	SEL_EN.1 SEL_EN.2	ActivationSEL
10	DriveSLS	0 .. 7	SLS_EN.1 .. SLS_EN.8	Activation SLS
11	DriveSDI	0 1	SDI_EN.1 SDI_EN.2	Activation SDI
12	DriveSAC	0 .. 7	SAC_EN.1 .. SAC_EN.8	Activation SAC
13	DriveSummary	0 1	PDM_EN.1 PDM_EN.2	Activation PDM

Index	PAE-variable	Bit Pos.	Bit variable	Description
14	DO8	0 1 2 3 4 5 6 7	Q0.0_P Q0.1_N Q0.2_P Q0.3_N Q4 Q5 IQQ1.8 IQQ1.9	Semi-conductor output HISIDE1 Semi-conductor output LOSIDE1 Semi-conductor output HISIDE2 Semi-conductor output LOSIDE2 Relay Q4 Relay Q5 Semi-cond. output PSC31 log. addr 1 Semi-cond. output PSC31 log. addr 1
15	HW_Output	0 1 2 3 4 5 6 7	Y0.0 Y0.1 Y1.0 Y1.1 Y2.0 Y2.1 IQQ2.8 IQQ2.9	Auxiliary outputs PSC1 Auxiliary outputs PSC1 Auxiliary output PSC31 log. addr 1 Auxiliary output PSC31 log. addr 1 Auxiliary output PSC31 log. addr 2 Auxiliary output PSC31 log. addr 2 Semi-cond. output PSC31 log. addr 2 Semi-cond. output PSC31 log. addr 2
16	PLC_Marker	0 .. 7	M.1 .. M.8	
18	PLCTimer_EN	0 .. 7	PLCT_EN.1 .. PLCT_EN.8	
19 – 64	MX8 MX16 MX 24 .. MX368	each 0 .. 7	MX.1 .. MX.368	PLC_MX Marker
65	Diag 17_24	0 .. 7		Diagnostic Bit 16 .. 23
66	Diag25_32	0 .. 7		Diagnostic Bit 24 .. 31
67	EnableInputTim er	0 1 2 3 4 5 6 7	META_EN.1 METB_EN.1 META_EN.2 METB_EN.2 META_EN.3 METB_EN.3 META_EN.4 METB_EN.4	Activation of input element with time monitoring
68	EnableInputZw eihandTimer	0 .. 2	MEZ_EN.1 .. MEZ_EN.3	Activation of two-hand button
69	EnableStartele ment	0 1	MES_EN.1 MES_EN.2	Activation of start element
70	EnableAnlaufte st			
71	IQQ1_8	0 .. 7	IQQ1.0 .. IQQ1.7	Extension output PSC31 log. addr 1
72	IQQ2_8	0 .. 7	IQQ2.0 .. IQQ2.7	Extension output PSC31 log. addr 2
73	Diag_1_16			Diagnostic Bit 0 .. 15
74	Diag_33_40			Diagnostic Bit 30..39
75	Diag_41_48			Diagnostic Bit 40..47

Index	PAE-variable	Bit Pos.	Bit variable	Description
76	Diag_49_56			Diagnostic Bit 48..55
77	EnableInputTimer2	0 1 2 3 4 5 6 7	META_EN.5 METB_EN.5 META_EN.6 METB_EN.6 META_EN.7 METB_EN.7 META_EN.8 METB_EN.8	Activation of input element with time monitoring
78	Reserve1			Reserve
79	Reserve2			Reserve
80	Reserve3			Reserve
81	Reserve4			Reserve
82	Reserve5			Reserve
83	Reserve6			Reserve
84	Reserve7			Reserve
85	Reserve8			Reserve
86	Reserve9			Reserve
87	Reserve10			Reserve
88	Reserve11			Reserve
89	Reserve12			Reserve

12.3.6 PLC - Output variables for PSC1-C-100 devices

Output variables for the PLC-system are identified by:

- Affiliation to the system image of the PSC1-system
- the unambiguously determined address (byte index in system image, bit index in entry of system image).
- by the 1-bit value of the input variable (TRUE or FALSE)

Syntax and addressing:

Idx	PAA name	Description
1	Drive SAC_EN 1-8	Enable SAC Function 1-48
2	Drive SAC_EN 9-16	
3	Drive SAC_EN 17-24	
4	Drive SAC_EN 25-32	
5	Drive SAC_EN 33-40	
6	Drive SAC_EN 41-48	
7	Drive SDI_EN 1-8	Enable SDI Function 1..12
8	Drive SDI_EN 9-16	One Function needs 2 enable bits
9	Drive SDI_EN 17-24	
10	Drive SLI_EN 1-8	Enable SDI Function 1..12
11	Drive SLI_EN 9-16	One Function needs 2 enable bits
12	Drive SLI_EN 17-24	
13	Drive SEL_EN 1-8	Enable SEL Function 1..12
14	Drive SEL_EN 9-16	bit 13-16 not used
15	Drive SSX_EN 1-8	Enable SSX Function 1..24
16	Drive SSX_EN 9-16	
17	Drive SSX_EN 17-24	
18	Drive SLP_EN 1-8	Enable SLP Function 1..12
19	Drive SLP_EN 9-16	One Function needs 4 enable bits
20	Drive SLP_EN 17-24	
21	Drive SLP_EN 25-32	
22	Drive SLP_EN 33-40	
23	Drive SLP_EN 41-48	
24	Drive SLS_EN 1-8	Enable SLS Function 1..48
25	Drive SLS_EN 9-16	
26	Drive SLS_EN 17-24	
27	Drive SLS_EN 25-32	
28	Drive SLS_EN 33-40	
29	Drive SLS_EN 41-48	
30	Drive SCA_EN 1-8	Enable SCA Function 1..64
31	Drive SCA_EN 9-16	
32	Drive SCA_EN 17-24	
33	Drive SCA_EN 25-32	

Idx	PAA name	Description
34	Drive SCA_EN 33-40	
35	Drive SCA_EN 41-48	
36	Drive SCA_EN 49-56	
37	Drive SCA_EN 57-64	
38	Drive SF 1-8	Not used
39	Drive SF 9-16	
40	Drive SOS_EN 1-8	Enable SOS Function 1..12
41	Drive SOS_EN 9-16	bit 13-16 not used
42	DriveBASE_EN	
43	Drive PDM_EN 1-8	Not used
44	Drive PDM _EN 9-16	
45	Drive ECS_EN 1-8	Enable ECS Function 1..12
46	Drive ECS_EN 9-16	bit 13-16 not used
47	Drive ACS_EN 1-8	Enable ACS Function 1..12
48	Drive ACS_EN 9-16	bit 13-16 not used
49	Drive EMU_EN 1-8	Not used
50	Drive EMU_EN 9-16	
51	PLC Timer_EN 1-8	Enable PLC Timer 1-64
52	PLC Timer_EN 9-16	
53	PLC Timer_EN 17-24	
54	PLC Timer_EN 25-32	
55	PLC Timer_EN 33-40	
56	PLC Timer_EN 41-48	
57	PLC Timer_EN 49-56	
58	PLC Timer_EN 57-64	
59	Enable Input Timer 1-8	Enable inPort element with time monitored
60	Enable Input Timer 9-16	One Function needs 2 enable bits
61	Enable Input Timer 17-24	
62	Enable Input Timer 25-32	
63	Enable Input Timer 33-40	
64	Enable Input Timer 41-48	
65	Enable Input Timer 49-56	
66	Enable Input Timer 57-64	
67	Enable Input Timer 65-72	
68	Enable Input Timer 73-80	
69	Enable Input Timer 81-88	
70	Enable Input Timer 89-96	
71	Enable Input Timer 97-104	
72	Enable Input Timer 105-112	
73	Enable Input Timer 113-120	
74	Enable Input Timer 121-128	
75	Start behaviour 1-8	Enable start behaviour monitored
76	Start behaviour 8-16	One Function needs 2 enable bits

Idx	PAA name	Description
77	Start behaviour 17-24	
78	Start behaviour 25-32	
79	Start behaviour 33-40	
80	Start behaviour 41-48	
81	Start behaviour 49-56	
82	Start behaviour 57-64	
83	Start behaviour 65-72	
84	Start behaviour 73-80	
85	Start behaviour 81-88	
86	Start behaviour 89-96	
87	Start behaviour 97-104	
88	Start behaviour 105-112	
89	Start behaviour 113-120	
90	Start behaviour 121-128	
91	Enable Input Two-hand timer 1-8	Enable Two-hand button
92	Enable Input Two-hand timer 9-16	
93	Digital Outp. 1-8	Output Master Bit0:HISIDE1 Bit1:LOSIDE1 Bit2: HISIDE2 Bit3: LOSIDE2 Bit4: Relay Q4 Bit5: Relay Q5 Bit6: A0.1 Bit7: A0.2
94	Digital Outp. 9-16	OutPort Master IQQ0.1-IQQ0.8
95	Digital Outp. 17-24	OutPort Master IQQ0.9-IQQ0.16
96	Digital Outp. 25-32	OutPort Master IQQ0.17-IQQ0.24
97	Digital Outp. 33-40	OutPort Master IQQ0.25-IQQ0.32
98	Digital Outp. 41-48	OutPort Master IQQ0.33-IQQ0.40
99	Digital Outp. 49-56	Not used
100	Digital Outp. 57-64	OutPort Slave Adresse1
101	Digital Outp. 65-72	
102	Digital Outp. 73-80	
103	Digital Outp. 81-88	
104	Digital Outp. 89-96	OutPort Slave Adresse2
105	Digital Outp. 97-104	
106	Digital Outp. 105-112	
107	Digital Outp. 113-120	
108	Digital Outp. 121-128	OutPort Slave Adresse3
109	Digital Outp. 129-136	
110	Digital Outp. 137-144	

Idx	PAA name	Description
111	Digital Outp. 145-152	
112	Digital Outp. 153-160	OutPort Slave Adresse4
113	Digital Outp. 161-168	
114	Digital Outp. 169-176	
115	Digital Outp. 177-184	
116	Digital Outp. 185-192	OutPort Slave Adresse5
117	Digital Outp. 193-200	
118	Digital Outp. 201-208	
119	Digital Outp. 209-216	
120	Digital Outp. 217-224	OutPort Slave Adresse6
121	Digital Outp. 225-232	
122	Digital Outp. 233-240	
123	Digital Outp. 241-248	
124	Digital Outp. 249-256	OutPort Slave Adresse7
125	Digital Outp. 257-264	
126	Digital Outp. 265-272	
127	Digital Outp. 273-280	
128	Digital Outp. 281-288	OutPort Slave Adresse8
129	Digital Outp. 289-296	
130	Digital Outp. 297-304	
131	Digital Outp. 305-312	
132	Digital Outp. 313-320	Not used
133	PLC-Merker 1..8	PLC Flags
…	…	
260	PLC-Merker 1017…1024	
261	SCO_cmd_status1-8	Status information to the Slave Adresse1
262	SCO_cmd_status9-16	
263	SCO_cmd_status17-24	
264	SCO_cmd_status25-32	
265	SCO_cmd_status33-40	Status information to the Slave Adresse2
266	SCO_cmd_status41-48	
267	SCO_cmd_status49-56	
268	SCO_cmd_status57-64	
269	SCO_cmd_status65-72	Status information to the Slave Adresse3
270	SCO_cmd_status73-80	
271	SCO_cmd_status81-88	
272	SCO_cmd_status89-96	
273	SCO_cmd_status97-104	Status information to the Slave Adresse4
274	SCO_cmd_status105-112	
275	SCO_cmd_status113-120	
276	SCO_cmd_status121-128	
277	SCO_cmd_status129-136	Status information to the Slave Adresse5
278	SCO_cmd_status137-144	

Idx	PAA name	Description
279	SCO_cmd_status145-152	
280	SCO_cmd_status153-160	
281	SCO_cmd_status161-168	Status information to the Slave Adresse6
282	SCO_cmd_status169-176	
283	SCO_cmd_status177-184	
284	SCO_cmd_status185-192	
285	SCO_cmd_status193-200	Status information to the Slave Adresse7
286	SCO_cmd_status201-208	
287	SCO_cmd_status209-216	
288	SCO_cmd_status217-224	
289	SCO_cmd_status225-232	Status information to the Slave Adresse8
290	SCO_cmd_status233-240	
291	SCO_cmd_status241-248	
292	SCO_cmd_status 249-256	
293	MasterSwitch_Enable 1-8	Enable Master switch
294	MasterSwitch_Enable 9-16	
295	MasterSwitch_Enable 17-24	
296	MasterSwitch_Enable 25-32	
297	DriveDEM_EN 1-8	Enable DEM Function 1..12
298	DriveDEM_EN 9-16	Bit 13-16 not used

12.3.7 PLC - Processing elements

12.3.7.1 PLC-Marker

PLC-markers can be set and reset with the command's "S" or "R". PLC-markers are part of the process output image "Outputs". The user can only address markers through the macro "RS-Flipflop".

12.3.7.2 PLC - Timer

A total of 24 (PSC1-C-10) or 64 (PSC1-C-100) PLC timers are provided by the runtime system of the PLC processing.

These have the following properties:

- Generation of time events Cycle time…31.999.992ms
- Downwards counter limited to ZERO, starts from configured initial value (part of configuration data)
- In the system image the timers only occupy 2 bits for ENABLE and RESULT (TRUE = timer elapsed, i.e. internal value at ZERO). Start of timer by setting ENABLE. ENABLE = FALSE resets the timer to the initial value (initial value = FALSE).

ENABLE	Timer value	Initial value / Result	Activity
FALSE	Initial value on configuration	FALSE	Counter inactive
TRUE	1 ... < INITIAL VALUE	FALSE	Counter active
TRUE	ZERO	TRUE	Counter inactive

PLC-Timer - ENABLE can only be started or disabled with the command “ST”. Release and status of timers are part of the process image. The initial values of the timers are saved in the configuration data in the PLC segment.

12.3.8 PLC - Processing list

The PLC-instruction list consists of a header and a linear list of single PLC-instructions, consisting of operator and operands, in the format specified in chapter 12.2.1.

Contents	Index	Contents	Description
Header	0	ID_PLC	Identification of the PLC-list
	2	CRC	CRC over the structure
	4	Date1	Date of creation/change
	6	Date2	
	8	PLC_Len	Number of AWL-instructions
	10	free	
	12	free	
	14	free	
PLC-Timer	16	Timer 1	Time events from 1 Tcyc to 3.999.999 Tcyc Each timer occupies 4 bytes
	.....		
	44	Timer 8	
Reserve	48	free	
	50	free	
	52	free	
	54	free	
AWL – List	56	Instruction 1	AWL acc. to format (Chapter 12.2.1)
	....		
	48 + (PLC_Len*4) – 4	Instruction no. PLC_Len	
Reserve	1056	free	
	1058	free	

12.3.9 Assignment of resources

Element	In	Out	Qty. MX	IN/OUT Process image	PLC-Code	Qty. IL
AND2	2	1	1	0	LD x1.y1 AND x2.y2 ST MX.z	3

Element	In	Out	Qty. MX	IN/OUT Process image	PLC-Code	Qty. IL
AND5	5	1	1	0	LD x1.y1 AND x2.y2 AND x3.y3 AND x4.y4 AND x5.y5 ST MX.z	6
OR2 .. OR5					Analogue AND	3 … 6
XOR 2					Analogue AND	3
NOT	1	1	1	0	LD x1,y1 NOT ST MX.z	3
RS-Flipflop	2	1	0	Output = 1	LD x1.y1 (Source S) S M.z LD x2.y2 (Source R) R M.z	4
Timer	1	1	0	Output = 1	Timer enable: LD x1.y1 ST PLCT_EN.z	2
Monitoring functions	1	1	0	Output = 1	Monitoring function enable: LD x1.y1 ST uuu_EN.z	2
Semi-conductor output Single	1	1	0	Output = 1	LD x1.y1 ST DO.x_y	2
Semi-conductor output Redundant	1	2	0	Output = 2	LD x1.y1 ST DO.x_P ST DO.x_M	3

Processing of input elements see document TS-37330-340-02 PLC switch types!

13 APPENDIX - Encoder combinations

Version: PSC1-C-10-SDM1 / PSC1-C-10-SDM2 in 2-axis operation

Type	Encoder A			Encoder B			Not available	Configurable axis	Entry Info field	
	Type	**Pulse multiple**	**Enable direction**	**Type**	**Pulse multiple**	**Enable direction**			**Fault exclusion/ comment**	**PI**
0	NC	0	No	NC	0	No	all	1 and 2		B
1	Incremental	2	No	NC	2	No	SOS, SDI, SEL, SLP, SCA, SLI	1 and 2	Fault exclusion mech. shaft breakage, positive encoder shaft connection required	d
2	SINCOS	4	Yes	NC	4	No	SEL, SLP, SCA	1 and 2	Fault exclusion mech. shaft breakage, positive encoder shaft connection required	d
3	Incremental	2	Yes	Proxy sw. 1 count. inp.	1	No	SOS, SDI, SLI, SEL, SLP, SCA	1 and 2		e
4	SINCOS	4	Yes	Proxy sw. 1 count. inp.	1	No	SEL, SLP, SCA	1 and 2	(not implemented)	e
5	Incremental	4	Yes	Proxy sw. 2 count. inp. w. 90° - signal	4	Yes	SEL, SLP, SCA	1		e
6	SINCOS	4	Yes	HTL/incremental	4	Yes	SEL, SLP, SCA	1		e
7	SSI	1	Yes	Proxy sw. 1 count. inp.	1	No		1	(not implemented)	d
8	SSI	1	Yes	Proxy sw. 2 count. inp. w. 90° - signal	4	Yes		1		e
9	Proxy sw. 1 count. inp.	1	No	Proxy sw. 1 count. inp.	1	No	SSX, SOS, SLS, SCA	1	Fault exclusion mech. shaft fracture, positive locking encoder shaft connection, required if common	d

									element in the take-off, protected cable laying,	
10	Proxy sw. 2 count. inp. w. 90° - signal	4	Yes	Proxy sw. 2 count. inp. w. 90° - signal	4	Yes	SSX, SOS, SLS,SLI, SDI, SCA	1	Fault exclusion mech. shaft fracture, positive locking encoder shaft connection, required if common element in the take-off, protected cable laying, DC values only with 2x 3-wire proximity switch	d
11	Proxy sw. 2 count. inp. w. 90° - signal	4	Yes	Incremental	4	Yes	SEL, SLP, SCA	2		e
12	HTL/incremental	4	Yes	SINCOS	4	Yes	SEL, SLP, SCA	2		e
13	Proxy sw. 1 count. inp.	1	No	SSI	1	Yes		2	(not implemented)	d
14	Proxy sw. 2 count. inp. w. 90° - signal	4	Yes	SSI	1	Yes		2		e

Version: PSC1-C-10-SDM2 in single axis operation

Type	Encoder A			Encoder B			Not available	Configurable axis	Entry Info field	
	Type	Pulse multiple	Enable direction	Type	Pulse multiple	Enable direction			Fault exclusion/ comment	PI
32	Incremental	4	Yes	Incremental	4	Yes	SEL, SLP, SCA	1		e
33	SINCOS	4	Yes	Incremental	4	Yes	SEL, SLP, SCA	1		e
34	SINCOS	4	Yes	SINCOS	4	Yes	SEL, SLP, SCA	1		e
35	Incremental	4	Yes	SSI	1	Yes		1		e

36	SINCOS	4	Yes	SSI	1	Yes		1		e
37	SSI	1	Yes	SSI	1	Yes		1		e

14 APPENDIX - Alarms and Fatal faults

14.1 Target

Error list regarding the assembly group series PSC1.

This error list applies from the following firmware versions:

PSC1-C-10

Firmware Version **05-00-00-03**

PSC1-C-100

Firmware Version **04-00-00-01**

14.2 PSC1 error types

The PSC1 distinguishes two types of errors in accordance with the following allocation:

Error type	Description	Impact on the system	Reset condition
Fatal Error 	Fatal exception caused by an internal program or hardware failure PSC1. Safe operation is no longer possible. The last active process is the operation of the 7 segment display by system A. System B is in the “Stop” mode.	All outputs will be switched off!	Resettable by switching off/on the PSC1(POR).
Alarm 	Functional error, caused by an external process. Both systems keep on running in a cyclical manner and fulfill all requirements of the communication interfaces. The scanning of the external process will also be maintained.	All outputs will be switched off!	Reset by parametrizable input
ECS Alarm 	When using the ECS function on the programming interface, the sensor alarm messages are marked with ‘E’ instead of ‘A’.	ECS-function block result is „0“	Reset by parametrizable input

Identification of the errors in System A and System B:

- System A: odd-numbered
- System B: even-numbered

14.3 Bus Status

When using PSC1-C-100 slave devices bus errors may be shown on the master device. The following bus error messages do exist:

Display	Description	Impact on the system	Reset condition
b0003	Initialization/Synchronization with slave devices	All outputs are switched off!	Resettable by switching off/on the PSC1(POR).
b0008	Transmission of configuration data to slave devices.	All outputs are switched off!	Not necessary
b0010	Bus in „RUN“	All outputs active based on application	Not necessary
b0012	Bus Error	All outputs are switched off!	Resettable by switching off/on the PSC1(POR).

In case of an error the bus state may remain in „b0003“ or „b0012“.

Bus Status	**b0003**
message	Communication establishment with slave devices
Cause	Slave does not respond
Remedy	• Check slave addresses • Check slave status LED (must be blinking green) • Check back pane bus connection between master and slaves

Bus Status	**b0012**
message	Bus error
Cause	Bus error cause by faulty slave device
Remedy	• Check if configured slave device matches the connected one • Check slave addresses (duplicates) • Check slave status LED (must be blinking green)

14.4 Display of the error types

There are two ways in which the error number is displayed:

- **PSC1-C-10/100 <u>without</u> expansion modules**

  __   __ __ __ __

  F,A or E   Error number

- **PSC1-C-10/100 <u>with</u> expansion modules**

  __   __   __ __ __ __

  F,A or E   1)   Error number

<u>Note 1)</u>

0: Basic assembly group
1: expansion assembly group with logical address 1
2: expansion assembly group with logical address 2 (max. node id for PSC1-C-10)
3: expansion assembly group with logical address 3
4: expansion assembly group with logical address 4
5: expansion assembly group with logical address 5
6: expansion assembly group with logical address 6
7: expansion assembly group with logical address 7
8: expansion assembly group with logical address 8

- **PSC1-C-100 with decentral slave devices**

  If no communication can be established to one or more of the decentral slave devices the following sequence is shown:

  b   __ __ __ __   -   d   __   __ __

       Bus status   1)   2)

<u>Note 1)</u>

1: expansion assembly group with logical address 1
2: expansion assembly group with logical address 2
3: expansion assembly group with logical address 3
4: expansion assembly group with logical address 4
5: expansion assembly group with logical address 5
6: expansion assembly group with logical address 6
7: expansion assembly group with logical address 7
8: expansion assembly group with logical address 8

Note 2)

Error number (see list below)

Error codes decentral slaves:

No.	message	Cause
00	No Link	Device not connected
03	Invalid device type	The device type of the configured and the connected device do not match
04	Invalid device type	The device type of the configured and the connected device do not match
05	Invalid serial number	Device has an invalid serial number
06	Invalid serial number and device type	Device has an invalid serial number and the wrong device type

14.5 Alarm Muting

Several functions exist to muted alarm messages:

- ICS: Muting of digital input related alarms
- ACS: Muting of analog input related alarms
- ECS: Muting of encoder input alarms

If an error can be muted using one of the latter functions it is marked inside the error description.

⚠	Suppressing an alarm using one of the muting functions can have a negative impact on the safety of the application and can only be done after evaluating the safety regulations! Solving the cause of the error must be preferred to muting the alarm.

14.7 Alarm list

Alarm Code	A 1212
Alarm message	SD card with new application program was found
Cause	• A new application program on the inserted SD card is ready to be loaded. • The system is waiting for user confirmation
Error correction	• Double-Press the reset button to store the application program on the device. • Remove the SD card if you do not want to change the application

Alarm Code	A 2101 / A 2102
Alarm message	Timeout receipt telegram PSC1-E-31 (address 1)
Cause	Telegram of expansion assembly group not received in time
Error correction	• Check configuration of extension devices • Check physical connection to extension devices • Check address switch on extension devices • Power Cycle of all connected devices

Alarm Code	A 2105 / A 2106
Alarm message	CRC error transmission telegram PSC1-E-31 (address 1)
Cause	Transmission telegram incorrect
Error correction	• Check configuration of extension devices • Check physical connection to extension devices • Check address switch on extension devices • Power Cycle of all connected devices

Alarm Code	A 2107 / A 2108
Alarm message	CRC error transmission telegram
Cause	Transmission telegram incorrect
Error correction	• Check configuration of extension devices • Check physical connection to extension devices • Check address switch on extension devices • Power Cycle of all connected devices

Alarm Code	A 2109 / A 2110
Alarm message	CRC error receipt telegram
Cause	Receipt telegram incorrect
Error correction	• Check configuration of extension devices • Check physical connection to extension devices • Check address switch on extension devices • Power Cycle of all connected devices

Alarm Code	A 2111
Alarm message	Timeout communication with expansion assembly group PSC1-E-31 (address 1)
Cause	Incorrect Installation of expansion assembly group
Error correction	• Check configuration of extension devices • Check physical connection to extension devices • Check address switch on extension devices • Power Cycle of all connected devices

Alarm Code	A 2113
Alarm message	Expansion assembly group PSC1-E-31 (address 1) existing but not configured
Cause	Incorrect configuration
Error correction	• Check configuration of extension devices • Check physical connection to extension devices • Check address switch on extension devices • Power Cycle of all connected devices

Alarm Code	A 2115 / A2116
Alarm message	Expansion assembly group PSC1-E-31 has incorrect logical address
Cause	Incorrect configuration
Error correction	• Check configuration of extension devices • Check physical connection to extension devices • Check address switch on extension devices • Power Cycle of all connected devices

Alarm Code	A 2121 / A 2122
Alarm message	Timeout receipt telegram PSC1-E-31 (address 2)
Cause	Telegram of expansion assembly group not received in time
Error correction	• Check configuration of extension devices • Check physical connection to extension devices • Check address switch on extension devices • Power Cycle of all connected devices

Alarm Code	A 2125 / A 2126
Alarm message	CRC error transmission telegram PSC1-E-31 (address 2)
Cause	Transmission telegram incorrect
Error correction	• Check configuration of extension devices • Check physical connection to extension devices • Check address switch on extension devices • Power Cycle of all connected devices

Alarm Code	A 2131
Alarm message	Timeout communication with expansion assembly group PSC1-E-31 (address 2)
Cause	Incorrect installation of expansion assembly group
Error correction	• Check configuration of extension devices • Check physical connection to extension devices • Check address switch on extension devices • Power Cycle of all connected devices

Alarm Code	A 2133
Alarm message	Expansion assembly group PSC1-E-31 (address 2) existing but not configured
Cause	Incorrect configuration
Error correction	• Check configuration of extension devices • Check physical connection to extension devices • Check address switch on extension devices • Power Cycle of all connected devices

Alarm Code	A 2135 / A 2136
Alarm message	Timeout reading functional inputs
Cause	• Incorrect configuration • CAN telegram not received in time
Error correction	• Check configuration (CAN ID) • Check transmission time (Timeout)

Alarm Code	A 2301
Alarm message	Communication Error KI Module
Cause	• Incorrect data transmission • External EMC influences
Error correction	• Check EMC regulations • Power Cycle • Replace device

Alarm Code	A 2303
Alarm message	Timeout Communication KI Module
Cause	• Incorrect data transmission • External EMC
Error correction	• Check EMC regulations • Power Cycle • Replace device

Alarm Code	A 2305
Alarm message	Invalid data length in SPI transmission to KI Module
Cause	• Incorrect data transmission • External EMC
Error correction	• Check EMC regulations • Power Cycle • Replace device

Alarm Code	A 2307
Alarm message	Invalid identifier in SPI transmission to KI Module
Cause	• Incorrect data transmission • External EMC
Error correction	• Check EMC regulations • Power Cycle • Replace device

Alarm Code	A 3031 / A 3032
Alarm message	Test pulse (T0) plausibility error on expanding input IQIx.0
Cause	This input does not have the configured Test pulse (T0) voltage.
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring

Alarm Code	A 3033 / A 3034
Alarm message	Test pulse (T1) plausibility error on expanding input IQIx.0
Cause	This input does not have the configured Test pulse (T1) voltage.
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring

Alarm Code	A 3035 / A 3036
Alarm message	Incorrect 24V signal on IQIx.0
Cause	The input does not have a permanent 24V voltage.
Error correction	• Check voltage on digital input! • Check wiring • Check whether Test pulse (T0) or Test pulse (T1) is active

Alarm Code	A 3037 / A 3038
Alarm message	Test pulse (T0) plausibility error on expanding input IQIx.1
Cause	This input does not have the configured Test pulse (T0) voltage.
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring

Alarm Code	A 3039 / A 3040
Alarm message	Test pulse (T1) plausibility error on expanding input IQIx.1
Cause	This input does not have the configured Test pulse (T1) voltage.
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring

Alarm Code	A 3041 / A 3042
Alarm message	Incorrect 24V signal on IQIx.1
Cause	The input does not have a permanent 24V voltage.
Error correction	• Check voltage on digital input! • Check wiring • Check whether Test pulse (T0) or Test pulse (T1) is active

Alarm Code	A 3043 / A 3044
Alarm message	Test pulse (T0) plausibility error on expanding input IQIx.2
Cause	This input does not have the configured Test pulse (T0) voltage.
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring

Alarm Code	A 3045 / A 3046
Alarm message	Test pulse (T1) plausibility error on expanding input IQIx.2
Cause	This input does not have the configured Test pulse (T1) voltage.
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring

Alarm Code	A 3047 / A 3048
Alarm message	Incorrect 24V signal on IQIx.2
Cause	The input does not have a permanent 24V voltage.
Error correction	• Check voltage on digital input! • Check wiring • Check whether Test pulse (T0) or Test pulse (T1) is active

Alarm Code	A 3049 / A 3050
Alarm message	Test pulse (T0) plausibility error on expanding input IQIx.3
Cause	This input does not have the configured Test pulse (T0) voltage.
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring

Alarm Code	A 3051 / A 3052
Alarm message	Test pulse (T1) plausibility error on expanding input IQIx.3
Cause	This input does not have the configured Test pulse (T1) voltage.
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring

Alarm Code	A 3053 / A 3054
Alarm message	Incorrect 24V signal on IQIx.3
Cause	The input does not have a permanent 24V voltage.
Error correction	• Check voltage on digital input! • Check wiring • Check whether Test pulse (T0) or Test pulse (T1) is active

Alarm Code	A 3055 / A 3056
Alarm message	Test pulse (T0) plausibility error on expanding input IQIx.4
Cause	This input does not have the configured Test pulse (T0) voltage.
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring

Alarm Code	A 3057 / A 3058
Alarm message	Test pulse (T1) plausibility error on expanding input IQIx.4
Cause	This input does not have the configured Test pulse (T1) voltage.
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring

Alarm Code	A 3059 / A 3060
Alarm message	Incorrect 24V signal on IQIx.4
Cause	The input does not have a permanent 24V voltage.
Error correction	• Check voltage on digital input! • Check wiring • Check whether Test pulse (T0) or Test pulse (T1) is active

Alarm Code	A 3061 / A 3062
Alarm message	Test pulse (T0) plausibility error on expanding input IQIx.5
Cause	This input does not have the configured Test pulse (T0) voltage.
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring

Alarm Code	A 3063 / A 3064
Alarm message	Test pulse (T1) plausibility error on expanding input IQIx.5
Cause	This input does not have the configured Test pulse (T1) voltage.
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring

Alarm Code	A 3065 / A 3066
Alarm message	Incorrect 24V signal on IQIx.5
Cause	The input does not have a permanent 24V voltage.
Error correction	• Check voltage on digital input! • Check wiring • Check whether Test pulse (T0) or Test pulse (T1) is active

Alarm Code	A 3067 / A 3068
Alarm message	Test pulse (T0) plausibility error on expanding input IQIx.6
Cause	This input does not have the configured Test pulse (T0) voltage.
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring

Alarm Code	A 3069 / A 3070
Alarm message	Test pulse (T1) plausibility error on expanding input IQIx.6
Cause	This input does not have the configured Test pulse (T1) voltage.
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring

Alarm Code	A 3071 / A 3072
Alarm message	Incorrect 24V signal on IQIx.6
Cause	The input does not have a permanent 24V voltage.
Error correction	• Check voltage on digital input! • Check wiring • Check whether Test pulse (T0) or Test pulse (T1) is active

Alarm Code	A 3073 / A 3074
Alarm message	Test pulse (T0) plausibility error on expanding input IQIx.7
Cause	This input does not have the configured Test pulse (T0) voltage.
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring

Alarm Code	A 3075 / A 3076
Alarm message	Test pulse (T1) plausibility error on expanding input IQIx.7
Cause	This input does not have the configured Test pulse (T1) voltage.
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring

Alarm Code	A 3077 / A 3078
Alarm message	Incorrect 24V signal on IQIx.7
Cause	The input does not have a permanent 24V voltage.
Error correction	• Check voltage on digital input! • Check wiring • Check whether Test pulse (T0) or Test pulse (T1) is active

Alarm Code	A 3079 / A 3080
Alarm message	Test pulse (T0) plausibility error on expanding input IQIx.8
Cause	This input does not have the configured Test pulse (T0) voltage.
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring

Alarm Code	A 3081 / A 3082
Alarm message	Test pulse (T1) plausibility error on expanding input IQIx.8
Cause	This input does not have the configured Test pulse (T1) voltage.
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring

Alarm Code	A 3083 / A 3084
Alarm message	Incorrect 24V signal on IQIx.8
Cause	The input does not have a permanent 24V voltage.
Error correction	• Check voltage on digital input! • Check wiring • Check whether Test pulse (T0) or Test pulse (T1) is active

Alarm Code	A 3085 / A 3086
Alarm message	Test pulse (T0) plausibility error on expanding input IQIx.9
Cause	This input does not have the configured Test pulse (T0) voltage.
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring

Alarm Code	A 3087 / A 3088
Alarm message	Test pulse (T1) plausibility error on expanding input IQIx.9
Cause	This input does not have the configured Test pulse (T1) voltage.
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring

Alarm Code	A 3089 / A 3090
Alarm message	Incorrect 24V Signal am IQIx.9
Cause	The input does not have a permanent 24V voltage.
Error correction	• Check voltage on digital input! • Check wiring • Check whether Test pulse (T0) or Test pulse (T1) is active

Alarm Code	A 3101 / A 3102	ICS
Alarm message	Test pulse (T0) plausibility error on input DI0	
Cause	This input does not have the configured Test pulse (T0) voltage.	
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring	

Alarm Code	A 3103 / A 3104	ICS
Alarm message	Test pulse (T0) plausibility error on input DI1	
Cause	This input does not have the configured Test pulse (T0) voltage.	
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring	

Alarm Code	A 3105 / A 3106	ICS
Alarm message	Test pulse (T0) plausibility error on input DI2	
Cause	This input does not have the configured Test pulse (T0) voltage.	
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring	

Alarm Code	A 3107 / A 3108	ICS
Alarm message	Test pulse (T0) plausibility error on input DI3	
Cause	This input does not have the configured Test pulse (T0) voltage.	
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring	
Alarm Code	A 3109 / A 3110	ICS
Alarm message	Test pulse (T0) plausibility error on input DI4	
Cause	This input does not have the configured Test pulse (T0) voltage.	
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring	

Alarm Code	A 3111 / A 3112	ICS
Alarm message	Test pulse (T0) plausibility error on input DI5	
Cause	This input does not have the configured Test pulse (T0) voltage.	
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring	

Alarm Code	A 3113 / A 3114	ICS
Alarm message	Test pulse (T0) plausibility error on input DI6	
Cause	This input does not have the configured Test pulse (T0) voltage.	
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring	

Alarm Code	A 3115 / A 3116	ICS
Alarm message	Test pulse (T0) plausibility error on input DI7	
Cause	This input does not have the configured Test pulse (T0) voltage.	
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring	

Alarm Code	A 3117 / A 3118	ICS
Alarm message	Test pulse (T1) plausibility error on input DI0	
Cause	This input does not have the configured Test pulse (T1) voltage.	
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring	

Alarm Code	A 3119 / A 3120	ICS
Alarm message	Test pulse (T1) plausibility error on input DI1	
Cause	This input does not have the configured Test pulse (T1) voltage.	
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring	

Alarm Code	A 3121 / A 3122	ICS
Alarm message	Test pulse (T1) plausibility error on input DI2	
Cause	This input does not have the configured Test pulse (T1) voltage.	
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring	
Alarm Code	A 3123 / A 3124	ICS
Alarm message	Test pulse (T1) plausibility error on input DI3	
Cause	This input does not have the configured Test pulse (T1) voltage.	
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring	

Alarm Code	A 3125 / A 3126	ICS
Alarm message	Test pulse (T1) plausibility error on input DI4	
Cause	This input does not have the configured Test pulse (T1) voltage.	
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring	

Alarm Code	A 3127 / A 3128	ICS
Alarm message	Test pulse (T1) plausibility error on input DI5	
Cause	This input does not have the configured Test pulse (T1) voltage.	
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring	

Alarm Code	A 3129 / A 3130	ICS
Alarm message	Test pulse (T1) plausibility error on input DI6	
Cause	This input does not have the configured Test pulse (T1) voltage.	
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring	

Alarm Code	A 3131 / A 3132	ICS
Alarm message	Test pulse (T1) plausibility error on input DI7	
Cause	This input does not have the configured Test pulse (T1) voltage.	
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring	

Alarm Code	A 3133 / A 3134	ICS
Alarm message	Test pulse (T0) plausibility error on input DI8	
Cause	This input does not have the configured Test pulse (T0) voltage.	
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring	

Alarm Code	A 3135 / A 3136	ICS
Alarm message	Test pulse (T0) plausibility error on input DI09	
Cause	This input does not have the configured Test pulse (T0) voltage.	
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring	

Alarm Code	A 3137 / A 3138	ICS
Alarm message	Test pulse (T0) plausibility error on input DI10	
Cause	This input does not have the configured Test pulse (T0) voltage.	
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring	

Alarm Code	A 3139 / A 3140	ICS
Alarm message	Test pulse (T0) plausibility error on input DI11	
Cause	This input does not have the configured Test pulse (T0) voltage.	
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring	

Alarm Code	A 3141 / A 3142	ICS
Alarm message	Test pulse (T0) plausibility error on input DI12	
Cause	This input does not have the configured Test pulse (T0) voltage.	
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring	

Alarm Code	A 3143 / A 3144	ICS
Alarm message	Test pulse (T0) plausibility error on input DI13	
Cause	This input does not have the configured Test pulse (T0) voltage.	
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring	

Alarm Code	A 3147 / A 3148	ICS
Alarm message	Test pulse (T1) plausibility error on input DI8	
Cause	This input does not have the configured Test pulse (T1) voltage.	
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring	

Alarm Code	A 3149 / A 3150	ICS
Alarm message	Test pulse (T1) plausibility error on input DI09	
Cause	This input does not have the configured Test pulse (T1) voltage.	
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring	

Alarm Code	A 3151 / A 3152	ICS
Alarm message	Test pulse (T1) plausibility error on input DI10	
Cause	This input does not have the configured Test pulse (T1) voltage.	
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring	
Alarm Code	A 3153 / A 3154	ICS
Alarm message	Test pulse (T1) plausibility error on input DI11	
Cause	This input does not have the configured Test pulse (T1) voltage.	
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring	

Alarm Code	A 3155 / A 3156	ICS
Alarm message	Test pulse (T1) plausibility error on input DI12	
Cause	This input does not have the configured Test pulse (T1) voltage.	
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring	

Alarm Code	A 3157 / A 3158	ICS
Alarm message	Test pulse (T1) plausibility error on input DI13	
Cause	This input does not have the configured Test pulse (T1) voltage.	
Error correction	• Check the configuration of the digital input according to projection and circuit diagram • Check wiring	

Alarm Code	A 3191 / A 3192	ICS
Alarm message	Short circuit error digital inputs	
Cause	Short circuit between the digital inputs within the assembly group	
Error correction	• Power Reset • Check degree of pollution of device • Check external wiring • Replace device	

Alarm Code	A 3197 / A 3198	ICS
Alarm message	Incorrect OSSD input check	
Cause	OSSD test incorrect	
Error correction	• Check 24V input voltage of all OSSD inputs • Power Reset	

Alarm Code	A 3209 / A 3210	ACS
Alarm message	Sensor supply voltage X1 incorrect.	
Cause	Sensor supply voltage does not correspond to the configured threshold	
Error correction	• Check configuration! • Check sensor supply voltage • Switch off/on device	

Alarm Code	A 3213 / A 3214	ACS
Alarm message	Sensor supply voltage X2 incorrect.	
Cause	Sensor supply voltage does not correspond to the configured threshold	
Error correction	• Check configuration! • Check sensor supply voltage • Switch off/on device	

Alarm Code	A 3225 / A 3226	ACS
Alarm message	Deviation Ain1 compared to AIn2 too big	
Cause	• Voltage difference on both analog sensors of analog input 1 • Configured threshold too low	
Error correction	• Check voltages on X25 • Check configuration threshold/input filter • Switch off/on device	

Alarm Code	A 3227 / A 3228	ACS
Alarm message	Deviation Ain3 compared to AIn4 too big	
Cause	• Voltage difference on both analog sensors of analog input 2 • Configured threshold too low	
Error correction	• Check voltages on X26 • Check configuration threshold/input filter • Switch off/on device	

Alarm Code	A 3229 / A 3230	ECS
Alarm message	Plausibility error sensor voltage incorrect	
Cause	Sensor voltage value	
Error correction	• Check sensor voltage supply • Check wiring of sensor voltage supply • Power Cycle	

Alarm Code	A 3231 / A 3232	ACS
Alarm message	Plausibility error analogue inputs incorrect	
Cause	Error in the analogue input signal Analogue input voltage outside of range	
Error correction	• Check connection analogue inputs	

Alarm Code	A 3233 / A 3234	ACS
Alarm message	Wire breakage monitoring AIN1 actuated	
Cause	Wire breakage monitoring activated (< 1000mV)	
Error correction	• Check configuration activation/sensor • Check sensor connection	

Alarm Code	A 3235 / A 3236	ACS
Alarm message	Wire breakage monitoring AIN2 actuated	
Cause	Wire breakage monitoring activated (< 1000mV)	
Error correction	• Check configuration activation/sensor • Check sensor connection	

Alarm Code	A 3237 / A 3238	ACS
Alarm message	Analog sensor monitoring test AIN1 has triggered	
Cause	• Faulty Sensor • Configured Test duration is too short for analog sensor	
Error correction	• Configuration Activation / sensor check • Check the sensor connection	

Alarm Code	A 3239 / A 3240	ACS
Alarm message	Analog sensor monitoring test AIN2 has triggered	
Cause	• Faulty Sensor • Configured Test duration is too short for analog sensor	
Error correction	• Configuration Activation / sensor check • Check the sensor connection	

Alarm Code	A 3301 / A 3302	ECS
Alarm message	Plausibility error speed recording axis 1	
Cause	The difference between the two speed sensors is higher than the configured switch off threshold for speed	
Error correction	• Check the theory of the distance by comparing the data in the configuration of the sensors. • Check the signals of the speed sensor • Check the correct wiring on the 9-pin encoder plug • Analyze the speed signals using the scope function • Check the parameterization of the axis (Resolution, Direction, Cutoff Threshold Speed, Filter) • Check the track for slippage or speed deviations	

Alarm Code	A 3303 / A 3304	ECS
Alarm message	Plausibility error position recording axis 1	
Cause	The difference between the two position signals is higher than the configured switch off threshold for increments	
Error correction	• Check the theory of the distance by comparing the data in the configuration of the sensors. • Check the signals of the position sensor • Check the correct wiring on the 9-pin encoder plug • Analyze the position signals using the scope function • Check the parameterization of the axis (Resolution, Direction, Cutoff Threshold Speed, Filter)	

Alarm Code	A 3307 / A 3308	ECS
Alarm message	Plausibility error incorrect position range axis 1	
Cause	The current position is outside of the configured measuring length	
Error correction	• Check the theory of the distance by comparing the data configured in the sensor adjustment • Check position signal, if applicable, correct offset • Manually drive to the preset position and execute preset	

Alarm Code	A 3309 / A 3310	ECS
Alarm message	Plausibility error incorrect speed axis 1	
Cause	• The current speed is outside of the configured maximal speed • The drive is moving above the allowed maximum speed	
Error correction	• Check configuration. • Analyze the speed course via SCOPE • Check the driveway for speed deviations • Check absolute encoders for position discontinuity if applicable	

Alarm Code	A 3313 / A 3314	ECS
Alarm message	SSI sensor error	
Cause	Sensor switch SSI value too large within a cycle	
Error correction	• Check sensor wiring • Check sensor configuration	

Alarm Code	A 3317 / A 3318	ECS
Alarm message	Plausibility error of the signals of the incremental encoder (single and quad-counter comparison failed)	
Cause	• Signals on track A do not correspond to track B • Damaged RS485 encoder interface • Encoder operates out of encoder interface specification	
Error correction	• Check sensor wiring • Check sensor configuration • Check the level of the encoder signals • Check the maximum counter frequency of the encoder	

Alarm Code	A 3321 / A 3322	ECS
Alarm message	Plausibility error speed recording axis 2	
Cause	The difference between the two speed sensors is higher than the configured switch off threshold for speed	
Error correction	• Check the theory of the distance by comparing the data in the configuration of the sensors. • Check the signals of the speed sensor • Check the correct wiring on the 9-pin encoder plug • Analyze the speed signals using the scope function • Check the parameterization of the axis (Resolution, Direction, Cutoff Threshold Speed, Filter) • Check the track for slippage or speed deviations	

Alarm Code	A 3323 / A 3324	ECS
Alarm message	Plausibility error position recording axis 2	
Cause	The difference between the two position signals is higher than the configured switch off threshold for increments	
Error correction	• Check the theory of the distance by comparing the data in the configuration of the sensors. • Check the signals of the position sensor • Check the correct wiring on the 9-pin encoder plug • Analyze the position signals using the scope function • Check the parameterization of the axis (Resolution, Direction, Cutoff Threshold Speed, Filter)	

Alarm Code	A 3327 / A 3328	ECS
Alarm message	Plausibility error incorrect position range axis 2	
Cause	The current position is outside of the configured measuring length	
Error correction	• Check the theory of the distance by comparing the data configured in the sensor adjustment • Check position signal, if applicable, correct offset • Manually drive to the preset position and execute preset	

Alarm Code	A 3329 / A 3330	ECS
Alarm message	Plausibility error incorrect speed axis 2	
Cause	• The current speed is outside of the configured maximal speed • The drive is moving above the allowed maximum speed	
Error correction	• Check configuration. • Analyze the speed course via SCOPE • Check the driveway for speed deviations • Check absolute encoders for position discontinuity if applicable	

Alarm Code	A 3331 / A 3332	ECS
Alarm message	Configuration error: Acceleration axis 2	
Cause	Current acceleration is outside the configured acceleration range	
Error correction	• The drive has exceeded the permissible acceleration range. • Check maximum speed configuration • Analyzing the course of speed/acceleration with SCOPE	

Alarm Code	A 3333 / A 3334	ECS
Alarm message	Plausibility error SinCos encoder	
Cause	Wrong sensor type connected	
Error correction	• Check configuration • Check sensor connector • Record and check sin/cos signals	

Alarm Code	A 3337 / A3338	ECS
Alarm message	Incremental encoder axis 2 incorrect	
Cause	• Track A does not correspond to track B	
Error correction	• Check sensor wiring • Check sensor configuration • Check and record encoder signals	

Alarm Code	A 3407 / A 3408	ECS
Alarm message	Difference level RS485 driver 1 fault (X1): • A3407: TTL track B or SSI CLK • A3408: TTL track A or SSI DATA	
Cause	• No encoder connection • Wrong encoder type connected	
Error correction	• Control the encoder connection • Check the encoder wiring	

Alarm Code	A 3409 / A 3410	ECS
Alarm message	Difference level RS485 driver fault (X2): • A3409: TTL Signal B or SSI CLK • A3410: TTL Signal A or SSI DATA	
Cause	• No encoder connection • Wrong encoder type connected	
Error correction	• Control the encoder connection • Check the encoder wiring	

Alarm Code	A 3411 / A 3412	ECS
Alarm message	Plausibility error Sinus/Cosinus X1	
Cause	• Plausibility monitoring of detached line faulty	
Error correction	• Check sensor wiring • Sinus to Cosinus must be linear • Attenuation on Sin/Cos lines too big • Interference on Sin/Cos lines	

Alarm Code	A 3413 / A 3414	ECS
Alarm message	Plausibility error Sinus/Cosinus X2	
Cause	Plausibility monitoring of detached line faulty	
Error correction	• Check sensor wiring • Sinus to Cosinus must be linear • Attenuation on Sin/Cos lines too big • Interference on Sin/Cos lines	

Alarm Code	A 3415 / A 3416	ECS
Alarm message	Proxy counter plausibility fault.	
Cause	Difference level monitoring on proxy switch lines failed.	
Error correction	• Check sensor wiring • Check phase shift on sensor lines • Check maximum counter frequency (see Installation Manual)	

Alarm Code	A 3417 / A 3418	ECS
Alarm message	Error CLK number for SSI listener 1st axis	
Cause	Plausibility monitoring of the number of configured CLK's	
Error correction	• Check encoder wiring • Check SSI Master configuration • Configured number of clocks has to match physical clocks from SSI master • The mono flop time must be greater than 40 µs	

Alarm Code	A 3419 / A 3420	ECS
Alarm message	CLK error number for SSI listener 2nd axis	
Cause	Plausibility monitoring of the number of configured CLK's	
Error correction	• Check encoder wiring • Check SSI Master configuration • Configured number of clocks has to match physical clocks from SSI master • The mono flop time must be greater than 40 µs	

Alarm Code	A 3451 / A 3452	ECS
Alarm message	Incorrect resolver frequency	
Cause	• Resolver frequency is outside of admissible range • Error of excitation frequency of resolver	
Error correction	• Check resolver frequency if it is in the admissible range. • Check encoder wiring • Power reset	

Alarm Code	A 3453 / A 3454	ECS
Alarm message	Arithmetic mean value of resolver reference signal is out of range	
Cause	Mean value of reference signal of resolver is outside of the admissible range.	
Error correction	• Check the connected resolver • Record and analyze the resolver signals • Check the voltage level of the resolver signals (Min, Max, Variance)	

Alarm Code	A 3455 / A 3456	ECS
Alarm message	Generic PIC error	
Cause	• HW error on the extension board • PIC controller reported generic error	
Error correction	• Check the encoder wiring on X3/X4 • Check the settings for encoder X3/X4 • Power Reset • Replace Device	

Alarm Code	A 3457 / A 3458	ECS
Alarm message	Encoder reference voltage on extension board X3/X4 is incorrect (U_REF monitoring)	
Cause	• Wrong encoder wiring • HW error on extension board	
Error correction	• Check the encoder wiring on X3/X4 • Check the settings for encoder X3/X4 • Power Reset • Replace Device	

Alarm Code	A 3459 / A 3460	ECS
Alarm message	The amplitude of the Sinus/Cosinus signals is out of range	
Cause	• Incorrect configuration of sensor • Incorrect connection of encoder • Wrong encoder signals • Interference on encoder signals	
Error correction	• Check sensor configuration • Check connections of sensors • Record encoder signals • Check EMC guidelines • Power Reset	

Alarm Code	A 3461 / A 3462	ECS
Alarm message	The PIC reports a general status error, e.g. during connection establishment or because a timeout during processing has occurred.	
Cause	• Wrong encoder signals • Defect RS485 encoder driver	
Error correction	• Power cycle of device • Check encoder signals on X3/X4 • Check encoder wiring on X3/X4 • Replace device	

Alarm Code	A 3463 / A 3464	ECS
Alarm message	Plausibility check between the analogue sine signal and the TTL levels on the Schmitt trigger output do not correspond.	
Cause	• Wrong encoder signals • Defect RS485 encoder driver	
Error correction	• Check encoder signals on X3/X4 • Check encoder wiring on X3/X4 • Power cycle of device • Record and analyses the encoder signals • Replace device	

Alarm Code	A 3465 / A 3466	ECS
Alarm message	The quotient of arithmetic mean value / quadratic mean value is outside of the admissible range.	
Cause	Incorrect signals from sensor	
Error correction	• Check encoder signals on X3/X4 • Check encoder wiring on X3/X4 • Record and analyze the encoder signals	

Alarm Code	A 3467 / A 3468	ECS
Alarm message	Connection establishment between CPU and PIC has failed.	
Cause	• Incorrect Encoder signals • Hardware defect on X3/X4	
Error correction	• Check extension board • Check encoder input level on X3/X4 • Power Cycle • Replace device	

Alarm Code	A 3469 / A 3470	ECS
Alarm message	Resolver_Quadrant	
Cause	Incorrect sensor signals from encoder	
Error correction	• Check the encoder connection • Check the encoder signals • Power Cycle	

Alarm Code	A 3471 / A 3472	ECS
Alarm message	Resolver_UENC	
Cause	• Encoder supply voltage is not connected • Wrong encoder supply voltage configured	
Error correction	• Check encoder supply voltage on X17/X19 • Check configuration for encoder supply voltage monitoring on X3/X4 • Check the encoder signals • Power Cycle	

Alarm Code	A 3473 / A 3474	ECS
Alarm message	TTL/HTL signal incorrect	
Cause	Incorrect sensor signal from encoder	
Error correction	• Check the encoder connection • Check the encoder signals • Power Cycle	

Alarm Code	A 3475 / A 3476	ECS
Alarm message	Resolver_TRACE Error	
Cause	Counter signals of encoder are incorrect	
Error correction	• Check the encoder connection X3/X4 • Check the encoder signals • Check extension board • Power Cycle	

Alarm Code	A 3477 / A 3478	ECS
Alarm message	SSI clock error	
Cause	• Plausibility check SSI Clock (Clock missing) • Wrong clock signals on SSI Listener • SSI mono flop time out of range	
Error correction	• Clock Signal Check • Check cables • Check the configuration of the SSI Master • Record and check the SSI Signals	

Alarm Code	A 3551 / A 3552	ECS
Alarm message	SSI_ECE STATUS 1. axis SSI ext encoder	
Cause	Analysis of 1. status bit is incorrect	
Error correction	• Check the encoder connection • Check the encoder signals • Check the meaning of the error bit in the encoder manual • Exchange the SSI encoder	

Alarm Code	A 3553 / A 3554	ECS
Alarm message	SSI_ECE STATUS 1. axis SSI ext encoder	
Cause	Analysis of 2. status bit is incorrect	
Error correction	• Check the encoder connection • Check the encoder signals • Check the meaning of the error bit in the encoder manual • Exchange the SSI encoder	

Alarm Code	A 3555 / A 3556	ECS
Alarm message	SSI_ECE STATUS 1. axis SSI ext encoder	
Cause	Analysis of 3. status bit is incorrect	
Error correction	• Check the encoder connection • Check the encoder signals • Check the meaning of the error bit in the encoder manual • Exchange the SSI encoder	

Alarm Code	A 3557 / A 3558	ECS
Alarm message	SSI_ECE STATUS 1. axis SSI ext encoder	
Cause	Analysis of 4. status bit is incorrect	
Error correction	• Check the encoder connection • Check the encoder signals • Check the meaning of the error bit in the encoder manual • Exchange the SSI encoder	

Alarm Code	A 3559 / A 3560	ECS
Alarm message	SSI_ECE STATUS 1. axis SSI ext encoder	
Cause	Analysis of 5. status bit is incorrect	
Error correction	• Check the encoder connection • Check the encoder signals • Check the meaning of the error bit in the encoder manual • Exchange the SSI encoder	

Alarm Code	A 3561 / A 3562	ECS
Alarm message	SSI_ECE STATUS 2. axis SSI ext encoder	
Cause	Analysis of 1. status bit is incorrect	
Error correction	• Check the encoder connection • Check the encoder signals • Check the meaning of the error bit in the encoder manual • Exchange the SSI encoder	

Alarm Code	A 3563 / A 3564	ECS
Alarm message	SSI_ECE STATUS 2. axis SSI ext encoder	
Cause	Analysis of 2. status bit is incorrect	
Error correction	• Check the encoder connection • Check the encoder signals • Check the meaning of the error bit in the encoder manual • Exchange the SSI encoder	

Alarm Code	A 3565 / A 3566	ECS
Alarm message	SSI_ECE STATUS 2. axis SSI ext encoder	
Cause	Analysis of 3. status bit is incorrect	
Error correction	• Check the encoder connection • Check the encoder signals • Check the meaning of the error bit in the encoder manual • Exchange the SSI encoder	

Alarm Code	A 3567 / A 3568	ECS
Alarm message	SSI_ECE STATUS 2. axis SSI ext encoder	
Cause	Analysis of 4. status bit is incorrect	
Error correction	• Check the encoder connection • Check the encoder signals • Check the meaning of the error bit in the encoder manual • Exchange the SSI encoder	

Alarm Code	A 3569 / A 3570	ECS
Alarm message	SSI_ECE STATUS 2. axis SSI ext encoder	
Cause	Analysis of 5. status bit is incorrect	
Error correction	• Check the encoder connection • Check the encoder signals • Check the meaning of the error bit in the encoder manual • Exchange the SSI encoder	

Alarm Code	A 3571 / A3572	ECS
Alarm message	SSI STATUS 1. axis SSI encoder	
Cause	Analysis of 1. status bit is incorrect	
Error correction	• Check the encoder connection • Check the encoder signals • Check the meaning of the error bit in the encoder manual • Exchange the SSI encoder	

Alarm Code	A 3573 / A3574	ECS
Alarm message	SSI STATUS 1. axis SSI encoder	
Cause	Analysis of 2. status bit is incorrect	
Error correction	• Check the encoder connection • Check the encoder signals • Check the meaning of the error bit in the encoder manual • Exchange the SSI encoder	

Alarm Code	A 3575 / A3576	ECS
Alarm message	SSI STATUS 1. axis SSI encoder	
Cause	Analysis of 3. status bit is incorrect	
Error correction	• Check the encoder connection • Check the encoder signals • Check the meaning of the error bit in the encoder manual • Exchange the SSI encoder	

Alarm Code	A 3577 / A3578	ECS
Alarm message	SSI STATUS 1. axis SSI encoder	
Cause	Analysis of 4. status bit is incorrect	
Error correction	• Check the encoder connection • Check the encoder signals • Check the meaning of the error bit in the encoder manual • Exchange the SSI encoder	

Alarm Code	A 3579 / A3580	ECS
Alarm message	SSI STATUS 1. axis SSI encoder	
Cause	Analysis of 5. status bit is incorrect	
Error correction	• Check the encoder connection • Check the encoder signals • Check the meaning of the error bit in the encoder manual • Exchange the SSI encoder	

Alarm Code	A 3627 / A 3628
Alarm message	Error static test Highside output 0
Cause	Faulty switching of the output: • Incorrect wiring (short circuit) • Hardware defect
Error correction	• Check the wiring of the output (short-circuit) • Checking the Hardware

Alarm Code	A 3629 / A 3630
Alarm message	Error static test Highside output 1
Cause	Faulty switching of the output: • Incorrect wiring (short circuit) • Hardware defect
Error correction	• Check the wiring of the output (short-circuit) • Checking the Hardware

Alarm Code	A 3631 / A 3632
Alarm message	Error static test Highside output 2
Cause	Faulty switching of the output: • Incorrect wiring (short circuit) • Hardware defect
Error correction	• Check the wiring of the output (short-circuit) • Checking the Hardware

Alarm Code	A 3633 / A 3634
Alarm message	Error static test Highside output 3
Cause	Faulty switching of the output : • Incorrect wiring (short circuit) • Hardware defect
Error correction	• Check the wiring of the output (short-circuit) • Checking the Hardware

Alarm Code	A 3635 / A 3636
Alarm message	Error static test Main Switch 1 High Side outputs 0 and 1
Cause	• Incorrect wiring (short circuit) • Hardware defect
Error correction	• Check the wiring (short circuit) • Checking the Hardware

Alarm Code	A 3637 / A 3638
Alarm message	Error static test Main Switch 2 High Side outputs 2 and 3
Cause	• Incorrect wiring (short circuit) • Hardware defect
Error correction	• Check the wiring (short circuit) • Checking the Hardware

Alarm Code	A 3653 / A 3654
Alarm message	Error dynamic test Main Switch 1 High Side outputs 0 and 1
Cause	• Incorrect wiring (short circuit) • Hardware defect
Error correction	• Check the wiring (short circuit) • Checking the Hardware

Alarm Code	A 3655 / A 3656
Alarm message	Error dynamic test Main Switch 2 High Side outputs 2 and 3
Cause	• Incorrect wiring (short circuit) • Hardware defect
Error correction	• Check the wiring (short circuit) • Checking the Hardware

Alarm Code	A 3657 / A 3658
Alarm message	Error dynamic test HighSide 1
Cause	• Incorrect wiring (short circuit) • Hardware defect
Error correction	• Check the wiring (short circuit) • Checking the Hardware

Alarm Code	A 3659 / A 3660
Alarm message	Error dynamic test HighSide 2
Cause	• Incorrect wiring (short circuit) • Hardware defect
Error correction	• Check the wiring (short circuit) • Checking the Hardware

Alarm Code	A 3661 / A 3662
Alarm message	Error dynamic test HighSide 3
Cause	• Incorrect wiring (short circuit) • Hardware defect
Error correction	• Check the wiring (short circuit) • Checking the Hardware

Alarm Code	A 3663 / A 3664
Alarm message	Error dynamic test HighSide 4
Cause	• Incorrect wiring (short circuit) • Hardware defect
Error correction	• Check the wiring (short circuit) • Checking the Hardware

Alarm Code	A 3801 / A3802
Alarm message	Incorrect switching of output IQQ.0
Cause	Short circuit of output with „24V“ or „0V“
Error correction	• Check the wiring of the outputs on extension device • Power cycle

Alarm Code	A 3803 / A3804
Alarm message	Incorrect switching of output IQQ.1
Cause	Short circuit of output with „24V“ or „0V“
Error correction	• Check the wiring of the outputs on extension device • Power cycle

Alarm Code	A 3805 / A3806
Alarm message	Incorrect switching of output IQQ.2
Cause	Short circuit of output with „24V“ or „0V“
Error correction	• Check the wiring of the outputs on extension device • Power cycle

Alarm Code	A 3807 / A3808
Alarm message	Incorrect switching of output IQQ.3
Cause	Short circuit of output with „24V“ or „0V“
Error correction	• Check the wiring of the outputs on extension device • Power cycle

Alarm Code	A 3809 / A3810
Alarm message	Incorrect switching of output IQQ.4
Cause	Short circuit of output with „24V“ or „0V“
Error correction	• Check the wiring of the outputs on extension device • Power cycle

Alarm Code	A 3811 / A3812
Alarm message	Incorrect switching of output IQQ.5
Cause	Short circuit of output with „24V“ or „0V“
Error correction	• Check the wiring of the outputs on extension device • Power cycle

Alarm Code	A 3813 / A3814
Alarm message	Incorrect switching of output IQQ.6
Cause	Short circuit of output with „24V“ or „0V“
Error correction	• Check the wiring of the outputs on extension device • Power cycle

Alarm Code	A 3815 / A3816
Alarm message	Incorrect switching of output IQQ.7
Cause	Short circuit of output with „24V“ or „0V“
Error correction	• Check the wiring of the outputs on extension device • Power cycle

Alarm Code	A 3817 / A3818
Alarm message	Incorrect switching of output IQQ.8
Cause	Short circuit of output with „24V“ or „0V“
Error correction	• Check the wiring of the outputs on extension device • Power cycle

Alarm Code	A 3819 / A3820
Alarm message	Incorrect switching of output IQQ.9
Cause	Short circuit of output with „24V“ or „0V“
Error correction	• Check the wiring of the outputs on extension device • Power cycle

Alarm code	A 3901 / A3902
Fault message	Faulty switching of output IQQ0.10
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check the wiring of the outputs on extension device • Power cycle

Alarm code	A 3903 / A3904
Fault message	Faulty switching of output IQQ0.11
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check the wiring of the outputs on extension device • Power cycle

Alarm code	A 3905 / A3906
Fault message	Faulty switching of output IQQ0.12
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check the wiring of the outputs on extension device • Power cycle

Alarm code	A 3907 / A3908
Fault message	Faulty switching of output IQQ0.13
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check the wiring of the outputs on extension device • Power cycle

Alarm code	A 3909 / A3910
Fault message	Faulty switching of output IQQ0.14
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check the wiring of the outputs on extension device • Power cycle

Alarm code	A 3911 / A3912
Fault message	Faulty switching of output IQQ0.15
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check the wiring of the outputs on extension device • Power cycle

Alarm code	A 3913 / A3914
Fault message	Faulty switching of output IQQ0.16
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check the wiring of the outputs on extension device • Power cycle

Alarm code	A 3915 / A3916
Fault message	Faulty switching of output IQQ0.17
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check the wiring of the outputs on extension device • Power cycle

Alarm code	A 3917 / A3918
Fault message	Faulty switching of output IQQ0.18
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check the wiring of the outputs on extension device • Power cycle

Alarm code	A 3919 / A3920
Fault message	Faulty switching of output IQQ.19
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check the wiring of the outputs on extension device • Power cycle

Alarm code	A 3921 / A3922
Fault message	Faulty switching of output IQQ.20
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check the wiring of the outputs on extension device • Power cycle

Alarm code	A 3923 / A3924
Fault message	Faulty switching of output IQQ.21
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check the wiring of the outputs on extension device • Power cycle

Alarm code	A 3925 / A3926
Fault message	Faulty switching of output IQQ.22
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check the wiring of the outputs on extension device • Power cycle

Alarm code	A 3927 / A3928
Fault message	Faulty switching of output IQQ.23
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check the wiring of the outputs on extension device • Power cycle

Alarm code	A 3929 / A3930
Fault message	Faulty switching of output IQQ.24
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check the wiring of the outputs on extension device • Power cycle

Alarm code	A 3931 / A3932
Fault message	Faulty switching of output IQQ.25
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check the wiring of the outputs on extension device • Power cycle

Alarm code	A 3933 / A3934
Fault message	Faulty switching of output IQQ.26
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check the wiring of the outputs on extension device • Power cycle

Alarm code	A 3935 / A3936
Fault message	Faulty switching of output IQQ.27
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check the wiring of the outputs on extension device • Power cycle

Alarm code	A 3937 / A3938
Fault message	Faulty switching of output IQQ.28
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check the wiring of the outputs on extension device • Power cycle

Alarm code	A 3939 / A3940
Fault message	Faulty switching of output IQQ.29
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check the wiring of the outputs on extension device • Power cycle

Alarm code	A 3941 / A3942
Fault message	Faulty switching of output IQQ0.30
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check the wiring of the outputs on extension device • Power cycle

Alarm code	A 3943 / A3944
Fault message	Faulty switching of output IQQ0.31
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check the wiring of the outputs on extension device • Power cycle

Alarm code	A 3945 / A3946
Fault message	Faulty switching of output IQQ0.32
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check the wiring of the outputs on extension device • Power cycle

Alarm code	A 3947 / A3948
Fault message	Faulty switching of output IQQ0.33
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check the wiring of the outputs on extension device • Power cycle

Alarm code	A 3949 / A3950
Fault message	Faulty switching of output IQQ0.34
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check the wiring of the outputs on extension device • Power cycle

Alarm code	A 3951 / A3952
Fault message	Faulty switching of output IQQ0.35
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check the wiring of the outputs on extension device • Power cycle

Alarm code	A 3953 / A3954
Fault message	Faulty switching of output IQQ0.36
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check the wiring of the outputs on extension device • Power cycle

Alarm code	A 3955 / A3956
Fault message	Faulty switching of output IQQ0.37
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check the wiring of the outputs on extension device • Power cycle

Alarm code	A 3957 / A3958
Fault message	Faulty switching of output IQQ0.38
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check the wiring of the outputs on extension device • Power cycle

Alarm code	A 3959 / A3960
Fault message	Faulty switching of output IQQ.39
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check the wiring of the outputs on extension device • Power cycle

Alarm code	A 4001 / A 4002
Alarm message	Counter-clockwise and clockwise rotation SDI1 have been activated simultaneously
Cause	Multiple activation: • CW (Clockwise) and CCW (Counter-clockwise) input on function block SDI1 are activated simultaneously
Remedy	• Check the logic of the SDI function blocks in the application program • Check the levels of the connected inputs for the application program • Analyze the input and logic signals using the device function block diagnosis

Alarm Code	A 4003 / A 4004
Alarm message	Counter-clockwise and clockwise rotation SDI2 have been activated simultaneously
Cause	Multiple activation: • CW (Clockwise) and CCW (Counter-clockwise) input on function block SDI2 are activated simultaneously
Remedy	• Check the logic of the SDI function blocks in the application program • Check the levels of the connected inputs for the application program • Analyze the input and logic signals using the device function block diagnosis

Alarm Code	A 4005 / A 4006
Alarm message	Counter-clockwise and clockwise rotation SDI3 have been activated simultaneously
Cause	Multiple activation: • CW (Clockwise) and CCW (Counter-clockwise) input on function block SDI3 are activated simultaneously
Remedy	• Check the logic of the SDI function blocks in the application program • Check the levels of the connected inputs for the application program • Analyze the input and logic signals using the device function block diagnosis

Alarm Code	A 4007 / A 4008
Alarm message	Counter-clockwise and clockwise rotation SDI4 have been activated simultaneously
Cause	Multiple activation: • CW (Clockwise) and CCW (Counter-clockwise) input on function block SDI4 are activated simultaneously
Remedy	• Check the logic of the SDI function blocks in the application program • Check the levels of the connected inputs for the application program • Analyze the input and logic signals using the device function block diagnosis

Alarm Code	A 4009 / A 4010
Alarm message	Counter-clockwise and clockwise rotation SDI5 have been activated simultaneously
Cause	Multiple activation: • CW (Clockwise) and CCW (Counter-clockwise) input on function block SDI5 are activated simultaneously
Remedy	• Check the logic of the SDI function blocks in the application program • Check the levels of the connected inputs for the application program • Analyze the input and logic signals using the device function block diagnosis

Alarm Code	A 4011 / A 4012
Alarm message	Counter-clockwise and clockwise rotation SDI6 have been activated simultaneously
Cause	Multiple activation: • CW (Clockwise) and CCW (Counter-clockwise) input on function block SDI6 are activated simultaneously
Remedy	• Check the logic of the SDI function blocks in the application program • Check the levels of the connected inputs for the application program • Analyze the input and logic signals using the device function block diagnosis

Alarm Code	A 4013 / A 4014
Alarm message	Counter-clockwise and clockwise rotation SDI7 have been activated simultaneously
Cause	Multiple activation: • CW (Clockwise) and CCW (Counter-clockwise) input on function block SDI17 are activated simultaneously
Remedy	• Check the logic of the SDI function blocks in the application program • Check the levels of the connected inputs for the application program • Analyze the input and logic signals using the device function block diagnosis

Alarm Code	A 4015 / A 4016
Alarm message	Counter-clockwise and clockwise rotation SDI8 have been activated simultaneously
Cause	Multiple activation: • CW (Clockwise) and CCW (Counter-clockwise) input on function block SDI8 are activated simultaneously
Remedy	• Check the logic of the SDI function blocks in the application program • Check the levels of the connected inputs for the application program • Analyze the input and logic signals using the device function block diagnosis

Alarm Code	A 4017 / A 4018
Alarm message	Counter-clockwise and clockwise rotation SDI9 have been activated simultaneously
Cause	Multiple activation: • CW (Clockwise) and CCW (Counter-clockwise) input on function block SDI9 are activated simultaneously
Remedy	• Check the logic of the SDI function blocks in the application program • Check the levels of the connected inputs for the application program • Analyze the input and logic signals using the device function block diagnosis

Alarm Code	A 4019 / A 4020
Alarm message	Counter-clockwise and clockwise rotation SDI10 have been activated simultaneously
Cause	Multiple activation: • CW (Clockwise) and CCW (Counter-clockwise) input on function block SDI10 are activated simultaneously
Remedy	• Check the logic of the SDI function blocks in the application program • Check the levels of the connected inputs for the application program • Analyze the input and logic signals using the device function block diagnosis

Alarm Code	A 4021 / A 4022
Alarm message	Counter-clockwise and clockwise rotation SDI11 have been activated simultaneously
Cause	Multiple activation: • CW (Clockwise) and CCW (Counter-clockwise) input on function block SDI11 are activated simultaneously
Remedy	• Check the logic of the SDI function blocks in the application program • Check the levels of the connected inputs for the application program • Analyze the input and logic signals using the device function block diagnosis

Alarm Code	A 4023 / A 4024
Alarm message	Counter-clockwise and clockwise rotation SDI12 have been activated simultaneously
Cause	Multiple activation: • CW (Clockwise) and CCW (Counter-clockwise) input on function block SDI12 are activated simultaneously
Remedy	• Check the logic of the SDI function blocks in the application program • Check the levels of the connected inputs for the application program • Analyze the input and logic signals using the device function block diagnosis

Alarm Code	A 4401 / A 4402
Alarm message	Faulty EMU (ID1) monitoring in axis assembly
Cause	External EMU feedback signal has invalid state
Remedy	• Check EMU feedback signal • Check output control and output wiring • Check reaction time inside configuration

Alarm code	A 4403 / A 4404
Alarm message	Faulty EMU (ID2) monitoring in axis assembly
Cause	External EMU feedback signal has invalid state
Remedy	• Check EMU feedback signal • Check output control and output wiring • Check reaction time inside configuration

Alarm code	A 4411 / A 4412
Alarm message	Faulty EMU (ID0) monitoring in IO module
Cause	External EMU feedback signal has invalid state
Remedy	• Check EMU feedback signal • Check output control and output wiring • Check reaction time inside configuration

Alarm code	A 4413 / A 4414
Alarm message	Faulty EMU (ID1) monitoring in IO module
Cause	External EMU feedback signal has invalid state
Remedy	• Check EMU feedback signal • Check output control and output wiring • Check reaction time inside configuration

Alarm code	A 4415 / A 4416
Alarm message	Faulty EMU (ID2) monitoring in IO module
Cause	External EMU feedback signal has invalid state
Remedy	• Check EMU feedback signal • Check output control and output wiring • Check reaction time inside configuration
Alarm code	A 4417 / A 4418
Alarm message	Faulty EMU (ID3) monitoring in IO module
Cause	External EMU feedback signal has invalid state
Remedy	• Check EMU feedback signal • Check output control and output wiring • Check reaction time inside configuration

Alarm code	A 4419 / A 4420
Alarm message	Faulty EMU (ID4) monitoring in IO module
Cause	External EMU feedback signal has invalid state
Remedy	• Check EMU feedback signal • Check output control and output wiring • Check reaction time inside configuration

Alarm code	A 4421 / A 4422
Alarm message	Faulty EMU (ID5) monitoring in IO module
Cause	External EMU feedback signal has invalid state
Remedy	• Check EMU feedback signal • Check output control and output wiring • Check reaction time inside configuration

Alarm code	A 4423 / A 4424
Alarm message	Faulty EMU (ID6) monitoring in IO module
Cause	External EMU feedback signal has invalid state
Remedy	• Check EMU feedback signal • Check output control and output wiring • Check reaction time inside configuration

Alarm code	A 4425 / A 4426
Alarm message	Faulty EMU (ID7) monitoring in IO module
Cause	External EMU feedback signal has invalid state
Remedy	• Check EMU feedback signal • Check output control and output wiring • Check reaction time inside configuration

Alarm code	A 4427 / A 4428
Alarm message	Faulty EMU (ID8) monitoring in IO module
Cause	External EMU feedback signal has invalid state
Remedy	• Check EMU feedback signal • Check output control and output wiring • Check reaction time inside configuration

Alarm code	A 4429 / A 4430
Alarm message	Faulty EMU (ID9) monitoring in IO module
Cause	External EMU feedback signal has invalid state
Remedy	• Check EMU feedback signal • Check output control and output wiring • Check reaction time inside configuration

Alarm code	A 4601 / A 4602
Alarm message	Monitoring range left and right of SLP1 activated at the same time
Cause	Multiple activation: • CW (Clockwise) and CCW (Counter-clockwise) input on function block SLP1 are activated simultaneously
Remedy	• Check the logic of the SLP function blocks in the application program • Check the levels of the connected inputs for the application program • Analyze the input and logic signals using the device function block diagnosis

Alarm code	A 4603 / A 4604
Alarm message	Monitoring range left and right of SLP2 activated at the same time
Cause	Multiple activation: • CW (Clockwise) and CCW (Counter-clockwise) input on function block SLP2 are activated simultaneously
Remedy	• Check the logic of the SLP function blocks in the application program • Check the levels of the connected inputs for the application program • Analyze the input and logic signals using the device function block diagnosis

Alarm code	A 4605 / A 4606
Alarm message	Monitoring range left and right of SLP3 activated at the same time
Cause	Multiple activation: • CW (Clockwise) and CCW (Counter-clockwise) input on function block SLP3 are activated simultaneously
Remedy	• Check the logic of the SLP function blocks in the application program • Check the levels of the connected inputs for the application program • Analyze the input and logic signals using the device function block diagnosis

Alarm code	A 4607 / A 4608
Alarm message	Monitoring range left and right of SLP4 activated at the same time
Cause	Multiple activation: • CW (Clockwise) and CCW (Counter-clockwise) input on function block SLP4 are activated simultaneously
Remedy	• Check the logic of the SLP function blocks in the application program • Check the levels of the connected inputs for the application program • Analyze the input and logic signals using the device function block diagnosis

Alarm code	A 4609 / A 4610
Alarm message	Monitoring range left and right of SLP5 activated at the same time
Cause	Multiple activation: • CW (Clockwise) and CCW (Counter-clockwise) input on function block SLP5 are activated simultaneously
Remedy	• Check the logic of the SLP function blocks in the application program • Check the levels of the connected inputs for the application program • Analyze the input and logic signals using the device function block diagnosis

Alarm code	A 4611 / A 4612
Alarm message	Monitoring range left and right of SLP6 activated at the same time
Cause	Multiple activation: • CW (Clockwise) and CCW (Counter-clockwise) input on function block SLP6 are activated simultaneously
Remedy	• Check the logic of the SLP function blocks in the application program • Check the levels of the connected inputs for the application program • Analyze the input and logic signals using the device function block diagnosis

Alarm code	A 4613 / A 4614
Alarm message	Monitoring range left and right of SLP7 activated at the same time
Cause	Multiple activation: • CW (Clockwise) and CCW (Counter-clockwise) input on function block SLP7 are activated simultaneously
Remedy	• Check the logic of the SLP function blocks in the application program • Check the levels of the connected inputs for the application program • Analyze the input and logic signals using the device function block diagnosis

Alarm code	A 4615 / A 4616
Alarm message	Monitoring range left and right of SLP8 activated at the same time
Cause	Multiple activation: • CW (Clockwise) and CCW (Counter-clockwise) input on function block SLP8 are activated simultaneously
Remedy	• Check the logic of the SLP function blocks in the application program • Check the levels of the connected inputs for the application program • Analyze the input and logic signals using the device function block diagnosis

Alarm code	A 4617 / A 4618
Alarm message	Monitoring range left and right of SLP9 activated at the same time
Cause	Multiple activation: • CW (Clockwise) and CCW (Counter-clockwise) input on function block SLP9 are activated simultaneously
Remedy	• Check the logic of the SLP function blocks in the application program • Check the levels of the connected inputs for the application program • Analyze the input and logic signals using the device function block diagnosis

Alarm Code	A 4619 / A 4620
Alarm message	Monitoring range left and right of SLP10 activated at the same time
Cause	Multiple activation: • CW (Clockwise) and CCW (Counter-clockwise) input on function block SLP10 are activated simultaneously
Remedy	• Check the logic of the SLP function blocks in the application program • Check the levels of the connected inputs for the application program • Analyze the input and logic signals using the device function block diagnosis

Alarm Code	A 4621 / A 4622
Alarm message	Monitoring range left and right of SLP11 activated at the same time
Cause	Multiple activation: • CW (Clockwise) and CCW (Counter-clockwise) input on function block SLP11 are activated simultaneously
Remedy	• Check the logic of the SLP function blocks in the application program • Check the levels of the connected inputs for the application program • Analyze the input and logic signals using the device function block diagnosis

Alarm Code	A 4623 / A 4624
Alarm message	Monitoring range left and right of SLP12 activated at the same time
Cause	Multiple activation: • CW (Clockwise) and CCW (Counter-clockwise) input on function block SLP12 are activated simultaneously
Remedy	• Check the logic of the SLP function blocks in the application program • Check the levels of the connected inputs for the application program • Analyze the input and logic signals using the device function block diagnosis

Alarm Code	A 4625 / A 4626
Alarm message	SLP1 teach in Status error
Cause	SET and QUIT input and have a faulty switching sequence
Remedy	• Check input configuration • Check switching sequence

Alarm Code	A 4627 / A 4628
Alarm message	SLP2 teach in Status error
Cause	SET and QUIT input and have a faulty switching sequence
Remedy	• Check input configuration • Check switching sequence

Alarm Code	A 4629 / A 4630
Alarm message	SLP3 teach in Status error
Cause	SET and QUIT input and have a faulty switching sequence
Remedy	• Check input configuration • Check switching sequence

Alarm Code	A 4631 / A 4632
Alarm message	SLP4 teach in Status error
Cause	SET and QUIT input and have a faulty switching sequence
Remedy	• Check input configuration • Check switching sequence

Alarm Code	A 4633 / A 4634
Alarm message	SLP5 teach in Status error
Cause	SET and QUIT input and have a faulty switching sequence
Remedy	• Check input configuration • Check switching sequence

Alarm Code	A 4635 / A 4636
Alarm message	SLP6 teach in Status error
Cause	SET and QUIT input and have a faulty switching sequence
Remedy	• Check input configuration • Check switching sequence

Alarm Code	A 4637 / A 4638
Alarm message	SLP7 teach in Status error
Cause	SET and QUIT input and have a faulty switching sequence
Remedy	• Check input configuration • Check switching sequence

Alarm Code	A 4639 / A 4640
Alarm message	SLP8 teach in Status error
Cause	SET and QUIT input and have a faulty switching sequence
Remedy	• Check input configuration • Check switching sequence

Alarm Code	A 4641 / A 4642
Alarm message	SLP9 teach in Status error
Cause	SET and QUIT input and have a faulty switching sequence
Remedy	• Check input configuration • Check switching sequence

Alarm Code	A 4643 / A 4644
Alarm message	SLP10 teach in Status error
Cause	SET and QUIT input and have a faulty switching sequence
Remedy	• Check input configuration • Check switching sequence

Alarm Code	A 4645 / A 4646
Alarm message	SLP11 teach in Status error
Cause	SET and QUIT input and have a faulty switching sequence
Remedy	• Check input configuration • Check switching sequence

Alarm Code	A 4647 / A 4648
Alarm message	SLP12 teach in Status error
Cause	SET and QUIT input and have a faulty switching sequence
Remedy	• Check input configuration • Check switching sequence

Alarm Code	A 4649 / A 4650
Alarm message	SLP1 Teach In position error
Cause	Teach In Position out of range
Remedy	• Check TeachIn Position • Adapt configuration of SLP block to the real physics

Alarm Code	A 4651 / A 4652
Alarm message	SLP2 Teach In position error
Cause	Teach In Position out of range
Remedy	• Check TeachIn Position • Adapt configuration of SLP block to the real physics

Alarm Code	A 4653 / A 4654
Alarm message	SLP3 Teach In position error
Cause	Teach In Position out of range
Remedy	• Check TeachIn Position • Adapt configuration of SLP block to the real physics

Alarm Code	A 4655 / A 4656
Alarm message	SLP4 Teach In position error
Cause	Teach In Position out of range
Remedy	• Check TeachIn Position • Adapt configuration of SLP block to the real physics

Alarm Code	A 4657 / A 4658
Alarm message	SLP5 Teach In position error
Cause	Teach In Position out of range
Remedy	• Check TeachIn Position • Adapt configuration of SLP block to the real physics

Alarm Code	A 4659 / A 4660
Alarm message	SLP6 Teach In position error
Cause	Teach In Position out of range
Remedy	• Check TeachIn Position • Adapt configuration of SLP block to the real physics

Alarm Code	A 4661 / A 4662
Alarm message	SLP7 Teach In position error
Cause	Teach In Position out of range
Remedy	• Check TeachIn Position • Adapt configuration of SLP block to the real physics

Alarm Code	A 4663 / A 4664
Alarm message	SLP8 Teach In position error
Cause	Teach In Position out of range
Remedy	• Check TeachIn Position • Adapt configuration of SLP block to the real physics

Alarm Code	A 4665 / A 4666
Alarm message	SLP9 Teach In position error
Cause	Teach In Position out of range
Remedy	• Check TeachIn Position • Adapt configuration of SLP block to the real physics

Alarm Code	A 4667 / A 4668
Alarm message	SLP10 Teach In position error
Cause	Teach In Position out of range
Remedy	• Check TeachIn Position • Adapt configuration of SLP block to the real physics

Alarm Code	A 4669 / A 4670
Alarm message	SLP11 Teach In position error
Cause	Teach In Position out of range
Remedy	• Check TeachIn Position • Adapt configuration of SLP block to the real physics

Alarm Code	A 4671 / A 4672
Alarm message	SLP12 Teach In position error
Cause	Teach In Position out of range
Remedy	• Check TeachIn Position • Adapt configuration of SLP block to the real physics

Alarm Code	A 4673 / A 4674
Alarm message	SLP1 Teach in SOS activation error
Cause	During „teach in“ the drive has operated (SOS error)
Remedy	When using the „teach in“ function, the drive must be off Check whether SOS has already actuated

Alarm Code	A 4675 / A 4676
Alarm message	SLP2 Teach in SOS activation error
Cause	During „teach in“ the drive has operated (SOS error)
Remedy	When using the „teach in“ function, the drive must be off Check whether SOS has already actuated

Alarm Code	A 4677 / A 4678
Alarm message	SLP3 Teach in SOS activation error
Cause	During „teach in“ the drive has operated (SOS error)
Remedy	When using the „teach in“ function, the drive must be off Check whether SOS has already actuated

Alarm Code	A 4679 / A 4680
Alarm message	SLP4 Teach in SOS activation error
Cause	During „teach in“ the drive has operated (SOS error)
Remedy	When using the „teach in“ function, the drive must be off Check whether SOS has already actuated

Alarm Code	A 4681 / A 4682
Alarm message	SLP5 Teach in SOS activation error
Cause	During „teach in“ the drive has operated (SOS error)
Remedy	When using the „teach in“ function, the drive must be off Check whether SOS has already actuated

Alarm Code	A 4683 / A 4684
Alarm message	SLP6 Teach in SOS activation error
Cause	During „teach in“ the drive has operated (SOS error)
Remedy	When using the „teach in“ function, the drive must be off Check whether SOS has already actuated

Alarm Code	A 4685 / A 4686
Alarm message	SLP7 Teach in SOS activation error
Cause	During „teach in“ the drive has operated (SOS error)
Remedy	When using the „teach in“ function, the drive must be off Check whether SOS has already actuated

Alarm Code	A 4687 / A 4688
Alarm message	SLP8 Teach in SOS activation error
Cause	During „teach in“ the drive has operated (SOS error)
Remedy	When using the „teach in“ function, the drive must be off Check whether SOS has already actuated

Alarm Code	A 4689 / A 4690
Alarm message	SLP9 Teach in SOS activation error
Cause	During „teach in“ the drive has operated (SOS error)
Remedy	When using the „teach in“ function, the drive must be off Check whether SOS has already actuated

Alarm Code	A 4691 / A 4692
Alarm message	SLP10 Teach in SOS activation error
Cause	During „teach in“ the drive has operated (SOS error)
Remedy	When using the „teach in“ function, the drive must be off Check whether SOS has already actuated

Alarm Code	A 4693 / A 4694
Alarm message	SLP11 Teach in SOS activation error
Cause	During „teach in“ the drive has operated (SOS error)
Remedy	When using the „teach in“ function, the drive must be off Check whether SOS has already actuated

Alarm Code	A 4695 / A 4696
Alarm message	SLP12 Teach in SOS activation error
Cause	During „teach in“ the drive has operated (SOS error)
Remedy	When using the „teach in“ function, the drive must be off Check whether SOS has already actuated

Alarm Code	A 4705
Alarm message	Faulty communication with the SD card in status "Command"
Cause	• SD card is not inserted correctly • Faulty SD card • Incompatible SD card type
Error correction	• Check the SD card • Check the SD card type • Check if SD card is inserted completely into slot • Power Cycle

Alarm Code	A 4706
Alarm message	Faulty communication with the SD card in status "Fetch"
Cause	• SD card is not inserted correctly • Faulty SD card • Incompatible SD card type
Error correction	• Check the SD card • Check the SD card type • Check if SD card is inserted completely into slot • Power Cycle

Alarm Code	A 4707
Alarm message	Error reading the SMF data from the SD card
Cause	• Faulty SD card • Incorrect formatting of the SD card
Error correction	• Check the SD card • Re-transmitter of the SMF data to the module • Check if SD card is inserted completely into slot • Power Cycle

Alarm Code	A 4801 / A 4802
Alarm message	PRF deviation Encoder 1
Cause	The PRF leveling was done outside of a valid range.
Error correction	• Review of the physically measured and parameterized PRF positions • Careful increasing the PRF tolerance • Check the wiring of contact for PRF Enable

Alarm Code	A 4803 / A 4804
Alarm message	PRF deviation Encoder 2
Cause	The PRF leveling was done outside of a valid range.
Error correction	• Review of the physically measured and parameterized PRF positions • Careful increasing the PRF tolerance • Check the wiring of contact for PRF Enable

Alarm code	A 4901 / A 4902
Alarm message	CCW and CW rotation monitoring SLI1 activated at the same time
Cause	Multiple activation: • CW (Clockwise) and CCW (Counter-clockwise) input on function block SLI1 are activated simultaneously
Remedy	• Check the logic of the SLI function blocks in the application program • Check the levels of the connected inputs for the application program • Analyze the input and logic signals using the device function block diagnosis

Alarm code	A 4903 / A 4904
Alarm message	CCW and CW rotation monitoring SLI2 activated at the same time
Cause	Multiple activation: • CW (Clockwise) and CCW (Counter-clockwise) input on function block SLI2 are activated simultaneously
Remedy	• Check the logic of the SLI function blocks in the application program • Check the levels of the connected inputs for the application program • Analyze the input and logic signals using the device function block diagnosis

Alarm Code	A 4905 / A 4906
Alarm message	CCW and CW rotation monitoring SLI3 activated at the same time
Cause	Multiple activation: • CW (Clockwise) and CCW (Counter-clockwise) input on function block SLI3 are activated simultaneously
Remedy	• Check the logic of the SLI function blocks in the application program • Check the levels of the connected inputs for the application program • Analyze the input and logic signals using the device function block diagnosis

Alarm Code	A 4907 / A 4908
Alarm message	CCW and CW rotation monitoring SLI4 activated at the same time
Cause	Multiple activation: • CW (Clockwise) and CCW (Counter-clockwise) input on function block SLI4 are activated simultaneously
Remedy	• Check the logic of the SLI function blocks in the application program • Check the levels of the connected inputs for the application program • Analyze the input and logic signals using the device function block diagnosis

Alarm Code	A 4909 / A 4910
Alarm message	CCW and CW rotation monitoring SLI5 activated at the same time
Cause	Multiple activation: • CW (Clockwise) and CCW (Counter-clockwise) input on function block SLI5 are activated simultaneously
Remedy	• Check the logic of the SLI function blocks in the application program • Check the levels of the connected inputs for the application program • Analyze the input and logic signals using the device function block diagnosis

Alarm Code	A 4911 / A 4912
Alarm message	CCW and CW rotation monitoring SLI6 activated at the same time
Cause	Multiple activation: • CW (Clockwise) and CCW (Counter-clockwise) input on function block SLI6 are activated simultaneously
Remedy	• Check the logic of the SLI function blocks in the application program • Check the levels of the connected inputs for the application program • Analyze the input and logic signals using the device function block diagnosis

Alarm Code	A 4913 / A 4914
Alarm message	CCW and CW rotation monitoring SLI7 activated at the same time
Cause	Multiple activation: • CW (Clockwise) and CCW (Counter-clockwise) input on function block SLI7 are activated simultaneously
Remedy	• Check the logic of the SLI function blocks in the application program • Check the levels of the connected inputs for the application program • Analyze the input and logic signals using the device function block diagnosis

Alarm Code	A 4915 / A 4916
Alarm message	CCW and CW rotation monitoring SLI8 activated at the same time
Cause	Multiple activation: • CW (Clockwise) and CCW (Counter-clockwise) input on function block SLI8 are activated simultaneously
Remedy	• Check the logic of the SLI function blocks in the application program • Check the levels of the connected inputs for the application program • Analyze the input and logic signals using the device function block diagnosis

Alarm Code	A 4917 / A 4918
Alarm message	CCW and CW rotation monitoring SLI9 activated at the same time
Cause	Multiple activation: • CW (Clockwise) and CCW (Counter-clockwise) input on function block SLI9 are activated simultaneously
Remedy	• Check the logic of the SLI function blocks in the application program • Check the levels of the connected inputs for the application program • Analyze the input and logic signals using the device function block diagnosis

Alarm Code	A 4919 / A 4920
Alarm message	CCW and CW rotation monitoring SLI10 activated at the same time
Cause	Multiple activation: • CW (Clockwise) and CCW (Counter-clockwise) input on function block SLI10 are activated simultaneously
Remedy	• Check the logic of the SLI function blocks in the application program • Check the levels of the connected inputs for the application program • Analyze the input and logic signals using the device function block diagnosis

Alarm Code	A 4921 / A 4922
Alarm message	CCW and CW rotation monitoring SLI11 activated at the same time
Cause	Multiple activation: • CW (Clockwise) and CCW (Counter-clockwise) input on function block SLI11 are activated simultaneously
Remedy	• Check the logic of the SLI function blocks in the application program • Check the levels of the connected inputs for the application program • Analyze the input and logic signals using the device function block diagnosis

Alarm Code	A 4923 / A 4924
Alarm message	CCW and CW rotation monitoring SLI12 activated at the same time
Cause	Multiple activation: • CW (Clockwise) and CCW (Counter-clockwise) input on function block SLI12 are activated simultaneously
Remedy	• Check the logic of the SLI function blocks in the application program • Check the levels of the connected inputs for the application program • Analyze the input and logic signals using the device function block diagnosis

Alarm code	A 5001 / A 5002
Alarm message	Test deactivation of digital inputs 0...13 faulty
Cause	Inputs are still active after deactivation
Remedy	• Check wiring of digital inputs • Power Cycle • Replace device

Alarm code	A 5101 / A 5102
Alarm message	Pulse fault IQI0.0
Cause	Unexpected status of pulse input
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs

Alarm code	A 5103 / A 5104
Alarm message	Pulse fault IQI0.1
Cause	Unexpected status of pulse input
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs

Alarm code	A 5105 / A 5106
Alarm message	Pulse fault IQI0.2
Cause	Unexpected status of pulse input
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs

Alarm code	A 5107 / A 5108
Alarm message	Pulse fault IQI0.3
Cause	Unexpected status of pulse input
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs

Alarm code	A 5109 / A 5110
Alarm message	Pulse fault IQI0.4
Cause	Unexpected status of pulse input
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs

Alarm code	A 5111 / A 5112
Alarm message	Pulse fault IQI0.5
Cause	Unexpected status of pulse input
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs

Alarm code	A 5113 / A 5114
Alarm message	Pulse fault IQI0.6
Cause	Unexpected status of pulse input
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs

Alarm code	A 5115 / A 5116
Alarm message	Pulse fault IQI0.7
Cause	Unexpected status of pulse input
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs

Alarm code	A 5117 / A 5118
Alarm message	Pulse fault IQI0.8
Cause	Unexpected status of pulse input
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs

Alarm code	A 5119 / A 5120
Alarm message	Pulse fault IQI0.9
Cause	Unexpected status of pulse input
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs

Alarm code	A 5121 / A 5122
Alarm message	Pulse fault IQI0.10
Cause	Unexpected status of pulse input
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs

Alarm code	A 5123 / A 5124
Alarm message	Pulse fault IQI0.11
Cause	Unexpected status of pulse input
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs

Alarm code	A 5125 / A 5126
Alarm message	Pulse fault IQI0.12
Cause	Unexpected status of pulse input
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs

Alarm code	A 5127 / A 5128
Alarm message	Pulse fault IQI0.13
Cause	Unexpected status of pulse input
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs

Alarm code	A 5129 / A 5130
Alarm message	Pulse fault IQI0.14
Cause	Unexpected status of pulse input
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs

Alarm code	A 5131 / A 5132
Alarm message	Pulse fault IQI0.15
Cause	Unexpected status of pulse input
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs

Alarm code	A 5133 / A 5134
Alarm message	Pulse fault IQI0.16
Cause	Unexpected status of pulse input
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs

Alarm code	A 5135 / A 5136
Alarm message	Pulse fault IQI0.17
Cause	Unexpected status of pulse input
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs

Alarm code	A 5137 / A 5138
Alarm message	Pulse fault IQI0.18
Cause	Unexpected status of pulse input
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs

Alarm code	A 5139 / A 5140
Alarm message	Pulse fault IQI0.19
Cause	Unexpected status of pulse input
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs

Alarm code	A 5141 / A 5142
Alarm message	Pulse fault IQI0.20
Cause	Unexpected status of pulse input
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs

Alarm code	A 5143 / A 5144
Alarm message	Pulse fault IQI0.21
Cause	Unexpected status of pulse input
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs

Alarm code	A 5145 / A 5146
Alarm message	Pulse fault IQI0.22
Cause	Unexpected status of pulse input
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs

Alarm code	A 5147 / A 5148
Alarm message	Pulse fault IQI0.23
Cause	Unexpected status of pulse input
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs

Alarm code	A 5149 / A 5150
Alarm message	Pulse fault IQI0.24
Cause	Unexpected status of pulse input
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs

Alarm code	A 5151 / A 5152
Alarm message	Pulse fault IQI0.25
Cause	Unexpected status of pulse input
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs

Alarm code	A 5153 / A 5154
Alarm message	Pulse fault IQI0.26
Cause	Unexpected status of pulse input
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs

Alarm code	A 5155 / A 5156
Alarm message	Pulse fault IQI0.27
Cause	Unexpected status of pulse input
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs

Alarm code	A 5157 / A 5158
Alarm message	Pulse fault IQI0.28
Cause	Unexpected status of pulse input
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs

Alarm code	A 5159 / A 5160
Alarm message	Pulse fault IQI0.29
Cause	Unexpected status of pulse input
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs

Alarm code	A 5161 / A 5162
Alarm message	Pulse fault IQI0.30
Cause	Unexpected status of pulse input
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs

Alarm code	A 5163 / A 5164
Alarm message	Pulse fault IQI0.31
Cause	Unexpected status of pulse input
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs

Alarm code	A 5165 / A 5166
Alarm message	Pulse fault IQI0.32
Cause	Unexpected status of pulse input
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs

Alarm code	A 5167 / A 5168
Alarm message	Pulse fault IQI0.33
Cause	Unexpected status of pulse input
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs

Alarm code	A 5169 / A 5170
Alarm message	Pulse fault IQI0.34
Cause	Unexpected status of pulse input
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs

Alarm code	A 5171 / A 5172
Alarm message	Pulse fault IQI0.35
Cause	Unexpected status of pulse input
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs

Alarm code	A 5173 / A 5174
Alarm message	Pulse fault IQI0.36
Cause	Unexpected status of pulse input
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs

Alarm code	A 5175 / A 5176
Alarm message	Pulse fault IQI0.37
Cause	Unexpected status of pulse input
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs

Alarm code	A 5177 / A 5178
Alarm message	Pulse fault IQI0.38
Cause	Unexpected status of pulse input
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs

Alarm code	A 5179 / A 5180
Alarm message	Pulse fault IQI0.39
Cause	Unexpected status of pulse input
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs

Alarm code	A 6001 / A 6002
Alarm message	Diagnosis DI_Test fault IO-Board 1
Cause	Unexpected state of input barrier
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs • Check power supply on IO board

Alarm code	A 6003 / A 6004
Alarm message	Diagnosis DI_Test fault IO-Board 2
Cause	Unexpected state of input barrier
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs • Check power supply on IO board

Alarm code	A 6005 / A 6006
Alarm message	Diagnosis DI_Test fault IO-Board 3
Cause	Unexpected state of input barrier
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs • Check power supply on IO board

Alarm code	A 6007 / A 6008
Alarm message	Diagnosis DI_Test fault IO-Board 4
Cause	Unexpected state of input barrier
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs • Check power supply on IO board

Alarm code	A 6009 / A 6010
Alarm message	Diagnosis UDI fault IO-Board 1
Cause	Unexpected state of input barrier
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs • Check power supply on IO board

Alarm code	A 6011 / A 6012
Alarm message	Diagnosis UDI fault IO-Board 2
Cause	Unexpected state of input barrier
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs • Check power supply on IO board

Alarm code	A 6013 / A 6014
Alarm message	Diagnosis UDI fault IO-Board 3
Cause	Unexpected state of input barrier
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs • Check power supply on IO board

Alarm code	A 6015 / A 6016
Alarm message	Diagnosis UDI fault IO-Board 4
Cause	Unexpected state of input barrier
Remedy	• Check wiring of digital inputs • Check configuration of digital inputs • Check power supply on IO board

Alarm code	A 6701 / A 6702
Alarm message	Timeout fault MET
Cause	Input element with time supervision faulty
Remedy	• Check the wiring of the input unit • Check the type of the Input element • Input element faulty

Alarm code	A 6703 / A 6704
Alarm message	Timeout fault MEZ
Cause	Two hand control unit with time supervision faulty
Remedy	• Check the wiring of the input unit • Check the type of the Input element • Input element faulty

Alarm Code	A 7401
Alarm message	Master in alarm status. Slaves put on alert.
Cause	STOP / START request
Remedy	BUS reboot reset

Alarm Code	A 7403 / A 7404
Alarm message	Faulty transmission telegram from slave to master
Cause	Module change or STOP / START request
Remedy	BUS reboot reset

Alarm Code	A 9101 / A 9102
Alarm message	SDDC signature error master -> slave
Cause	Configuration bus communication error
Remedy	Switch off/on device

14.8 Fatal fault list

Fatal Error Code	F 1001/ F 1002
Fault message	Configuration data were loaded faultily into the supervision device
Cause	• Connection fault during the download of the program • Transmission of wrong or incomplete binary file
Remedy	• Send configuration data again • Check tooling connection • Power Cycle

Fatal Error Code	F 1003 / F1004
Fault message	Configuration data for software version assembly group invalid!
Cause	Assembly group has been configured with a wrong software version of the programming interface.
Remedy	• Check FW Version and Version of the application software • Configured device with released application software • Power Cycle

Fatal Error Code	F 1007 / F1008
Fault message	Configured device does not match actual device (Device ID)
Cause	• A wrong device type was selected during programming • Binary data from different device type were used to send
Remedy	• Select the correct device type before programming the device • Select the necessary device variant according to your hardware requirement

Fatal Error Code	F 1009
Error message	Configured device variant does not match actual device
Cause	• A wrong device type was selected during programming • Binary data from different device type were used to send
Error correction	• Select the correct device type before programming the device • Select the necessary device variant according to your hardware requirement

Fatal Error Code	F 1307
Error message	Error while erasing the configuration flash
Cause	-
Remedy	• Check FW Version and Version of the application software • Send the configuration again • Power Cycle • Replace device

Fatal Error Code	F 1311 / F1312
Error message	Error while erasing the configuration flash
Cause	-
Remedy	• Check FW Version and Version of the application software • Send the configuration again • Power Cycle • Replace device

Fatal Error Code	F 1314
Error message	Error while erasing the configuration flash
Cause	-
Remedy	• Check FW Version and Version of the application software • Send the configuration again • Power Cycle • Replace device

Fatal Error Code	F 1330
Error message	I2C Bus error while writing to FRAM
Cause	-
Remedy	• Power Cycle • Replace device

Fatal Error Code	F 1401 / F 1402
Error message	Test counter configuration CRC out of range
Cause	-
Remedy	• Power Cycle • Replace device

Fatal Error Code	F 1403 / F 1404
Error message	CRC of configuration data invalid!
Cause	Configuration data transmitted incorrectly
Remedy	• Check FW Version and Version of the application software • Re-compile program • Re-transmit configuration to device • Power Cycle

Fatal Error Code	F 1406
Error message	Incorrect boot
Cause	-
Remedy	• Send the configuration again • Power Cycle • Replace device

Fatal Error Code	F 1407 / F 1408
Error message	Config identifier not supported by hardware
Cause	• Programming software does not support connected hardware • Error transmitting configuration
Remedy	• Check version of programming software • Check FW Version and Version of the application software • Re-Transmit configuration data

Fatal Error Code	F 1409 / F 1410
Error message	CRC of PLC program invalid (AWL list)
Cause	• Programming software does not support connected hardware • Error transmitting configuration
Remedy	• Check version of programming software • Check FW Version and Version of the application software • Re-Transmit configuration data

Fatal Error Code	F 1411 / F 1412
Error message	Configuration data differences in System A and B
Cause	Error transmitting configuration
Remedy	• Re-Transmit configuration data • Power Cycle

Fatal Error Code	F 1413 / F 1414
Fault message	Error sequentially calculating the CRC's configuration data
Cause	Error configuration crc test length
Remedy	• Re-Transmit configuration data • Power Cycle

Fatal Error Code	F 1501 / F 1502
Error message	Firmware parameter CRC test counter
Cause	-
Remedy	• Power Cycle • Replace device

Fatal Error Code	F 1503 / F 1504
Error message	Wrong firmware parameter CRC
Cause	-
Remedy	• Power Cycle • Replace device

Fatal Error Code	F 1505 / F 1506
Error message	Error while sending firmware parameter to CPU B
Cause	-
Remedy	• Power Cycle • Replace device

Fatal Error Code	F 1601 / F 1602
Error message	Range check of device information incorrect.
Cause	• Incompatible application software • Error when importing old layout on new application software
Error correction	• Check FW Version and Version of the application software • Check and correct faulty blocks inside application • Delete and reinsert faulty blocks inside function plan • Program device with originally shipped application software

Fatal Error Code	F 1603 / F 1604
Error message	Range check of access data incorrect.
Cause	• Incompatible application software • Error when importing old layout on new application software
Error correction	• Check FW Version and Version of the application software • Check and correct faulty blocks inside application • Delete and reinsert faulty blocks inside function plan • Program device with originally shipped application software

Fatal Error Code	F 1605 / F 1606
Error message	Range check of EMU incorrect.
Cause	• Incompatible application software • Error when importing old layout on new application software
Error correction	• Check FW Version and Version of the application software • Check and correct faulty blocks inside application • Delete and reinsert faulty blocks inside function plan • Program device with originally shipped application software

Fatal Error Code	F 1607 / F 1608
Error message	Range check of SCA incorrect.
Cause	• Incompatible application software • Error when importing old layout on new application software
Error correction	• Check FW Version and Version of the application software • Check and correct faulty blocks inside application • Delete and reinsert faulty blocks inside function plan • Program device with originally shipped application software

Fatal Error Code	F 1609 / F 1610
Error message	Range check of SSX incorrect.
Cause	• Incompatible application software • Error when importing old layout on new application software
Error correction	• Check FW Version and Version of the application software • Check and correct faulty blocks inside application • Delete and reinsert faulty blocks inside function plan • Program device with originally shipped application software

Fatal Error Code	F 1611 / F 1612
Error message	Range check of SEL incorrect.
Cause	• Incompatible application software • Error when importing old layout on new application software
Error correction	• Check FW Version and Version of the application software • Check and correct faulty blocks inside application • Delete and reinsert faulty blocks inside function plan • Program device with originally shipped application software

Fatal Error Code	F 1613 / F 1614
Error message	Range check of SLP incorrect.
Cause	• Incompatible application software • Error when importing old layout on new application software
Error correction	• Check FW Version and Version of the application software • Check and correct faulty blocks inside application • Delete and reinsert faulty blocks inside function plan • Program device with originally shipped application software

Fatal Error Code	F 1615 / F 1616
Error message	Range check of SOS incorrect.
Cause	• Incompatible application software • Error when importing old layout on new application software
Error correction	• Check FW Version and Version of the application software • Check and correct faulty blocks inside application • Delete and reinsert faulty blocks inside function plan • Program device with originally shipped application software

Fatal Error Code	F 1617 / F 1618
Error message	Range check of SLS incorrect.
Cause	• Incompatible application software • Error when importing old layout on new application software
Error correction	• Check FW Version and Version of the application software • Check and correct faulty blocks inside application • Delete and reinsert faulty blocks inside function plan • Program device with originally shipped application software

Fatal Error Code	F 1619 / F 1620
Error message	Range check of SDI incorrect.
Cause	• Incompatible application software • Error when importing old layout on new application software
Error correction	• Check FW Version and Version of the application software • Check and correct faulty blocks inside application • Delete and reinsert faulty blocks inside function plan • Program device with originally shipped application software

Fatal Error Code	F 1621 / F 1622
Error message	Range check of SLI incorrect.
Cause	• Incompatible application software • Error when importing old layout on new application software
Error correction	• Check FW Version and Version of the application software • Check and correct faulty blocks inside application • Delete and reinsert faulty blocks inside function plan • Program device with originally shipped application software

Fatal Error Code	F 1623 / F 1624
Error message	Range check PLC program incorrect.
Cause	• Incompatible application software • Error when importing old layout on new application software
Error correction	• Check FW Version and Version of the application software • Check and correct faulty blocks inside application • Delete and reinsert faulty blocks inside function plan • Program device with originally shipped application software

Fatal Error Code	F 1625 / F 1626
Error message	Range check of switch off channel incorrect.
Cause	• Incompatible application software • Error when importing old layout on new application software
Error correction	• Check FW Version and Version of the application software • Check and correct faulty blocks inside application • Delete and reinsert faulty blocks inside function plan • Program device with originally shipped application software

Fatal Error Code	F 1627 / F 1628
Error message	Range check of outputs incorrect.
Cause	• Incompatible application software • Error when importing old layout on new application software
Error correction	• Check FW Version and Version of the application software • Check and correct faulty blocks inside application • Delete and reinsert faulty blocks inside function plan • Program device with originally shipped application software

Fatal Error Code	F 1629 / F 1630
Error message	Range check of digital inputs incorrect.
Cause	• Incompatible application software • Error when importing old layout on new application software
Error correction	• Check FW Version and Version of the application software • Check and correct faulty blocks inside application • Delete and reinsert faulty blocks inside function plan • Program device with originally shipped application software

Fatal Error Code	F 1631 / F 1632
Error message	Range check of analogue input
Cause	• Incompatible application software • Error when importing old layout on new application software
Error correction	• Check FW Version and Version of the application software • Check and correct faulty blocks inside application • Delete and reinsert faulty blocks inside function plan • Program device with originally shipped application software

Fatal Error Code	F 1633 / F 1634
Error message	Range check of sensor type incorrect.
Cause	• Incompatible application software • Error when importing old layout on new application software
Error correction	• Check FW Version and Version of the application software • Check and correct faulty blocks inside application • Delete and reinsert faulty blocks inside function plan • Program device with originally shipped application software

Fatal Error Code	F 1635 / F 1636
Error message	Range check of sensor processing incorrect.
Cause	• Incompatible application software • Error when importing old layout on new application software
Error correction	• Check FW Version and Version of the application software • Check and correct faulty blocks inside application • Delete and reinsert faulty blocks inside function plan • Program device with originally shipped application software

Fatal Error Code	F 1637 / F 1638
Error message	Range check of sensor position incorrect.
Cause	• Incompatible application software • Error when importing old layout on new application software
Error correction	• Check FW Version and Version of the application software • Check and correct faulty blocks inside application • Delete and reinsert faulty blocks inside function plan • Program device with originally shipped application software

Fatal Error Code	F 1639 / F 1640
Error message	Range check of PDM incorrect.
Cause	• Incompatible application software • Error when importing old layout on new application software
Error correction	• Check FW Version and Version of the application software • Check and correct faulty blocks inside application • Delete and reinsert faulty blocks inside function plan • Program device with originally shipped application software

Fatal Error Code	F 1641 / F 1642
Error message	Range check of adder switching incorrect.
Cause	• Incompatible application software • Error when importing old layout on new application software
Error correction	• Check FW Version and Version of the application software • Check and correct faulty blocks inside application • Delete and reinsert faulty blocks inside function plan • Program device with originally shipped application software

Fatal Error Code	F 1645 / F 1646
Error message	Range check of axis management incorrect.
Cause	• Incompatible application software • Error when importing old layout on new application software
Error correction	• Check FW Version and Version of the application software • Check and correct faulty blocks inside application • Delete and reinsert faulty blocks inside function plan • Program device with originally shipped application software

Fatal Error Code	F 1647 / F 1648
Error message	Range check of expansion assembly groups incorrect.
Cause	• Incompatible application software • Error when importing old layout on new application software
Error correction	• Check FW Version and Version of the application software • Check and correct faulty blocks inside application • Delete and reinsert faulty blocks inside function plan • Program device with originally shipped application software

Fatal Error Code	F 1649 / F 1650
Error message	Range check of PLC timer incorrect.
Cause	• Incompatible application software • Error when importing old layout on new application software
Error correction	• Check FW Version and Version of the application software • Check and correct faulty blocks inside application • Delete and reinsert faulty blocks inside function plan • Program device with originally shipped application software

Fatal Error Code	F 1651 / F 1652
Error message	Range check of system incorrect.
Cause	• Incompatible application software • Error when importing old layout on new application software
Error correction	• Check FW Version and Version of the application software • Check and correct faulty blocks inside application • Delete and reinsert faulty blocks inside function plan • Program device with originally shipped application software

Fatal Error Code	F 1653 / F 1654
Error message	Range check of connection table incorrect.
Cause	• Incompatible application software • Error when importing old layout on new application software
Error correction	• Check FW Version and Version of the application software • Check and correct faulty blocks inside application • Delete and reinsert faulty blocks inside function plan • Program device with originally shipped application software

Fatal Error Code	F 1655 / F 1656
Error message	Range check of SAC incorrect.
Cause	• Incompatible application software • Error when importing old layout on new application software
Error correction	• Check FW Version and Version of the application software • Check and correct faulty blocks inside application • Delete and reinsert faulty blocks inside function plan • Program device with originally shipped application software

Fatal Error Code	F 1657 / F 1658
Error message	Range check of diagnosis incorrect.
Cause	• Incompatible application software • Error when importing old layout on new application software
Error correction	• Check FW Version and Version of the application software • Check and correct faulty blocks inside application • Delete and reinsert faulty blocks inside function plan • Program device with originally shipped application software

Fatal Error Code	F 1659 / F 1660
Error message	Range check of FBus incorrect.
Cause	• Incompatible application software • Error when importing old layout on new application software
Error correction	• Check FW Version and Version of the application software • Check and correct faulty blocks inside application • Delete and reinsert faulty blocks inside function plan • Program device with originally shipped application software

Fatal Error Code	F 1661 / F 1662
Error message	Range check FBus
Cause	• Incompatible application software • Error when importing old layout on new application software
Error correction	• Check FW Version and Version of the application software • Check and correct faulty blocks inside application • Delete and reinsert faulty blocks inside function plan • Program device with originally shipped application software

Fatal Error Code	F 1671 / F 1672
Error message	Range check PRF void
Cause	No PRF reference table is present even though configuration PRF function used on the device.
Error correction	• Send PRF position table to device • Insert X/Y position tables and PRF function, then delete the inserted PRF block and position tables again (if not used) • Re-transmit configuration to device

Fatal Error Code	F 1673 / F 1674
Error message	Range check PRF sorting
Cause	Entries inside PRF position table are not sorted ascendingly
Error correction	• Check PRF X/Y tables for ascending positions • Re-transmit configuration to device

Fatal Error Code	F 1675 / F 1676
Error message	Range check PRF steps
Cause	The distances of the reference table are too small. Should be: Table [n] - Table [n-1] > Switch-off position
Error correction	• Check PRF X/Y tables to meet requirement • Re-transmit configuration to device

Fatal Error Code	F 1677 / F 1678
Error message	Range check PRF tolerance
Cause	The PRF tolerance threshold is too large. Should be: PRF tolerance <switch-off threshold position / 2
Error correction	• Check PRF X/Y tables to meet requirement • Re-transmit configuration to device

Fatal Error Code	F 2001 / F 2002
Error message	CRC of SPI cross communication CPU A-B wrong
Cause	Interference on SPI cross communication between both CPUs
Remedy	• Check wiring on device • Check EMC requirements • Power Cycle • Replace device

Fatal Error Code	F 2003 / F 2004
Error message	Timeout during transmission of configurations and firmware data
Cause	Interference on SPI cross communication between both CPUs
Remedy	• Check wiring on device • Check EMC requirements • Power Cycle • Replace device

Fatal Error Code	F 2005
Error message	Timeout cyclic cross communication
Cause	Interference on SPI cross communication between both CPUs
Remedy	• Check wiring on device • Check EMC requirements • Power Cycle • Replace device

Fatal Error Code	F 2007
Error message	Timeout synchronization CPU B
Cause	Interference on SPI cross communication between both CPUs
Remedy	• Check wiring on device • Check EMC requirements • Power Cycle • Replace device

Fatal Error Code	F 2009
Error message	Timeout data transmission complementary channel
Cause	Interference on SPI cross communication between both CPUs
Remedy	• Check wiring on device • Check EMC requirements • Power Cycle • Replace device

Fatal Error Code	F 2011
Error message	Timeout synchronization cycle start
Cause	-
Remedy	• Check wiring on device • Check EMC requirements • Power Cycle • Replace device

Fatal Error Code	F 3001 / F 3002
Error message	Ticker sync error
Cause	-
Remedy	• Check wiring on device • Check EMC requirements • Power Cycle • Replace device

Fatal Error Code	F 3201 / F 3202
Fault message	Processor voltage 2.5V outside defined range
Cause	• Supply voltage for module not correct! • Component fault in module
Remedy	• Check device supply voltage! • Switch device off/on.

Fatal Error Code	F 3203
Fault message	Supply voltage 24V module faulty.
Cause	• Supply voltage for module not correct! • Component fault in module
Remedy	• Check device supply voltage! • Switch device off/on.

Fatal Error Code	F 3204
Fault message	Internal supply voltage 5.7V faulty
Cause	• Supply voltage for module not correct! • Component fault in module
Remedy	• Check device supply voltage! • Switch device off/on.

Fatal Error Code	F 3217 / F 3218
Error message	Internal supply voltage 5V incorrect.
Cause	• Supply voltage of assembly group incorrect! • Component error in assembly group
Remedy	• Check device supply voltage! • Switch off/on device.

Fatal Error Code	F 3239 / F 3240
Error message	24V Supply voltage on IO-Board 1 incorrect
Cause	• Supply voltage of assembly group incorrect! • Component error in assembly group
Remedy	• Check device supply voltage! • Switch off/on device.

Fatal Error Code	F 3241 / F 3242
Error message	24V Supply voltage on IO-Board 2 incorrect
Cause	• Supply voltage of assembly group incorrect! • Component error in assembly group
Remedy	• Check device supply voltage! • Switch off/on device.

Fatal Error Code	F 3243 / F 3244
Error message	24V Supply voltage on IO-Board 3 incorrect
Cause	• Supply voltage of assembly group incorrect! • Component error in assembly group
Remedy	• Check device supply voltage! • Switch off/on device.

Fatal Error Code	F 3245 / F 3246
Error message	24V Supply voltage on IO-Board 4 incorrect
Cause	• Supply voltage of assembly group incorrect! • Component error in assembly group
Remedy	• Check device supply voltage! • Switch off/on device.

Fatal Error Code	F 3603 / F 3604
Fault message	Faulty switching of relay Q4
Cause	Internal relay activation incorrect
Remedy	• Check output wiring of device • Check environmental conditions of device • Power Cycle • Replace Device

Fatal Error Code	F 3605 / F 3606
Fault message	Faulty switching of relay Q5
Cause	Internal relay activation incorrect
Remedy	• Check output wiring of device • Check environmental conditions of device • Power Cycle • Replace Device

Fatal Error Code	F 3609
Fault message	Faulty switching of “0V” driver Q0.1_N
Cause	Switching status output incorrect
Remedy	• Check output wiring of device • Check wiring for short circuit • Power Cycle • Replace Device

Fatal Error Code	F 3610
Fault message	Faulty switching of “24V” driver Q0.0_P
Cause	Switching status output incorrect
Remedy	• Check output wiring of device • Check wiring for short circuit • Power Cycle • Replace Device

Fatal Error Code	F 3611
Fault message	Faulty switching of “0V” driver Q0.3_N
Cause	Switching status output incorrect
Remedy	• Check output wiring of device • Check wiring for short circuit • Power Cycle • Replace Device

Fatal Error Code	F 3612
Fault message	Faulty switching of “24V” driver Q0.2_P
Cause	Switching status output incorrect
Remedy	• Check output wiring of device • Check wiring for short circuit • Power Cycle • Replace Device

Fatal Error Code	F 3613
Fault message	Faulty switching of “0V” driver Q0.1_N
Cause	Switching status output incorrect
Remedy	• Check output wiring of device • Check wiring for short circuit • Power Cycle • Replace Device

Fatal Error Code	F 3614
Fault message	Faulty testing of “24V” driver Q0.0_P
Cause	Switching status output incorrect
Remedy	• Check output wiring of device • Check wiring for short circuit • Power Cycle • Replace Device

Fatal Error Code	F 3615
Fault message	Faulty testing of “0V” driver Q0.3_N
Cause	Switching status output incorrect
Remedy	• Check output wiring of device • Check wiring for short circuit • Power Cycle • Replace Device

Fatal Error Code	F 3616
Fault message	Faulty testing of “24V” driver Q0.2_P
Cause	Switching status output incorrect
Remedy	• Check output wiring of device • Check wiring for short circuit • Power Cycle • Replace Device

Fatal Error Code	F 3617
Error message	Incorrect switching power switch Q0.1_N
Cause	Wrong wiring on device
Remedy	• Check output wiring of device • Check wiring for short circuit • Power Cycle • Replace Device

Fatal Error Code	F 3618
Error message	Incorrect switching power switch Q0.0_P
Cause	Wrong wiring on device
Remedy	• Check output wiring of device • Check wiring for short circuit • Power Cycle • Replace Device

Fatal Error Code	F 3619
Error message	Incorrect switching power switch Q0.3_N
Cause	Wrong wiring on device
Remedy	• Check output wiring of device • Check wiring for short circuit • Power Cycle • Replace Device

Fatal Error Code	F 3620
Error message	Incorrect switching power switch Q0.2_P
Cause	Wrong wiring on device
Remedy	• Check output wiring of device • Check wiring for short circuit • Power Cycle • Replace Device

Fatal Error Code	F 3621
Error message	Incorrect switching of NO/NC contact relay Q4
Cause	Wrong wiring on device
Remedy	• Check output wiring of device • Check wiring for short circuit • Power Cycle • Replace Device

Fatal Error Code	F 3622
Error message	Incorrect switching of NO/NC contact relay Q5
Cause	Wrong wiring on device
Remedy	• Check output wiring of device • Check wiring for short circuit • Power Cycle • Replace Device

Fatal Error Code	F 3623
Error message	Incorrect switching of output main switch
Cause	• Wrong wiring on device • Short circuit
Remedy	• Check output wiring of device • Check wiring for short circuit • Power Cycle • Replace Device

Fatal Error Code	F 3625 / F3626
Error message	Incorrect switching of output main switch
Cause	• Wrong wiring on device • Short circuit
Remedy	• Check output wiring of device • Check wiring for short circuit • Power Cycle • Replace Device

Fatal Error Code	F 3623 / F 3625 / F3626
Fault message	Internal Error Startup test slave module
Cause	Missing or faulty 24V power supply
Remedy	• Check 24V power supply PSC1-C-100 master module • Check that all power connectors are connected

Fatal Error Code	F 3641 / F 3642
Fault message	Internal Error Startup test master module REL
Cause	Missing or faulty 24V power supply
Remedy	• Check 24V power supply PSC1-C-100 master module • Check that all power connectors are connected • Check input and output voltage • Power Cycle

Fatal Error Code	F 3643 / F 3644
Fault message	Internal Error Startup test master module EA1
Cause	Missing or faulty 24V power supply
Remedy	• Check 24V power supply PSC1-C-100 master module • Check that all power connectors are connected • Check input and output voltage • Power Cycle

Fatal Error Code	F 3645 / F 3646
Fault message	Internal Error Startup test master module EA2
Cause	Missing or faulty 24V power supply
Remedy	• Check 24V power supply PSC1-C-100 master module • Check that all power connectors are connected • Check input and output voltage • Power Cycle

Fatal Error Code	F 3647 / F 3648
Fault message	Internal Error Startup test master module EA3
Cause	Missing or faulty 24V power supply
Remedy	• Check 24V power supply PSC1-C-100 master module • Check that all power connectors are connected • Check input and output voltage • Power Cycle

Fatal Error Code	F 3649 / F 3650
Fault message	Internal Error Startup test master module EA4
Cause	Missing or faulty 24V power supply
Remedy	• Check 24V power supply PSC1-C-100 master module • Check that all power connectors are connected • Check input and output voltage • Power Cycle

Fatal Error Code	F 3651 / F 3652
Fault message	Internal Error Startup test master module HS
Cause	Missing or faulty 24V power supply
Remedy	• Check 24V power supply PSC1-C-100 master module • Check that all power connectors are connected • Check input and output voltage • Power Cycle

Fatal Error Code	F 3665 / F 3666
Fault message	Static test loss of ground HighSide 2
Cause	• Wrong wiring (short circuit) • Hardware defect
Remedy	• Check the wiring • Power Cycle

Fatal Error Code	F 3667 / F 3668
Fault message	Static test loss of ground HighSide 4
Cause	• Wrong wiring (short circuit) • Hardware defect
Remedy	• Check the wiring • Power Cycle

Fatal Error Code	F 3669 / F 3670
Fault message	Dynamic test loss of ground HighSide 2
Cause	• Wrong wiring (short circuit) • Hardware defect
Remedy	• Check the wiring • Power Cycle

Fatal Error Code	F 3671 / F 3672
Fault message	Dynamic test loss of ground HighSide 4
Cause	• Wrong wiring (short circuit) • Hardware defect
Remedy	• Check the wiring • Power Cycle

Fatal Error Code	F 3701 / F 3702
Error message	Error comparing process images CPU A – CPU B
Cause	-
Error correction	• Check EMC requirements • Power Cycle • Replace device

Fatal Error Code	F 3821 / F 3822
Error message	Incorrect switching of output IQQ.0
Cause	Short circuit of output with „24V" or „0V"
Error correction	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 3823 / F 3824
Error message	Incorrect switching of output IQQ.1
Cause	Short circuit of output with „24V“ or „0V“
Error correction	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 3825 / F 3826
Error message	Incorrect switching of output IQQ.2
Cause	Short circuit of output with „24V“ or „0V“
Error correction	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 3827 / F 3828
Error message	Incorrect switching of output IQQ.3
Cause	Short circuit of output with „24V“ or „0V“
Error correction	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 3829 / F 3830
Error message	Incorrect switching of output IQQ.4
Cause	Short circuit of output with „24V“ or „0V“
Error correction	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 3831 / F 3832
Error message	Incorrect switching of output IQQ.5
Cause	Short circuit of output with „24V“ or „0V“
Error correction	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 3833 / F 3834
Error message	Incorrect switching of output IQQ.6
Cause	Short circuit of output with „24V“ or „0V“
Error correction	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 3835 / F 3836
Error message	Incorrect switching of output IQQ.7
Cause	Short circuit of output with „24V“ or „0V“
Error correction	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 3837 / F 3838
Error message	Incorrect switching of output IQQ.8
Cause	Short circuit of output with „24V“ or „0V“
Error correction	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 3839 / F 3840
Error message	Incorrect switching of output IQQ.9
Cause	Short circuit of output with „24V“ or „0V“
Error correction	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 3841 / F 3842
Error message	Incorrect testing of output IQQ.0
Cause	Short circuit of output with „24V“ or „0V“
Error correction	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 3843 / F 3844
Error message	Incorrect testing of output IQQ.1
Cause	Short circuit of output with „24V“ or „0V“
Error correction	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 3845 / F 3846
Error message	Incorrect testing of output IQQ.2
Cause	Short circuit of output with „24V“ or „0V“
Error correction	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 3847 / F 3848
Error message	Incorrect testing of output IQQ.3
Cause	Short circuit of output with „24V“ or „0V“
Error correction	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 3849 / F 3850
Error message	Incorrect testing of output IQQ.4
Cause	Short circuit of output with „24V“ or „0V“
Error correction	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 3851 / F 3852
Error message	Incorrect testing of output IQQ.5
Cause	Short circuit of output with „24V“ or „0V“
Error correction	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 3853 / F 3854
Error message	Incorrect testing of output IQQ.6
Cause	Short circuit of output with „24V“ or „0V“
Error correction	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 3855 / F 3856
Error message	Incorrect testing of output IQQ.7
Cause	Short circuit of output with „24V“ or „0V“
Error correction	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 3857 / F 3858
Error message	Incorrect testing of output IQQ.8
Cause	Short circuit of output with „24V“ or „0V“
Error correction	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 3859 / F 3860
Error message	Incorrect testing of output IQQ.9
Cause	Short circuit of output with „24V“ or „0V“
Error correction	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 3871 / F 3872
Error message	Incorrect switching of power main switch 1 for outputs on extension device
Cause	-
Error correction	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle • Replace Device

Fatal Error Code	F 3873 / F 3874
Error message	Incorrect switching of power main switch 2 for outputs on extension device
Cause	-
Error correction	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle • Replace Device

Fatal Error Code	F 3891 / F 3892
Error message	Incorrect switching of power main switch 1 for outputs on extension device
Cause	-
Error correction	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle • Replace Device

Fatal Error Code	F 3893 / F 3894
Error message	Incorrect switching of power main switch 2 for outputs on extension device
Cause	-
Error correction	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle • Replace Device

Fatal Error Code	F 3971 / F 3972
Fault message	MainTrans IQQ10 … IQQ14 static test
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 3973 / F 3974
Fault message	MainTrans IQQ15 … IQQ19 static test
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 3975 / F 3976
Fault message	MainTrans IQQ10 … IQQ14 static test
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 3977 / F 3978
Fault message	MainTrans IQQ15 … IQQ19 static test
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 3981 / F 3982
Fault message	MainTrans IQQ20 … IQQ24 static test
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 3983 / F 3984
Fault message	MainTrans IQQ25 … IQQ29 static test
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 3985 / F 3986
Fault message	MainTrans IQQ20 … IQQ24 dynamic test
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 3987 / F 3988
Fault message	MainTrans IQQ25 … IQQ29 dynamic test
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 3991 / F 3992
Fault message	MainTrans IQQ30 … IQQ34 static test
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 3993 / F 3994
Fault message	MainTrans IQQ35 … IQQ39 static test
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 3995 / F 3996
Fault message	MainTrans IQQ30 … IQQ34 dynamic test
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 3997 / F 3998
Fault message	MainTrans IQQ35 … IQQ39 dynamic test
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 4501 / F 4502
Alarm message	Incorrect calculation of brake ramp SSX
Cause	Calculation of brake ramp would lead to integer overflow. Incorrect configuration
Remedy	• Check monitored sector and stopping distance • Check SSX configuration • Contact manufacturer

Fatal Error Code	F 4503 / F 4504
Alarm message	Incorrect calculation of SSX limit ramp
Cause	Calculation of limit ramp would lead to integer overflow. Incorrect configuration
Remedy	• Check monitored sector and stopping distance • Check SSX configuration • Contact manufacturer

Fatal Error Code	F 4701 / F 4702
Alarm message	Faulty SMF CRC
Cause	The registered CRC of the SMF data on the SD card does not match the calculated CRC
Error correction	• Resend the SMF data and configuration data to the module • Check the SD card • Power Cycle

Fatal Error Code	F 5203 / F 5204
Fault message	Fault IQQ0.10 dynamic test
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 5205 / F 5206
Fault message	Fault IQQ0.11 dynamic test
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 5207 / F 5208
Fault message	Fault IQQ0.12 dynamic test
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 5209 / F 5210
Fault message	Fault IQQ0.13 dynamic test
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 5211 / F 5212
Fault message	Fault IQQ0.14 dynamic test
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 5213 / F 5214
Fault message	Fault IQQ0.15 dynamic test
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 5215 / F 5216
Fault message	Fault IQQ0.16 dynamic test
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 5217 / F 5218
Fault message	Fault IQQ0.17 dynamic test
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 5219 / F 5220
Fault message	Fault IQQ0.18 dynamic test
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 5221 / F 5222
Fault message	Fault IQQ0.19 dynamic test
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 5223 / F 5224
Fault message	Fault IQQ0.20 dynamic test
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 5225 / F 5226
Fault message	Fault IQQ0.21 dynamic test
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 5227 / F 5228
Fault message	Fault IQQ0.22 dynamic test
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 5229 / F 5230
Fault message	Fault IQQ0.23 dynamic test
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 5231 / F 5232
Fault message	Fault IQQ0.24 dynamic test
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 5233 / F 5234
Fault message	Fault IQQ0.25 dynamic test
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 5235 / F 5236
Fault message	Fault IQQ0.26 dynamic test
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 5237 / F 5238
Fault message	Fault IQQ0.27 dynamic test
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 5239 / F 5240
Fault message	Fault IQQ0.28 dynamic test
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 5241 / F 5242
Fault message	Fault IQQ0.29 dynamic test
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 5243 / F 5244
Fault message	Fault IQQ0.30 dynamic test
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 5245 / F 5246
Fault message	Fault IQQ0.31 dynamic test
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 5247 / F 5248
Fault message	Fault IQQ0.32 dynamic test
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 5249/ F 5250
Fault message	Fault IQQ0.33 dynamic test
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 5251 / F 5252
Fault message	Fault IQQ0.34 dynamic test
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 5253 / F 5254
Fault message	Fault IQQ0.35 dynamic test
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 5255 / F 5256
Fault message	Fault IQQ0.36 dynamic test
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 5257 / F 5258
Fault message	Fault IQQ0.37 dynamic test
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 5259 / F 5260
Fault message	Fault IQQ0.38 dynamic test
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 5260 / F 5261
Fault message	Fault IQQ0.39 dynamic test
Cause	Short circuit of output with „24V“ or „0V“
Remedy	• Check wiring of the outputs • Check the wiring for short circuits • Power Cycle

Fatal Error Code	F 6705
Fault message	Master switch status error
Cause	Invalid state while evaluating the master switch
Remedy	• Check wiring of the outputs • Check the wiring of input elements • Power Cycle

Fatal Error Code	F 6801 / F 6802
Error message	Invalid PLC Op Code
Cause	-
Remedy	• Check FW Version and Version of application software for compatibility • Re-transmit configuration • Power Cycle

Fatal Error Code	F 6803 / F 6804
Error message	PLC processing
Cause	-
Remedy	• Check FW Version and Version of application software for compatibility • Re-transmit configuration • Power Cycle

Fatal Error Code	F 6805 / F 6806
Error message	PLC AWL
Cause	-
Remedy	• Check FW Version and Version of application software for compatibility • Re-transmit configuration • Power Cycle

Fatal Error Code	F 6807 / F 6808
Error message	PLC timer overflow
Cause	• Incompatible application software • On or more PLC timer values are not multiples of the cycle time
Remedy	• Check FW Version and Version of application software for compatibility • Check every PLC timer to be a multiple of 8ms • Re-transmit configuration • Power Cycle

Fatal Error Code	F 6809 / F 6810
Error message	Wrong PLC macro CRC
Cause	-
Remedy	• Check FW Version and Version of application software for compatibility • Re-transmit configuration • Power Cycle

Fatal Error Code	F 6811 / F 6812
Error message	Wrong PLC macro termination
Cause	-
Remedy	• Check FW Version and Version of application software for compatibility • Re-transmit configuration • Power Cycle

Fatal Error Code	F 6813 / F 6814
Error message	PLC kernel raised a fatal error
Cause	-
Remedy	• Check FW Version and Version of application software for compatibility • Re-transmit configuration • Power Cycle

Fatal Error Code	F 7001 / F 7002
Error message	Internal error FSoE stack
Cause	Error while processing FSoE data
Error correction	• Check the settings of the FSoE Master • Check connectivity of the device • Power Cycle

Fatal Error Code	F 7429 / F 7430
Error message	Inconsistent logical Profisafe Program Counter
Cause	-
Error correction	• Check the bus configuration • Check connectivity of the device • Power Cycle

Fatal Error Code	F 8205 / F 8206
Error message	Maximum cycle length exceeded
Cause	Processing the application would exceed the maximum cycle time of the device
Remedy	• Reduce the number of used PLC operands by simplifying your program • Remove unused blocks from application • Power Cycle

Fatal Error Code	F 8207 / F 8208
Error message	Logical Program counter exceeds maximum
Cause	-
Remedy	• Re-transmit configuration to device • Power Cycle

Fatal Error Code	F 8213 / F 8214
Error message	Runtime overflow interrupt
Cause	-
Remedy	• Re-transmit configuration to device • Power Cycle

Fatal Error Code	F 8221 / F 8222
Error message	Maximum runtime complementary channel exceeded
Cause	Processing the application would exceed the maximum cycle time of the device
Remedy	• PSC1-C-100: increase cycle time • Reduce the number of used PLC operands by simplifying your program • Power Cycle

Fatal Error Code	F 8223 / F 8224
Error message	Inconsistent logical Interrupt program counter
Cause	-
Remedy	• PSC1-C-100: increase cycle time • Re-transmit configuration to device • Power Cycle

Fatal Error Code	F 8225 / F 8226
Error message	Ticker sync error
Cause	• Maximum runtime exceeded • Communication error with extension device (s)
Remedy	• PSC1-C-100: increase cycle time • Check the back pane bus connection • Reduce the number of used PLC operands by simplifying your program • Power Cycle

Fatal Error Code	F 8227 / F 8228
Error message	Maximum interrupt runtime complementary channel exceeded
Cause	Processing the application would exceed the maximum cycle time of the device
Remedy	• PSC1-C-100: increase cycle time • Reduce the number of used PLC operands by simplifying your program • Power Cycle

Fatal Error Code	F 9001 / F 9002
Error message	CPU self test error
Cause	-
Error correction	• Check EMC requirements • Power Cycle • Replace device

Fatal Error Code	F 9007 / F 9008
Error message	CPU RAM test returned with error
Cause	-
Error correction	• Check EMC requirements • Power Cycle • Replace device

Fatal Error Code	F 9009 / F 9010
Error message	Firmware CRC mismatch
Cause	-
Error correction	• Power Cycle • Replace device

Fatal Error Code	F 9011 / F 9012
Error message	Internal stack test returned with an error
Cause	-
Error correction	• Power Cycle • Replace device

Fatal Error Code	F 9013 / F 9014
Error message	Error NVRAM test
Cause	-
Error correction	• Power Cycle • Replace device

Fatal Error Code	F 9015 / F 9016
Error message	Error CPU RAM test
Cause	-
Error correction	• Power Cycle • Replace device

Fatal Error Code	F 9017 / F 9018
Error message	Error CPU register test
Cause	-
Error correction	• Power Cycle • Replace device

Fatal Error Code	F 9019 / F 9020
Error message	Switch default
Cause	-
Error correction	• Power Cycle • Replace device

15 History of changes

No.	Chapter	Modifier	Description	Date
1	11.3.1.7	Filip Martinko	Status Address Block was replaced by Dummy Block	17.3.2015
2	11.3.3.5	Filip Martinko	DEM parameters note has changed from “SLS, SOS, SLI and SCA” to “SLS, SOS, SDI and SCA”. So SLI was changed to SDI.	26.3.2015
3	2	František Eperješi	SPS definition changed	30.3.2015
4	11.2.1.10	František Eperješi	Input signal Limitation changed	30.3.2015
5	11.2.2.3	Terrones	Changed title, picture, text	15.04.2015
6	11.2.2.4	Terrones	Changed title, picture	15.04.2015
7	11.2.2	Terrones	Changed picture	15.04.2015
8	Appendix Encoder combinations	Terrones	PSC1 11 must be replaced with PSC1-C-10-SDM1 and PSC1 12 must be changed with PSC1-C-10-SDM2	15.04.2015
9	Heading	Terrones	Added Schmersal logo	29.04.2015
10	4.1.2	Terrones	Added text and pictures	20.05.2015
11	11.2.4.1	Terrones	Changed formulas to table in rotational measuring length	08.07.2015
12	4.1.4.1	František Eperješi	Added message Window toggle button, signal table button.	12.11.2015
13	4.1.4.1	František Eperješi	Password for lock function sentence added.	12.11.2015
14	4.8	František Eperješi	Changed Options in message Window section.	12.11.2015
15	4.11	František Eperješi	Added “New document device group” section.	12.11.2015
16	5.1	František Eperješi	Added Hardware/Firmware sentence.	12.11.2015
17	5.5	František Eperješi	Added section about signal trace.	12.11.2015
18	5.9, 5.9.1.2	František Eperješi	“Add selected devices to diagnosis” renamed to “block diagnosis”	12.11.2015

19	7	František Eperješi	Changed: This function is presented in Document Properties window. “Locking” requires a password with at least 5 characters	12.11.2015
20	8	František Eperješi	Device interface icon tool section changed (added PRF, PSC1 etc.)	12.11.2015
21	All	Heinzer Lumpe Fippinger	Removal of unimplemented functions, editorial revision; V2.0	13.04.2018
22	 10 10.1.4 10.1.4.1 10.3.3.1 All	Heinzer Lumpe	A 3657 - A 3664 added, A 4411 - A 4430 ID adapted, Note on sending the network configuration separately Note on addressing SMMC in IL Note on number of transferred bits in SMMC Note regarding the use of the upper input connector on the "Functional input" block, Editorial revision; V2.1	31.10.2018
23	13	Heinzer	DC value specified for 2x Proxy 2	31.10.2018
24	5.9.3 11.3.1.10 11.3.7.3 14.8	Lumpe	Logbook added Edge detection added Terminal alignment added Fatal errors reworked	28.08.2019
25	4.9 4.12 5.8 5.10 11.3.2 11.3.8.3 11.3.8.4 11.3.8.6 14.8 All	Lumpe	Global search extended Updated via SafePLC2 Saving on MC card added Simulator description added Univ. Input element added Added image assignment for groups Description field Groups added Lock&Hide added Error messages F8221ff adapted General editorial revision, Revision of examples Correction of chapter references	08.05.2020