

TECHNICAL REFERENCE

– PANATERM for Safety Programming Manual –

MODEL

Product Name: AC Servo Driver

Product No.: MINAS-A6 Multi EtherCAT series

(EtherCAT communication/rotation type)

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1. PanatermForSafety

The program "PanatermForSafety" is a graphically oriented software for the creation of a PLC-based monitoring program for a MINAS system.



This programming software provides graphical preparation of sequencing programs using functional block method, as well as the parameterization of sensors, actuators and other technological functions used.

About this guide

This guide explains the basics of the PanatermForSafety. The manual describes the main dialogue windows and the procedures on the basis of practical examples, which are designed in such a way that, in principle, you can start with any chapter. Basic knowledge of Windows applications, dialogue boxes, menus, and so on are beneficial. Basic principles of programmable logic control should be familiar.

2. Terms

PLC

The English name for **p**rogrammable **l**ogic **c**ontrol (PLC).

PanatermForSafety

Programming software for the graphical preparation of sequencing programs using functional block method as well as the parameterization of sensors, actuators and other technological functions used.

MINAS

Fail-safe control system with integrated technological functions. The performance of the MINAS system depends on the user configuration and associated logical links.

Function block (function module)

Block in a PLC which either has physical or logical influence on the programming sequence of a PLC program. A physical function block (hardware) is for example a button or a MINAS system output. A function block is also the logical operation (such as AND or OR) of input and output signals in the PLC.

Function block diagram (function block language)

Graphic-based, descriptive programming language in accordance with IEC 1131 that uses function blocks for the visualization of logical links between function block inputs and outputs of a PLC. The function chart shows the function blocks and their logical link in graphical form (*Function Block Diagram, FBD*).

Input / Output

Position at a function block, at which the logical link can be connected with other function blocks.

Logic operation

A specific connection between:

- a.) a function block output and a function block input.
- b.) a PLC input and function block input.
- c.) a function block output and the PLC output.

Connector

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

Attribute

Non-graphical feature of a function block. An attribute consists of an identifier 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 in and out of the PLC in tabular form.

Signal cell

A selectable area of the signal list which can be commented on.

PLC Input signal list

Signal lines in the PLC in tabular form. In the **PanatermForSafety**, the PLC inputs can be set by the user. They have a unique number and must be assigned to the inputs of a function block.

PLC output signal list

Signal lines from the PLC in tabular form. In the **PanatermForSafety**, the PLC outputs can be set by the user and have a unique identification number like the inputs.

Instruction list (IL)

Assembler-like programming language, which can be loaded into a central MINAS module. The task of the **PanatermForSafety** is the generation of an instruction list based on defined function blocks as well as their attributes and connections.

Compilation

Compilation and verification of the function block diagram created by **PanatermForSafety** and the associated parameter.

Function block group

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

Function block types

Accurate identification of a function block within a group (e.g. "EMERGENCY-stop")

Message window

Multiline output window, embedded in a Windows toolbar. The message window displays errors, warnings, and instructions of the program to the user. The message window can be turned on or off.

Configuration

Configuration is the general term for a monitoring program and the associated parameters for permissible deviations or minimum and maximum values. In this context, it should be noted that a monitoring program is always accompanied by additional data to which the program can relate.

3. Installation

This chapter describes the procedure for the installation and associated conditions.

3-1 System requirements

The following system requirements are required to install the program:

❖ **Minimum system requirements:**

OS: Windows 7, Windows 10 (32 bit / 64 bit)

Processor: Intel® Pentium® 4 or AMD Athlon™ dual core, 3.0 GHz or higher

Memory: 2 GB

HDD: 500 MB free disk space

❖ **Recommended system requirements:**

Processor: Intel® Core™ i3 or AMD quad core, 3.0 GHz or higher

Memory: 4 GB or more

The program uses .Net Framework 3.5 and 4.0, but the installation wizard installs the program even if the files are missing. With the .NET installation, you can use local files in the components folder or files from the Internet. The program will be installed even if there is no internet connection. However, the user must install .Net 3.5 and 4.0 separately for the program to work.

The installation wizard installs the VC 2010 distribution files.

Also, the installation wizard installs the following drivers:

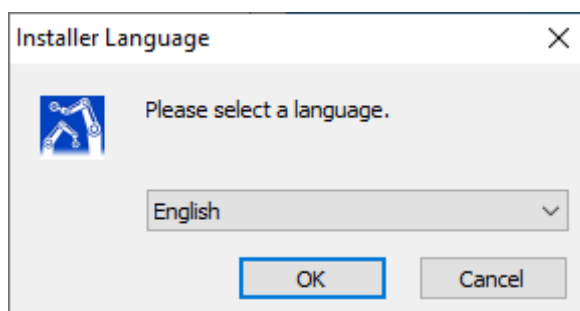
- Matrix-USB driver (driver for dongle)
- FTDI CDM driver (RS485 - USB) - for the connection between PC and PLC technology for the transmission of programs by PanatermForSafety to the PLC hardware

3-2 Installation Set-up

Administrator rights are required for installation only, after which end users can use the installed program.

Start the program installation by double-clicking on the file

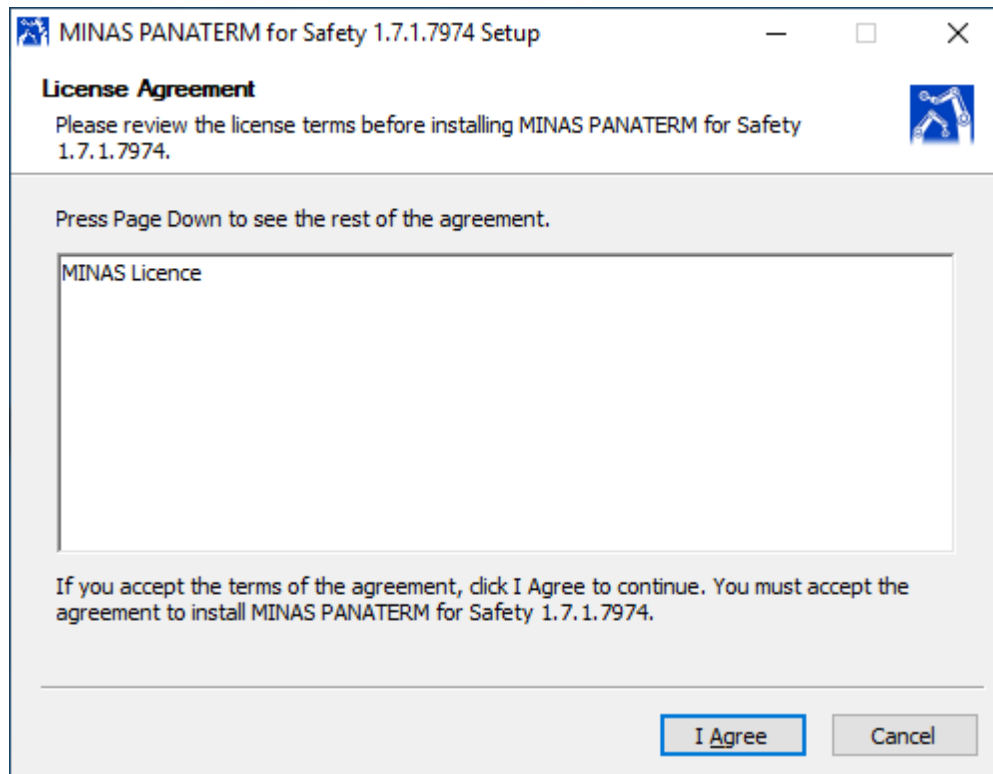
"Setup_PANATERM_for_Safety_x_x_x_xxxx.exe" with the left mouse button. The following window appears:



By expanding the menu, you can select the installation language (English or German).

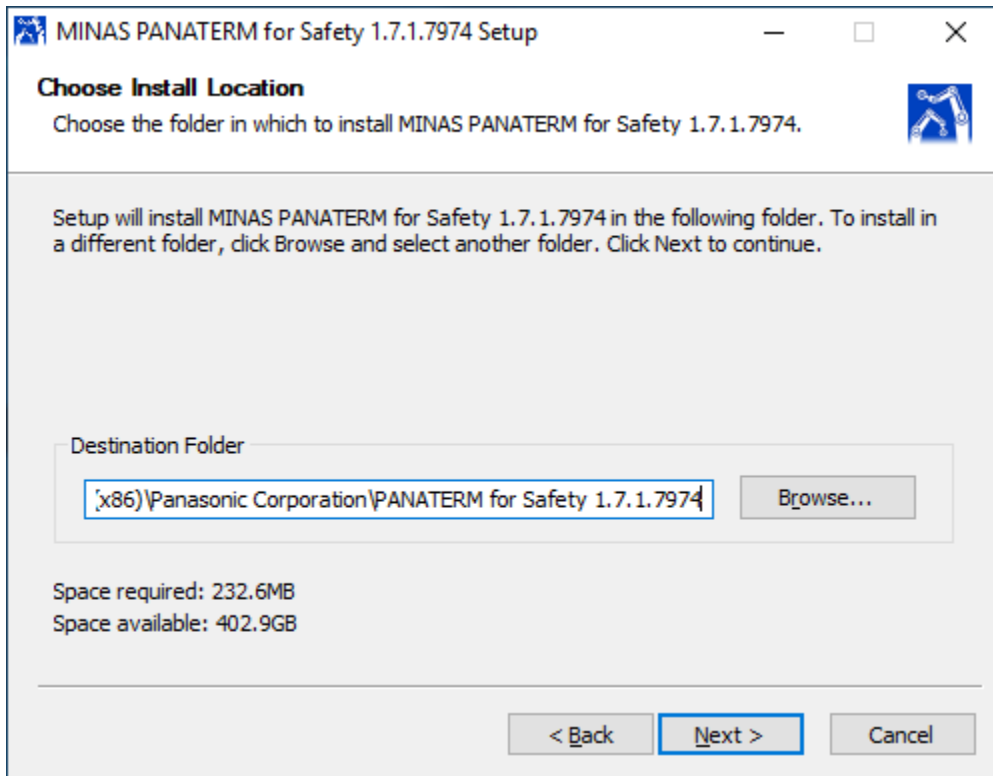
Note: This window appears only when you first install. The language is saved for the next time and the first window appearing is the window with the license agreement. Only the language for the installation is set in the window of the installation language, not the language of the user interface of **PanatermForSafety**.

After selecting the language, click "OK" to continue with the installation. If you click on "Cancel", the installation is completed without installing the program. If you click "OK", the next window with the license agreement will appear.

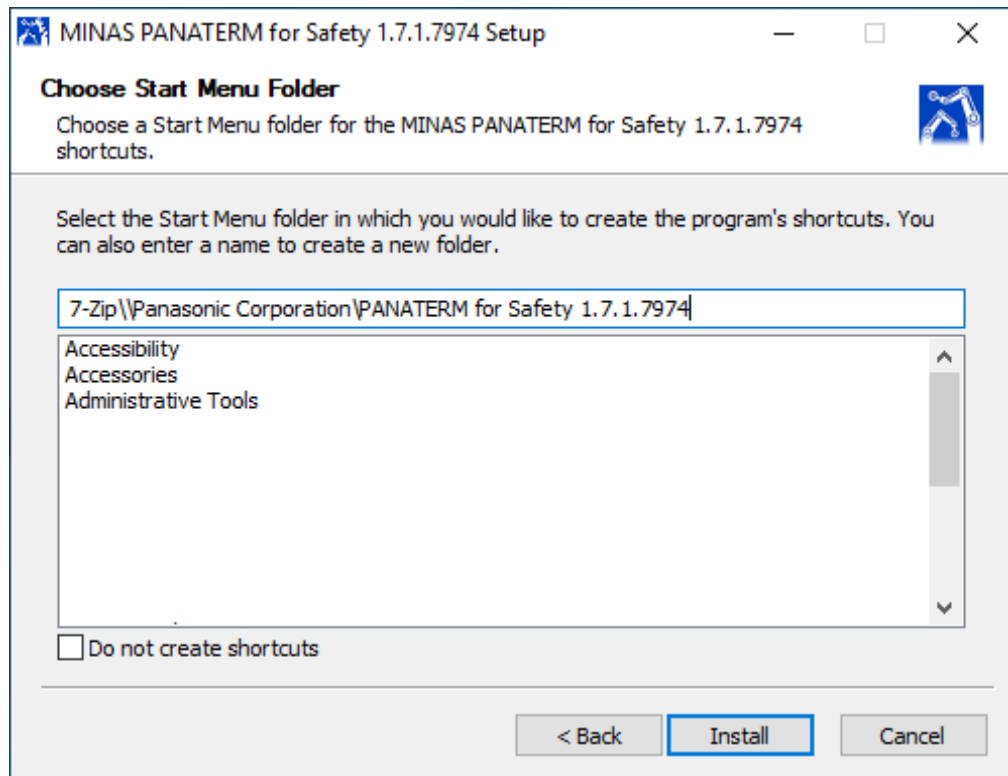


To continue with the installation, click "I Agree". If you do not agree to the license agreement, click "Cancel". The installation is completed without installing the program.

Once you have clicked on "I Agree", a window will appear where you can select the destination folder in which the program is to be installed.

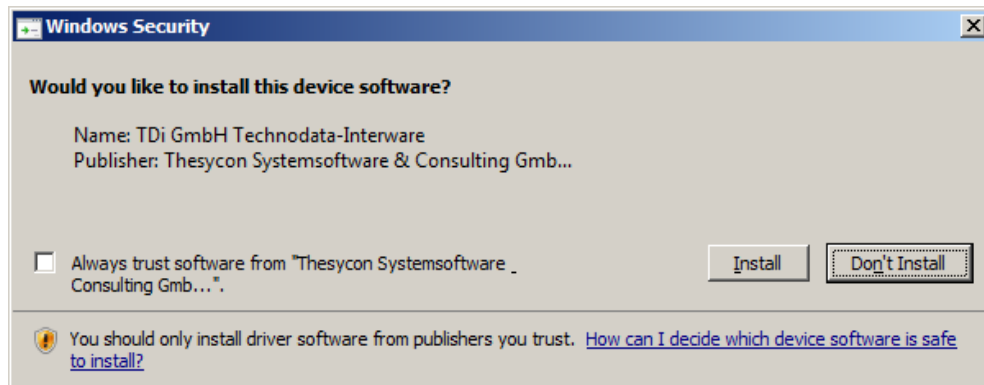


If you click on "Next" a window will appear in which you can select the start-up folder for quick access to the Panasonic PanatermForSafety program. There is also the possibility to create a shortcut in the start menu. If you opt for this possibility, an icon to start the program appears on the desktop of the computer.



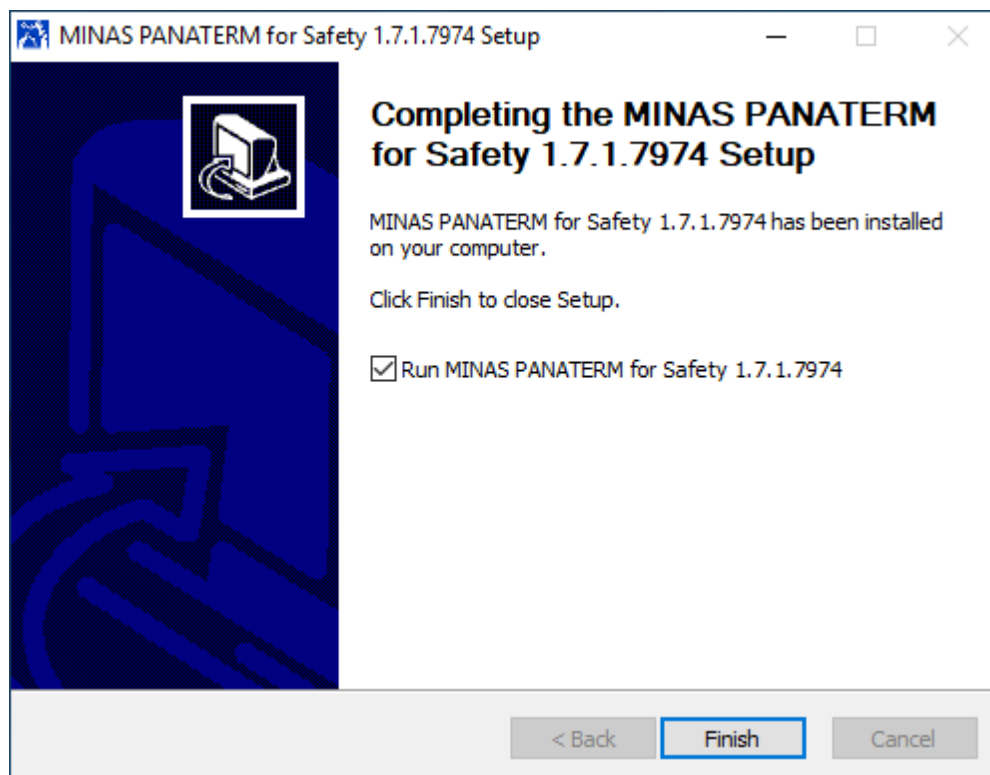
Once you have clicked on "Install", the installation will begin.

If you see a windows security alert during installation, please click on "Install" - to install the Matrix-USB driver (drivers for the dongle) and the FTDI CDM driver (RS485 - USB) - for the connection between PC and PLC to transfer programs from **PanatermForSafety** to the PLC hardware.



Tip: Click on "do not check for Windows updates" during the USB driver installation, this will speed up the installation.

After the installation is complete, the following window will appear:



If you tick the box, you can select whether the program should be started immediately or later. If the check box is not ticked, the dialogue box closes after clicking on "Finish" and the program starts. A desktop icon is created for starting the program when the installation is completed. You can use this icon to start the program any time. If a shortcut was created in the start menu folder during the installation, the program can also be started via the shortcut in this folder.

3-3 Starting the application

To start the program, click twice on the desktop icon or start it from the start menu.
The "Starting dialogue" appears.



3-4 Uninstallation

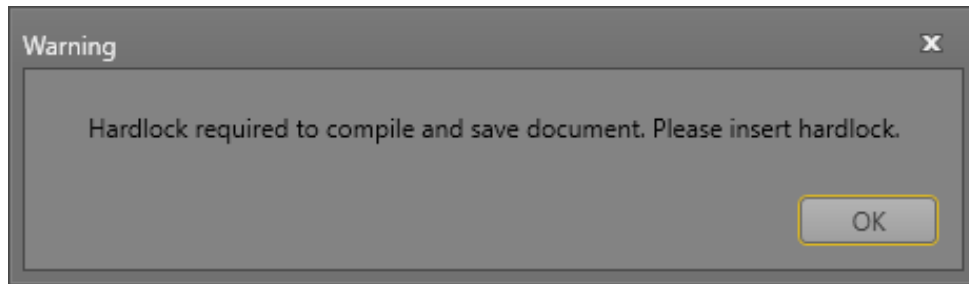
To uninstall **PanatermForSafety** you can use the shortcut in the start menu or the function "Uninstall a program" in the Windows Control Panel.

If you want to install the program again and change the installation language, you need to delete the registry key "Installation language" under the branch
HKEY_CURRENT_USER\Software\MINAS\PANATERM for Safety X.X.X.XXXX.

3-5 Accessories – License Dongle for PanatermForSafety



The license dongle (Hardlock) activates the entire functionality of the PanatermForSafety software and allows the user to change the application program and save it. Without license dongle, the software functionality is limited and the following message will appear by starting the program.



Following software functionality of PanatermForSafety are not possible without dongle:

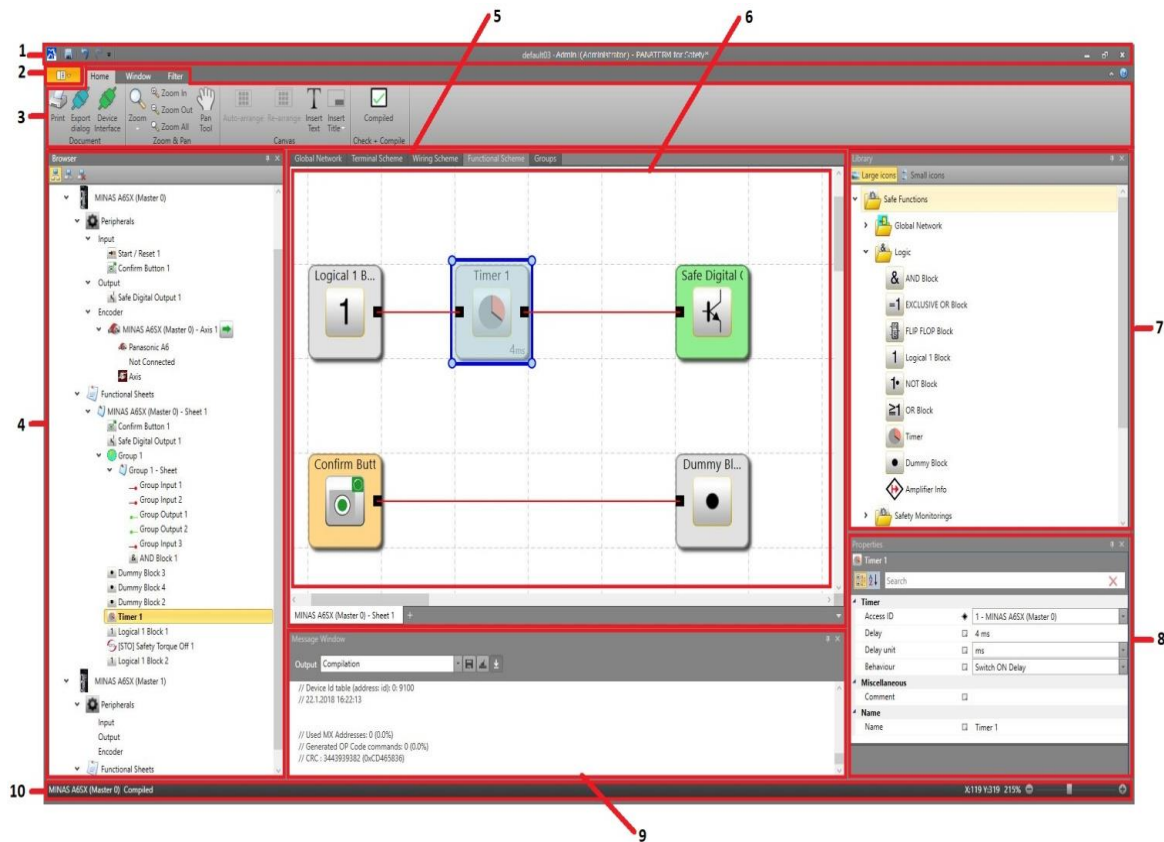
- Compiling a program
- Saving a program

The driver of the license dongle is automatically installed during installation of the PanatermForSafety software.

- ➡ PanatermForSafety requires read and write permissions of the user logged in to the computer used for programming.
- ➡ Missing access rights can result in undesired effects when debugging the function block diagram or when saving the function block diagrams to directories with limited rights.

4. User interface

4-1 Main window



The application window is the main window of the PanatermForSafety application. The window can be adjusted in size, minimized, maximized or closed via the window function areas.

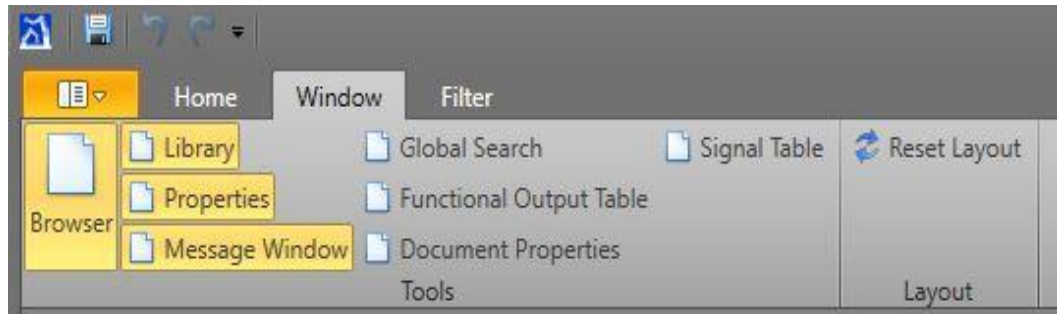
It is divided into the following elements:

1. Title bar with quick access toolbar
2. Start menu
3. Ribbon menu (tabs with groups)
4. Browser
5. Control via document tabs with plan tabs top and sheet tabs bottom
6. Workspace/Canvas
7. Library window
8. Properties window
9. Message window
10. Status Bar

4-1-1 Customizing the main window

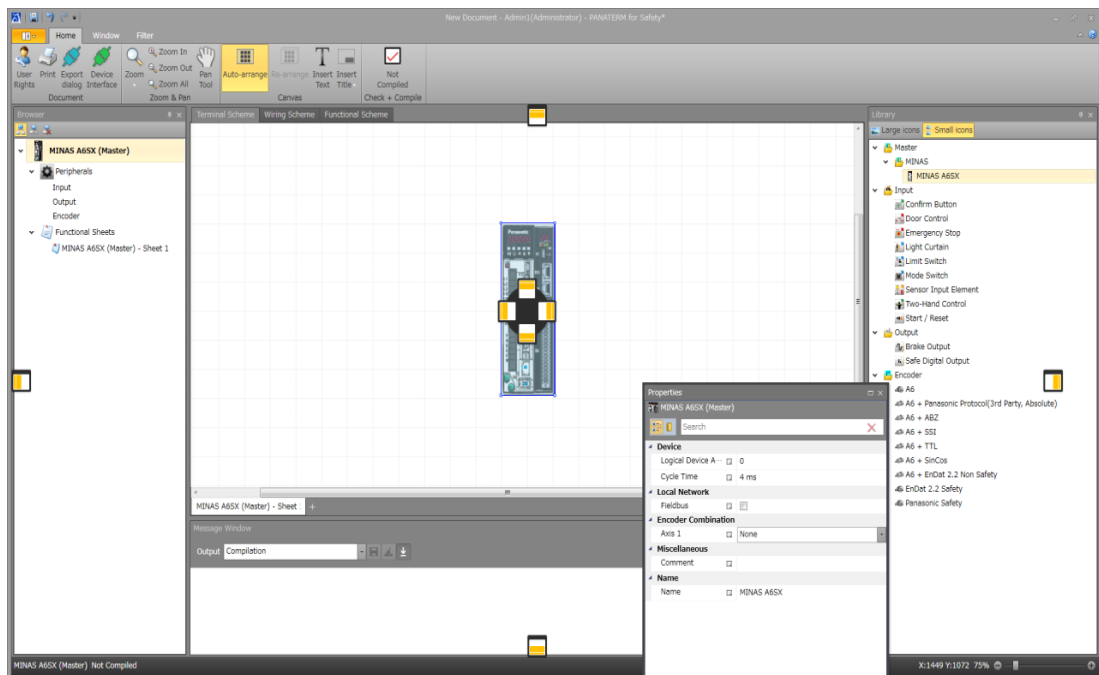
4-1-1-1 Resetting the layout

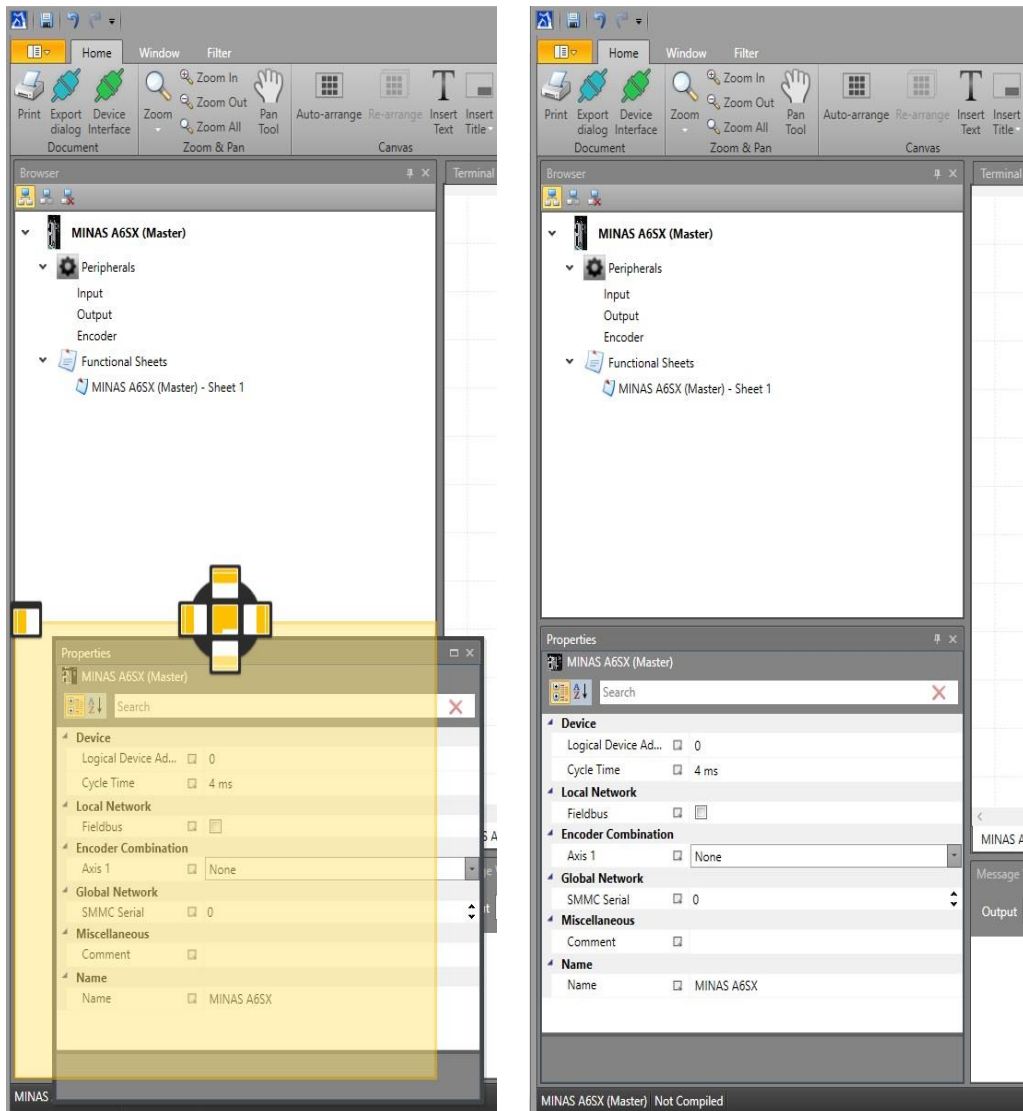
You can reset the layout of the application to the default setting by clicking on "RESET layout" in the tab "Window". Keep in mind that with this command, the user layout is deleted and cannot be restored.



4-1-1-2 Docking

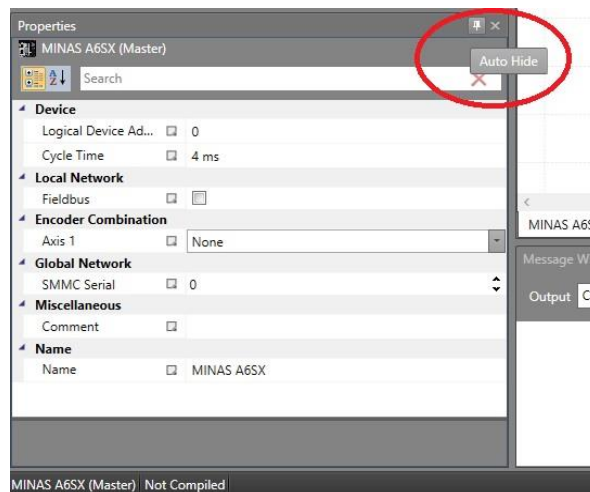
The layout of the application can be personalized via docking. Each area (except for plans and sheets) can be pulled out from the application window and placed in another area or a group of registers.



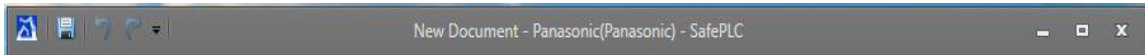


4-1-1-3 Auto-hide

Each area with the symbol for auto-hide  can be moved automatically into the background. The user can turn off auto-hide and make the area visible again by clicking the auto-hide icon  again.



4-1-2 Title Bar



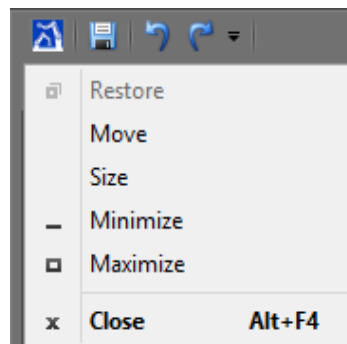
The title bar at the top of the application window contains application icons, buttons for quick access and the application title. The quick access buttons are "Save"  (via the keyboard with CTRL + S), "Undo"  (CTRL + Z) and "Redo"  (CTRL + Y).

The title of the application

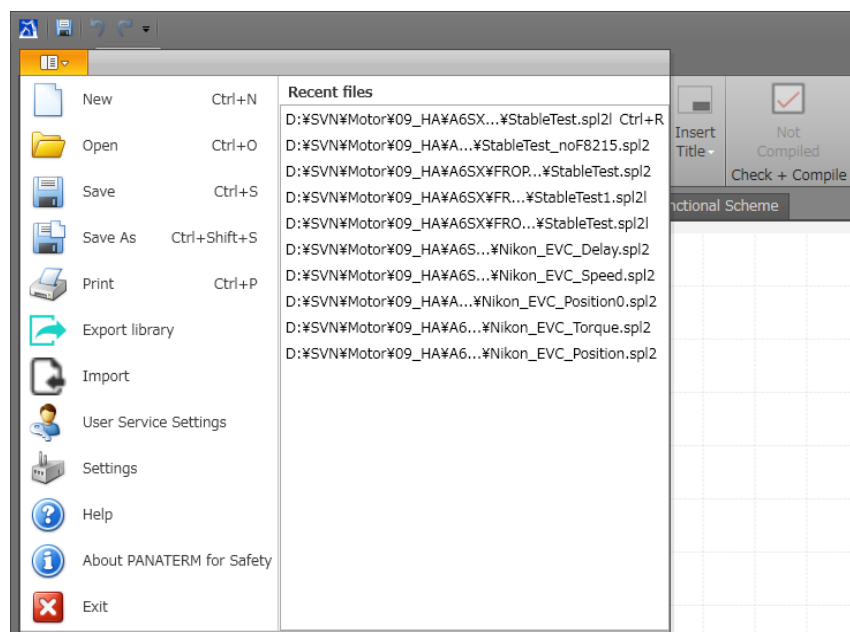
New Document - Admin1(Administrator) - PANATERM for Safety*

consists of the current document name, the currently logged on user and the application name with an asterisk, indicating that at least one unsaved change was made.

By clicking on the application icon, you can invoke the context menu of the application window. The context menu contains the well-known window functions.



4-1-3 Start menu



Basic document and application functions can be called from the start menu, for example new document, save, print, user management, settings, etc.

The most recently used documents are displayed in the "recent documents" (last first).

New

Creates a new project. If a new project is opened, the program asks the user whether to save the changes to the old document.

Open

Opens an existing PanatermForSafety document or a document with a full library. If a new project is opened, the program asks the user whether to save the changes to the old document.

Save

Saves the document in the selected location. For a new project, a window appears with advanced save options (such as "Save as").

Save As

Saves the document by selecting name type and location of the document. The folder contains a document with the same parameters; the program asks the user whether the document should be replaced.

Print

Displays the print options. For a description of this function, see "4.10 Print".

Export Library

Export of a PanatermForSafety library into a *.splib file.

Import

This option is not supported by PanatermForSafety.

Change user

With this command, a user can log on and off.

User Service Settings

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

Settings

Application settings can be changed in the preferences window. See chapter "4.11 Settings".

Help

Opens the PanatermForSafety help window.

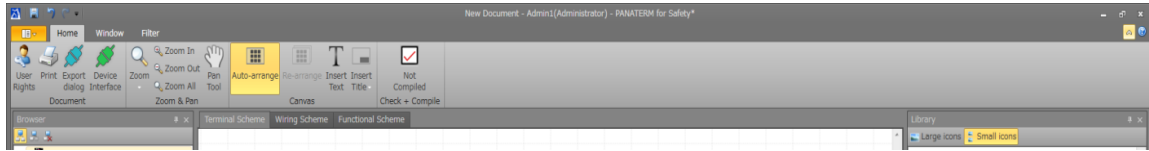
About PanatermForSafety

Brief information about the Windows system, application creation and compilation information are displayed under "About PanatermForSafety".

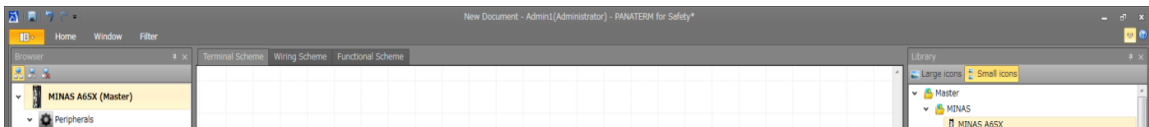
Exit

Closes the entire program.

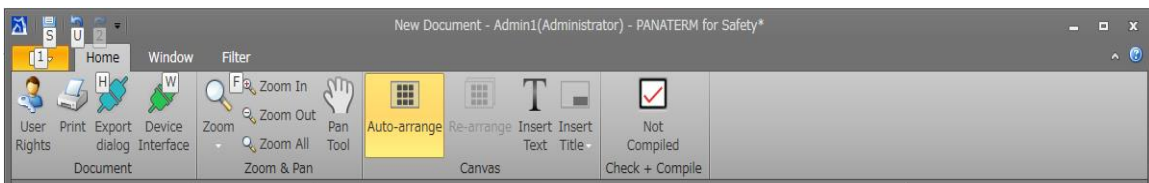
4-1-4 Ribbon menu



The ribbon menu is part of the main window and consists of several tabs. The user can toggle in ribbon mode (minimize - maximize), by clicking on the button  in the upper right corner of the menu. If the ribbon is minimized, the user must click on the appropriate tab. This opens automatically and closes again when no longer clicked.

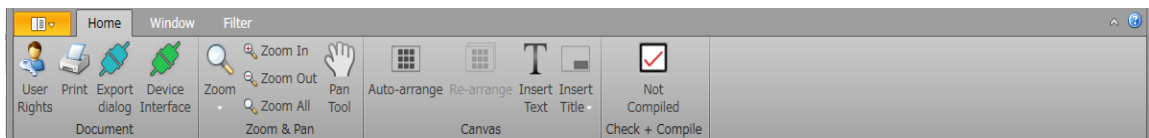


The user can call the tabs by pressing the ALT key and the ToolTip button displayed in the ribbon.



After which the tool tip buttons next to each function in the ribbon menu appear again. The “help” button , which opens the help dialogue window, is located next to the toggle mode.

4-1-4-1 Home



Document

The “User Rights Dialog” appears under “**User Rights**”.

The printer menu appears under “**Print**”.

Under “**Export dialogue**” the export dialogue is displayed.

Under “**device interface**” the devices dialogue box appears.

Zoom and Pan

The drop-down list “**Zoom**” provides access to defined zoom values.

The current zoom is increased by 25% via the button “**Zoom Out**”.

The current zoom is reduced by 25% via the button “**Zoom In**”.

The area can be maximized to page size with the “**Zoom All**” button.

With “**Pan Tool**” it can be toggled in panning mode. If the function is activated, the user can move the area with the left mouse button or middle mouse button.

Canvas

With the toggle button "**auto-arrange**" the mode for automatic arranging can be toggled. If the function is enabled, elements are arranged automatically. Not all plans support the automatic placement.

The "**Re-arrange**" button re-arranges elements immediately; however this arrangement is not saved. Not all plans support the automatic arrangement.

Use the "**Insert Text**" button to enable text placement. When enabled, the user can place text in the workspace by clicking the left mouse button.

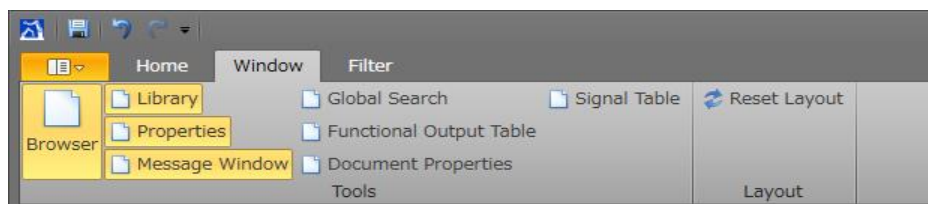
The available titles are listed in the "**Insert Title**" drop-down menu. By clicking on the selected title, it is immediately inserted into all the sheets of the entire document.

Check + compile

The "**Compile**" button is used to compile the current document. After successful compilation, a green check mark appears in the "**Compiled**" text box. Otherwise, "**Not Compiled**" is displayed with a red cross.



4-1-4-2 Window



The user can display or hide windows using the appropriate toggle area.

The "**RESET Layout**" button restores the layout of the application to the default setting.

With the "**Browser**" button the browser window can be switched on and off in the user interface.

With the "**Library**" button the library window can be switched on and off in the user interface.

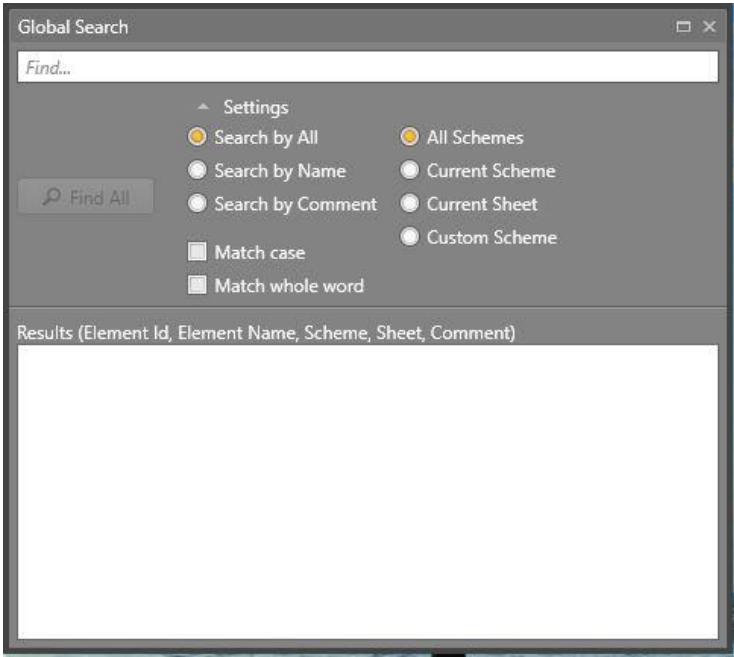
The message window can be switched on and off using the "**Message Window**" button.

The "**Global Search**" button allows you to switch on the global search window. For more information on this function, see chapter 4.9.

The "Functional Output Table" shows all functional outputs used throughout the PLC program.

The "**Document Properties**" button is used to switch the properties window on and off.

"Signal Table" can be used to display all connected signals.



The following table is displayed with the "Functional Output Table" button (see figure).

Functional Output Table					
Bit ID	Custom ID	High Active	Axis Number	Function Module	Comment

The “**Document Properties**” button displays the Document Management window. The window contains the document and device tabs. The “document” tab consists of:

- Developer name - Name of responsible programmer / developer.
- Comment - Descriptive text can be entered via this input field. Here, for example, program or parameter changes can be entered during the operating time of the currently used device.

Document Properties

Document MINAS A6SX (Master)

Password: Lock

Developer Name:

Document device group: MINAS DSMD

Comment:

Document Properties

Document MINAS A6SX (Master)

* Device Information

Descriptions

End Customer

Labelling

Location

Installer

Configuration

Create Date

Functional Characteristics

Hardware

Comments

Contact Details

Installation Name

Installation Phone

Installation Fax

Customer Name

Customer Phone

Customer Fax

Supplier Name

Supplier Phone

Supplier Fax

Installer Name

Installer Phone

Installer Fax

Version

AKZ

* Connection Settings

Timeout 5000

USB Cable ☒ COM Port COM1

Ethernet ☐ IP

Propertie Locked

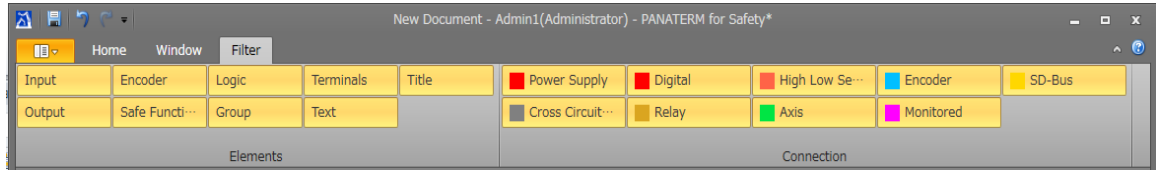
Propertie Unlocked

The device board consists of information fields and connection settings.

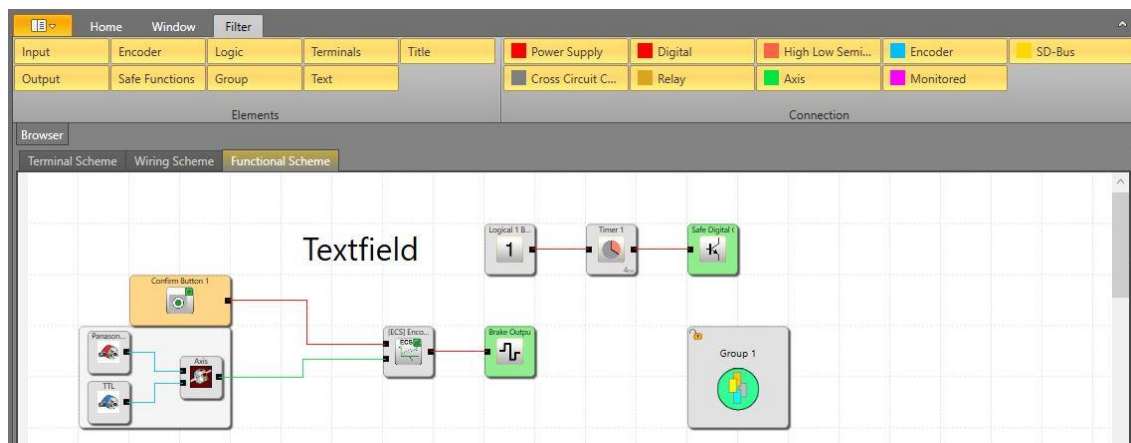
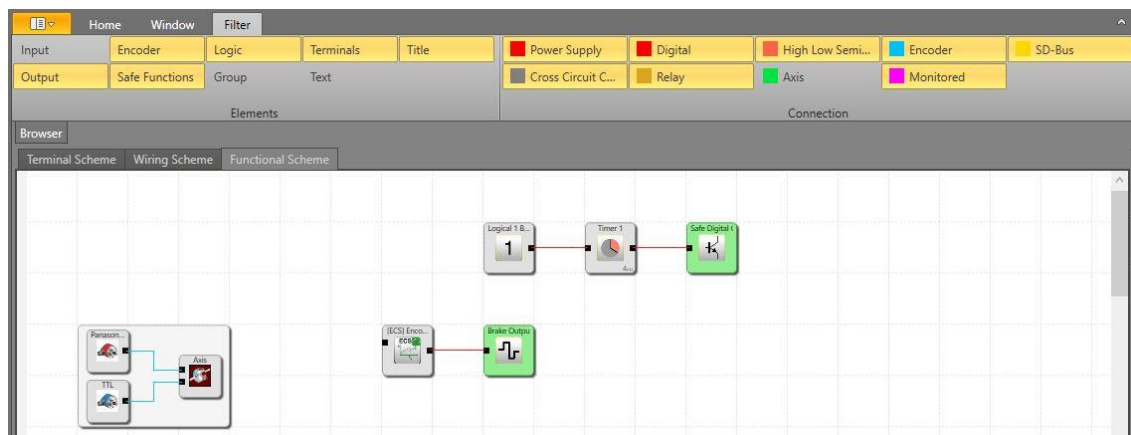
- Device information - For more information about edited fields, see Chapter 6. Validation Report.
- Connection settings - For further information please refer to chapter 5.7 " Program transition to MINAS ".

You can use the "**Lock**" button to lock and unlock documents. If a document is locked, the user cannot edit the document. However, the user can select items and switch between plans or sheets.

4-1-4-3 Filter



The filter settings make it possible to ensure the readability of the work surface by hiding desired element and connection types. There are 2 filter categories: Elements and Connection. Each group contains several filters. If the function is deactivated, the filter elements (or connections) of a specific filter are no longer displayed in the work area.



4-1-5 Status bar



The status bar is located in the main window, showing the name of the master device, the action mode on the left, the cursor position in the workspace on the right, the workspace zoom control and the resize icon. The resize icon indicates that the user can change the size of the main window. The action mode displays the current action that the user performs in the workspace.

4-2 Mouse and keyboard commands

4-2-1 Mouse-dependent actions

- Left mouse click on a function block → Select / deselect corresponding block

Note: Multiple selections can be made by holding down the Shift key (Add a block to the selection) or the Ctrl key (Removing a block from the selection).

- Cursor over the block or the link → Highlight the block or link
- Shift + left mouse button on a function block → Add a block to the selection
- Ctrl + left mouse button on a function block → Removing a block from the selection
- Del key → Deletes the elements of the current selection, including their links
- Right mouse button on object → Displays the context menu
- Left-click on link → Highlight the existing connection line
- Scroll with the mouse wheel → Scroll up / down through the work area
- Move the middle mouse and mouse → Pan the work surface
- Shift + Scroll with the mouse wheel → Scroll to the left / right through the workspace
- Ctrl + Scroll with the mouse wheel → Dynamic zooming in the workspace
- Hold the left mouse button and move the mouse pointer → Move an item in the workspace

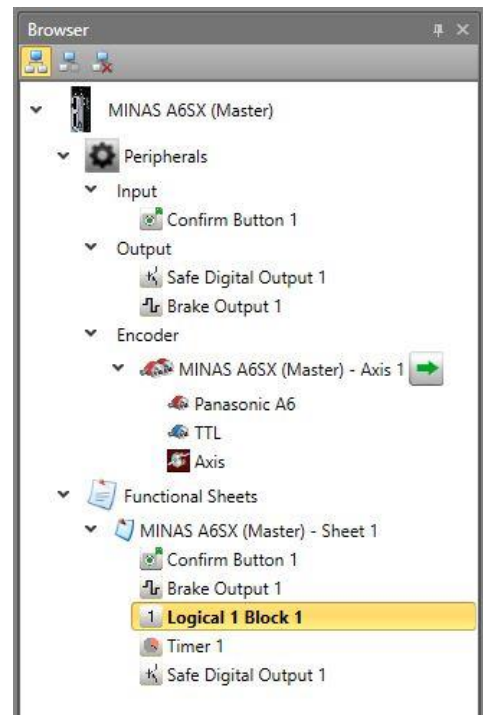
4-2-2 Shortcut Keys

- Ctrl + N: New document
- Ctrl + O: Open the document
- Ctrl + S: Save the document
- Ctrl + Shift + S: Save document as
- Ctrl + P: Print
- Ctrl + R: Open the last used document
- CTRL+ Z: Redo
- Ctrl + A: Select all
- Del: Delete
- Ctrl + C: Copy selected items
- Ctrl + X: Cut selected items
- Ctrl + V: Insert selected elements
- Esc: Cancel
- Backspace: Remove previous connection point while drawing a link
- Ctrl + F: Call up the global search
- Ctrl + F: Display the search elements (only if the message window is activated)
- Ctrl + Tab key: toggles between plans
- F1: Display help for PanatermForSafety (in the individual windows, the help opens in the corresponding chapter).

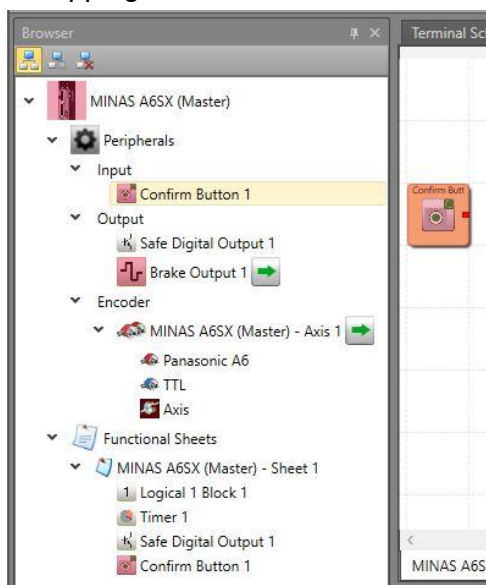
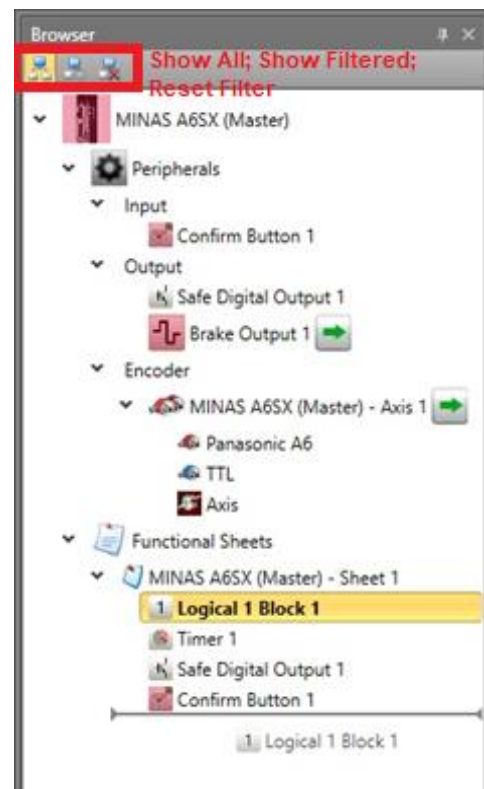
4-3 Browser

The browser area provides an overview of the entire document. Devices, elements and function sheets are displayed as nodes in a tree view. The library area automatically adjusts its content to the currently selected element in the browser. Each node in the browser can be displayed or hidden. The user can rename each node either by double-clicking the node or using the context menu. Several selections are possible by holding down the Ctrl or Shift key. The selection in the browser is adapted to the selection in the workspace.

If a function block diagram has been selected and inputs, outputs or sensor elements have not yet been inserted into the function block diagram, these elements are marked with a green arrow. This allows these elements to be inserted into the function block diagram via drag and drop.



The order of subordinate elements within a parent node can be changed by the user dragging and dropping to the desired location.



Show All: shows all objects.

Show Filtered: hides hidden objects.

Reset Filter: resets hide properties of the objects.

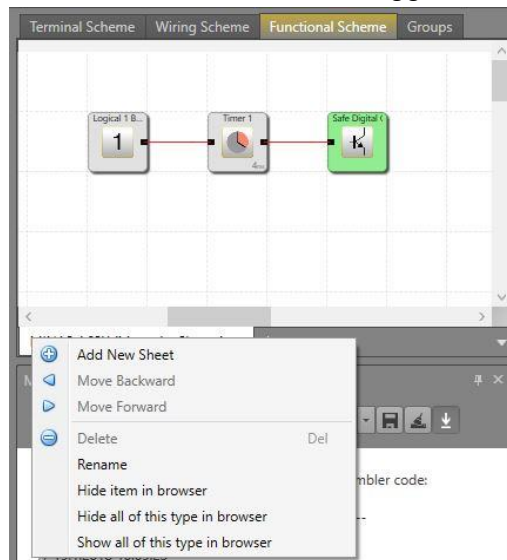
4-4 Control via document register cards

The PanatermForSafety has the following plans:

- Global network
- Local network
- Terminal Scheme
- Wiring Scheme
- Functional Scheme
- Groups

The plans and sheets are represented by individual tabs within the document tab. Control via the document tab allows the user to toggle between schedules and sheets. The arrangement of the chart tabs is located at the top of the window and the tabs are at the bottom. Please note that the Terminal Scheme, Wiring Scheme and Functional Scheme tabs are only visible by default. The other tabs (networks, groups) are only displayed under certain circumstances. Each sheet belongs to one unit.

Note: Use the keyboard command "Ctrl + Tab button" to toggle between the plans.



Add new sheet

adds a new sheet to the current plan.

Move Backward

moves the current sheet to the left.

Move Foreward

moves the current sheet to the right.

Delete

deletes the current sheet. This command is not available if there is only one sheet.

Rename

renames the current sheet.

Hide item in browser

hides item in the current browser

(Option "**Show Filtered**" is to be selected)

Hide all of this type in browser

hides all of types in the current browser

(Option "**Show Filtered**" is to be selected)

Show all of this type in browser

shows all of this type in the current browser

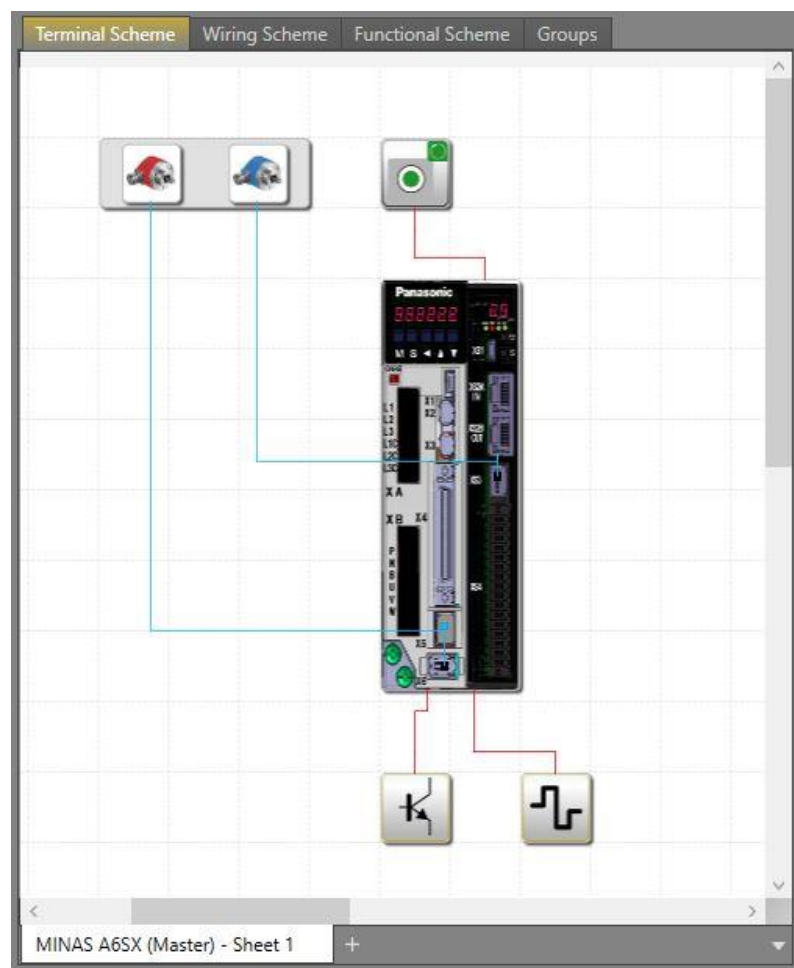
(Option "**Show All**" is to be selected)

4-4-1 Diagram types

The diagrams and sheets are represented by individual tabs in the document tab.

4-4-1-1 Terminal Scheme

A simplified schematic with selected devices and peripherals of the MINAS system is displayed under "Terminal Scheme".

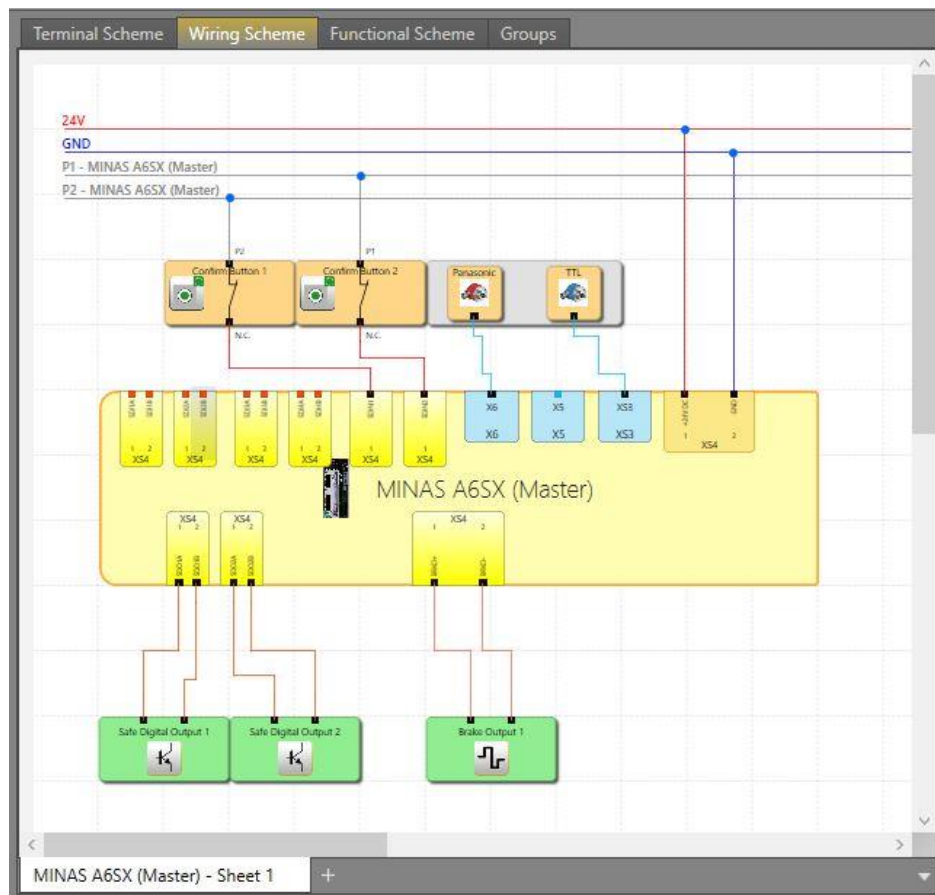


Terminal Scheme: If function blocks are inserted into the Terminal Scheme, the elements are automatically connected to the device.

4-4-1-2 Wiring Scheme

The "Wiring Scheme" shows the external connected sensors and actuators. When creating a new project, (Menu> New... all possible inputs and outputs as well as sensor interfaces (encoders, analogue sensors) are shown here.

Although auto-arrange is enabled, in some cases it can happen that links are displayed unfavorably. However, this has no effect on the function! If the corresponding module is moved, the connection wiring is redrawn and will appear more clearly.



24V: This line represents a permanently applied voltage of 24 V. The MINAS module requires a power supply of 24 V DC for the I/O. If no I/O is configured this line is not shown.

GND: This line represents the I/O ground and is a (relatively) constant potential that can serve as a reference for other measured potentials. If no I/O is configured this line is not shown.

Cross Wire Detection P1/P2:

Wiring of P1, P2 feedback circuit monitoring.

Note: In this view, no logical elements can be defined; the corresponding commands are available in the Functional Scheme.

4-4-1-3 Functional Scheme

The connection between input, monitoring, output and logic blocks is established in the Functional Scheme.

In this view, the output connectors of the input elements correspond to input data of the Functional Scheme. Analogously, the input connectors of the output elements are to be regarded as output data of the plan.

In order to make a Functional Scheme clear, it is possible to define so-called connection points. These represent a named connection between input and output connectors of function blocks. One or more connection point outputs can be defined for a connection point input (see chapter "Connections").

Tip: Use the comment line for inputs. This information facilitates the use of the complementary terminal outputs. This will make the overview easier!

4-4-1-4 Groups

"Groups" contains one sheet per group for each group block in the Functional Scheme. This function is available in the Functional Scheme after creating a group block. For further information on creating groups, please refer to chapter "9-3-6 Groups".

4-4-1-5 Global network

In the "Global network" overview, all networks are displayed. Master connections and connections with a fieldbus are displayed.

4-4-1-6 Local network

The other network types are device-dependent and have their own plans, which are displayed for the corresponding device. This plan is called "Local Network".

4-5 Workspace

The workspace is the basic drawing tool.
Each sheet is displayed in its own workspace.

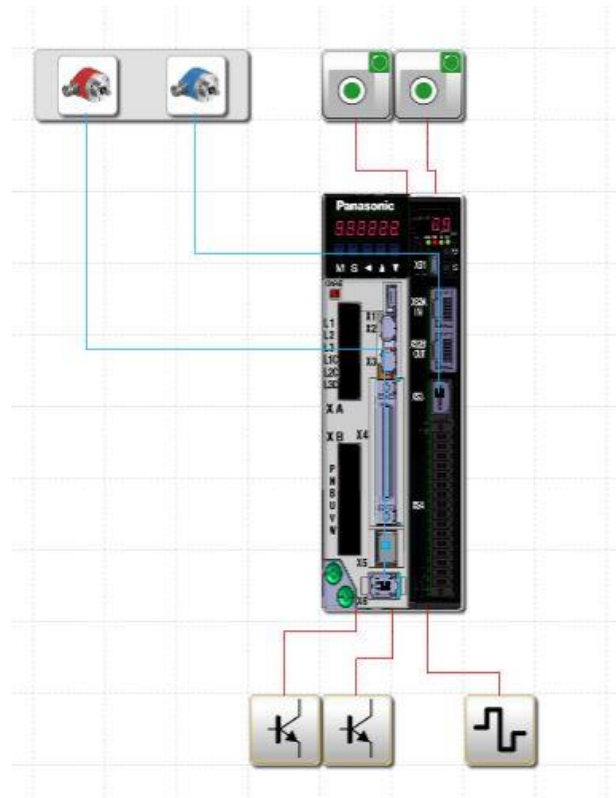
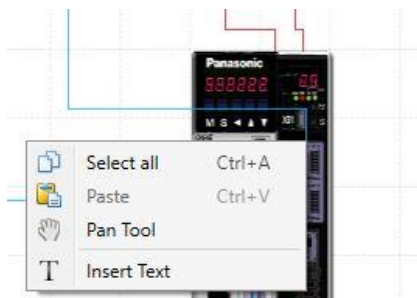
Helpful Hints:

You can move the work area by pressing the middle mouse button, even if the move mode is not activated.

The zoom can be changed by scrolling the mouse wheel while holding down the Ctrl key. The user can scroll vertically through the work area with the mouse wheel.

The user can scroll horizontally through the workspace using the mouse wheel and the Shift key.

Each workspace stores its own zoom factor.



Workspace context menu

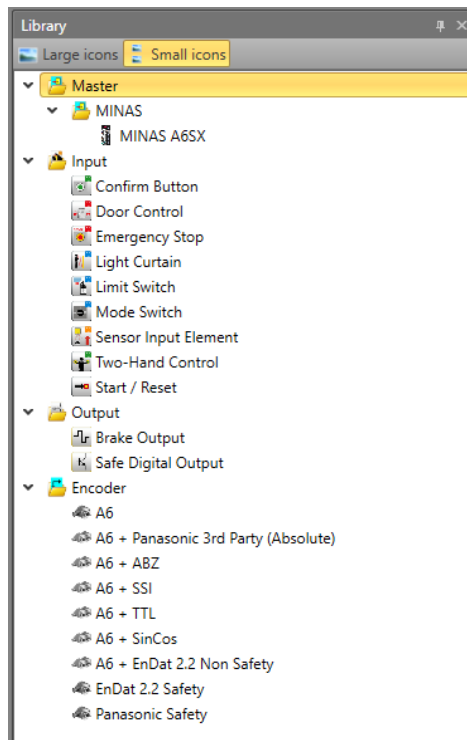
Select All selects all elements and links in a workspace.

Paste inserts elements and links from the clipboard (if present).

Pan Tool can be used to move the view of the Workspace.

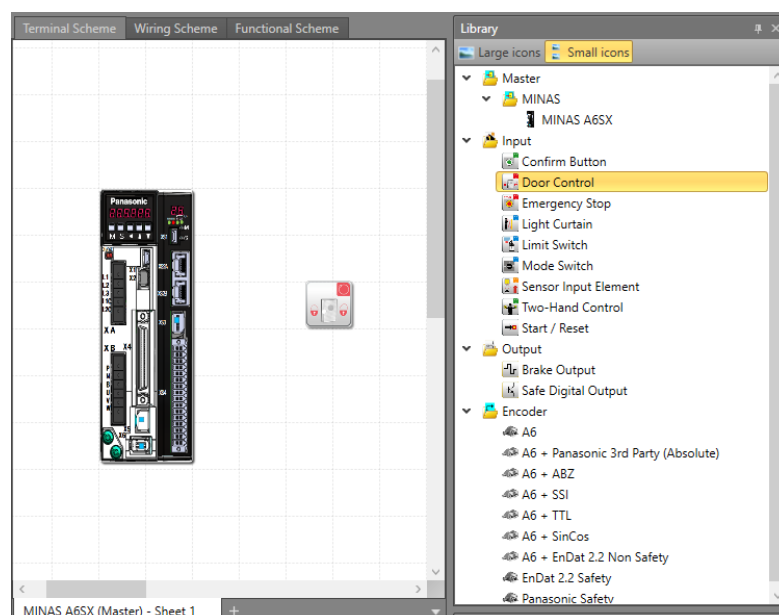
Use **Insert Text** to insert text into the workspace at the current position of the mouse pointer.

4-6 Library window

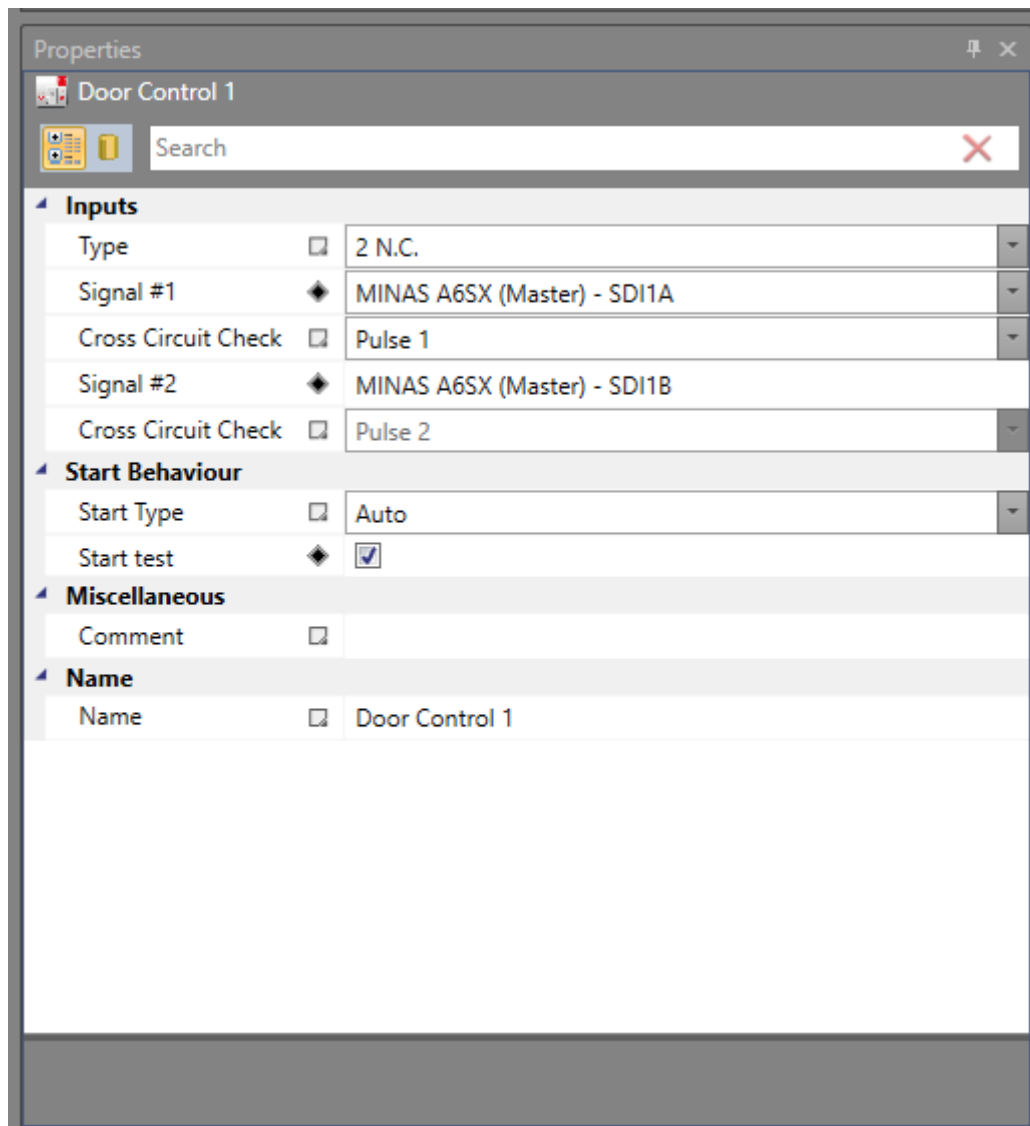


The library window is the main tool for the user to insert elements into a document. The library window consists of pop-up folders. Each folder contains one or more items. Folders and items are filtered according to the current plan, current sheet, and currently selected item in the browser or workspace. There are 2 icons at the top of the window which can be used to switch between the view sizes of the elements.

To insert an element into a document, the user must insert the element from the library window into the workspace using Drag&Drop.



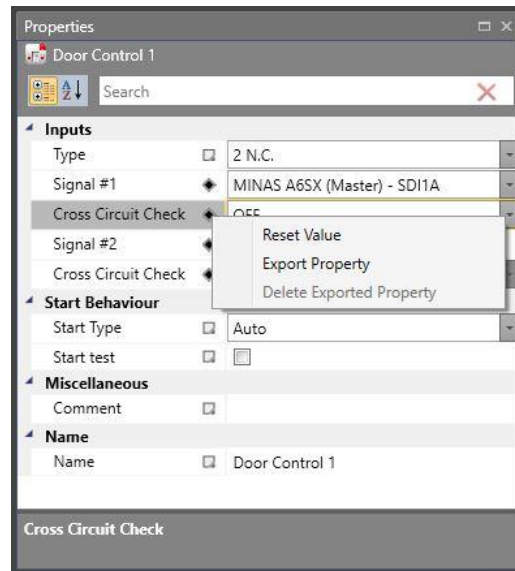
4-7 Properties window



You can use the Properties window to change the property values of elements. The content of the properties window is automatically updated and displays the currently selected element. By default, the "Categorized"-Button  is selected and the properties are grouped into categories. Clicking the "Uncategorized"-Button  allows the properties to be arranged without categories.

Using the search field , the desired property can be found quickly and easily.

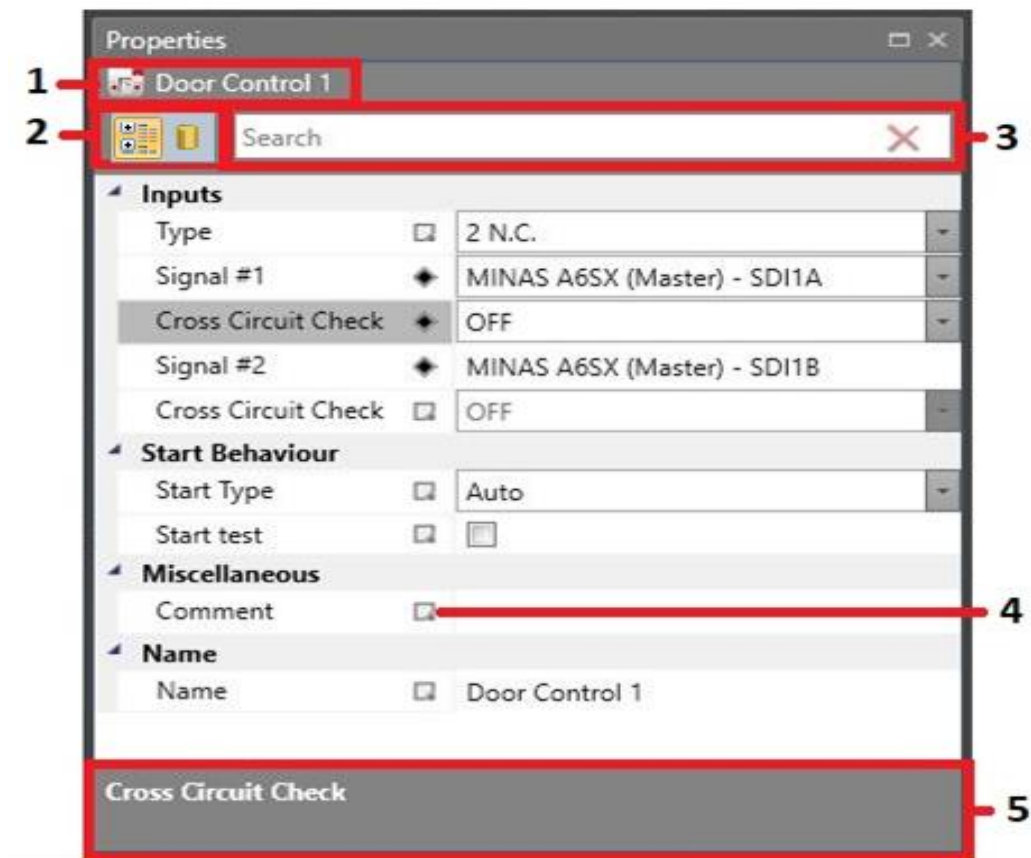
If the property value is reset to the default value, a white symbol appears next to the name of the property. If a value is set that does not match the default value, the icon becomes black. After clicking on this icon, the user can reset the value to the default value.



The bottom bar of the Properties window displays additional information about the currently selected property.

In the Properties window, you can view and modify the properties of a selected object. In this area, various processing fields are displayed depending on the requirements of a specific property. These edit fields include input fields, drop-down lists, and links to individual software dialogues. You can open the Properties window by clicking the Properties button on the Window tab of the menu bar.

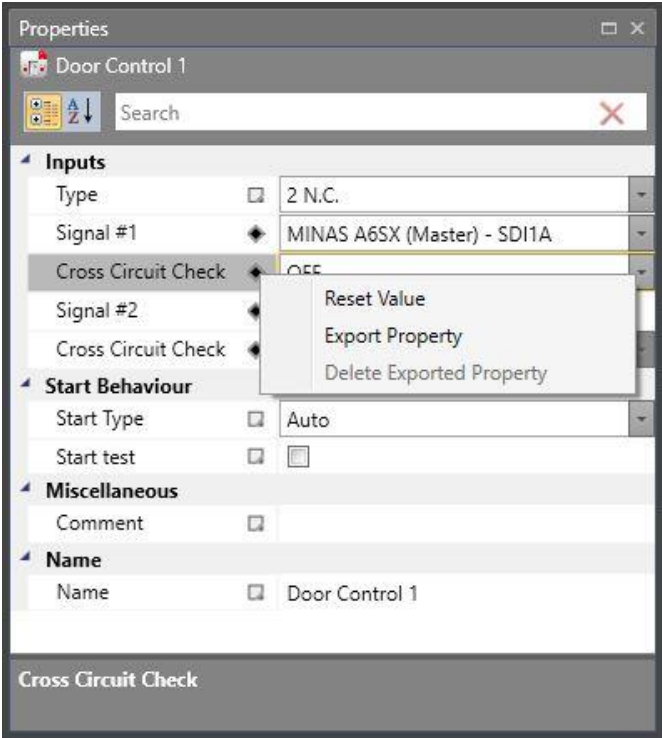
Tip: The comment field can contain multiple lines. Press the Enter key to move to the next line.



1. The name of the selected object.
2. Select fields to change the arrangement of the property list:
By Categories - List all properties and property values for the selected object by category. You can hide categories to reduce the number of properties displayed. Categories are sorted alphabetically.
3. The **search field** can be used to filter the properties according to the entered text.
4. Button to open the “Advanced Options” pop-up menu.
5. The description of the selected property.

4-7-1 Menu Advanced Options

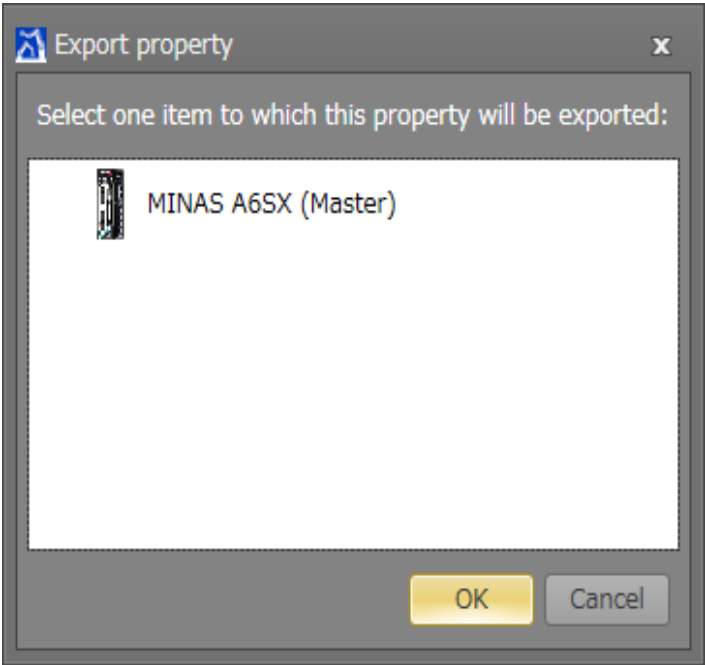
The “Advanced Options” menu allows the user to perform custom-specific commands.



Advanced Option

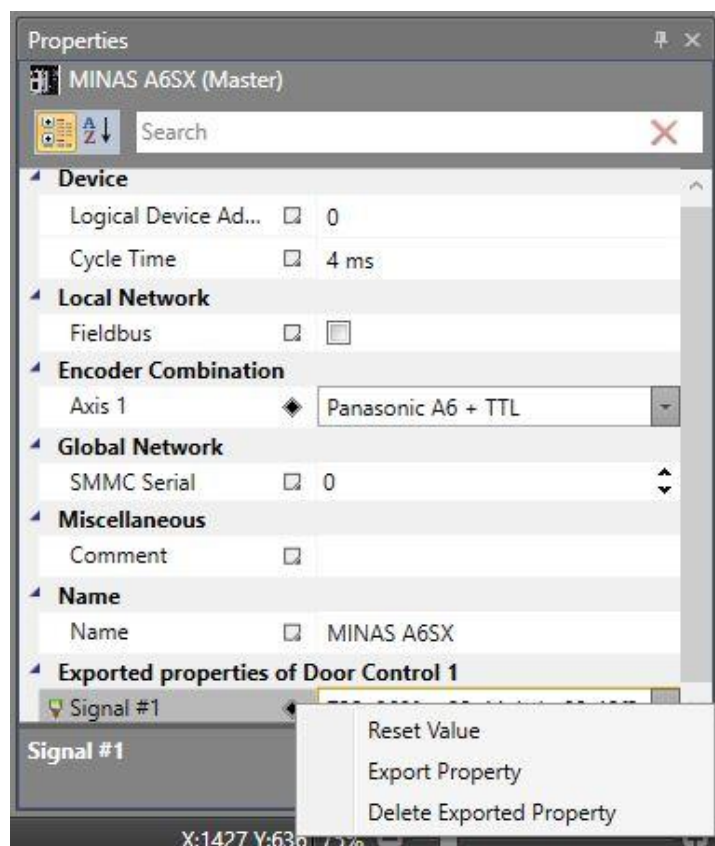
RESET value: The user can reset the property value to the default value.

Export property: The user can export the property to any item that is higher in the hierarchy.



Export Property dialogue

Delete exported property: The exported property is deleted from the element.

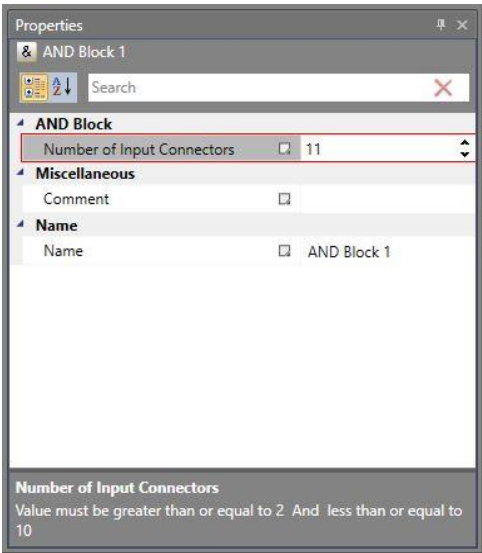


Exported property on a master device

4-7-2 Validation of properties

4-7-2-1 Validation

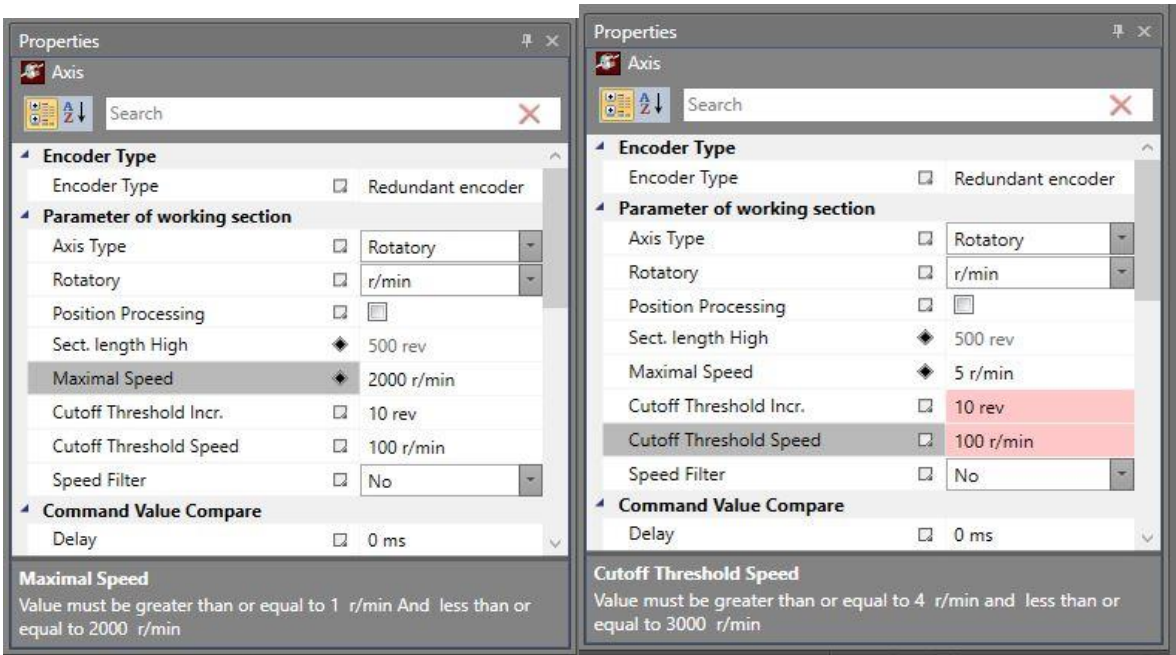
The input validation controls whether an input value is within the range specified by the property and does not contain any invalid characters. If the value is invalid, a red rectangle is drawn around the editor.



Value of the property "Number of input connections" is not in the range

4-7-2-2 Value Validation

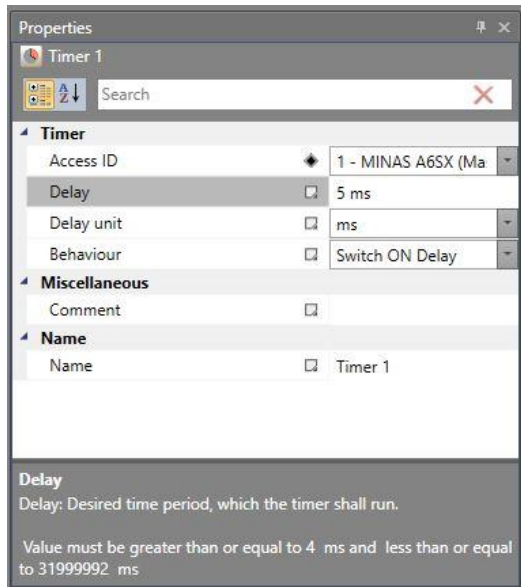
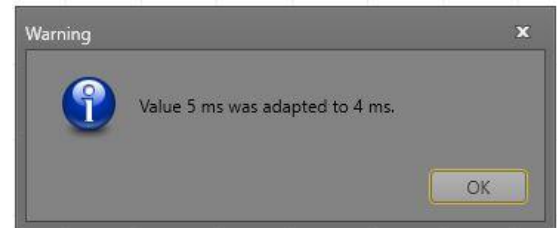
The value validation controls whether an input value satisfies the conditions defined by other properties. If the value is invalid, the background of the editor becomes red.



Example of a value validation. After changing the "Maximum speed" property to the value 5, the "Shut-down threshold..." property is invalid.

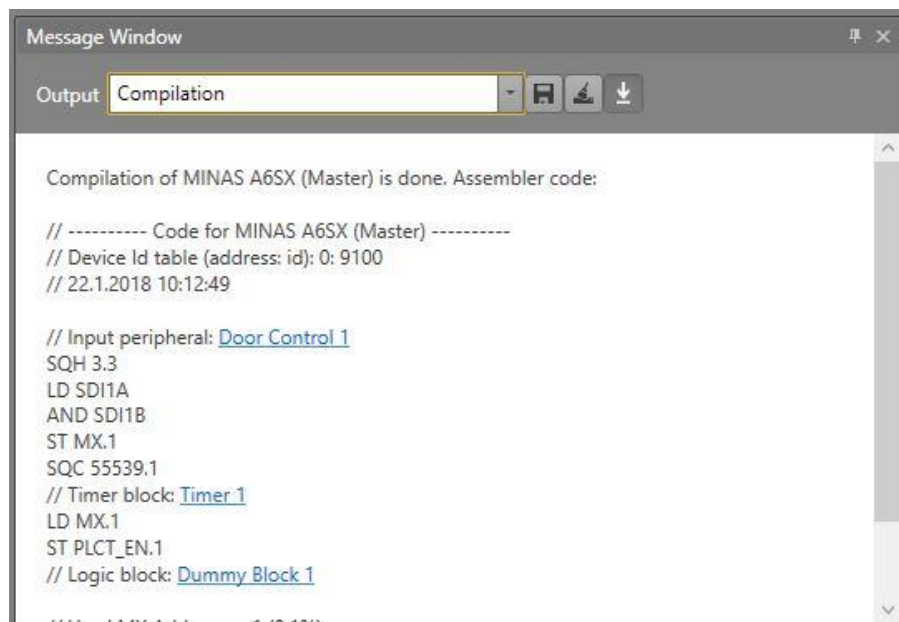
4-7-2-3 Adaption

The property values are evaluated with the special validation function "Adaption". If a value does not meet the restrictions of the function, the function updates the value and a message window appears with a description of how the value has been changed.



Example of the adaption. After changing the property value from "delay" to 5, the value was evaluated by the adaption function and changed to 4.

4-8 Message window



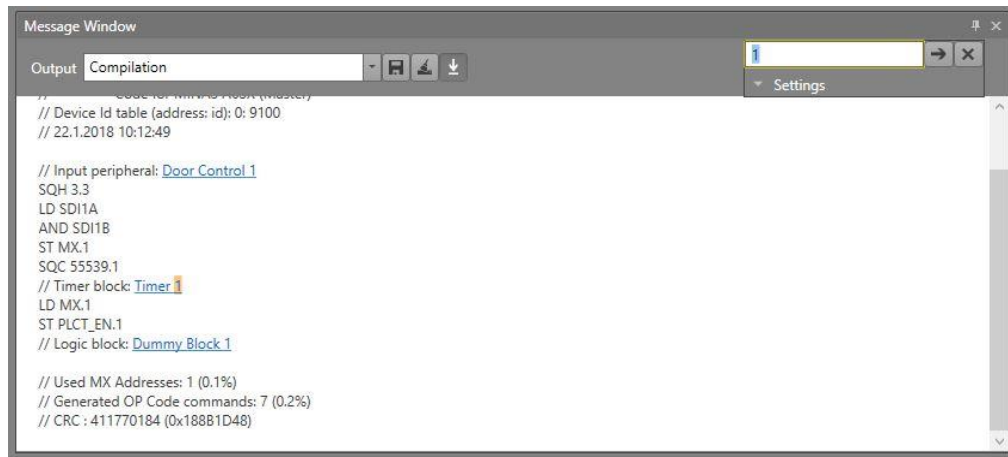
In addition to the output of status and error messages as well as the evaluation results display of the Functional Scheme, the message window is also an important tool for controlling function building data within its context.

4-8-1 Quickly jump to an element

It is possible to jump to the required element by clicking the colored block IDs in the message window. The workspace scrolls to the desired position and the element is visible.

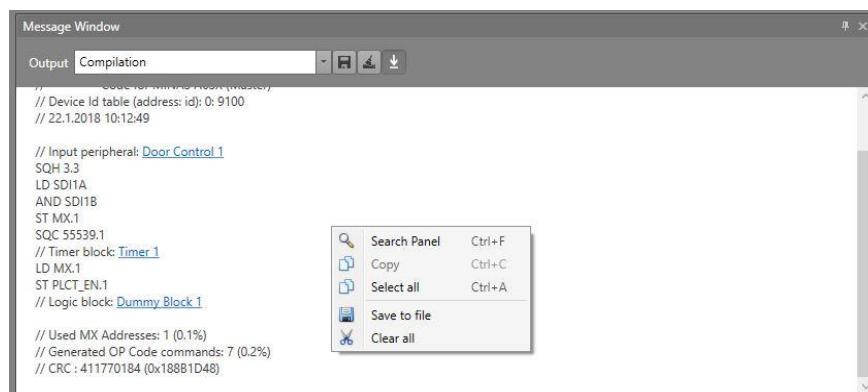
4-8-2 Search field

The search field opens via the key combination Ctrl + F. Note that this key combination only works when the message window is active. The search field can also be accessed via the context menu.



Using the search field, the user can search the compiled code. To display the next hit, click the "Search" button or the F3 key. By clicking on "Settings", additional settings can be displayed or hidden. By selecting the boxes, the user can set the search method.

4-8-3 Context menu in the message window



"Search field" can be used to display or hide the search field.

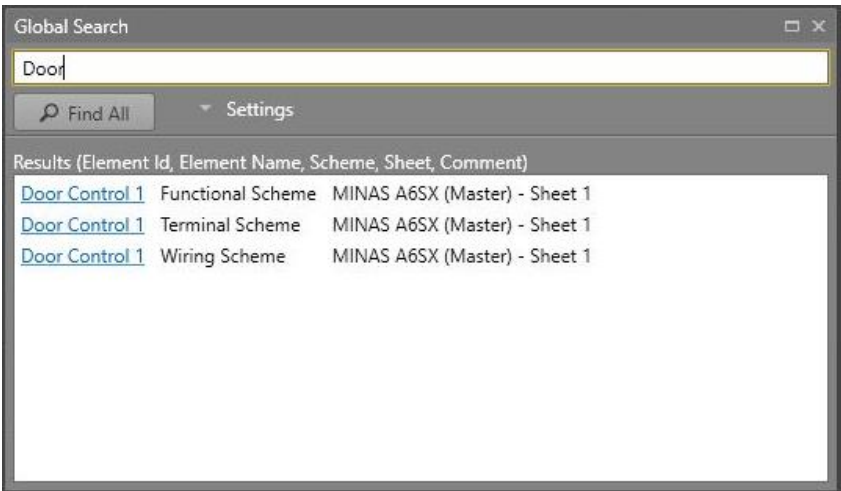
"Copy", the selected text can be copied to the clipboard and is available for insertion.

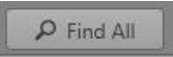
"Select All" selects the entire text.

"Save as file" saves the entire text to a text file.

"Delete All" deletes the entire text.

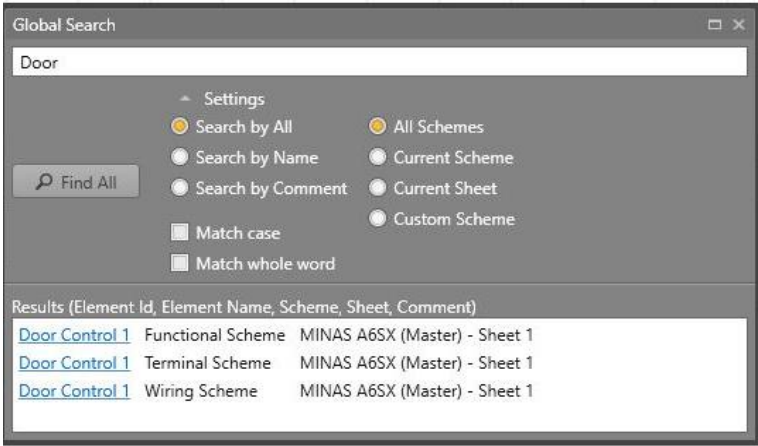
4-9 Global Search



Global search is an important search tool. The text entered in the search field is searched for based on the settings. To display all hits of the desired text, click the "Search All"  button or press Enter.

4-9-1 Search settings

The search settings are hidden by default. Click on the "Settings"  button to display the settings.

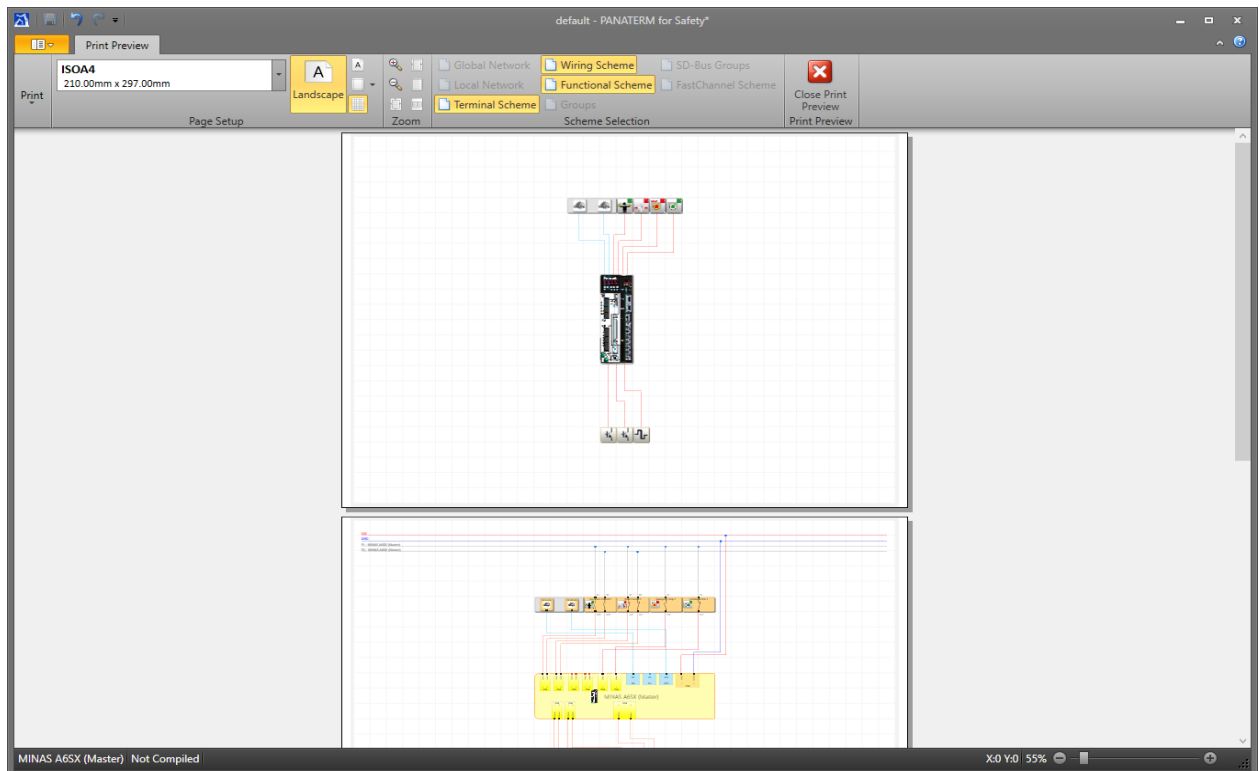


In addition to the known settings such as "case-sensitive" or "search only entire word", the search can be searched for ID, name or comment in the global search. It is also possible to determine from which plans the results are to be displayed.

4-9-2 Quickly jump to an element

If you click on the block ID, the program immediately jumps to this block.

4-10 Print



Schemes can be printed using "Print". It is possible to select the printer and change the printing characteristics. You can set how many copies and which pages to print.

Menu group "Page Set-up":

It is possible to switch on or off the page size, orientation (page or portrait), page margins (left, right, top, bottom) and the grid on the printout using the print grid button.

Menu group "Zoom":

Zoom in - Increases the content in the preview window (+10%).

Zoom out - Decreases the content in the preview window (-10%).

Original size - Adjusts the size of the content to 100%.

Page width - Displays the page in full width.

Whole page - Displays the entire page in the preview window.

Two pages - Displays 2 pages simultaneously.

Menu group "Scheme selection":

Global Network button – Sets whether or not to print the Global Network.

Local Network - Sets whether the Local Network is to be printed or not.

Terminal Scheme - Sets whether the Terminal Scheme is printed or not.

Wiring Scheme - Sets whether the wiring Scheme is printed or not.

Functional Scheme - Sets whether the Functional Scheme is printed or not.

Groups - Sets whether the groups are to be printed or not.

SD-Bus Groups - Sets whether the SD-Bus groups are to be printed or not.

FastChannel Scheme - Sets whether the FastChannel Scheme is to be printed or not.

Close print preview - Closes the print preview window.

To print a plan from a document:

1. Under "Start", click "Print" (or select the print command from the Quick Access toolbar or the Ctrl + P shortcut).
2. Before printing, check the print preview of connection, switch and functional Schemes.
3. Select the printer from the list of ready-to-use printers.
4. Set the number of copies and pages.
5. Select the properties of the page body, such as page size, orientation, and margins. You can also turn on or off the grid print.
6. Under "Page Set-up" you can select the page size, orientation and margins. You can also turn on or off the grid print. For more print settings, click "Print Properties".

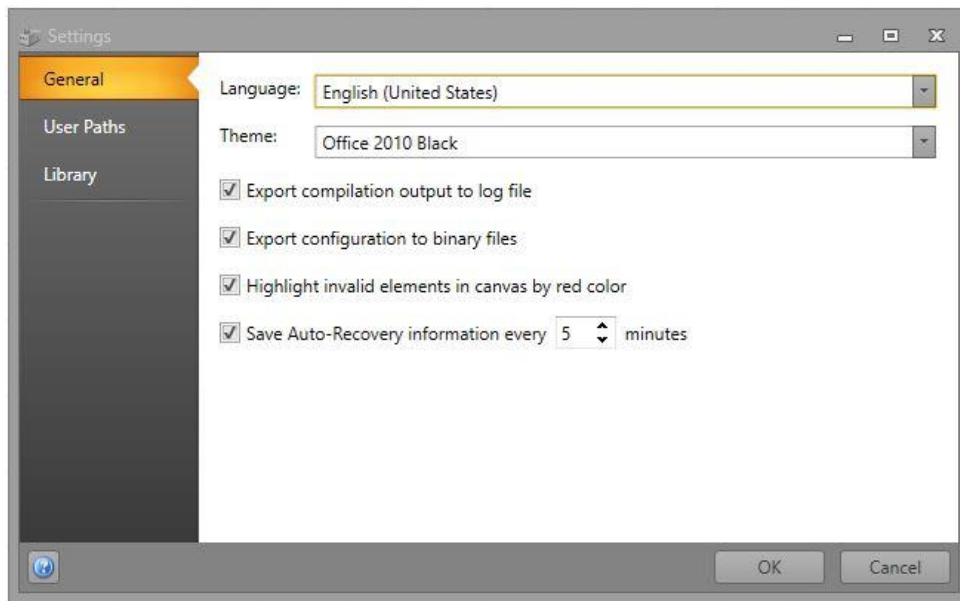


7. Click the "Print" button. If you want to edit or continue a plan, close the print preview.



Under "Zoom", you can set the size for the print preview.

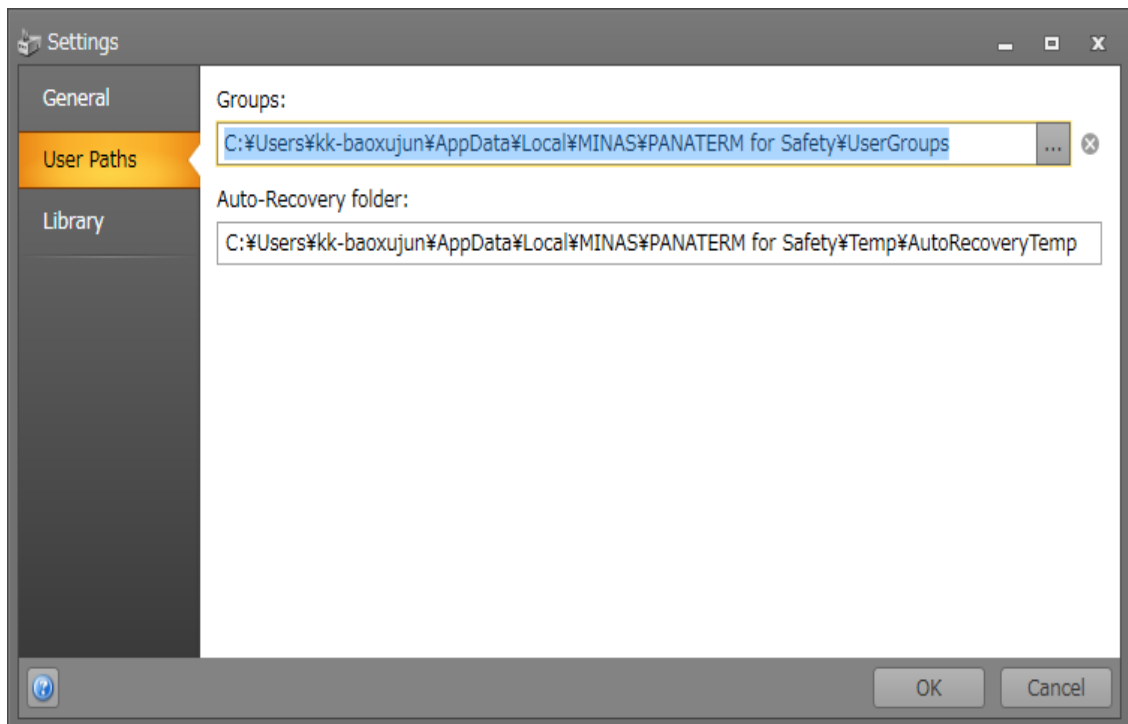
4-11 Settings



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

General: Select Language, Theme, and Checkbox to save the compilation output as a log file and save the configuration in binary format, "Invalid items are highlighted in the workspace" to enable validation in workspace. And adjust Auto-restore function.

User paths: Stores the target of groups and auto-recovery folders



Library:

Setting of document type, path and device series.

Default document type:

The mode can be specified by selecting the document type:

without library *.spl2:

File size very small. Program can be opened with the same or newer PanatermForSafety with the same functionality.

with library *.spl2l:

File size very big. Program can be opened with the same or newer PanatermForSafety, regardless of the range of functionality.

Note:

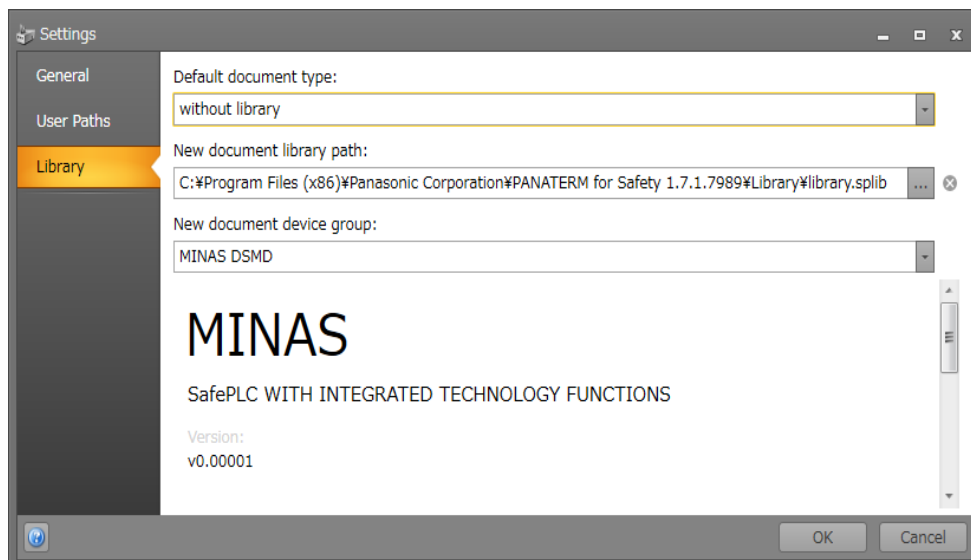
In the *.spl2l stored all necessary libraries. The parity of the function is given. Although a possible change in function of a new version has been made.

New document library path:

Stores the target of library folders_*.splib.

New document device group:

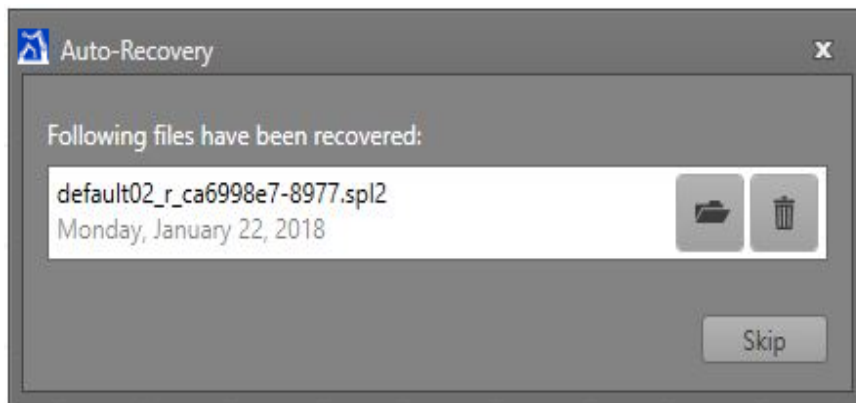
For several created device groups this can be preset.



Note: A device group change requires a restart of the application, please take this into account.

4-12 Auto-Recovery function

PanatermForSafety has an integrated auto-recovery function. This function saves the document process of the opened file in a user-definable fixed interval (1 to 60 minutes). The files can be recovered if the program closes unexpectedly, such as during a power outage or an unexpected crash. This **PanatermForSafety** function stores the document operation in the temporary file directory whose path is on the User Paths tab. Restarting **PanatermForSafety** the crash allows the user to save, delete or bypass automatic recovery to make the selection when the PanatermForSafety is started next time. However, no data is saved if **PanatermForSafety** is closed normally.

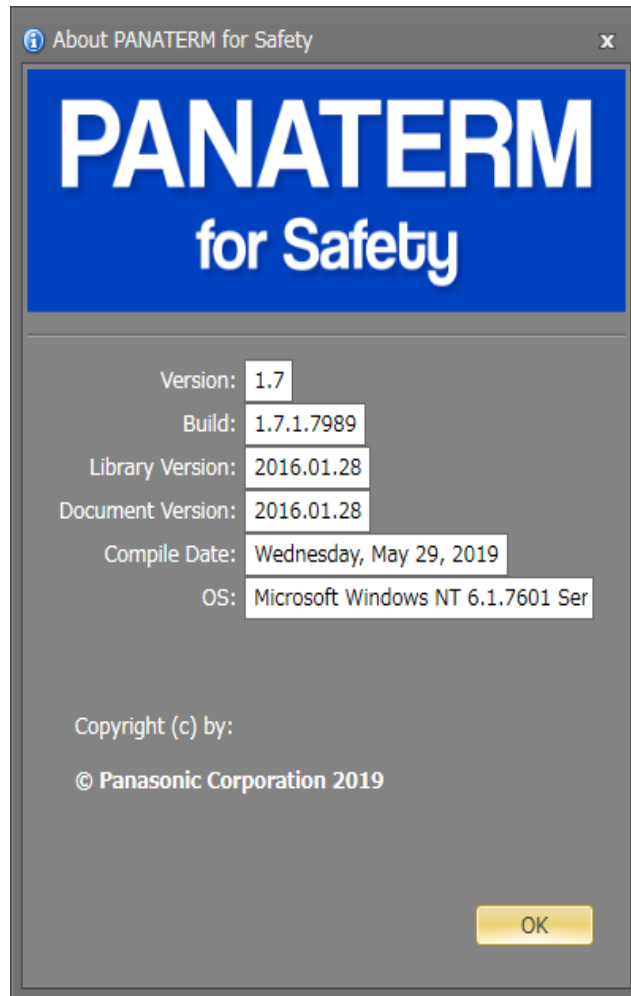


Open File - This allows the process to continue with the selected recovery file. Other saved recovery files will be retained the next time you restart **PanatermForSafety**.

Delete file - Delete restoration file and continue the program with an empty document. If only one recovery file is present, a next selection is not required.

Skip - Skips the restore selection and continues the program with an empty document. Restore selection files to the next start.

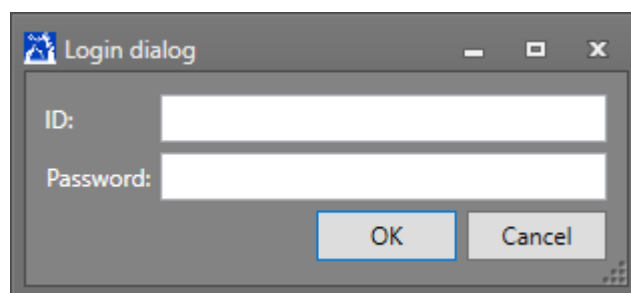
4-13 Information about the program



"About PanatermForSafety" provides brief information about the Windows system, program and build versions, as well as library, document versions and compilation date. This typically includes vendor information.

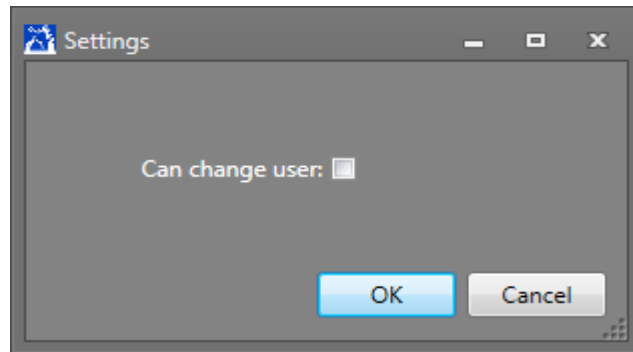
4-14 Change User

Change user window allows user to log in or log off. The list of the users, their user groups and passwords are part of the installation library. This library is highly vendor dependent.



4-15 User Service Settings

This option allows current user to choose if he wants to be able to change users. Clicking on this option opens following dialog.



4-16 User Rights Dialog

The User Rights Dialog allows an administrator to change user permissions for every object in the scheme. The application implements three specific permissions that apply to each object:

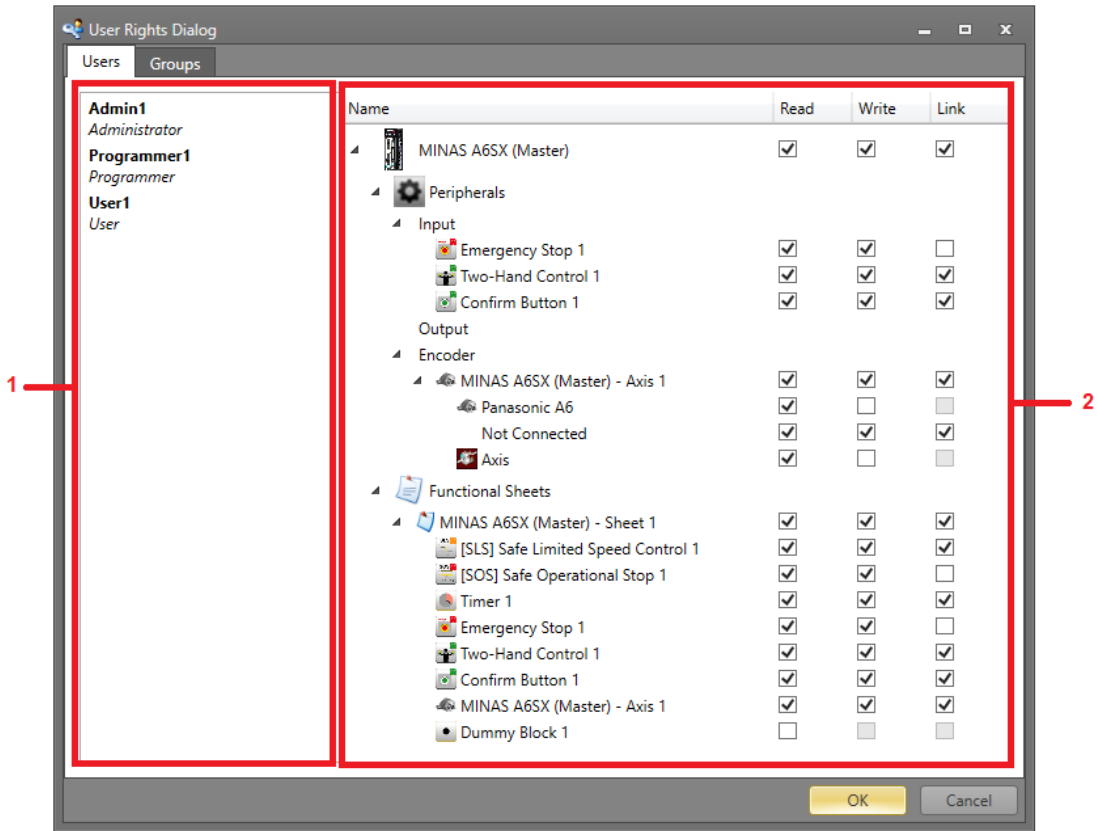
1. The **Read** permission grants the ability to read the properties of an object.
2. The **Write** permission grants the ability to modify the properties of an object.
3. The **Link** permission grants the ability to link an object with another objects.

 **Note:** The User Rights Dialog is accessible only to administrators. It can be opened by pressing the User Rights button in the Home tab.

The User Rights Dialog consists of Users and Groups tabs.

4-16-1 Users Tab

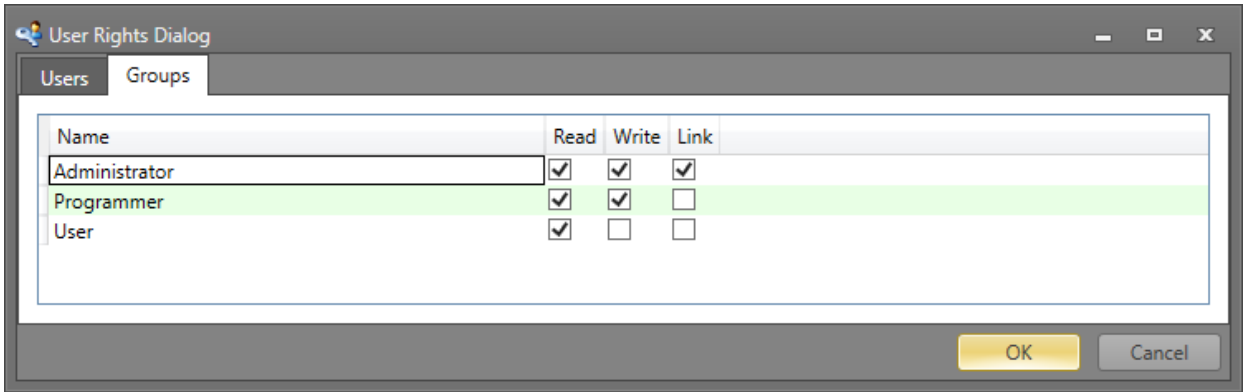
On the users tab, an administrator is able to modify permissions for every other user.



1. 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 permission, unless overridden, which he inherits from the user group.
2. 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.

4-16-2 Groups Tab



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

5. Procedure

The program **PanatermForSafety** is graphic oriented software for the creation of a PLC based monitoring program for a MINAS system. The device allows reliable monitoring of drive motors. The procedure described below has proved to be the most effective for the programming of MINAS devices, but is not mandatory.

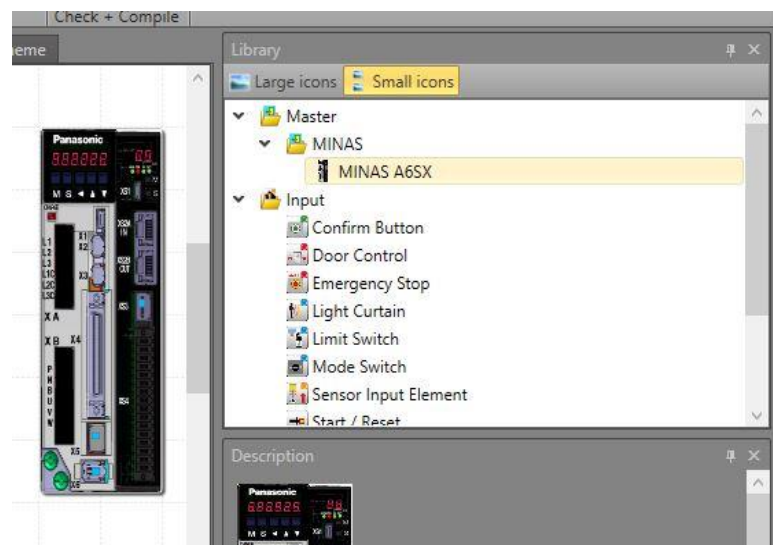
General note:

The program requires the write and read authorization of the user logged on to the PC used for programming. Missing access rights can lead to undesirable effects when troubleshooting the functional plan or to problems with the storage of logic plans in restricted-access directories.

5-1 General workflow

Drag an icon from the library or from a menu option and Drop it to the canvas to insert it into the selected scheme. If this is possible, the element is automatically inserted into the canvas. The proposed process steps correspond to the considerations that should be executed when planning a safety-related monitoring for a drive axis.

5-1-1 “Drag & Drop”



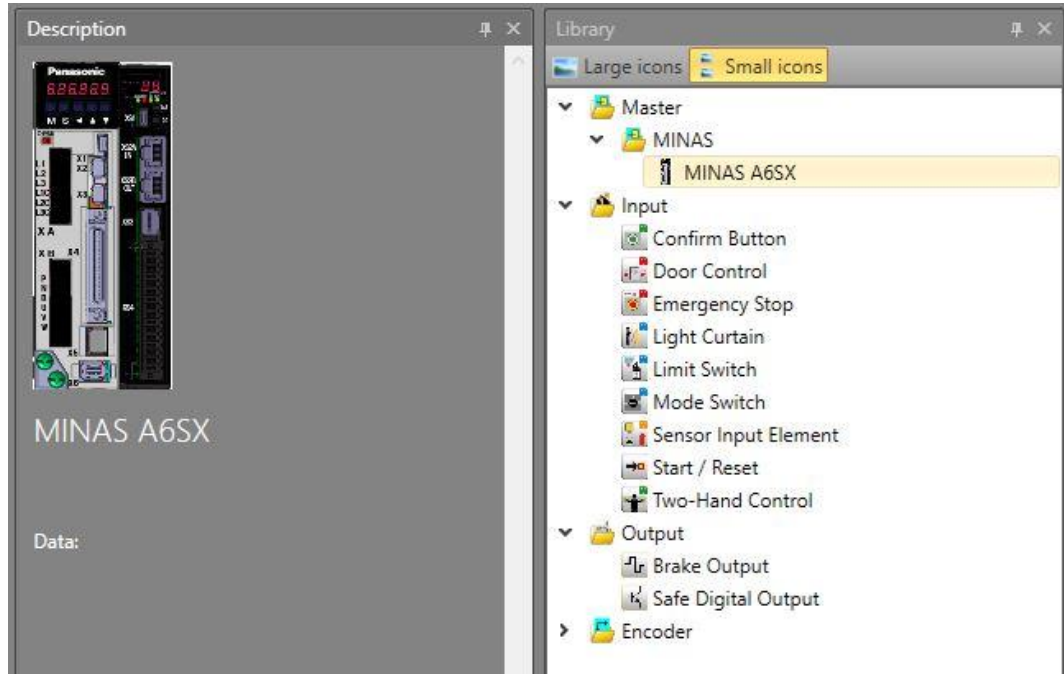
Simply add a module or a device using "drag and drop". The basic steps are:

- Move the pointer to the object.
- Press and hold the mouse or button of the pointing device to "grab" the object. Use the Esc key to undo this.
- "Drag" the object with the pointer to the desired location.
- You can "insert" the object by releasing the button.

To create an application, proceed as follows:

5-1-2 Selection of the device type to be programmed:

After the start of **PanatermForSafety** or the creation of a new logic plan, an empty workspace appears. All available devices are in the library. If the corresponding module is clicked, the module preview and the following information are displayed in the description window: programming interface, digital I/O, outputs, inputs, etc. The desired module can be added using "Drag&Drop".

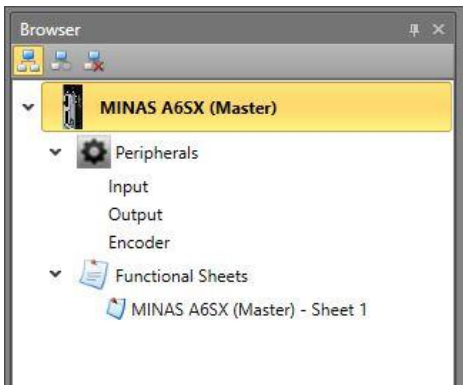


Description of the device preview

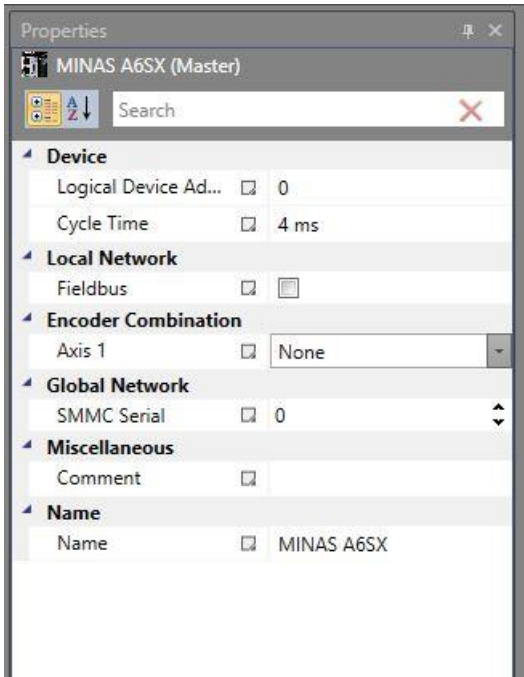
To proceed with the flow, a device must be selected for adding.

5-1-3 Adding a slave device:

If a master device has been added to the connection plan, a slave device must be selected in the browser tree to add a secondary device. Otherwise, the master device is replaced. The program displays a warning message before replacing it.



Note: Due to the associated resources and their management in the programming environment, the change of the equipment type is not recommended at a later date.



Properties window of the device

5-1-4 Determination of the peripheral devices in the connection diagram

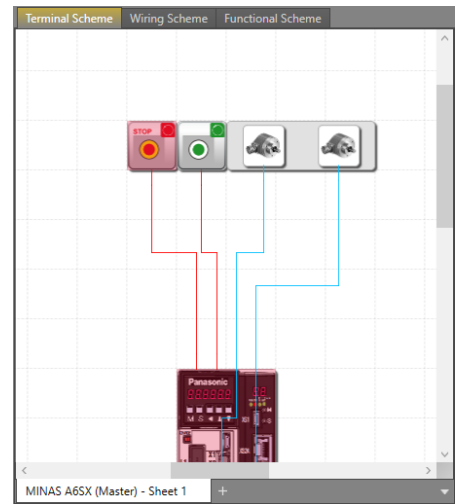
The Terminal Scheme shows a simplified schematic with selected devices, sensors, inputs and outputs of the MINAS system. The required modules are linked automatically after insertion.

The following procedure is recommended:

- Select the appropriate type of peripherals in the browser tree.
- Select a module from the library.
- For modules with the monitoring of speed and position, the definition of encoders and their parameters is necessary.

Note: A red icon indicates a missing setting.

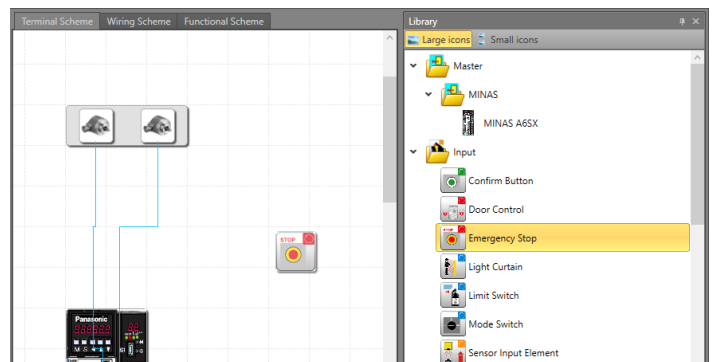
“Emergency Stop”-button with missing setting (red)



For a module with analogue processing, the interfaces must be set.

The selection of input and peripherals (Confirm Button, Door Control, Emergency Stop, Light Curtain, etc.) takes place via the library "Input".

Equally, the selection of the required output modules (Brake Output (SBC), Safe Digital Output (SDO), etc.) takes place via the library "Output".

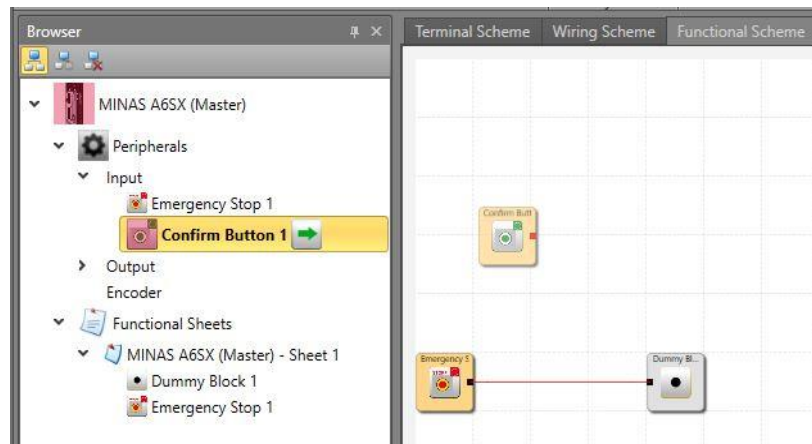


The connections to the sensors and actuators of the MINAS system with their respective connections are shown in the circuit diagram. After selecting the necessary peripherals, they are connected to each other.

Note: The program connects the first and last control point with the associated function block element. The input and output connector is not considered a control point and therefore does not have to be specified.

5-1-5 Definition of peripherals in the Functional Scheme

The function Scheme shows the logic modules and their connections between each other. Peripherals that have not yet been inserted into a Functional Scheme are marked with a green arrow indicating that these elements can be dragged and inserted into the functional Scheme.



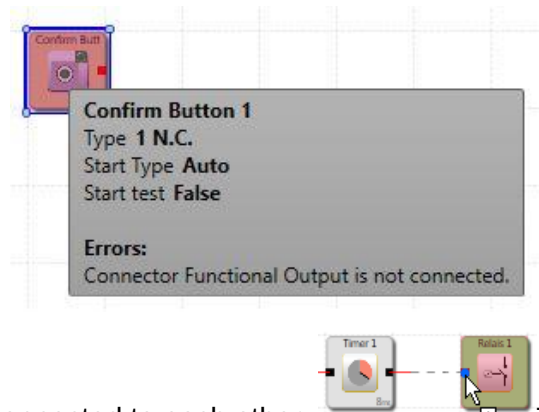
Inserting the input module

Definition of monitoring functions and logic modules in the Functional Scheme

The Functional Scheme shows the logic modules and their connections between each other.

Programming of the Functional Scheme with:

- Logic and processing elements.
- Timers, flip-flops (triggering elements) and connection blocks.
- Monitoring modules for the drive monitoring (this is only possible if the corresponding sensors have been defined).



After selecting the required modules, they are connected to each other. To do so, drag the mouse pointer over a "start connector". Click the start connector with the left mouse button. With a click (single click) it is connected to a "target connector". Further information can be found in the section "Wiring".

5-1-6 Compiling the monitoring program



After completion of programming, the Functional Scheme is compiled and converted to a machine-readable format.

This consists of the following steps:

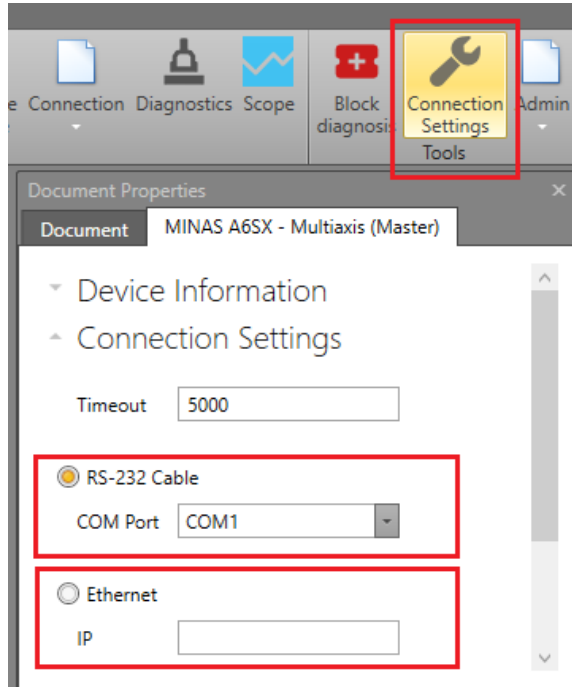
- Check for open connectors in the logic plan
- Check of the boundary conditions for the monitoring functions
- Check the correct distribution of the test pulses via the input elements
- Creation of a transferable OP programming code for the MINAS system

5-1-7 Program transmission to MINAS by clicking on the device interface

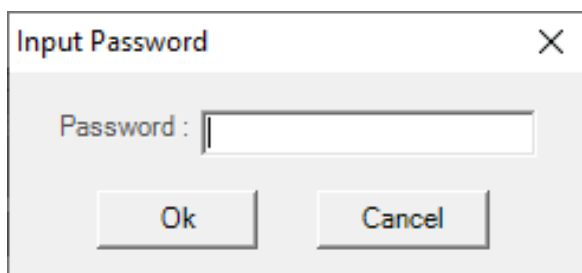


After the dialogue box of the device interface is opened, the software compiles the program automatically. The sequence of the program transition consists of:

- Use “Connection Settings” for selecting the COM output (Connection via USB) or setting the IP address (Connection via Ethernet)



Note: When using connection via Ethernet/EoE you have to enter the password in the window “Input Password” that appears automatically when pressing the button “Connect”. As password the serial number of the target device is to be entered.



- Transmission of the machine program
- Test the program in the MINAS module
- Deactivation of the logic plan after the release
- Creation of the validation report and validation of the configuration

5-2 Adding input modules

The input elements to create the digital connection between one or more connected sensors or additional subordinate switching devices in the **MINAS system**. Each input element, except for the mode selector, provides one logic output signal "0" or "1" for further processing in the PLC.

The input elements are automatically added and edited in the connection plan or wiring plan. The input modules are inserted in the connection plan from the browser.

The resource control of the function block elements of the MINAS system manages the available elements whose number can be limited.

If no further elements are available when programming the connection diagram, no blocks are available for adding the corresponding modules or function blocks. The available blocks are displayed in the library. These resources can be released again by deleting the corresponding function blocks. To delete a block, select the block from the browser or the work area. Right-click on it and select "Delete" or press "Del".

5-3 Inserting output elements

The output elements create the digital connection between one or more external circuits in the **MINAS system**. This element of the logic diagram has a direct influence on the drive to be monitored. It is also possible to define how external switching devices are to be monitored. Each output element is controlled by a logic input signal "0" or "1" via the function chart.

The output elements are added in the connection plan or wiring plan. The output elements are processed in the Functional Scheme.

The output modules are drawn and stored in the connection plan from the browser.

By automatically monitoring the resources of the MINAS system function blocks, only the available elements in the program are activated. If no resources are available for the monitoring program, the commands for inserting the corresponding components or function blocks are deactivated (the library functions are not available). This is, for example, the case when all digital outputs are already in use. These resources can be released again by deleting the corresponding function blocks.

5-4 The logic modules

These modules are the basis for creating a safety application. They enable the logical connection of the inputs with monitoring functions and with the outputs. The insertion of logic modules is only possible in the "Functional Scheme" view otherwise the corresponding menu commands are deactivated. This is the case if the resources for a module are already exhausted, for example after all timer devices were inserted.

A description of the logic modules can be found in the section "Logical Functions".

5-5 Circuit

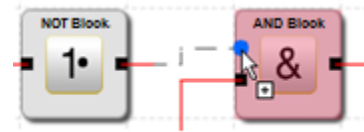
The assignments in the Functional Scheme are achieved by linking the input and output connectors of the functional modules.

An output of a module can, if necessary, be connected several times to inputs of other modules, but an input may only be assigned once.

In addition, certain module groups cannot be

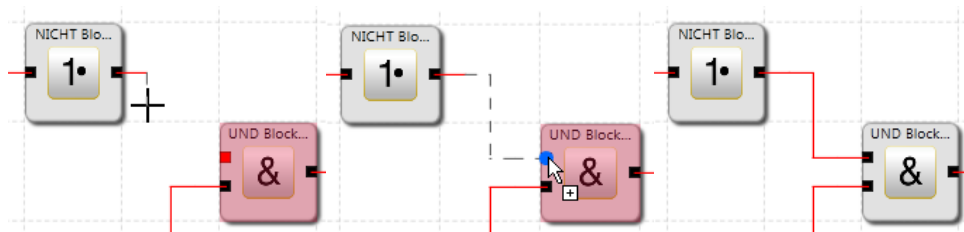
connected to one another for technical reasons. If the connection is invalid, the program displays a warning.

Only rectangular control points can be created, i.e. the connection lines always run horizontally or vertically.



Creation of the connection:

1. Press the left mouse button to select a start connector.
2. The user can influence the connection history by clicking in a free area.
3. A second click selects the destination connector.



Note: Connections can only be selected with the mouse and be deleted with the Delete key.

Tip: If all connections of a module are to be deleted, then the corresponding function block can be deleted. The connected connections are automatically deleted in this case.

The program automatically creates a new connection in the connection or circuit diagram. The program records the connection by inserting additional control points (breakpoints) based on a bisection algorithm.

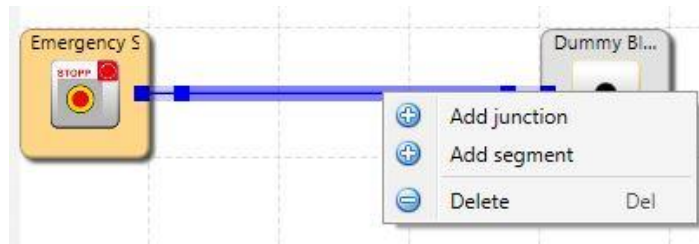
The graphical representation can be adapted and the general representation can be optimized by moving the function blocks (if the automatic arrangement has been deactivated). In complex diagrams, a connection line may cross a function block. This has no effect on the internal function of the connection.

Note: The connection is not created automatically in all plans.

Drawing custom link lines is also supported. These will remain until the displacement of a connected function block forces the recalculation of the control points (see the "Arrange" button).

Adding segment

To add a segment to the connection line, press the right mouse button and select "Add branch".



To add a node, click the connection line twice or press the right mouse button and select Add Node. The user can define the connection by selecting the connection and change each segment.

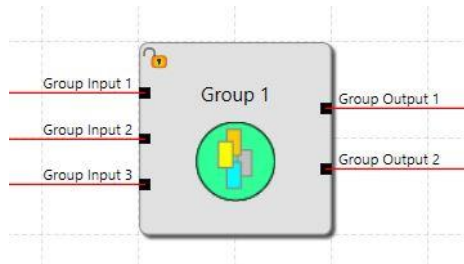
Note: If the segments of a connection are adapted, they are automatically unified.

Control points can be entered only with rectangular lines, i.e. the connection lines are always horizontal and vertical. The program links the entered points until the character command is completed.

Tip: Visual corrections to the logic plan should be performed just before the logic plan is disabled. Then the layout is complete and the blocks no longer have to be moved.

5-6 Use of groups

Function groups connect several function blocks to a super ordinate logical structure. This appropriate block group is formed within the function group and linked via this block.



This grouping gives the Functional Scheme a clearer structure and allows the creation of its own function library via the export / import function.

5-7 Creation of a program

After the programming is completed, the compilation can be started by activating the compiler ☒. The results are displayed in the message window that appears automatically when compiling. After the compiler has been called, the compilation runs through the steps described below.

Verifying open connections

PanatermForSafety ensures that all connections between function blocks have been pulled. Unconnected connectors are detected as errors.

Verifying non-referenced "connection point input" and "connection point output"

PanatermForSafety ensures that all connection points inserted in the logic plan are used. Unused ones are detected as errors.

Verify the value ranges of the monitoring functions

Before creating the STL, the **PanatermForSafety** checks whether the parameters of the monitoring functions are within the range of the current encoder configuration. In the event of a subsequent modification of the encoder settings, an unintended overflow of the range may occur.

Creating an Statement List (STL)

The STL code generated on the basis of the function blocks is displayed in the message window, where it can also be verified. The code segments of the corresponding function modules are identified by the associated module ID.

Creating the OP code

Generating a machine-readable code for the system, which is then, transmitted together with the parameter data.

Message window

All results of the compilation are displayed in the message window. If errors are found, they will appear automatically in the message window.

Tip: Use the "Quick Jump" function to jump directly to the corresponding block in the diagram by double-clicking on the displayed block ID in the message window. As a result, the corresponding function block can be easily identified in the event of a fault message.

CRC Backup

After a successful compiler run, a CRC signature is created:

- Configuration CRC: Signature for the program and the parameter data

Note: If an existing PanatermForSafety program is opened with a later version of PanatermForSafety, this program is ported. In order to ensure the complete porting, an additional step is absolutely necessary.

Important:

➡ This display is for information purposes only and may not be used for safety-relevant documentation!

5-8 Transferring the program to the device

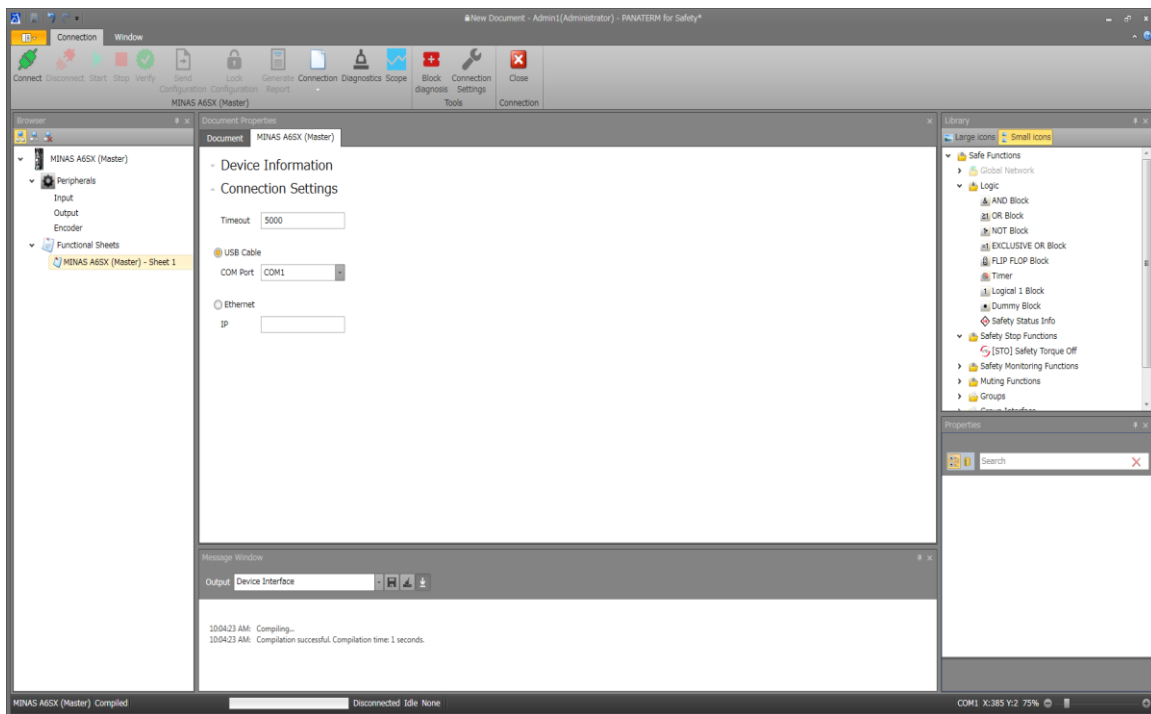
This section describes the data and program transfer to a MINAS module. If the interface has been



started (via the device button), the interface toolbar for the device appears. The toolbar contains connection and transfer tools for communicating with the device. You will find a description for the device interface in the chapter "Device interface".

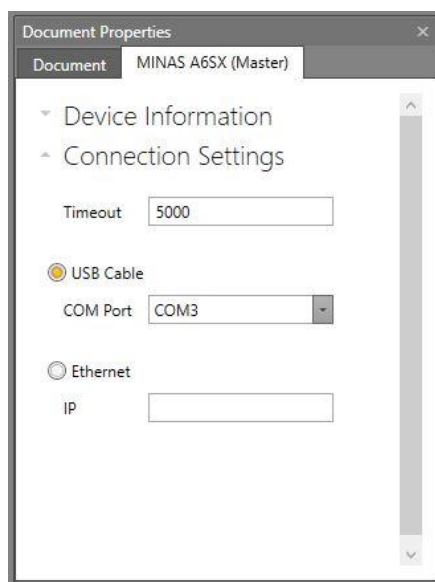
Via "Connection settings", the window for the document dialogues, in which the "Document" and "Master Device" tabs are located, is opened.

For multiple devices, each device is stored in its own tab. On the Document tab, the user can add the developer name and enter a comment. The "Master device" tab consists of device information and connection settings. This menu can also be accessed via the "Document properties" button in the menu bar.



Exact current transmission states or possible errors states are displayed in the message window. Because of the limited space, this window is not automatically activated in every message, so that as much of the logic plan as possible can be displayed during diagnosis.

Note: The connection between PC and the MINAS system is based on a USB interface which requires installation of the correct driver. The driver is included in the scope of delivery. You can find it in the installation directory of the **PanatermForSafety** programming environment (directory USB_Driver).



Connection settings

Timeout: The timeout for communication can be set in milliseconds.

COM Port: The COM interface used by the Windows driver must be set.

Ethernet: The IP address of the Device must be set.

(Note: The connection via Ethernet is not available for MINAS system)

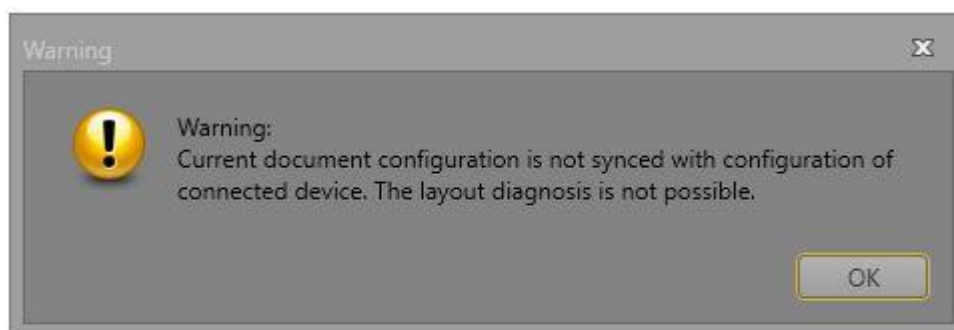
Disconnection by PC:

After 5 seconds the system detects that the connection no longer exists and will not be automatically restored when the connection is to be re-established.

Disconnection by MINAS:

The system waits for a maximum of 10 s and detects that the connection no longer exists. However, the connection is re-established automatically when the physical connection is restored.

If the connection is successfully, a warning window may appear.

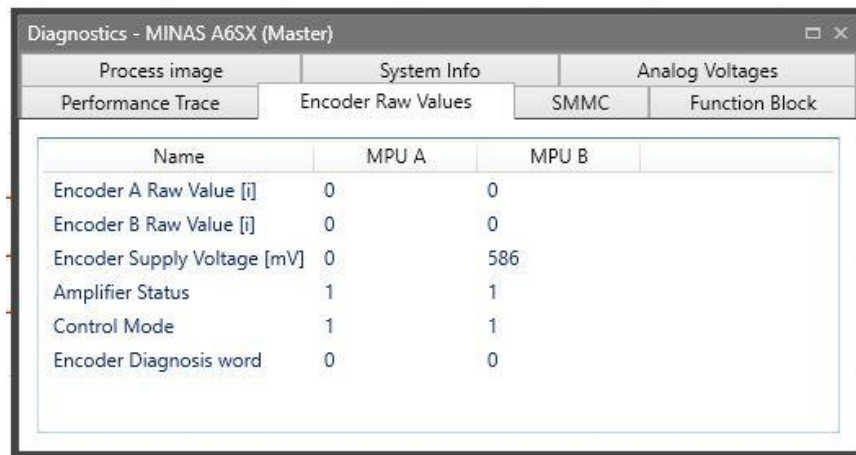


That happens if the actual configuration does not match with the configuration of the device.

5-9 Diagnosis

After the device interface is activated, the "Diagnostics" button is available. Click the "Diagnostics" button to display the diagnostics window. The diagnostic function cannot be executed simultaneously with the range function.

Note: Correct diagnosis requires the adjustment of the data between the Functional Scheme and hardware configuration. A missing logic plan or inconsistencies between the available logic plan and the hardware configuration allows only a limited diagnosis. The function "Diagnosis of function blocks" is not available in this case.



Name	MPU A	MPU B
Encoder A Raw Value [i]	0	0
Encoder B Raw Value [i]	0	0
Encoder Supply Voltage [mV]	0	586
Amplifier Status	1	1
Control Mode	1	1
Encoder Diagnosis word	0	0

The diagnostic window consists of the following sheets:

Process image:

Displays the states of all addresses of the input and output image in the MINAS module.

System info:

System information about the MINAS module. These are as follows:

Parameters	Description
Configuration - CRC	CRC signature for the program and the parameter data
Transfer count	Status of the internal transfer counter. The counter increases with each transmission to the MINAS module and can be used as a reference for documentation purposes
Serial number	Current serial number of the equipment
Version no.	Version number of the firmware
HW Version	Version number of the hardware
FPGA Version	Version number of the FPGA firmware
Lifetime [s]	Lifetime of the operating device in seconds
Temperature MPU A	Current temperature of MPU A
Temperature MPU B	Current temperature of the MPU B

Analog voltages:

Displays the analog values of the hardware in [mV]

Performance Trace:

Displays the cycle time and different time-critical barriers [us]

Encoder Raw Values: Displays the various encoder values which can be diagnosed.

Parameters	Description
Encoder A Raw value [i]	Raw value of encoder A in MPU A and B in increments
Encoder B Raw value [i]	Raw value of encoder B in MPU A and B in increments
Encoder Supply Voltage [mV]	Current encoder supply voltage in mV MPU A: 5V Supply of X5/X6 MPU B: Configurable 5V/8V/10V of XS3
Amplifier Status	Status of the amplifier
Control mode	Current operating mode of the amplifier
Encoder diagnostic word	Encoder diagnostic word

Function block:

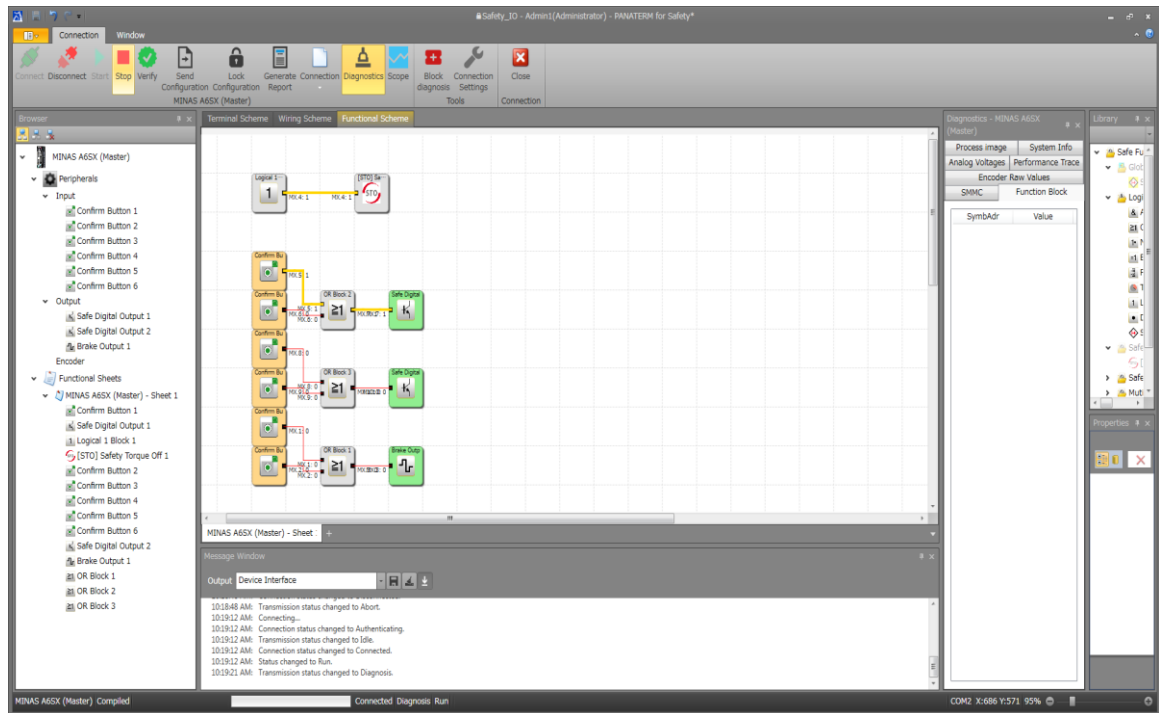
Enables selective monitoring of memory states for previously selected function blocks. To select function blocks for diagnostics from the workspace, use the "Add selected function module (s) to diagnostics" button. The logic state "0" or "1" can be displayed in the function diagram via this tab.

5-9-1 Procedure of the diagnosis in the Functional Scheme

The most important prerequisite for the diagnostics is the start of the program, for example the "Start" button in the "Connection" toolbar is highlighted in grey.

5-9-1-1 Diagnosis in the working surface

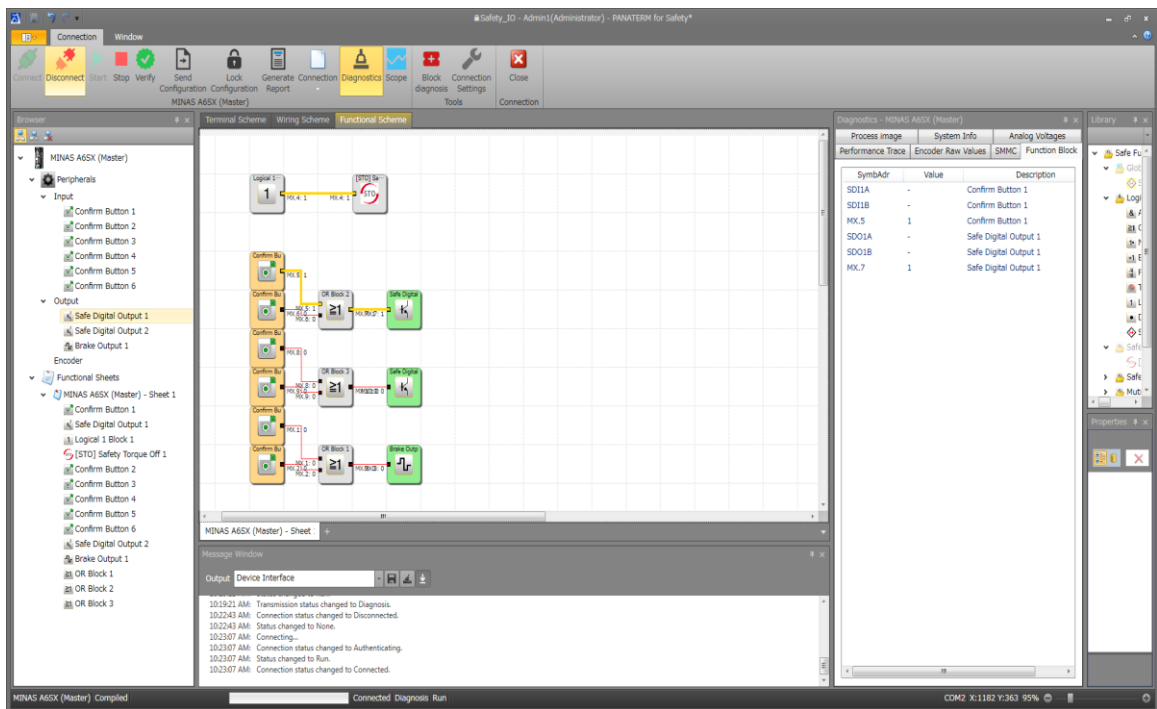
The diagnostics in the workspace is only possible if the user has selected the "Function block" tab in the diagnostics window. After selecting the "Function block" tab, the diagnosis starts automatically.



Procedure of the diagnosis in the working surface

When performing diagnostics in the work area, the current input and output states are displayed according to their logical state "0" (red line) or "1" (yellow line). The logical state is specified in the workspace next to the connection ID.

If the "Function block" tab is left in the diagnostics window and another diagnostic type is opened, i.e. a different tab (e.g. "System info"), the diagnostic information is removed from the work area.



A block can be removed from the monitoring list by marking it and pressing the Delete key.

Note: The symbol addresses displayed in the list are also used during compilation and validation replay.

Tip: All data can be selected from the Functional Scheme with the "Select all" command in the context menu (right mouse button).

The selected data can only be diagnosed if the information in the Functional Scheme matches the information in the actively connected system.

Note: The integrated diagnostic function requires intensive data transmission between the MINAS system and **PanatermForSafety**. This may cause a temporary delay in the display of data. Short status changes at module outputs may not be detected.

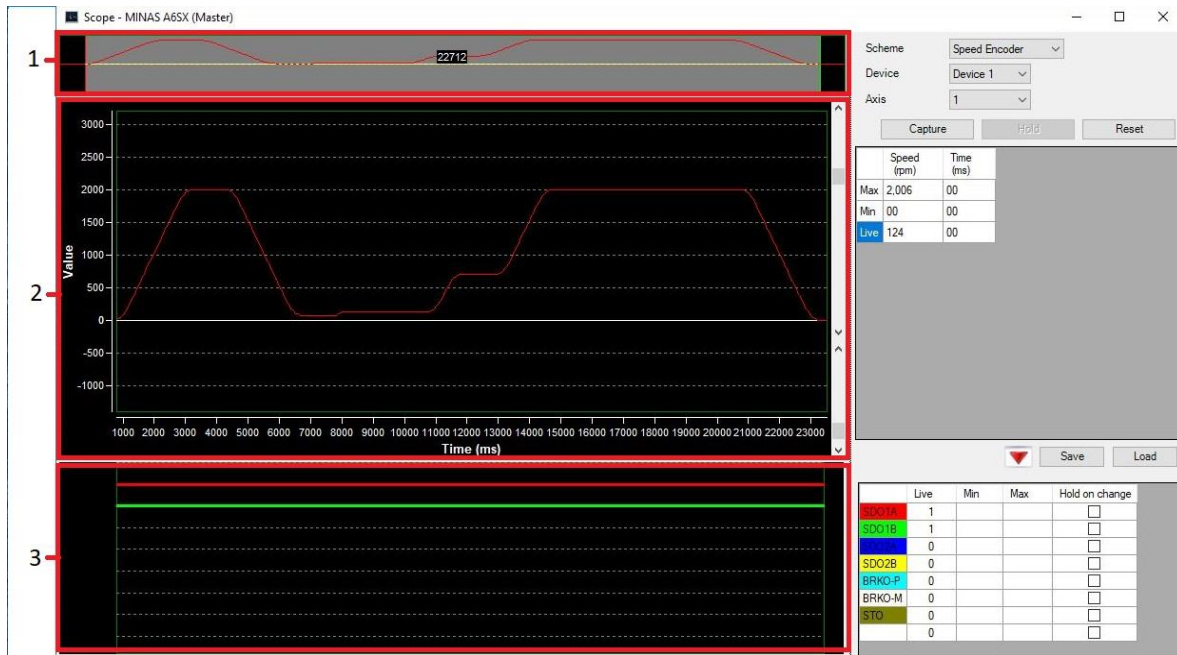


ATTENTION:

If the MINAS module is set to an alarm state, the process representation is no longer updated. The change of input levels is no longer effective and is no longer displayed in the diagnostics.

5-9-2 Diagnosis with Scope

The parameterization of drive monitoring requires an exact knowledge of the process data from MINAS system standpoint. Knowledge about the time course of the speed, acceleration and position is of crucial importance. This is the only way to set correct thresholds and minimum parameters. The scope function is available in the dialogue box of the device interface. You can select the scope by activating the "Scope" button. If the diagnostic button is activated, the "Scope" button is immediately deactivated.

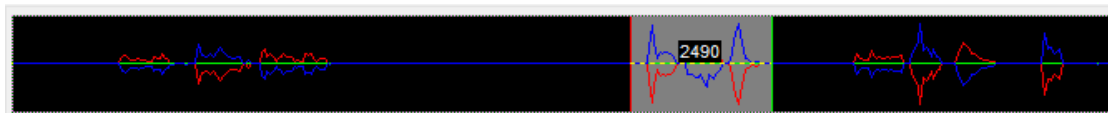


Area

view in the device interface

- 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 MINAS system via the communication interface for the time-based display. Current values are displayed to the right of the scope-monitor, move to the left during recording, and then disappear at the left edge of the screen. Even if these data have disappeared from the visible window, they are stored in a temporary store. They can be made visible again by dragging the scroll bar over the main diagram window.



Overview of the scroll bar for the main diagram

Scheme:

With the "Scheme" function, the current context for the desired visualization can be selected. Depending on the selection of plan from the selection list, the context of the displayed curves changes. These are given a color assignment specified in the legend. See schemes

Depending on whether the scheme displays time-dependent or position-dependent values, the expiring control time or the measuring length configured in the encoder are displayed on the X axis. The Y values are based on the selected scheme.

The scheme cannot be changed during a running measurement.

Device:

Selecting the device.

Axis:

When several identical functions are used, they can be selected and displayed separately via this selection. The values of these measured data are displayed for the respective relevant cursor positions.

Capture / Stop: Start or stop the recording.

Pause: Press the "Pause" button to pause the displayed values in the main diagram. The data is still available in the cache.

RESET: RESET the graph values and process data.

Tip: The pointer is inserted at this point by double-clicking on the main diagram window. This adds the cursor to the optional measurement table.

Save: If the area has been stopped, the current recording can be saved in a file. The range data is written to the file as ASCII values. The individual values have XML markers, so the recording can be used for documentation purposes or for the analysis associated with the encoder configuration. The data can also be viewed with the current Microsoft Explorer or with another XML viewer.

Load: This control area can be used to load a measurement stored in the area function in an XML file. In this case, the area window changes to the view mode. Due to possible differences in the encoder configuration of the displayed measurement to the current program and the resulting deviations in the scaling of the position and speed values, the "Start" button and the plan selection list are deactivated after the data has been loaded to the display. The measurements remain disabled until the range function is restarted.

	Live	Min	Max	Hold on change
SDO1A	1			☐
SDO1B	1			☐
SDO1C	0			☐
SDO2B	0			☐
BRKO-P	0			☐
BRKO-M	0			☐
STO	0			☐
	0			☐

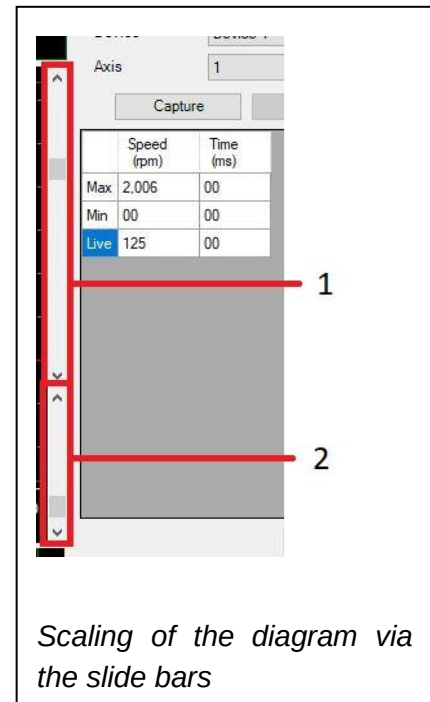
Stopping at change: If the "Hold on change" button is activated, the recording stops for 2 seconds after an edge change of the corresponding output (see above). This function allows long-term recording and error analysis in the absence of the operator.

Scaling:

By scaling the graph function, you can adjust the Y values in the individual curves via the slider bar 1/2.

Scrollbar 1: Changes the visible range of the Y values in the diagram.

Scrollbar 2: Changes the displayed maximum range of the Y values in the diagram.

**5-9-3 Flow during measurement in the range**

After the range window has been opened, it is still set to "stop", i.e. no cyclic process data is read from the MINAS system. In order to perform a largely error-free measurement, proceed as described below.

Note: All Internet and LAN-based applications (e.g. e-mail programs) running in the background should be closed before commencing with the measurement.

5-9-4 Preparing the measurement

Select the desired scheme: For a speed- or position-oriented measurement, the current control time of the MINAS module is displayed on the X axis. It represents a continuously increasing counter for the system selectors of the MINAS module. The measurement data for the curve are constantly updated and stored in the temporary memory. After stopping the recording, the measurement data can be manually saved in an XML file.

Note: When the scheme is changed, recorded data from the previous measurements are lost. When changing the window size, the displayed data must be rescaled. This requires a position-oriented measurement and the reset of the data buffer (SSX).

5-9-5 Starting a Measurement

The "Capture" button for starting a measurement is available only if the MINAS system is active. After clicking this button, the data is cyclically transferred to the buffer and displayed from left to right in the diagram. An active recording can be stopped with the "Stop" button.

5-9-6 Stopping a measurement and displaying the data

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

5-9-7 Measurement schemes

- Encoder
- Position Pass 1
- Speed Pass 1
- EVC Position
- EVC Speed
- SDI Position
- SDI Speed
- SLI
- SEL
- SSX
- SLP
- SLS
- SCA
- SCA Position
- SOS Position
- SOS Speed
- SLA

5-10 Firmware update

5-10-1 Requested files

To update a firmware for a device the following components are needed:

1. Firmware Container

Firmware Image file containing MPU A, MPU B and FPGA binary files (*.frm).

This file can be generated using an Administrator dongle using PANATERM for Safety.

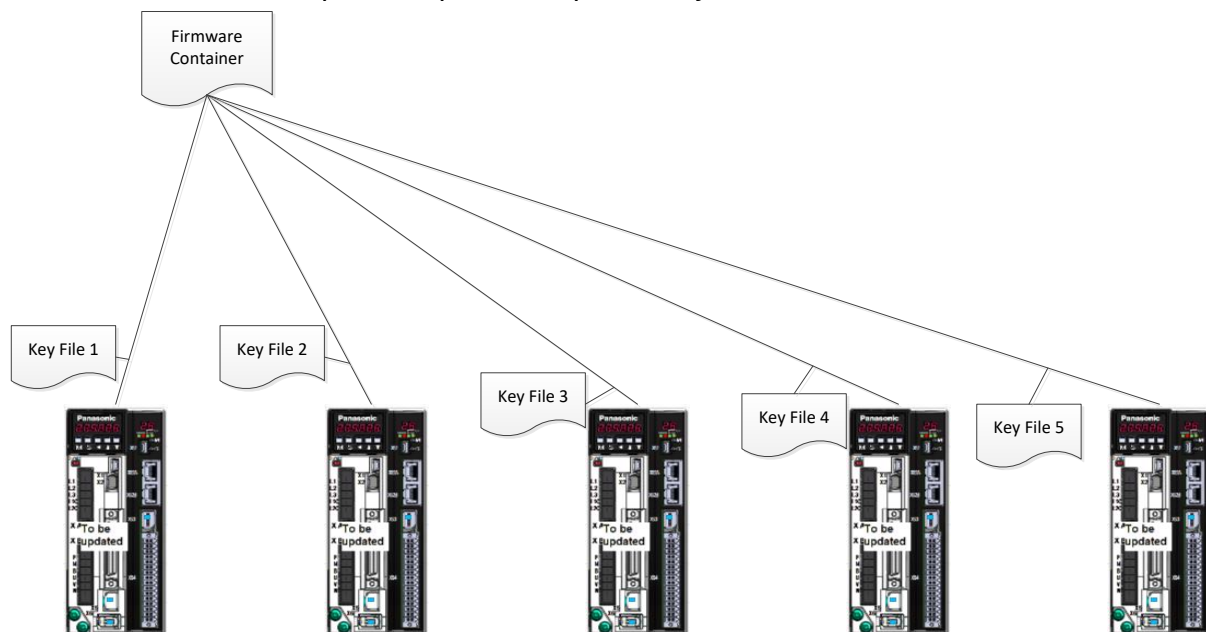
It contains all necessary binary data of a firmware release.

2. Key-File

Key-File created by Panasonic only valid for a single device. It can be generated using an Administrator dongle using PANATERM for Safety.

This file ensures that Panasonic has full control over the update done by the customer. It contains the serial number of the target device, the original firmware version and the target firmware version. The update itself is only possible with a matching key file (serial number) from the correct firmware (original firmware) to a specific firmware (firmware container).

Each device and each update requires a separate key file.

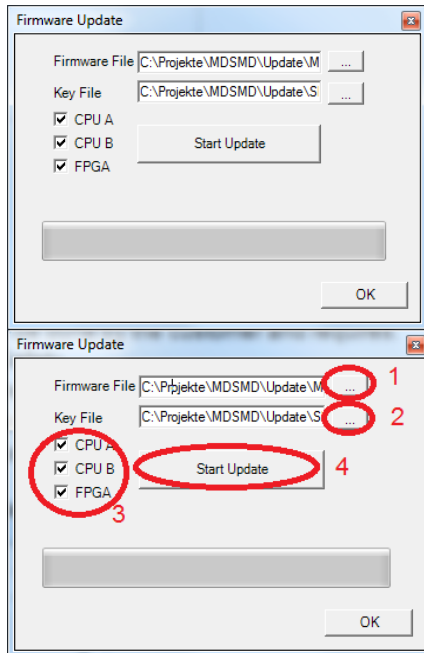


5-10-2 Procedure

The firmware update can be done by the customer and requires:

- PANATERM for Safety
- Firmware Container (*.frm)
- Key File for the device to update, matching the Firmware Container (*.key)
- Tooling connection to device (USB or Ethernet)

Select the “Firmware Update” dialog by pressing the button inside the Connection Dialog.



1. Select the firmware file (*.frm)
2. Select the key file suitable for your current device (*.key)
3. Select which components you need to update (keep all selected unless stated otherwise)
4. Press Start Update to begin the update procedure. PANATERM for Safety is now sending the *.frm and *.key file to the device.
5. The send process may take some time:
MPU ~2 minutes each, FPGA > 8 minutes.
Please do not power cycle or disconnect your device until the send process is completed.
6. Power cycle your device. After Power On it may take up to 20 seconds until the bootloader is processing the update and the flash is safely written (only once)
7. A failed update or power-down during flash writing process does not lead to a damaged device. The bootloader retries the flash write procedure on next power on.

6. Validation Report

PanatermForSafety uses it to create a validation report for the hardware configuration. This function is only available for an active connection with a MINAS system. This function can be activated via the "Generate Validation Report" icon in the toolbar.

In the "Document properties" window, information and descriptions can be entered or edited.

Fields with the device information for the configuration report

Each field has a lock function.

The report is saved in a PDF file and can then be edited.



ATTENTION:

The printed file serves as a template for the safety-relevant inspection!

Note: The report cannot be created until the logic plan has been saved.

The created file (*.pdf) has the same name and is located in the same directory as the corresponding logic plan.

Step: Edit the header in the report

The following fields can be edited in the header.

End Customer: Name of the customer

System description Plant description

Configuration: Configuration name

Comments: Helpful comments, e.g. file name of the logic plan

Step: Completion of approval

Inspector 1 Inspector Name

Date: Date of the examination

Signature: Field for the signature of the inspector

Inspector: Inspector Name

Date: Date of the examination

Signature: Field for the signature of the inspector

Step: Fill in the contact details

Version: Document version

Installation: Description of the installation site

Customer: Operator of the equipment

Supplier: Manufacturer of equipment / equipment

Installer: Information on putting the equipment into operation

A telephone and fax number can also be entered in the fields Installation, Customer, Supplier and Installer.

Step: Fill in the description

Constructor: Person who installs the device

System designation: Identify the hardware

Set-up location: Description of the exact location of the system

End Customer: Operator of the equipment

Configuration: Safety-relevant functions of the system, which must be monitored via the safety module

Date of creation: Date on which the report was created

Function description: Description of the function or scope of the installation

Comments: Safety related functions of the devices

Hardware: Device names

Step: Single control of the system components

In this area there are checkboxes, which should be marked if the given information is correct.

Visual inspection for mechanical damage and correct mounting:

Component documentation is available:

Visual inspection for deviations from the installation guidelines:

Device type: Registration of the device type, e.g. A6SX.

Serial number: Serial number of the safety module (label)

CRC-Device Config: Signature for the program and the parameter data

CRC-Parameter: Signature for parameter data

CRC-Program: Signature for the program

Expansion units: Description of expansion devices

Transfer count This field can also be edited.

Number of axles: Number of all axes

Check the correct function:

➡ To generate the validation report, the correct program and parameter data must be loaded!

The test engineer must again validate all the configured data in the printed report by detecting the programmed functions on the equipment / device.

All set limit values of the monitoring functions used must be checked for correctness. The reaction times specified in the installation manual must be observed.

➡ Successful validation should be completed by clicking the "Validate Validation" button.

7. User Management

Via the user management, logic plans can be blocked against unintended and unauthorized changes. Access to function blocks in the current logic plan can be deactivated or activated. This means that in a deactivated logic plan, all menu options and toolbars for adding function blocks are grey (= deactivated). Furthermore, parameters in function modules that have already been added cannot be changed.

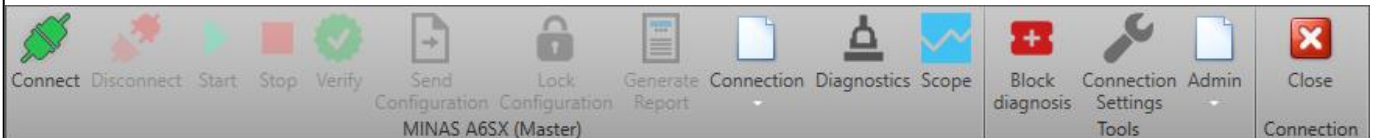
A password is required for unlocking. The configured values and functional modules of a deactivated plan can be displayed in this case but cannot be changed. This function ensures that no changes to the logic plan can be performed by unauthorized persons.

Note: Logic plans can only be unlocked with the password that was also used to deactivate the plan.
It is still possible to send a locked logic plan to the device. By doing this, the MINAS is automatically compiling the configuration and generating the *.toc-file.

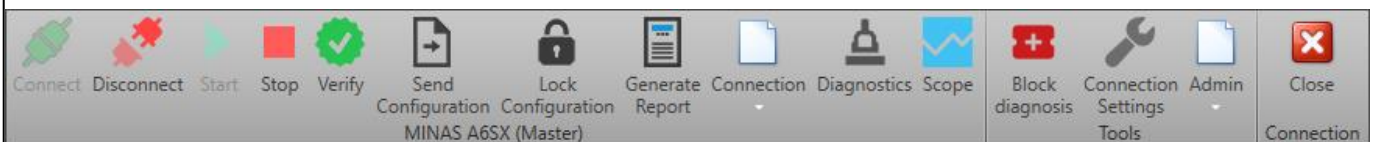
8. Device Interface

The device interface is displayed in the device window. This window contains advanced communication options such as program transmission, diagnostics and area monitoring with connected MINAS devices. If the device interface is opened, the program automatically starts with the compilation. The window contains the instruments of the device interface.

Symbols in the device interface:



Symbols in the device interface - not connected



Symbols – connected

Connect: Starts the connection to the MINAS system.

Disconnect: Disconnects an active connection.

Start: Starts the program sequence in "Connected" mode.

Stop: Stops the program sequence in "Connected" mode.

Verify: Checks whether the current layout is consistent the layout of the connected device.

Send configuration: Transfers the configuration of the function block diagram to the MINAS system. This is only possible in "Stop" mode.

Lock configuration: After each configuration data transfer to a MINAS system, this data is marked as "not validated".

Generate report: Creates a PDF or Excel file of the current MINAS configuration for the connected device. The text file lists the parameters of the configured modules and the STL program. The printout must be confirmed and approved within the framework of the TÜV approval and the required guidelines.

Firmware Update: Opens the firmware update window See Chapter "5-10 Firmware update".

Connection: Sends or reads the current configuration from / to the file. This function is not possible with the diagnostic or range window open.

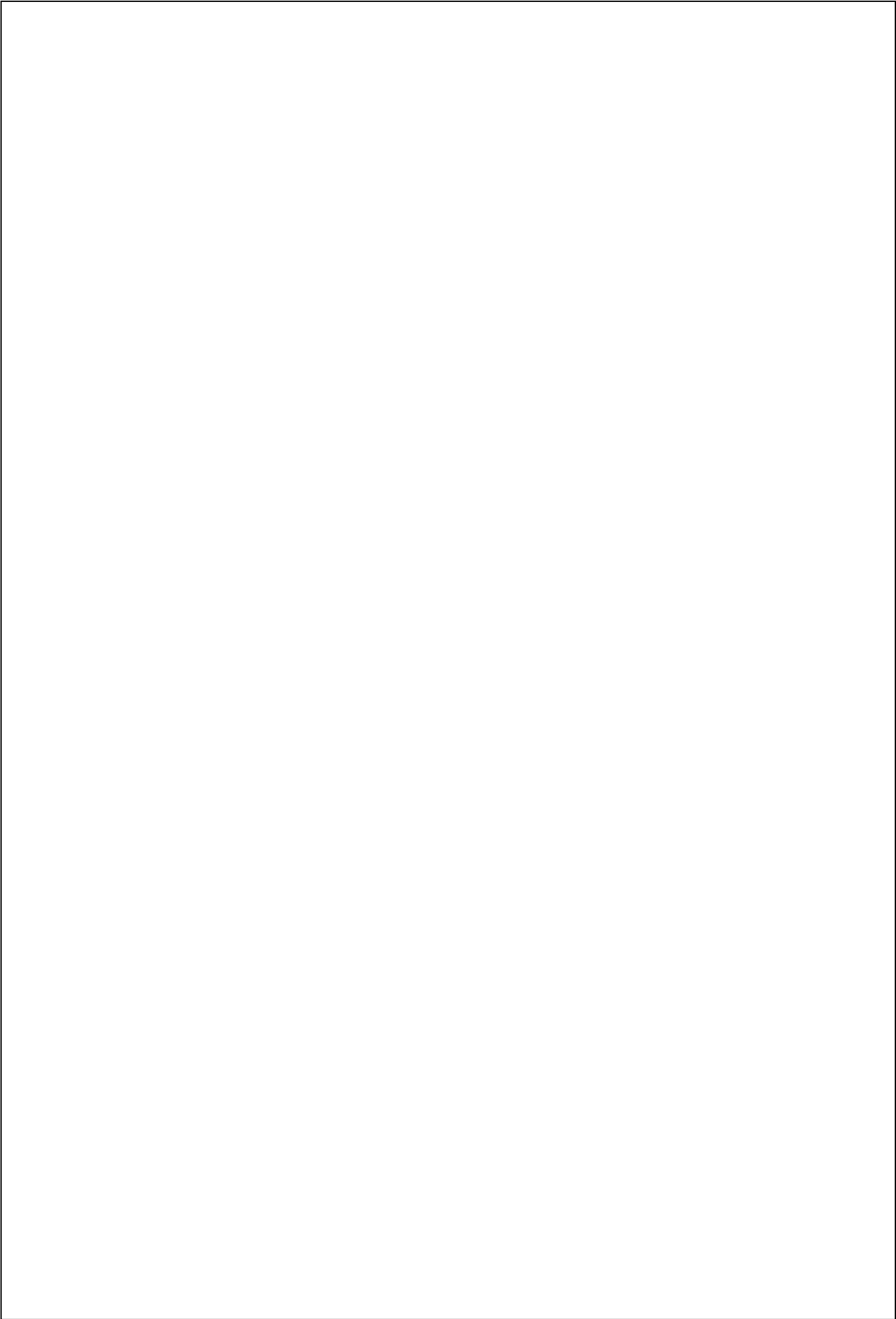
Diagnostics: Opens the diagnostic window. See Chapter "Diagnosis".

Scope: Opens the Scope window. See Chapter "Diagnosis".

Block diagnostics: With this button, selected elements can be added in the device diagnostics window in the "Function block" tab. This button is only enabled when the device window is displayed.

Connection settings: Opens the document properties with the connection settings. In order to establish a connection to a MINAS system, the transmission parameters must be set accordingly.

Close: Closes the device interface.



Device Interface Status Bar:1) Compile-time display

- a. **Compiled** - current file compiled
- b. **Not compiled** - current file not compiled

2) Progress

- a. **None** - grey shade indicates no configuration process
- b. **Send configuration** - Transfer the configuration of Functional Scheme to MINAS module
- c. **Read configuration** - Read the current MINAS device configuration

3) Connection status with display

- a. **Connected** - active connection to the COM interface of a MINAS monitoring unit
- b. **Disconnected** - no active connection

4) Program status

- a. **Idle** - program has executed all tasks of the control
- b. **Upload** - Program uploads to the MINAS system
- c. **Download binary** - program downloads the configuration from the device
- d. **Diagnostics** - program uses diagnostic tools in the Diagnostics tab
- e. **Range** - program monitors the time-dependent profiles of speed, acceleration and position in the "Range" tab

5) Device status

- a. **Stop** - stops the transferred program
- b. **RUN** - starts the transferred program
- c. **Initialization** - Program initializes the device
- d. **None** - no connected device (only "disconnected" status)
- e. **Alarm** - Alarm case with number of errors

6) Connected COM port7) Cursor coordinate

Current cursor coordinates in the workspace

8) Zoom in / out

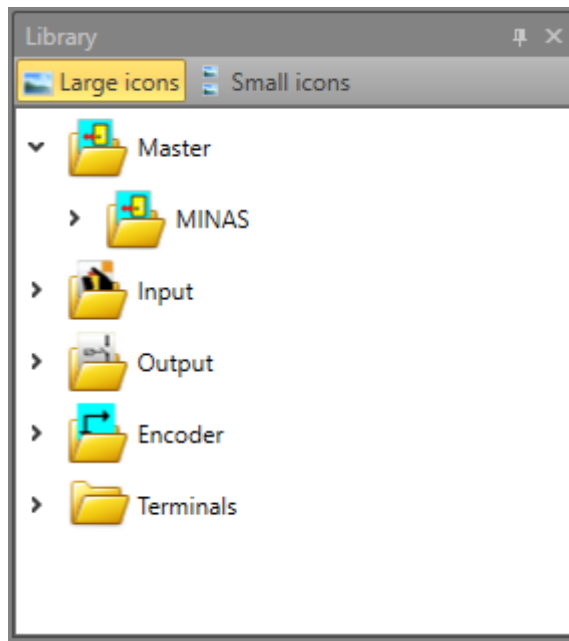
Current zoom in% of 10% - 500%

Note: The diagnostics function is described in the section "Diagnostics". For more information on the area, please refer to chapter "Monitoring the area".

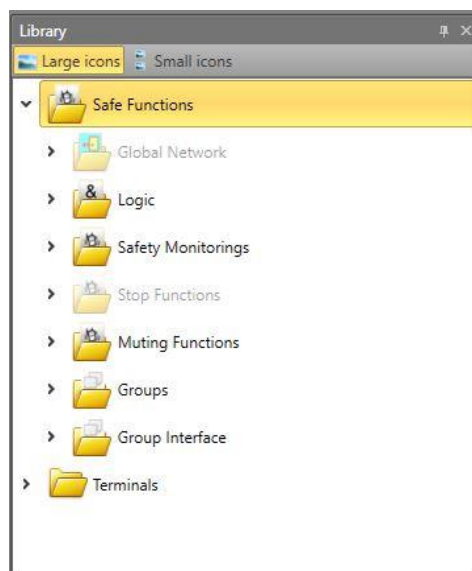
9. Library contents

The library provides all available building blocks for building the desired function block diagrams. Only those items that can be used in the selected plan are displayed.

The blocks can be added with Drag&Drop in plan view and edited in the Properties window.



View of the library - wiring scheme selected



View of the library - Functional scheme selected

The resource panel of the component elements for the MINAS system manages the available elements although numbering may be limited.

The automatic monitoring of the resources for the component elements of the MINAS module enables only the available items in the program. This concerns especially the time-controlled peripheral devices.

Some modules depend on other components and are only available when these modules are already present in the plan.

If there are no resources (memory) for the audit program in the MINAS module, the components or functions are grey and cannot be used again.

This is the case if all digital connections of a MINAS module are occupied or all timer blocks were used.

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

9-1 Device modules

Master devices

The master device is the base module for programming.

A PanatermForSafety document may include programs for multiple master devices of different types. The master units with this ability can communicate with each other via the Communication network.



9-2 Periphery

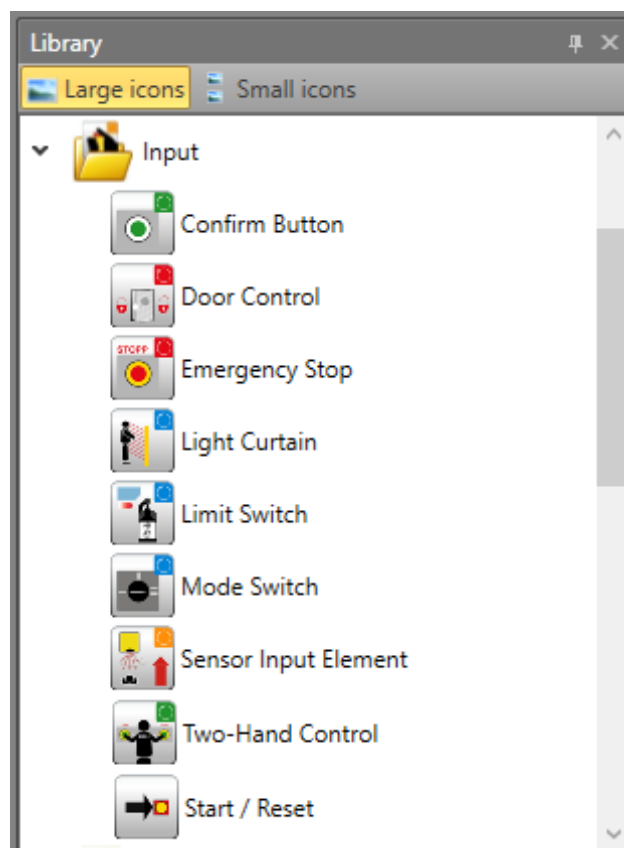
This represents external modules, which are connected with the inputs and outputs of the MINAS module. Hereby, the input and output signals are provided.

It can be inserted in a connection or wiring diagram, where they are automatically linked to the corresponding connectors of the MINAS device.



After inserting, the corresponding function module is created, which can be used with other functional modules to configure the desired function of the system (in the Functional Scheme).

9-2-1 Input modules



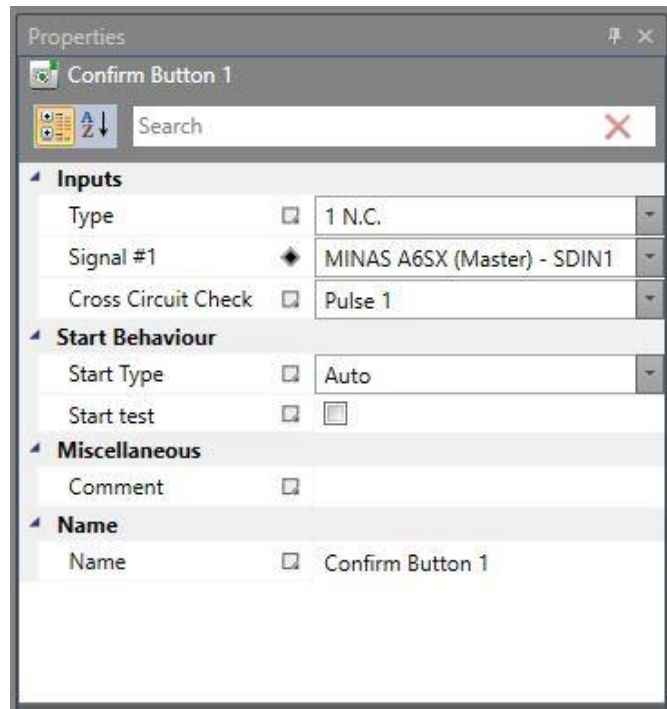
List of input modules

The input elements create the digital connection between one or more connected sensors and/or further lower-level switching devices in the **MINAS system**. They provide data about the operating condition of the system monitored by the MINAS module.

These components, which are located outside of the appliance from the perspective of the MINAS module, can be added and configured only in the connection or wiring diagram. Each input item, except the mode switch, provides one logical output signal "0" or "1" for further processing in the PLC.

The elements are structured by use and type of the input signal so that a targeted resource monitoring of the MINAS module is possible. The input elements are structured according to their application (e.g. "Activate" button).

The following sections provide details about this type (e.g. button "Confirm").



Button "confirm" under "Properties"

Notes:

The configuration of the input module has significant impact on the level of performance. See the installation guide.

Unused inputs are always assigned to Pulse 1 (standard configuration).

Unused inputs are still listed in the configuration report using the default configuration.

The configuration of the digital inputs is always based on the same flow.

Type of switch

Switch type of component that is connected to the MINAS module. The number of the corresponding input signals and the MINAS module monitoring behavior varies with the selection.

For time-controlled actuators another signal change must take place at $t = 3$ s after the first signal was carried out. If this does not happen, a malfunction is detected.

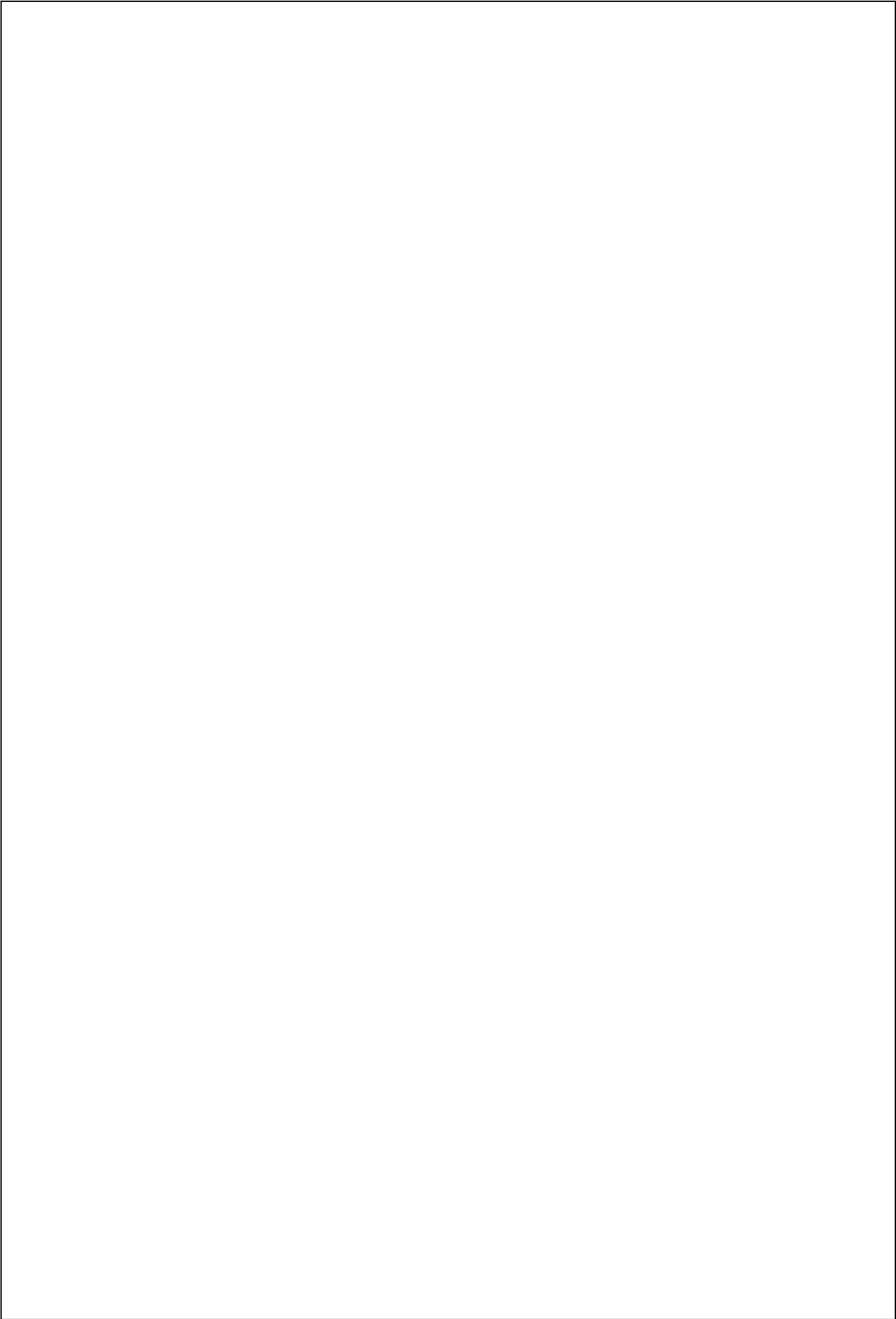
Signal No.

The assigned number of the external signal to the digital input of the MINAS module. This list shows the unused identifier of the MINAS module input signal (e.g. ("E.1"). These are assigned by the user. A double assignment of the input signals is not allowed. The selection list remains empty if the MINAS module resources are almost exhausted and the selection of the type of switch would need too many input signals. Here, a type of switch with fewer connections must be used.

Cross Circuit Check

Two signal pulses, Pulse 1/Pulse 2 and are available and can be used for the Cross Wire Detection (CWD). Alternatively, the option "Off" can be selected.

To ensure reliable monitoring of short circuits and wire breakage, adjacent inputs must have different pulse numbers in the MINAS module. If this is not the case, a warning is issued.

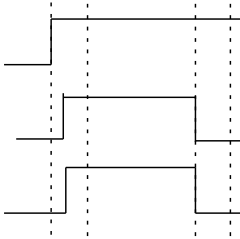


Start Behavior

This setting is used to set how the peripherals behave when switched on or the system is reset.

Start Type: Automatic

By this default start-up type, the ramping up of the MINAS module without confirmation by the user is possible.

Start typology	How it functions	Plan
Automatic start	Automatic start after a reset or after activation of the function. Output of the input element is '1', if safety circuit according to definition type switch closed/active	 Unit start-up Switching function Output

Start Type: Monitoring

Release of the monitored input element upon falling edge at the given monitor input. This is required every time the monitored input element is to be switched.

Example: Start drive only if it is confirmed by the operating personnel.

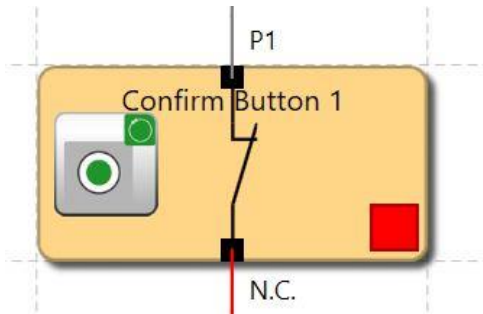
For monitored start type, an additional connector will be made available to connect to a start element. The further behavior for monitoring of the input element in the start-up phase can be configured here.

Start test

Manual start after reset or interruption of the defined security crises with a test of the connected command authority. Here, the control devices must release once in the direction of monitoring and return back, normal operation resumes on completion of this.

This one time pressing of the input element at the start (or reset) of the monitored system ensures the function of the input element at the time of the launch. A start test can be performed for all input elements with the exception of the operating mode choice switch.

An activated start test is indicated by a red rectangle on the inserted function block.



Each input module can perform an automatic function test (= start test). In total, 2 switch elements for the home test can be configured.

Start type	Function	AWL	Plan
Start test	Manual start after a reboot or reset of alarms, including the examination of the connected monitoring device. The monitoring device must operate once in the direction of monitoring and will then turn on again. This is followed by the normal operation. E1: switching function y1: Service memory	LD E1 ST MX. y1 LD NOT MX.y1 ST MEAA_EN.1 LD MX. y1 ST MEAA_EN 2 LD MEA. 1 AND MX.y1 ST MX.2	 Unit start-up Switchingfunction Output

Comment

Text to be displayed on the module. You can enter your own comment.

9-2-1-1 Confirm Button

Type of switch	Designation	Comment
1 (1 N.C.)	1 Opener	Enabling switch simple
2 (1 N.O.)	1 Closer	Enabling switch simple
3 (2 N.C.)	2 Opener	Enabling switch with increased requirement
4 (2 N.C. Time Monitored)	2 Opener time monitored	Enabling switch monitored

9-2-1-2 Door Control

Type of switch	Designation	Comment
3 (2 N.C.)	2 Opener	Door monitoring with higher requirements
4 (2 N.C. Time Monitored)	2 Opener time monitored	Door monitoring monitored
5 (1 N.O. 1 N.C.)	1 Closer + 1 opener	Door monitoring with higher requirements
6 (1 N.O. 1 N.C. Time Monitored)	1 Closer + 1 Opener time monitored	Door monitoring monitored

9-2-1-3 EMERGENCY Stop

Type of switch	Designation	Comment
1 (1 N.C.)	1 Opene	EMERGENCY off simple
3 (2 N.C.)	2 Opener	EMERGENCY-stop with higher requirements
4 (2 N.C. Time Monitored)	2 Opener time monitored	EMERGENCY off monitored

9-2-1-4 Light Curtain

Type of switch	Designation	Comment
3 (2 N.C.)	2 Opener	Light curtain with higher requirements
4 (2 N.C. Time Monitored)	2 Opener time monitored	Light curtain monitored
5 (1 N.O. 1 N.C.)	1 Closer + 1 Opener	Light curtain with higher requirements
6 (1 N.O. 1 N.C. Time Monitored)	1 Closer+ 1 Opener time monitored	Light curtain monitored

9-2-1-5 Limit Switch



Type of switch	Designation	Comment
1 (1 N.C.)	1 Opener	Activation switch simple
2 (1 N.O.)	1 Closer	
3 (2 N.C.)	2 Opener	Activation switch with higher requirements
4 (2 N.C. Time Monitored)	2 Opener time monitored	Activation switch monitors

9-2-1-6 Mode Switch



Type of switch	Designation	Comment
13 (N.C. N.O.)	Selector switch opener/closer	Mode selection switch monitored
15 (4 Phase)	Selector switch 4 stages	Mode selection switch monitored

Note: To modify the status of the switch, the PanatermForSafety program must ensure that the outputs of the module are disabled (caution: standard 60204 part 1 section 9.2.3).

9-2-1-7 Sensor Input Element



Type of switch	Designation	Comment
1 (1 N.C.)	1 Opener	Simple sensor input
2 (1 N.O.)	1 Closer	Simple sensor input
3 (2 N.C.)	2 Opener	Sensor input with higher requirements
4 (2 N.C. Time Monitored)	2 Opener time monitored	Sensor input monitored
6 (1 N.O. 1 N.C. Time Monitored)	1 Closer + 1 Opener time monitored	Sensor input monitored

9-2-1-8 Two-Hand Control



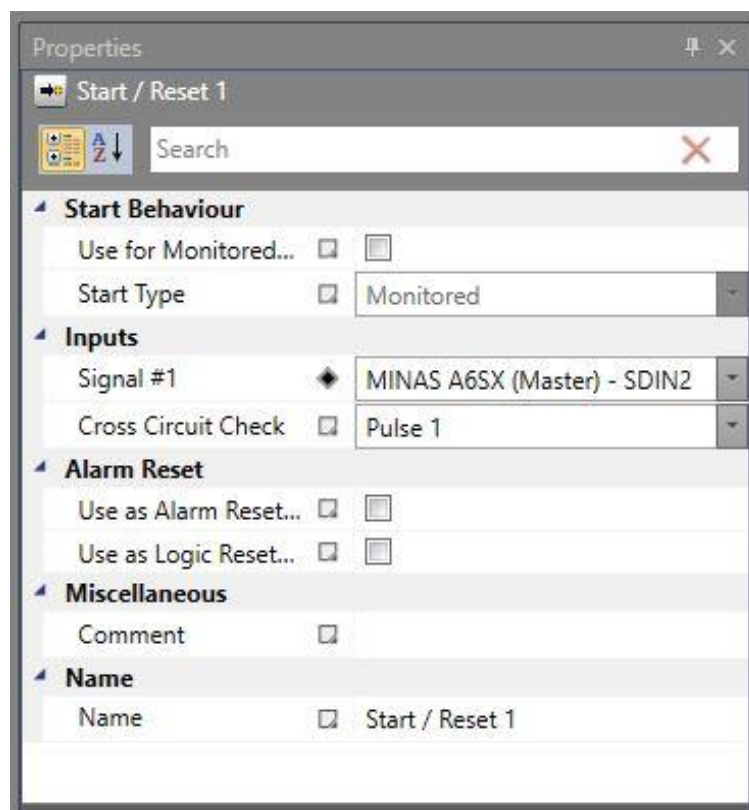
Type of switch	Designation	Comment
11 (Two-Hand 2 Toggle Switches)	2 Closer + 2 Opener	Two-hand control with higher requirements type III C
12 (Two-Hand 2 N.O.)	2 Opener	Two-hand switch monitoring type III A

Note: With these input elements a fixed allocation of pulse takes place, which cannot be influenced by the user!

9-2-1-9 Start / Reset



This input element offers an advanced monitoring function as well as the ability to reset an alarm that may have occurred.

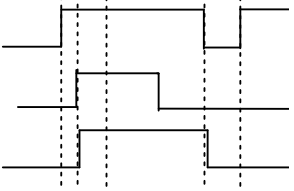
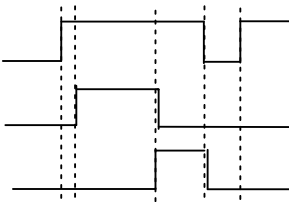


Properties of start / reset element

Use of the monitored start

Start monitoring enabled automatically creates a special IL code segment for the monitoring of an assigned input segment during a restart or reset of an alarm of the equipment/system to be monitored.

This function relevant test of a peripheral element (e.g. triggering an emergency off switch) is to make sure of correct function at the start of the equipment.

Start type	Function	AWL	Plan
Manually	Manual start after reset. Output of the input element is 1, 1 x press safety circuit according to the definition of closed/active type of switch and start button. Output will be 0 after safety circuit open. E1: switching function E2: Start button M.(X1): Service memory 1	LD E.1 AND E.2 S M.(X1) LD EMERGENC Y E.1 R M.(X1) LD M.(X1) AND E.1 ST IE.X	 Switching function Start button output
Monitored	After reset, manual start with monitoring of the starting circle on static 1 signal. Output of the input element is 1 when safety circuit was 1 x pressed and released in accordance with the definition of closed/active type of switch and start button. Output will be 0 after safety circuit open. E1: switching function E2: Start button M.(X1): Service memory 1 M.(X2): Service memory 2	LD E.1 AND E.2 S M.(X1) LD EMERGENC Y E.1 R M.(X1) LD M.(X1) AND E.1 AND EMERGENC Y E. 2 S M.(X2) LD EMERGENC Y E.1 R M.(X2) LD M.(X2) AND E.1 ST IE.X	 Switching function Start button output

Collection of start types via the "Activate" button



The monitoring input of the starting element must be connected to the output of the input element named "Start element". Various elements can be monitored.

Safety Functions	RESET necessary
STO	Yes (alarm reset)
SSX	Yes
SLS	Yes
SSM	No
SSR	No
SOS	Yes
SDI	Yes
SLI	Yes
SLP	Yes
SEL	Yes
SCA	No
SLA	Yes
SAR	Yes
SRX	No
SRS	No
EDM	Yes
ECS	Yes
ICS	Yes

Resettable safety modules

Note:

The same function is achieved when the button "SW2" on the basis of MINAS module is used.

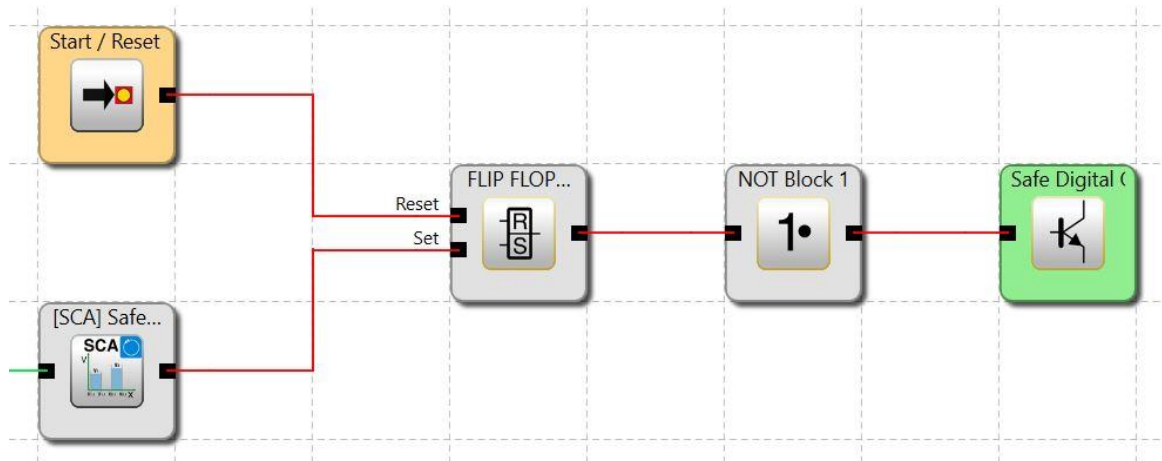
The MINAS module must be restarted for error messages of the type "Fatal error".

The input of the alarm reset can be operated with 24 V continuous voltages and is triggered by the flank.

Use as a logical default (closing contact)

With this option, the default / reset function in the logic plan for further processing is available. In this case, the output of the function module is automatically created and can be used to connect to a logical function. This logical default signal is typically used for the acknowledgement of RS-Flip-Flops.

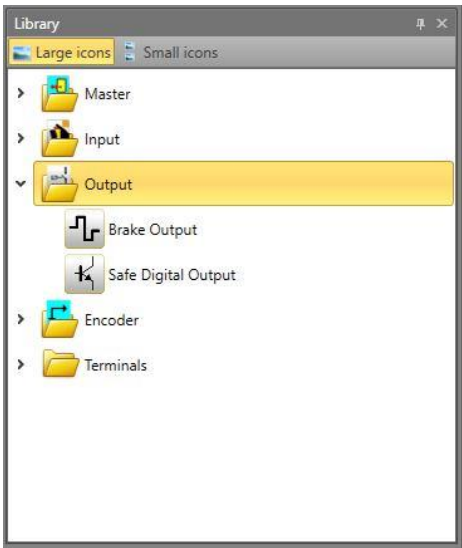
This is intended for the case that a SCA error is constantly on the RS module and can be reset by pressing the reset button on the RS module.



Start / reset to save and reset errors of the SCA module via RS-FlipFlop

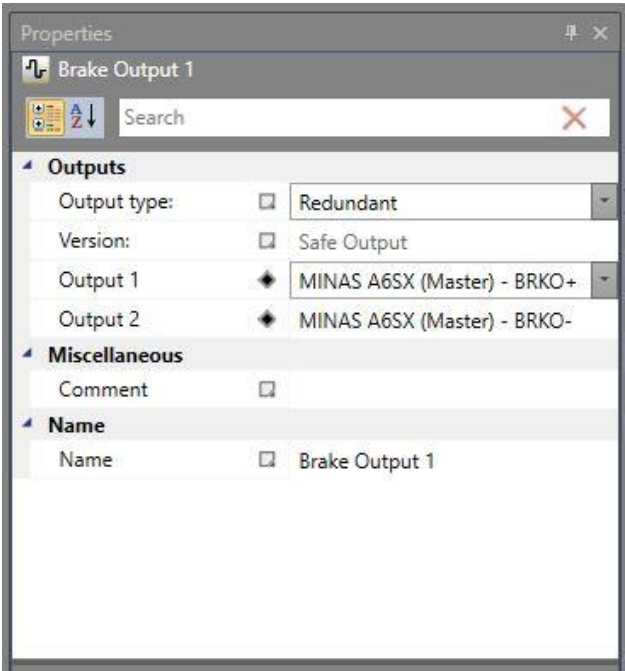
Type of switch	Comment	Classification category	Classification SIL
1 Closer	Alarm resetting default (evaluation of the flank)	--	--
1 Closer	Logical reset default	Category 3	SIL 2
1 Closer	Start monitoring standard (optional function)	--	--

9-2-2 Output modules



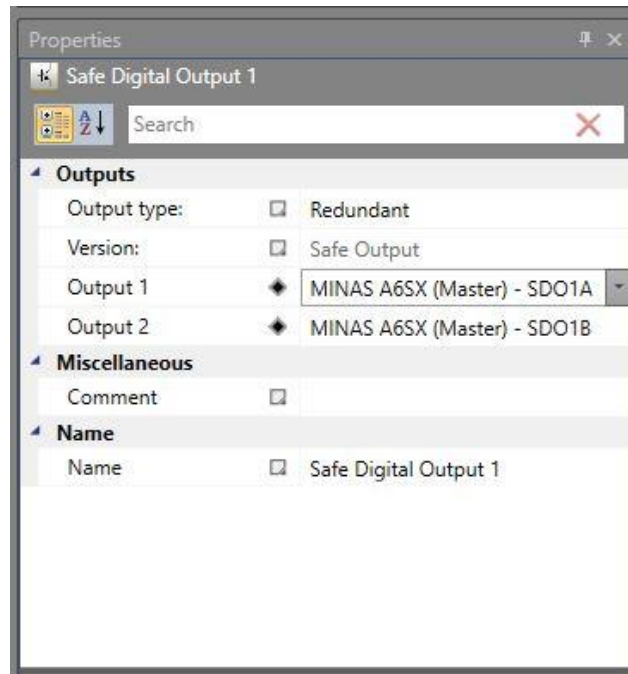
The initial building blocks create the digital connection between one or more external circuits in the **MINAS system**. Each module is approached by a logical input signal "0" or "1" via the Functional Scheme.

9-2-2-1 Brake Output



Output type

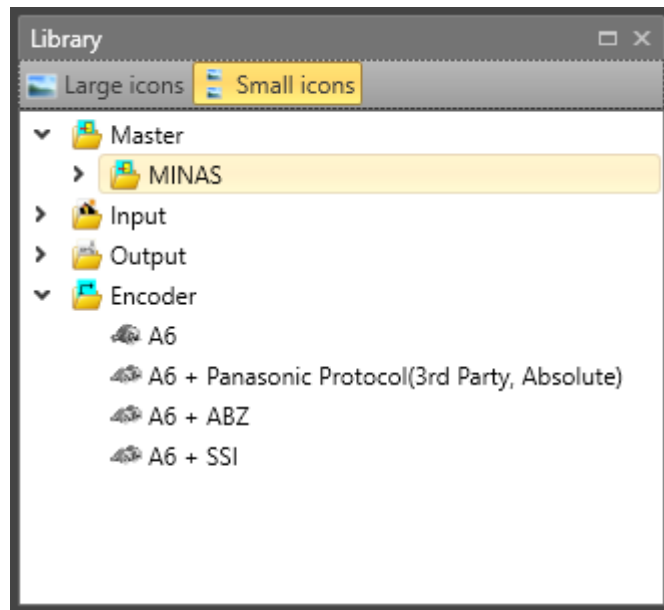
The brake output can be selected only as **redundant** output. This option requires a combination of „BREAKEO0.0" and „BREAKEO0.1".

9-2-2-2 Safe Digital OutputOutput type

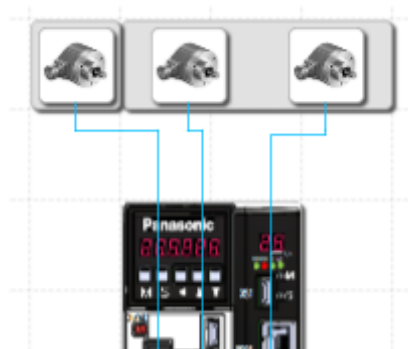
The SDO output can be selected only as **redundant** output. This option requires a combination of „SDO1A" and „SDO1B" or "SDO2A" and „SDO2B".

9-2-3 Encoder combinations

The encoder combinations are listed in the library and the selection in the library can be dragged into the connection plan via Drag&Drop. Only combinations that can be used with the selected MINAS system are shown.



Note: The setting of encoders must always refer to a common axis. If the 2 encoders are connected to different mechanical positions and these positions are connected with an intermediate gear, the measuring range must be set on one of the 2 positions of the encoder and for the other encoder the transmission ratio must be taken into account.



Encoder combinations in the "Terminal scheme" view [Wiring Scheme]

9-2-3-1 Encoder type



Add encoder using Drag&Drop

Selection of the function type of the encoder:

- **Panasonic A6**

Absolute value encoder, i.e. the position is determined absolutely and retentive.

- **Panasonic Protocol (3rd Party, Absolute)**

Absolute value encoder, i.e. the position is determined absolutely and retentive. This encoder type is to be used only in combination with Panasonic encoder.

- **ABZ**

Position and velocity are observed across impulses / distance.

This encoder type is to be used only in combination with Panasonic encoder.

- **EnDat 2.2**

Absolute value encoder, i.e. the position is determined absolutely and retentive.

- **SSI (absolute value encoder)**

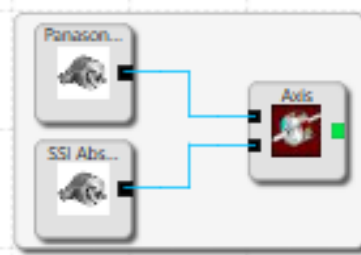
Absolute value encoder, i.e. the position is determined absolutely and retentive. This encoder type is to be used only in combination with Panasonic encoder.

Note: For position monitoring at least one encoder with an absolute position must be available. If none of the 2 sensors is an absolute value encoder, the fields for the position inputs in all other input masks of the monitoring function are disabled.

With an incremental encoder a relative position is calculated based on the encoder pulses. The resolution of the axis must be specified in pulses per revolution (PPR) via the button "Resolution" [resolution]. The reproduction depends on the set sensor configuration and automatically expires. See installation guide for more information.

9-2-3-2 Adjusting the encoder area

The parameterization of the 2 encoders for position and speed detection can be set in the properties by clicking on the corresponding timer of the axis in the Functional scheme or the browser.



Specific encoder area in the combinations of timer - functional scheme

The configuration affects only the control software of the encoder. An advanced setting of the encoder interface hardware is necessary for the correct function. For further details on this topic can be found in the installation manual of the MINAS module.

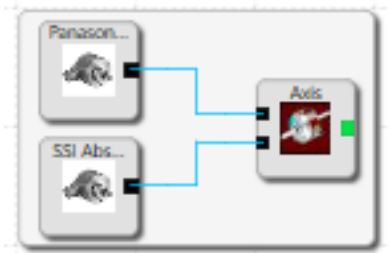
Properties of the encoder: parameter depends on the sensor type.

Parameters	Description	Value
Direction	Selection of sensor counting direction	Up/Down
Supply Voltage	Power supply encoder	5V, 8V, 10V
Resolution	Encoder resolution with respect to the measuring axis in the predefined context (linear or rotating) <i>Note: For EnDat and HDSL the safe position has to be considered.</i>	Range: 1 - 2 147 483 647 Linear: Incr / 1000 Rotatory: Incr / r
Resolution [Calculate...]	This button opens an auxiliary dialogue. This facilitates the determination of the value.	-
SSI interface (absolute value encoder)		
Interface Type	Type of the SSI interface (Master, Listener)	SSI Masterclock
Master clock frequency	Clock frequency in master mode	125 kHz 250 kHz 500 kHz 1 MHz 2 MHz
Data format	Format of the position data	Binary code Gray code
Frame length	Length overall SSI Frame	10 - 31 bit
Data length	Length SSI data starting at MSB. This data field, e.g. no status bits are allowed (SSI data only).	10 - 28 bits
Data index	Start index for bit information of the encoder data.	Integer Value Bit position starting with LSB 0 - 31 bit
EnDat 2.2		
Resolution	As mentioned above, for EnDat resolution the safe position has to be considered. Example: Type EQI1131 Safe position: → safety-related measuring step SM = 0,35° → 360°/0,35° (2 ¹⁰) → Safe position resolution = 10 bit	

Configuration (read-only): Displayed results data regarding the currently used encoders.

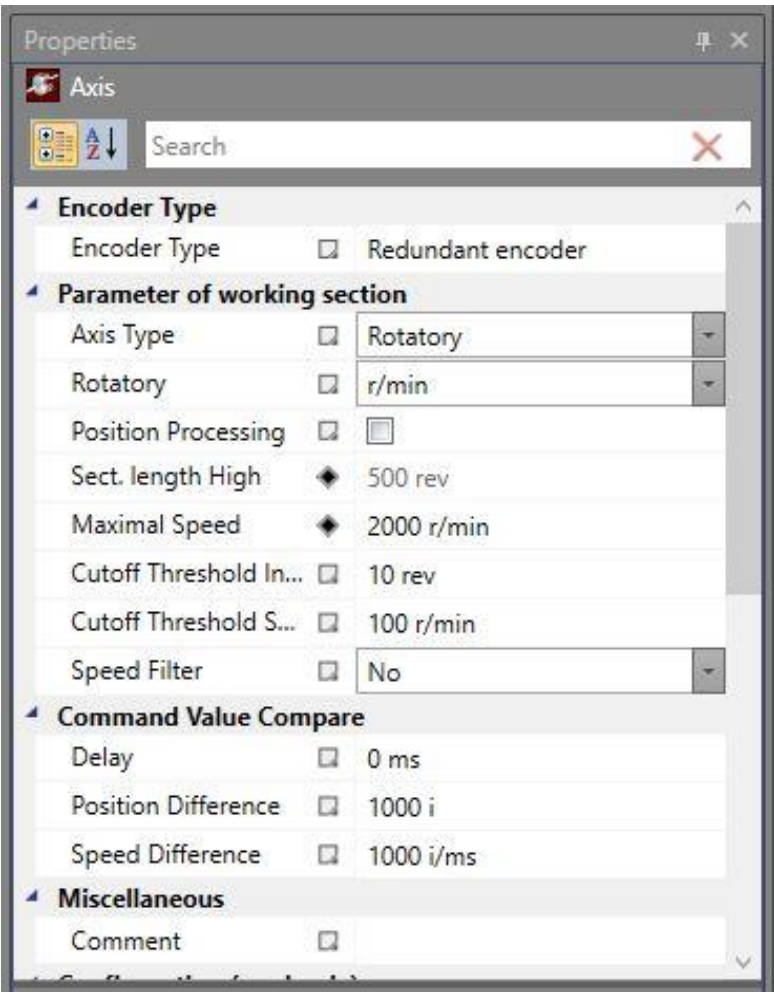
Column name	Meaning
General Flags	BIT encoded assignment D0: 1 = Encoder input is activated
Class ID	Unique ID of the encoder configuration
Modes	BIT-coded assignment for the selected encoder
ExtModes	BIT-coded assignment for Encoder voltage
Resolution	Resolution of the encoder with respect to the measuring axis in steps / m or steps / r
Offset	Offset between encoder value and position in the measurement area
ShiftPos	Integer exponent for base 2 used for the position normalization (internal calculation value)
NormPos	Normalization value for position (internal calculation value)
ShiftSpeed	Integer exponent for base 2 used for the speed normalization (internal calculation value)
NormSpeed	Normalization value for speed (internal calculation value)
Filter Time	Not used
DataLength	The data length of the position value field
FrameLength	Total length of the data
StatusLength	Total length of the status
DataIdx	Start index for bit information of the encoder data.
StatusIdx	Start index for bit information of the encoder status.
StatusMaskErr	Not used
StatusMaskDef	Not used
ResolvParam	Not used

9-2-3-3 Setting the axis



Axis range in the encoder combinations - Functional scheme

The following options and inputs can be set in the Properties window by selecting the axis range in the encoder combinations.



Properties of the axis:**Encoder type:*****Single encoder:***

An encoder type E.g.: Incremental or SinCos

Redundant encoder:

Two different encoder types, for example: Incremental SSI

Axis type:***Linear:***

The measuring range has linear characteristics. The unit of position is in this case "Mm" and the speed can be expressed in "mm/s" or "m/s".

Rotatory:

The range features a rotating pattern, i.e. the movement is turning. The position is specified in "degr" or "rev", the speed in "degr/s", "rev/s" or "r/min".

Position processing

Processing of an absolute measuring section. This functionality is only available for selection if an absolute sensor has been parameterized beforehand!

With position processing activated all position related monitoring functions are enabled.

Sect. length High

Specifying the maximum measuring length of position in mm, m or degree, U. With position processing activated, the application must also stay inside the limits of the adjusted measuring length. Any actual position outside the defined measuring length leads to an alarm of MINAS-axis.

Maximal Speed

Specifies the maximum 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. The maximum value that can be reached by the axis to be monitored should be entered here. 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 mechanical situation. 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.

If this happens, the MINAS module changes to alarm status and all outputs are switched off.

This means, that the "maximum 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 "Increment shut-down threshold" and the "Speed shut-down threshold".

A higher maximum speed permits higher shut-down thresholds between the encoders. The maximum value should therefore not be chosen too high, as otherwise the shut-down thresholds

could be too high for the reliability of the sensors amongst each other. The table with the property values of the configuration (read-only) shows these calculated limits for the variable V_max, V_min.

Note: The speed calculation is based on the maximum speed that is entered inside this field. This normalization optimizes the calculation to use the maximum accuracy up to the maximum speed. If this maximum speed is exceeded by a large margin the speed cannot be calculated, overlaps and may not be displayed correctly in the scope. The user has to enter the maximum physically possible speed of the application and validate this input.

Switch-off threshold/Position / speed

The cut-off threshold indicates the permissible speed / position deviation between 2 detection channels / sensor channels. It can depend on the arrangement of the sensors and the maximum mechanical game (E.g. by gearless and spring stiffness) between the 2 locations. The smallest possible value where the monitor in normal operation still not raised should be selected taking into account the dynamic processes (e.g. load/play in the gearbox).

Speed filter

Average filter that covers the detected speed values of the encoder, to reduce peak speeds in case of a low resolution or deviation of the connected sensor. The filter increases the reaction time of the entire system to the set time. The filter affects the speed-related parameters of the monitoring modules.

Command Value Compare (EVC)

As a safety requirement for Panasonic A6 and Panasonic Safety encoders, the command value must be evaluated for consistency.

This command value is the target position for the drive and has to be compared with the actual value of the encoder.

Because of the drive control and mechanical reasons the real position always lags behind the target position. A user defined delay value and two thresholds for the comparison are added to the configuration.

- **Delay**

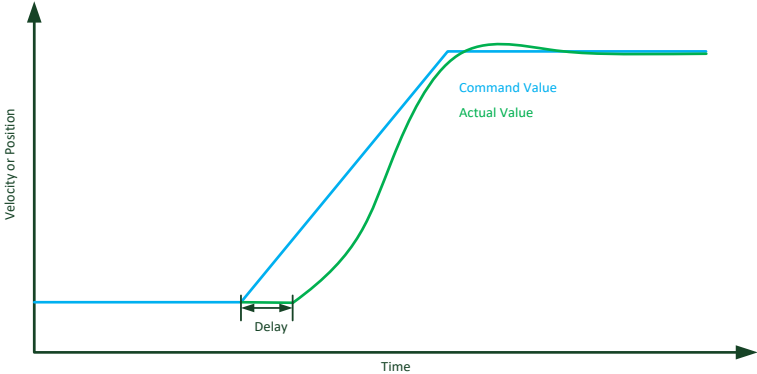
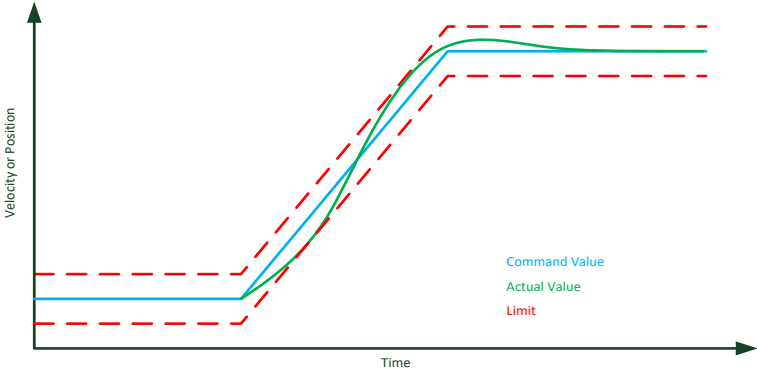
Delay expected in [ms] between actual value and command value.

- **Position Difference**

The maximum permissible position difference [i] (increments) between actual value and command value.

- **Speed Difference**

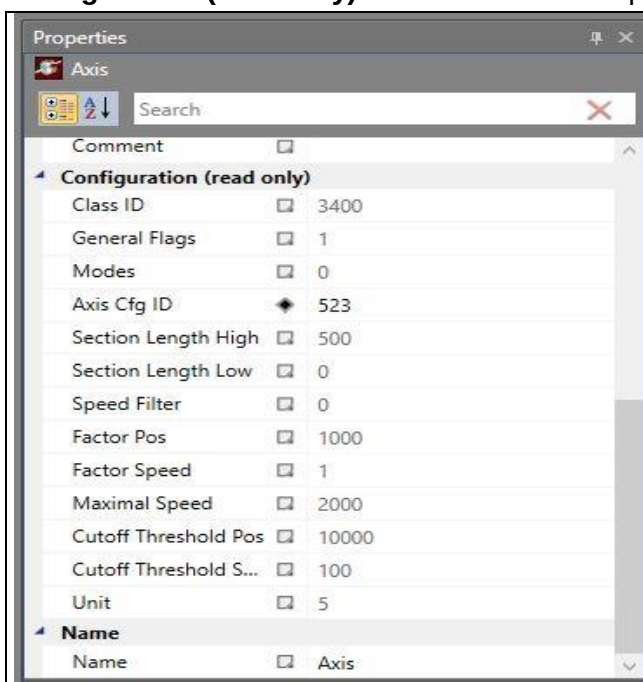
The maximum permissible speed difference between command speed and calculated speed.

Name	Length	Unit	Description
Delay	16 bit	ms	Expected delay between actual value and command value $ActualValue[t] = CommandValue[t - Delay]$  Range: [0..1000] ms
Position Limit	32 bit	Increments	Limit for ActualValue exceeding the CommandValue $ActualValue[t] - CommandValue[t - Delay] \leq Limit$  Range: [0..2^32]
Speed Limit	32 Bit	Increments / ms	Difference between command speed and calculated speed Range: [0..2^32]

Comment

Here, a comment for the axis properties can be entered.

Configuration (read-only): Result data is displayed on the current axis.



Name	Meaning
Class ID	Unique identifier of the axis configuration
General Flags	BIT-coded assignment D0: 1 = axis input is activated
Modes	BIT-coded assignment for Position processing and type of measuring range D0: 1 = Position processing active 0 = Inactive D1: 1 = Linear 0 = rotating
Axis Cfg ID	Unique ID for both encoder configurations
Section Length High	Higher limit of the measurement length for the position from the main dialogue
Section Length Low	Lower limit of the measurement length for the position from the main dialogue
Speed Filter	Average filter that covers the detected speed values of the encoder, to reduce peak speeds in case of a low resolution or deviation of the connected sensor.
Factor Position	Factor for the position calculation Standardization
Factor Speed	Factor for speed calculation Standardization
Maximal Speed	Standardized maximum speed
Cutoff Threshold Pos	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 due consideration of the dynamic processes (e.g. load/play in gearbox).
Cutoff Threshold Speed	
Unit	Unit of the displayed values 1 = mm / sec 2 = meters / second 3 = degrees / second 4 = revolution / second 5 = revolution / minute

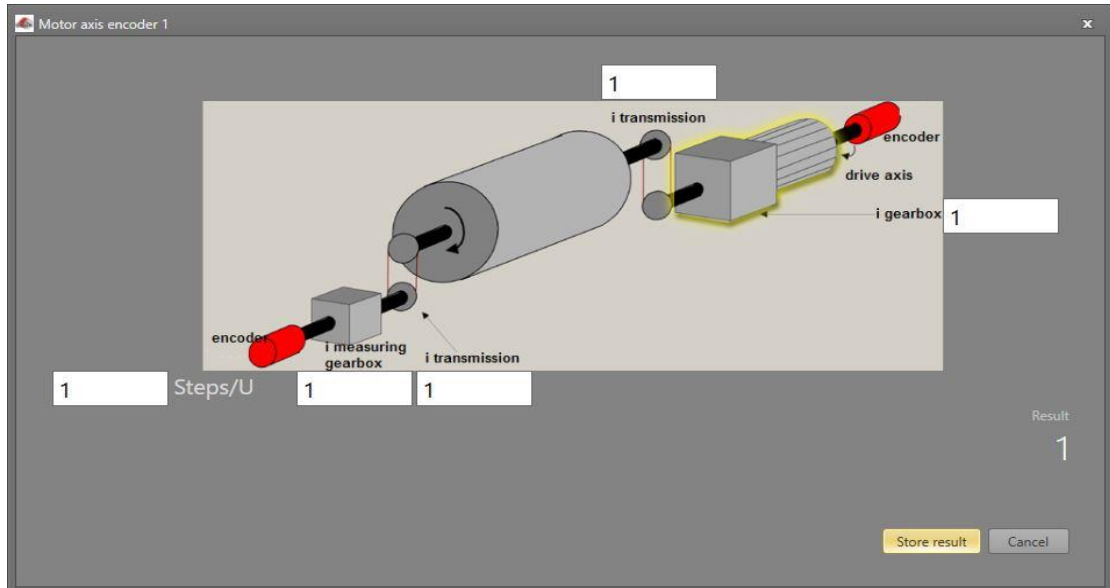
Note: The displayed values are for the technical support of the encoder configuration and are used for the standardized calculation in the MINAS module!

- Determination of the characteristic of the measuring length as linear or rotating generally affects all position and speed inputs of the monitoring functions. This changes the input of mm, m or m /s, m/s in degr, rev or degr/s, rev/s or r/min, and vice versa.
- The maximum measuring length and the maximum speed must be specified. The monitoring functions can attract unwanted due to a missing or incorrect entry.
- In general, the first encoder has the function of a process sensor and the second encoder is a reference sensor. For the combination of absolute encoder / incremental encoder, the absolute encoder is always used as a process sensor. If encoders with different resolutions are used, the encoder with the higher resolution must be configured as a process sensor.
- Upon changing basic settings like maximum speed and measuring length the tooltips and the context sensitive help is only updated after you deselect the axis.

9-2-4 Determination of resolution

Determination of the resolution with respect to differently characterized measuring lengths. The values must always be entered via the calculation button in the resolution of the encoder. Encoder resolution with respect to the measurement axis in the predefined context (linear or rotating). Input data for the establishment must be stored lying down.

9-2-4-1 Rotating measuring lengths:



Reference axis	Input values		Resolution with respect to measuring length
Feed Axis (Process axis)	Encoder 1 Resolution Gb 1 i measuring gear i transmission	A_Gb1 in [steps/Rev] I_MG I_VG	$Gb1 = I\_MG * I\_VG * A\_Gb1$
	Encoder 2 Resolution Gb 2 i Gearbox i transmission drive	A_Gb2 in [steps / U] I_G I_VA	$Gb2 = I\_G * I\_VA * A\_Gb2$
Motor axis	Encoder 1 Resolution Gb 1 i measuring gear i transmission Measuring gear i Gearbox i transmission	A_Gb1 in [steps / U] I_MG I_VG D_MR in [mm] I_G I_VA	

Input example 1:

In a production device the speed on a sure reduced value, next stop and direction should be monitored in certain manual tasks. The active movement to monitor represents a rotation. Powered by an electric motor with an integrated motor feedback system that incorporates an intermediate gear.

Selection of the type of timer:

No monitoring of positions required are needed-> absolute encoders, speed record with encoders are sufficient.

Definition of the measuring length:

The rotational axis of the manufacturing device is selected as the reference axis. The following parameters are selected:

- Rotating
- Measuring length unknown
- Reference axis is axis of rotation => designation = mgrd

Setting the parameters for encoder 1:

Encoder 1 is directly connected to the output axis of the gearbox = load axis. An encoder with the data: pulse generator A / B track, 5000 pulses / revolution is used.

The following parameters are selected:

- Encoder type: incremental encoder
- Resolution:

Encoder 1	
Resolution Gb 1	5000 [steps / U]
in measuring gear	1
in transmission	1

$$Gb1 = I\_MG * I\_VG * A\_Gb1 = 1 * 1 * 5000 = 5000;$$

Determination of parameters for timer 2:

The existing motor feedback system is used as sensor 2. The motor is connected to the axis of rotation of the production unit via an intermediate gear.

The encoder interface is connected to the pulse output of the voltage converter. The sensor data is as follows: Hiperface, 1024 I/U. According to voltage converter manufacturer's data sheet sine/cosine traces of the Hiperface encoder outputs in the form of pulses are-> qualified for pulse output of the power inverter, pulse generator, A/B track = 1024 I/U.

The following parameters are selected:

- Encoder type: Incremental encoder
- Resolution:

Geber2:	
Resolution Gb2	1024 [Steps / U]
in gear	350
in intermediate shaft for drive	1

$$Gb2 = I\_G * I\_VA * A\_Gb2 = 1024 * 350 * 1 = 35840;$$

Setting the maximum speed:

The maximum speed of the output axis is determined by the maximum motor speed. In r/min with respect to the load axis and with

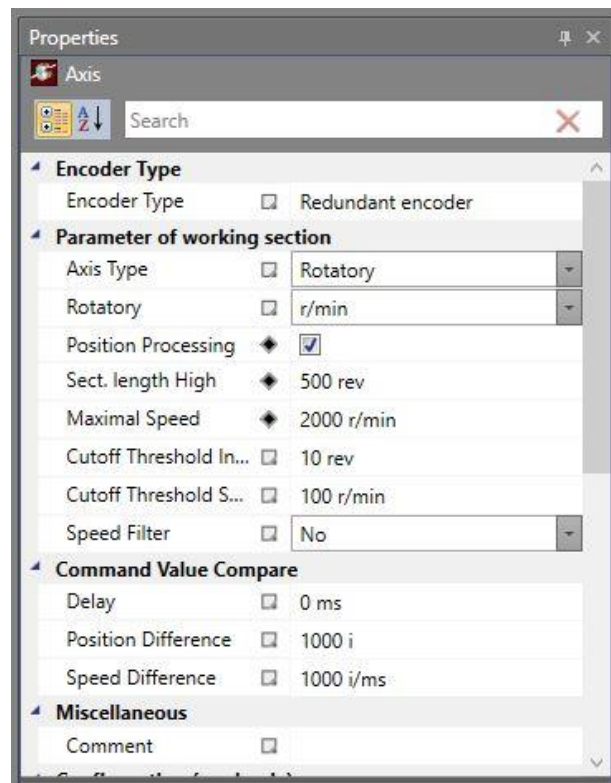
$$N_{\max} = 1500 \text{ r/min}, (1500 [\text{r/min}] / 60 [\text{s}]) / 350 = 0,$$

$$\text{Converted in } \mu\text{d} / \text{s}, 0.07142 [1 / \text{s}] * 360 * 10^3 [\mu\text{d}] = 25\,714 [\mu\text{d} / \text{s}]$$

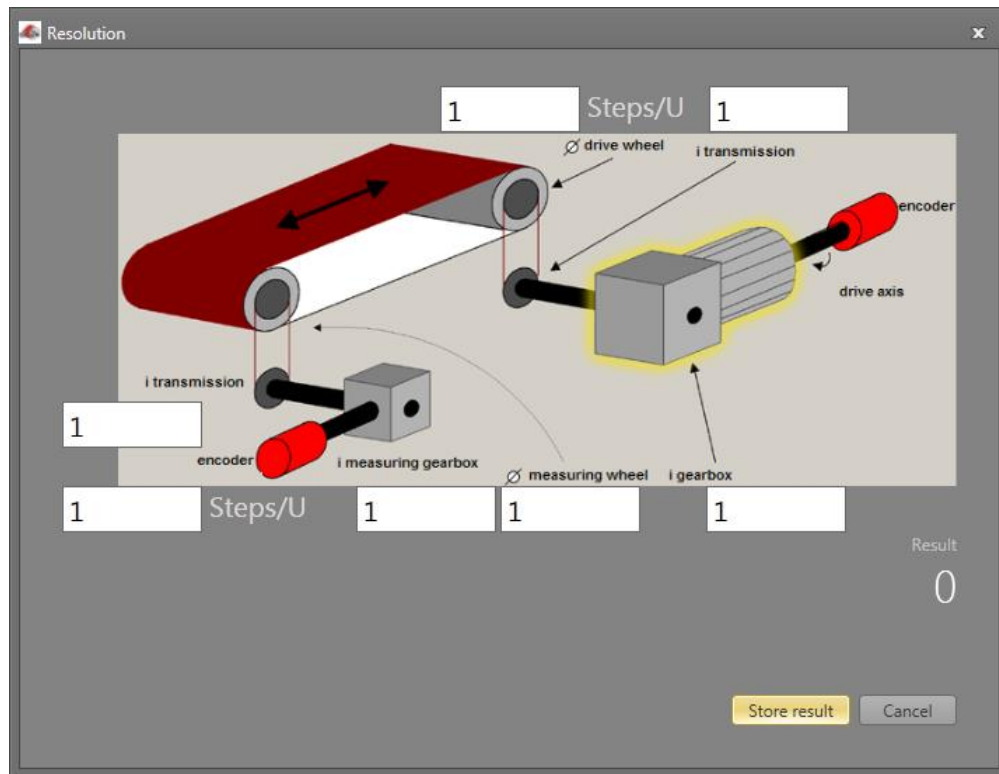
Input of the maximum deviation:

From the empirical measurement, a maximum difference between the 2 detection points of 80 m.

Selected will be 100 mgrd.



9-2-4-2 Linear measurement length



Reference axis	Input values		Resolution with respect to measuring length
Feed Axis (Process axis)	Encoder1: Resolution Gb 1 i measuring gear i transmission Measuring gear	A_Gb1 in [steps / U] 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 Gb 2 i Gearbox i intermediate shaft drive Drive wheel	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 gear i transmission Measuring gear i Gearbox i transmission drive Drive wheel	A_Gb1 in [steps / U] I_MG I_VG D_MR in [mm] I_G I_VA D_AR in [mm]	$Gb1 = \frac{\frac{1000}{D_{MR} \cdot \pi} \cdot I_{MG} \cdot I_{VG} \cdot A_{Gb1}}{\frac{1000}{D_{AR} \cdot \pi} \cdot I_G \cdot I_{VA} \cdot A}$

Input example 2:

The access to the work area for manual insertion or set-up at certain positions of the main feed roller should be released on a production machine. The drive will remain active in this position and is monitored only at standstill. The boundaries of the working stroke are variable and as replacement to the mechanical safety limit switches are monitored electronic safety-critical. The active movement to be monitored is a linear movement. An absolute encoder is positively connected directly with the main drive shaft as the linear measuring system. Powered by an electric motor with integrated motor feedback system with an intermediate gear. The intermediate gearbox output shaft is with a drive wheel 31.83 mm (= 100 mm circumference) connected.

Module selection**Selection of the encoder type:**

Monitoring of positions is required-> absolute value encoder is required, for the second encoder, incremental acquisition and reference switch are sufficient.

Setting the measuring length parameters:

The main axis of the system is selected as a reference axis. The following parameters are selected:

- Linear.
- Measuring length = 600 mm
- Reference axis is rotation axis → Designation = mm

Setting the parameters for encoder 1:

Encoder 1 is connected directly to the drive axis. Absolute value encoder SSI, 4096 steps / U is used.

The following parameters are selected:

- Encoder type: absolute value encoder
- Data format: SSI
- Resolution:

Encoder 1	
Resolution Gb 1	4096 [Steps / U]
i measuring gear	1
i transmission	1
Drive wheel	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 timer 2:

The existing motor feedback system is used as sensor 2. The motor is connected to the rear wheel via an intermediate gear. The ratio of the gearbox driving wheel is 31.831 mm 4.51 time Ø.

The encoder interface is connected to the pulse output of the voltage converter. The encoder data are as follows: Hiperface, 1024 I/U. According to voltage converter manufacturer's data sheet sine/cosine traces of the Hiperface encoder outputs in the form of pulses are-> qualified for pulse output of the power inverter, pulse generator, A/B track = 1024 I/U.

The following parameters are selected:

- Encoder type: incremental encoder
- Resolution:

Encoder 1	
Resolution Gb 2	1024 [Steps / U]
i Gearbox	4.51
i transmission	1
Drive wheel	31.83

$$Gb2 = \frac{1000}{D_{AR} \cdot \pi} \cdot I_G \cdot I_{AV} \cdot A_{Gb2} = \frac{1000}{31,83 \cdot \pi} \cdot 4,51 \cdot 1 \cdot 1024 = 46182$$

Default of maximum speed:

The maximum speed of the departure axis is derived from the maximum engine speed. It is U / s on the load axis and nMax = 1500 r/min

$$(1500 [U/min] / 60 [s]) \cdot 0,012 [m] = 0,3 [m/s] = 300 [mm/s].$$

Input of the maximum deviation:

Empirical measurement entails a maximum difference between the 2 entry points to the motor axis and the axis of the procedure of < 1 mm. 1 mm is selected.

The information received for the encoder configuration:

Properties

 SSI Absolut



Search



Configuration (read only)

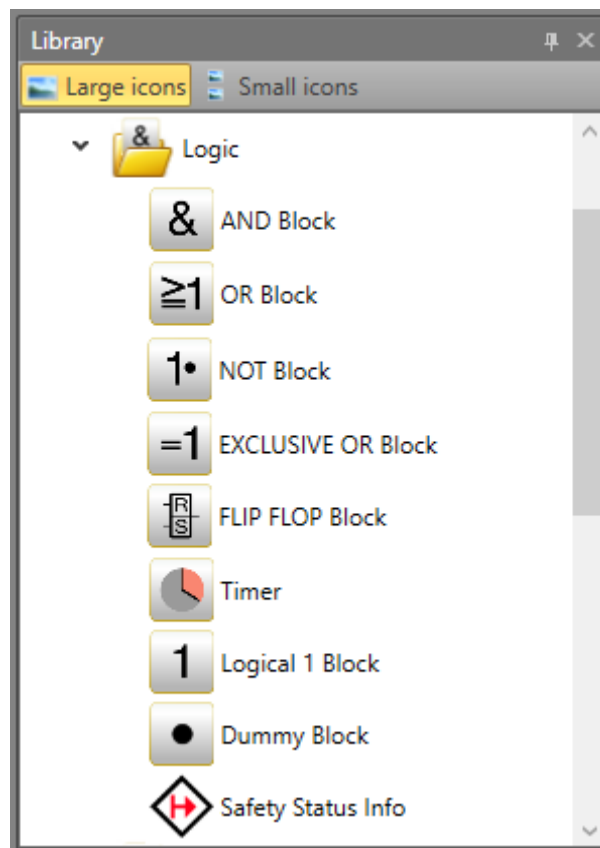
General Flags	☒	1
Class ID	☒	3300
Modes	☒	6
ExtModes	☒	1
Resolution	☒	1024
Offset	☒	0
ShiftPos	☒	12
NormPos	☒	4194
ShiftSpeed	☒	24
NormSpeed	☒	286331
FilterTime	☒	50
DataLength	☒	24
FrameLength	☒	24
StatusLength	☒	0
DataIdx	☒	0
StatusIdx	☒	0
StatusMaskErr	☒	0
StatusMaskDef	☒	0
ResolvParam	☒	0

Name

Name	☒	SSI Absolut

9-3 Function Blocks

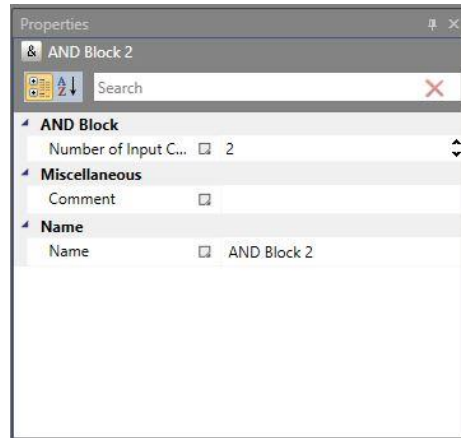
9-3-1 Logical functions



These modules are the basis for creating a safety application. They enable the logical connection of the inputs with monitoring functions with the outputs. Adding function modules is possible only in the view "Functional Scheme"; otherwise the corresponding menu commands are disabled. This is also the case if the resources for a module are already exhausted, for example after all of the timer devices have been inserted.

9-3-1-1 AND Block

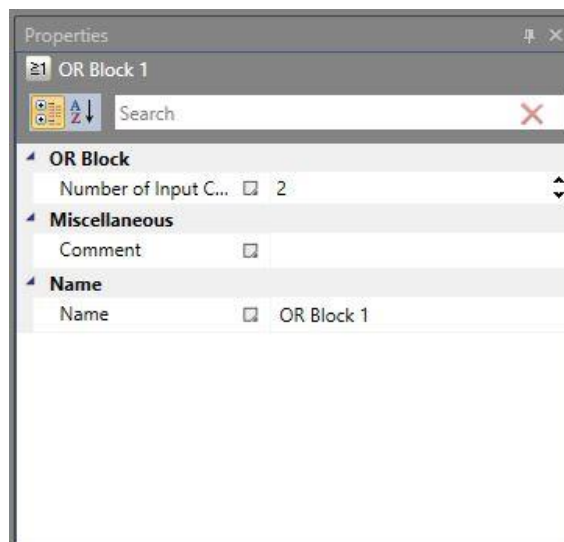
"AND" links for a maximum of 10 output signals of other function modules. AND link delivers the signal state "1" for all input signals "1" as a logical result; otherwise it is "0".



Note: The number of input connections can be reduced only if there are free connectors. If all connectors have linkages assigned, they must be deleted first.

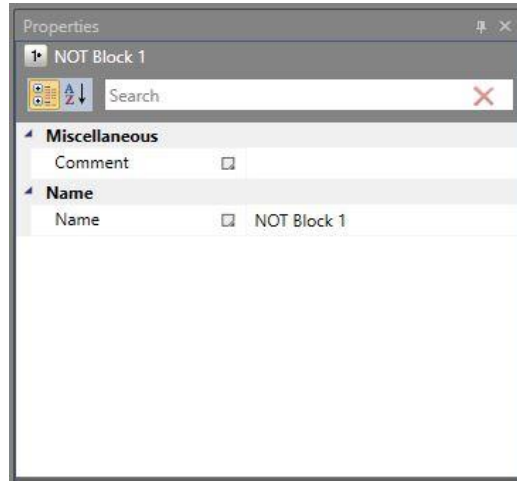
9-3-1-2 OR Block

"OR" links of a maximum of 10 output signals of other function modules. The "OR" delivers the signal state "1" for at least one input with signal state "1", otherwise it is "0".



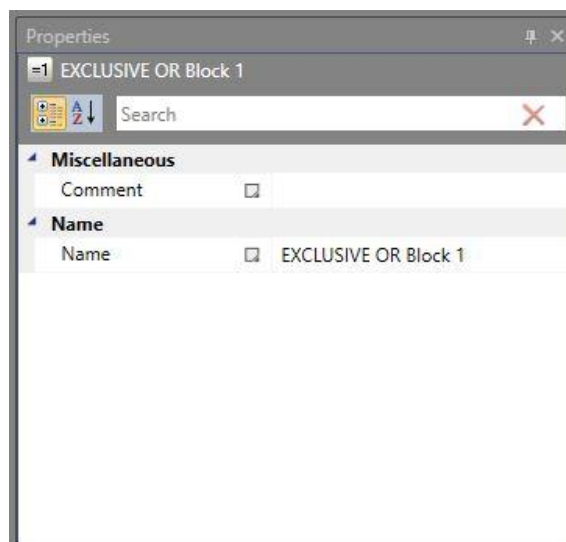
9-3-1-3 NOT Block

The logical result of this function module is the negation of the input signal. The term "Negation" means, that the logical result is negated and vice versa.



9-3-1-4 EXCLUSIVE OR Block

"EXCLUSIVE OR" links of 2 output signals from other function modules. The XOR module provides "1" as logical result, only when inputs differ (one is true, the other is false), otherwise it is "0".

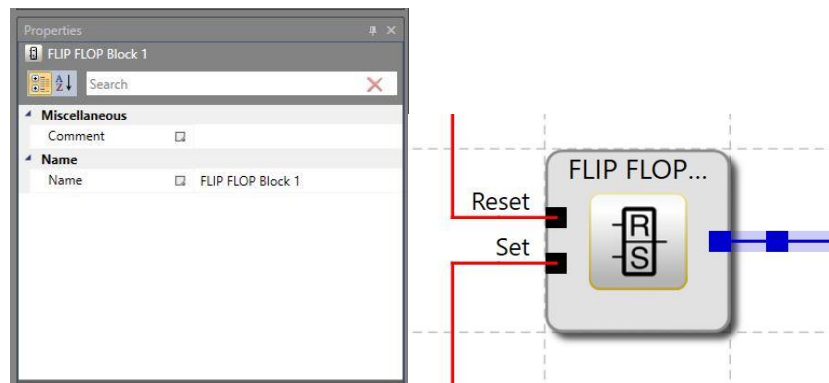


9-3-1-5 FLIP FLOP Block



Setting / resetting of a contact item. The switching element has the following properties:

- The logical result is "0" during the initialization of the element.
- The logical result is "1" if a signal change takes place from "0" to "1" on the input "Set". The output remains "1", even if the state of the "Set" input changes again to "0".
- The logical result is "0" if a state change takes place from "0" to "1" on the input "Set".
- If both inputs are set to "1", the result is "0"!



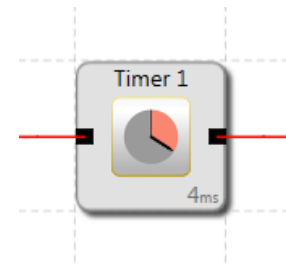
Note: The desired state of this element is achieved only by the connection according to the label (default/setting).

9-3-1-6 Timer

Functional Description

PLC Timers are handled as a part of the PLC processing. 64 timers in total can be used with different timer modes.

A timer is represented inside the functional layout as a simple block with 1 input and 1 output.



The timer is counting if the enable input is set to logical high.

Its result is set on the output depending on the functionality of the timer.

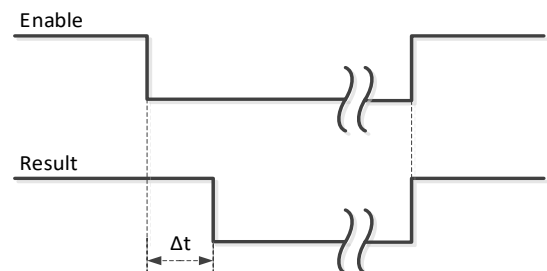
A timer can be configured through its properties with the following modes:

- Switch-Off Delay
- Switch-On Delay
- Impulse
- Intermittent

Switch-Off Delay

With the falling edge of the enable signal the timer is starting and switches off after the configured time threshold elapsed.

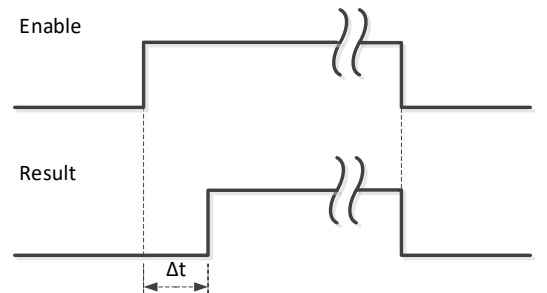
On the rising edge of the enable signal the result is switched on synchronously



Switch-On Delay

With the rising edge of the enable signal the timer is starting and switches on after the configured time threshold elapsed.

On the falling edge of the enable signal the result is switched off synchronously.

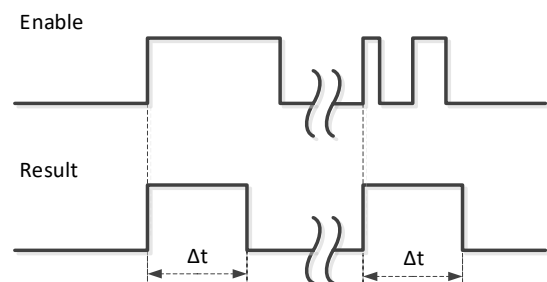


Impulse

With the rising edge of the enable signal the timer is switching on synchronously.

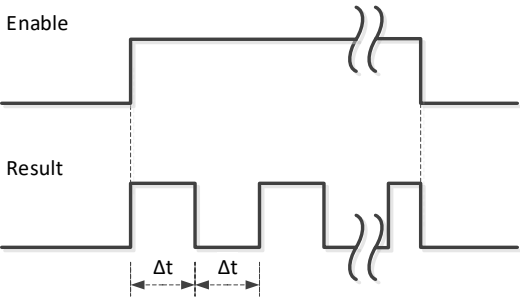
It stays high for its timer duration and then switches off regardless of the enable signal.

A second rising edge on the enable signal does not extend or retrigger the high pulse of the result.

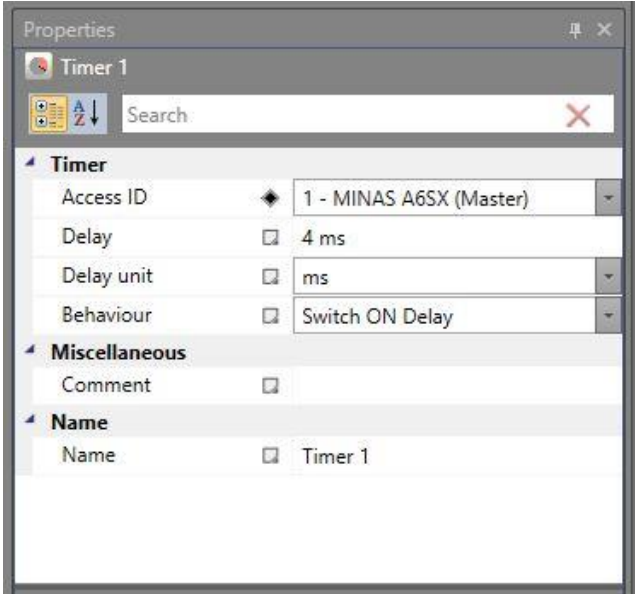


Intermittent On a rising edge of the enable signal the timer switches on and generates a rectangle pulse with a period of two times its duration.

On a falling edge the result switches off synchronously.

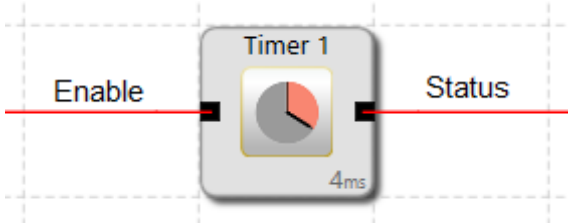


Parameters



Parameter	Description	Range	Unit
Access ID	The access ID is used to identify the function element in the application program. This ID can be used only once.	Available number of Timer block (64)	-
Delay	The timer value; Depending on the timer behavior/type it has a different influence on the functionality.	[4... 8.640.000]	[ms]
Delay Unit	The unit for the Delay value. Inside the configuration this value is always written as system cycles. For the user configuration it may be easier to enter huge values as a different time unit, for this reason the unit can be selected.	{ms, s, min}	-
Behavior	The mode of the timer defining the behavior of the timer.	{Switch ON Delay, Switch OFF Delay, Impulse, Intermittent}	-
Comment	Input possibility for an application-related comment		
Name	Input possibility for an application-specific name		

Control signals



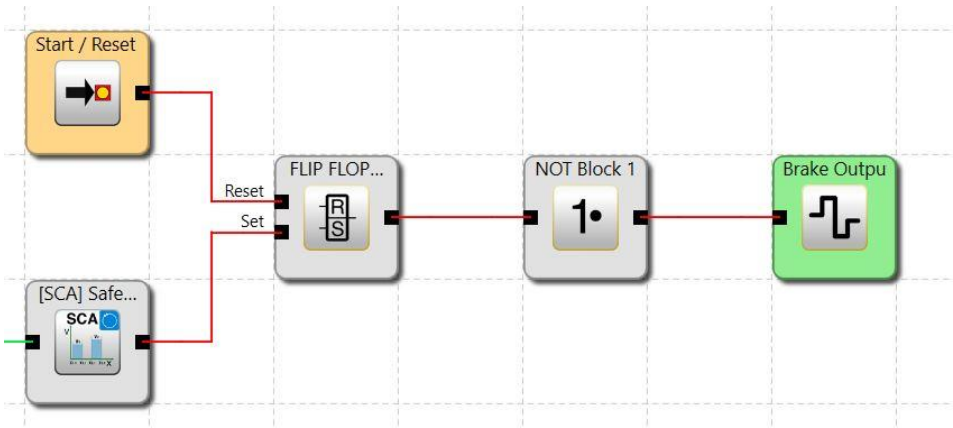
Enable	Input signal to activate the function
Status	Output signal to indicate the status of the function.

9-3-1-7 Logical 1 Block



This module always provides the value "1". This function can be used for programming of static states in the functional Scheme.

For example, assigning an unused input on a direction-dependent SDI



9-3-1-8 Dummy Block

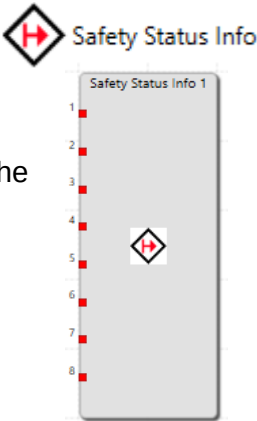
This block does not have any effect on the functionality of the device and running program. Normally it should be used temporary for debugging. The dummy block is not part of the process image and cannot be used for diagnosis.



9-3-1-9 Safety Status Info

This block is used to send diagnostic information from the MINAS to the amplifier. It consists of 8 byte and is part of the process image. The information is sent to the amplifier using the UART communication.

The user can configure inside the PLC logic which logic data should be sent to the amplifier.

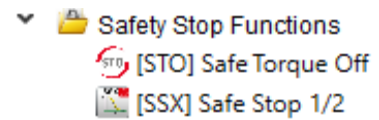


Properties:

- 8 Inputs
- It is not necessary to connect all inputs (Can be left open)
- The logic information connected to an input is stored inside the process image

9-3-2 Safety Stop Functions

The safety stop functions are used to safely shut-down of the drive. They can be selected, configured and parameterized depending on the application. Following safety stop function are available:



STO – Safe Torque OFF: Safely stop in accordance with EN 60204-1, Stop Category 0.

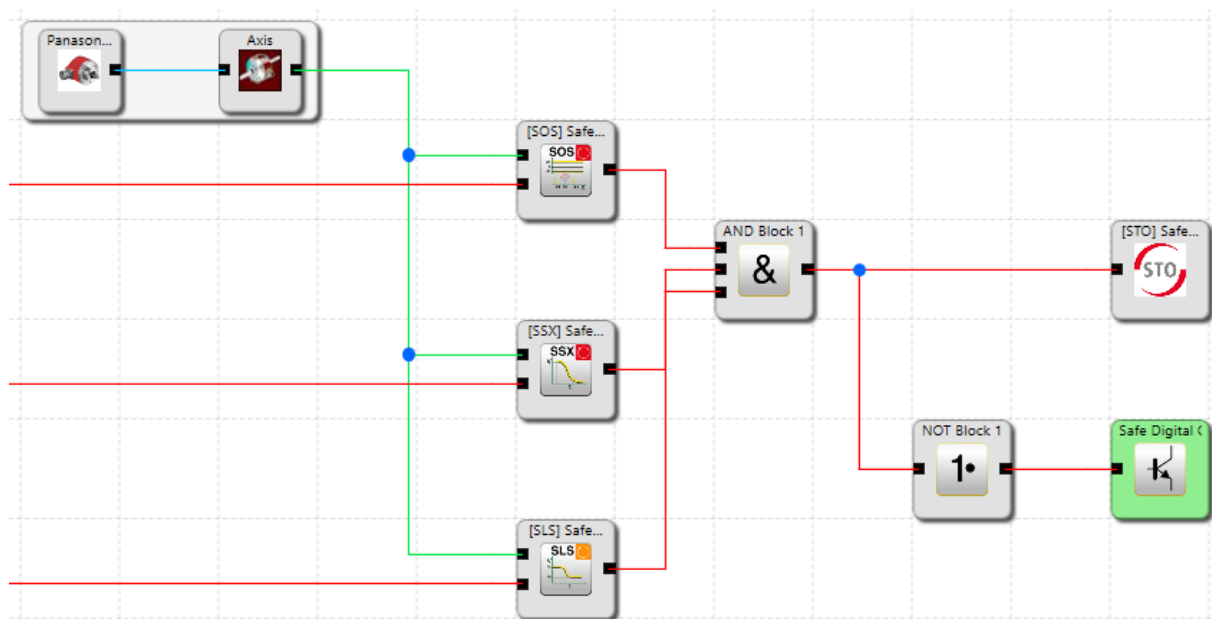
SS1 – Safe Stop 1: Safely stop in accordance with EN 60204-1, Stop Category 1.

SS2 – Safe Stop 2: Safely stop in accordance with EN 60204-1, Stop Category 2.

For each stop function, there is a limited number of blocks available. If these are used up, the menu entry for the relevant function block is locked. The following table gives an overview of the stop function and their maximum available number with reference to the MINAS system.

Function named in EN 61800-5-2	Description	Number of blocks for MINAS system
STO – Safe Torque OFF	Safe disabling of the torque on the drive by means of an immediate switching OFF of the energy supply	1
SSX – Safe Stop 1/2	Monitoring of stop ramps by comparison of target and actual course of the speed	2

If the shut-down is to be externally displayed by a monitoring function, e.g. a control unit, an auxiliary output can be used for this purpose. If "1" was signaled to the outputs and the monitoring functions are in a state of "OK", the result as shown in the following example for feedback must be negated.



Example of logical connection of safety functions.

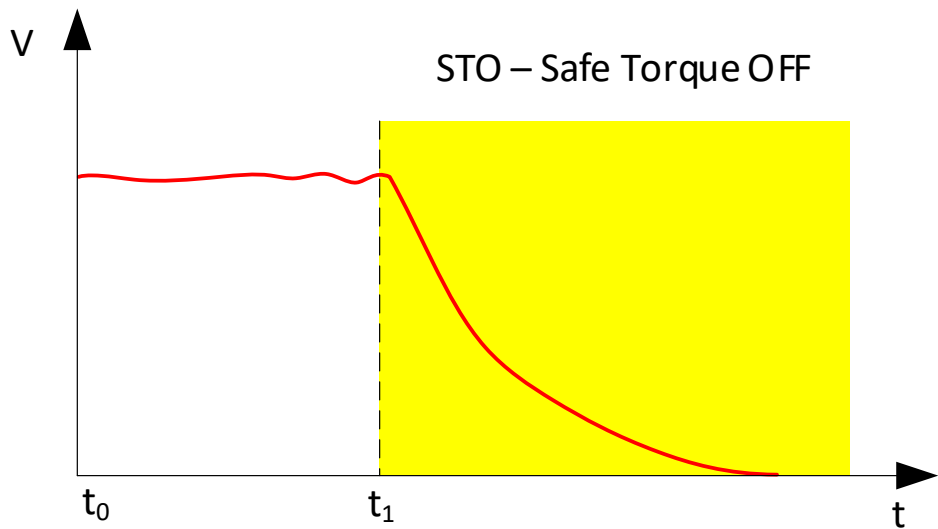
9-3-2-1 STO (Safe Torque OFF)

Icon



Functional Description

The STO function ensures an immediate disconnect of the torque on the drive by means of switching off of the energy supply. This means, when the STO function is active, the drive inverter cannot supply any torque-generating energy to the motor and that prevents the machine from an unexpected restarting. This safety function corresponds to a non-controlled stop according to EN 60204-1, stop category 0.



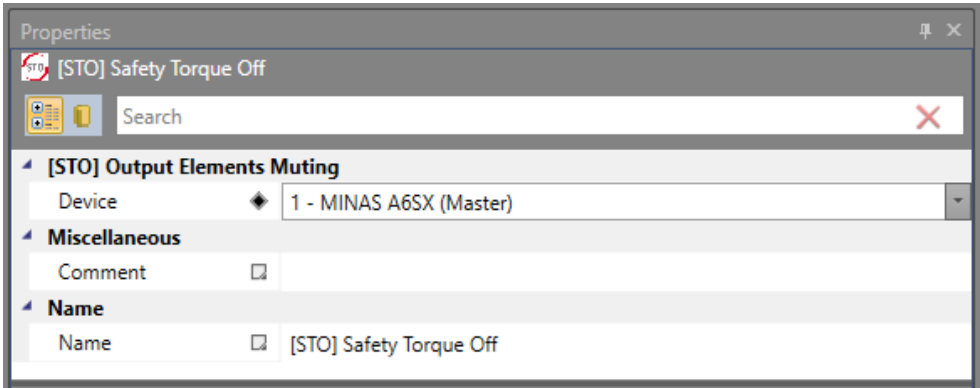
$[t_0, t_1[$	<i>Movement with initial speed</i>
t_1	<i>A safe torque off is initiated</i>

i INFORMATION

In the practice, it is not preferred to stop the motor in a non-controlled manner. Therefore, the STO function is usually combined with the SS1 function.

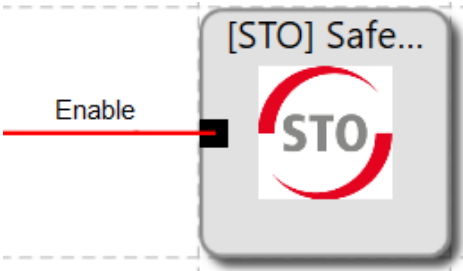
The STO function can be used as a safe restart interlock to prevent an unexpected restarting of the machine.

Parameters



Device	Drop-Down menu to select the master device for the STO
Comment	Input possibility for an application-related comment
Name	Input for an application-specific name

Control signals



Enable	Input signal to activate the function

9-3-2-2 SSX (Safe Stop 1 / Safe Stop 2)

Icon



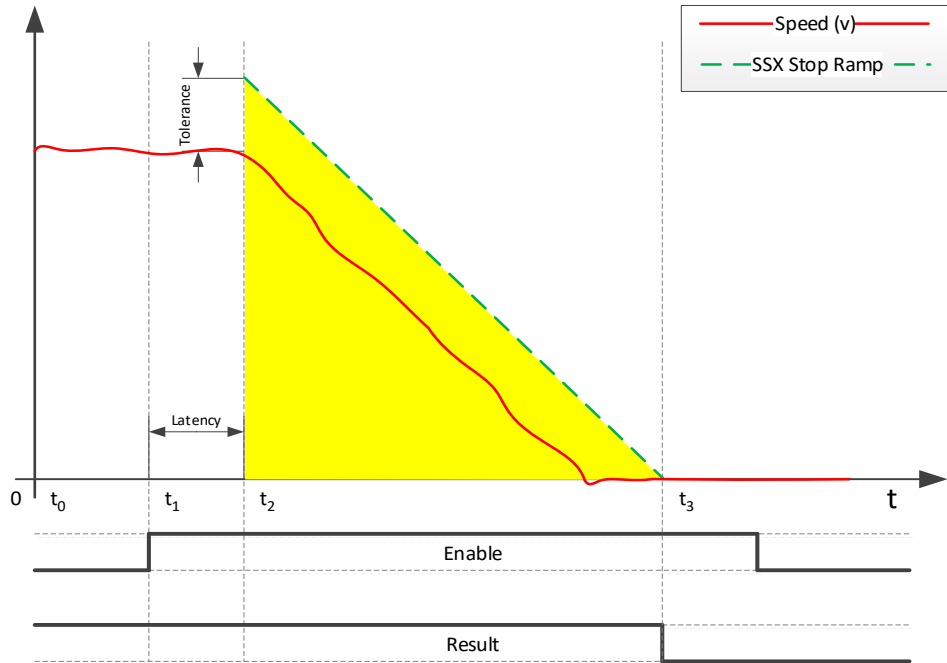
Functional Description

The SSX safely monitors the sequence of a controlled emergency stop by comparing the speed with a parameterizable monitoring curve over the course of time.
This monitoring speed curve is the result of a latency, the curve characteristics calculated based on a parametrizable maximum acceleration, jerk (acceleration change) and a certain tolerance.

Based on the stop category, the SSX also monitors the standstill after reaching the safe stop.

Safe Stop 1 (SS1): SSX initiates a Safe Stop 0 by switching off after reaching standstill or violation of the speed curve.

SS1 (Stop Category 1)

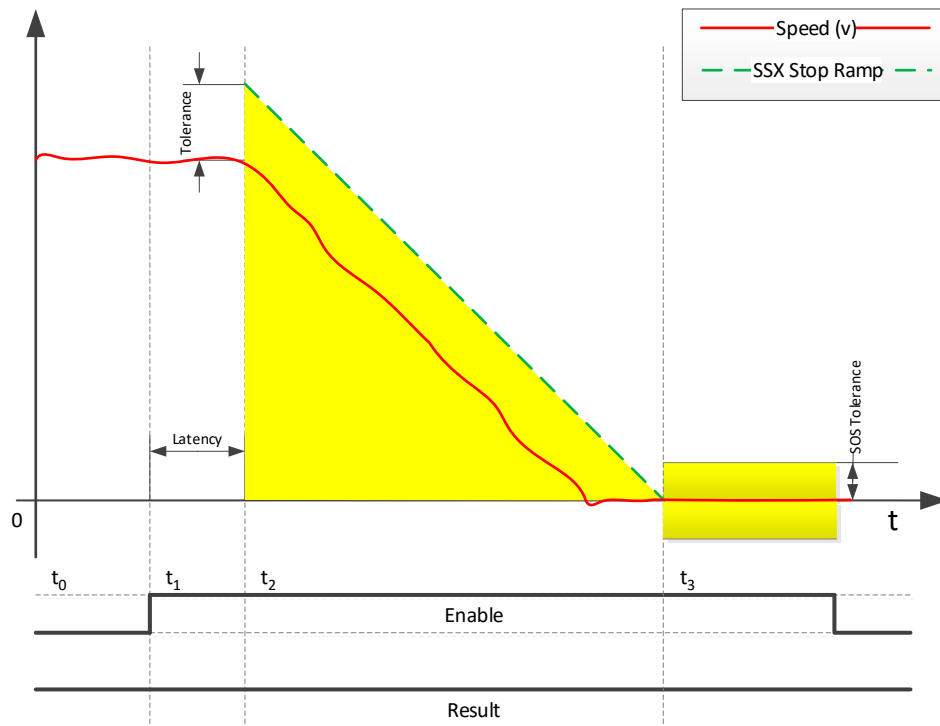


t_0	<i>Movement with initial speed</i>
t_1	<i>A safe stop is initiated by enabling the SS1 function. The internal timer for the Latency starts</i>
t_2	<i>The internal timer for the latency elapsed and the stop ramp is monitored with the configured speed tolerance.</i>
t_3	<i>The speed came to the expected halt and the Safe Stop 0 is requested by setting the result to logical low.</i>

After a standstill is reached, a safe torque off (Safe Stop 0) is initialized as the SS1 function switches off.
If during the stop motion the monitored speed curve is violated, the SS1 function switches off immediately.
The SS1 function remains in this state until it is deactivated and reset.

Safe Stop 2 (SS2): SSX activates an SOS to monitor the safe stop after reaching standstill.

SS2 (Stop Category 2)



t_0	<i>Movement with initial speed</i>
t_1	<i>A safe stop is initiated by enabling the SS2 function. The internal timer for the Latency starts</i>
t_2	<i>The internal timer for the latency elapsed and the stop ramp is monitored with the configured speed tolerance.</i>
t_3	<i>The speed came to the expected halt and a Safe Operational Stop is requested internally by enabling the SOS. The result of the SS2 remains active as long as neither the speed ramp nor the stop condition is violated.</i>

After a standstill is reached, the SS2 function activates the SOS functionality and continues to monitor the standstill condition. The drive remains operational.

In case the monitoring brake speed curve is violated before reaching the standstill condition, the SS2 function switches off immediately and forces a safe torque off. The SS2 function remains in this state until it is deactivated and reset.

Once the standstill condition is reached, the SOS function takes over the monitoring of the standstill not being violated.

Definition of the standstill condition

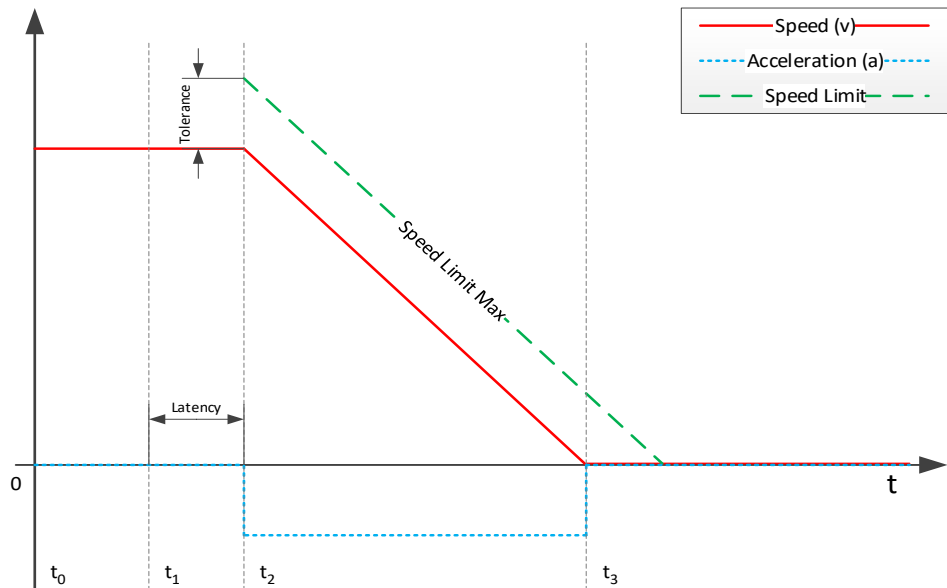
- SOS with position-dependent monitoring
The standstill condition is reached, when the monitoring speed curve is "0"
- SOS with speed-dependent monitoring
The standstill condition is reached, when the monitoring speed curve falls below the parameterized SOS-Speed-Tolerance.

Curve
Types

The speed monitoring curve is a function of speed with either linear or s-shaped characteristics. This means the difference between the two speed monitoring curves is the acceleration portion, which can either be constant or jerk limited.

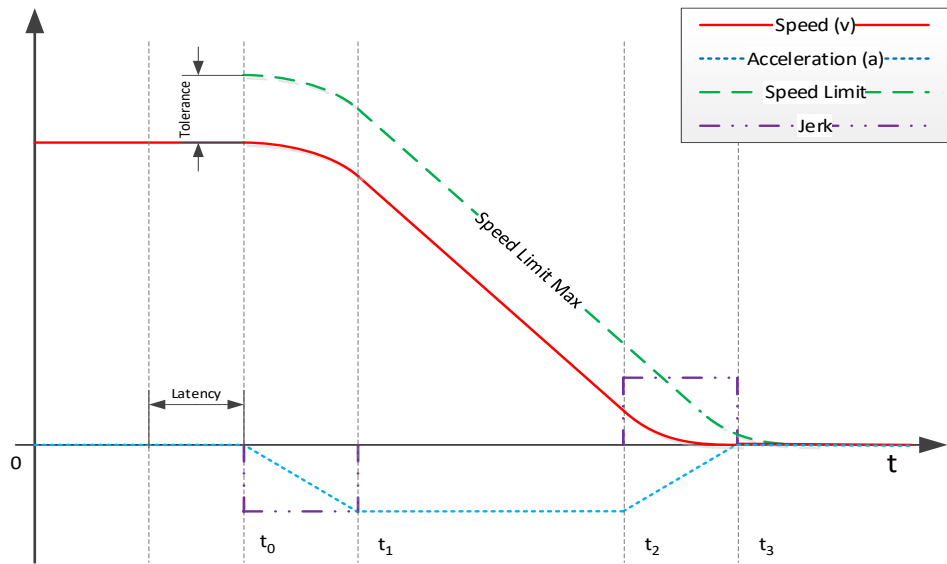
Linear

Safe Stop (Linear)



S-Shape: The s-shaped curve is split into three different parts. The brake ramp is jerk limited and the deceleration is accumulated to its maximum, continues with a constant deceleration and at the end reduced to zero as it reaches standstill.

Safe Stop (Jerk Limited/S-Shape)



t_0	Safe Stop is initiated, deceleration is increasing
t_1	Deceleration reached its configured maximum and continues linear
t_2	The linear part ended and the deceleration is now constantly reduced
t_3	Standstill; deceleration has been reduced to zero as the drive comes to halt

$[t_0, t_1[$	Jerk limited increase of deceleration
$[t_1, t_2[$	Maximum acceleration
$[t_2, t_3[$	Jerk limited decrease of deceleration



INFORMATION

Monitoring an emergency stop in a safely manner consists of the following steps:

- ➔ Characterization of the monitoring curve through parameters within the configuration by the user
- ➔ Automatic generation of the curve during runtime based on data points according to the cycle time of the device.
- ➔ Dynamic adjusting of the monitoring curve based on the current speed and acceleration
- ➔ Automatic transition to the stop functionality after reaching standstill, based on the safe stop category.

For all categories and curve types a tolerance for the actual speed can be configured to allow inaccuracies of the motor control.

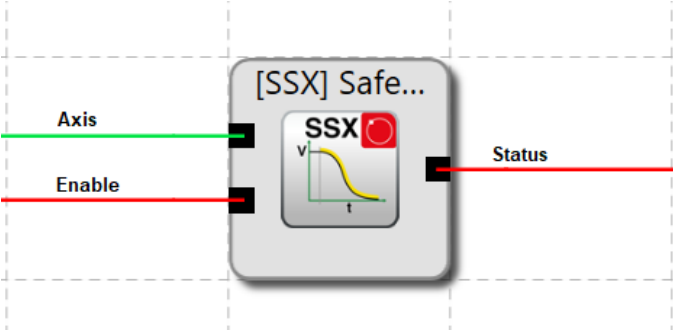
Parameters

Parameter	Description	Range	Unit
Stop Category	For setting the safe stop category; Safe Stop 1 or Safe Stop 2	Safe Stop 1 Safe Stop 2	
Curve Type	For setting the type of velocity during acceleration and deceleration; Linear or S-Shape/Jerk-Limited.	Linear S-Shaped	
Latency Time	Latency time delaying the start of the speed monitoring to cope with drive reaction times	[0..10000]	[ms]
Speed Tolerance	Allowed speed deviation from the theoretically calculated brake ramp	See PanatermFor Safety	[Speed]
Max. Deceleration	Constant deceleration value for linear curves or maximum deceleration during $[t_1, t_2]$ of an s-shaped brake ramp	See PanatermFor Safety	[ACC]

S-Ramp Time	[Only for S-Shaped] Time for the jerk limited brake ramp sectors $[t_0, t_1[$ and $[t_2, t_3[$. This time characterizes the S-shaped ramp.	[ms]/	[8..125 0 ms]

Comment	Input possibility for an application-related comment
Name	Input possibility for an application-specific name

Control signals



Axis	Input signal to assign the axis to be monitored
Enable	Input signal to activate the function
Status	Output signal to indicate the status of the function. The status is high as long as the SSX did not detect a fault After a fault the status signal is pulled to zero and remains zero until the function is reset using the reset acknowledgement.

RESET-Function   The violation of the permissible monitoring curve/range is saved and requires a RESET acknowledgement.

Note: The SSX cannot be reset from a fault state while activated. Before resetting, the function is to be disabled.

Logic Table

Enable	Condition	Status	
		SS1	SS2
0	Initial	1	1
-	$t \leq t_{Latency}$	1	1
1	$t > t_{Latency}$ AND $v_{Current} \leq v_{Limit}$	1	1
1	$t > t_{Latency}$ AND $v_{Current} > v_{Limit}$	0	0
1	$v_{Limit} = 0$	0	1
0	Status = 1	1	1
0	Status = 0	0	0



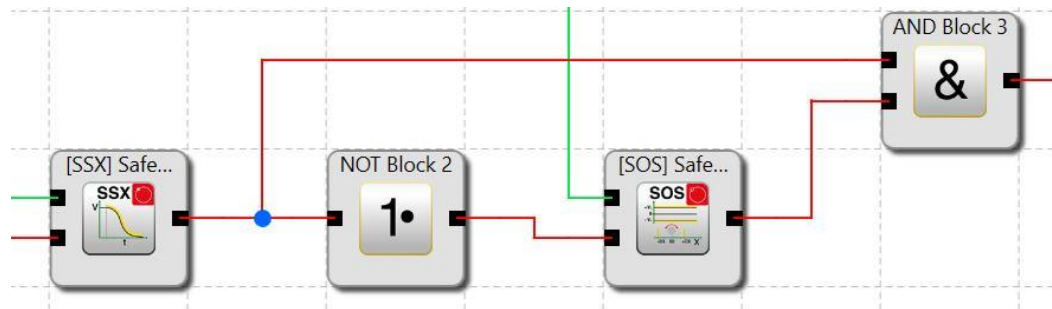
INFORMATION

Each SSX function block can be set as stop category 1 or 2.

In stop category 2, the SOS function is automatically activated after the expected standstill is reached.

In order to use the SSX function in connection with SOS, the following circuit “Application circuit for SS2” is to be considered.

Application circuit for SS2:



If a standstill is detected, the operating system automatically activates the SOS monitoring.

To implement a standstill monitoring outside of this function, the SOS module will need to be activated. This must be linked with only one OR.

**Input
example**

On a production station, the access to the storage/retrieval area is monitored. As soon as a person enters this area during operation, the system has to be brought to a safe stop. The drive remains active in this position and is only monitored for standstill. During the braking process, the ramp has to be monitored for compliance with a defined maximum deceleration. The drive works with an electric motor with integrated motor feedback system and intermediate gear. It uses a ramp limitation (jerk-limited) for the acceleration with resulting in S-slip of the speed, in order to minimize deviations and processing marks.

1. Selection of the stop category

In order to ensure short standstill times and high productivity, the drive remains active in stop position and is only monitored for standstill. The stop category 2 according to DIN 60604-1 is to be used → Selection SS2 (SSX with stop category 2).

2. Selection of the speed curve

The movement to be monitored is a "S-Shape" movement.
→ Selection *S-Shaped* speed curve

3. Selection of the limit values

For monitoring purposes, the worst-case latency period must be entered, starting with the occurrence of the Emergency Stop event, until the start of the braking process executed with the standard controller.

The program runtime of the standard control results in:
Latency = cycle time*2 = 50 ms

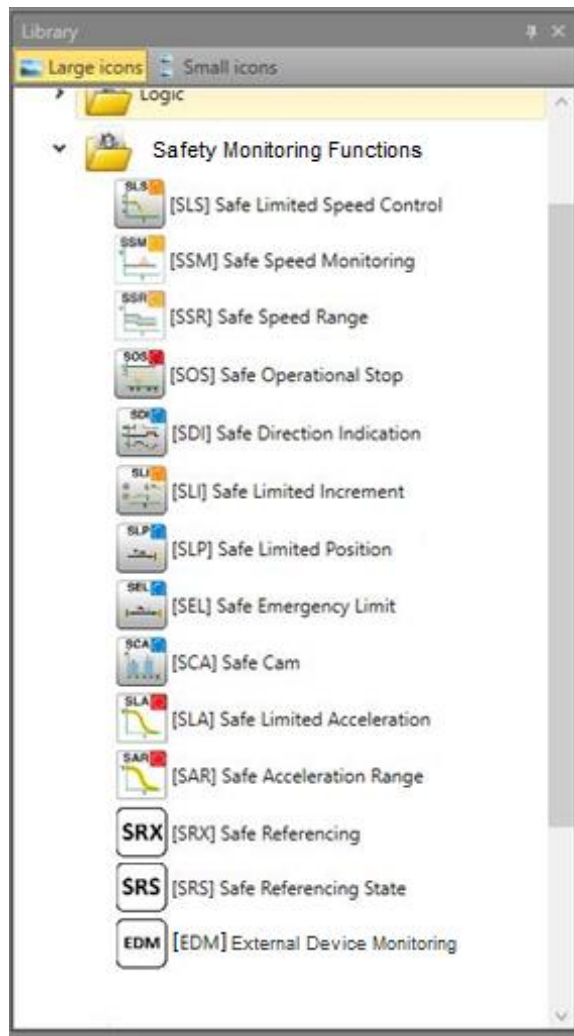
All other limit values are taken from the machine parameterization.

Maximum feed speed = 300 mm/s

Maximum deceleration = 1000 mm/s²

Maximum change of deceleration = 3000 mm/s³

9-3-3 Safety Monitoring Functions



The monitoring functions are calculated within the cycle time of the safety option and form the essential functionality of the device. Their result can be further interconnected with logical operators up to an output. The following predefined functions are available for:

- Speed monitoring
- Position detection
- Monitoring of borders and target positions
- Standstill monitoring
- Direction monitoring
- Function monitoring of external switch-off devices
- Safe referencing
- Muting

The functionality to monitor the position and speed only activated after successful configuration of the encoder/axis in the terminal diagram. There is a limited number of modules available for each monitoring functionality. If these are used up, the menu entry for the relevant function block is locked.

Function named in EN 61800-5-2	Description	Number of blocks per axis
SLS – Safely Limited Speed	Monitoring of the speed to a maximum value. Optional monitoring mode Overspeed Distance Filter	8
SSM – Safe Speed Monitoring	Detection and monitoring of compliance by a given parameter tolerance band at a given speed	4
SSR – Safe Speed Range	Detection and monitoring of a defined by parameter speed range	Resources SCA
SOS – Safe Operating Stop	Standstill monitoring by comparing tolerance threshold velocity or position actual values	1
SDI – Safe Direction	Safe monitoring of the direction of movement of drive	1
SLI – Safely Limited Increment	Safely monitoring of the travel of the drive for compliance with a defined maximum step measurement	1
SLP – Safe Limited Position	Monitoring of a target position by directional comparison with actual position	4
SEL – Safe Emergency Limit	Monitoring of maximum and minimum position value by comparison with actual position	1
SCA – Safe Cam	Detection and monitoring of position areas by comparison with actual position, direction and speed	16
SLA – Safe Limited Acceleration	Monitoring of the acceleration to a configured maximum value	2
SAR – Safe Acceleration Range	Monitoring of the deceleration to a configured maximum range	Resources SSX
SRX – Safe Referencing	Setup of the encoder position reference by special input activation	1
SRS – Safe Referencing State	Status of the referencing	1
EDM – External Device Monitoring	Monitoring the status of downstream contactors. Using this function, it can be detected if a relay has any issues, such as a welded contact	4

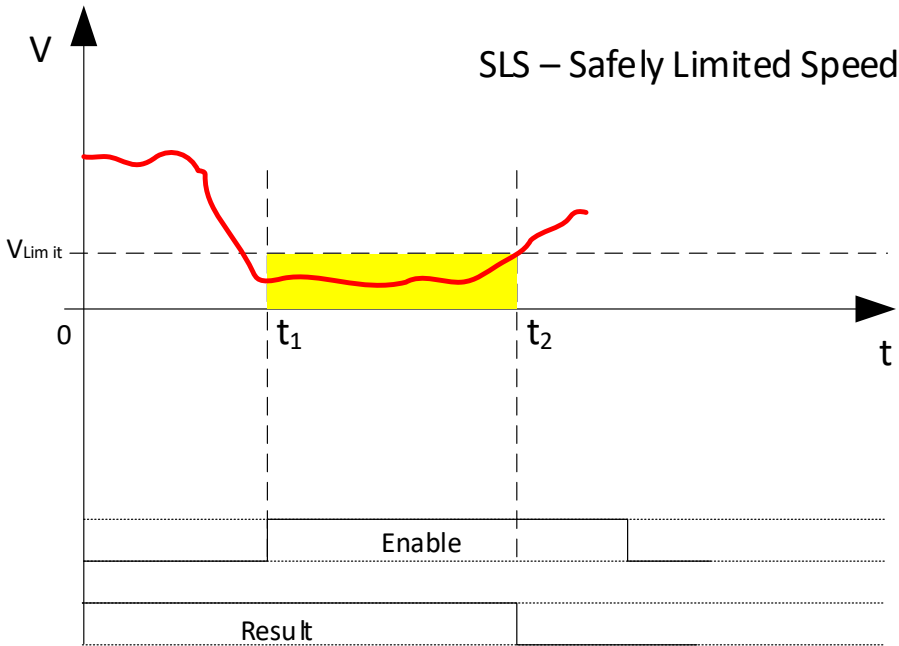
9-3-3-1 SLS (Safely Limited Speed)

Icon



Functional Description

The SLS safely monitors the speed of the drive. Once the permitted speed limit is violated, the status of the safety function is triggered (set to low) and results in an application countermeasure that prevents further operation.



t_1	<i>SLS has been enabled. The speed monitoring starts.</i>
$[t_1, t_2[$	<i>Speed below the parametrized speed limit. SLS is not triggered.</i>
t_2	<i>Speed exceeds the parametrized speed limit. SLS detects an abnormality and get triggered.</i>

As an option, the SLS includes further monitoring functions that can be used individually or in combination. These possible monitoring functions are:

- Monitoring of a maximum acceleration
- Speed profile monitoring
- Overspeed distance monitoring

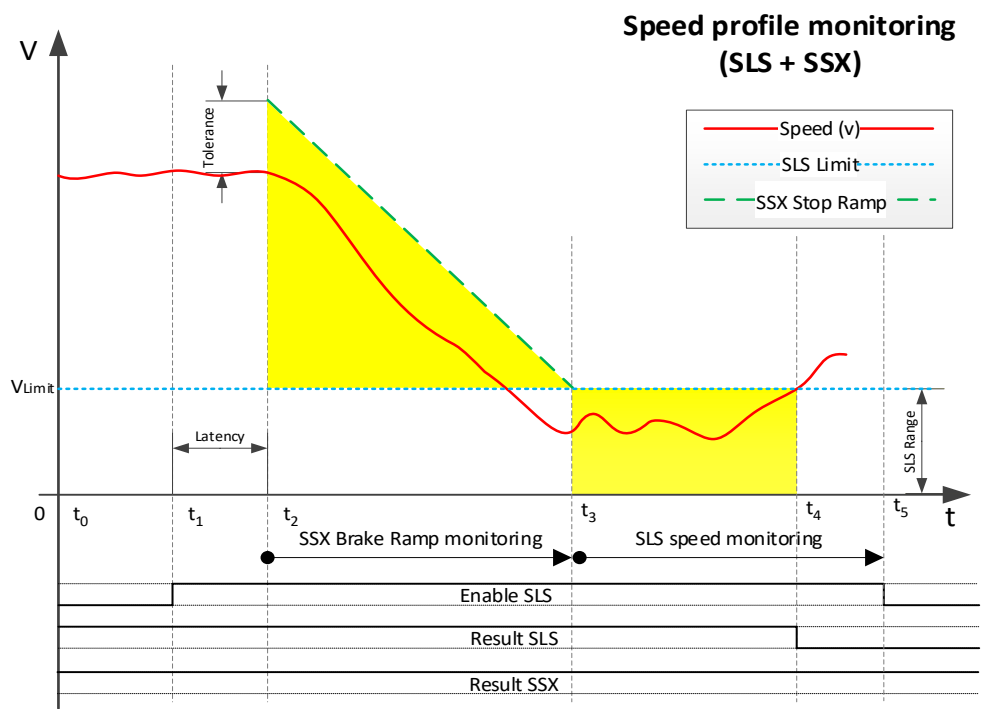
Acceleration monitoring:

When acceleration monitoring is active, the SLI monitors the acceleration of the axis for compliance with the parametrized maximum acceleration value. Once the acceleration of the axis to be monitored exceeds the parametrized maximum acceleration, the SLI get triggered and its output changes to “0”.

Note: Acceleration monitoring can only be activated when overspeed distance monitoring is disabled.

Speed profile monitoring:

The SLS can be used in combination with an associated SSX function to monitor the maximum speed during a controlled brake movement with the identical brake ramp that would be used for a safe stop.

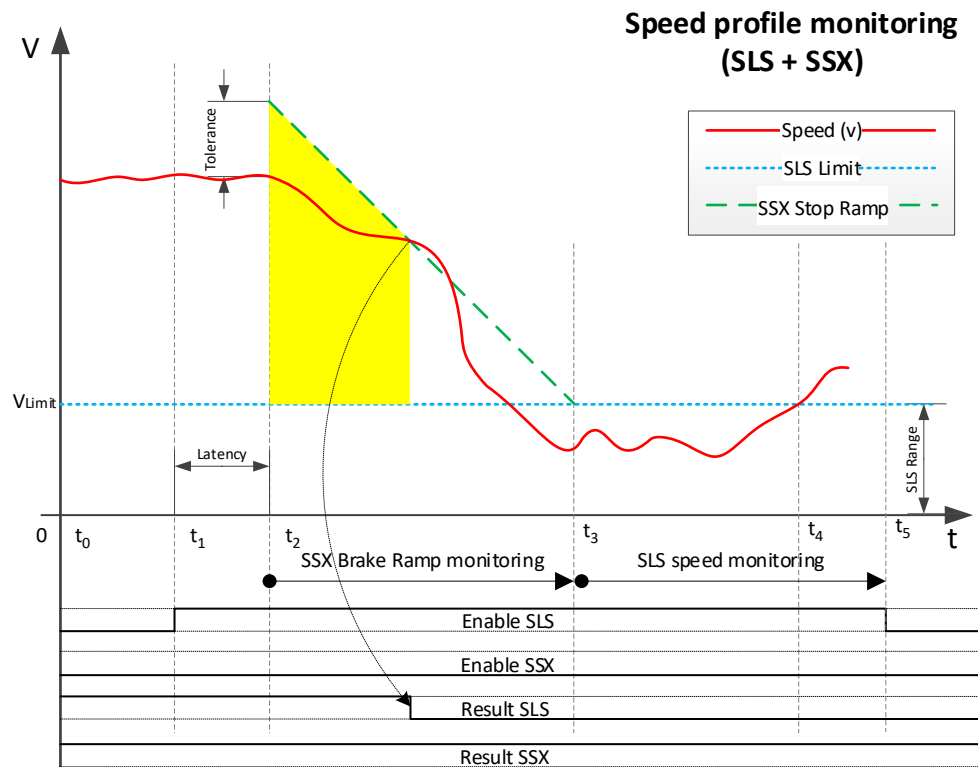


$[t_0, t_1[$	<i>Movement with initial speed.</i>
t_1	<i>SLS is activated and a safe stop is initiated by enabling the SSX monitoring automatically. The internal timer for the Latency starts.</i>
t_2	<i>The internal timer for the latency elapsed and the stop ramp is monitored with the configured speed tolerance inside the associated SSX.</i>
t_3	<i>The stop ramp falls below the SLS speed limit. The SSX monitoring is disabled and the SLS function takes over further speed monitoring.</i>

By activating the SLS function (t_1), the associated SSX function monitors the speed transition from fast to slow according to the configured stop ramp ($t_2 \dots t_3$) until the calculated speed profile falls below the configured SLS speed limit.

Once the stop ramp falls below the SLS speed limit (t_3), the SSX monitoring is disabled and the SLS function takes over further speed monitoring.

In case the monitoring stop ramp is violated, the SLS function is triggered and its output is forced to “0”. The output of the SSX function remains “1”.



INFORMATION

- ➡ Speed profile monitoring can only be activated when the SSX function has been integrated.
- ➡ If the associated SSX function is enabled during "SLS ramp monitoring" (i.e. normal EMERGENCY STOP function via the SSX enable), then the parametrized SSX processing is always prioritized.
- ➡ The SSX function remains enabled by the SLS as long as the current speed is above the SLS threshold.
- ➡ The threshold of the SLS must be higher than 0.
- ➡ If the calculated speed profile is violated during stop ramp monitoring, the result is saved in both monitoring functions SLS and SSX.
- ➡ If several SLS functions with ramp monitoring are activated, the lowest parameterized SLS limit is used as threshold value for the SSX ramp.

Overspeed distance monitoring:

This additional functionality allows you to filter speed peaks in the event of irregular travel operation (speed peaks in the signal). The path integral is calculated based on the difference between the current speed and the parametrized speed monitoring value. The result is compared with the entered value. If the entered value is exceeded, the monitoring function is triggered and the output state of the SLS function changes from "1" to "0".

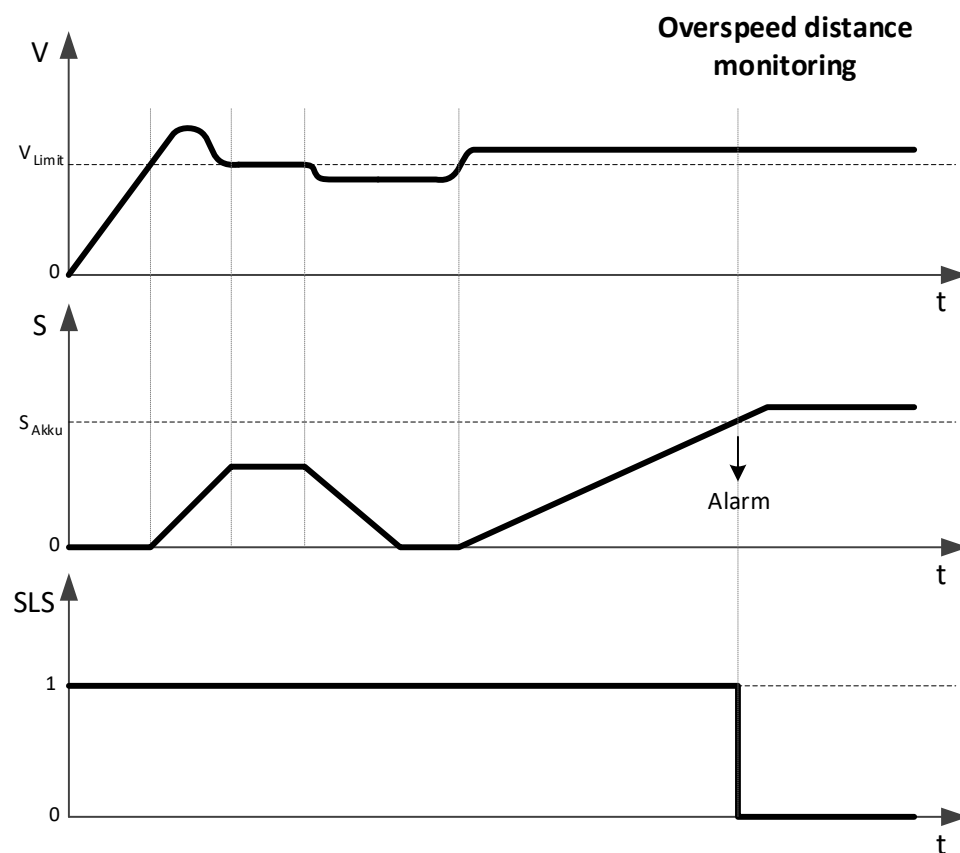


INFORMATION

- ➡ Overspeed distance monitoring can only be activated when the acceleration monitoring is disabled.
- ➡ The response time behavior of the application is affected (increases) when using overspeed distance monitoring. This must be considered! (See the installation guide for the response time)

Example of overspeed distance monitoring:

The following figure shows an example of overspeed distance monitoring.



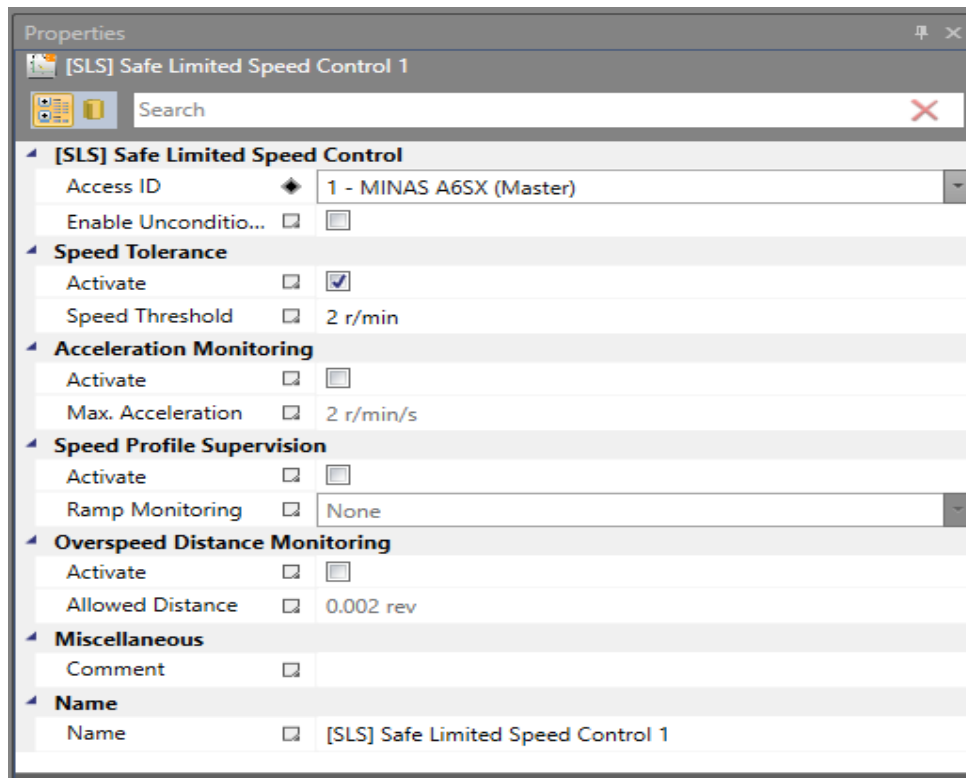
A drive exceeds the threshold " V_{limit} " which is parameterized in the SLS function. If this value is exceeded, the speed above the threshold is integrated (S). If the current speed drops below the threshold " V_{limit} " again, the integral decreases again to "0".

When the speed rises again and remains above the parametrized threshold " V_{limit} ", the integral increases again. Once the overspeed allowed distance " S_{Akku} " is exceeded, the associated SLS function is triggered and its output state changes from "1" to "0".

INFORMATION

- The process of the fault integrator can be visualized via SCOPE function in the "SLS filter" scheme.
- For using overspeed distance monitoring for the first time, the SCOPE function in the "SLS filter" scheme lets you record the speed profile. When stopping recording, the maximal reached integrator value of speed distance monitoring is displayed in the SCOPE. In a first approximation, this value can be used as limit value for overspeed distance monitoring taking account of possible tolerances.

Parameters



The screenshot shows the 'Properties' window for '[SLS] Safe Limited Speed Control 1'. The window has a search bar and a list of expandable sections. The sections and their parameters are:

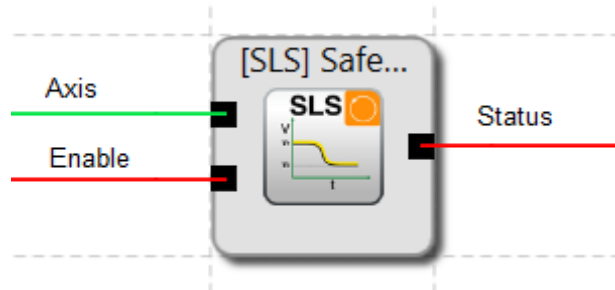
- [SLS] Safe Limited Speed Control**
  - Access ID: 1 - MINAS A6SX (Master)
  - Enable Unconditioned: ☐
- Speed Tolerance**
  - Activate: ☒
  - Speed Threshold: 2 r/min
- Acceleration Monitoring**
  - Activate: ☐
  - Max. Acceleration: 2 r/min/s
- Speed Profile Supervision**
  - Activate: ☐
  - Ramp Monitoring: None
- Overspeed Distance Monitoring**
  - Activate: ☐
  - Allowed Distance: 0.002 rev
- Miscellaneous**
  - Comment: ☐
- Name**
  - Name: [SLS] Safe Limited Speed Control 1

Parameter	Description	Range	Unit
Access ID	The access ID is used to identify the function element in the application program. This ID can be used only once.	Available number of SLS block	
Enable Unconditioned	If this option is ticked, the monitoring function is permanently active and does not have an input connector.	Checked Unchecked	
Speed Tolerance	"Activate" checkbox: For activating speed monitoring. Speed Threshold: For setting the maximum permitted speed limit.	Checked Unchecked [0...SpeedMax]	- [Speed]
Acceleration Monitoring	"Activate" checkbox: For activating acceleration monitoring. Max. Acceleration: For setting the maximum permitted acceleration.	Checked Unchecked [0...AccMax]	 [ACC]
Speed Profile Supervision	Activate" checkbox: For activating speed profile monitoring. Ramp Monitoring: Monitoring	Checked Unchecked SSX Access	-

	characteristics is taken over by the selected SSX function.	ID	
Overspeed Distance Monitoring	“Activate” checkbox: For activating speed profile monitoring. Allowed Distance: For setting the maximum permitted distance with reference to the speed violation.	Checked Unchecked	- [POS]

Comment	Input possibility for an application-related comment
Name	Input possibility for an application-specific name

Control signals



Axis	Input signal to assign the axis to be monitored
Enable	Input signal to activate the function
Status	Output signal to indicate the status of the function. The status is high as long as the SLS did not detect a fault After a fault the status signal is pulled to zero and remains zero until the function is reset using the reset acknowledgement.

RESET-Function

The violation of the permissible monitoring curve/range is saved and requires a RESET acknowledgement.

Note: The SLS cannot be reset from a fault state while activated, if the actual value is still out of the allowed limits.

Disable the function or move the drive back inside the allowed limits before resetting.

Logic Table

Enable	Condition	Status
0	Initial	1
1	$v_{Current} \leq v_{Limit}$	1
1	$v_{Current} > v_{Limit}$	0

**Input
example**

On a production station, the access to the machine for maintenance or setup is monitored. The safety of the people can only be guaranteed by reduced speed. Therefore, as soon as a person enters this area during operation, the speed must be safely reduced to a safe speed, then safe monitoring is activated using the SLS function to prevent any accidental exceeding of the maximum allowed speed limit. Under this condition, the operator can safely enter the danger zone of the machine.

1. Setting the speed tolerance

According to risk analysis: Speed Tolerance = 100 mm/s.

2. Selection of the speed profile supervision

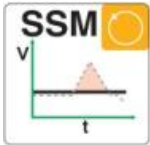
The system has to be safely brought to a safe stop until the reduced speed is reached.

→ The barking process is to be monitored by using an SSX function.

→ Parametrization of the associated SSX

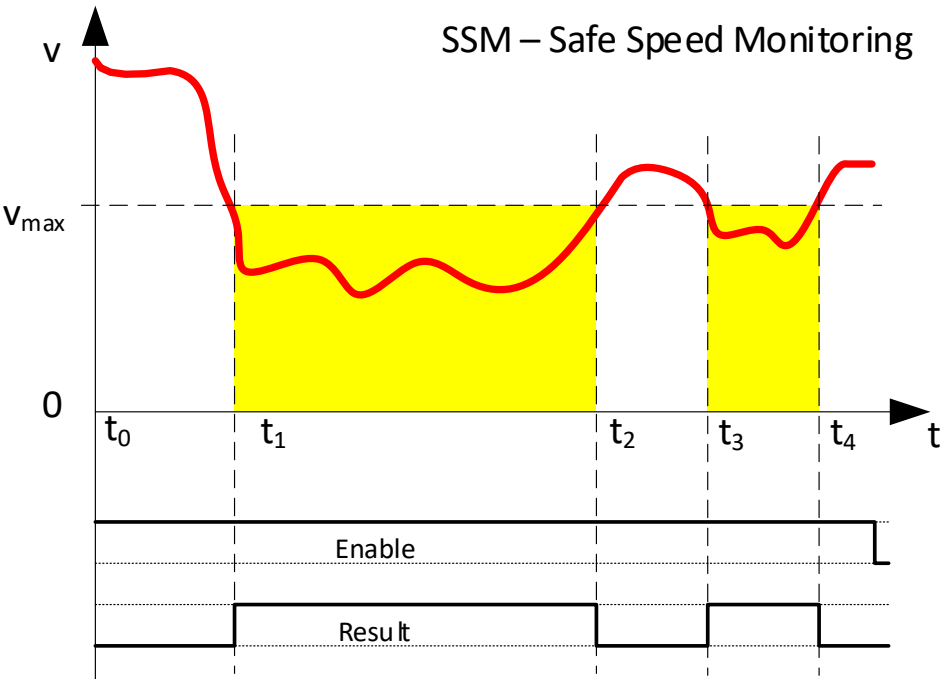
9-3-3-2 SSM (Safe Speed Monitoring)

Icon



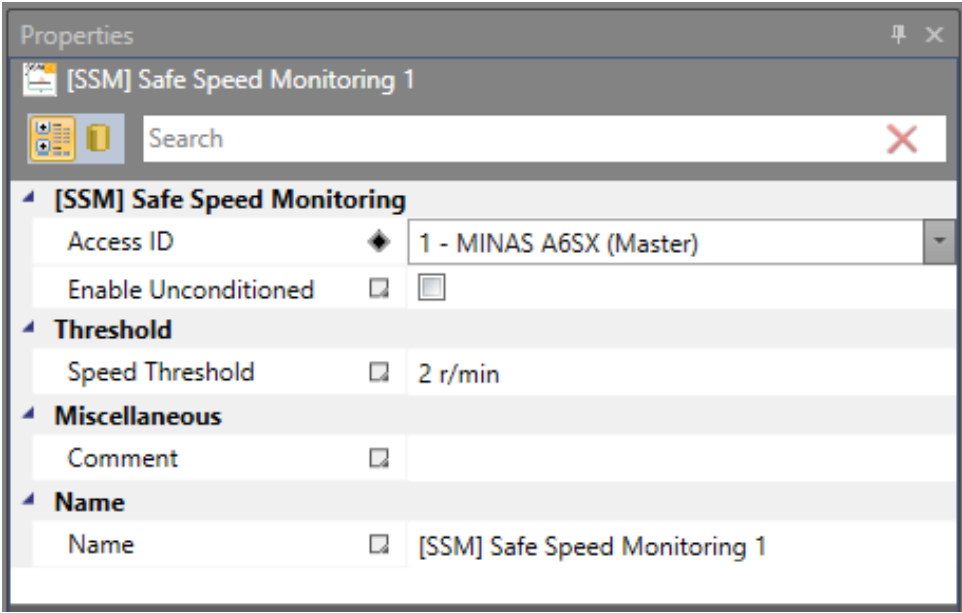
Functional Description

The SSM safely monitors the speed of the drive for compliance with a specified speed threshold. If the speed value drops below a parametrized threshold, the output of the SSM function is triggered and changes its status from “0” to “1”. Compared with the SLS, there is no functional fault reaction from the components that are monitored, when the speed exceeds the specified limit. Merely a safe signal is provided, which can be evaluated and processed in the application. This allows the user to decide appropriately depending on the situation.



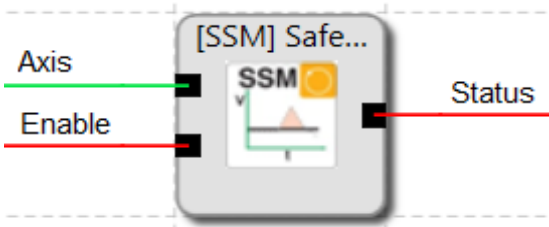
$[t_0, t_1[$	Speed is above the parametrized threshold. SSM result is “0”.
$[t_1, t_2[$	Speed is below the parametrized threshold. SSM result is “1”.
$[t_2, t_3[$	Speed is above the parametrized threshold. SSM result is “0” again.
$[t_3, t_4[$	Speed is below the parametrized threshold. SSM result is “1” again.

Parameters



Parameter	Description	Range	Unit
Access ID	The access ID is used to identify the function element in the application program. This ID can be used only once.	Available number of SSM block	-
Enable Unconditioned	If this option is ticked, the monitoring function is permanently active and does not have an input connector.	Checked Unchecked	-
Speed Threshold	For setting the maximum permitted speed limit.	[0...Speed Max]	[Speed]
Comment	Input possibility for an application-related comment		
Name	Input possibility for an application-specific name		

Control signals



Axis	Input signal to assign the axis to be monitored
Enable	Input signal to activate the function
Status	Output signal to indicate the status of the function. The status is high as long as the speed is below the specified threshold. Once the specified threshold is exceeded, the output of SSM is pulled to zero and remains zero as long as the current speed is above the specified threshold. When the speed drops below the specified threshold the output changes back from “0” to “1” (no RESET is required).

RESET-Function

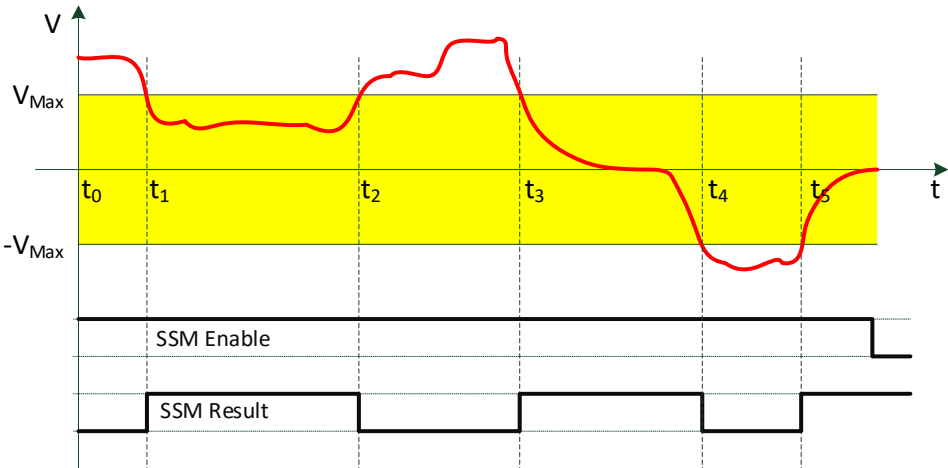
No RESET acknowledgement is necessary.

The SSM is automatically reset as soon as the current speed drops below the specified threshold.

Logic Table

Enable	Condition	Status
0	Initial	1
1	$0 \leq v_{Current} \leq v_{Max}$ OR $-v_{Max} \leq v_{Current} \leq 0$	1
1	$v_{Current} > v_{Max}$ OR $v_{Current} < -v_{Max}$	0

Illustration of the SSM Result:



Input example

On a production station, a safety door is to be unlocked when the speed is below a specified threshold. For this purpose, the SSM is generating a safety signal, which can be evaluated accordingly.

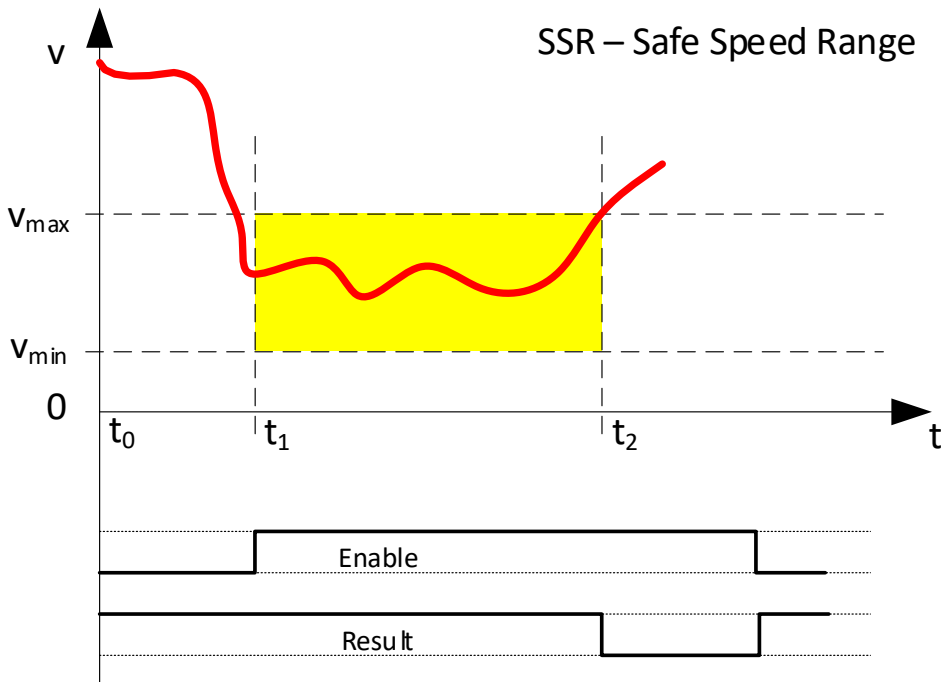
9-3-3-3 SSR (Safe Speed Range)

Icon



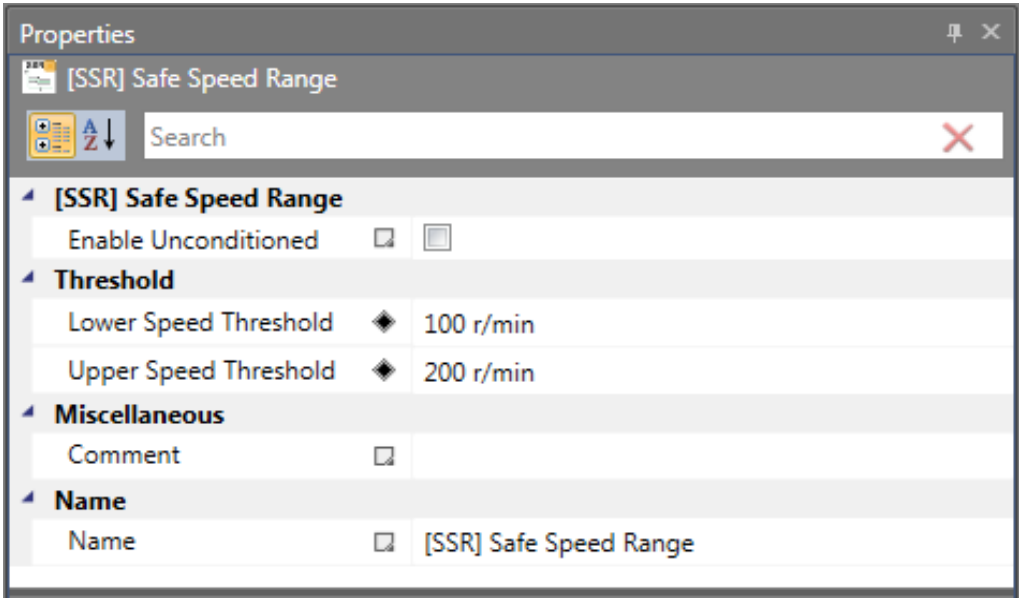
Functional Description

The SSR safely monitors the speed of the drive for compliance with a specified speed range. Once the permitted speed limits are violated, the status of the safety function is triggered (set to low) and results in an application countermeasure that prevents further operation.



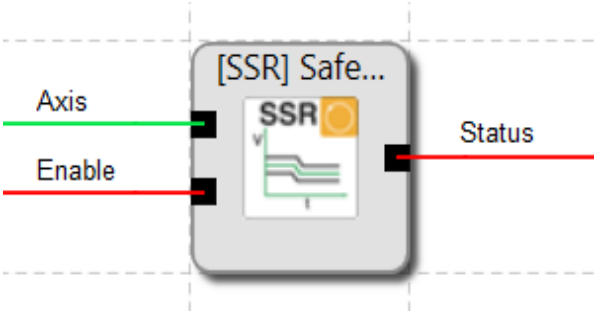
$[t_0, t_1[$	Movement with initial speed.
t_1	SSR has been enabled. The monitoring of the speed range starts.
$[t_1, t_2[$	Speed within the parametrized speed limits. SSR is not triggered.
t_2	Speed exceeds the parametrized speed limit. SSR detects an abnormality and get triggered.

Parameters



Parameter	Description	Range	Unit
Enable Unconditioned	If this option is ticked, the monitoring function is permanently active and does not have an input connector.	Checked Unchecked	-
Lower Speed Threshold	For setting the minimum permitted speed limit.	[0... UpperLimit[	[Speed]
Upper Speed Threshold	For setting the maximum permitted speed limit.	]LowerLimit... SpeedMax]	[Speed]
Comment	Input possibility for an application-related comment		
Name	Input possibility for an application-specific name		

Control signals



Axis	Input signal to assign the axis to be monitored
Enable	Input signal to activate the function
Status	Output signal to indicate the status of the function. The status is high as long as the SSR did not detect a fault After a fault the status signal is pulled to zero and remains zero as long as the specified speed range is violated (current speed is outside the parametrized limits).

RESET-Function

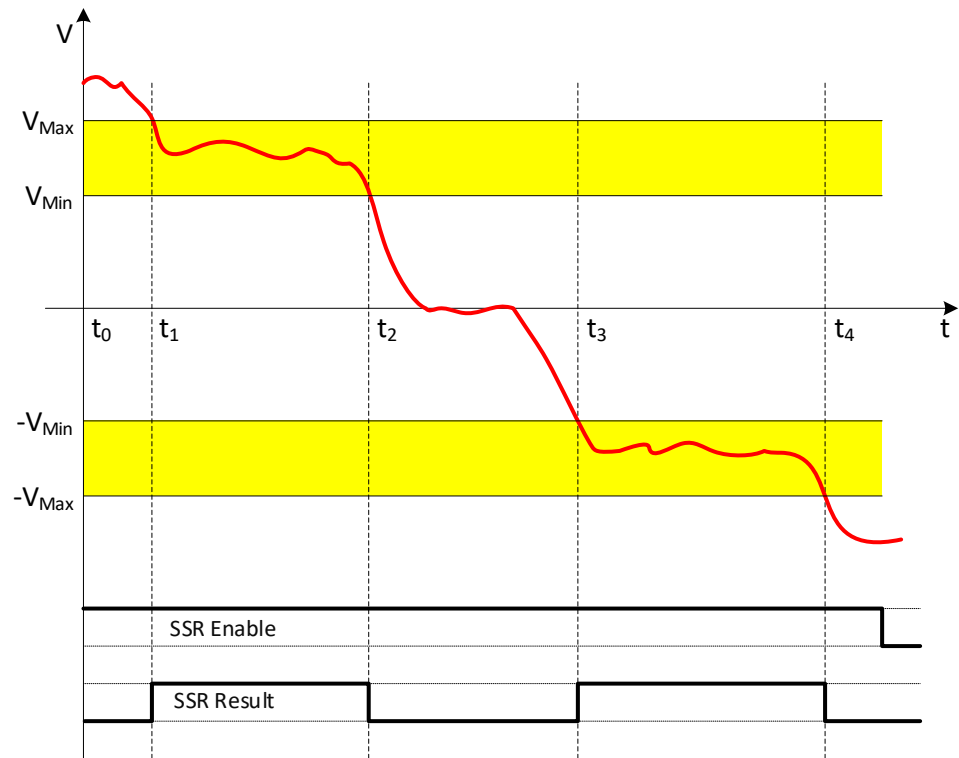
No RESET acknowledgement is necessary.

The violation of the permissible monitoring range is automatically reset as soon as the current speed enters the specified range again.

Logic Table

Enable	Condition	Status
0	Initial	1
1	$v_{Min} \leq v_{Current} \leq v_{Max}$ OR $-v_{Max} \leq v_{Current} \leq -v_{Min}$	1
1	$-v_{Min} < v_{Current} < v_{Min}$ OR $v_{Current} > v_{Max}$ OR $v_{Current} < -v_{Max}$	0

Illustration of the SSR Result:



9-3-3-4 SOS (Safe Operating Stop)

Icon

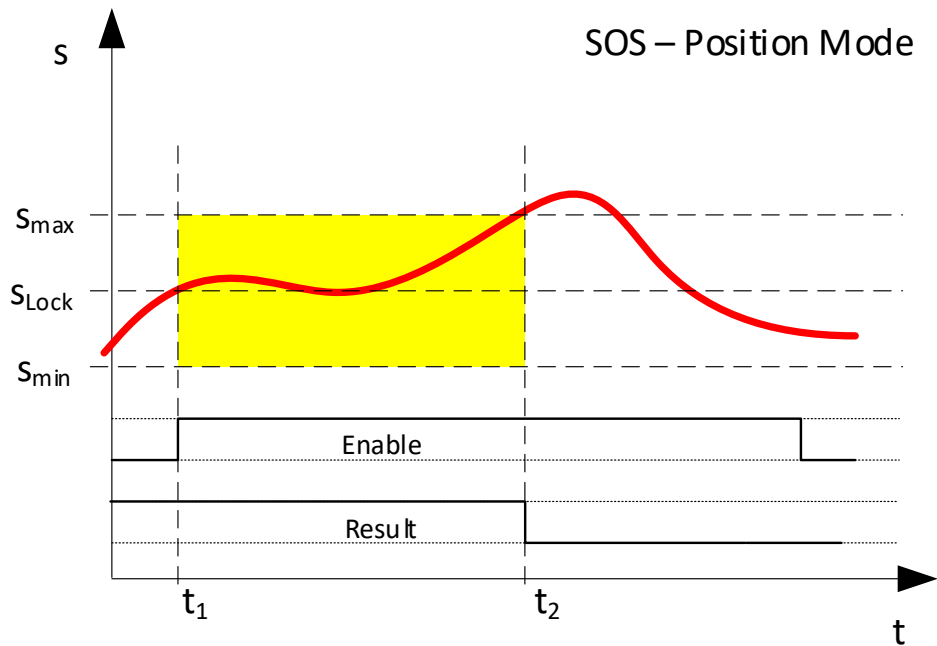


Functional Description

The SOS safely monitors the standstill condition while the drive remains in operation to deliver the full torque to hold the current position. The standstill condition can be monitored using the position or the speed.

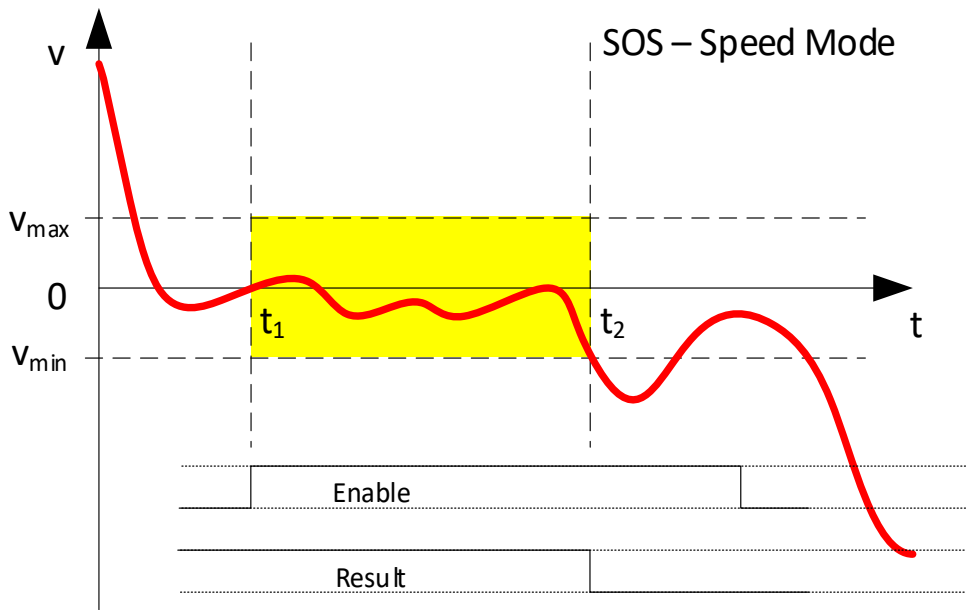
If the actual process value (position or speed depending on parameterization) exceeds the limit in positive or negative direction the output of the safety function is set to zero.

SOS - Position Mode: When the SOS is activated (t_1) the current position is stored (S_{stop}) and used to calculate the allowed position range (S_{min} to S_{max}) using a configurable tolerance value. The function switches off, if the actual position moves out of the allowed position range.



S_{Lock}	Locked position when the SOS is activated
S_{max}	Maximum allowed position tolerance in positive direction
S_{min}	Maximum allowed position tolerance in negative direction
S_{max} to S_{min}	Allowed tolerance for position at standstill

SOS - Speed Mode: While the SOS is activated (t_1 to t_2) the current speed is checked to be within a configurable speed tolerance (V_{min} to V_{max}). The function switches off, if the actual speed exceeds the allowed speed thresholds (t_2).



V_{max}	Maximum allowed speed tolerance in positive direction
V_{min}	Maximum allowed speed tolerance in negative direction
V_{max} to V_{min}	Allowed tolerance for speed at standstill



WARNING

When using the speed monitoring mode, a drift within the parameterized speed tolerance limits cannot be detected

- ➡ Make sure that moving the drive within the parameterized speed thresholds does not cause a hazard to persons.
- ➡ Personal working with the machine must be aware of the risks involved.

Parameters

Properties

[SOS] Safe Operational Stop 1

Search

Monitoring type

Monitoring type ☐ Speed

Speed Tolerance

Speed Tolerance... ☐ 2 rpm

Acceleration Monitoring

Acceleration Moni... ☐ ☐

Maximum Acceler... ☐ 2 rpm/s

Miscellaneous

Comment ☐

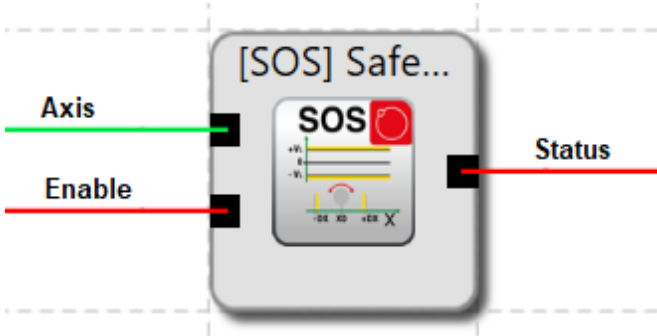
Name

Name ☐ [SOS] Safe Operational Stop 1

Parameter	Description	Range	Unit
Monitoring type	Type of standstill monitoring. The standstill condition can be monitored using the position or the speed.	Position Speed	
Speed Tolerance	Allowed speed deviation from the standstill If the actual process value exceeds the limit in positive or negative direction the output of the safety function is set to zero.	Please refer to PanatermF orSafety	[Speed]
Position Tolerance	Allowed position deviation from the standstill If the actual process value exceeds the limit in positive or negative direction the output of the safety function is set to zero.	Please refer to PanatermF orSafety	[POS]
Acceleration Monitoring	Select possibility for acceleration monitoring at standstill	Checked Unchecked	-
Max. Acceleration	Allowed acceleration deviation while monitoring the standstill If the actual process value exceeds the limit in positive or negative direction the output of the safety function is set to zero.	Please refer to PanatermF orSafety	[ACC]

Comment	Input possibility for an application-related comment
Name	Input possibility for an application-specific name

Control signals



Axis	Input signal to assign the axis to be monitored Since both SOS modes can be activated on any axis configuration a separate position input connected is not necessary
Enable	Input signal to activate the function
Status	Output signal to indicate the status of the function. The status is high as long as the SOS did not detect a fault After a fault the status signal is pulled to zero and remains zero until the function is reset using the reset acknowledgement.

RESET-Function

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

*Note: The SOS cannot be reset from a fault state while activated, if the actual value is still out of the allowed limits.
Disable the function or move the drive back inside the allowed limits before resetting.*

Logic Table

Enable	Mode	Condition	Status
0	-	Initial	1
1	Position	$S \geq S_{min}$ AND $S \leq S_{max}$	1
1	Position	$S < S_{min}$ OR $S > S_{max}$	0
1	Speed	$V \geq V_{min}$ AND $V \leq V_{max}$	1
1	Speed	$V < V_{min}$ OR $V > V_{max}$	0



INFORMATION

In case the acceleration monitoring mode is selected (checkbox is ticked), a violation of the parameterized limit (a_{max}) at standstill monitoring forces the output of the safety function to zero.

**Input
example 1**

On a production station and during certain manual operations, the reduced speed, standstill and the direction for the travel are to be safely monitored. The active movement to be monitored represents a rotary movement and is driven by an electric motor with integrated motor feedback system and intermediate gear.

1. Selection of the monitoring type

Only the speed is to be monitored (e.g. via incremental encoder)

→ Monitoring Type: Speed

2. Selection of the speed tolerance

Specification of the allowed speed deviation from the standstill (e.g. 10 r/min)

**Input
example 2**

On a production station, the access to the working area for manual loading or setup mode of the machine is to be enabled at certain positions of the main feed axis. 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 monitored is a linear movement. An absolute encoder is form-fitting 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. Selection of the monitoring type

Monitoring the position (absolute Encoder available)

2. Selection of the position tolerance

Specification of the allowed position deviation from the standstill (e.g. 2 rev.)

9-3-3-5 SDI (Safe Direction)

Icon



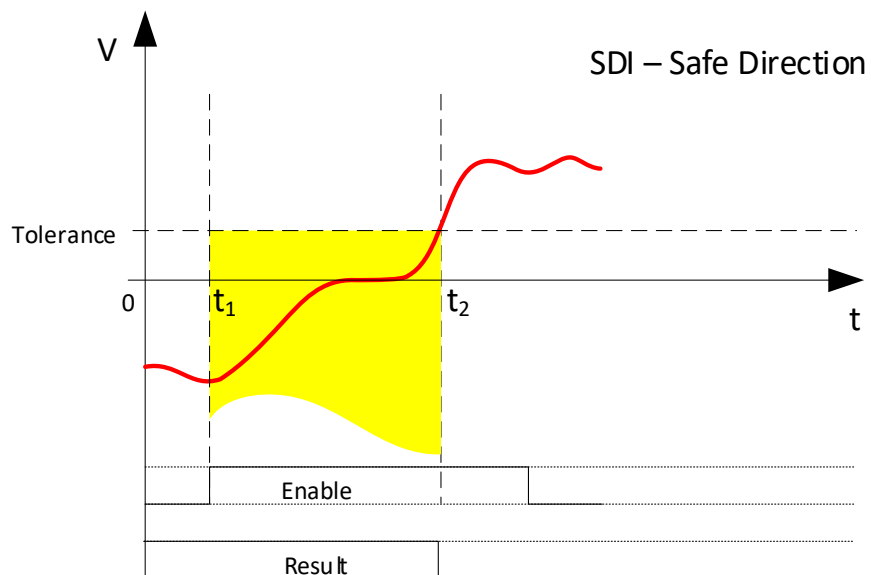
Functional Description

The SDI safely monitors the direction of movement of the drive. Once the selected monitoring direction is violated, the status of the safety function is triggered (set to low) and results in an application countermeasure that prevents further operation. As an option, it is possible to allow a tolerance threshold in the opposite direction.

For the monitoring type, you can choose between **speed dependent** and **position dependent monitoring** of the direction of movement of the drive.

Speed dependent monitoring:

With speed dependent monitoring of the direction of motion/rotation, the drive may move without limitations in the permitted direction. In opposite direction, the drive can be moved as long as the parametrized speed tolerance is not exceeded.



When the SDI is enabled (t_1), the direction of movement of the drive is monitored. A deviation from the selected direction is immediately detected, the output of the SDI becomes low (t_2) and the drive must be safely brought to a standstill.



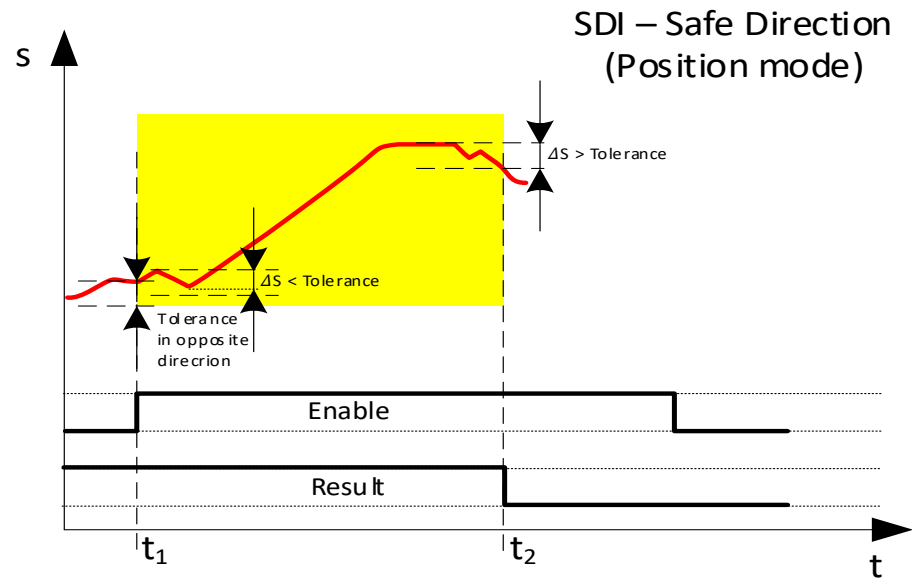
WARNING

Unattended moving of the drive in the non-permitted direction below the speed tolerance can result in severe or fatal injuries.

- ➡ Make sure that moving the drive in the non-permitted direction does not cause a hazard to persons.
- ➡ Personal working with the machine must be aware of the risks involved.

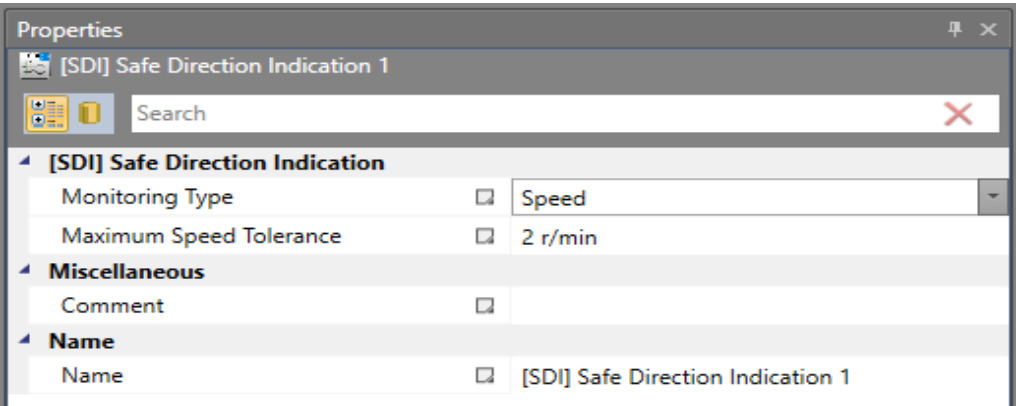
Position dependent monitoring:

With position dependent monitoring of the direction of motion/rotation, the drive may move without limitations in the permitted direction. In opposite direction, the drive can be moved up to the parametrized position threshold.



ΔS : Distance in opposite direction from the maximum position reached

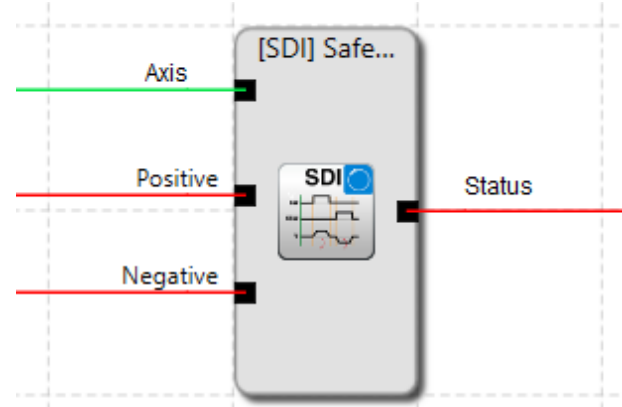
Parameters



Parameter	Description	Range	Unit
Monitoring Type	Selection possibility for speed or position dependent monitoring of the direction of movement.	Speed Position	
Max. Speed (Position) Tolerance	Tolerance threshold in opposite direction. In case “Monitoring Type Speed” has been selected, the drive can move in opposite direction of movement, as long as the current speed is below the parametrized speed threshold. By using “Monitoring Type Position”, the drive can move in opposite direction of movement up to the parametrized position threshold.	Please refer to Panater mForSaf ety	[Speed] ([POS])

Comment	Input possibility for an application-related comment
Name	Input for an application-specific name

Control signals



Axis	Input signal to assign the axis to be monitored.
Positive	Input signal to activate the function with positive direction monitoring.
Negative	Input signal to activate the function with negative direction monitoring.
Status	Output signal to indicate the status of the function. The status is high as long as the SDI did not detect a fault. After a fault the status signal is pulled to zero and remains zero until the function is reset using the reset acknowledgement.



INFORMATION

The function stays active while one enable input is logically high.

A logical “1” on both input signals at the same time is detected as a non-permitted condition and leads to an alarm message. If both inputs are set to “0” the function is disabled.

RESET-Function

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

With speed dependent monitoring of the direction of movement, the SDI cannot be reset from a fault state while activated, if the actual speed is still out of the allowed position limits.
Disable the function or move the drive back inside the allowed limits before resetting.

With position dependent monitoring of the direction of movement, the SDI can only be reset when inactive.

Logic Table

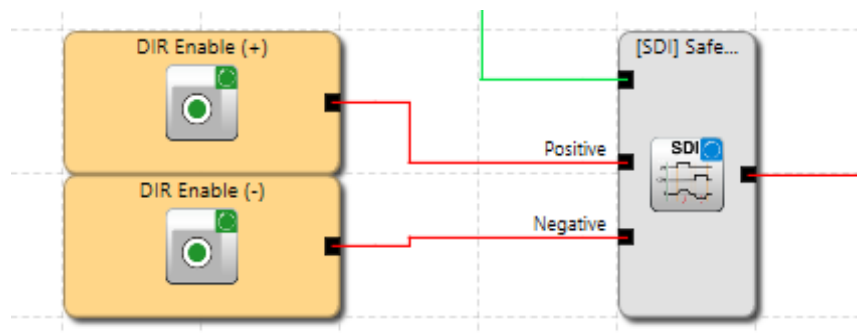
Speed dependent monitoring of the direction of movement of the drive:

Selected Direction		Condition	Status
Positive	Negative		
0	0	Initial	1
0	1	$v_{Current} \leq Tolerance$	1
		$v_{Current} > Tolerance$	0
1	0	$v_{Current} \geq Tolerance$	1
		$v_{Current} < Tolerance$	0
1	1	Don't care	0

Position dependent monitoring of the direction of movement of the drive:

Selected Direction		Condition	Status
Positive	Negative		
0	0	Initial	1
0	1	$v_{Current} \leq 0$ OR $(v_{Current} > 0 \text{ AND } \Delta S \leq Tolerance)$	1
		$v_{Current} > 0 \text{ AND } \Delta S > Tolerance$	0
1	0	$v_{Current} \geq 0$ OR $(v_{Current} < 0 \text{ AND } \Delta S \leq Tolerance)$	1
		$v_{Current} < 0 \text{ AND } \Delta S > Tolerance$	0
1	1	Don't care	0

Activation example



Input example

The access to the work area of a production station is to be safely released for certain manual tasks. As soon as a person enters this area during operation, the moving direction of the machine is to be safely monitored in order to prevent a movement into the critical zone. Under this condition, the operator can safely feed material into or remove it from the work zone.

Definition of the safe direction

The machine has to move in the positive direction, i.e. away from the operation (= safe direction)

→ The SDI function is to be enabled with “positive” direction

Selection of the Monitoring Type

The system is not permitted to drift in opposite direction.

→ The SDI function is to be parametrized with “position monitoring”

Setting of the position tolerance

According to the risk analysis, only 5 mm are to be permitted in the opposite direction.

→ Position Tolerance = 5 mm

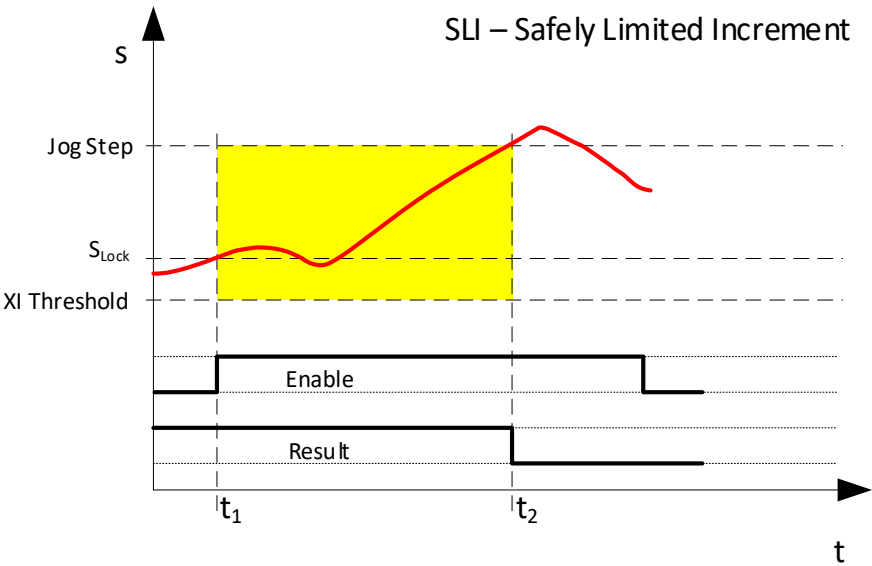
9-3-3-6 SLI (Safely Limited Increment)

Icon



Functional Description

The SLI safely monitors the travel of the drive for compliance with a defined maximum step measurement. Once the permitted monitoring range is violated, the status of the safety function is triggered (set to low) and results in an application countermeasure that prevents further operation.



When the SLI is activated (t_1) the current position is locked (S_{Lock}) and used to calculate the maximum allowed travel range (XI Threshold to Jog Step) using configurable values.
If the permitted distance is violated (t_2), the output of the function becomes low and the drive must be safely brought to a standstill.

Parameters

Properties

[SLI] Safe Limited Increment 1

A Z

Search

Threshold

Jog Step

☐

0.002 rev

XI Threshold

☐

0.002 rev

Miscellaneous

Comment

☐

Name

Name

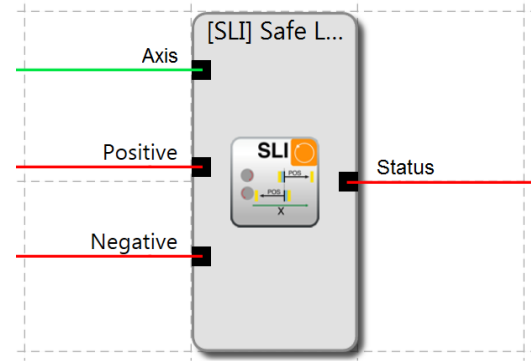
☐

[SLI] Safe Limited Increment 1

Parameter	Description	Range	Unit
Jog Step	Maximum relative travel after activating the monitoring function	Please refer to PanatermForSafety	[POS]
XI Threshold	Tolerance threshold for monitoring the travel in opposite direction		[POS]

Comment	Input possibility for an application-related comment
Name	Input for an application-specific name

Control signals



Axis	Input signal to assign the axis to be monitored.
Positive	Input signal to activate the function in positive direction . A High flank triggers the lock position sampling for SLI.
Negative	Input signal to activate the function in negative direction . A High flank triggers the lock position sampling for SLI.
Status	Output signal to indicate the status of the function. The status is high as long as the SLI did not detect a fault. After a fault the status signal is pulled to zero and remains zero until the function is reset using the reset acknowledgement.

 INFORMATION

The function stays active while one enable input is logically high.

A logical “1” on both input signals at the same time is detected as a non-permitted condition and leads to an alarm message. If both inputs are set to “0” the function is disabled.

RESET-Function

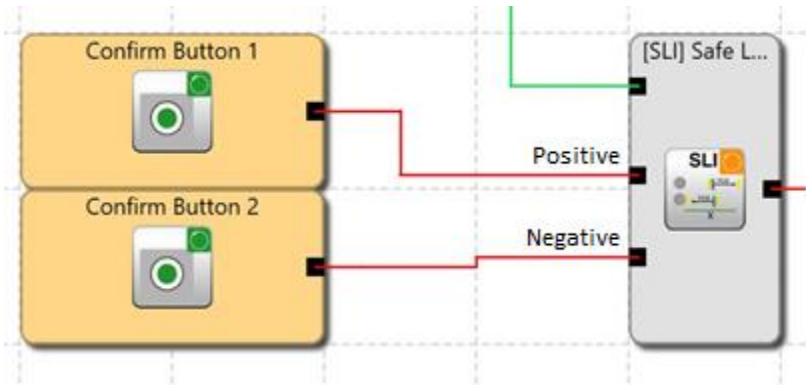
The violation of the permissible monitoring range is saved and requires a RESET acknowledgement.

The SLI cannot be reset from a fault state while activated, if the actual position is still out of the allowed position limits.
Disable the function or move the drive back inside the allowed limits before resetting.

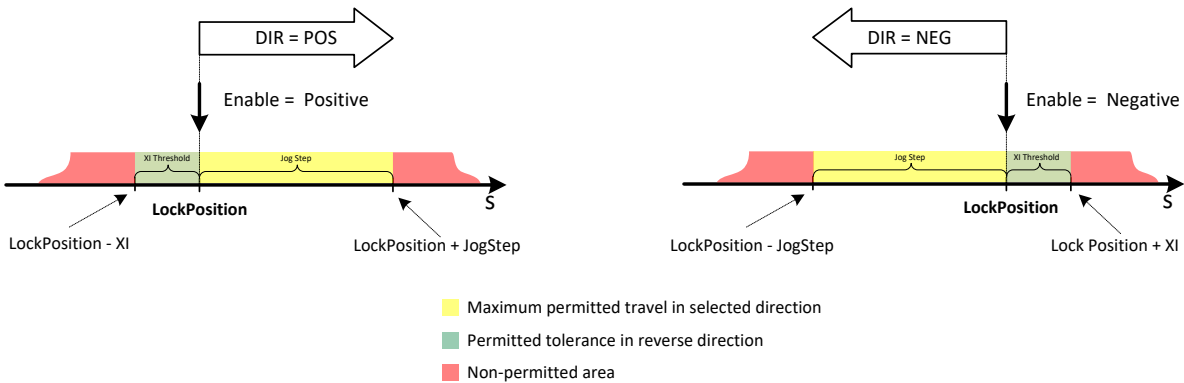
Logic Table

Selected Direction		Condition	Status
Positive	Negative		
0	0	Initial	1
0	1	$ActPos \geq (LockPosition - JogStep)$ AND $ActPos \leq (LockPosition + XI)$	1
		$ActPos < (LockPosition - JogStep)$ OR $ActPos > (LockPosition + XI)$	0
1	0	$ActPos \leq (LockPosition + JogStep)$ AND $ActPos \geq (LockPosition - XI)$	1
		$ActPos > (LockPosition + JogStep)$ OR $ActPos < (LockPosition - XI)$	0
1	1	Don't care	0

Activation example



Enable selection and threshold dependencies



**Input
example**

The manual jog operation and the maximum travel distance in the material feed system of a manufacturing facility is to be safely monitored. According to the risk analysis, this is 50 mm max. A faulty travel in the opposite direction has to be monitored as well.

Jog step

The relative travel is monitored from the time when SLI function is activated.
Input of the max. allowable travel according to the risk analysis: 50 mm

Monitoring the travel in opposite direction

Acceptable travel in opposite direction
(= Slow movement of the actuator) = 1 mm

Monitor input

The monitoring module also has 2 inputs for setting the direction. The monitoring function is activated with an active directional signal

9-3-3-7 SLP (Safely Limited Position)

Icon

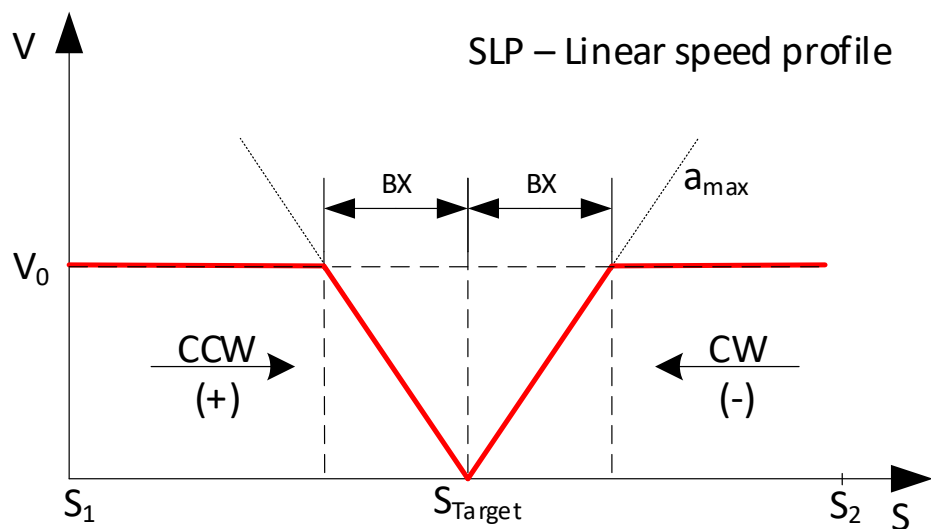


Functional Description

The SLP safely monitors the permitted speed related to the relative distance to a parameterized target position to ensure that the axis remains within the permissible traversing range. When the SLP function is active, a cyclical check is made whether stopping before the specified limit position is possible at the current speed and with the parameterized limit curve. If not, the SLP function is triggered and changes its output state from "1" to "0". This safety function can replace the conventional safety limit switches and save the use of external components and their associated wiring.

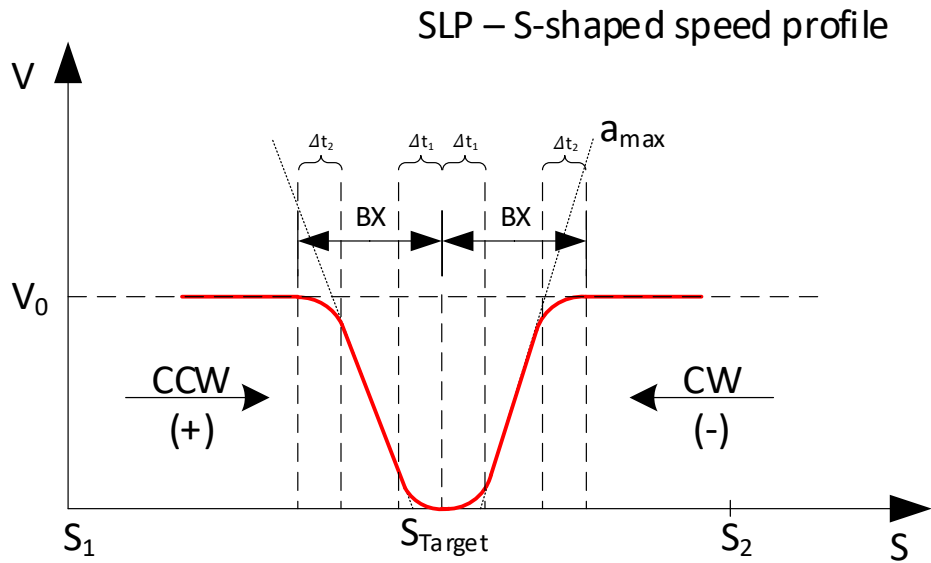
As a speed profile of the limit curve you can choose between a linear or S-shaped type.

Linear speed profile of the limit curve: The stopping distance to the limit position is based on a linear calculation method.



<i>CW</i>	<i>SLP is activated with CW (-) direction monitoring (PosAct - StopDistanceAct. > TargetPosition)</i>
<i>CCW</i>	<i>SLP is activated with CCW (+) direction monitoring (PosAct + StopDistanceAct. < TargetPosition)</i>
$[S_1, S_2]$	<i>Measuring length, see encoder configuration</i>
S_{Target}	<i>Target position</i>
<i>BX</i>	<i>Braking/approaching range</i>
V	<i>Current speed</i>
V_0	<i>Maximum speed for $S < (S_{Target} - BX)$, CCW (+) activated Maximum speed for $S > (S_{Target} + BX)$, CW (-) activated</i>
a_{max}	<i>Maximum deceleration</i>

S-shaped speed profile of the limit curve: The stopping distance to the limit position is based on a quadratic calculation method.



<i>CW</i>	SLP is activated with CW (-) direction monitoring (PosAct - StopDistanceAct. > TargetPosition)
<i>CCW</i>	SLP is activated with CCW (+) direction monitoring (PosAct + StopDistanceAct. < TargetPosition)
$[S_1, S_2]$	Measuring length, see encoder configuration
S_{Target}	Target position
BX	Braking/approaching range
V	Current speed
V_0	Maximum speed for $s < (S_{Target} - BX)$, CCW (+) activated Maximum speed for $s > (S_{Target} + BX)$, CW (-) activated
a_{max}	Maximum deceleration
$\Delta t_1 + \Delta t_2$	S-ramp time



INFORMATION

The SLP function can only be selected when the position processing is activated (i.e. by using an absolute encoder).

The stopping distance is calculated from the current speed V and the parameterized stop ramp.

Parameters

The screenshot shows a software interface titled 'Properties' for '[SLP] Safe Limited Position'. It features a search bar and several expandable sections. The 'Access ID' is set to 1. The 'Curve Profile Type' is set to 'Linear'. The 'Threshold' section includes 'Max. Acceleration' at 2 r/min/s and 'S-Ramp Time' at 1 ms. The 'Target Position' is set to 0.002 rev. The 'Miscellaneous' section has a 'Comment' field. The 'Name' section shows the name '[SLP] Safe Limited Position'.

Parameter	Description	Range	Unit
Access ID	The access ID is used to identify the function element in the application program. This ID can be used only once.	Available number of SLP block	-
Curve Profile Type	For setting the type of speed curve during acceleration and deceleration; Linear or S-Shape/Jerk-Limited.	Linear S-Shaped	-
Max. Acceleration	Value of the maximum acceleration/deceleration within BX	[2..16384]	[ACC]
S-Ramp Time	[Only for S-Shaped] This time characterizes the S-shaped ramp. It calculates the period during which the speed changes non-linearly. The S-ramp time also designates the period for changing the acceleration/deceleration from " $a = 0$ " to " $a = a_{max}$ ", or vice versa	[1..16384]	[ms]
Target position	Absolute position value that must not be exceeded with active SLP safety function.	Please refer to PanatermFor Safety	[POS]

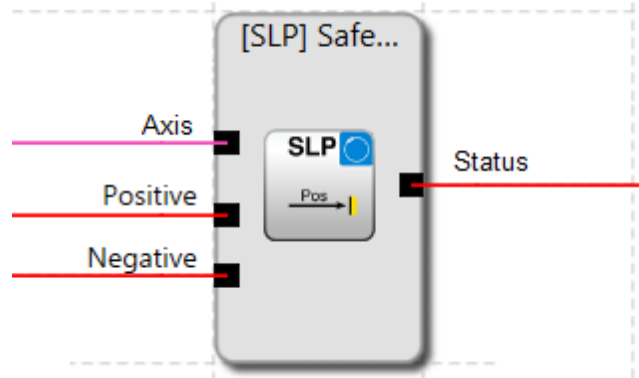
Comment	Input possibility for an application-related comment
Name	Input possibility for an application-specific name



INFORMATION

A logical "1" on both input signals (positive/negative) at the same time is detected as a non-permitted condition and leads to an alarm message. If both inputs are set to "0" the function is disabled.

Control signals



Axis	Input signal to assign the axis to be monitored
Positive	Input signal to activate the function with positive direction monitoring.
Negative	Input signal to activate the function with negative direction monitoring.
Status	Output signal to indicate the status of the function. The status is high as long as the SLP did not detect a fault After a fault the status signal is pulled to zero and remains zero until the function is reset using the reset acknowledgement.

RESET-Function

The violation of the permissible monitoring curve/range is saved and requires a RESET acknowledgement.

Note: The SLP cannot be reset from a fault state while activated. Before resetting, the function is to be disabled.

Logic Table

Selected Direction		Condition	Status
Positive	Negative		
0	0	Initial	1
0	1	$S \geq (S_{Target} + BX)$	1
		$S \geq S_{Target}$ AND $S \leq (S_{Target} + BX)$ AND $V < \text{limit curve}$	1
		$S < S_{Target}$	0
		$S \geq S_{Target}$ AND $S \leq (S_{Target} + BX)$ AND $V > \text{limit curve}$	0
1	0	$S \leq (S_{Target} - BX)$	1
		$S \geq (S_{Target} - BX)$ AND $S \leq S_{Target}$ AND $V < \text{limit curve}$	1
		$S > S_{Target}$	0
		$S \geq (S_{Target} - BX)$ AND $S \leq S_{Target}$ AND $V > \text{limit curve}$	0
1	1	Don't care	0

Limit curve = speed profile derived from the current parameterization.

Input example

On a production station, the access to the work area is to be granted for manual setup, if the main feed of the machine is in certain positions. To provide an alternative to the mechanical safety limit switch, the limits of the working stroke are to be monitored in a safety-related manner.
The possible maximum travel range of teach mode is 5 mm to 620 mm.

Setting the limit positions s_{min} and s_{max} :

The reference zero point of the main drive axis is at the upper dead center. A mechanical coasting distance is subordinated.

➔ Lower limit position $s_{min} = 15 \text{ mm}$

The lower end point is at 620 mm – 10 mm.

➔ Upper limit position $s_{max} = 610 \text{ mm}$

Setting the type of speed curve:

The drive/position controller uses a ramp limitation (jerk limitation) for the acceleration/deceleration with resulting S-pattern of the speed in order to minimize deviations and processing marks.

➔ Selection “**S-shape/jerk limited**” as curve profile type

Setting the maximum acceleration/deceleration:

This value can be taken from the machine parameterization.

➔ Maximum acceleration/deceleration $a_{max} = 1000 \frac{\text{mm}}{\text{s}^2}$

Setting the S-ramp time:

This value can be taken from the machine parameterization.

S-ramp time = 500 ms

9-3-3-8 SEL (Safely EMERGENCY Limit)

Icon

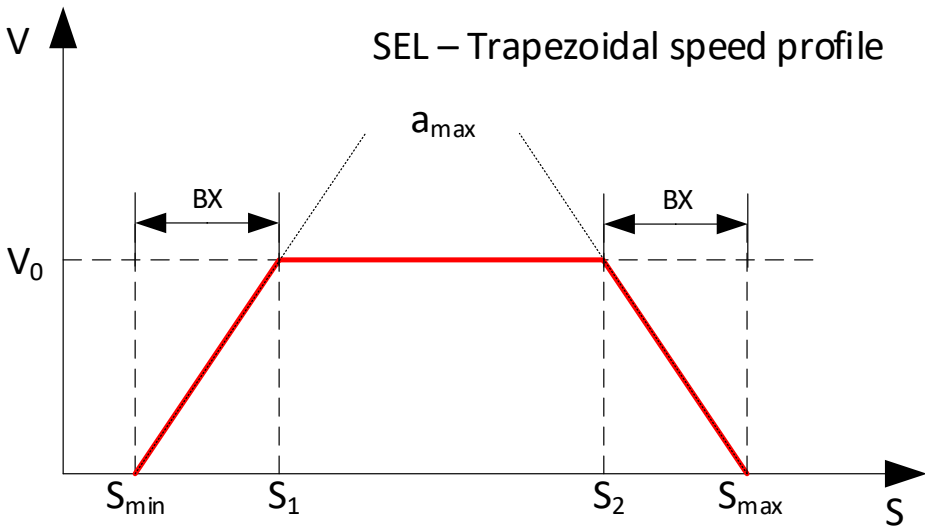


Functional Description

The SEL safely monitors the minimum and maximum limit positions to prevent the travel range from being exceeded. The function checks cyclically whether stopping before the specified limit positions is possible at the current speed and with the parameterized limit curve. If not, the SEL function is triggered and changes its output state from “1” to “0”. This safety function can replace the conventional safety limit switches and save the use of external components and their associated wiring.

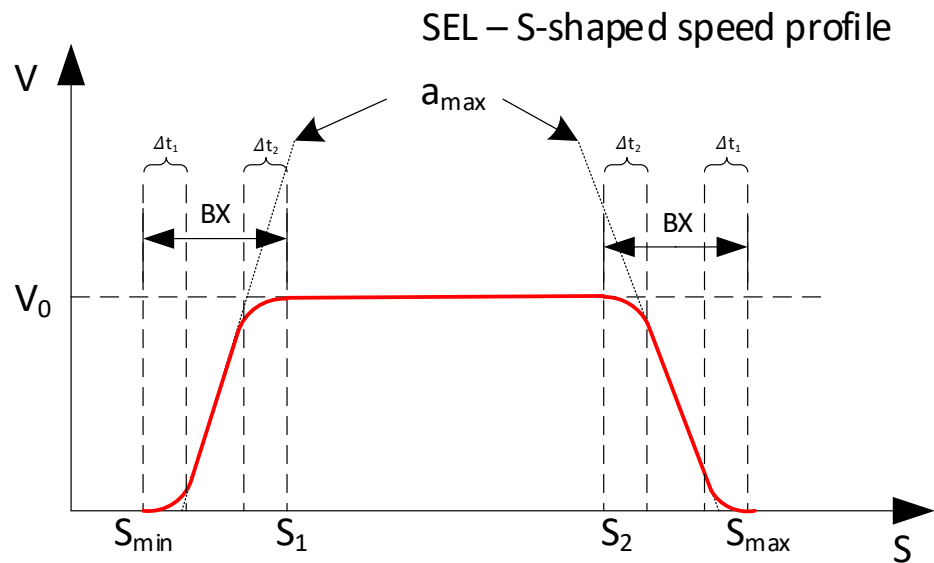
As a speed profile of the limit curve you can choose between a trapezoidal or S-shaped type.

Trapezoidal speed profile of the limit curve: The stopping distance to the limit position is based on a linear calculation method.



S_{max}	Maximum permitted position
S_{min}	Minimum permitted position
S_{stop}	Stop position = current position + current stop distance
$[S_{min}, S_{max}]$	Permitted travel range
BX	Braking/approaching range
V	Current speed
V_0	Maximum speed for $(S_{min} + BX) < S < (S_{max} - BX)$
a_{max}	Maximum deceleration

S-shaped speed profile of the limit curve: The stopping distance to the limit position is based on a quadratic calculation method.



S_{max}	Maximum permitted position
S_{min}	Minimum permitted position
S_{stop}	Stop position = current position + current stop distance
$[S_{min}, S_{max}]$	Permitted travel range
BX	Braking/approaching range
V	Current speed
V_0	Maximum speed for $(S_{min} + BX) < S < (S_{max} - BX)$
a_{max}	Maximum deceleration
$\Delta t_1 + \Delta t_2$	S-ramp time



INFORMATION

The SEL function can only be selected when the position processing is activated (i.e. by using an absolute encoder).

The stopping distance is calculated from the current speed V and the parameterized stop ramp.

The SEL function is available once for each axis.

Parameters

Properties

[SEL] Safe Emergency Limit

Search

[SEL] Safe Emergency Limit

Access ID ☒ 1

Enable Unconditioned ☒ ☐

Curve Profile Type ☒ Linear

Position

Lower Limit Position X1 ☒ 5 rev

Upper Limit Position X2 ☒ 20 rev

Threshold

Max. Acceleration ☒ 2 r/min/s

S-Ramp Time ☒ 1 ms

Miscellaneous

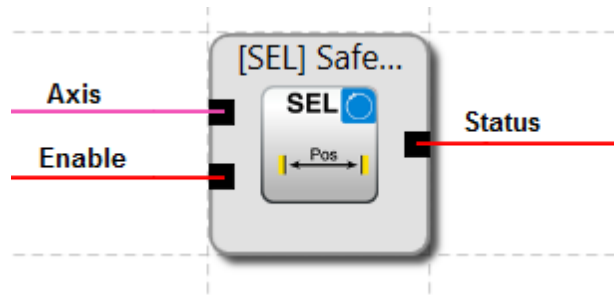
Comment ☒

Name

Name ☒ [SEL] Safe Emergency Limit

Parameter	Description	Range	Unit
Access ID	The access ID is used to identify the function element in the application program. This ID can be used only once.	Available number of SEL block	-
Enable Unconditioned	If this option is ticked, the monitoring function is permanently active and does not have an input connector.	Checked Unchecked	-
Curve Profile Type	For setting the type of speed curve during acceleration and deceleration; Linear or S-Shape/Jerk-Limited.	Linear S-Shaped	-
Lower Limit Position	For entering the minimum permitted position	Please refer to PanatermFor Safety	[POS]
Upper Limit Position	For entering the maximum permitted position	Please refer to PanatermFor Safety	[POS]
Max. Acceleration	Value of the maximum acceleration/deceleration within BX	[2..16384]	[ACC]
S-Ramp Time	[Only for S-Shaped] This time characterizes the S-shaped ramp. It calculates the period during which the speed changes non-linearly. The S-ramp time also designates the period for changing the acceleration/ deceleration from " $a = 0$ " to " $a = a_{max}$ ", or vice versa	[1..16384]	[ms]

Comment	Input possibility for an application-related comment
Name	Input possibility for an application-specific name

Control signals

Axis	Input signal to assign the axis to be monitored
Enable	Input signal to activate the function
Status	Output signal to indicate the status of the function. The status is high as long as the SEL did not detect a fault After a fault the status signal is pulled to zero and remains zero until the function is reset using the reset acknowledgement.

RESET-Function

The violation of the permissible monitoring curve/range is saved and requires a RESET acknowledgement.

Note: The SEL cannot be reset from a fault state while activated. Before resetting, the function is to be disabled.

Logic Table

Enable	Condition	Status
0	Initial	1
1	$S < S_{min}$ OR $S > S_{max}$	0
1	$S \geq (S_{min} + BX)$ AND $S \leq (S_{max} - BX)$	1
1	$S \geq S_{min}$ AND $S \leq (S_{min} + BX)$ AND $V < \text{limit curve}$	1
1	$S \geq S_{min}$ AND $S \leq (S_{min} + BX)$ AND $V \geq \text{limit curve}$	0
1	$S \geq (S_{max} - BX)$ AND $S \leq S_{max}$ AND $V < \text{limit curve}$	1
1	$S \geq (S_{max} - BX)$ AND $S \leq S_{max}$ AND $V \geq \text{limit curve}$	0

Limit curve = speed profile derived from the current parameterization.

Input example On a production station, the access to the work area is to be granted for manual setup, if the main feed of the machine is in certain positions. To provide an alternative to the mechanical safety limit switch, the limits of the working stroke are to be monitored in a safety-related manner.
The possible maximum travel range of teach mode is 5 mm to 620 mm.

Setting the limit positions s_{min} and s_{max} :

The reference zero point of the main drive axis is at the upper dead center. A mechanical coasting distance is subordinated.

➔ Lower limit position $s_{min} = 15 \text{ mm}$

The lower end point is at 620 mm – 10 mm.

➔ Upper limit position $s_{max} = 610 \text{ mm}$

Setting the type of speed curve:

The drive/position controller uses a ramp limitation (jerk limitation) for the acceleration/deceleration with resulting S-pattern of the speed in order to minimize deviations and processing marks.

➔ Selection “**S-shape/jerk limited**” as curve profile type

Setting the maximum acceleration/deceleration:

This value can be taken from the machine parameterization.

➔ Maximum acceleration/deceleration $a_{max} = 1000 \frac{\text{mm}}{\text{s}^2}$

Setting the S-ramp time:

This value can be taken from the machine parameterization.

S-ramp time = 500 ms

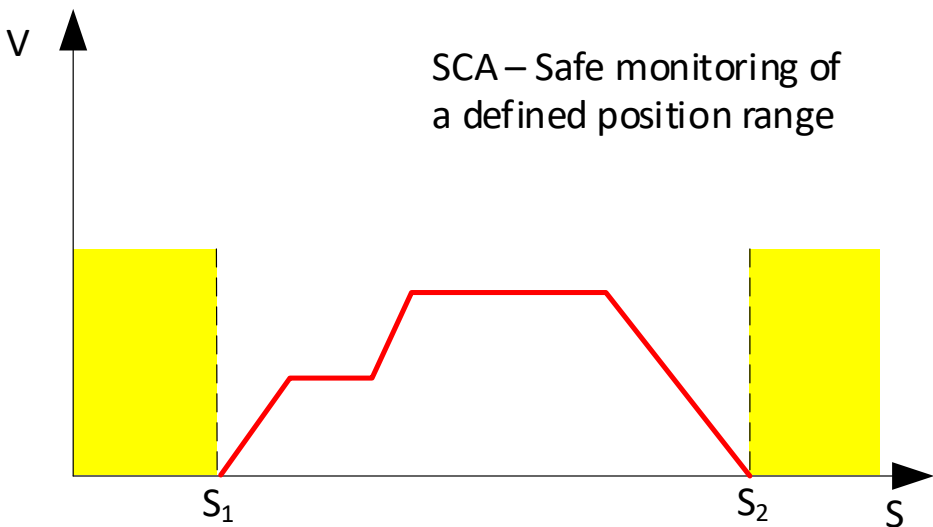
9-3-3-9 SCA (Safe Cam)

Icon



Functional Description

The SCA safely monitors a parametrizable speed/position range with allocated minimum and maximum limits. It provides a safe signal to indicate whether the drive is located in a specific area range. If not, the SCA function is triggered and changes its output state from “1” to “0”. This safe signal can be appropriately evaluated and processed in the application depending on the situation.



S_1	Lower limit of range
S_2	Upper limit of range
$[S_1, S_2]$	Permitted position range

The SCA function includes further monitoring functions that can be used individually or in combination. These possible monitoring functions are:

- Position monitoring of a defined position range
- Monitoring of a maximum speed
- Monitoring of a maximum acceleration
- Speed profile supervision
- Count direction control
- Overspeed distance monitoring

**INFORMATION**

- ➡ The SCA function can only be selected with position-dependent monitoring, when the position processing is activated (i.e. by using an absolute encoder).
- ➡ When activating several monitoring functions of an SCA, all limits must be adhered to so that a “1” signal is present at the output of the SCA function. This means the SCA function is triggered if one of the parametrized limits is exceeded.

**WARNING**

When programming the SCA function, you have to consider that a tripped SCA is properly interpreted and further processed in the user application program.

- ➡ Personal working with the machine must be aware of the risks involved.

Position monitoring

When position monitoring is active, a “1” signal is present at the SCA function output as long as the axis remains in the parameterized position range. Once this range is violated, the function is triggered and the output changes to “0”.

Speed monitoring

When speed monitoring is active, a “1” signal is present at the output of the SCA function as long as the speed of the axis to be monitored does not exceed the parametrized speed threshold. Above the parameterized speed threshold, the output changes to “0”.

Acceleration monitoring

When acceleration monitoring is active, a “1” signal is present at the output of the SCA function as long as the acceleration of the axis to be monitored does not exceed the parametrized acceleration threshold. Above the parameterized acceleration threshold, the output changes to “0”.

**INFORMATION**

- ➡ Acceleration monitoring can only be activated when overspeed distance monitoring is disabled.

Speed profile supervision

When speed profile monitoring is active, the speed at the limits is monitored based on the monitoring characteristics parameterized in the SEL or SLP function.

Count direction control

Count direction control enables the activation of downstream function blocks depending on the current direction of movement. Evaluation is only made beginning from a parameterized speed threshold. This means a “1” signal is present at the output of the SCA function if the speed value is greater than the parameterized speed threshold and if the direction of the movement corresponds with the parametrized direction. If this is not the case, the output changes to “0”.

**INFORMATION**

Count direction control can only be activated when speed and acceleration monitoring are disabled.

Overspeed distance monitoring

This additional functionality allows you to filter speed peaks in the event of irregular travel operation (speed peaks in the signal). Refer to the SLS function for more information.

**INFORMATION**

Overspeed distance monitoring can only be activated when acceleration monitoring is disabled.

**WARNING**

When using overspeed distance monitoring, the response time behavior of the application is affected (increases). This must be considered! Refer to the SLS function for more information.

RESET-Function

No RESET acknowledgement is necessary.

The SCA is automatically reset as soon as the current value is within the specified thresholds.

Parameters

The screenshot shows a software window titled 'Properties' for a component named '[SCA] Safe Cam'. The window contains a search bar and several expandable sections for configuration parameters. The parameters are organized into sections: '[SCA] Safe Cam', 'Position', 'Threshold', 'Speed Profile Supervision', 'Count Direction Control', 'Overspeed Distance Monitoring', 'Miscellaneous', and 'Name'.

Section	Parameter	Value / Status
[SCA] Safe Cam	Access ID	1 - MINAS A6SX (Master)
	Enable Unconditioned	☐
	Mode	Threshold
Position	Position Tolerance	☐
	Lower Limit Position X1	0.002 rev
	Upper Limit Position X2	1.002 rev
Threshold	Speed Tolerance	☒
	Speed Threshold	100 r/min
	Acceleration Monitoring	☐
	Max. Acceleration	2 r/min/s
Speed Profile Supervision	Profile	SLP
	Limits Inverted (Forbidden Sector)	☐
Count Direction Control	Position Signal	Decreasing
	Threshold Speed for Direction	2 r/min
Overspeed Distance Monitoring	Activate	☐
	Allowed Distance	0.002 rev
Miscellaneous	Comment	
Name	Name	[SCA] Safe Cam

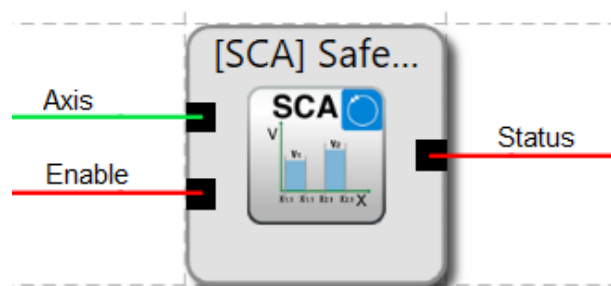
Parameter	Description	Range	Unit
Access ID	The access ID is used to identify the function element in the application program. This ID can be used only once.	Available number of SCA block	-
Enable Unconditioned	If this option is ticked, the monitoring function is permanently active and does not have an input connector.	Checked Unchecked	-

Mode	Drop-down menu to select the monitoring mode for the SCA. Following modes can be selected: ▪ Threshold ▪ Speed profile supervision ▪ Count direction control	-	-
“Position” section			
Position Tolerance	Checkbox for activating position monitoring.	Checked Unchecked	-
Lower Limit Position	For setting the minimum position.	Please refer to PanatermFor Safety	[POS]
Upper Limit Position	For setting the maximum position.	Please refer to PanatermFor Safety	[POS]
“Threshold” section			
Speed Tolerance	Checkbox for activating speed monitoring.	Checked Unchecked	[Speed]
Speed Threshold	For setting the maximum permitted speed limit.	Please refer to PanatermFor Safety	
Acceleration Monitoring	Checkbox for activating acceleration monitoring.	Checked Unchecked	
Max. Acceleration	For setting the maximum permitted acceleration.	Please refer to PanatermFor Safety	[ACC]
“Speed Profile Supervision” section			
Profile	Drop-down menu to select the monitoring profile. When selection “SLP”, the monitoring characteristics of the SLP function are applied. When selection “SEL”, the monitoring characteristics of the SEL function are applied.	SLP SEL	-

Limits inverted (Forbidden sector)	When the check box is disabled, the specified minimum and maximum values reflect the limits of the permitted range between these limits. When the check box is enabled, the permitted range is located outside the range between minimum and maximum values. The minimum and maximum values specify only the “forbidden range” between the values.	Checked Unchecked	-

“Count direction control” section			
Position signal	For selecting the direction. Decreasing: Monitoring for decreasing position values. Increasing: Monitoring for increasing position values.	Decreasing Increasing	-
Threshold Speed for Direction	For setting the speed threshold for the direction-dependent control. The evaluation takes place only when exceeding the parametrized speed threshold.	Please refer to PanatermFor Safety	[Speed]
“Overspeed Distance Monitoring” section			
Activate	checkbox: For activating speed profile monitoring.	Checked Unchecked	-
Allowed Distance	For setting the maximum permitted distance with reference to the speed violation.	Please refer to PanatermFor Safety	[POS]
Comment	Input possibility for an application-related comment		
Name	Input possibility for an application-specific name		

Control signals



Axis	Input signal to assign the axis to be monitored
Enable	Input signal to activate the function
Status	Output signal to indicate the status of the function. The status is high as long as the SCA did not detect a fault.

Logic Table

Enable	Condition	Status
0	Initial	1
1	$S < S_1$ OR $S > S_2$	0
1	$S \geq S_1$ AND $S \leq S_2$ AND $v_{Current} < v_{Limit}$	1
1	$S \geq S_1$ AND $S \leq S_2$ AND $v_{Current} \geq v_{Limit}$	0



INFORMATION



When activating several monitoring functions of an SCA, the SCA function is triggered if one of the parametrized limits is exceeded.

Input example

A production hall is separated into 3 areas. A crane in the hall that can travel in all 3 areas must not exceed a speed of 1 m/s in the second area. A violation of the maximum speed must not lead to an immediate standstill of the crane in order to avoid oscillations. In case the maximum speed is violated, a higher-level controller reduces the speed of the drive and the crane can keep moving without stopping. Once the speed falls below the maximum speed, the monitoring message is acknowledged automatically and the controller does not need to intervene further.

1. Setting the limit positions

The second area has the limits:

Lower limit position = **10 m**

Upper limit position = **20 m**

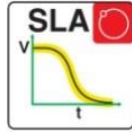
2. Setting the speed threshold

In the above described position range, the speed of the crane must not exceed a speed of 1 m/s.

→ *Speed threshold* = $\frac{1m}{s}$

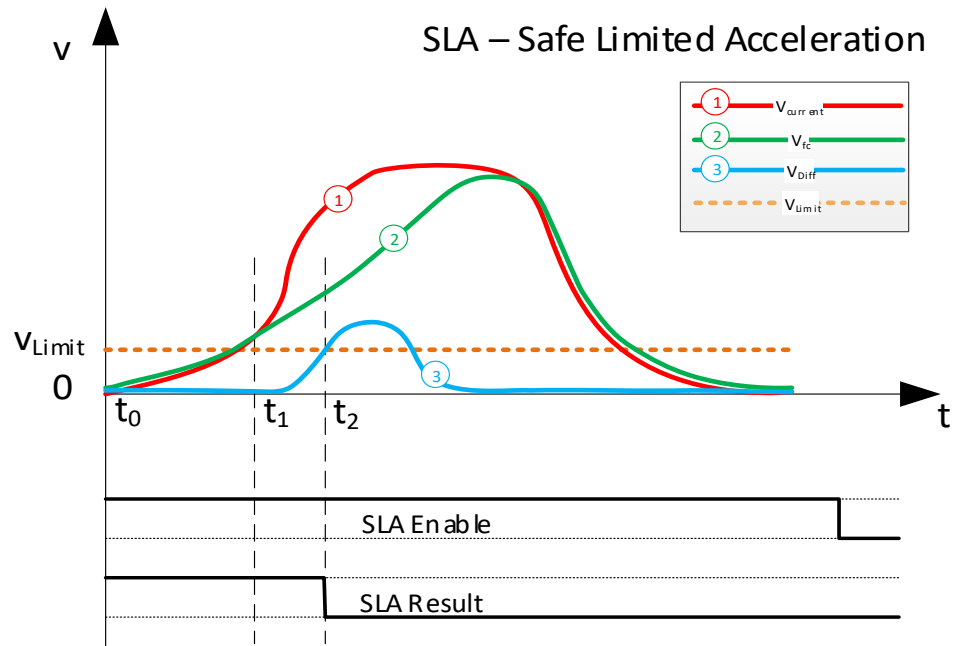
9-3-3-10 SLA (Safe Limited Acceleration)

Icon



Functional Description

The SLA safely monitors the acceleration of the drive for compliance with a specified acceleration value. If the permitted acceleration value is exceeded, the output of the SLA function is triggered (changes from “1” to “0”) and results in an application countermeasure that prevents further operation.



$V_{current}$	Actual speed.
V_{fc}	Forecast speed: expected speed calculated based on a parameterizable maximum acceleration and the last measured speed.
V_{Diff}	Speed difference between forecast speed and current speed.
V_{Limit}	Parameterized maximum permitted tolerance.

Based on a configurable maximum acceleration (a_{max}), which results from physical characteristics of the drive, a forecast speed (V_{fc}) is predicted by using the last measured speed value (V_{t-1}).

From the forecast speed (V_{fc}) and the actual speed ($V_{current}$), a speed difference (V_{Diff}) is calculated.

If the speed difference (V_{Diff}) exceeds a parametrizable threshold (V_{Limit}), the function is triggered and signals this by changing its output from “1” to “0”.

The speed threshold V_{Limit} must be determined by the user in order to tolerate speed variations by controlling the drive.

**INFORMATION**

The SLA function monitors the acceleration of the drive, not the braking process (deceleration).

Parameters

Properties

[SLA] Safe Limited Acceleration

Search

▲ [SLA] Safe Limited Acceleration

Access ID

Enable Unconditioned ☐

▲ Speed Tolerance

Speed Threshold ☐

▲ Acceleration Monitoring

Max. Acceleration ☐

▲ Miscellaneous

Comment

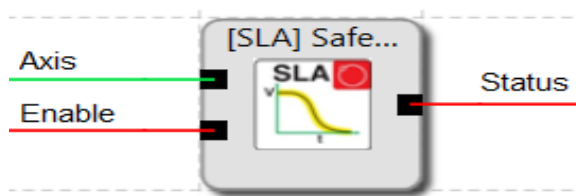
▲ Name

Name ☐

Parameter	Description	Range	Unit
Access ID	The access ID is used to identify the function element in the application program. This ID can be used only once.	Available number of SLA block	-
Enable Uncondi-tioned	If this option is ticked, the monitoring function is permanently active and does not have an input connector.	Checked Unchecked	-
Speed Threshold	For setting the permitted speed tolerance V_{Limit} . The entered value must not exceed $\frac{1}{10} V_{Max}$ V_{Max} : Configured maximum speed for the axis.	$< \frac{1}{10} V_{Max}$	[Speed]
Max. Acceleration	For setting the maximum permitted acceleration of the drive.		[ACC]

Comment	Input possibility for an application-related comment
Name	Input possibility for an application-specific name

Control signals



Axis	Input signal to assign the axis to be monitored
Enable	Input signal to activate the function
Status	Output signal to indicate the status of the function. The status is high as long as the SLA did not detect a fault After a fault the status signal is pulled to zero and remains zero until the function is reset using the reset acknowledgement.

**RESET-
Function**

The violation of the permissible monitoring threshold is saved and requires a RESET acknowledgement.

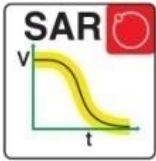
The SLA cannot be reset from a fault state while activated.

Logic Table

Enable	Condition	Status
0	Initial	1
1	$V_{Diff} \leq V_{Limit}$	1
1	$V_{Diff} > V_{Limit}$	0

9-3-3-11 SAR (Safe Acceleration Range)

Icon

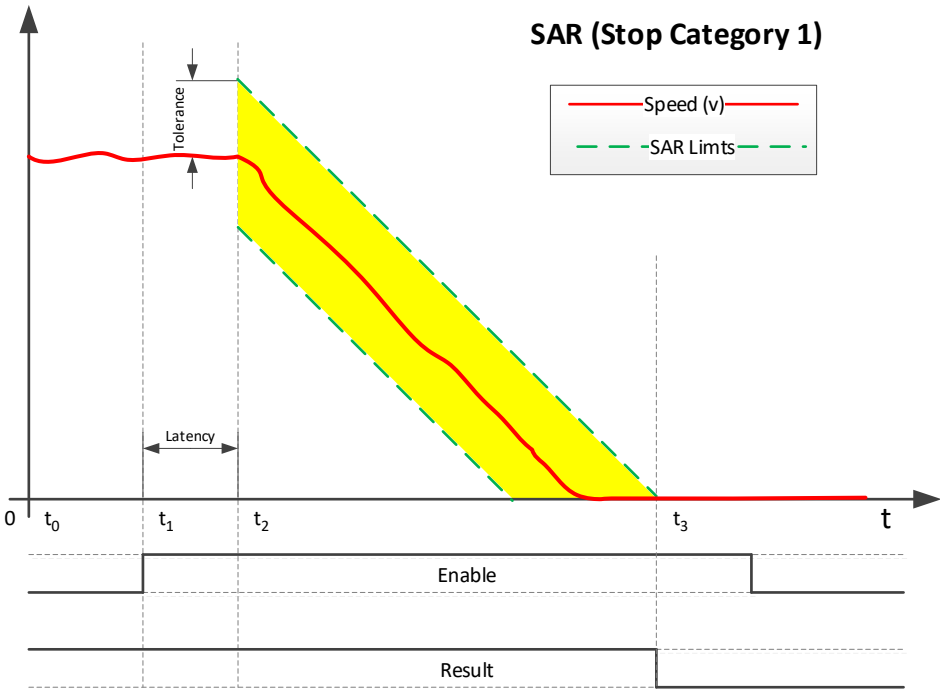


Functional Description

The SAR safely monitors a deceleration range by comparing the speed with a parameterizable monitoring curve over the course of time. This monitoring speed curve is the result of a latency, the curve characteristics calculated based on acceleration and jerk (acceleration change) and a certain tolerance.

Based on the stop category, the SAR also monitors the standstill after reaching the safe stop.

SAR (Stop category 1): SAR initiates a Safe Stop 0 by switching off after reaching standstill or violation of the deceleration range.



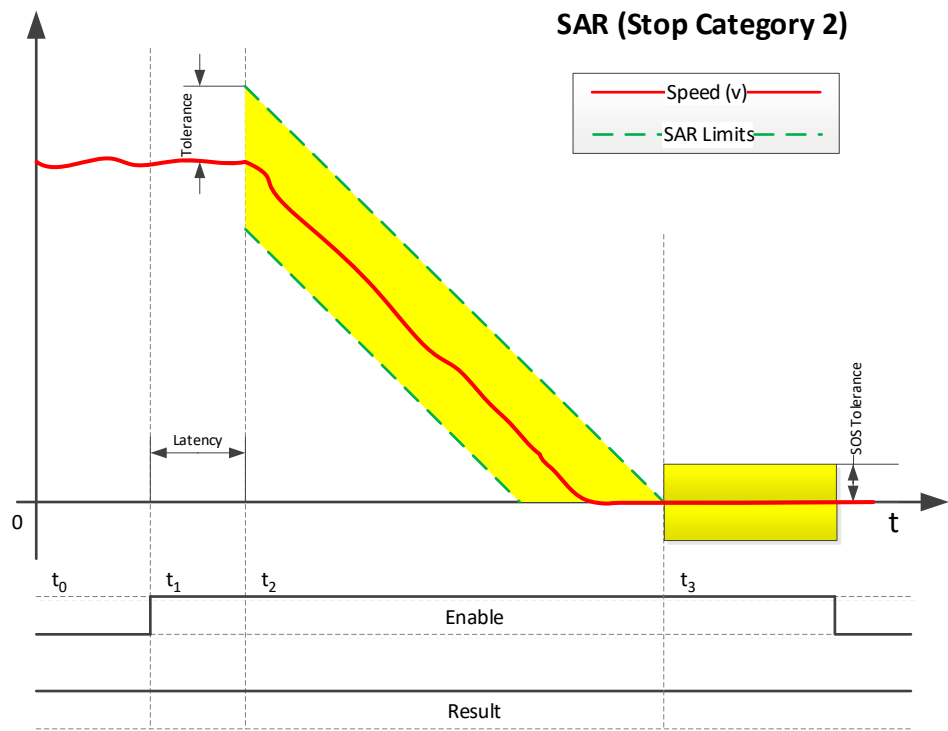
t_0	Movement with initial speed
t_1	A safe stop is initiated by enabling the SAR function. The internal timer for the Latency starts
t_2	The internal timer for the latency elapsed and the stop ramp is monitored with the configured speed tolerance.
t_3	The speed came to the expected halt and the Safe Stop 0 is requested by setting the result to logical low.

After a standstill is reached, a safe torque off (Safe Stop 0) is initialized as the SAR function switches off.

If during the stop motion the monitored speed curve is violated, the SAR function switches off immediately.

The SAR function remains in this state until it is deactivated and reset.

SAR (Stop category 2): SAR activates an SOS to monitor the safe stop after reaching standstill.



t_0	Movement with initial speed
t_1	A safe stop is initiated by enabling the SAR function. The internal timer for the Latency starts
t_2	The internal timer for the latency elapsed and the stop ramp is monitored with the configured speed tolerance.
t_3	The speed came to the expected halt and a Safe Operational Stop is requested internally by enabling the SOS. The result of the SAR remains active as long as neither the speed ramp nor the stop condition is violated.

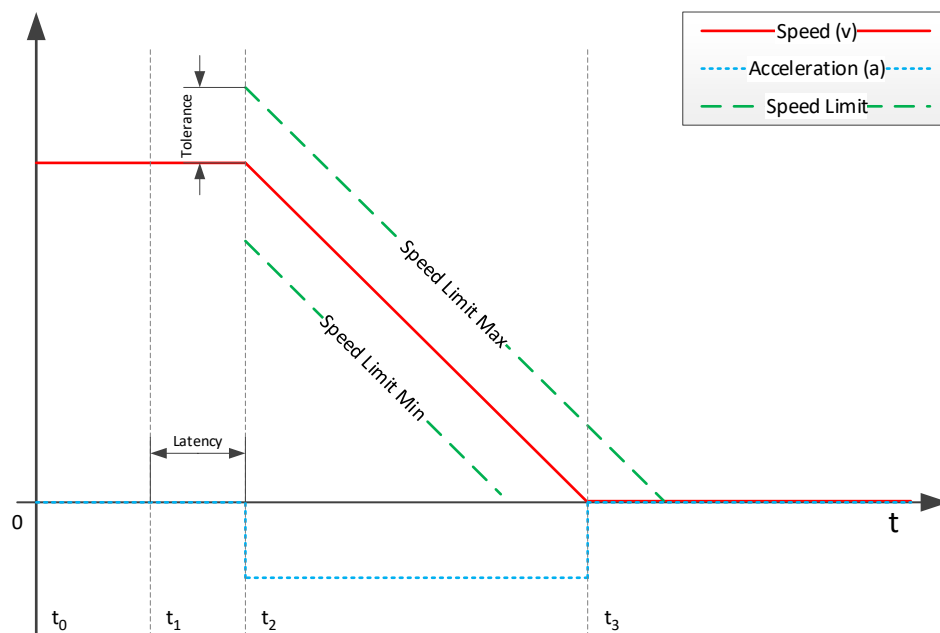
After a standstill is reached, the SAR function activates the SOS functionality and continues to monitor the standstill condition. The drive remains operational.

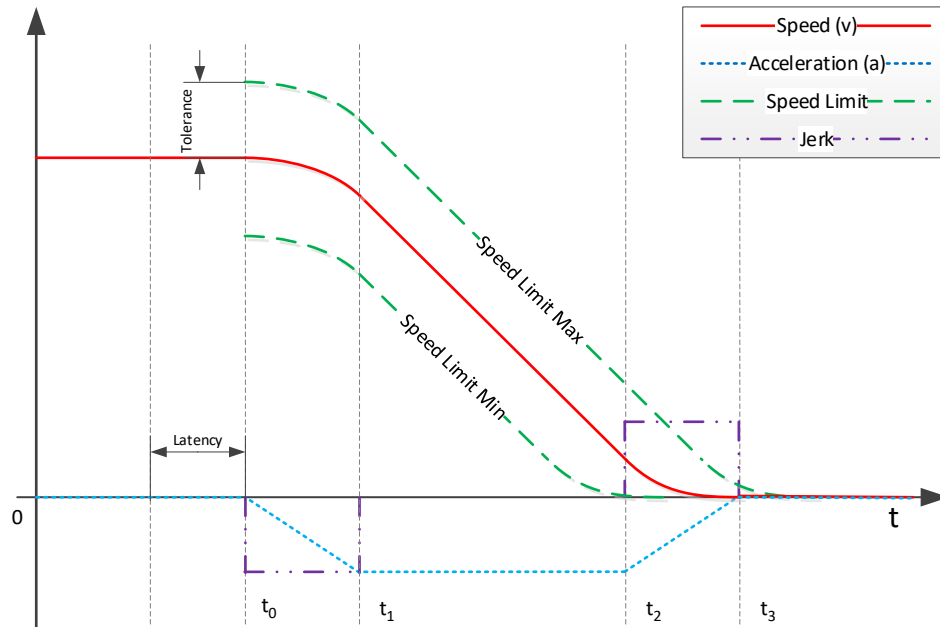
In case the monitoring brake speed curve is violated before reaching the standstill condition, the SAR function switches off immediately and forces a safe torque off. The SAR function remains in this state until it is deactivated and reset. Once the standstill condition is reached, the SOS function takes over the monitoring of the standstill not being violated.

Definition of the standstill condition

- SOS with position-dependent monitoring
The standstill condition is reached, when the monitoring speed curve is “0”
- SOS with speed-dependent monitoring
The standstill condition is reached, when the monitoring speed curve falls below the parameterized SOS-Speed-Tolerance.

Curve Types The speed monitoring curve is a function of speed with either linear or s-shaped characteristics. This means the difference between the two speed monitoring curves is the acceleration portion, which can either be constant or jerk limited.

Linear



t_0	Safe Stop is initiated, deceleration is increasing
t_1	Deceleration reached its configured maximum and continues linear
t_2	The linear part ended and the deceleration is now constantly reduced
t_3	Standstill; deceleration has been reduced to zero as the drive comes to halt

$[t_0, t_1[$	<i>Jerk limited increase of deceleration</i>
$[t_1, t_2[$	<i>Maximum acceleration</i>
$[t_2, t_3[$	<i>Jerk limited decrease of deceleration</i>

Properties

[SAR] Safe Acceleration Range 1

Search

[SAR] Safe Acceleration Range

Access ID	☐	1
Stop Category according EN 60204-1	☐	1 (Shut off following expected standstill)
Curve Profile Type	☐	Linear

Threshold

Standard Latency Time	☐	16 ms
Speed Threshold	☐	2 r/min
Max. Acceleration	☐	25 r/min/s
S-Ramp Time	☐	64 ms

Minimal Acceleration

Minimal/Maximal Acceleration	☐	☐

Miscellaneous

Comment	☐	

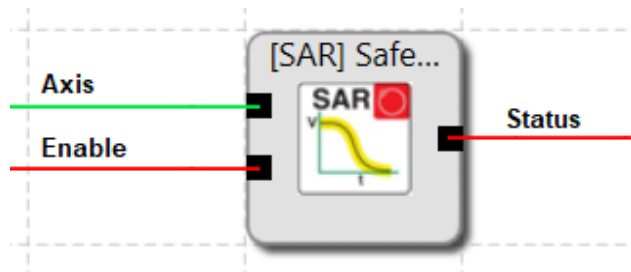
Name

Name	☐	[SAR] Safe Acceleration Range 1

Parameter	Description	Range	Unit
Stop Category	The safe stop category;	Safe Stop 1 Safe Stop 2	-
Curve Type	The curve type of the monitored speed curve; Linear or S-Shape/Jerk-Limited.	Linear S-Shaped	-
Latency Time	Latency time delaying the start of the speed monitoring to cope with drive reaction times	[0..10000]	[ms]
Speed Tolerance	Allowed speed deviation from the theoretically calculated brake ramp	See PanatermFor Safety	[Speed]
Max. Deceleration	Constant deceleration value for linear curves or maximum deceleration during $[t_1, t_2]$ of an s-shaped brake ramp	See PanatermFor Safety	[ACC]
S-Ramp Time	[Only for S-Shaped] Time for the jerk limited brake ramp sectors $[t_0, t_1]$ and $[t_2, t_3]$. This time characterizes the S-shaped ramp.	[8..1250]	[ms]
Min./Max. Deceleration	Select possibility for minimum deceleration monitoring In case this parameter is selected, the SAR monitors the maximum deceleration as well as the minimum deceleration.	Checked Unchecked	-

Comment	Input possibility for an application-related comment
Name	Input possibility for an application-specific name

Control signals



Axis	Input signal to assign the axis to be monitored
Enable	Input signal to activate the function
Status	Output signal to indicate the status of the function. The status is high as long as the SAR did not detect a fault After a fault the status signal is pulled to zero and remains zero until the function is reset using the reset acknowledgement.

RESET-Function

The violation of the permissible monitoring curve/range is saved and requires a RESET acknowledgement.

Note: The SAR cannot be reset from a fault state while activated. Before resetting, the function is to be disabled.

Logic Table

Enable	Condition	SAR Status	
		Cat. 1	Cat. 2
0	Initial	1	1
-	$t \leq t_{Latency}$	1	1
1	$t > t_{Latency}$ AND $v_{Limit,Min} \leq v_{Current} \leq v_{Limit,Max}$	1	1
1	$t > t_{Latency}$ AND $v_{Current} > v_{Limit,Max}$	0	0
1	$t > t_{Latency}$ AND $v_{Current} < v_{Limit,Min}$	0	0
1	$v_{Limit,Max} = 0$	0	1
0	Status = 1	1	1
0	Status = 0	0	0

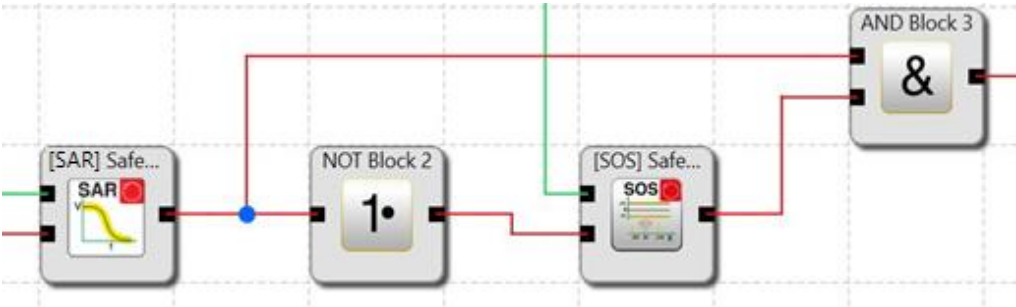


INFORMATION

Each SAR function block can be set as stop category 1 or 2.
In stop category 2, the SOS function is automatically activated after the expected standstill is reached.
In order to use the SAR function in connection with SOS, the following circuit is to be considered.

If a standstill is detected, the operating system will automatically activate the SOS monitoring.
To implement a standstill monitoring outside of this function, the SOS module will need to be activated. This must be linked with only one OR.

Application circuit for SAR (Category 2):



**Input
example**

On a production station, the access to the storage/retrieval area is monitored. As soon as a person enters this area during operation, the system has to be brought to a safe stop. The drive remains active in this position and is only monitored for standstill. During the braking process, the ramp has to be monitored for compliance with a defined deceleration range.

1. Selection of the stop category

In order to ensure short standstill times and high productivity, the stop category 2 according to DIN 60604-1 is to be used → Selection SS2 (SSX with stop category 2).

2. Selection of the speed curve

The drive uses a ramp limitation (jerk-limited) for the acceleration with resulting in S-slip of the speed, in order to minimize deviations and processing marks → Selection *S-Shaped* speed curve

3. Selection of the limit values

For monitoring purposes, the worst-case latency period must be entered, 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 runtime 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/s

Maximum deceleration = 1000 mm/s²

Maximum change of deceleration = 3000 mm/s³

9-3-3-12 SRX (Safe Referencing on X-Axis)

Icon



Functional Description

With the SRX function the position of an axis can be set to a defined value and thus referenced to a physical position.

If you want to implement position monitoring with the safety device, many applications require that you adjust the internal position of the safety device to the physical position in the system using an offset. This is the case, for example, for initial startup or when replacing an encoder. Using the SRX function, you can adjust the internal position of the safety device to the physical position of the system without subsequently changing the safety program.

For this purpose, the reference position is to be approached by moving the system to the physical mark and then a safe referencing is to be executed. When activating the SRX for safe referencing, the safety device calculates the offset from the current encoder value and adjusts its internal position to the physical position of the system. In this way the safety device can be referenced after disassembly or after encoder replacement without having to adjust the safety program. This means another validation is not required.

Once you have successfully referenced the system, the configured mess length (measuring section) can be traveled irrespective of the encoder system used or its current position. The current position of the system is permanently stored in non-volatile memory and used with the calculated offset to check the referencing status. Therefore, after switching off or power loss of the device no re-referencing is required for absolute multiturn encoder, however, a position check is to be executed. To do this, the reference position must be approached again and a Safe Turn Counter Restore is to be evaluated.

If a sine/cosine or resolver encoder is used, the SRX function can also be used for position processing. In this case, however, the referencing must be restored after switching on and at a regular interval of 12-48 hours by means of the Turn Counter Restore.



WARNING

- ➞ Before executing the safe referencing, make sure that the axis to be adjusted is located at the proper position (reference mark).
- ➞ For a successful adjustment and in order to keep position tolerances to a minimum when executing the referencing, we recommend that you execute the referencing only when the associated axis is at standstill.
- ➞ You can execute the safe referencing only when the safety device is in state "RUN".
- ➞ When using the SRX function, no further offset must be configured for the respective encoder system.
- ➞ After referencing, the activating processing for SRX must be blocked by the logic or by selecting the corresponding input elements.

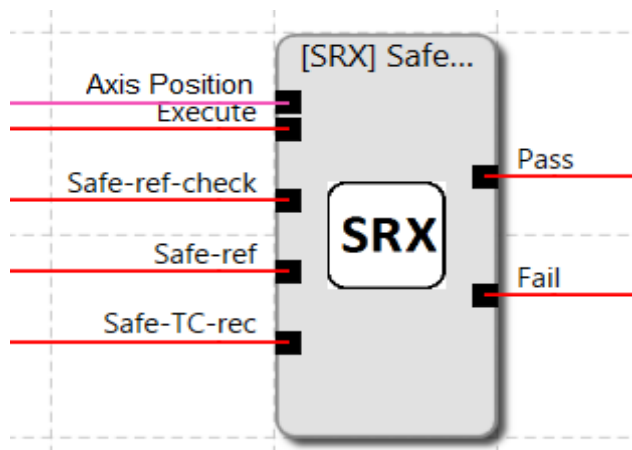
Parameters

The screenshot shows the 'Properties' dialog box for '[SRX] Safe Referencing 1'. The dialog has a search bar at the top. Below it, there are several expandable sections: '[SRX] Safe Referencing', 'Reference Configuration', 'Miscellaneous', and 'Name'. The 'Access ID' is set to 1. Under 'Reference Configuration', 'Use Only For Safe Reference Checks' is checked, 'Reference Position' is 0 rev, and 'Tolerance Value' is 0 rev. Under 'Miscellaneous', 'Comment' is empty. Under 'Name', 'Name' is '[SRX] Safe Referencing 1'.

Parameter	Description	Unit/Range
Access ID	The access ID is used to identify the function element in the application program.	-
Use Only for Safe Reference Checks	If this option is ticked, the SRX function can only be used to check the safe referencing status.	Checked Unchecked
Reference Position	The physical position (e.g. physical mark), where the position of the axis to be referenced is to be adjusted to.	[Position]
Tolerance Value	Tolerance value for the referencing check.	[Position]

Comment	Input possibility for an application-related comment
Name	Input possibility for an application-specific name

Control signals



Axis Position	Input signal to assign the axis to be referenced.
Execute	Edge-triggered signal for the execution of the selected function.
Safe-ref-check	Function selector to check the referencing.
Safe-ref	Function selector to perform the referencing.
Safe-TC-rec	Function selector to restore the referencing.
Pass	Output signal to indicate a successfully execution of the selected functionality.
Fail	Output signal to indicate a faulty execution of the selected functionality.

**RESET-
Function**

The axis referencing can be reset by using the RESET functionality inside the SRS function.

Logic Table

	Signal					
	Execute	Safe-ref-check	Safe-ref	Safe-TC-rec	Pass	Fail
Function						
Inactive	0	-	-	-	0	0
Check the referencing	1	1	0	0	X	!X
Set the referencing	1	0	1	0	X	!X
Restore the referencing	1	0	0	1	X	!X
Invalid	1	1	1	-	0	1
Invalid	1	1	-	1	0	1
Invalid	1	-	1	1	0	1



INFORMATION

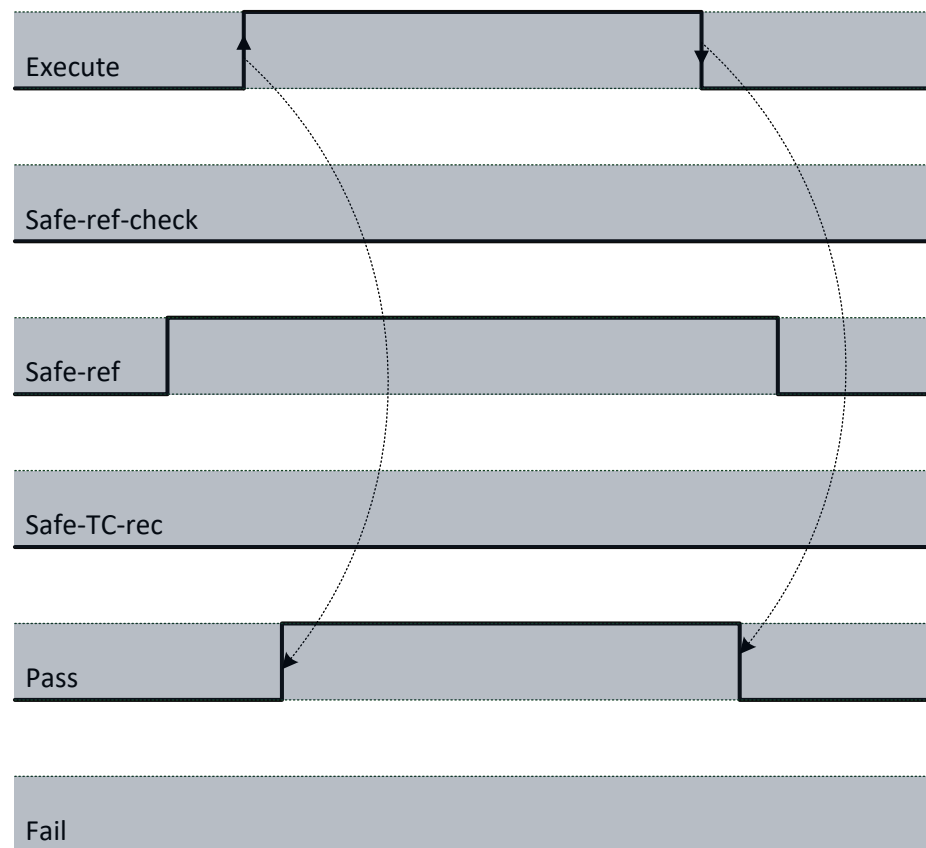
In principle, the inputs Safe-ref-check, Safe-ref and Safe-TC-rec are used as function selectors - a high level marks the functionality to be executed.

With a rising edge of the Execute input, the selected functionality is performed.

Only one function selector signal may be active at the time of execution.

The output status is set after the functionality is activated and remains in the corresponding state until the Execute signal changes back to a low level.

Executing a successful referencing:



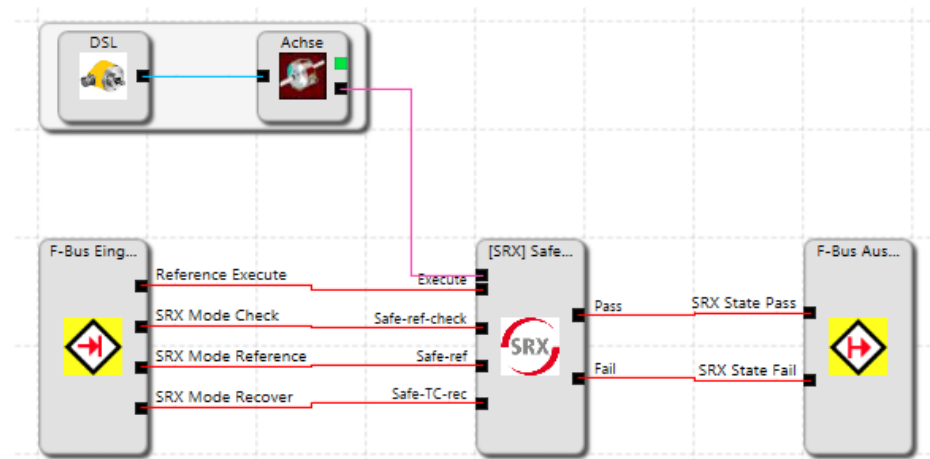
Input example 1

A safe multi-turn absolute encoder provides position information for a rotating shaft. After the encoder has been mounted, the system is to be referenced to a physical mark, which is defined by the user as reference position. For this purpose, the system can be moved at reduced speed to the physical mark and a safe referencing can to be executed.

Input example 2

On a production station, a trolley is using a rotatory absolute encoder in combination with an incremental encoder as a system for position processing.

As the absolute encoder has to be removed for maintenance purposes, it must be possible that the internal position of the safety device can be referenced after maintenance to the physical mark without having to change the safety program. For this purpose, the reference position is to be approached by moving the system to the physical mark and then a safe referencing is to be executed.



9-3-3-13 SRS (Safe Referencing State)

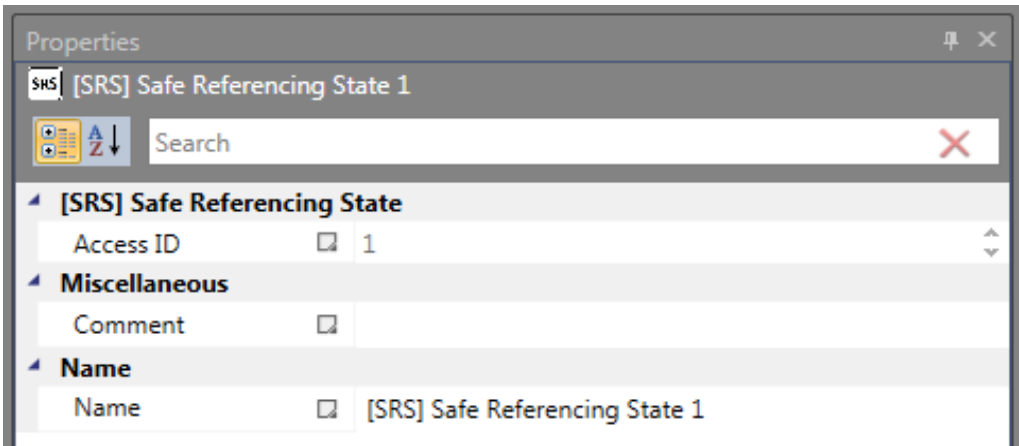
Icon



Functional Description

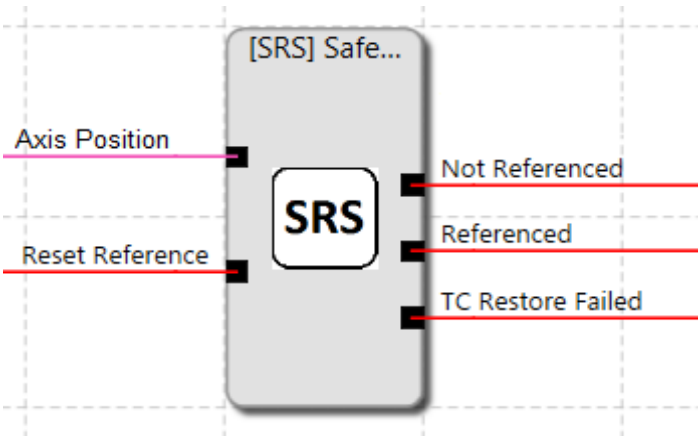
The SRS function is to be considered as a status block of the SRX. It signals the status of the referencing via the corresponding logic output. In addition, the SRS can be used to reset the referencing of the axis by providing a rising edge at the input “Reset Reference”.

Parameters



Parameter	Description
Access ID	The access ID is used to identify the function element in the application program.
Comment	Input possibility for an application-related comment
Name	Input possibility for an application-specific name

Control signals

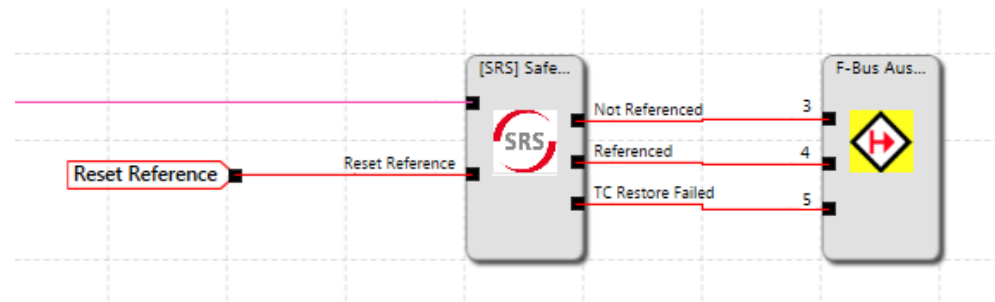


Axis Position	Input signal to assign the corresponding axis.
Reset Reference	Edge-triggered signal to reset the referencing of the axis.

Not Referenced	The axis is not referenced: Encoder position was plausible after switching on (system did not move) but no referencing has been made yet.
Referenced	The axis is referenced.
TC Restore Failed	The axis is no longer referenced: After switching on, a deviation of the encoder position was detected and thus the referencing was deactivated. Restoring referencing via safe-TC-rec is possible.

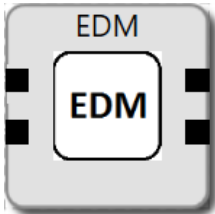
RESET-Function   The axis referencing can be reset by providing a rising edge at the input “Reset Reference”.

Input example



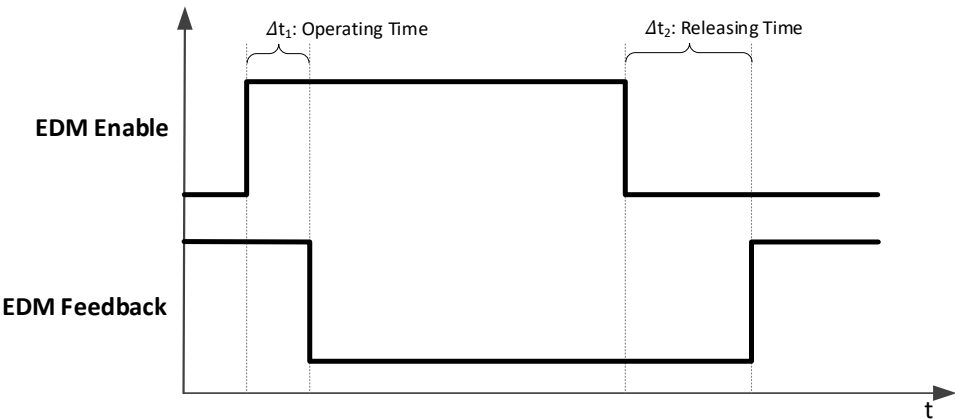
9-3-3-14 EDM (External Device Monitoring)

Icon

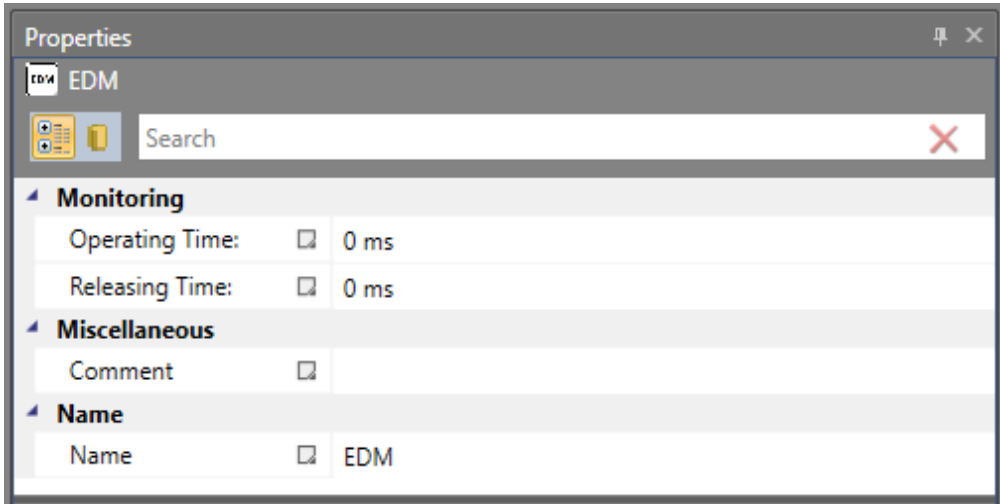


Functional Description

The multiplication of contacts and power usually requires additional switching devices that are triggered via the output of the safety module. EDM monitoring implements the “safe relay” function by processing an external feedback loop. For applications with increased requirements on safety, i.e. according to category 4 of EN 954-1, functional monitoring is necessary for these switching devices, among others. For this purpose, the switching devices must be equipped with positively-driven auxiliary contacts. The contacts to be monitored are connected in series and are closed when in idle state.



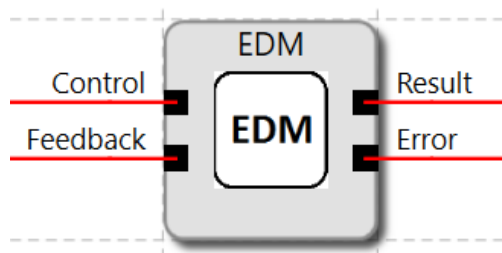
Parameters



Parameter	Description	Range	Unit
Operating Time	Variable time slot (closing delay) for testing the safe contacts Time from the beginning of the current flow to the successful contact closing	4..1000	[ms]
Releasing Time	Variable time slot (release delay) for testing the safe contacts Time from the disabling of the current flow to the successful contact releasing	4..1000	[ms]

Comment	Input possibility for an application-related comment
Name	Input possibility for an application-specific name

Control signals



Control	Enable signal for the EDM monitoring
Feedback	Feedback loop signal of positively-driven auxiliary contacts of the external switching being monitored
Result	Result of the EDM (Enable signal for the output) 0: EDM output is not active 1: EDM output is active
Error	Status of the EDM 0: EDM is OK 1: EDM has detected a failure



INFORMATION

- ➡ Adjacent feedback loops of the safety module should be assigned different pulses (pulse 1 / pulse 2) to ensure safe monitoring of cross circuit or external voltage.
- ➡ The result of the EDM function can be further processed via logic elements in the user application program.

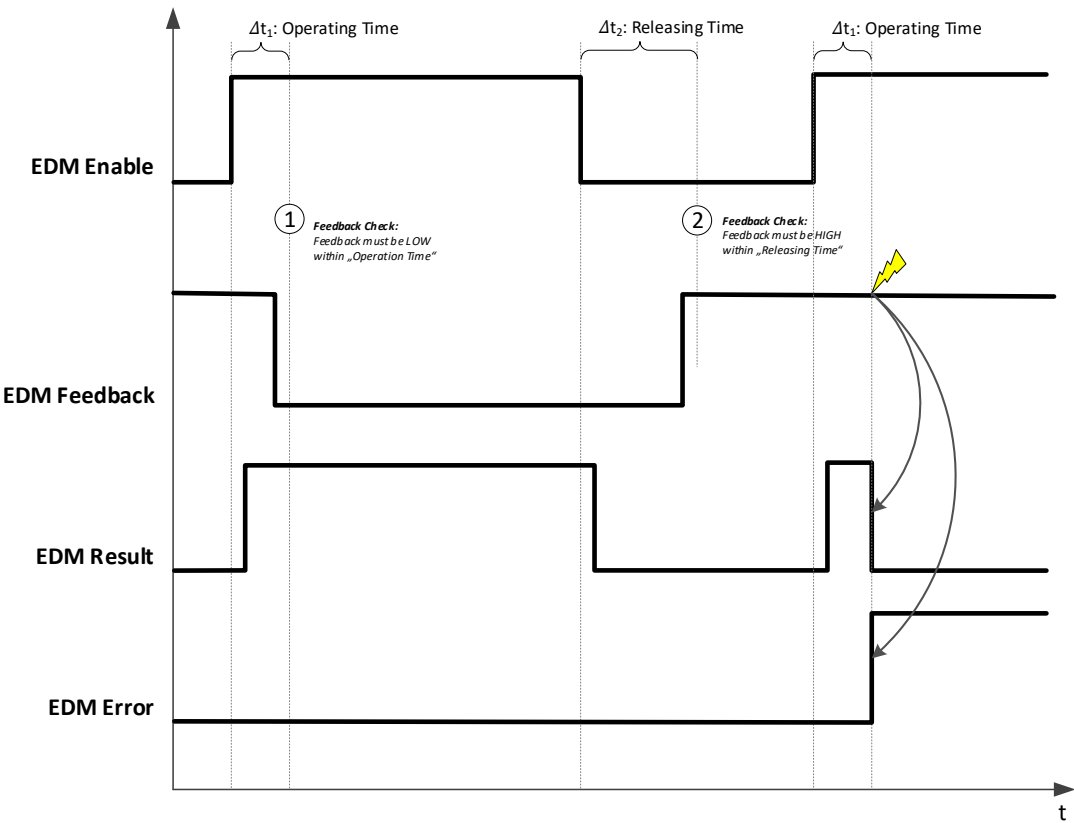
RESET-Function

A fault state of the EDM function is saved and requires a RESET acknowledgement.

Logic Table

Control	Feedback	Result	Error
0	0	0	1
0	1	0	0
1	0	1	0
1	1	0	1

Chart



9-3-4 Muting Functions

Function name	Description	Number of blocks for MINAS system
ECS – Encoder Control Supervisor	Muting and status output for diagnostic functions of the speed and position sensors	1
ICS – Input Element Muting	Muting and status output for diagnoses for digital inputs	1

9-3-4-1 ECS (Encoder Control Supervisor)

Icon



Functional Description

The ECS function muted alarm messages concerning the encoder interface and signals this by changing its output from “1” to “0”.

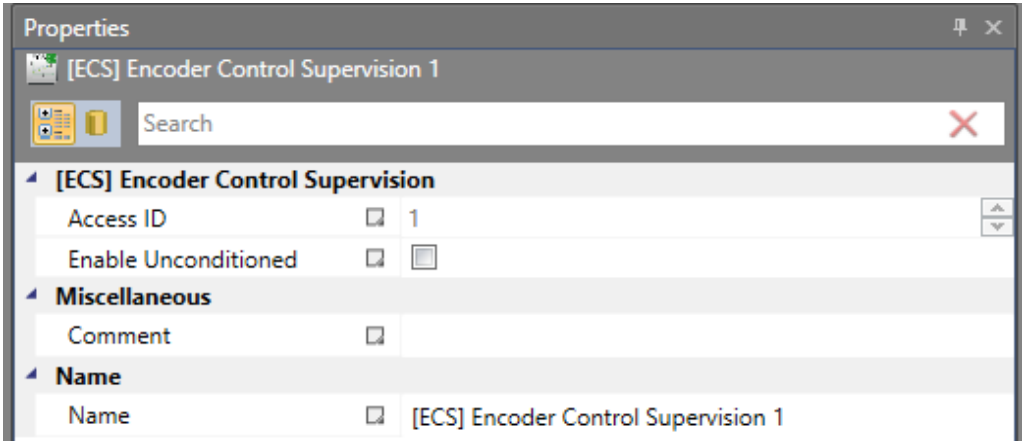
The detection of safe speed and position is based on a number of measures and different error responses in the form of alarm messages. Without using the ECS function, the operating system switches from RUN to ALARM state as soon as a speed or position error is detected, or an error is detected in the encoder system. As a result, all outputs of the operating system are blocked immediately.

This change from RUN to ALARM is suppressed by including the ECS function in the function block diagram. The operating system then remains in RUN state despite the alarm message. In this case, the ECS output changes from “1” to “0”. This state has now to be evaluated in the PLC program and measures have to be taken to prevent hazardous states in the application.

**WARNING**

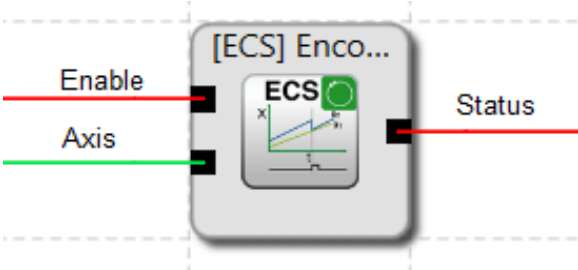
- ➔ This function can significantly affect the safety of an application. It must be ensured that the use of the ECS function does not lead to safety-critical situations!
- ➔ The State of the ECS function has to be evaluated in the user program and measures have to be taken to prevent hazardous states in the application.
- ➔ The ECS function is treated like a supervision function and enables the error muting after the PLC processing has run at least once. Encoder errors that occur during power-on may not be muted at first; the muting gets active after the first Alarm Reset.

Parameters



Parameter	Description	Unit/Range
Access ID	The access ID is used to identify the function element in the application program. This ID can be used only once.	Available number of ECS block
Enable Unconditioned	If this option is ticked, the monitoring function is permanently active and does not have an input connector.	Checked Unchecked
Comment	Input possibility for an application-related comment	
Name	Input possibility for an application-specific name	

Control signals



Axis	Input signal to assign the axis to be monitored
Enable	Input signal to activate the function
Status	Output signal to indicate the status of the function. The status is high as long as the ECS did not detect a fault After a fault the status signal is pulled to zero and remains zero until the alarm is cleared and the function is reset using the reset acknowledgement.

RESET-Function

The ECS function is automatically reset, when the encoder alarm message is cleared by using the RESET acknowledgement.

Logic
Table

Enable	Condition	Status
0	Initial	1
1	No encoder alarm	1
1	Encoder alarm is detected	0 (Muting is active, system remains in RUN and alarm message is displayed with prefix "E")



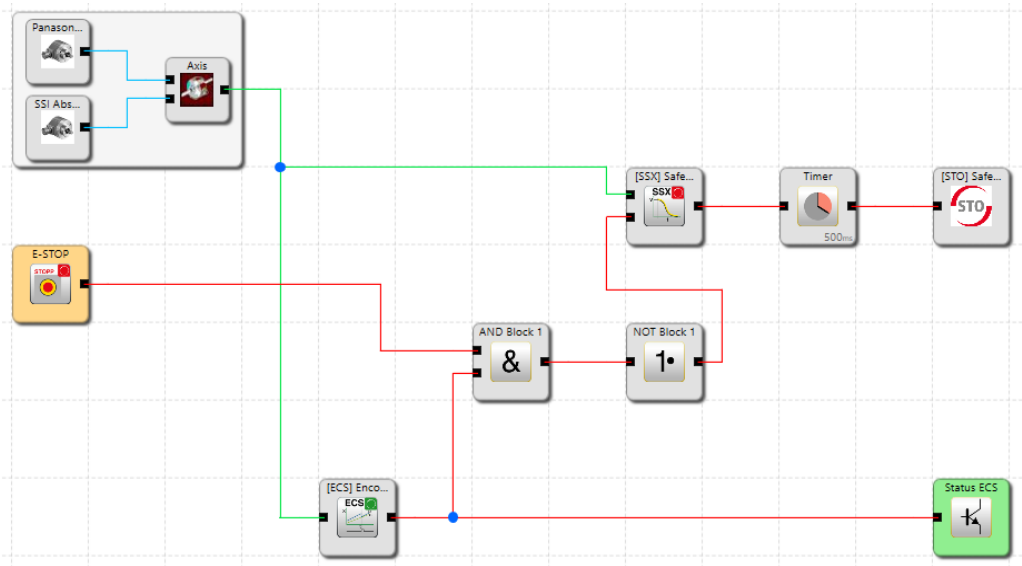
INFORMATION

Alarms which can be muted using the ECS muting function are listed with “ECS” in the alarm list (See chapter 11, Appendix B - Error list)

**Input
example**

On a production station, a trolley is using an absolute linear encoder (laser) in combination with an incremental encoder for position processing. Encoder errors due external influence (e.g. dirt, drift...) must not lead to an immediate switch-off of the operating system. Else, the load might drift or fall from the trolley because of high deceleration values.

To prevent this, the ECS function is inserted in the application program and its state is combined with standstill via the SSX function. Possible encoder alarm messages are suppressed. A status change of the ECS function from “1” to “0” leads to a controlled standstill of the machine.



9-3-4-2 ICS (Input Element Muting)

Icon



Functional Description

The ICS function muted alarm messages concerning the input interface and signals this by changing its output from “1” to “0”.

The correct wiring of the digital inputs is monitored by various diagnostic measures. A detected fault in the circuit, such as:

- Cross-wiring between two inputs
- Wrong pulse assignment
- Exceeding of switching times for time-monitored inputs

triggers an alarm.

Alarms switch off the outputs in standard mode and safely hold the module in ALARM state. These alarms can also be triggered by detected errors concerning the digital inputs. As a result, all outputs of the operating system are blocked immediately.

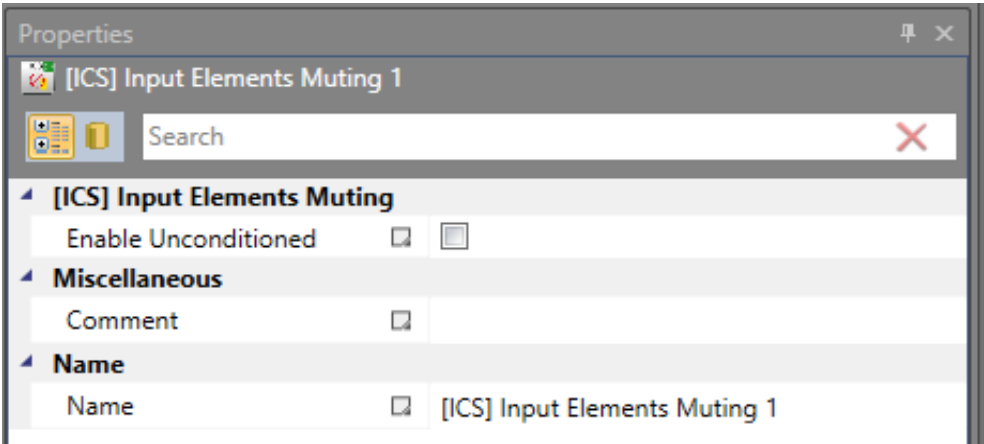
This change from RUN to ALARM is suppressed by including the ICS function in the function block diagram. The operating system then remains in RUN state despite the alarm message of the input interface. In this case, the ICS output changes from “1” to “0” and the corresponding state of the faulty input is set to “0”. This state has now to be evaluated in the PLC program and measures have to be taken to prevent hazardous states in the application.



WARNING

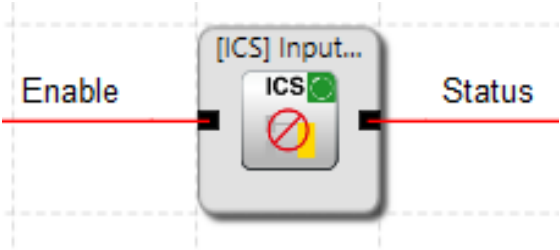
- ➞ This function can significantly affect the safety of an application. It must be ensured that the use of the ICS function does not lead to safety-critical situations!
- ➞ The State of the ICS function has to be evaluated in the user program and measures have to be taken to prevent hazardous states in the application.
- ➞ No safety-relevant functions are to be evaluated with a faulty input that can be misinterpreted by the setting of the input state to “0” during the muting process.

Parameters



Parameter	Description	Unit/Range
Enable Unconditioned	If this option is ticked, the monitoring function is permanently active and does not have an input connector.	Checked Unchecked
Comment	Input possibility for an application-related comment	
Name	Input possibility for an application-specific name	

Control signals



Enable	Input signal to activate the function
Status	Output signal to indicate the status of the function. The status is high as long as the ICS did not detect a fault. After a fault the status signal is pulled to zero and remains zero until the alarm is cleared and the function is reset using the reset acknowledgement.

RESET-Function

The ICS function is automatically reset, when the alarm message is cleared by using the RESET acknowledgement.

Logic
Table

Enable	Condition	Status
0	Initial	1
1	No input alarm	1
1	Input alarm is detected	0 (Muting is active, system remains in RUN and alarm message is displayed with prefix "E")



INFORMATION

Detected alarms are displayed with the prefix “E” followed by the same reference number as under normal circumstances.

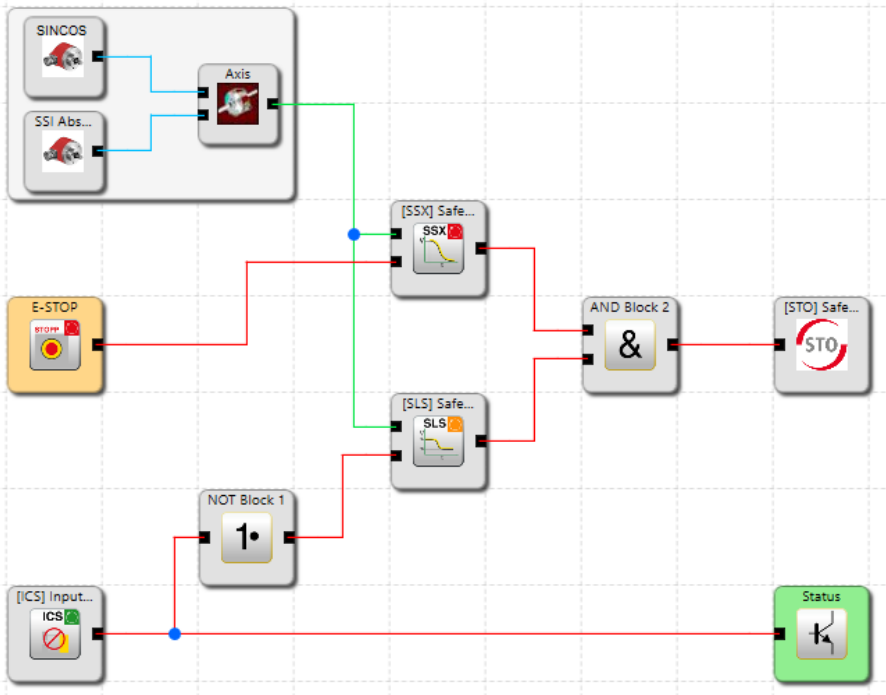
The state of the faulty input is forced to “0”.

Alarms which can be muted using the ICS muting function are listed with “ICS” in the alarm list (See chapter 11, Appendix B - Error list)

Input
example

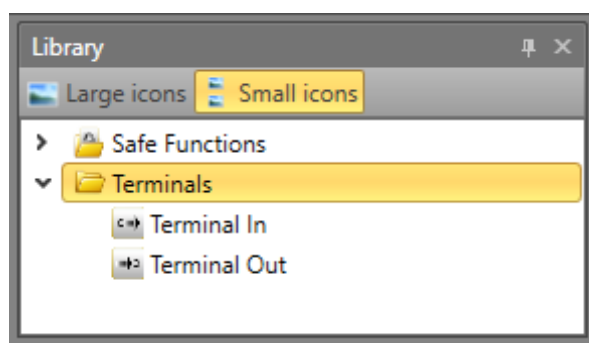
The movement of a foundry crane must continue to be possible (at reduced speed) during the casting process, when an alarm occurs, otherwise significant damage to the crucible or even danger to persons may occur.

For this purpose, the ICS function is inserted in the application program, so that alarm messages which are related to the input interface can be muted and a movement of the crane at reduced speed is possible via manual control.



9-3-5 Terminals

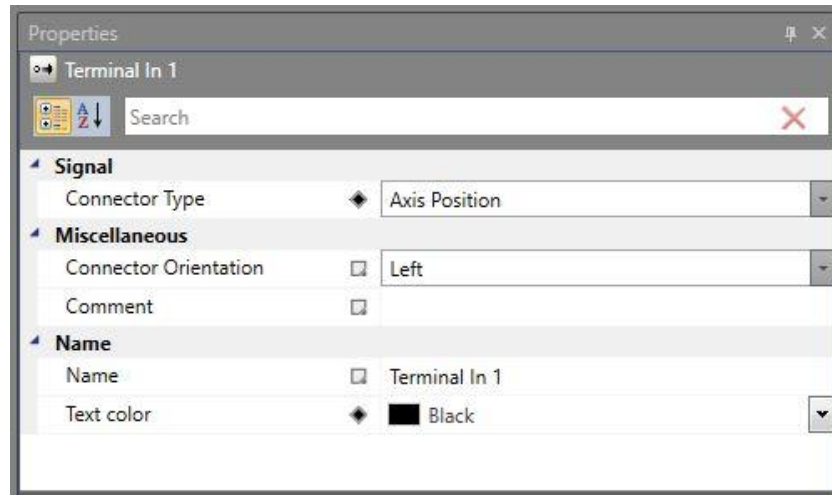
These elements are used for a clear representation in the Functional Scheme. These elements provide "connection points for outputs / inputs", allowing for connections between the elements to be drawn.



9-3-5-1 Terminal In



These elements provide connection points for outputs. The reference numbers of the connection points are generated automatically. If a "connection point input" is selected, the corresponding "connection point output" is also marked. If the input has been selected with the corresponding number, the output with the corresponding number can be added. If you want to use the connection point several times, you can simply drag it from the browser window into the Functional Scheme.



Parameter:

Signal

Connection type

The connector type can be selected here: i.e. digital signal, axis signal, etc.
This type is automatically assigned when connecting to an output point.

Miscellaneous

Connection orientation

Setting the element connection point (Top, Bottom, Left, Right)

Comment

Input possibility for an application-related comment.

Name

Name

Input for an application-specific name.

Text colour

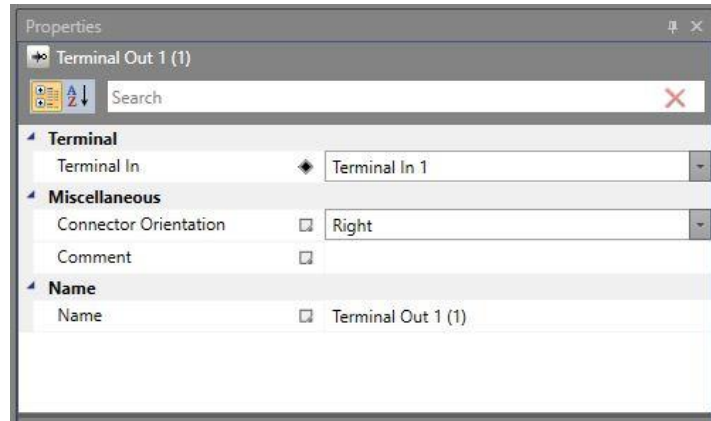
Text colour selection for the element.

Note: When deleting a "connection point input" which already has a reference to a "connection point output", the user is informed with the following message. "Are you sure you want to delete the following points?" Here you will have to ensure that "connection point output" elements are also deleted.

A compiler error will occur in the case of a non-referenced "connection point input" whereby the corresponding "connection point output" is not used and is connected to an additional element.

9-3-5-2 Terminal Out

This element allows the further use of a signal that is already connected to a block "connection point input". These elements can only be inserted after at least one "connection point input" has been defined.



Parameter:

Terminal

Connection point input

Selection of the signal that is to be passed on from the "connection point output".

Miscellaneous

Connection orientation

Setting the connection point of the element (Top, Bottom, Left, Right)

Comment

Input possibility for an application-related comment.

Name

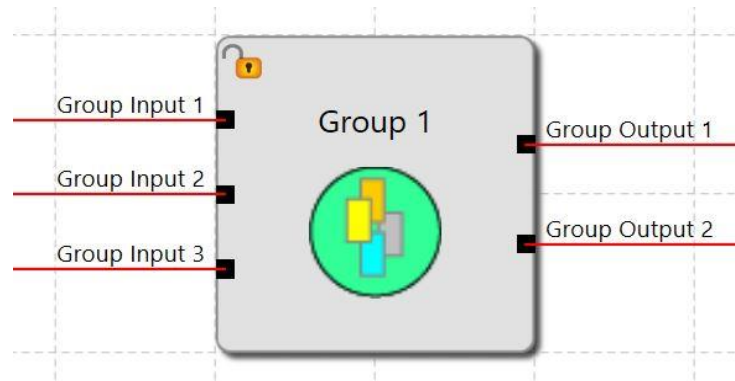
Name

Input for an application-specific name.

Note: Because this element refers to the selected point, the comment for this item will be shown.

9-3-6 Groups

A group can have a variety of function blocks and logic links, allowing selection for more complex functionalities into a group.



This grouping also gives the Functional Scheme a clearer overview and allows you to create your own function library via the export / import function.

9-3-6-1 Create Group

➤ Building group block

Create function group

The library window contains an element "groups" where you can add a new group with the element "new group" . Just drag the "New Group" icon from the Library window and paste it into the workspace of the Functional Scheme. The created group does not yet have an input / output interface.

Creating a function group from a pre-programmed functionality in the capability map

The scope of the area to be selected can be set with the mouse pointer:

- Use the left mouse button to position the mouse pointer at any position and hold down the mouse button.
- Then drag the mouse pointer with the left mouse button in the desired direction. Anything that has been marked after releasing the mouse button as described in point 3. Describing how to add a new group.
- Right-click the selection and create a new group with "Create a new group from the selection". The group that has now been created can be opened by double-clicking on its "Group" tab for editing.

The block types, which cannot be contained in a group, are filtered out. A message displays the filtered blocks.

➤ **Adding function blocks to the group**

The group workspace can be selected by double-clicking on the group. In this area, function blocks can be inserted, moved or deleted. The blocks are automatically inserted in the group; unless the group has been blocked function blocks can be added or deleted to the range of the group frame.

Note: In the group, only logic and monitoring modules can be inserted. Input and output elements and default elements such as signal list, analogue modules, or axis are not allowed.
For elements with existing connections, it is possible that a connection with the gradual shift of selection from the group box protrudes; in this case the connection will be automatically deleted.

The following block types cannot be contained in a group. They are filtered out when the modules are moved into the frame area.

- Input modules
- Output modules
- All function blocks, which are pre-set in the capability map (E.g. axes, analogue modules, E/A)
- Network and field bus elements

The maximum number of blocks is defined by the sheet size.

Right-clicking on the group displays the export to the library function.

➤ **Adding an input / output interface**

You can add a module for a group interface by dragging a group input / output from the group interface library and dragging it to the corresponding group element (or in the group in the Functional Scheme). After you add a module to one group, the group interface is added.
 For more information, see the chapter "Group Interface".

➤ **Create connections**

See chapter "Wiring".

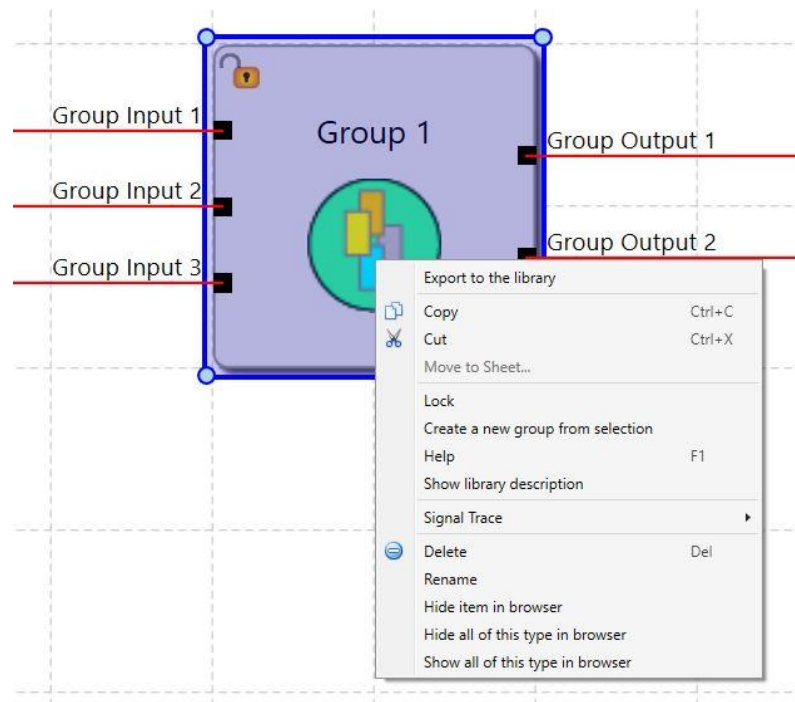
➤ **Connecting the group interface**

The function blocks in a group can only be connected to the function elements outside the group frame via the interface modules described above. The connection type can be selected arbitrarily in the interface, but the same connection constellation is necessary when importing the group into another function block diagram. The interface blocks allow a description of the input and output of the function group. The description should be documented in the commentary.

Tips:

- The group (s) should remain as far as possible in the activated state.
- Activate as few groups as possible in the Functional Scheme.
- Do not move groups in the function chart.
- If possible, edit only one group in the function block diagram.
- Disable groups before saving.
- Make connections as late as possible.

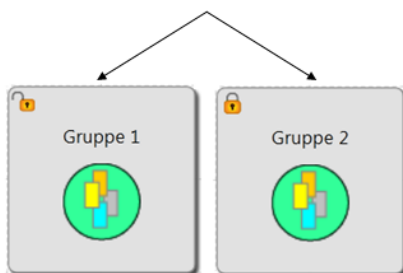
9-3-6-2 Setting the group management



If you right-click on the group, the context menu with the function for blocking appears. This function deactivates the block management of the frame and the blocks are permanently connected to the group:

- Modules can no longer be deleted from the group, but the configuration of the parameters is still permissible.
- If a group frame is deleted, all group blocks are also deleted.
- No new building blocks can be added to the group.

The group status "locked" is indicated by the lock symbol in the group block in the upper left corner.



Group locked / unlocked

If a new group is added, it is not initially blocked.

9-3-6-3 Export/import group

Right-clicking on the group displays the "Export to Library". The created group can be exported to the user group library. An exported group can be dragged to another function pane. This allows you to create a library of predefined function groups, which can then be used in new projects. The group cannot be renamed in the Library window. The user has the option to change the image of the exported groups.

The insert includes verification of the sensor configuration and existing resources in the Functional Scheme. The group can only be inserted if the resources are available for all modules. The necessary sensor settings must be checked, especially with position-dependent monitoring modules. If a resource is no longer available, an error message appears.

In case of resource errors, make sure that the sensor settings match the requirements of the group especially when position-dependent modules have been used in the function groups (SEL, SLP, SCA).

9-3-6-4 Group interface

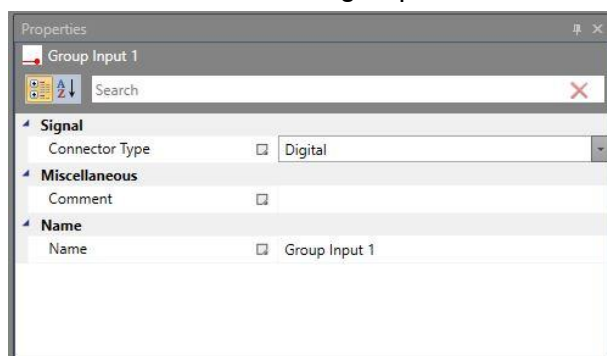
The blocks of the group interface represent the interface of the function group to the elements outside the group. Connections to function blocks outside the group can only be made via the group interface. You can add a module for a group interface by dragging a group input / output from the group interface library and inserting it into the corresponding group module (or in the group in the Functional Scheme). After you add a module to one group, the group interface is added. The connection type can be arbitrarily selected in the interface elements.

Connection type: This option can be used to set elements of the group inputs and group outputs and to avoid unauthorized assignments.

Example: The axis of the connection type is connected to the module of the group interface. In the user mode, the group modules must always be connected with the same connection type.

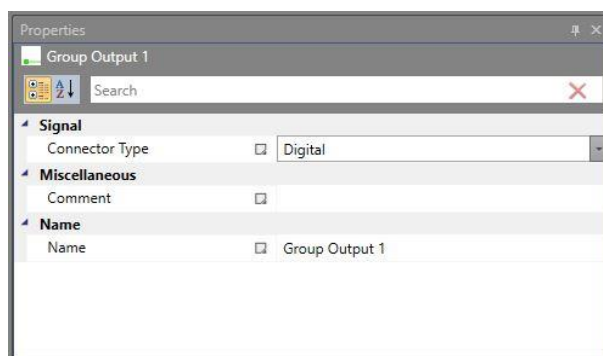
Group input

—● This element connects the function blocks outside the group with external group elements. If possible, the block should be on the left side of the group area.



Group output

●— This symbol is used to transfer a result from the group to external elements of the function module language.



Input / output modules can only be deleted in the group sheet.

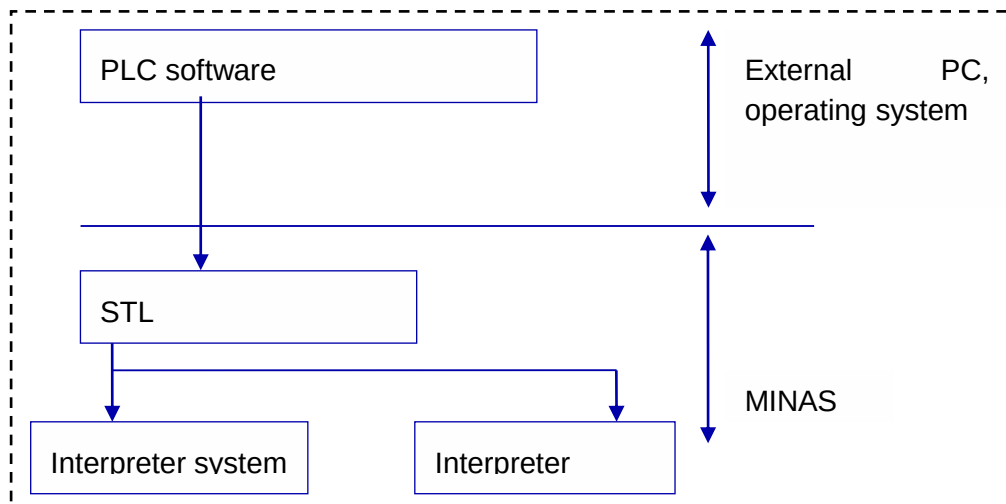
10. Appendix A

10-1 Process diagram

10-1-1 Introduction

The MINAS system is able to execute the interpreter code stored in the block with the PLC function in real time.

With external non-safety-relevant PLC software (**PanatermForSafety**), a program according to IEC 61131 can be created, compiled and stored in the **STL** format in the display of the function blocks. With the same program, the **STL** statements are added to the configuration data and the data are transferred to the MINAS system.



The user must prove the correct assignment of inputs and outputs as part of the safety documentation (validation report).

The STL CODE is executed by both systems in each cycle. For this purpose, the input variables used in the program are connected according to the interpreter code. The result of the interpreter pass is obtained by:

- Set / delete one or more variables in the original process image
- Activation / deactivation of monitoring functions
- Setting / Deleting Outputs
- Setting / deleting flags
- Start and stop timers

The compiler-generated STL code must be verified during the validation process. Exceptions are the so-called MACRO-functions, which are checked internally by the system via 2 channels. In the MACRO function, only the connection of the inputs must be verified. MACRO-functions refer, for example, to a two-hand operation.

10-1-2 Description of functional elements

The following description is necessary to perform the application validation.

10-1-2-1 PLC commands

The following list contains all commands used in the MINAS system:

Operator	Operand	Description
LD	All operands of the inputs / outputs	Corresponds to the actual result with the operand
LD NOT	All operands of the inputs / outputs	Corresponds to the current operand and returns the operand
ST	Only operands of the outputs	Stores the current result in the address of the operands
AND	All operands of the inputs / outputs	Boolean AND
AND NOT	All operands of the inputs / outputs	Negated Boolean AND
OR	All operands of the inputs / outputs	Boolean OR
OR NOT	All operands of the inputs / outputs	Negated Boolean OR
XOR	All operands of the inputs / outputs	Boolean exclusive OR
EMERGENCY	All operands of the inputs / outputs	Reverses the accumulated value
SET MARKER	PLC_MARKER in the output image	Sets a flag
RESET MARKER	PLC_MARKER in the output image	Resets a flag
SET	All operands of the inputs / outputs	Sets the operand to 1
RESET	All operands of the inputs / outputs	Sets the operand to 0
MACRO_INFO	Description of the macro element	Operand field: 2 bytes for macro identification
MACRO_CRC	CRC of the previous macro field	Operand field: 1. Operand CRC_LO (8 bits) 2. Operand CRC_HI (8 bits)
INFO	Info field	Operand field: 1. Operand Free reserved! 2. Operand Free reserved!

10-1-2-2 Input variables in function block diagram

Note: The output values of the monitoring functions must be considered as inputs in the process image!

○ Process Image Input (PII) **TBD**

Idx	Name	Description	Size [Bit]	Count	Full Size [Byte]	Offset [Byte]
1	DriveSSX	SSX Result	1	2	1	20
2	DriveSLS	SLS Result	1	8	1	21
3	DriveSOS	SOS Result	1	8	1	22
4	Drive SDI	SDI Result	1	4	1	23
5	DriveSLI	SLI Result	1	4	1	24
6	DriveSLA	SLA Result	1	4	1	25
7	DriveSEL	SEL Result	1	4	1	26
8	DriveSLP	SLP Result	1	4	1	27
9	DriveSCA	SCA Result	1	16	2	28
10	DriveEOS	EOS Result	1	1	1	30
11	DriveSRS	SRS Result	4	1	1	31
12	DriveSRX	SRX Result	2	1	1	32
13	DriveSAC	SAC Result	1	8	1	33
14	DriveSMT	SMT Result	1	8	1	34
15	DriveSLT	SLT Result	1	8	1	35
16	DriveSTR	STR Result	1	8	1	36
17	DriveEDM	EDM Result	1	4	1	37
18	DriveECS	ECS Result	1	1	1	38
19	DriveICS	ICS Result	1	1	1	39
20	DriveACS	ACS Result	1	2	1	40
21	Align1	Reserved	1	1	1	41
22	SIN	Safe Digital Input	1	10	2	42
23	DriveTimer	PLC Timer	1	64	8	44
24	FunctionalInput	Functional Inputs	1	32	4	52
25	F-Bus	F-Bus Safe Inputs	1	32	4	56
26	SMMC State	Not used Safe Master Master Status	2	8	2	60
27	SMMC Inputs	Not used Safe Master-Master Image	16	8	16	62
28	IET	Input Element Timer	1	8	1	78
29	IES	Input Element Start	1	8	1	79
30	IE2	Input Element Two Hand	1	8	1	80
31	Align2	Reserved	8	3	3	81
					64	84

○ **Process Image Data (PID)**

Idx	Name	Description	Size [Bit]	Count	Full Size [Byte]	Offset [Byte]
1	Position	System Position	32	1	4	152
2	Speed	System Speed	32	1	4	156
3	Acceleration	System Acceleration	16	2	4	160
3	Analog In Channel 1	Analog Input value	16	1	2	164
4	Analog In Channel 2	Analog Input value	16	1	2	166
					16	168

10-2 PLC processing

10-2-1 PLC syntax

The PLC program is CRC-protected and part of the MINAS configuration data. Each PLC command is structurally structured as follows:

Syntax of the list entry:

Size of the list entry = 4 bytes

Byte index	0	1	2	3
Assignment	PLC command	Byte address of the operand	Bit address	Count down 0..255

10-2-2 PLC commands

Operator	Operand	OPCODE	Description
LD	All operands of the inputs / outputs	02	Corresponds to the actual result with the operand
LD NOT	All operands of the inputs / outputs	04	Corresponds to the current operand and returns the operand
ST	Only operands of the outputs	06	Stores the current result in the address of the operands
AND	All operands of the inputs / outputs	08	Boolean AND
AND NOT	All operands of the inputs / outputs	10	Negated Boolean AND
OR	All operands of the inputs / outputs	12	Boolean OR
OR NOT	All operands of the inputs / outputs	14	Negated Boolean OR
XOR	All operands of the inputs / outputs	16	Boolean exclusive OR
EMERGENCY	All operands of the inputs / outputs	18	Reverses the accumulated value
SET MARKER	PLC_MARKER in the output image	20	Sets a flag
RESET MARKER	PLC_MARKER in the output image	22	Resets a flag
SET	All operands of the inputs / outputs	24	Sets the operand to 1
RESET	All operands of the inputs / outputs	26	Sets the operand to 0
MACRO_INFO	Description of the macro element	28	Operand field: 2 bytes for macro identification
MACRO_CRC	CRC of the previous macro field	30	Operand field: 1. Operand CRC_LO (8 bits) 2. Operand CRC_HI (8 bits)
INFO	Info field	32	Operand field: 1. Operand Free reserved! 2. Operand Free reserved!

10-2-3 PLC elements (I / O)

The input and output elements of the PLC are described in the document "TS-37350-340-02 PLC Switch Modes"!

10-2-3-1 Input elements

E/A	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	n/a
TwoHand_2S	n/a
Mode_1S1O	13
Mode_3Switch	14

10-2-3-2 Output elements

E/A	Type
SDO1A	H
SDO1B	H
SDO2A	H
SDO2B	H
BRKO1	H
BRKO1-	L
BRKO2	H
BRKO2-	L
STO1	H
STO2	H

10-2-4 PLC output variables

Output variables for the PLC system are identified by:

- Connection to the system image of the MINAS system
- The uniquely determined address (byte index in the system image, bit index in the system image entry).
- PAEOFFS = size of segment **PIO = 68**
- By the 1-bit value of the input variables (TRUE or UNTRUE)

○ **Process Image Output (PIO) TBD**

Idx	Name	Description	Size [Bit]	Count	Full Size [Byte]	Offset [Byte]
1	EnableSSX	SSX Enable	1	2	1	84
2	EnableSLS	SLS	1	8	1	85
3	EnableSOS	SOS	1	8	1	86
4	EnableSDI	SDI	1	4	1	87
5	EnableSLI	SLI	1	4	1	88
6	EnableSLA	SLA	1	4	1	89
7	EnableSEL	SEL	1	4	1	90
8	EnableSLP	SLP	1	4	1	91
9	EnableSCA	SCA	1	16	2	92
10	EnableEOS	EOS	1	1	1	94
11	EnableSRS	SRS	2	1	1	95
12	EnableSRX	SRX	4	1	1	96
13	EnableSAC	SAC	1	4	1	97
14	EnableSMT	SMT	1	4	1	98
15	EnableSLT	SLT	1	4	1	99
16	EnableSTR	STR	1	4	1	100
17	EnableEDM	EDM	2	4	1	101
18	EnableECS	ECS	1	1	1	102
19	EnableICS	ICS	1	1	1	103
20	EnableACS	ACS	1	1	1	104
21	SDO	Safe Digital Output	1	2	1	105
22	STO	Safe Torque Off	1	1	1	106
23	SBC	Safe Break Output	1	2	1	107
24	EnableTimer	PLC Timer Enable	1	64	8	108
25	Functional Output	Functional Output	1	32	4	116
26	F-Bus	Safe Bus Output	1	32	4	120
27	SMMC Output	Not used Safe Master-Master Output	16	1	2	124
28	EnableIET	Enable Input Element Timer	2	8	2	126
29	EnableIES	Enable Input Element Start	2	8	2	128
30	EnableIE2	Enable Input Element Two Hand	2	8	2	130
31	AmplInfo	Amplifier Functional Information	1	8	1	132
32	Align	Alignment	3	8	3	133
31	MX	MX	1	128	16	136
					68	152

10-2-5 PLC processing elements

PLC flags can be set or reset via the "S" or "R" commands. PLC flags are part of the outputs in the process image. The user can only address the memory via the macro "RS flip flop".

10-2-5-1 PLC Timer

The runtime system of PLC processing provides a total of 8 PLC timers. These have the following characteristics:

- Generation of time events 1... 1 073 741 820 ms
- Down counter limited to NULL, starts with a configured output value (part of the configuration data)
- In the system image the timers use only 2 bits for ACTIVATION and RESULT (TRUE = time elapsed, i.e. internal value at NULL). Start the timer by setting ACTIVATION. ACTIVATION = UNTRUE Resetting the timer to the output value (output value = UNTRUE).

ACTIVATION	Timer	Output value	Activity
NOT TRUE	Output value of the configuration	UNTRUE	Counter inactive
TRUE	1... OUTPUT VALUE	UNTRUE	Counter active
TRUE	ZERO	TRUE	Counter inactive

PLC timer - ACTIVATION can only be started or deactivated using the "ST" command. The release and status of the timers are part of the process image. The output values of the timers are stored in the PLC configuration data segment.

10-2-6 PLC processing list

The PLC processing list consists of a header and a linear list of individual PLC statements, which consist of an operator and operands in the format according to 10.2.1.

Content	Index	Content	Description
Header	0	ID_PLC	Description of the PLC list
	2	CRC	CRC over the structure
	4	date1	Date of creation / modification
	6	Date2	
	8	PLC_Len	Number of STL statements
	10	free	
	12	free	
	14	free	
PLC timer	16	Timer 1	Time events from 1 Tcyc to 3,999,999 Tcyc Each timer takes 4 bytes
	.....		
	44	Timer 8	
Reserve	48	free	
	50	free	
	52	free	
	54	free	
STL List	56	Instruction 1	(STL according to format section 10.2.1)
	....		
	48 + (PLC_Len*4) – 4	Instruction no. PLC_Len	
Reserve	1056	free	
	1058	free	

10-2-7 Allocation of resources

Element	On	Off	No. MX	ON/OFF Process image	PLC code	No. STL
AND2	2	1	1	0	LD x1.y1 AND x2.y2 ST MX.z	3
						...
AND 5	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
EMERGENCY	1	1	1	0	LD x1, y1 EMERGENCY ST MX.z	3
RS-Flipflop	2	1	0	Output = 1	LD x1.y1 (source S) S Mz LD x2.y2 (source R) R Mz	4
Timer	1	1	0	Output = 1	Timer activated: LD x1.y1 ST PLCT_EN.z	2
Monitoring functions	1	1	0	Output = 1	Monitoring function activated: LD x1.y1 ST uuu_EN.z	2
Semiconductor output Simple	1	1	0	Output = 1	LD x1.y1 ST DO.x_y	2
Semiconductor output Redundant	1	2	0	Output = 2	LD x1.y1 ST DO.x_P ST DO.x_M	3

11. Appendix B – Error list

This error list is valid for firmware versions up to:

Firmware Version V0.01 Rev0.15

11-1 MDSMD error types

The MDSMD 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. Safe operation is no longer possible.	All outputs are switched off!	POR necessary
Alarm 	Functional error, caused by an external process. Both systems keep on running in a cyclical manner and fulfil all requirements of the communication interfaces.	All outputs are switched off!	Alarm cause has been resolved
Alarm Muting 	An alarm has been raised with the respective muting function active. The system remains in operational state, all outputs can be driven.	Status of the Muting Block is set to '0'	Alarm cause has been resolved

Identification of the errors in System A and System B:

- System A: odd-numbered
- System B: even-numbered

11-2 Display of the error types

The error number is displayed by selecting “Mode 1” via the 7 segment display.



(For more information, please refer to the installation manual chapter 5 “Displays and control elements”)

11-3 Alarm Muting

Several alarms can be muted using the corresponding muting function:

- 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.

11-4 Alarm list

Code	A3101 / A3102	ICS
Message	Invalid Pulse1 SDI1	
Cause	An invalid input signal was detected on the corresponding input when Pulse 1 is expected. A3101: SDI1A A3102: SDI1B	
Remedy	• Check the input wiring of the input for inverted connections • Check the input wiring for possible shortcuts • Review the Pulse configuration in your project	

Code	A3103 / A3104	ICS
Message	Invalid Pulse1 SDI2	
Cause	An invalid input signal was detected on the corresponding input when Pulse 1 is expected. A3103: SDI2A A3104: SDI2B	
Remedy	• Check the input wiring of the input for inverted connections • Check the input wiring for possible shortcuts • Review the Pulse configuration in your project	

Code	A3105 / A3106	ICS
Message	Invalid Pulse1 SDI3	
Cause	An invalid input signal was detected on the corresponding input when Pulse 1 is expected. A3105: SDI3A A3106: SDI3B	
Remedy	• Check the input wiring of the input for inverted connections • Check the input wiring for possible shortcuts • Review the Pulse configuration in your project	

Code	A3107 / A3108	ICS
Message	Invalid Pulse1 SDI4	
Cause	An invalid input signal was detected on the corresponding input when Pulse 1 is expected. A3107: SDI4A A3108: SDI4B	
Remedy	• Check the input wiring of the input for inverted connections • Check the input wiring for possible shortcuts • Review the Pulse configuration in your project	

Code	A3109 / A3110	ICS
Message	Invalid Pulse1 SDIN1	

Cause	An invalid input signal was detected on the corresponding input when Pulse 1 is expected. A3109: System A A3110: System B
Remedy	• Check the input wiring of the input for inverted connections • Check the input wiring for possible shortcuts • Review the Pulse configuration in your project

Code	A3121 / A3122	ICS
Message	Invalid Pulse2 SDI1	
Cause	An invalid input signal was detected on the corresponding input when Pulse 2 is expected. A3121: SDI1A A3122: SDI1B	
Remedy	• Check the input wiring of the input for inverted connections • Check the input wiring for possible shortcuts • Review the Pulse configuration in your project	

Code	A3123 / A3124	ICS
Message	Invalid Pulse2 SDI2	
Cause	An invalid input signal was detected on the corresponding input when Pulse 2 is expected. A3123: SDI2A A3124: SDI2B	
Remedy	• Check the input wiring of the input for inverted connections • Check the input wiring for possible shortcuts • Review the Pulse configuration in your project	

Code	A3125 / A3126	ICS
Message	Invalid Pulse2 SDI3	
Cause	An invalid input signal was detected on the corresponding input when Pulse 2 is expected. A3125: SDI3A A3126: SDI3B	
Remedy	• Check the input wiring of the input for inverted connections • Check the input wiring for possible shortcuts • Review the Pulse configuration in your project	

Code	A3127 / A3128	ICS
Message	Invalid Pulse2 SDI4	
Cause	An invalid input signal was detected on the corresponding input when Pulse 2 is expected. A3127: SDI4A A3128: SDI4B	
Remedy	• Check the input wiring of the input for inverted connections • Check the input wiring for possible shortcuts • Review the Pulse configuration in your project	

Code	A3129 / A3130	ICS
Message	Invalid Pulse2 SDIN1	
Cause	An invalid input signal was detected on the corresponding input when Pulse 2 is expected.	
Remedy	• Check the input wiring of the input for inverted connections • Check the input wiring for possible shortcuts • Review the Pulse configuration in your project	

Code	A3141 / A3142	ICS
Message	Active Input Signal on SDI1	
Cause	The corresponding input is not configured but a signal has been detected. A3141: SDI1A A3142: SDI1B	
Remedy	• Check the input wiring of the input for inverted connections • Check the input wiring for possible shortcuts • Review the Input configuration in your project	

Code	A3143 / A3144	ICS
Message	Active Input Signal on SDI2	
Cause	The corresponding input is not configured but a signal has been detected. A3143: SDI2A A3144: SDI2B	
Remedy	• Check the input wiring of the input for inverted connections • Check the input wiring for possible shortcuts • Review the Input configuration in your project	

Code	A3145 / A3146	ICS
Message	Active Input Signal on SDI3	
Cause	The corresponding input is not configured but a signal has been detected. A3145: SDI3A A3146: SDI3B	
Remedy	• Check the input wiring of the input for inverted connections • Check the input wiring for possible shortcuts • Review the Input configuration in your project	

Code	A3147 / A3148	ICS
Message	Active Input Signal on SDI4	
Cause	The corresponding input is not configured but a signal has been detected. A3147: SDI4A A3148: SDI4B	
Remedy	• Check the input wiring of the input for inverted connections • Check the input wiring for possible shortcuts • Review the Input configuration in your project	

Code	A3149 / A3150	ICS
Message	Active Input Signal on SDIN1	

Cause	The corresponding input is not configured but a signal has been detected. A3149: System A A3150: System B
Remedy	• Check the input wiring of the input for inverted connections • Check the input wiring for possible shortcuts • Review the Input configuration in your project

Code	A3241 / A3242	ECS
Message	Encoder supply voltage out of range (too low)	
Cause	The encoder supply voltage does not match the configuration setting.	
Remedy	• Check the encoder wiring • Check the pinning of the encoder connector for possible shortcuts • Power Cycle the device • Replace the MDSMD device	

Code	A3243 / A3244	ECS
Message	Encoder supply voltage out of range (too high)	
Cause	The encoder supply voltage does not match the configuration setting.	
Remedy	• Check the encoder wiring • Check the pinning of the encoder connector for possible shortcuts • Power Cycle the device • Replace the MDSMD device	

Code	A3301 / A3302	ECS
Message	Speed difference	
Cause	The difference between the measured speeds in both MPUs is greater than the configured threshold.	
Remedy	• Make sure the configuration of the axis in your project matches the actual track • Make sure the resolution of both encoders (if applicable) matches the actual track conditions • Correct the maximum speed difference threshold • Check the encoder wiring and connection • Check the mechanical connection of both encoders (if applicable) to the shaft	

Code	A3303 / A3304	ECS
Message	Position difference	
Cause	The difference between the calculated position in both MPUs is greater than the configured threshold	
Remedy	• Make sure the configuration of the axis in your project matches the actual track • Make sure the resolution of both encoders (if applicable) matches the actual track conditions • Correct the maximum position threshold • Check the encoder wiring and connection • Check the mechanical connection of both encoders (if applicable) to the shaft	

Code	A3307 / A3308	ECS
Message	Position exceeds measure limit	
Cause	The calculated position exceeded its limits. It is either below 0 or above the configured measuring section maximum.	
Remedy	• Make sure the configuration of the axis in your project matches the actual track • Make sure the resolution of both encoders (if applicable) matches the actual track conditions • Reference the axis to the physical position using the SREF function • Check the SREF configuration and the external reference marker to match the physical position	

Code	A3309 / A3310	ECS
Message	Speed exceeds maximum	
Cause	The measured speed exceeds the configured limit of the axis configuration.	
Remedy	• Make sure the configuration of the axis in your project matches the actual track • Check the resolution of your encoder(s) to correctly reflect the gear ratio (if applicable) • Review the theoretical maximum speed of your drive and adjust the configuration setting accordingly	

Code	A3311 / A3312	ECS
Message	Encoder raw value difference	
Cause	The encoder raw value comparison for the safe digital encoder exceeds the maximum allowed difference according to the safety integration manual.	
Remedy	• Check the mounting of your encoder to comply with the encoder installation / operational manual. • Check the mechanical bearings of the encoder (for encoders without integral bearings) • Replace the encoder	

Code	A3313 / A3314	ECS
Message	Invalid encoder values in NVRAM	
Cause	The restored encoder position from the internal NVRAM is invalid. The position has never been stored before or the last previous write cycle was invalid or incomplete. A hardware defect will return invalid data upon reading after power on.	
Remedy	• Reset the alarm; the encoder position is stored every cycle if the device is in an operational state (4 or E) • Power cycle • Replace the device if the alarm occurrence accumulates	

Code	A3315 / A3316	ECS
Message	Actual Position below minimum	
Cause	The EVC position compare failed because the actual encoder position exceeds the lower bound of the drive's command position. This indicates that the physical encoder movement does not follow the drive's target position.	

Remedy	• Reduce the acceleration of the drive • Adjust the torque of the drive • Check and adjust the EVC position limit in the axis configuration

Code	A3317 / A3318	ECS
Message	Actual Position above maximum	
Cause	The EVC position compare failed because the actual encoder position exceeds the upper bound of the drive's command position. This indicates that the physical encoder movement does not follow the drive's target position.	
Remedy	• Reduce the acceleration of the drive • Adjust the torque of the drive • Check and adjust the EVC position limit in the axis configuration	

Code	A3319 / A3320	ECS
Message	Actual Velocity below minimum	
Cause	The EVC speed compare failed because the actual encoder speed exceeds the lower bound of the drive's command speed. This indicates that the physical encoder movement does not follow the drive's target speed.	
Remedy	• Reduce the acceleration of the drive • Adjust the torque of the drive • Check and adjust the EVC speed limit in the axis configuration	

Code	A3321 / A3322	ECS
Message	Actual Velocity above maximum	
Cause	The EVC speed compare failed because the actual encoder speed exceeds the upper bound of the drive's command speed. This indicates that the physical encoder movement does not follow the drive's target speed.	
Remedy	• Reduce the acceleration of the drive • Adjust the torque of the drive • Check and adjust the EVC speed limit in the axis configuration	

Code	A3323 / A3324	ECS
Message	Invalid amplifier control mode	
Cause	The control mode sent from amplifier is not supported	
Remedy	• Make sure the MDSMD and amplifier have compatible firmware versions	

Code	A3351 / A3352	ECS
Message	Communication error for UART communication with amplifier	
Cause	The UART communication between the drive and the MDSMD was invalid for more than 2 cycles.	
Remedy	• Power Cycle the device • Check the EMC requirements and guidelines • Make sure the MDSMD and amplifier have compatible firmware versions	

Code	A3353 / A3354	ECS
Message	Synchronization indication exceeded maximum duration	
Cause	The synchronization communication between the drive and the MDSMD exceeded maximum duration.	
Remedy	• Power Cycle the device • Check the synchronization duration • Make sure the MDSMD and amplifier have compatible firmware versions	

Code	A3401 / A3402	ECS
Message	SinCos amplitude below minimum	
Cause	The signal amplitude of the connected SinCos encoder was below the minimum threshold.	
Remedy	• Check the encoder wiring, connector and pinning • Make sure the configured encoder power supply is suitable for the connected encoder • Make sure the SinCos encoder signal levels from the datasheet comply with the device specification • Check the encoder signal damping at high speeds • Replace the encoder	

Code	A3403 / A3404	ECS
Message	SinCos amplitude exceeds maximum	
Cause	The signal amplitude of the connected SinCos encoder was above the maximum threshold.	
Remedy	• Check the encoder wiring, connector and pinning • Make sure the configured encoder power supply is suitable for the connected encoder • Make sure the SinCos encoder signal levels from the datasheet comply with the device specification • Replace the encoder	

Code	A3405 / A3406	ECS
Message	SinCos variance exceeds maximum	
Cause	The variance of the SinCos signal is too high, $\sin^2 + \cos^2$ is not constant.	
Remedy	• Check the encoder wiring, connector and pinning • Make sure the configured encoder power supply is suitable for the connected encoder • Make sure the SinCos encoder signal levels from the datasheet comply with the device specification • Replace the encoder	

Code	A3407 / A3408	ECS
Message	SinCos differential value (Sinus) below minimum	
Cause	The Sinus signal level of the encoder is below the minimum threshold.	

Remedy	• Check the encoder wiring, connector and pinning • Make sure the configured encoder power supply is suitable for the connected encoder • Make sure the SinCos encoder signal levels from the datasheet comply with the device specification • Replace the encoder

Code	A3409 / A3410	ECS
Message	SinCos differential value (Sinus) exceeds maximum	
Cause	The Sinus signal level of the encoder is above the maximum threshold.	
Remedy	• Check the encoder wiring, connector and pinning • Make sure the configured encoder power supply is suitable for the connected encoder • Make sure the SinCos encoder signal levels from the datasheet comply with the device specification • Replace the encoder	

Code	A3411 / A3412	ECS
Message	SinCos differential value (Cosinus) below minimum	
Cause	The Cosinus signal level of the encoder is below the minimum threshold.	
Remedy	• Check the encoder wiring, connector and pinning • Make sure the configured encoder power supply is suitable for the connected encoder • Make sure the SinCos encoder signal levels from the datasheet comply with the device specification • Replace the encoder	

Code	A3413 / A3414	ECS
Message	SinCos differential value (Cosinus) exceeds maximum	
Cause	The Cosinus signal level of the encoder is above the maximum threshold.	
Remedy	• Check the encoder wiring, connector and pinning • Make sure the configured encoder power supply is suitable for the connected encoder • Make sure the SinCos encoder signal levels from the datasheet comply with the device specification • Replace the encoder	

Code	A3415 / A3416	ECS
Message	Incremental encoder differential value A+/A- wrong	
Cause	The signal level of the incremental A signal is in an invalid range. It is not possible to determine the signal as logical high or logical low.	
Remedy	• Check the encoder wiring, especially the A+/A- wires • Make sure the configured encoder power supply is suitable for the connected encoder • Replace the encoder	

Code	A3417 / A3418	ECS
Message	Incremental encoder differential value B+/B- wrong	

Cause	The signal level of the incremental B signal is in an invalid range. It is not possible to determine the signal as logical high or logical low.
Remedy	• Check the encoder wiring, especially the B+/B- wires • Make sure the configured encoder power supply is suitable for the connected encoder • Replace the encoder

Code	A3419 / A3420	ECS
Message	Panasonic A6 SF ERR0 Bit set	
Cause	The error bit ERR0 is set inside the Panasonic encoder. This bit indicates a Multiturn Error.	
Remedy	• Refer to the encoder manual to clear the error cause • Reset the encoder error using the drive software • Make sure the external battery for Panasonic A6 is connected • Replace the encoder	

Code	A3421 / A3422	ECS
Message	Panasonic A6 BLA Bit set	
Cause	The error bit BLA is set inside the Panasonic encoder. This bit indicates a Multiturn Error.	
Remedy	• Refer to the encoder manual to clear the error cause • Reset the encoder error using the drive software • Make sure the external battery for Panasonic A6 is connected • Replace the encoder	

Code	A3423 / A3424	ECS
Message	Panasonic A6 SDE Bit set	
Cause	The error bit SDE is set inside the Panasonic encoder. This bit indicates a System Down Error.	
Remedy	• Refer to the encoder manual to clear the error cause • Reset the encoder error using the drive software • Make sure the external battery for Panasonic A6 is connected • Replace the encoder	

Code	A3425 / A3426	ECS
Message	Panasonic A6 OSE Bit set	
Cause	The error bit OSE is set inside the Panasonic encoder. This bit indicates an Overspeed Error.	
Remedy	• Refer to the encoder manual to clear the error cause • Reset the encoder error using the drive software • Make sure the external battery for Panasonic A6 is connected • Replace the encoder	

Code	A3427 / A3428	ECS
Message	Panasonic A6 MTE Bit set	
Cause	The error bit MTE is set inside the Panasonic encoder. This bit indicates a Multiturn Error.	
Remedy	• Refer to the encoder manual to clear the error cause • Reset the encoder error using the drive software • Make sure the external battery for Panasonic A6 is connected • Replace the encoder	

Code	A3429 / A3430	ECS
Message	Panasonic A6 OFE Bit set	
Cause	The error bit OFE is set inside the Panasonic encoder. This bit indicates an Overflow Error.	
Remedy	• Refer to the encoder manual to clear the error cause • Reset the encoder error using the drive software • Make sure the external battery for Panasonic A6 is connected • Replace the encoder	

Code	A3431 / A3432	ECS
Message	Panasonic A6 Position Verify failed	
Cause	Encoder position and verify position fields do not match.	
Remedy	• Check if the connected encoder supports Data ID 1 • Make sure that the drive is correctly configured for Panasonic A6 encoder • Check the encoder wiring • Replace the encoder	

Code	A3433 / A3434	ECS
Message	Panasonic A6 Invalid CF DataID	
Cause	Data ID in the encoder response frame is not equal to 1	
Remedy	• Check if the connected encoder supports Data ID 1 • Make sure that the drive is correctly configured for Panasonic A6 encoder • Check the encoder wiring • Replace the encoder	

Code	A3435 / A3436	ECS
Message	Panasonic A6 Invalid CF SyncCode	
Cause	SyncCode in the encoder response frame is not equal to 2	
Remedy	• Check if the connected encoder supports Data ID 1 • Make sure that the drive is correctly configured for Panasonic A6 encoder • Check the encoder wiring • Replace the encoder	

Code	A3437 / A3438	ECS
Message	Panasonic A6 Invalid CF Parity	
Cause	The Parity field in the encoder response frame is not equal to 1	
Remedy	• Check if the connected encoder supports Data ID 1 • Make sure that the drive is correctly configured for Panasonic A6 encoder • Check the encoder wiring • Replace the encoder	

Code	A3439 / A3440	ECS
Message	Panasonic A6 SF ERR1 Bit set	
Cause	The error bit ERR1 is set inside the Panasonic encoder. This bit indicates a Singleturn Error.	

Remedy	- Refer to the encoder manual to clear the error cause - Reset the encoder error using the drive software - Make sure the external battery for is connected - Replace the encoder

Code	A3441 / A3442	ECS
Message	Panasonic A6 SF FSA Bit set	
Cause	The encoder was moving more than 100 r/min during power on.	
Remedy	- Encoder must not move during power On - Refer to the encoder manual to clear the error cause - Reset the encoder error using the drive software	

Code	A3443 / A3444	ECS
Message	Panasonic A6 Invalid ERR1 verify data VDF2	
Cause	The verify data field does not match the inverted ERR1 bit	
Remedy	- Check if the connected encoder supports Data ID 1 - Make sure that the drive is correctly configured for Panasonic A6 encoder - Check the encoder wiring - Replace the encoder	

Code	A3445 / A3446	ECS
Message	Panasonic A6 M Code Error (MCE)	
Cause	The corresponding error bit is set in the encoder. Please refer to the encoder manual for detailed information.	
Remedy	- Refer to the encoder manual to clear the error cause - Reset the encoder error using the drive software - Power cycle	

Code	A3447 / A3448	ECS
Message	Panasonic A6 Digital Signal Error (DSE)	
Cause	The corresponding error bit is set in the encoder. Please refer to the encoder manual for detailed information.	
Remedy	- Refer to the encoder manual to clear the error cause - Reset the encoder error using the drive software - Power cycle	

Code	A3449 / A3450	ECS
Message	Panasonic A6 Interpolation Calculation Error 1 (ICE1)	
Cause	The corresponding error bit is set in the encoder. Please refer to the encoder manual for detailed information.	
Remedy	- Refer to the encoder manual to clear the error cause - Reset the encoder error using the drive software - Power cycle	

Code	A3451 / A3452	ECS
Message	Panasonic A6 Interpolation Calculation Error 2 (ICE2)	
Cause	The corresponding error bit is set in the encoder. Please refer to the encoder manual for detailed information.	
Remedy	- Refer to the encoder manual to clear the error cause - Reset the encoder error using the drive software - Power cycle	

Code	A3453 / A3454	ECS
Message	Panasonic A6 Analog Signal Error (ASE)	
Cause	The corresponding error bit is set in the encoder. Please refer to the encoder manual for detailed information.	
Remedy	- Refer to the encoder manual to clear the error cause - Reset the encoder error using the drive software - Power cycle	

Code	A3455 / A3456	ECS
Message	Panasonic A6 Clock Error (CKE)	
Cause	The corresponding error bit is set in the encoder. Please refer to the encoder manual for detailed information.	
Remedy	- Refer to the encoder manual to clear the error cause - Reset the encoder error using the drive software - Power cycle	

Code	A3457 / A3458	ECS
Message	Panasonic A6 LED Lightning Error (LLE)	
Cause	The corresponding error bit is set in the encoder. Please refer to the encoder manual for detailed information.	
Remedy	- Refer to the encoder manual to clear the error cause - Reset the encoder error using the drive software - Power cycle	

Code	A3459 / A3460	ECS
Message	Panasonic A6 Internal Data Error (IDE)	
Cause	The corresponding error bit is set in the encoder. Please refer to the encoder manual for detailed information.	
Remedy	- Refer to the encoder manual to clear the error cause - Reset the encoder error using the drive software - Power cycle	

Code	A3461 / A3462	ECS
Message	Panasonic A6 EEPROM Write Error (EWE)	
Cause	The corresponding error bit is set in the encoder. Please refer to the encoder manual for detailed information.	
Remedy	- Refer to the encoder manual to clear the error cause - Reset the encoder error using the drive software - Power cycle	

Code	A3463 / A3464	ECS
Message	Panasonic A6 EEPROM Read Error (ERE)	
Cause	The corresponding error bit is set in the encoder. Please refer to the encoder manual for detailed information.	
Remedy	- Refer to the encoder manual to clear the error cause - Reset the encoder error using the drive software - Power cycle	

Code	A3465 / A3466	ECS
Message	Panasonic Communication Counter is wrong/stucked	

Cause	The corresponding error bit is set in the encoder. Please refer to the encoder manual for detailed information.
Remedy	- Refer to the encoder manual to clear the error cause - Reset the encoder error using the drive software - Power cycle

Code	A3467 / A3468	ECS
Message	Panasonic A6 frame invalid	
Cause	The received A6 encoder data are invalid (CRC1, CRC2 or CF). Please refer to the encoder manual for detailed information.	
Remedy	- Refer to the encoder manual to clear the error cause - Reset the encoder error using the drive software - Power cycle	

Code	A3469 / A3470	ECS
Message	Panasonic A6 frame could not be erased inside FPGA	
Cause	MPU could not erase the FPGA area for A6 to force an update of the data.	
Remedy	- Power cycle - Replace device	

Code	A3471 / A3472	ECS
Message	Panasonic 3 rd party frame invalid	
Cause	The received 3 rd party encoder data are invalid (CRC or CF). Please refer to the encoder manual for detailed information.	
Remedy	- Refer to the encoder manual to clear the error cause - Reset the encoder error using the drive software - Power cycle	

Code	A3473 / A3474	ECS
Message	A6A 3rd Party CF Data ID unknown or invalid	
Cause	The Data ID returned from the encoder is invalid or not supported. Supported Data IDs are: 1, 4, 5, A, 9, B, E	
Remedy	- Make sure the connected Panasonic 3rd Party encoder is supported - Check the drive configuration to handle the connected encoder correctly - Replace the encoder	

Code	A3475 / A3476	ECS
Message	A6A 3rd Party Invalid CF SyncCode	
Cause	SyncCode in the encoder response frame is not equal to 2	
Remedy	- Make sure the connected Panasonic 3rd Party encoder is supported - Check the drive configuration to handle the connected encoder correctly - Replace the encoder	

Code	A3477 / A3478	ECS
Message	A6A 3rd Party Invalid CF Parity	
Cause	Parity in the encoder response frame is not equal to 1	

Remedy	• Make sure the connected Panasonic 3rd Party encoder is supported • Check the drive configuration to handle the connected encoder correctly • Check the encoder wiring • Replace the encoder

Code	A3479 / A3480	ECS
Message	A6A 3rd Party ALMC Battery Low Alarm (BLA)	
Cause	The corresponding error bit is set in the encoder. Please refer to the encoder manual for detailed information.	
Remedy	• Refer to the encoder manual to clear the error cause • Reset the encoder error using the drive software • Power cycle	

Code	A3481 / A3482	ECS
Message	A6A 3rd Party ALMC System Down Error (SDE)	
Cause	The corresponding error bit is set in the encoder. Please refer to the encoder manual for detailed information.	
Remedy	• Refer to the encoder manual to clear the error cause • Reset the encoder error using the drive software • Power cycle	

Code	A3483 / A3484	ECS
Message	A6A 3rd Party ALMC Multi Turn Error (MTE)	
Cause	The corresponding error bit is set in the encoder. Please refer to the encoder manual for detailed information.	
Remedy	• Refer to the encoder manual to clear the error cause • Reset the encoder error using the drive software • Power cycle	

Code	A3485 / A3486	ECS
Message	A6A 3rd Party ALMC Multi Turn Counter Overflow Error (OFE)	
Cause	The corresponding error bit is set in the encoder. Please refer to the encoder manual for detailed information.	
Remedy	• Refer to the encoder manual to clear the error cause • Reset the encoder error using the drive software • Power cycle	

Code	A3487 / A3488	ECS
Message	A6A 3rd Party ALMC Single Turn Error (STE)	
Cause	The corresponding error bit is set in the encoder. Please refer to the encoder manual for detailed information.	
Remedy	• Refer to the encoder manual to clear the error cause • Reset the encoder error using the drive software • Power cycle	

Code	A3489 / A3490	ECS
Message	A6A 3rd Party ALMC Full Absolute Status Alarm (FSA)	
Cause	The corresponding error bit is set in the encoder. Please refer to the encoder manual for detailed information.	

Remedy	- Refer to the encoder manual to clear the error cause - Reset the encoder error using the drive software - Power cycle

Code	A3491 / A3492	ECS
Message	A6A 3rd Party ALMC Over Speed Error (OSE)	
Cause	The corresponding error bit is set in the encoder. Please refer to the encoder manual for detailed information.	
Remedy	- Refer to the encoder manual to clear the error cause - Reset the encoder error using the drive software - Power cycle	

Code	A3493 / A3494	ECS
Message	Panasonic 3 rd party frame could not be erased inside FPGA	
Cause	MPU could not erase the FPGA area for 3 rd party encoder to force an update of the data.	
Remedy	Power cycle	

Code	A3511 / A3512	ECS
Message	EnDat CRC mismatch	
Cause	The checksum of the EnDat frame was invalid. This is usually cause by faulty or delayed transmissions to the encoder. Note: It may not be possible to reset this alarm because of the internal encoder status. A power cycle may be necessary.	
Remedy	- Check the encoder wiring - Check the mechanical connection in regards to the bearings of the encoder - Check the EMC guidelines - Power cycle - Replace the encoder	

Code	A3513 / A3514	ECS
Message	EnDat Invalid cycle	
Cause	The internal position sample was taken in an invalid cycle.	
Remedy	- Check the EMC guidelines - Power cycle - Replace the encoder	

Code	A3515 / A3516	ECS
Message	EnDat F1 error bit set	
Cause	The summary bit F1 is set inside the encoder. Please refer to the EnDat manual for possible causes.	
Remedy	- Refer to the EnDat manual for possible solutions - Power Cycle - Replace the encoder	

Code	A3517 / A3518	ECS
Message	EnDat F2 error bit set	
Cause	The summary bit F2 is set inside the encoder. Please refer to the EnDat manual for possible causes.	

Remedy	• Refer to the EnDat manual for possible solutions • Power Cycle • Replace the encoder

Code	A3519 / A3520	ECS
Message	EnDat Monoflop measurement failed	
Cause	The error bit TM is set inside the encoder. Please refer to the EnDat manual for possible causes.	
Remedy	• Refer to the EnDat manual for possible solutions • Power Cycle • Replace the encoder	

Code	A3521 / A3522	ECS
Message	EnDat Watchdog elapsed	
Cause	The error bit WD is set inside the encoder. Please refer to the EnDat manual for possible causes.	
Remedy	• Refer to the EnDat manual for possible solutions • Power Cycle • Replace the encoder	

Code	A3523 / A3524	ECS
Message	EnDat F3 error bit set	
Cause	The error bit F3 is set inside the encoder. Please refer to the EnDat manual for possible causes.	
Remedy	• Refer to the EnDat manual for possible solutions • Power Cycle • Replace the encoder	

Code	A3525 / A3526	ECS
Message	EnDat F4 error bit set	
Cause	The error bit F4 is set inside the encoder. Please refer to the EnDat manual for possible causes.	
Remedy	• Refer to the EnDat manual for possible solutions • Power Cycle • Replace the encoder	

Code	A3527 / A3528	ECS
Message	EnDat CRC Pos 1	
Cause	The error bit CRC1 is set inside the encoder. Please refer to the EnDat manual for possible causes.	
Remedy	• Refer to the EnDat manual for possible solutions • Power Cycle • Replace the encoder	

Code	A3529 / A3530	ECS
Message	EnDat CRC Pos 2	
Cause	The error bit CRC2 is set inside the encoder. Please refer to the EnDat manual for possible causes.	
Remedy	• Refer to the EnDat manual for possible solutions • Power Cycle • Replace the encoder	

Code	A3531 / A3532	ECS
Message	EnDat Error Type I	
Cause	The error bit F Type I is set inside the encoder. Please refer to the EnDat manual for possible causes.	
Remedy	- Refer to the EnDat manual for possible solutions - Power Cycle - Replace the encoder	

Code	A3533 / A3534	ECS
Message	EnDat Error Type II	
Cause	The error bit F Type II is set inside the encoder. Please refer to the EnDat manual for possible causes.	
Remedy	- Refer to the EnDat manual for possible solutions - Power Cycle - Replace the encoder	

Code	A3535 / A3536	ECS
Message	EnDat Error Type III	
Cause	The error bit F Type III is set inside the encoder. Please refer to the EnDat manual for possible causes.	
Remedy	- Refer to the EnDat manual for possible solutions - Power Cycle - Replace the encoder	

Code	A3537 / A3538	ECS
Message	EnDat Strobe Error	
Cause	The error bit Strobe Error is set inside the encoder. Please refer to the EnDat manual for possible causes.	
Remedy	- Refer to the EnDat manual for possible solutions - Power Cycle - Replace the encoder	

Code	A3539 / A3540	ECS
Message	EnDat Position prediction jump	
Cause	The position from the encoder is not in a valid range according to the position prediction. The encoder position jumped between two transmissions.	
Remedy	- Check the encoder wiring - Refer to the EnDat manual for possible solutions - Replace the encoder	

Code	A3541 / A3542	ECS
Message	EnDat efficiency test timeout	
Cause	The efficiency tests could not be executed and timed out because the encoder is in an invalid state.	
Remedy	- Check the encoder wiring - Power Cycle - Replace the encoder	

Code	A3543 / A3544	ECS
Message	EnDat efficiency test failed	

Cause	The efficiency tests for the encoder failed.
Remedy	• Check the encoder wiring • Refer to the EnDat manual for possible solutions • Power Cycle • Replace the encoder

Code	A3545 / A3546	ECS
Message	EnDat dynamization test timeout	
Cause	The dynamization could not be executed and timed out because the encoder is in an invalid state.	
Remedy	• Check the encoder wiring • Power Cycle • Replace the encoder	

Code	A3549 / A3550	ECS
Message	EnDat dynamization test failed	
Cause	The dynamisation of the encoder error flags failed.	
Remedy	• Check the encoder wiring • Refer to the EnDat manual for possible solutions • Power Cycle • Replace the encoder	

Code	A3551 / A3552	ECS
Message	EnDat NonSafe CRC_PW	
Cause	The error bit CRC_PW is set inside the encoder. Please refer to the EnDat manual for possible causes.	
Remedy	• Refer to the EnDat manual for possible solutions • Power Cycle • Replace the encoder	

Code	A3553 / A3554	ECS
Message	EnDat NonSafe Error 1	
Cause	The summary bit F1 is set inside the encoder. Please refer to the EnDat manual for possible causes.	
Remedy	• Refer to the EnDat manual for possible solutions • Power Cycle • Replace the encoder	

Code	A3555 / A3556	ECS
Message	EnDat NonSafe Error 2	
Cause	The summary bit F2 is set inside the encoder. Please refer to the EnDat manual for possible causes.	
Remedy	• Refer to the EnDat manual for possible solutions • Power Cycle • Replace the encoder	

Code	A3557 / A3558	ECS
Message	EnDat NonSafe Watchdog	
Cause	The error bit WD is set inside the encoder. Please refer to the EnDat manual for possible causes.	

Remedy	• Refer to the EnDat manual for possible solutions • Power Cycle • Replace the encoder

Code	A3561 / A3562	ECS
Message	SSI Sample Invalid (Clock count mismatch)	
Cause	The configured number of SSI clocks does not match the recorded number of clocks.	
Remedy	• Check the encoder wiring • Check the encoder connector and pinning • Replace the encoder	

Code	A3563 / A3564	ECS
Message	SSI data line invalid state pre sample	
Cause	The SSI data line was not in an idle state before sampling.	
Remedy	• Check the encoder wiring • Check the encoder connector and pinning • Replace the encoder	

Code	A3565 / A3566	ECS
Message	SSI data low during pause time (encoder not connected)	
Cause	The SSI data line was idle during the pause time and a suspicious position was received (0 or 0xFFFFFFFF).	
Remedy	• Make sure the encoder is connected • Check the encoder wiring • Check the encoder connector and pinning • Replace the encoder	

Code	A3567 / A3568	ECS
Message	SSI data low during pause time (mismatching frame length)	
Cause	The SSI data line was idle during the pause time.	
Remedy	• Make sure the configured SSI data length matches the actual data length of the encoder • Check the encoder wiring • Check the encoder connector and pinning • Replace the encoder	

Code	A3583 / A3584	ECS
Message	PANASONIC SAFETY encoder received invalid or unknown SID.	
Cause	Incompatible Encoder or drive controller.	
Remedy	• Make sure the drive is correctly configured for PANASONIC SAFETY encoder. • Check the encoder wiring • Check the encoder connector and pinning • Replace the encoder	

Code	A3585 / A3586	ECS
Message	PANASONIC SAFETY SIFA/B Frame CRC incorrect	
Cause	Incompatible Encoder or drive controller. EMI or noise on the MDSMD board.	

Remedy	• Make sure the drive is correctly configured for PANASONIC SAFETY encoder. • Check the EMC requirements and guidelines • Check the encoder wiring • Check the encoder connector and pinning • Replace the encoder

Code	A3587 / A3588	ECS
Message	PANASONIC SAFETY Watchdog expired.	
Cause	The PANASONIC SAFETY IP core did not re-trigger the internal watchdog. Please check the encoder manual for possible causes.	
Remedy	• Make sure the drive is correctly configured for PANASONIC SAFETY encoder. • Check the EMC requirements and guidelines • Check the encoder wiring • Check the encoder connector and pinning • Replace the encoder	

Code	A3589 / A3590	ECS
Message	PANASONIC SAFETY Position difference	
Cause	The difference between Position1 and Position 2 exceeds the threshold.	
Remedy	• Make sure the drive is correctly configured for PANASONIC SAFETY encoder. • Check the encoder wiring • Check the encoder connector and pinning • Replace the encoder	

Code	A3591 / A3592	ECS
Message	PANASONIC SAFETY encoder returned one or more error bits inside the DIAG field.	
Cause	One or more error bits are set inside the encoder. Please use the encoder diagnosis to read out the diagnosis field and refer to the encoder manual for possible causes.	
Remedy	• Make sure the drive is correctly configured for PANASONIC SAFETY encoder. • Refer to the encoder manual • Check the encoder wiring • Check the encoder connector and pinning • Replace the encoder	

Code	A3593 / A3594	ECS
Message	PANASONIC SAFETY encoder communication error.	
Cause	The field CA of the encoder contains one or more errors. Please use the encoder diagnosis to read out the diagnosis field and refer to the encoder manual for possible causes.	
Remedy	• Make sure the drive is correctly configured for PANASONIC SAFETY encoder. • Refer to the encoder manual • Check the encoder wiring • Check the encoder connector and pinning • Replace the encoder	

Code	A3595 / A3596	ECS
Message	PANASONIC SAFETY SIFA/SIFB communication status error	
Cause	The field CES of the IP core contains one or more errors. Please use the encoder diagnosis to read out the diagnosis field and refer to the encoder manual for possible causes.	
Remedy	• Make sure the drive is correctly configured for PANASONIC SAFETY encoder. • Refer to the encoder manual • Check the encoder wiring • Check the encoder connector and pinning • Replace the encoder	

Code	A3597 / A3598	ECS
Message	PANASONIC SAFETY sequence number is frozen	
Cause	Please refer to the encoder manual for possible causes.	
Remedy	• Make sure the drive is correctly configured for PANASONIC SAFETY encoder. • Refer to the encoder manual • Check the encoder wiring • Check the encoder connector and pinning • Replace the encoder	

Code	A3599 / A3600	ECS
Message	PANASONIC SAFETY invalid CRC	
Cause	The CRC1, CRC2 or CRC3 is/are invalid Please refer to the encoder manual for possible causes.	
Remedy	• Make sure the drive is correctly configured for PANASONIC SAFETY encoder. • Refer to the encoder manual • Check the encoder wiring • Check the encoder connector and pinning • Replace the encoder	

Code	A3601 / A3602	ICS
Message	SDO1 Dynamic Test	
Cause	The corresponding output was active during the dynamic inactive test.	
Remedy	• Check the output wiring for shortcuts • Replace the MDSMD	

Code	A3603 / A3604
Message	SDO2 Dynamic Test
Cause	The corresponding output was active during the dynamic inactive test.
Remedy	• Check the output wiring for shortcuts • Replace the MDSMD

Code	A3605 / A3606
Message	Main Switch did not switch off
Cause	The main switch was active during the dynamic inactive test.
Remedy	• Check the output wiring for shortcuts • Replace the MDSMD

Code	A3607 / A3608
Message	Main Switch did not switch off SDO1
Cause	The corresponding output was active during the dynamic inactive test.
Remedy	• Check the output wiring for shortcuts • Replace the MDSMD

Code	A3609 / A3610
Message	Main Switch did not switch off SDO2
Cause	The corresponding output was active during the dynamic inactive test.
Remedy	• Check the output wiring for shortcuts • Replace the MDSMD

Code	A3611 / A3612
Message	Overvoltage Test 3V3 MainSwitch
Cause	The main switch was active while the overvoltage test switched off.
Remedy	• Check the output wiring for shortcuts • Replace the MDSMD

Code	A3613 / A3614
Message	Overvoltage Test 3V3 SDO1
Cause	SDO1 was active while the overvoltage test switched off.
Remedy	• Check the output wiring for shortcuts • Replace the MDSMD

Code	A3615 / A3616
Message	Overvoltage Test 3V3 SDO2
Cause	SDO2 was active while the overvoltage test switched off.
Remedy	• Check the output wiring for shortcuts • Replace the MDSMD

Code	A3617 / A3618
Message	Undervoltage Test 3V3 MainSwitch
Cause	The main switch was active while the undervoltage test switched off.
Remedy	• Check the output wiring for shortcuts • Replace the MDSMD

Code	A3619 / A3620
Message	Undervoltage Test 3V3 SDO1
Cause	SDO1 was active while the undervoltage test switched off.
Remedy	• Check the output wiring for shortcuts • Replace the MDSMD

Code	A3621 / A3622

Message	Undervoltage Test 3V3 SDO2
Cause	SDO2 was active while the undervoltage test switched off.
Remedy	- Check the output wiring for shortcuts - Replace the MDSMD

Code	A3623 / A3624
Message	Overvoltage Test 2V5 MainSwitch
Cause	The main switch was active while the undervoltage test switched off.
Remedy	- Check the output wiring for shortcuts - Replace the MDSMD

Code	A3625 / A3626
Message	Overvoltage Test 2V5 SDO1
Cause	SDO1 was active while the undervoltage test switched off.
Remedy	- Check the output wiring for shortcuts - Replace the MDSMD

Code	A3627 / A3628
Message	Overvoltage Test 2V5 SDO2
Cause	SDO2 was active while the undervoltage test switched off.
Remedy	- Check the output wiring for shortcuts - Replace the MDSMD

Code	A3629 / A3630
Message	Overvoltage Test 1V2 MainSwitch
Cause	The main switch was active while the undervoltage test switched off.
Remedy	- Check the output wiring for shortcuts - Replace the MDSMD

Code	A3631 / A3632
Message	Overvoltage Test 1V2 SDO1
Cause	SDO1 was active while the undervoltage test switched off.
Remedy	- Check the output wiring for shortcuts - Replace the MDSMD

Code	A3633 / A3634
Message	Overvoltage Test 1V2 SDO2
Cause	SDO2 was active while the undervoltage test switched off.
Remedy	- Check the output wiring for shortcuts - Replace the MDSMD

Code	A3635 / A3636
Message	Watchdog Test SDO1
Cause	SDO1 was active while the Watchdog test switched off.
Remedy	- Check the output wiring for shortcuts - Replace the MDSMD

Code	A3637 / A3638
Message	Watchdog Test SDO2
Cause	SDO2 was active while the Watchdog test switched off.
Remedy	- Check the output wiring for shortcuts - Replace the MDSMD

Code	A3639 / A3640
Message	SBC Dynamic Test
Cause	The corresponding output was active during the dynamic inactive test.
Remedy	- Check the output wiring for shortcuts - Replace the MDSMD

Code	A3641 / A3642
Message	SBC Dynamic Test switching 3V3 OV/UV
Cause	The corresponding output was active during the dynamic inactive test.
Remedy	- Check the output wiring for shortcuts - Replace the MDSMD

Code	A3643 / A3644
Message	SBC Dynamic Test switching 2V5 OV/UV
Cause	The corresponding output was active during the dynamic inactive test.
Remedy	- Check the output wiring for shortcuts - Replace the MDSMD

Code	A3645 / A3646
Message	SBC Dynamic Test switching 1V2 OV/UV
Cause	The corresponding output was active during the dynamic inactive test.
Remedy	- Check the output wiring for shortcuts - Replace the MDSMD

Code	A3647 / A3648
Message	SBC Dynamic Test switching WD
Cause	The corresponding output was active during the dynamic inactive test.
Remedy	- Check the output wiring for shortcuts - Replace the MDSMD

Code	A3651 / A3652
Message	SDO1 static output test
Cause	The feedback of the corresponding output differs from the current logical state.
Remedy	- Check the output wiring for shortcuts - Replace the MDSMD

Code	A3653 / A3654
Message	SDO2 static output test

Cause	The feedback of the corresponding output differs from the current logical state.
Remedy	- Check the output wiring for shortcuts - Replace the MDSMD

Code	A3655 / A3656
Message	SBC1 static output test
Cause	The feedback of the corresponding output differs from the current logical state.
Remedy	- Check the output wiring for shortcuts - Replace the MDSMD

Code	A3657 / A3658
Message	MainSwitch static output test
Cause	The feedback of the corresponding MainSwitch differs from the current logical state.
Remedy	- Check the output wiring for shortcuts - Replace the MDSMD

Code	A3661 / A3662
Message	STO1A dynamic test feedback A3661: STO1 SF2 A (A_SF2A_FB_MPUA invalid) A3662: STO1 SF1 A (A_SF1A_FB_MPUB invalid)
Cause	The corresponding output could not be switched off during its dynamic test.
Remedy	- Check the output configuration for shortcuts - Alarm reset - Replace device

Code	A3663 / A3664
Message	STO1B dynamic test feedback A3663: STO1 SF2 B (A_SF2B_FB_MPUA invalid) A3664: STO1 SF1 B (A_SF1B_FB_MPUB invalid)
Cause	The corresponding output could not be switched off during its dynamic test.
Remedy	- Check the output configuration for shortcuts - Alarm reset - Replace device

Code	A3665 / A3666
Message	STO2A dynamic test feedback A3665: STO2 SF2 A (B_SF2A_FB_MPUA invalid) A3666: STO2 SF1 A (B_SF1A_FB_MPUB invalid)
Cause	The corresponding output could not be switched off during its dynamic test.
Remedy	- Check the output configuration for shortcuts - Alarm reset - Replace device

Code	A3667 / A3668
Message	STO2B dynamic test feedback A3667: STO2 SF2 B (B_SF2B_FB_MPUA invalid) A3668: STO2 SF1 B (B_SF1B_FB_MPUB invalid)
Cause	The corresponding output could not be switched off during its dynamic test.
Remedy	• Check the output configuration for shortcuts • Alarm reset • Replace device

Code	A3669 / A3670
Message	STO feedback EDM1 invalid
Cause	The STO feedback signal did not match the logical STO state.
Remedy	• Check the output configuration for shortcuts • Alarm reset • Replace device

Code	A3671 / A3672
Message	STO feedback EDM2 invalid
Cause	The STO feedback signal did not match the logical STO state.
Remedy	• Check the output configuration for shortcuts • Alarm reset • Replace device

Code	A3673 / A3674
Message	STO1A static test failed A3673: STO1 SF2 A (A_SF2A_FB_MPUA invalid) A3674: STO1 SF1 A (A_SF1A_FB_MPUB invalid)
Cause	The STO1A feedback signal did not match the logical STO state.
Remedy	• Check the output configuration for shortcuts • Alarm reset • Replace device

Code	A3675 / A3676
Message	STO1B static test failed A3675: STO1 SF2 B (A_SF2B_FB_MPUA invalid) A3676: STO1 SF1 B (A_SF1B_FB_MPUB invalid)
Cause	The STO1B feedback signal did not match the logical STO state.
Remedy	• Check the output configuration for shortcuts • Alarm reset • Replace device

Code	A3677 / A3678
Message	STO2A static test failed A3677: STO2 SF2 A (B_SF2A_FB_MPUA invalid) A3678: STO2 SF1 A (B_SF1A_FB_MPUB invalid)
Cause	The STO2A feedback signal did not match the logical STO state.
Remedy	• Check the output configuration for shortcuts • Alarm reset • Replace device

Code	A3679 / A3680
Message	STO2B static test failed A3679: STO2 SF2 B (B_SF2B_FB_MPUA invalid) A3680: STO2 SF1 B (B_SF1B_FB_MPUB invalid)
Cause	The STO2B feedback signal did not match the logical STO state.
Remedy	• Check the output configuration for shortcuts • Alarm reset • Replace device

Code	A4001 / A4002
Message	SDI1 enable
Cause	SDI1 enabled in both direction simultaneously
Remedy	• Check the input wiring • Use the diagnosis functionality to check your application (SDI enable)

Code	A4003 / A4004
Message	SDI2 enable
Cause	SDI2 enabled in both direction simultaneously
Remedy	• Check the input wiring • Use the diagnosis functionality to check your application (SDI enable)

Code	A4601 / A4602
Message	SLP1 enable
Cause	SLP1 enabled in both direction simultaneously
Remedy	• Check the input wiring • Use the diagnosis functionality to check your application (SLP enable)

Code	A4603 / A4604
Message	SLP2 enable
Cause	SLP2 enabled in both direction simultaneously
Remedy	• Check the input wiring • Use the diagnosis functionality to check your application (SLP enable)

Code	A4605 / A4606
Message	SLP3 enable
Cause	SLP3 enabled in both direction simultaneously
Remedy	• Check the input wiring • Use the diagnosis functionality to check your application (SLP enable)

Code	A4607 / A4608
Message	SLP4 enable
Cause	SLP4 enabled in both direction simultaneously
Remedy	• Check the input wiring • Use the diagnosis functionality to check your application (SLP enable)

Code	A4609 / A4610
Message	SLP5 enable
Cause	SLP5 enabled in both direction simultaneously
Remedy	• Check the input wiring • Use the diagnosis functionality to check your application (SLP enable)

Code	A4611 / A4612
Message	SLP6 enable
Cause	SLP6 enabled in both direction simultaneously
Remedy	• Check the input wiring • Use the diagnosis functionality to check your application (SLP enable)

Code	A4613 / A4614
Message	SLP7 enable
Cause	SLP7 enabled in both direction simultaneously
Remedy	• Check the input wiring • Use the diagnosis functionality to check your application (SLP enable)

Code	A4615 / A4616
Message	SLP8 enable
Cause	SLP8 enabled in both direction simultaneously
Remedy	• Check the input wiring • Use the diagnosis functionality to check your application (SLP enable)

Code	A4901 / A4902
Message	SLI1 enable
Cause	SLI1 enabled in both direction simultaneously
Remedy	• Check the input wiring • Use the diagnosis functionality to check your application (SLI enable)

Code	A4903 / A4904
Message	SLI2 enable
Cause	SLI2 enabled in both direction simultaneously
Remedy	• Check the input wiring • Use the diagnosis functionality to check your application (SLI enable)

Code	A6701 / A6702	ICS
Message	Invalid state Input element with Timer 0	
Cause	The time monitored input element with the corresponding timer was longer than 3 seconds in an invalid state.	
Remedy	• Check the input wiring • Check the input configuration • Review the necessary switching behaviour and the used input element	

Code	A6703 / A6704	ICS
Message	Invalid state Input element with Timer 1	
Cause	The time monitored input element with the corresponding timer was longer than 3 seconds in an invalid state.	
Remedy	• Check the input wiring • Check the input configuration • Review the necessary switching behaviour and the used input element	

Code	A6705 / A6706	ICS
Message	Invalid state Input element with Timer 2	
Cause	The time monitored input element with the corresponding timer was longer than 3 seconds in an invalid state.	
Remedy	• Check the input wiring • Check the input configuration • Review the necessary switching behaviour and the used input element	

Code	A6707 / A6708	ICS
Message	Invalid state Input element with Timer 3	
Cause	The time monitored input element with the corresponding timer was longer than 3 seconds in an invalid state.	
Remedy	• Check the input wiring • Check the input configuration • Review the necessary switching behaviour and the used input element	

Code	A6709 / A6710	ICS
Message	Invalid state Input element with Timer 4	
Cause		
Remedy	The time monitored input element with the corresponding timer was longer than 3 seconds in an invalid state.	
	• Check the input wiring • Check the input configuration • Review the necessary switching behaviour and the used input element	

Code	A6711 / A6712	ICS
Message	Invalid state Input element with Timer 5	
Cause	The time monitored input element with the corresponding timer was longer than 3 seconds in an invalid state.	
Remedy	• Check the input wiring • Check the input configuration • Review the necessary switching behaviour and the used input element	

Code	A6713 / A6714	ICS
Message	Invalid state Input element with Timer 6	
Cause	The time monitored input element with the corresponding timer was longer than 3 seconds in an invalid state.	

Remedy	• Check the input wiring • Check the input configuration • Review the necessary switching behaviour and the used input element

Code	A6715 / A6716	ICS
Message	Invalid state Input element with Timer 7	
Cause	The time monitored input element with the corresponding timer was longer than 3 seconds in an invalid state.	
Remedy	• Check the input wiring • Check the input configuration • Review the necessary switching behaviour and the used input element	

Code	A7001 / A7002
Message	FPGA Status
Cause	The status of the FPGA did not toggle in time.
Remedy	• Power Cycle

11-5 Fatal Error

Code	F 1001 / F1002
Message	Unable to initialize base TOC from flash
Cause	The TOC containing the device configuration could not be initialized from the flash.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device • Check the tooling connection to the device • Power cycle

Code	F 1003 / F1004
Message	Different Config CRCs in both MPUs
Cause	The configuration CRC is different in both MPUs.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device • Check the tooling connection to the device • Power cycle

Code	F 1005 / F1006
Message	Inconsistent Configuration CRC
Cause	The checksum of the configuration does not match the content.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device • Check the tooling connection to the device • Power cycle

Code	F 1007 / F1008
Message	Invalid Device ID
Cause	The device was not programmed with the correct configuration.
Remedy	• Make sure you are using a compatible programming software • Make sure you select the correct device inside your project • Send the configuration to the device • Check the tooling connection to the device • Power cycle

Code	F 1011 / F1012
Message	Configuration does not contain Device Descriptor
Cause	The mandatory device descriptor was not found inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device • Check the tooling connection to the device • Power cycle

Code	F 1013 / F1014

Message	Invalid Device Descriptor configuration
Cause	The device descriptor inside the configuration was invalid
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device • Check the tooling connection to the device • Power cycle

Code	F 1015 / F1016
Message	Configuration contains more than 1 Device Descriptor
Cause	More than 1 device descriptor was found inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device • Check the tooling connection to the device • Power cycle

Code	F 1101 / F1102
Message	Invalid FParameter CRC
Cause	The checksum of the firmware parameters in the FRAM does not match its content.
Remedy	• Power cycle • Replace MDSMD

Code	F 1301 / F1302
Message	Invalid or unknown PLC identifier
Cause	The identifier of a PLC operand was invalid or unknown.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device • Check the tooling connection to the device • Power cycle

Code	F 1303 / F1304
Message	PLC structure missing
Cause	The PLC structure is missing inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device • Power cycle

Code	F 1305 / F1306
Message	Internal Failure (PLC General flags)
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device • Power cycle

Code	F 1307 / F1308

Message	PLC Length exceeds maximum
Cause	The number of PLC elements exceeds the maximum.
Remedy	• Reduce the number of PLC operations by minimizing the logic of your program • Make sure you are using a compatible programming software

Code	F 1309 / F1310
Message	PLC invalid EOF identifier
Cause	The PLC code contains an invalid or no EOF identifier
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device • Power cycle

Code	F 1311 / F1312
Message	Invalid PLC OP code
Cause	An invalid or unsupported operand was found inside the PLC code.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device • Power cycle

Code	F 1313 / F1314
Message	PLC instruction filled out of bounds
Cause	A PLC instruction was detected beyond the maximum number of configured instructions.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device • Power cycle

Code	F 1315 / F1316
Message	PLC downcount invalid
Cause	The downcount entry of one or more PLC instructions was invalid.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device • Power cycle

Code	F1317 / F1318
Message	PLC instruction list identifier exceeds maximum
Cause	The instruction list identifier exceeds maximum and could not be resolved; it is invalid.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device • Power cycle

Code	F1319 / F1320
Message	Invalid PLC macro

Cause	PLC macro are invalid
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device • Power cycle

Code	F1321 / F1322
Message	PLC macro was not closed
Cause	PLC macro was not closed
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device • Power cycle

Code	F1325 / F1326
Message	Device CycleTime does not equal 4ms
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device • Power cycle

Code	F1331 / F1332
Message	Invalid Input configuration
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device • Power cycle

Code	F1333 / F1334
Message	Invalid reset alarm configuration
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device • Power cycle

Code	F1335 / F1336
Message	More than 1 reset alarm configured
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device • Power cycle

Code	F1341 / F1342
Message	Internal Failure (SLS General Flags)

Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device • Power cycle

Code	F1343 / F1344
Message	SLS Class ID
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device • Power cycle

Code	F1345 / F1346
Message	SLS Axis
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device • Power cycle

Code	F1347 / F1348
Message	SLS Mode
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device • Power cycle

Code	F1349 / F1350
Message	SLS Speed
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Check that the configured SLS threshold does not exceed the maximum speed of your axis

Code	F1351 / F1352
Message	SLS SSX Count
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Check that the configured SSX for the SLS ramp monitoring exist in your project and is configured on the same axis. • Send the configuration to the device

Code	F1353 / F1354
Message	SLS Acceleration
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1355 / F1356
Message	SLS Speed Profile Supervision
Cause	The range check detected that the Speed Limit is missing inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1361 / F1362
Message	Internal Failure (SDI General Flags)
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1363 / F1364
Message	SDI Class ID
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1365 / F1366
Message	SDI Axis
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1367 / F1368
Message	SDI Mode
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1369 / F1370
Message	SDI Speed

Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1371 / F1372
Message	SDI Position
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1381 / F1382
Message	Internal Failure (SCA General Flags)
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1383 / F1384
Message	SCA Class ID
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1385 / F1386
Message	SCA Axis
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1387 / F1388
Message	SCA Mode
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1389 / F1390
Message	SCA Speed
Cause	The range check detected an invalid value inside the configuration.

Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1391 / F1392
Message	SCA Min Position
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1393 / F1394
Message	SCA Max Position
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1395 / F1396
Message	SCA Position
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1397 / F1398
Message	SCA Acceleration
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1399 / F1400
Message	SCA Direction
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1401 / F1402
Message	SCA SEL Assignment
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1403 / F1404
Message	SCA SLP Assignment
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1405 / F1406
Message	SCA SEL Position
Cause	The range check detected an invalid value inside the configuration. The SEL is configured but the position values are inactive
Remedy	• If SEL is configured the position values must be active • Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1407 / F1408
Message	SCA SLP Position
Cause	The range check detected an invalid value inside the configuration. The SLP is configured but the position values are inactive
Remedy	• If SEL is configured the position values must be active • Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1409 / F1410
Message	SCA Overspeed Distance
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1411 / F1412
Message	Internal Failure (SEL General Flags)
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1413 / F1414
Message	SEL Class ID
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1415 / F1416
Message	SEL Axis
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1417 / F1418
Message	SEL Curve Type
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1419 / F1420
Message	SEL Speed
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1421 / F1422
Message	SEL Minimum Position
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1423 / F1424
Message	SEL Maximum Position
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1425 / F1426
Message	SEL Position Plausibility
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1427 / F1428
Message	SEL Acceleration

Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1429 / F1430
Message	SEL S-Ramp Jerk
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1431 / F1432
Message	SEL Ramp Latency
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1441 / F1442
Message	Internal Failure (SLP General Flags)
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1443 / F1444
Message	SLP Class ID
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1445 / F1446
Message	SLP Axis
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1447 / F1448
Message	SLP Type Curve
Cause	The range check detected an invalid value inside the configuration.

Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1449 / F1450
Message	SLP Mode
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1451 / F1452
Message	SLP Speed
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1453 / F1454
Message	SLP Position
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1455 / F1456
Message	SLP Acceleration
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1457 / F1458
Message	SLP S-Ramp Jerk
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1459 / F1460
Message	SLP Ramp Latency
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1471 / F1472
Message	Internal Failure (SOS General Flags)
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1473 / F1474
Message	SOS Class ID
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1475 / F1476
Message	SOS Axis
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1477 / F1478
Message	SOS Mode
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1479 / F1480
Message	SOS Speed
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1481 / F1482
Message	SOS Position
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1483 / F1484
Message	SOS Acceleration

Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1501 / F1502
Message	Internal Failure (SLI General Flags)
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1503 / F1504
Message	SLI Class ID
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1505 / F1506
Message	SLI Axis
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1507 / F1508
Message	SLI Limit
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1509 / F1510
Message	SLI Step Measure
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1521 / F1522
Message	Internal Failure (SSX General Flags)
Cause	The range check detected an invalid value inside the configuration.

Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1523 / F1524
Message	SSX Class ID
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1525 / F1526
Message	SSX Axis
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1527 / F1528
Message	SSX Type
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1529 / F1530
Message	SSX Curve Type
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1531 / F1532
Message	SSX Ramp Latency
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1533 / F1534
Message	SSX Speed
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1535 / F1536
Message	SSX Acceleration
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1537 / F1538
Message	SSX S-Ramp jerk
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1541 / F1542
Message	Internal Failure (SLA General Flags)
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1543 / F1544
Message	SLA Class ID
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1545 / F1546
Message	SLA Speed Difference Threshold
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1547 / F1548
Message	SLA Acceleration
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1549 / F1550
Message	SLA Axis

Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1551 / F1552
Message	Internal Failure (EOS General Flags)
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1553 / F1554
Message	Internal Failure (EOS Class ID)
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1555 / F1556
Message	Internal Failure (EOS Position)
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1561 / F1562
Message	Internal Failure (SRX General Flags)
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1563 / F1564
Message	SRX Class ID
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1565 / F1566
Message	SRX Reference Position
Cause	The range check detected an invalid value inside the configuration.

Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1567 / F1568
Message	SRX Reference Tolerance
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1569 / F1570
Message	SRX Axis
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1571 / F1572
Message	Internal Failure (EDM General Flags)
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1573 / F1574
Message	EDM Class ID
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1575 / F1576
Message	EDM Switch On Delay
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1577 / F1578
Message	EDM Switch Off Delay
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1581 / F1582
Message	Internal Failure (SAC General Flags)
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1583 / F1584
Message	SAC Class ID
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1585 / F1586
Message	SAC Lower Limit
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1587 / F1588
Message	SAC Upper Limit
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1589 / F1590
Message	SAC Hysteresis
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1591 / F1592
Message	SAC Input Source
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1593 / F1594
Message	SAC Mode/Muting

Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1601 / F1602
Message	Internal Failure (SMMC General Flags – Not used)
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1603 / F1604
Message	SMMC Class ID – Not used
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1605 / F1606
Message	SMMC Cycle Time – Not used
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1607 / F1608
Message	SMMC Timeout – Not used
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1609 / F1610
Message	SMMC Cycle Time/Timeout Consistency – Not used
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1611 / F1612
Message	SMMC Local Address – Not used
Cause	The range check detected an invalid value inside the configuration.

Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1613 / F1614
Message	SMMC Device – Not used
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1615 / F1616
Message	SMMC Port settings – Not used
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1621 / F1622
Message	Internal Failure (PLC Timer General Flags)
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1623 / F1624
Message	PLC Timer Class ID
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1625 / F1626
Message	PLC Timer Mode
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1627 / F1628
Message	PLC Timer Value
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1631 / F1632
Message	Axis Count
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1633 / F1634
Message	Axis Modes
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1635 / F1636
Message	Axis Encoder combination
Cause	The range check detected an invalid value inside the configuration. The selected encoder combination is invalid or unknown.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1637 / F1638
Message	Axis Sector Length High
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1639 / F1640
Message	Axis Sector Length Low
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1641 / F1642
Message	Axis EVC Delay
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1643 / F1644
Message	Axis EVC Position

Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1645 / F1646
Message	Axis EVC Speed
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1647 / F1648
Message	Axis Filter
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1649 / F1650
Message	Axis Max Acceleration
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1651 / F1652
Message	Axis Factor Position
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1653 / F1654
Message	Axis Factor Speed
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1655 / F1656
Message	Axis Max Speed
Cause	The range check detected an invalid value inside the configuration.

Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1657 / F1658
Message	Axis Cutoff Threshold Position
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1659 / F1660
Message	Cutoff Threshold Speed
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1661 / F1662
Message	Axis Unit
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1663 / F1664
Message	Encoder Flags
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1665 / F1666
Message	Encoder Modes
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1667 / F1668
Message	Encoder External Modes/Supply Voltage
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1669 / F1670
Message	Encoder Norm Position
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1671 / F1672
Message	Encoder Norm Speed
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1673 / F1674
Message	Encoder Shift Position
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1675 / F1676
Message	Encoder Shift Speed
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1677 / F1678
Message	Encoder Resolution
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1679 / F1680
Message	Encoder Data Length
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1681 / F1682
Message	Encoder Frame Length

Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1683 / F1684
Message	Internal Failure (FastChannel General Flags)
Cause	The range check detected an invalid value inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1685 / F1686
Message	FastChannel InMode
Cause	FastChannel Invalid InMode
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1687 / F1688
Message	FastChannel OutMode
Cause	FastChannel Invalid OutMode
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1689 / F1690
Message	FastChannel IO mismatch
Cause	FastChannel Out Mode configured but In Mode inactive
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1691 / F1692
Message	Invalid Encoder normalization
Cause	The TOC check found an error inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1701 / F1702
Message	Invalid Encoder configuration
Cause	The TOC check found an error inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1703 / F1704
Message	Invalid Axis configuration

Cause	The TOC check found an error inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1705 / F1706
Message	Invalid I/O definition
Cause	The TOC check found an error inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1707 / F1708
Message	Invalid SLS configuration
Cause	The TOC check found an error inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1709 / F1710
Message	Number of SLS instances exceeds maximum
Cause	The TOC check found an error inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1711 / F1712
Message	Invalid SDI configuration
Cause	The TOC check found an error inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1713 / F1714
Message	Number of SDI instances exceeds maximum
Cause	The TOC check found an error inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1715 / F1716
Message	Invalid SCA configuration
Cause	The TOC check found an error inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1717 / F1718
Message	Number of SCA instances exceeds maximum
Cause	The TOC check found an error inside the configuration.

Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1719 / F1720
Message	Invalid SEL configuration
Cause	The TOC check found an error inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1721 / F1722
Message	Number of SEL instances exceeds maximum
Cause	The TOC check found an error inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1723 / F1724
Message	Invalid SLP configuration
Cause	The TOC check found an error inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1725 / F1726
Message	Number of SLP instances exceeds maximum
Cause	The TOC check found an error inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1727 / F1728
Message	Invalid SOS configuration
Cause	The TOC check found an error inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1729 / F1730
Message	Number of SOS instances exceeds maximum
Cause	The TOC check found an error inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1731 / F1732
Message	Invalid SLI configuration
Cause	The TOC check found an error inside the configuration.

Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1733 / F1734
Message	Number of SLI instances exceeds maximum
Cause	The TOC check found an error inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1735 / F1736
Message	Invalid SSX configuration
Cause	The TOC check found an error inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1737 / F1738
Message	Number of SSX instances exceeds maximum
Cause	The TOC check found an error inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1739 / F1740
Message	Invalid SLA configuration
Cause	The TOC check found an error inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1741 / F1742
Message	Number of SLA instances exceeds maximum
Cause	The TOC check found an error inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1743 / F1744
Message	Invalid EOS configuration
Cause	The TOC check found an error inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1745 / F1746
Message	Number of EOS instances exceeds maximum
Cause	The TOC check found an error inside the configuration.

Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1747 / F1748
Message	Invalid EDM configuration
Cause	The TOC check found an error inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1749 / F1750
Message	Number of EDM instances exceeds maximum
Cause	The TOC check found an error inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1751 / F1752
Message	Invalid SMMC configuration – Not used
Cause	The TOC check found an error inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1753 / F1754
Message	Number of SMMC instances exceeds maximum – Not used
Cause	The TOC check found an error inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1755 / F1756
Message	Invalid SRX configuration
Cause	The TOC check found an error inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1757 / F1758
Message	Number of SRX instances exceeds maximum
Cause	The TOC check found an error inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1759 / F1760
Message	Invalid SAC configuration
Cause	The TOC check found an error inside the configuration.

Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1761 / F1762
Message	Number of SAC instances exceeds maximum
Cause	The TOC check found an error inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1763 / F1764
Message	Invalid PLC Timer configuration
Cause	The TOC check found an error inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1765 / F1766
Message	Number of PLC Timer instances exceeds maximum
Cause	The TOC check found an error inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1767 / F1768
Message	Invalid FastChannel configuration
Cause	The TOC check found an error inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1769 / F1770
Message	Number of FastChannel instances exceeds maximum
Cause	The TOC check found an error inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1801 / F1802
Message	Value NormPosition is Zero
Cause	The TOC check found an error inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1803 / F1804
Message	Invalid, unknown or unsupported encoder type
Cause	The TOC check found an error inside the configuration.

Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1805 / F1806
Message	Invalid Shift Value (negative)
Cause	The TOC check found an error inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F1807 / F1808
Message	Invalid Axis Config ID (unsupported encoder combination)
Cause	The TOC check found an error inside the configuration.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F2001 / F2002
Message	Invalid DPR Image CRC
Cause	The frame check of the DPR image used for the communication between both MPUs did not match its content.
Remedy	• Check for EMI disturbances and check the EMI requirements • Make sure a firmware update process was completed successfully (if applicable) • Power Cycle • Replace device

Code	F2003 / F2004
Message	Invalid DPR Ticker
Cause	The Ticker inside the DPR image between both MPUs did not match.
Remedy	• Make sure a firmware update process was completed successfully (if applicable) • Power Cycle • Replace device

Code	F2005 / F2006
Message	DPR Handshake Timeout
Cause	A timeout occurred when waiting on the handshake of the complementary MPU for the DPR image exchange
Remedy	• Make sure a firmware update process was completed successfully (if applicable) • Power Cycle • Replace device

Code	F2007 / F2008
Message	DPR Main State
Cause	The main state inside the DPR image of the complementary MPU did not match the local state.
Remedy	• Make sure a firmware update process was completed successfully (if applicable) • Power Cycle • Replace device

Code	F2009 / F2010
Message	DPR Identifier
Cause	The identifier inside the DPR image was invalid.
Remedy	• Make sure a firmware update process was completed successfully (if applicable) • Power Cycle • Replace device

Code	F2011 / F2012
Message	DPR Length
Cause	The length of the DPR image did not match the between both MPUs.
Remedy	• Make sure a firmware update process was completed successfully (if applicable) • Power Cycle • Replace device

Code	F3201 / F3202
Message	Min. Value 3V3
Cause	Internal analog voltage 3V3 is below the minimum threshold.
Remedy	• Check device power supply • Power cycle • Replace device

Code	F3203 / F3204
Message	Min. Value U12V0
Cause	Internal analog voltage U12V0 is below the minimum threshold.
Remedy	• Check device power supply • Power cycle • Replace device

Code	F3205 / F3206
Message	Min. Value 5V0
Cause	Internal analog voltage 5V0 is below the minimum threshold.
Remedy	• Check device power supply • Power cycle • Replace device

Code	F3207 / F3208
Message	Min. Value 2V5
Cause	Internal analog voltage 2V5 is below the minimum threshold.
Remedy	• Check device power supply • Power cycle • Replace device

Code	F3209 / F3210
Message	Min. Value 1V2
Cause	Internal analog voltage 1V2 is below the minimum threshold.

Remedy	• Check device power supply • Power cycle • Replace device

Code	F3211 / F3212
Message	Min. Value VDDC
Cause	Internal analog voltage VDDC is below the minimum threshold.
Remedy	• Check device power supply • Power cycle • Replace device

Code	F3213 / F3214
Message	Min. Value VIO
Cause	Internal analog voltage VIO is below the minimum threshold.
Remedy	• Check device power supply • Power cycle • Replace device

Code	F3221 / F3222
Message	Max. Value 3V3
Cause	Internal analog voltage 3V3 is above the maximum threshold.
Remedy	• Check device power supply • Power cycle • Replace device

Code	F3223 / F3224
Message	Max. Value U12V0
Cause	Internal analog voltage U12V0 is above the maximum threshold.
Remedy	• Check device power supply • Power cycle • Replace device

Code	F3225 / F3226
Message	Max. Value 5V0
Cause	Internal analog voltage 5V0 is above the maximum threshold.
Remedy	• Check device power supply • Power cycle • Replace device

Code	F3227 / F3228
Message	Max. Value 2V5
Cause	Internal analog voltage 2V5 is above the maximum threshold.
Remedy	• Check device power supply • Power cycle • Replace device

Code	F3229 / F3230
Message	Max. Value 1V2
Cause	Internal analog voltage 1V2 is above the maximum threshold.

Remedy	• Check device power supply • Power cycle • Replace device

Code	F3231 / F3232
Message	Max. Value VDDC
Cause	Internal analog voltage VDDC is above the maximum threshold.
Remedy	• Check device power supply • Power cycle • Replace device

Code	F3233 / F3234
Message	Max. Value EN_VENC CPU A/VIO CPU B
Cause	Internal analog voltage is above the maximum threshold.
Remedy	• Check device power supply • Power cycle • Replace device

Code	F3245 / F3246
Message	+24V IO missing
Cause	An input is configured but the input stage supply voltage is missing on the IO connector XS4 pin 1 and 17
Remedy	• Check the IO connector • Check the wiring on the IO connector • Check the power supply for the input supply voltage • Review the input configuration in your project

Code	F3323 / F3324
Message	Invalid amplifier control mode
Cause	The control mode sent from amplifier is not supported
Remedy	• Make sure the MDSMD and amplifier have compatible firmware versions

Code	F3501 / F3502
Message	EnDat initialization failed
Cause	The initialization of the EnDat encoder failed because the encoder is not connected or did not respond correctly.
Remedy	• Connect a supported EnDat 2.2 encoder • Check the encoder wiring • Review the encoder configuration on your axis • Power Cycle • Replace the encoder

Code	F3503 / F3504
Message	Invalid EnDat Master IP Core identifier
Cause	The IP core does not have the correct identifier
Remedy	• Make sure a previous firmware update was finished successfully • Power Cycle • Replace device

Code	F3505 / F3506
Message	Non-Safe EnDat Encoder connected as single solution

Cause	A non-safe EnDat 2.2 encoder was connected as a single encoder solution. EnDat 2.2 encoders without safety features can only be used in combination with another sensor.
Remedy	• Check the connected EnDat sensor type label • Correct the encoder combination in your axis configuration • Replace non-safety encoder with encoder with safety option

Code	F3571 / F3572
Message	PANASONIC SAFETY Power-On Test could not be completed due to timeout.
Cause	The internal status machine for the PANASONIC SAFETY Power-On Test was stuck and could not be completed. The Power-On Test was not successful and no position data is available.
Remedy	• Make sure a PANASONIC SAFETY encoder is connected • Check the encoder wiring • Make sure the drive controller is configured to use PANASONIC SAFETY encoder • Replace the encoder

Code	F3573 / F3574
Message	PANASONIC SAFETY Power-On Test could not be completed.
Cause	The internal status machine for the PANASONIC SAFETY Power-On Test failed in step "POT start".
Remedy	• Make sure a PANASONIC SAFETY encoder is connected • Check the encoder wiring • Make sure the drive controller is configured to use PANASONIC SAFETY encoder • Replace the encoder

Code	F3575 / F3576
Message	PANASONIC SAFETY Power-On Test could not be completed.
Cause	The internal status machine for the PANASONIC SAFETY Power-On Test failed in step "POT Diag Test-1".
Remedy	• Make sure a PANASONIC SAFETY encoder is connected • Check the encoder wiring • Make sure the drive controller is configured to use PANASONIC SAFETY encoder • Replace the encoder

Code	F3577 / F3578
Message	PANASONIC SAFETY Power-On Test could not be completed.
Cause	The internal status machine for the PANASONIC SAFETY Power-On Test failed in step "POT Diag Test-2".
Remedy	• Make sure a PANASONIC SAFETY encoder is connected • Check the encoder wiring • Make sure the drive controller is configured to use PANASONIC SAFETY encoder • Replace the encoder

Code	F3579 / F3580
Message	PANASONIC SAFETY Power-On Test could not be completed.
Cause	The internal status machine for the PANASONIC SAFETY Power-On Test failed in step "POT Communication Test".

Remedy	• Make sure a PANASONIC SAFETY encoder is connected • Check the encoder wiring • Make sure the drive controller is configured to use PANASONIC SAFETY encoder • Replace the encoder

Code	F3581 / F3582
Message	PANASONIC SAFETY Power-On Test could not be completed.
Cause	The internal status machine for the PANASONIC SAFETY Power-On Test failed in step "POT Done".
Remedy	• Make sure a PANASONIC SAFETY encoder is connected • Check the encoder wiring • Make sure the drive controller is configured to use PANASONIC SAFETY encoder • Replace the encoder

Code	F3661/F3662
Message	STO1A dynamic test feedback F3661: STO1 SF2 A (A_SF2A_FB_MPUA invalid) F3662: STO1 SF1 A (A_SF1A_FB_MPUB invalid)
Cause	The corresponding output could not be switched off during its dynamic test.
Remedy	• Check the output configuration for shortcuts • Power Cycle • Replace device

Code	F3663/F3664
Message	STO1B dynamic test feedback F3663: STO1 SF2 B (A_SF2B_FB_MPUA invalid) F3664: STO1 SF1 B (A_SF1B_FB_MPUB invalid)
Cause	The corresponding output could not be switched off during its dynamic test.
Remedy	• Check the output configuration for shortcuts • Power Cycle • Replace device

Code	F3665/F3666
Message	STO2A dynamic test feedback F3665: STO2 SF2 A (B_SF2A_FB_MPUA invalid) F3666: STO2 SF1 A (B_SF1A_FB_MPUB invalid)
Cause	The corresponding output could not be switched off during its dynamic test.
Remedy	• Check the output configuration for shortcuts • Power Cycle • Replace device

Code	F3667/F3668
Message	STO2B dynamic test feedback F3667: STO2 SF2 B (B_SF2B_FB_MPUA invalid) F3668: STO2 SF1 B (B_SF1B_FB_MPUB invalid)
Cause	The corresponding output could not be switched off during its dynamic test.
Remedy	• Check the output configuration for shortcuts • Power Cycle • Replace device

Code	F3669 / F3670
Message	STO feedback EDM1 invalid
Cause	The STO feedback signal did not match the logical STO state.
Remedy	• Check the output configuration for shortcuts • Power Cycle • Replace device

Code	F3671 / F3672
Message	STO feedback EDM2 invalid
Cause	The STO feedback signal did not match the logical STO state.
Remedy	• Check the output configuration for shortcuts • Power Cycle • Replace device

Code	F3673 / F3674
Message	STO1A static test failed F3673: STO1 SF2 A (A_SF2A_FB_MPUA invalid) F3674: STO1 SF1 A (A_SF1A_FB_MPUB invalid)
Cause	The STO1A feedback signal did not match the logical STO state.
Remedy	• Check the output configuration for shortcuts • Power Cycle • Replace device

Code	F3675 / F3676
Message	STO1B static test failed F3675: STO1 SF2 B (A_SF2B_FB_MPUA invalid) F3676: STO1 SF1 B (A_SF1B_FB_MPUB invalid)
Cause	The STO1B feedback signal did not match the logical STO state.
Remedy	• Check the output configuration for shortcuts • Power Cycle • Replace device

Code	F3677 / F3678
Message	STO2A static test failed F3677: STO2 SF2 A (B_SF2A_FB_MPUA invalid) F3678: STO2 SF1 A (B_SF1A_FB_MPUB invalid)
Cause	The STO2A feedback signal did not match the logical STO state.
Remedy	• Check the output configuration for shortcuts • Power Cycle • Replace device

Code	F3679 / F3680
Message	STO2B static test failed F3679: STO2 SF2 B (B_SF2B_FB_MPUA invalid) F3680: STO2 SF1 B (B_SF1B_FB_MPUB invalid)
Cause	The STO2B feedback signal did not match the logical STO state.
Remedy	• Check the output configuration for shortcuts • Power Cycle • Replace device

Code	F3681 / F3682
Message	Power On Test for +24V IO failed
Cause	An input is configured but the input stage supply voltage is missing on the IO connector XS4 pin 1 and 17 Hardware driver is damaged
Remedy	• Check the IO connector • Check the wiring on the IO connector • Check the power supply for the input supply voltage • Review the input configuration in your project

Code	F3683 / F3384
Message	Unable to switch off U24V0
Cause	During the power on test the voltage U24V0 could not be switched off by the overvoltage circuit
Remedy	• Check the input wiring • Check the power supply of the device • Power Cycle • Replace device

Code	F3685 / F3686
Message	Unable to switch off U12V0
Cause	During the power on test, the voltage U12V0 could not be switched off by the overvoltage circuit
Remedy	• Check the input wiring • Check the power supply of the device • Power Cycle • Replace device

Code	F3687 / F3688
Message	STO Voltage Monitoring invalid
Cause	During the INIOP power on test, the voltage monitoring of the STO-IC could not be tested as expected
Remedy	• Check the INIOP circuit • Check the STO power supply • Make sure that MDSMD and drive HW/FW are compatible • Power Cycle • Replace device

Code	F3701 / F3702
Message	Process Image cross check
Cause	The process image is different in both MPUs.
Remedy	• Make sure a previous firmware update finished successfully • Power Cycle • Replace device

Code	F3709 / F3710
Message	Process Image length invalid
Cause	The length of the process image is invalid and does not match the local MPU
Remedy	• Make sure a previous firmware update finished successfully • Power Cycle • Replace device

Code	F3711 / F3712
Message	Process Image alignment invalid
Cause	The alignment of the process image is potentially error prone and hence invalid.
Remedy	• Make sure a previous firmware update finished successfully • Power Cycle • Replace device

Code	F5001 / F5002
Message	SDI1 inactive failed (off but active)
Cause	The corresponding input is still active after the input stage was switched off by test signal DI_Test.
Remedy	• Check the input wiring • Check the input supply voltage • Power Cycle • Replace device

Code	F5003 / F5004
Message	SDI2 inactive failed (off but active)
Cause	The corresponding input is still active after the input stage was switched off by test signal DI_Test.
Remedy	• Check the input wiring • Check the input supply voltage • Power Cycle • Replace device

Code	F5005 / F5006
Message	SDI3 inactive failed (off but active)
Cause	The corresponding input is still active after the input stage was switched off by test signal DI_Test.
Remedy	• Check the input wiring • Check the input supply voltage • Power Cycle • Replace device

Code	F5007 / F5008
Message	SDI4 inactive failed (off but active)
Cause	The corresponding input is still active after the input stage was switched off by test signal DI_Test.
Remedy	• Check the input wiring • Check the input supply voltage • Power Cycle • Replace device

Code	F5009 / F5010
Message	SDIN1 inactive failed (off but active)
Cause	The corresponding input is still active after the input stage was switched off by test signal DI_Test.
Remedy	• Check the input wiring • Check the input supply voltage • Power Cycle • Replace device

Code	F5021 / F5022

Message	SDI1 inactive failed (off but active)
Cause	The corresponding input is still active after the input stage was switched off by test signal UDI.
Remedy	• Check the input wiring • Check the input supply voltage • Power Cycle • Replace device

Code	F5025 / F5026
Message	SDI3 inactive failed (off but active)
Cause	The corresponding input is still active after the input stage was switched off by test signal UDI.
Remedy	• Check the input wiring • Check the input supply voltage • Power Cycle • Replace device

Code	F5027 / F5028
Message	SDI4 inactive failed (off but active)
Cause	The corresponding input is still active after the input stage was switched off by test signal UDI.
Remedy	• Check the input wiring • Check the input supply voltage • Power Cycle • Replace device

Code	F5029 / F5030
Message	SDIN1 inactive failed (off but active)
Cause	The corresponding input is still active after the input stage was switched off by test signal UDI.
Remedy	• Check the input wiring • Check the input supply voltage • Power Cycle • Replace device

Code	F6801 / F6802
Message	Op code invalid or not supported
Cause	The PLC kernel detected an invalid or unsupported operand code.
Remedy	• Make sure you are using a compatible programming software • Send the configuration to the device

Code	F6803 / F6804
Message	PLC cache CRC mismatch
Cause	The PLC cache CRC is different in both MPUs.
Remedy	• Make sure the MDSMD firmware is updated correctly • Send the configuration to the device • Power Cycle

Code	F6805 / F6806
Message	PLC processing error
Cause	The PLC Index Sum does not match.

Remedy	• Make sure the MDSMD firmware is updated correctly • Check that the MDSMD and Panaterm for safety are compatible • Power Cycle

Code	F8201 / F8202
Message	Cycle time below minimum threshold
Cause	The cycle time measurement of the last cycle was below the minimum threshold.
Remedy	• Make sure the drive firmware is up to date • Check that the MDSMD and drive firmware are compatible • Power Cycle

Code	F8203 / F8204
Message	Cycle time exceeded maximum
Cause	The cycle time measurement of the last cycle was above the maximum threshold.
Remedy	• Make sure the drive firmware is up to date • Check that the MDSMD and drive firmware are compatible • Reduce the number of used PLC codes • Reduce the number of used supervision functions • Power Cycle

Code	F8205 / F8206
Message	Complementary cycle time below minimum threshold
Cause	The cycle time measurement of the last cycle of the complementary MPU was below the minimum threshold.
Remedy	• Make sure the drive firmware is up to date • Check that the MDSMD and drive firmware are compatible • Power Cycle

Code	F8207 / F8208
Message	Complementary cycle time exceeded maximum
Cause	The cycle time measurement of the last cycle of the complementary MPU was above the maximum threshold.
Remedy	• Make sure the drive firmware is up to date • Check that the MDSMD and drive firmware are compatible • Reduce the number of used PLC codes • Reduce the number of used supervision functions • Power Cycle

Code	F8209 / F8210
Message	PPI Interrupt cycle time below minimum threshold
Cause	The interrupt sampling grid was too short.
Remedy	• Make sure the drive firmware is up to date • Check that the MDSMD and drive firmware are compatible • Power Cycle

Code	F8211 / F8212
Message	PPI Interrupt cycle time exceeded maximum
Cause	The interrupt sampling grid was too long.
Remedy	• Make sure the drive firmware is up to date • Check that the MDSMD and drive firmware are compatible • Power Cycle

Code	F8213 / F8214
Message	Logical runtime program counter mismatch.
Cause	The main cycle did not execute correctly or the cycle time was exceeded.
Remedy	• Make sure the drive firmware is up to date • Check that the MDSMD and drive firmware are compatible • Power Cycle

Code	F8215 / F8216
Message	Logical interrupt program counter mismatch.
Cause	The interrupt cycle did not execute correctly or the cycle time was exceeded.
Remedy	• Make sure the drive firmware is up to date • Check that the MDSMD and drive firmware are compatible • Reduce the size of your application (less/optimized PLC logic, less supervision functions) • Power Cycle

Code	F8221 / F8222
Message	PPI Interrupt Timeout (Sync missing)
Cause	The PPI sync from the drive is missing or too late.
Remedy	• Make sure the drive firmware is up to date • Make sure the drive is running correctly • Check that the MDSMD and drive firmware are compatible • Power Cycle

Code	F8223 / F8224
Message	PPI Timeout Handshake
Cause	The handshake between both MPUs inside the PPI ran into a timeout.
Remedy	• Make sure the drive firmware is up to date • Make sure a previous firmware update completed successfully • Power Cycle

Code	F8225 / F8226
Message	PPI Main Ticker invalid
Cause	The ticker of the main program is invalid or stuck.
Remedy	• Make sure the drive firmware is up to date • Make sure a previous firmware update completed successfully • Power Cycle

Code	F8227 / F8228
Message	System cycle timeout
Cause	The system start was triggered by the timeout fallback interrupt after the PPI sync signal was missing.
Remedy	• Make sure the drive firmware is up to date • Make sure the drive is running correctly • Check that the MDSMD and drive firmware are compatible • Power Cycle

Code	F8229 / F8230
Message	System trigger timeout

Cause	The system cycle started after a PPI interrupt ran into a timeout.
Remedy	• Make sure the drive firmware is up to date • Make sure the drive is running correctly • Check that the MDSMD and drive firmware are compatible • Power Cycle

Code	F8231 / F8232
Message	PPI Sync Slot invalid
Cause	The PPI synchronization after POR is invalid
Remedy	• Make sure the drive firmware is up to date • Make sure the drive is running correctly • Check that the MDSMD and drive firmware are compatible • Power Cycle

Code	F8301 / F8302
Message	System state stuck at init
Cause	The system was stuck in status Init (1) and unable to initialize all necessary components.
Remedy	• Make sure the drive firmware is up to date • Make sure the drive is running correctly • Check that the MDSMD and drive firmware are compatible • Power Cycle

Code	F8303 / F8304
Message	System state stuck at startup
Cause	The system was stuck in status Startup (2) and unable to initialize all necessary components.
Remedy	• Make sure the drive firmware is up to date • Make sure the drive is running correctly • Check that the MDSMD and drive firmware are compatible • Power Cycle

Code	F8305 / F8306
Message	System state stuck at run safe
Cause	The system was stuck in status Run Safe (3) and unable to initialize the bus for the network communication.
Remedy	• Make sure the drive firmware is up to date • Make sure the drive is running correctly • Check that the MDSMD and drive firmware are compatible • Power Cycle

Code	F9001 / F9002
Message	Internal MPU instruction set self test failed
Cause	An internal MPU instruction was executed but did not return the expected result.
Remedy	• Power Cycle • Replace device

Code	F9003 / F9004
Message	Temperature below minimum (-25°)
Cause	The MPU temperature reached its absolute minimum operating temperature and safe operation cannot be guaranteed anymore.

Remedy	• Check allowed environmental conditions • Power Cycle • Install winter cap and provide warm tea • Replace device if error persists

Code	F9005 / F9006
Message	Temperature exceeds maximum (125°)
Cause	The MPU temperature reached its absolute maximum operating temperature and safe operation cannot be guaranteed anymore.
Remedy	• Check allowed environmental conditions • Power Cycle • Replace device if error persists

Code	F9009 / F9010
Message	ROM CRC invalid (local MPU)
Cause	The checksum of the firmware flash area does not match its content.
Remedy	• Make sure a previous firmware update finished successfully • Make sure the flash area was completely erase before programming • Power Cycle • Replace device

Code	F9011 / F9012
Message	ROM CRC invalid (complementary MPU)
Cause	The checksum of the firmware flash area of the complementary MPU does not match its content.
Remedy	• Make sure a previous firmware update finished successfully • Make sure the flash area was completely erase before programming • Power Cycle • Replace device

Code	F9013 / F9014
Message	Stack Area signature overwritten
Cause	The operating system caused a stack over- or underflow.
Remedy	• Power Cycle • Replace device

Code	F9015 / F9016
Message	Register value does not match expectation
Cause	A configuration register was changed and does not contain its expected value anymore.
Remedy	• Check and ensure the EMI requirements • Ensure the device is operating in its allowed environmental conditions • Power Cycle

Code	F9017 / F9018
Message	Internal RAM test failed (Galpat)
Cause	The test for the internal RAM failed.

Remedy	• Check and ensure the EMI requirements • Ensure the device is operating in its allowed environmental conditions • Power Cycle

Code	F9019 / F9020
Message	FCE Kernel0 did not work as expected
Cause	The CRC engine Kernel 0 did not return the expected result.
Remedy	• Power Cycle • Replace device

Code	F9021 / F9022
Message	FCE Kernel1 did not work as expected
Cause	The CRC engine Kernel 1 did not return the expected result.
Remedy	• Power Cycle • Replace device

Code	F9023 / F9024
Message	FCE Kernel2 did not work as expected
Cause	The CRC engine Kernel 2 did not return the expected result.
Remedy	• Power Cycle • Replace device

Code	F9025 / F9026
Message	FCE Kernel3 did not work as expected
Cause	The CRC engine Kernel 3 did not return the expected result.
Remedy	• Power Cycle • Replace device

Code	F9027 / F9028
Message	Internal RAM Test failed (Read/Write Test)
Cause	The internal read/write RAM test failed.
Remedy	• Check and ensure the EMI requirements • Ensure the device is operating in its allowed environmental conditions • Power Cycle • Replace device

Code	F9031 / F9032
Message	Internal MPU Hard Fault Trap
Cause	The internal MPU processing failed.
Remedy	• Check and ensure the EMI requirements • Ensure the device is operating in its allowed environmental conditions • Power Cycle • Replace device

Code	F9033 / F9034
Message	Internal MPU Mem Fault Trap
Cause	The internal MPU processing failed.

Remedy	• Check and ensure the EMI requirements • Ensure the device is operating in its allowed environmental conditions • Power Cycle • Replace device

Code	F9035 / F9036
Message	Internal MPU Bus Fault Trap
Cause	The internal MPU processing failed.
Remedy	• Check and ensure the EMI requirements • Ensure the device is operating in its allowed environmental conditions • Power Cycle • Replace device

Code	F9037 / F9038
Message	Internal MPU Usage Fault Trap
Cause	The internal MPU processing failed.
Remedy	• Check and ensure the EMI requirements • Ensure the device is operating in its allowed environmental conditions • Power Cycle • Replace device