Programming Manual
for the
PSCBR-C-100 Module

Programming Manual PSCBR-C-100

Table of Contents

Contents

TERMS 7
PLC 7
SafePLC 7
PSCBR-C-100 7
Function block (functional module) 7
Logic diagram (function module language) 7
InPort / OutPort 7
Linkage 7
Connector 7
Attribute 7
Routes 7
Signal list 8
Signal cell 8
PLC input signal list 8
PLC output signal list 8
Instruction list (IL) 8
Compilation 8
Function block group 8
Function block types 8
Message window 8
Info display 8
Configuration 8

MOUSE AND KEYBOARD COMMANDS 9
Mouse dependent actions 9
Keyboard commands 9

BRIEF DESCRIPTION OF PROCEDURE 10
General note 10
“Push & Pop” instead of “Drag & Drop” 10

LOGIC DIAGRAM 19

TERMINAL DIAGRAM 20

LOGIC DIAGRAM 22

PREPARING THE WIRING 24

MESSAGE WINDOW 26

PROGRAM CREATION 27

TRANSFERRING THE PROGRAM TO THE PSCBR-C-100 MODULE 29

Connection settings **29**

Connecting dialog **31**

Validation dialog **33**

DIAGNOSE OF A TRANSFERRED PROGRAM 35

The Scope Monitor **38**
Procedure when measuring with the Scope 40
Preparing the measurement 40
"Start" measurement 41
"Stopping" a measurement and viewing data 41
Measuring schemes 42

DIAGRAM MANAGEMENT 45
Diagram access 45
Program information 46

PROGRAM DEVELOPMENT AIDS 47

Info display **47**

Signal tracking **47**

Copying attributes into the message window **47**

QuickJump **48**

PREDEFINED FUNCTION BLOCKS 49
Sensorinterface 49
Digital inPorts 50
PSCBR-C-100 outPorts 50

INSERTING INPORT BLOCKS 51
Signal-No. 52
Cross-shorting test 52
Start behaviour 52
Start test 53

START TEST 57

START AND RESET ELEMENT 58

ANALOG SIGNAL INPUT 64
Analog inPort Ain1 / Ain2 65
Proportion adder 66

INSERTING OUTPORT BLOCKS 67
Relais outPort 67

OutPort type 68
Semi-conductor outPort/ Hi Lo semi-conductor outPort 69
HiLo outPort 71
EMU function 72

THE LOGIC MODULES 73

Logic AND 73

Logic OR 74

Logic EXCLUSIV OR 74

Logic NOT 75

RS Flip Flop 76

Timer 77

Permanently logic "1" module 79
Result of the EMU module 79

SET INPORT CONNECTING POINT 80

CONNECTING POINT OUTPORT 81

STATUS MESSAGE DATA 82
Logic data 82
Process data 84
Extended signal channel 85

FUNCTION GROUPS 87

Creating a function group frame 87
Inserting a group module 87
Opening the group editor 87
Setting the group management 88
Changing the size of a group frame 90
Showing and hiding function modules 90

Creating the group interface 91
Setting the usage 91
Restrictions 92

Procedure for Creating a Function Group 93
1. Step: Adding interface modules 93
2. Step: Adding function modules to the group 93
3. Step: Create connections 94
4. Step: Connect group interface 94
5. Step: Set connection restrictions 94
Test function group 94
Disabling a function group 94

Exporting a function group 95

Importing a function group **96**

THE SAFETY FUNCTIONS 97

ENCODER 99

Parameterization of the measuring section: **99**
Encoder Selection 102
Sensor 1 or Sensor 2 103
Sensor info field 105

Determination of the Resolution with Regard to Different Characterized Measuring Lengths: **107**
Rotational measuring length 107
Input example 1 108
Linear measuring length 111
Input example 2 112
The Sensor Info Field shows the following result entries: 115

SAFETY MODULES 116

SEL (Safe Emergency Limit) **117**

SLP = (Safe Limited Position) **123**

SCA (Safe Cam) **128**

SSX (Safe Stop 1/ Safe Stop 2) **134**

SLI (Safe Limited Increment) **140**

SDI (Safe Direction Indication) **144**

SLS (Safe Limited Speed) **147**

SOS (Safe Operating Stop) **153**

SAC (Safe Analog Control) **156**

ECS (Encoder Supervisor) **159**

DEM (Dynamic Encoder Muting) **161**

EOS (Encoder Offset Supervisor) **166**

I/O MODULE EXTENSION PSCBR-E-31-12-DI-10DIO 168

- **Equipment selection** **168**

Management of additional inPorts/outPorts **168**
Selection of inPorts and outPorts 168

Input of serial number for physical assignment **169**

APPENDIX PROCESS IMAGE 171

Introduction **171**

Designation of safety function **172**

SPECIFICATION OF THE PLC-FUNCTIONALITY **173**

Input variables **173**
PLC – Output variables 177

Process Data **181**
PLC – Commands 183
Assignment of resources 184

APPENDIX ENCODER COMBINATIONS **185**

FAULT TYPES PSCBR **185**

Terms

PLC

Programmable **L**ogic **C**ontroller, equals the German designation for **S**peicher**p**rogrammierte **S**teuerung (SPS). The term PLC is exclusively used within the PSCBR system.

SafePLC

Program editor for the graphical preparation of sequencing programs using the functional block method, as well as the parameterization of sensor, actuators and other technological functions used.

PSCBR-C-100

Modular monitoring module from SCHMERSAL for safe and reliable drive control. The behaviour of the “PSCBR-C-100” is defined by a user configuration and the associated logic operations.

Function block (functional module)

Module in a PLC-control that influences the program sequence of a PLC-program either physically or logically. A physical (hardware) function block is e.g. a push button or an outPort on the PSCBR-C-100 module. However, the logic operation (such as AND or OR) of inPort and outPort signals within a PLC is also referred to as a function block.

Logic diagram (function module language)

Graphically oriented, function block based, descriptive “programming language” acc. to IEC 1131, serving the purpose of visualizing logic operations of inPorts and outPorts on function blocks of a PLC control. The logic diagram shows the function modules and their logic operations in a graphical form. (engl. Function Block Diagram FBD)

InPort / OutPort

Location on a function block which can be used for linkage to other function blocks.

Linkage

A named connection between:
a.) a function block outPort with a function block inPort.
b.) a PLC inPort with a function block inPort.
c.) a function block outPort with the PLC outPort.

Connector

Connecting point between the beginning and the end of a linkage with an inPort and an outPort of a function module

Attribute

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

Routes

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

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

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

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

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

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

Compilation
Compilation and verification of the function plan created in SafePLC and the associated parameters.

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

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

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

Info display
Delayed display of information about a function block, following the Windows Tool Tip mechanism. The mouse pointer must be dragged across an object to display this information.

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

Mouse and keyboard commands

Mouse dependent actions

- **Left mouse button on a function block** Selected representation (highlight), whereby previous selections become invalid.
  Note: If the CTRL key is pressed while “Setting Markers”, the associated “Marker OutPort” blocks will also be selected.
- **Shift + Left mouse button on function block**: Multiple selection (adding to an existing selection).
- **Ctrl + Left mouse button on selected function block**: Deselection of block (removal from selection).
- **Delete key**: Deletes the elements of an existing selection incl. connections!
- **Double-clicking on function block**: Editing of settings.
- **Right mouse button on a function block:** Display of context menu for function block.
- **Right mouse button in drawing area:** Display of context menu for drawing area.
- **Left mouse button on connector**: Highlights the existing logic operation(s).
- **Ctrl + movement of mouse pointer over an object**: Display of information data, even if the display has been disabled via the menu.
- **Turning the scroll wheel on the mouse**: Dynamic zooming of the logic diagram.
- **Moving the mouse with the scroll wheel depressed**: Moving the logic diagram.

Keyboard commands

- **Ctrl + Q**: Start zoom-in command
- **Ctrl + W**: Start zoom-out command
- **Ctrl + A**: Zoom all command
- **Ctrl + I**: Switch automatic info display on/off
- **Ctrl + O**: Open file
- **Ctrl + S**: Save file
- **Ctrl + M**: Switch message window on/off
- **Ctrl + N**: New file
- **Ctrl + T**: signal trace
- **Ctrl + E**: edit a block
- **Ctrl + D**: Display status info in the message window
- **Ctrl + F**: Searching for a test in the message window
- **Esc**: Deselection of marked elements
- **Erase**: Erases selected objects
- **Ctrl+arrow left**: Logic diagram LineScroll left
- **Ctrl+arrow right**: Logic diagram LineScroll right
- **Ctrl+arrow up**: Logic diagram LineScroll up
- **Ctrl+arrow down**: Logic diagram LineScroll down
- **Ctrl+Tab**: Toggle between layout
- **Ctrl+R**: Open Connection window

- **Ctrl+F2**: Open Layout Management
- **>, <**: Maximize/mimimize functional group
- **F1**: Open help
- **F5**: PLC Check and Compile

Brief Description of Procedure

The program SafePLC from Schmersal is a graphically oriented software for creating a PLC-based monitoring program for the PSCBR-C-100 module. This device enables reliable monitoring of drive motors.
The structuring of the programming task inside SafePLC results from the years of experience of Schmersal by dealing with safety relevant control tasks. The procedure described hereafter has been found most effective for the programming of the PSCBR-C-100 devices, whereby it is not strictly prescribed. Images of the associated tool bars or commands serve the purpose of illustration.

General note

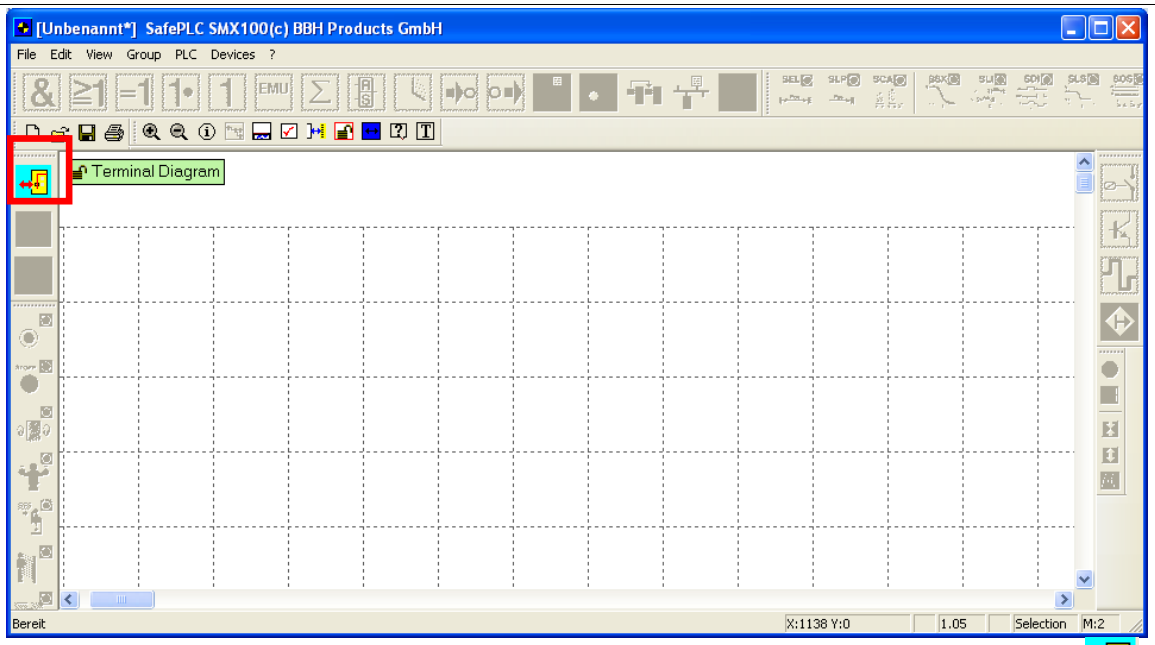
The program requires write and read rights of the user logged in to the PC that is used for programming. Missing access rights can lead to side effects in logic diagram debugging or cause problems when saving logic diagrams to directories with limited rights.

“Push & Pop” instead of “Drag & Drop”

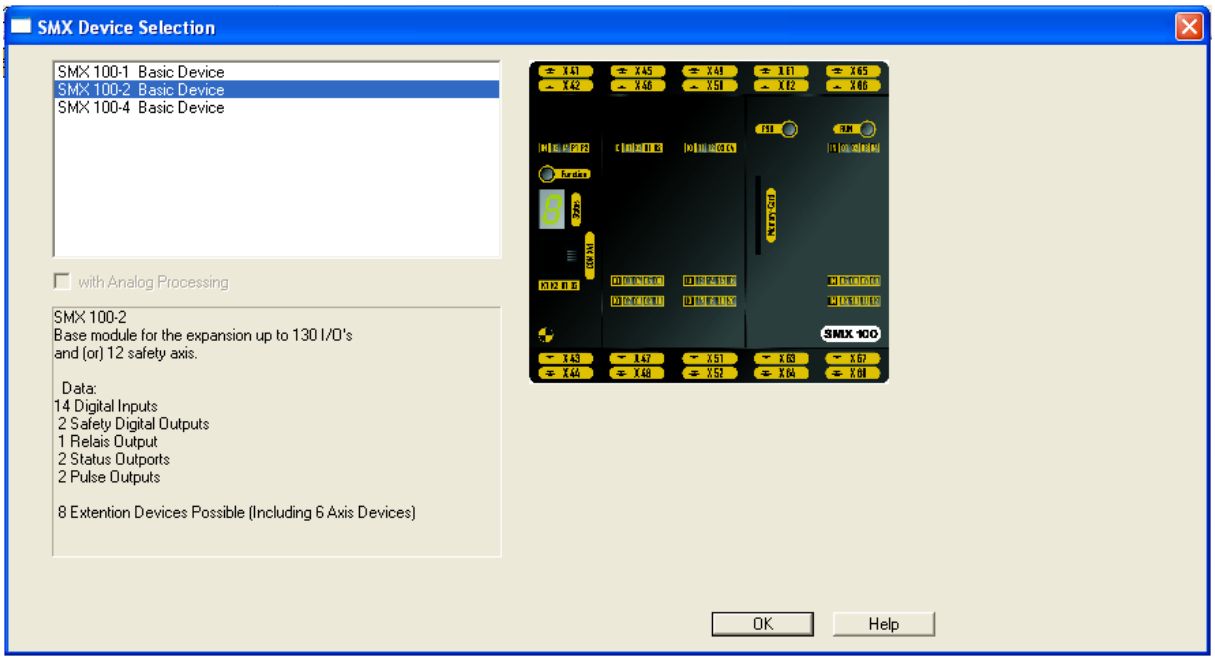
To begin with we would like to point out that the SafePLC developer team has decided against the “Drag & Drop” favoured by Windows. Instead you just click on an icon in the toolbar or a menu option (“Push”) to switch to insert mode. This mode is identified by a changed mouse pointer. You do not need to hold the left mouse button depressed. To insert (“Pop”) the selected function block click on the location at which it is to be inserted. The “Esc”-key cancels this mode. The proposed process steps correspond with the considerations, which should be executed when planning a safety related monitoring of a drive axis.

1. Setting up the device type to be programmed

Once the program SafePLC PSCBR-C-100 has been started, or a new logic plan is to be created, the following screen will appear.

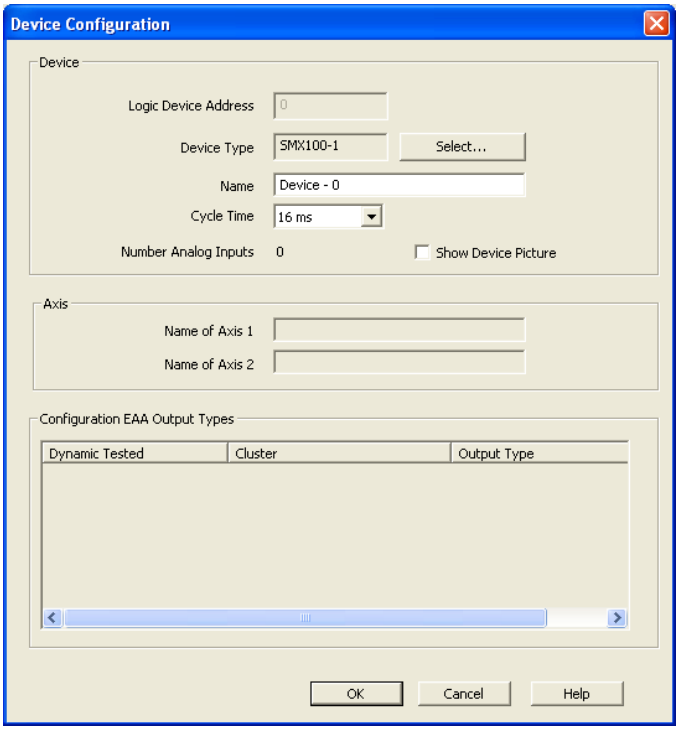


The selection window for the basic modules can be called up via the symbol .



Here one must set up the device type to be programmed.

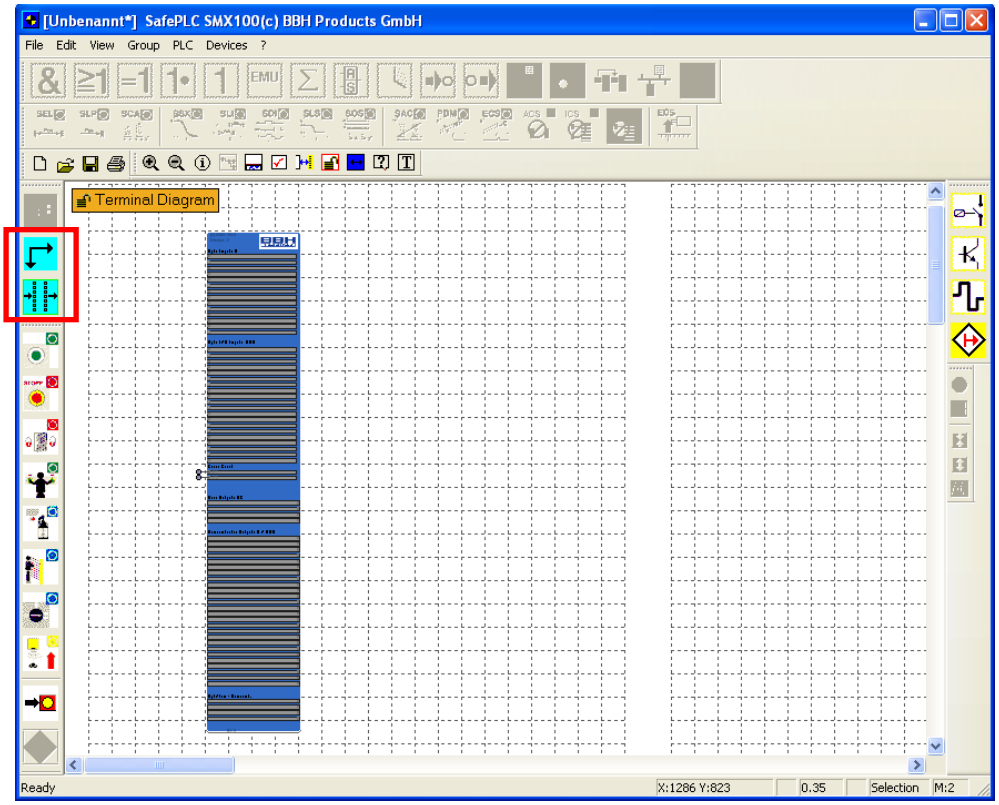
The following dialog can be used to assign a name and to choose the parameters “Cycle Time” and “Dynamic Tested” for each input cluster.
The setting “Cycle Time” is changeable to 16ms, 24ms and 32ms



Due to the associated resources and their management in the programming environment, the set device type cannot be changed any more at a later date.

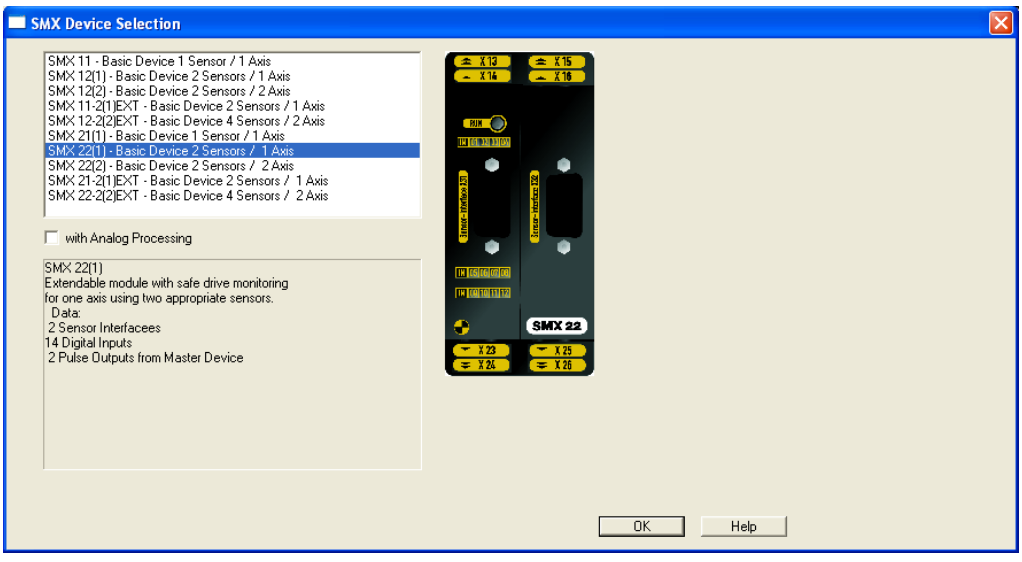
The whole device can be deleted later a new selected.

The selected and parameterized module is finally displayed:

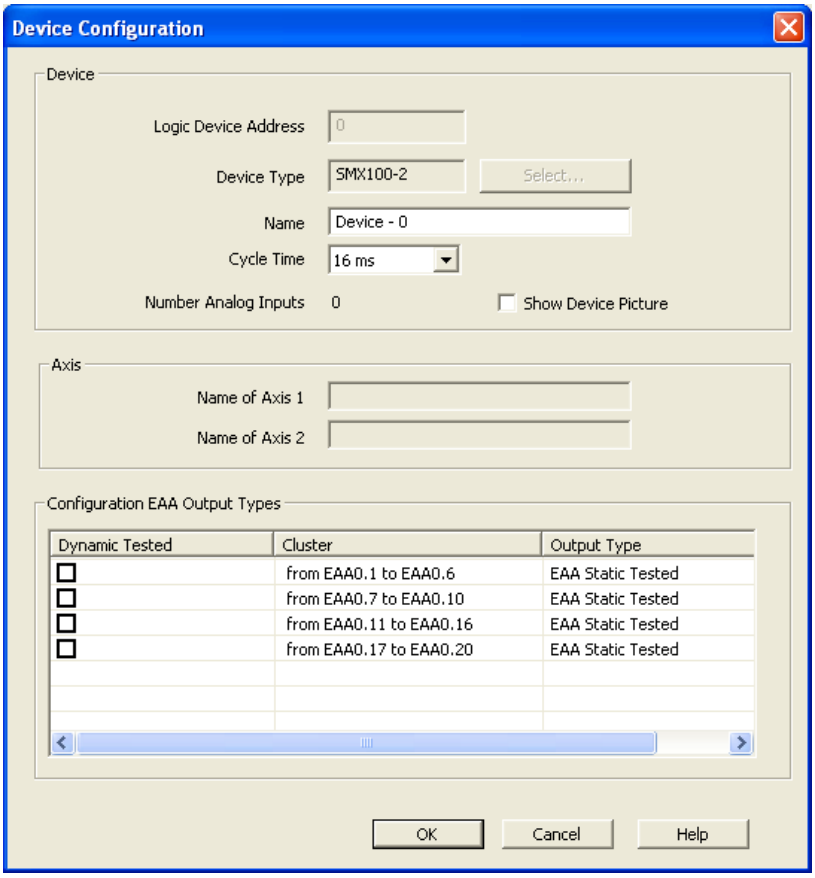


Axis extension modules must be used to control axes.
This is accomplished with the symbol:

The desired axis extension can be selected via the selection dialog:

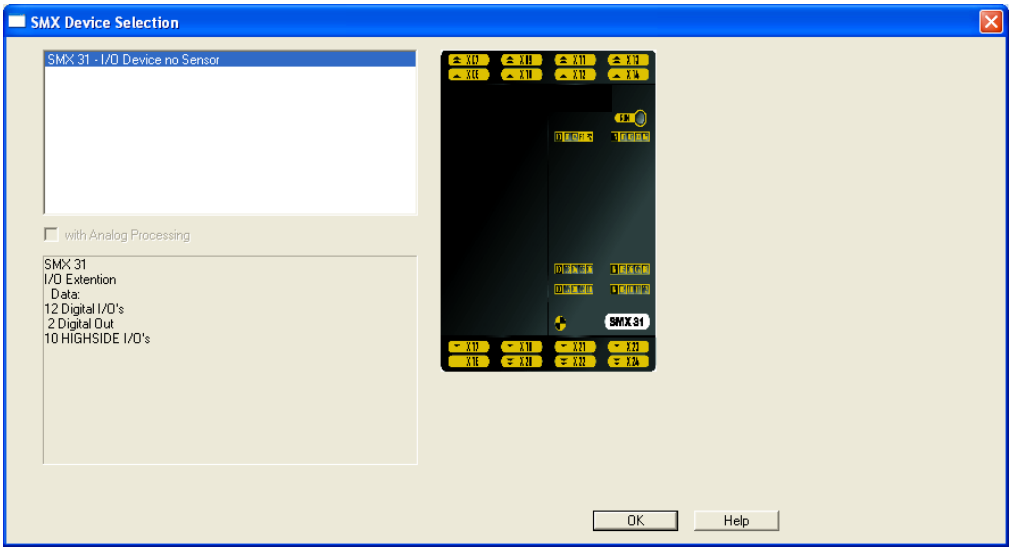


Parameters can be set in the “Device Configuration” window:

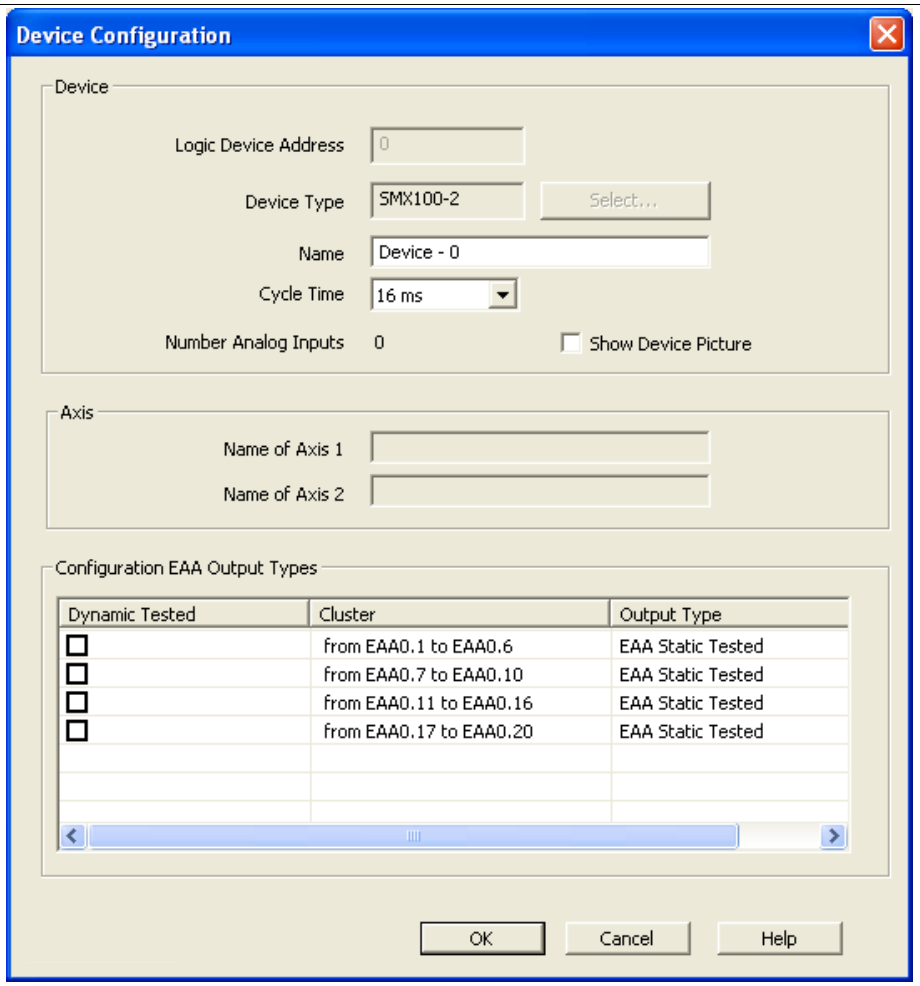


IO-extensions PSCBR-E-31-12-DI-10DIO can also be selected via the symbol:

The following screen shows the module to be inserted:



Parameters can be set again in the “Device Configuration” window:

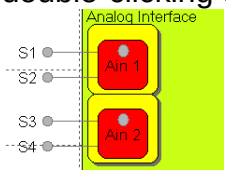


See also section: I/O Module Extension PSCBR-E-31-12-DI-10DIO

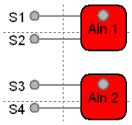
2. Determination of periphery in the terminal diagram

The terminal diagram represents the view from outside on the PSCBR-C-100 module. Here you should execute the following work steps.

- if necessary, definition of the encoders used and their parameters by double-clicking on the encoder symbol of the PSCBR-C-100 module.



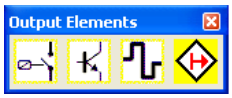
- if necessary definition of the analog signals to be monitored.



Note: A red symbol signalized no configuration

- determination of the input periphery modules (emergency stop, safety doors, sensors, etc.), their configuration and the definition at which monitoring input of the PSCBR-C-100 module these should be connected.

- Determination of the output modules used (semi-conductor / relay output) and which channels should be used for feedback in case of faults.



3. Definition of monitoring functions and logic modules in the logic diagram

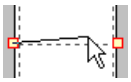
The logic diagram shows the logic modules and their logic operation to a program diagram inside the PSCBR-C-100 module. In the logic diagram you can:

- define the logic operation and logic elements such as Timer, Flip Flops and Terminal Blocks.

- determine the type of monitoring and the associated parameters (This is only possible, if the encoder parameters had been defined).

After the definition of the logic modules they be connected:

- "internally" wire peripheral equipment, monitoring and logic modules. For this purpose drag the mouse pointer across a start connector, press the left mouse button and connect via a target connector in active state.



- use the diagnostics and analysis tools. This includes the Info display, signal tracking, display of function block attributes in the message window, as well as quick jumping to modules in the logic diagram by double-clicking on the coloured BlockID in the message window.

4. Compilation of monitoring program

Once the required modules have been defined and logically linked, the program from the PSCBR-C-100 module can be created. SafePLC will do this for you:

- Examination for open connectors in the logic diagram
- Examination of boundary conditions for the monitoring functions
- Examination of the correct distribution of cross-circuit pulse numbers
- Generation of a transferable OP programming code for the PSCBR-C-100 module

5. Program transfer to the PSCBR-C-100 module

- Setting the COM outPort
- Transfer of the machine program
- Testing the program on the PSCBR-C-100 module
- Locking the logic diagram after the program has been released
- Preparation of the configuration report and validation of the configuration

Logic Diagram

Logic diagrams are the Windows documents with file extension “plc”, which were created with the program SafePLC. These files save all information for the automatic creation of a program for the PSCBR-C-100 module from Schmersal.
The logic diagram is subdivided into field, which can take up the function blocks. The function blocks are inserted and displaced within this raster. Overlapping of function blocks is not possible.
Within the logic diagram the two views “terminal diagram” and “logic diagram” are available for the user.
There are various possibilities to switch between the views.

- **Menu**: View -> Change layout
  Terminal Diagram:
  The definition of the PSCBR-C-100 module periphery to be monitored takes place in the terminal plan.
  Logic Diagram:
  The logic operation of inPorts and outPorts to be monitored with the logic and monitoring modules takes place in the logic diagram.
- **Keyboard**: Crtl + Tab
- **Button in the** “Drawing aid” **tool bar**

Permanent status display:

In the left upper corner of the logic diagram you find a status display: It informs about the following conditions:

- **Active logic diagram view**: This is displayed as text and changes between “terminal plan”and “logic diagram”.
- **Actual diagram access**: This is symbolized by a unlocked or locked padlock.
- **Compiler status**: The background colour of the status display indicates the current compilation status of the logic diagram.
  - **Red**: The logic diagram still needs to be compiled
  - **Green**: The current logic diagram has been compiled, the program can be transferred to the PSCBR-C-100 module.

Tip: Use the context menu of the logic diagram

Note: For safety related reasons function blocks cannot be handled with the Windows commands “Cut” and “Insert”.

Terminal diagram

The terminal diagram shows the logic operation of the switches and sensors to be monitored with the PSCBR-C-100 module.
When an empty diagram is opened, first the Hardware configuration should take place:

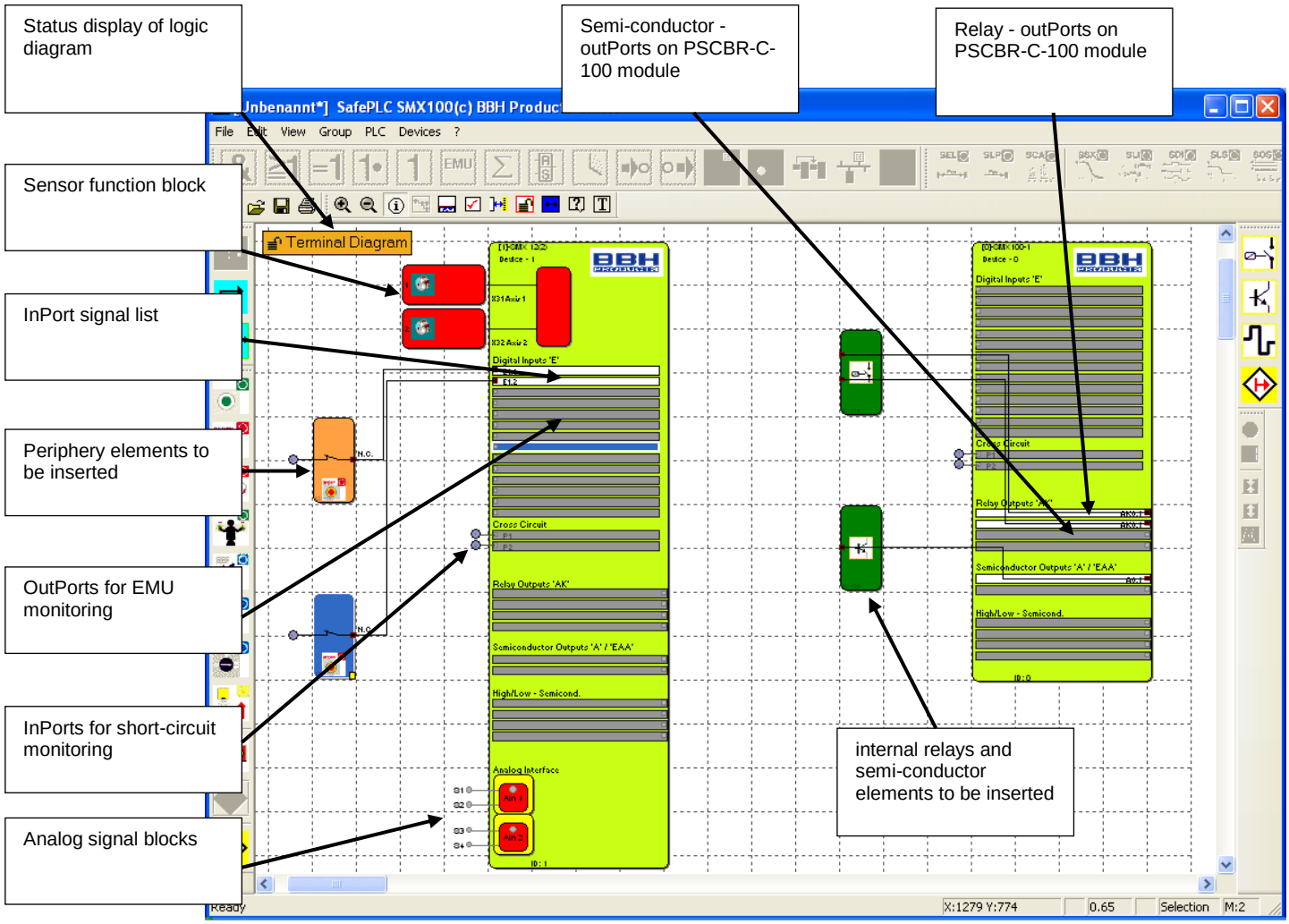
- Master Device

- Axis Device

- I/O Device

After this configuration the Terminal Diagram shows all useable inputs, outputs.

When inserting a new or double-clicking on an already existing function block, the associated attribute editor is opened and the parameters can be modified.



If function blocks are inserted into the terminal diagram, the elements will automatically be wired. In some instances it may happen, that the connections are unfavourably displayed. This, however, has no adverse effect on the functionality. You can trigger redrawing of the connection by displacing then corresponding block. Existing connections can also be erased and subsequently generated by hand.

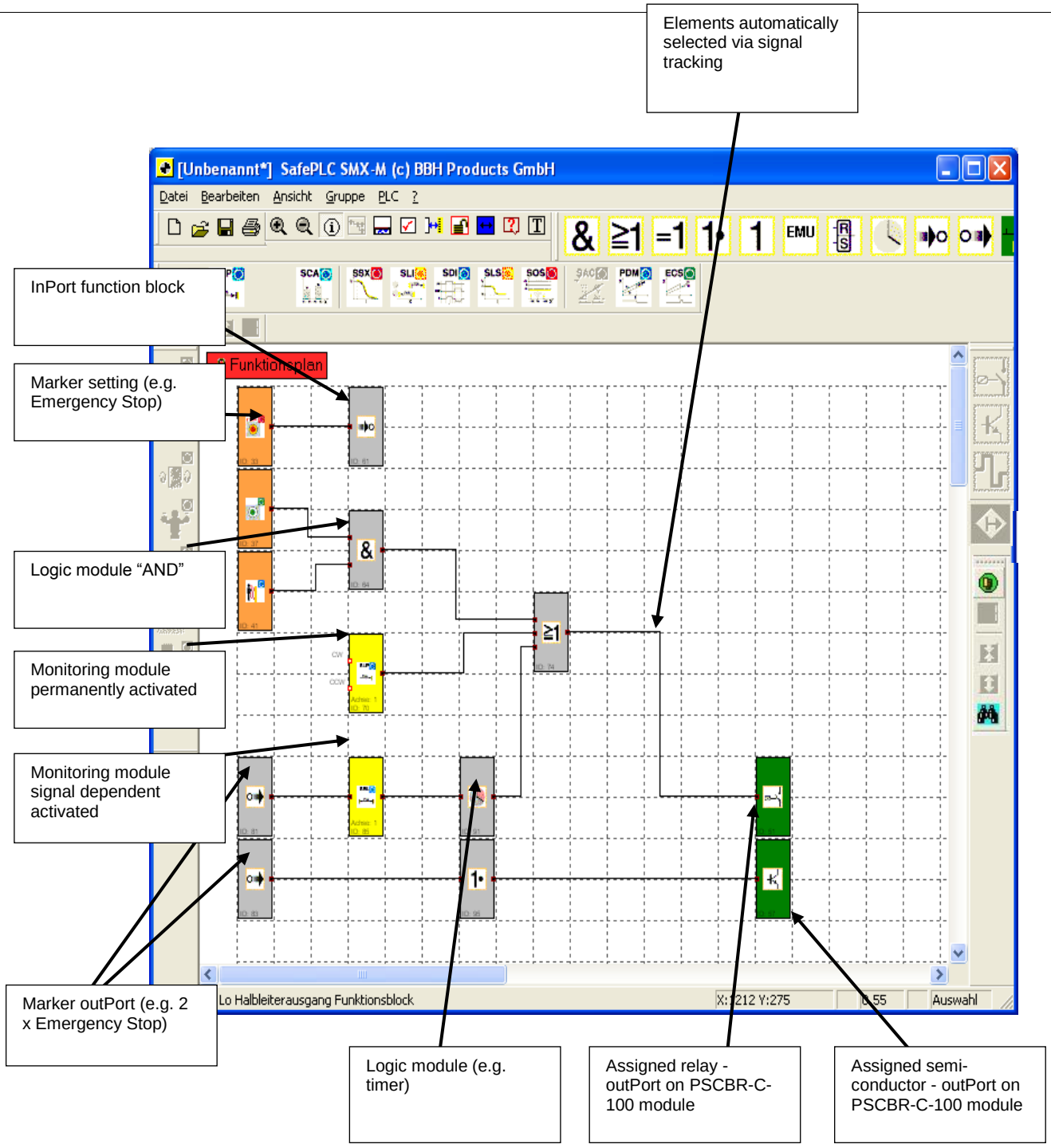
Tip: Start from the left border of the logic diagram and work downwards.

Note: Since no logic elements must be defined in this view, the corresponding commands are disabled.

Logic Diagram

In the logic diagram a programmatic logic operation between input elements, monitoring elements and logic modules as well as the outPorts of the PSCBR-C-100 module takes place. In this respect the outPorts on the inPort elements correspond with the inPorts on the PSCBR-C-100 module. In opposition to this, the inPorts of the output elements become outPorts of the PSCBR-C-100 module.

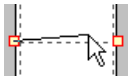
In order to be able to create a clearly structured logic diagram, one can define so-called terminal blocks. These represent a named connection between inPort and outPort connectors of function blocks. One or several marker outPort blocks (outPort terminals) can be defined for a marker setting block (inPort terminal).



Tip:
Use the comment line in the marker setting blocks. The comment appears when selecting the inscription for the marker setting block. This contributes to clarity!

Note: Parameters of the inPort elements cannot be modified in this view.

Preparing the Wiring

 The logic diagram is created by linking the inPort and outPort connectors of the functional modules. An outPort of a module may, if necessary, be multiply connected with inPorts on other modules, whereby any inPort must only be assigned once. Apart from this, certain module groups cannot be interconnected for technical reasons. In case of an invalid connection the program will display a corresponding message.
Connection set-up:

- Select a start connector with the left mouse button
- Position the mouse pointer with the left button depressed
- release the mouse button when the pointer is on the target connector

Note: Connections can be selected with a mouse click or by choosing a connector, no net selection.

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

Automatic connection
The program draws the connection automatically by inserting additional control points (breakpoints) based on a bisectioning algorithm. The graphics display can be varied by simply moving the function blocks. In complex diagrams it may happen that a connecting line will intersect with a function block. This behaviour has no influence on the program creation.

Self-defined connection
There is an additional command available for drawing self-defined connecting lines. These user defined connecting lines remain existent, until the dislocation of an associated function block forces the recalculation of the control points.
A user defined connection is set up as follows:

1.) either by selecting the connection to be edited and invoking the command: “User defined connecting points” in the “Edit” menu.
2.) or by opening the context menu (right mouse button) while the mouse pointer is positioned on the corresponding connection and selecting the command “User defined connecting points”.
3.) Input of control points (breakpoints). The program starts at the output connector. Only orthogonal control points can be generated, i.e. the connecting lines will always run horizontally or vertically. The program collects the entered points, until the drawing command is concluded.
4.) Conclusion of the command by pressing the Enter key (Return). The connection is then drawn.

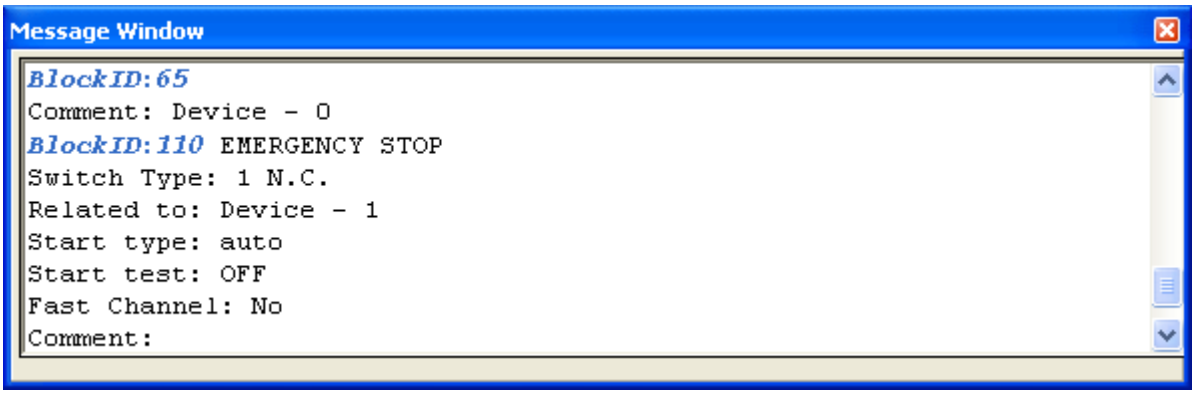
Note: The program matches the first and the last control point to the associated function block connector. The inPort and outPort connector is not considered a control point and does therefore not need to be specified.

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

Message window

Besides the output of status and error messages as well as the display of results from the examination of the logic diagram, the messages window also is a powerful tool for checking function block data within their context.

Quick Jump
By double-clicking on the colour-coded BlockID's in the message window one can have the associated block centred in the logic diagram window. This enables quick localization of function blocks belonging to an output.



Context menu in message window

Message window Hides an active message window

Clear window Deletes the contents of the message window. It is recommended to clear the contents in regular intervals, because with e.g. extensive use of the “Attributes in the message window” function quite a lot of data may collect in the memory of the message window, which may in turn slightly slow down the processing speed of the message output.

Select all and copy Copies the entire contents of the message window into the clipboard, making the text available for other Windows programs via the “Insert” command.

Search To find text within the message window.

Help on message window Opens the help page

Docking of message window Two-way switch to enable the message window to dock to the frame of the main program or to position the window freely on the screen.

Note: The “docking” behaviour for the message window of the application can be configured via the settings.

Program Creation

☑ Once all connectors of the inserted modules have been linked , the program for monitoring one or several motor axis can be generated.

After starting the compiler, the compilation process will run in the stages described below. The results are displayed in the message window, which is automatically switched on when the compiler is started.

Verifying for open connectors
SafePLC makes sure that all connections between function blocks can be opened. Non-connected connectors are recognized as faults.

Verifying for unreferenced "Marker" Blocks
SafePLC makes sure that all "Set marker" blocks inserted in the logic diagram are used. Otherwise any non-referenced addresses in the program would be occupied.

Verifying the value ranges of the monitoring functions
Before creating the IL, SafePLC checks whether the parameters of the monitoring functions are inside the value ranges of the current encoder configuration. In case of a modification of the encoder settings with a monitoring functionality that had already been determined, an unnoticed area overflow may otherwise occur. This test does *not* replace the context related evaluation of data after a change made by the user!

Creation of the instruction list (IL)
The IL-code created on basis of the function blocks is displayed in the message window and can there be verified or copied to the clipboard for the purpose of documentation (see: context menu of the message window). context menu of the message window). The code blocks belonging to the function blocks are segmented by the corresponding BlockID, which is output in form of a comment.

Creating the OP code
This generates the machine code for the PSCBR-C-100 module, which is then transferred together with the configuration data.

Message Window
All results after a compiler run are displayed in this window. If there are any faults, this window will be opened automatically.

Note: After a successful compiler run the dialog of the diagram management shows the current program CRC together with the compilation date. Please disable the logic diagram after successful compilation and transfer, so that compiling will not cause any accidental modifications The CRC of the currently loaded program can be read by pressing the "Func" button on the PSCBR-C-100 module or via the "SysInfo" tab in the diagnostic dialog. The diagnostic must have been started for this purpose.

Tip: Use the “Quick Jump” feature to be able to jump directly to the associated block in the diagram by simply double-clicking on a displayed ***BlockID*** in the message window. This way one can easily identify the corresponding function block in case of fault messages.

Security CRCs
After a successful compiler run a total of two CRC-signatures are made:

- Parameter CRC: Signature concerning parameter data
- Program CRC: Signature concerning the program

The calculated CRC-values can be displayed in off-line mode (no connection to module) via the menu "File->Diagram Management".

Important:
This display is only informative and must not be used for the safety related documentation!

Note: If an existing SafePLC program is opend with a new version of SafePLC this program will be ported. But all sensor settings have to be checked again.

Transferring the program to the PSCBR-C-100 module

This section described the data and program transfer to the PSCBR-C-100 module via network. Once the interface has been started, the windows below will appear. It consists of a small “Status bar” and control buttons to trigger (by pressing) the actions described below.

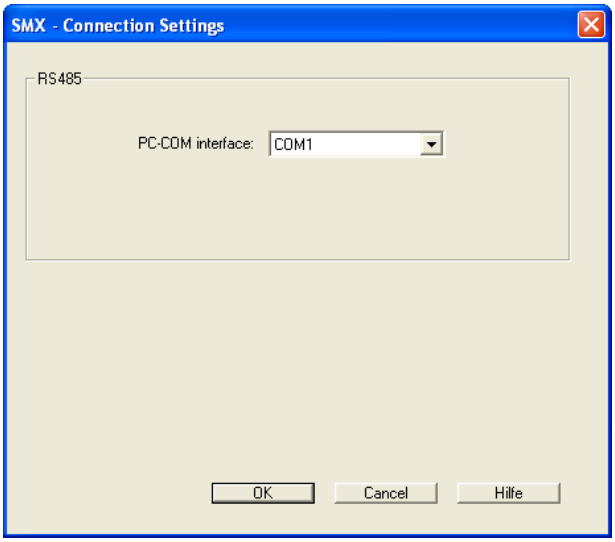
Note: More accurate current transfer states or possibly occurring faults are displayed in the neighbour window. Due to the limited space this window is not automatically activated with each message, so that as much of the logic diagram can be displayed in the diagnose.

Settings...: The dialog for the connection to the PSCBR-C-100 module opens.

Connection settings

In order to be able to set up a connection with a PSCBR-C-100 module, the correct COM interface must be set.

Note:
If necessary you must install the USB-driver for the RS485 / USB interface. The driver can be found in the ‚`RS485_USB_Treiber`‘ installation directory of the SafePLC programming environment.

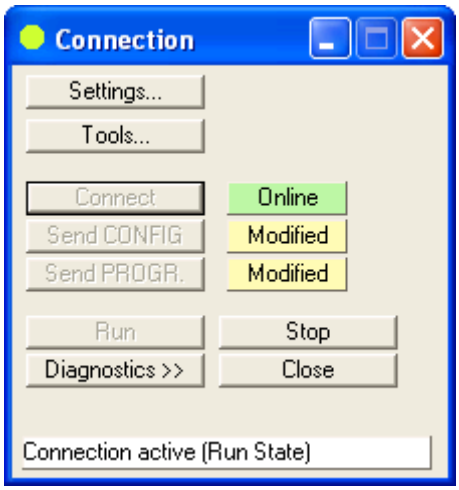


PC-COM interface
The COM interface used of the plugged in USB connecting plug to the PSCBR device must be set.
The settings for the CAN bus ID and the associated mode are only relevant, if no CAN bus extension is present. Please note that the device settings must be accounted for in the CRC. This applies also, even if the logic diagram is not changed. In this case a warning will be submitted.

Connecting dialog

Connect: Starts the connection to the COM interface of a PSCBR monitoring unit specified in “Settings...”.
One must enter the configured COM interface of the PSCBR-C-100 module to be used for work.

Quit: Aborts the communication.



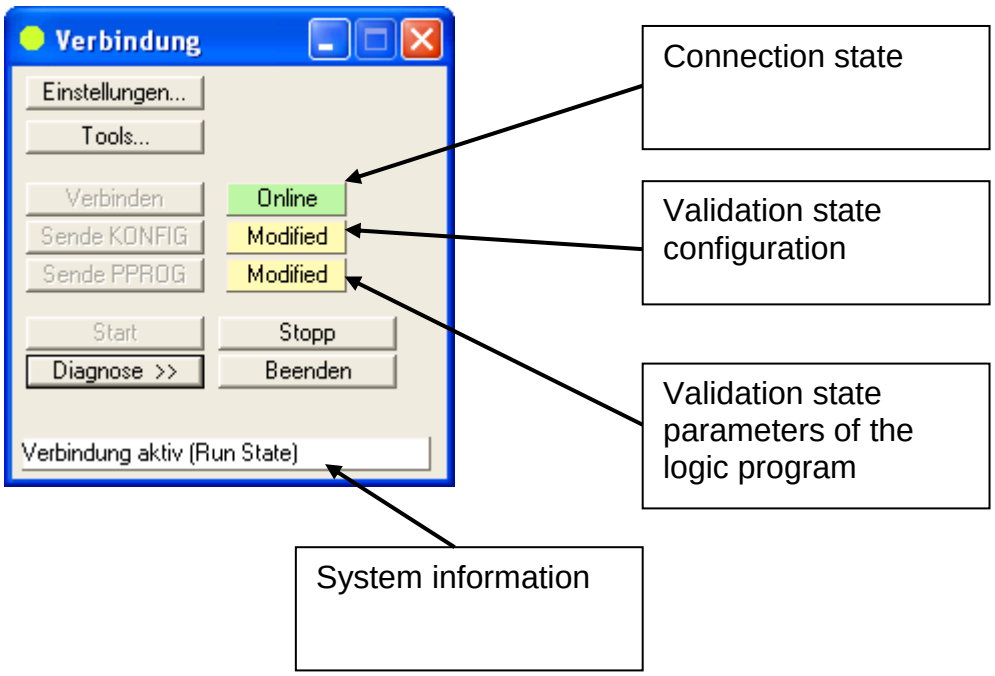
Send CONFIG: Transmits the configuration to the PSCBR-C-100 module.

Send PROGR.: Transmits the parameters of the logic program to the PSCBR-C-100 module.

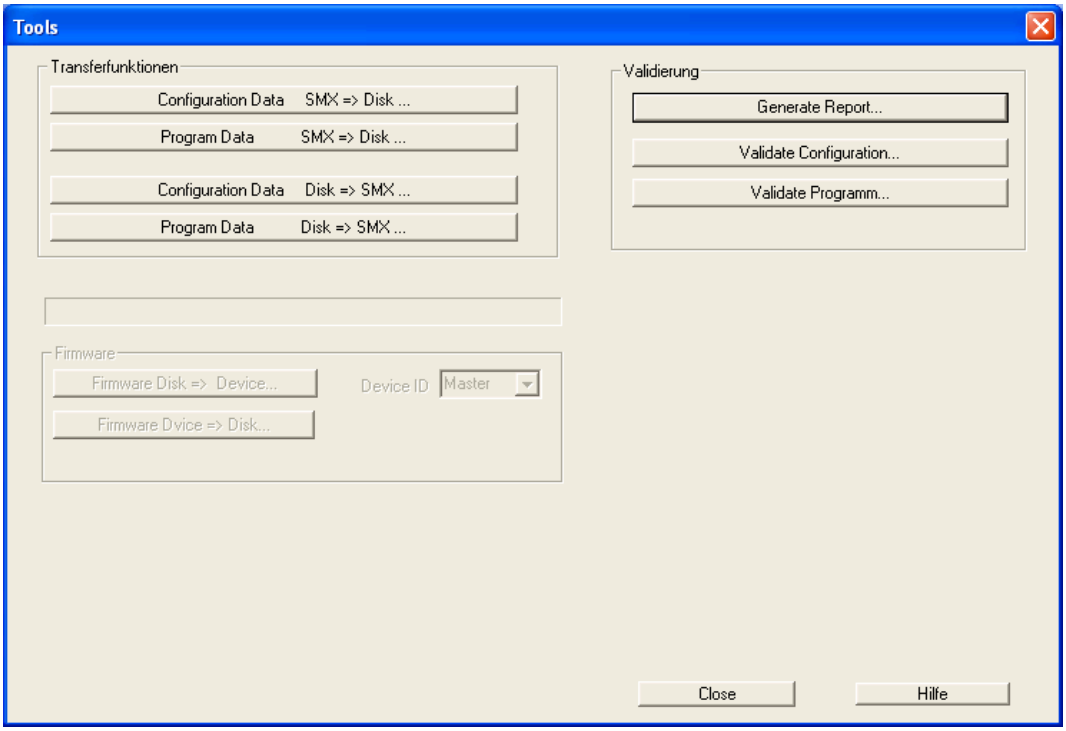
Start: Starts a transferred program

Stop: Stops the program running on the PSCBR-C-100 module

Note: The Configuration and the parameters of the logic program hast to be transmitted individual.


Verbindung
Einstellungen...
Tools...
Verbinden
Online
Sende KONFIG
Modified
Sende PPROG
Modified
Start
Stopp
Diagnose >>
Beenden
Verbindung aktiv (Run State)
Connection state
Validation state configuration
Validation state parameters of the logic program
System information

Validation dialog



Transfer function

Configuration Data PSCBR-> Disk : Reads out the current PSCBR-C-100 equipment configuration in a machine readable from. These data are not changed by SafePLC and can be saved to the drive in this form. This file can be used for changing the device hardware.

Program Data PSCBR-> Disk : Reads out the current PSCBR-C-100 logic program in a machine readable from. These data are not changed by SafePLC and can be saved to the drive in this form. This file can be used for changing the device hardware.

Configuration Data Disk -> PSCBR : Transfer of a machine readable equipment configuration from the PC drive to the PSCBR-C-100-system.

Program Data Disk -> PSCBR : Transfer of a machine readable logic program from the PC drive to the PSCBR-system.

Note: If there is afford for change the device hardware the configuration and the logic program has to be transferred.

Validation

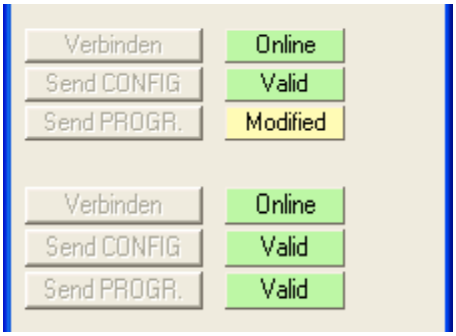
Generate report
Creates a report file for the current user project.

For more details read the document “instruction manual validation”

The printout must be confirmed and released within the framework of the TÜV-approval and in accordance with the demanded regulations.

Validate Configuration
Validate Program
If this buttons are activated the RUN LED of the master device is changed from colour orange to green. It shows the user a validate configuration.
In the connetion window it will be also shown.

Validate Configuration



Validate Program

Diagnose of a transferred program

If the diagnose is additionally switched on in the connection window, the following additional dialog elements are available.

Diagnose Start: Two-way switch to start and stop the diagnose: The corresponding mode (= Aus = Ein = alarm and fault status) is also displayed in the dialog text, so that feedback about the current status is available, even in case of a minimized dialog. After successful starting of the diagnose, the inscription of the switch will change to “**Diagnose Stop**”.

Note: Before starting a diagnose it is made sure that both the logic diagram and the PSCBR-C-100 module reference the same program. The configuration is therefore examined before the diagnose is started. This leads to the display of the charge status in the message bar of the connection dialog. If the two programs do not correspond, this will lead to fault messages with subsequent abortion of the diagnose.

Process Img.
See appendix process image

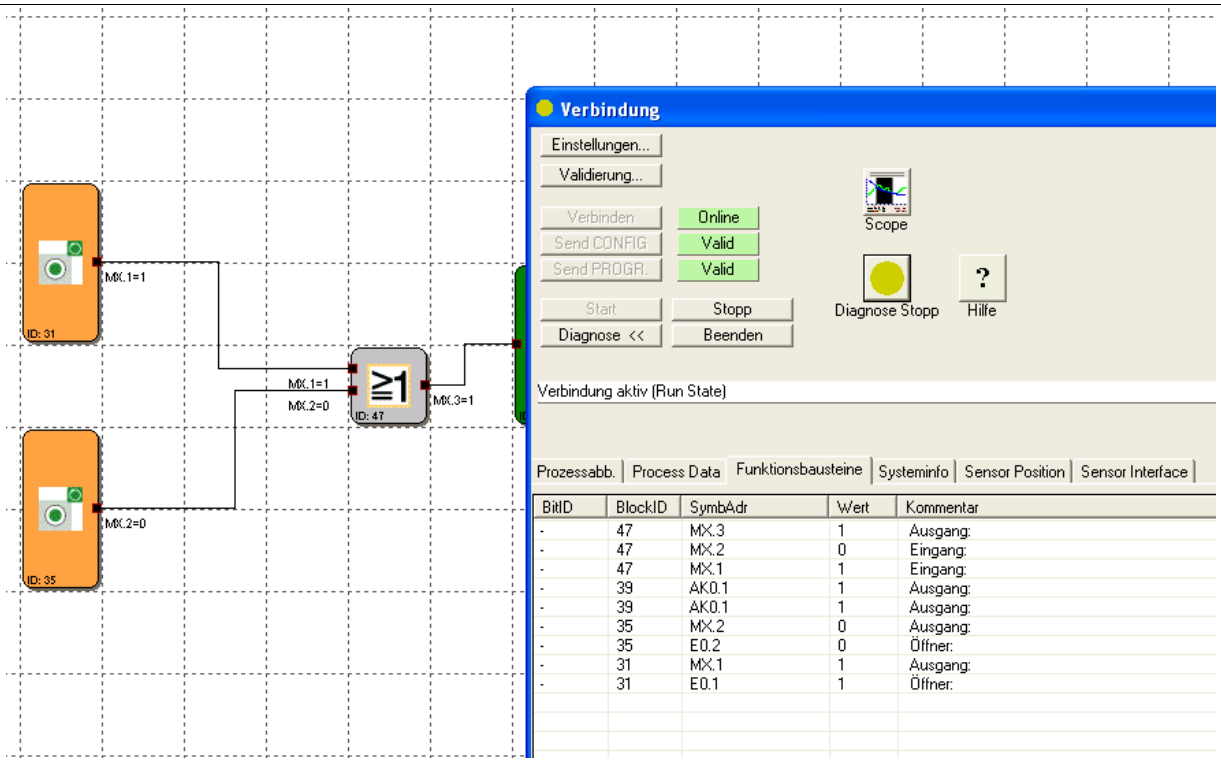
Process Data
See appendix process image

Function Block
When running a logic diagram diagnose, the current inPort and outPort states of the function blocks (0 or 1) are displayed in the logic diagram.

Step 1: Selecting the blocks
If one has changed to the logic diagram – tab, the program first of all expects a selection of the function blocks, the status of which is to be monitored. As soon as a selection has been made in the diagram, the “Add” button is enabled and, by pressing this button, the blocks are taken over into the monitoring list. As long as the diagnose has not be started, the addresses of symbols associated with the connectors are displayed in the diagram.

Note: The addresses associated with the blocks are also listed in the IL, which is output in the message window during program compilation.

Tip: If all blocks are to be selected, the command “Select all” from the context menu of the logic diagram can be used. For this purpose move the mouse pointer to a free patch of the diagram and press the right mouse button.
In order to select interdependent function blocks, use the comand “Signal tracking” from the context menu of a function block. For this purpose move the mouse pointer over a single selected function block and press the right mouse button.



Step 2: Starting the debugger
If the PSCBR-C-100 module is in “Run Mode”, the “Diagnose Start” button is enabled. Pressing this button first of all triggers a plausibility test between logic diagram and PSCBR-C-100 module (message in the message window). This test ensures the synchronism data via the program CRC. If this test is successfully passed, the memory states (0 or 1) of the corresponding addresses in the PSCBR-C-100 module are displayed in both the monitoring list and the logic diagram.

Add: Transfers the selected function blocks from the logic diagram into the monitoring list. The current memory states of the outPorts (and partly also of the inPorts) are displayed.

Delete: The display associated with selected entries in the monitoring list can be deleted by pressing this control button.

Show: Pressing this element centres selected entries in the logic diagram window.

Tip: By double-clicking on a list position in the function block list, the corresponding block will be displayed in the logic diagram (Quick-Jump).

Note: The values shown in debugger mode are updated in approx. 50 second intervals.

ATTENTION: If the PSCBR-C-100 module changes to a state of alarm, the process representation is no longer updated. Changing inPort levels no longer have any effect and will also no longer be shown in the diagnose. If the “Tabs” of the diagnose tab are used to change from “logic diagram” to another diagnose mode (e.g. “Encoder Position”), a question mark will be displayed instead of the address value, in order to show that the value cannot be displayed.

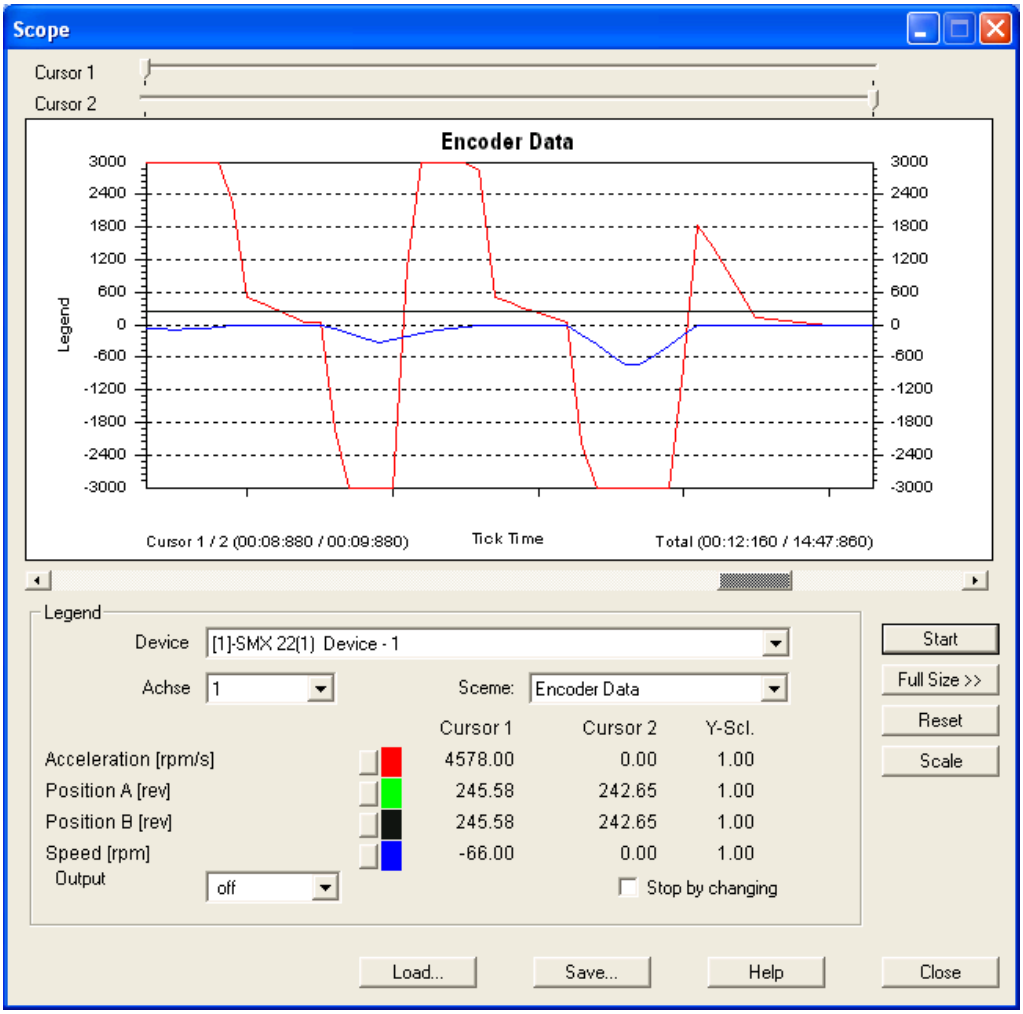
Sys.Info

Name	Description
Configuration CRC	CRC of configuration data inside the device
Program CRC	CRC of logic program inside the device
Transfer Counter	Every upload increments this counter with “1”
Serial Number	Serial number of master device
Version Number	Version of Firmware in the master device
Remaining C-Time	Remaining Cycletime of master device
Seriell DLL Version ID	Version of the communication dll

Enc. Position
Shows the position values for encoder A and encoder B which have actually been transferred by the encoders. The standardized positions are displayed in the scope monitor.

The Scope Monitor

Parameterization of drive monitoring requires exact knowledge of process data from the point of view of the PSCBR-C-100. Knowledge about the temporal course of speed, acceleration and position is of utmost importance. Only this enables the setting of correct threshold values and limiting parameters.
All available graphics functions read the required process data ONLINE from the PSCBR10 module through the communication interface and present this in real time. Up-to-date values are inserted at the right border of the Scope Monitor, moved further to the left during recording, until they finally disappear at the left border of the screen. Although these data have disappeared from the visible window, they are still maintained in a buffer memory and can still be moved back into the visible area by sliding the scroll bar below the graphics window.



***Note*:** With an active Scope Monitor the output of process image and logic diagram debugging is hidden and the diagnostics tabulator is blocked throughout the connection dialog. These data cannot be made available for performance reasons.

Cursor 1, Cursor 2: With these slide controllers two cursor positions for displaying specific diagram values can be set. Changing the position of the slide controllers moves a display line in the graph. The legend shows the values associated with the corresponding cursor positions. The times associated with the cursor positions are output in the graph.

Reset
Delete all data values inside the scope and reset the scaling.

Scaling
Opens a dialog to scale the displayed diagram function. This function can be used to scale the Y-values of the individual graphs, if these do not fit into the represented value range because of the configuration.

Start / Stop
Start / stop recording

Maximize >>
Enlarges the Scope Monitor to the complete available screen area. When changing to maximize, the dialog can be minimized again with the control button “Normal <<”.

Device:
Choice of all axis devices for display encoder values.
Note: This parameter hast o be set new after opening the scope window.

Axis:
Choice of axis number.
By using defined sceme it will be displayed as “ Zugriff_ID“ (safety modules).
Note: This parameter hast o be set new after opening the scope window.

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

- Encoder data
- Speed Encoder
- Data SSX Block
- SEL (position based)
- SEL2 (time based)
- SLS Filter
- SCA Filter
- Analog

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

Output
From this list one can select an outPort, the status of which is indicated as HI/LO in the monitor. LO corresponds with the value 0, all others correspond with HI. This enables a direct conclusion to when e.g. an outPort has been switched off by a safety function. The graph for the output state has a slightly bolder dash size than the graph of the scheme, so that the LO-level can be clearly recognized.

Stop with change
If the switch “Stop with change” is set, recording will stop approx. 2 seconds after an edge change of the output monitoring. This way the operating parameters at the time of shut-down can be traced and possibly saved during long-term recordings.

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

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

Procedure when measuring with the Scope

If the Scope is started from the connection dialog, it is in stop mode. In order to be able to perform a more or less fault-free measurement, you should proceed as described below.

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

Preparing the measurement

Choose the desired measuring scheme: In case of a speed oriented measurement the running tick time of the PSCBR-C-100 module is displayed on the X-axis. It must be considered as a continuously incrementing counter for the system ticks of the PSCBR-C-100 module. The measurement data for the graph are continuously updated and maintained in the buffer memory. The recording memory is approx. 15 minutes.

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

With position oriented measurement the configured measuring range of encoder 1 is displayed on the X-axis. The trailing pointer (cursor 1) is at the current position. Cursor 2 can be used to display the measuring values in dependence on the dragged cursor position in the area of the legend.

Note: When the scheme is changed, any recorded data from previous measurements will be deleted! In addition to this, the data buffer for a progressing ELC1 measurement must be deleted, if the dialog size is to be changed. When switching to full screen display, a corresponding message will appear. The currently performed measurement will thus be lost.

“Start” measurement

When this button is pressed, the progressing tick time in the graph of the Scope will move from right to left, in case of an active connection. The measuring values are now entered into the buffer memory of the Scope. It saves the continuous data of the measurement. Once the Scope has been started, the inscription of the control button changes to “Stop”.

Note: If the measurement exceeds the maximum measuring period of approx. 15 minutes, the measurement will be restarted.

“Stopping” a measurement and viewing data

After the measurement one can use the slide controller below the graph to move the recording along the X-axis for viewing. With slide controllers Cursor 1 / Cursor 2 one can position a bar indicator in direction X of the graph to view specific measuring values. The associated Y-values can then be read in the column “Cursor 1” or “Cursor 2” of the legend.

Measuring schemes

Encoder data

Functionality	Recording of scaled position values of system A and system B over the course of time. Recording of process values for speed and acceleration over the course of time. Note: Internally the position value of system A is used to generate the process value for the position.
Application	Scaling of the encoder systems A and B in case of position monitoring. In case of a correctly scaled encoder system there should be no significant deviations between positions A and B. Analysis and course of encoder signal for diagnostic purposes (e.g. trouble shooting, etc.). Acceleration and speed behaviour of the drive. Detection of thresholds.

Encoder speed

Functionality	Recording the current speed of system A and system B over the course of time. Recording the difference of speed signals from system A and system B over the course of time. Note: Internally the speed value from system A is used to generate the process value for the speed.

Application	Scaling of the encoder systems A and B in case of speed monitoring. In case of a correctly scaled encoder system the difference between positions A and B may only be of insignificant size. Analysis and course of encoder signal for diagnostic purposes (e.g. trouble shooting, etc.).

DataSSX Block

Functionality	Recording of process data for speed and acceleration over the course of time. Recording of speed limit for the monitoring function over the course of time.
Application	The diagram shows the dynamic behaviour of the drive via the visualization of speed and acceleration. With the SSX not activated, the limiting speed remains zero. When activating the SSX-function, the limiting speed is taken from the current speed and projected down. If the drive with its current speed remains below the limiting speed, the system will not be shut down.

SEL

Functionality	Recording of process data for speed and acceleration over the position. Visualization of current position in form of the parallel moving cursor: Visualization of the current stopping distance in form of a trailing pointer.
Application	The diagram shows the dynamic stopping distance value as minimum value for the braking distance. Examination of the set parameter values in the SEL-function, examination of the available reserve for shut-down.

SEL 2

Functionality	Recording of process data for speed and acceleration over the course of time. Visualization of current position in form of the parallel moving cursor: Visualization of the current stopping distance in form of a trailing pointer.
Application	The diagram shows the dynamic stopping distance value as minimum value for the braking distance. Examination of the set parameter values in the SEL-function, examination of the available reserve for shut-down.

SLS 1 Filter

Functionality	Recording the maximum speed of safety function Visualization of the integral value.
Application	The diagram shows the actual speed to the configured speed range. Examination of the set parameter values in the SLS-function. Visualization of the integral value.

SCA 1 Filter

Functionality	Recording the maximum speed of safety function Visualization of the integral value.
Application	The diagram shows the actual speed to the configured speed range. Examination of the set parameter values in the SCA-function. Visualization of the integral value.

Analog

Functionality	Recording of the analog input values slave devices. Recording the analog input values connected to system A and system B. Überwachen der Analogeingänge der Slavebaugruppen Aufzeichnung des Analogeingangswerts von System A und System B. Recording the differences of analoginput A to analoginput B.
Application	Visualization of analoginput A to analoginput B. Examination of the differences between the input values.

Diagram Management

With the diagram management the logic diagrams can be disabled against unintended or unauthorized modifications. It also provides documentation possibilities for program creation.

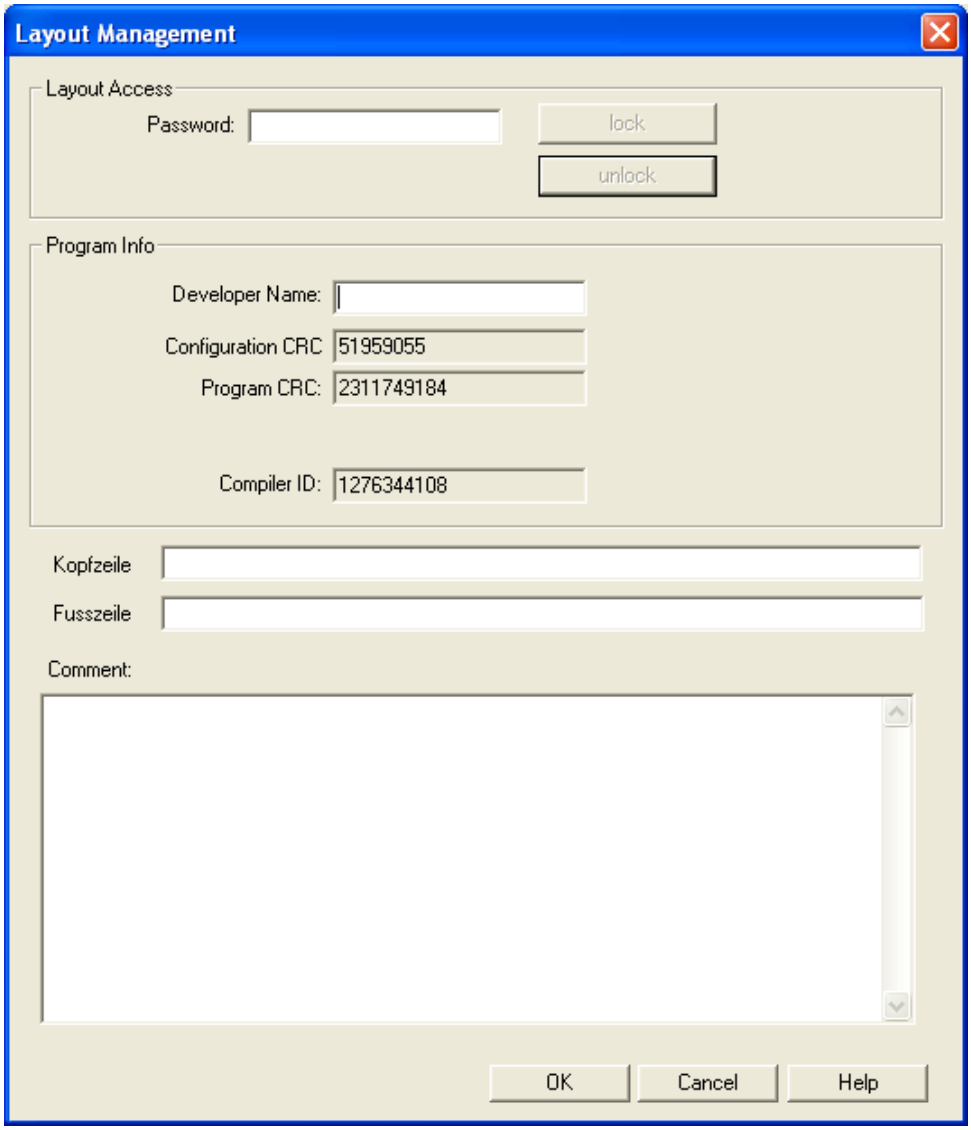


Diagram access

Here one can disable or enable access to the function blocks in the current logic diagram. This means, that in a disabled logic diagram all menu options and toolbars for adding function blocks appear in grey (= disabled). Moreover, parameters in function blocks, that had already been added, cannot be changed.
“Unlocking” requires a password. The configured values and the functional modules of a disabled diagram may in this case be viewed, but cannot be modified. This functionality make sure that no changes can be made to the logic diagram by unauthorized persons.
When a logic diagram is disabled, the dialog “Save File” will appear when exiting the diagram management, so that possible changes will not be lost.

Please note: Logic diagrams can only be unlocked using the password that was applied when the diagram was disabled. A disabled logic diagram can no longer be compiled! However, access to the PSCBR-C-100-PSCBR-C-100-module is still possible.

Program information

This information serve the purpose of documenting changes or peculiarities, which will be saved as belonging to the logic diagram.

Programmer:
Name of the responsible programmer.

Konfiguration CRC:
Checksumo f the configuration data, i.e. encoder setups, timer etc.

Program CRC:
Checksum of the OP-Code (SafePLC program) generated from the logic diagram elements during the last compiler run. This value is used to align the programs during debugging. This value does not change if changes to the configuration were made by the “SCHMERSAL SafePLC”.

Displayed PSCBR-C-100 **CRC:**
Checksum concerning the complete PSCBR-C-100 configuration contained in the logic diagram. This value is successively displayed in the status bar of the PSCBR-C-100-PSCBR-C-100-module, if the “Func” button is pressed in (fault free) Run mode.

Compiler ID:
Identifier for the Programming-Dongle.

Note: For validation of the project, the layout should be locked.

Note: This value changes every time a compiler run is started, even is no modifications were made to the logic diagram, because the program header receives a time stamp. If the CRC is used for the test report, it is recommended to disable the logic diagram, since this prevents accidental modification.

Comment:
This input field saves the comments associated with a logic diagram. It is highly recommended to use it for reporting the changes made to a running program in form of a revision schematic.

Program Development Aids

Info display

With the info display activated the attributes of the element touched by the mouse pointer will be displayed. The info display works similar to a Windows tool tip, with a slight temporal delay. This can be adapted in the “Settings” dialog. The info display can be activated when required by simply pressing the “Ctrl” key. The display will continue, until this key is released again.
e.g.

Signal tracking

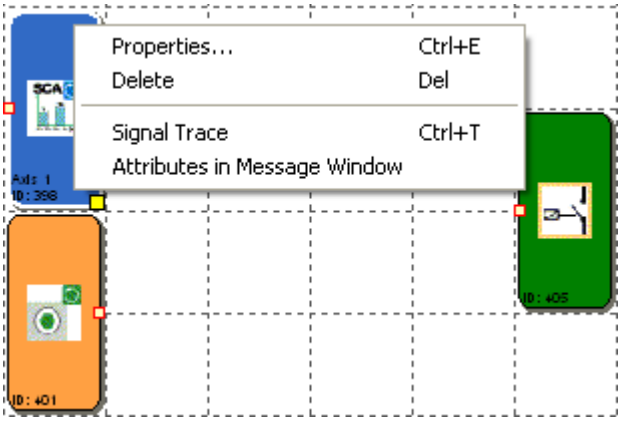
This command selects all other functional modules, which are linked with a currently selected block. This way all coherent linkages of modules can be represented.

Tip: This function can be used e.g. to find all blocks, which were indirectly linked with “Set Marker”.

Note: This command is only active, when exactly 1 function block has been selected.

Copying attributes into the message window

All attributes belonging to a block selection can also be displayed in the message window. This is possible either with the menu command “Edit->Attributes into Message Window”, or via the function block context menu.



Tip: If the attributes of all blocks are to be displayed in the message window, it is quite sufficient to execute the command via the menu option without selected elements.

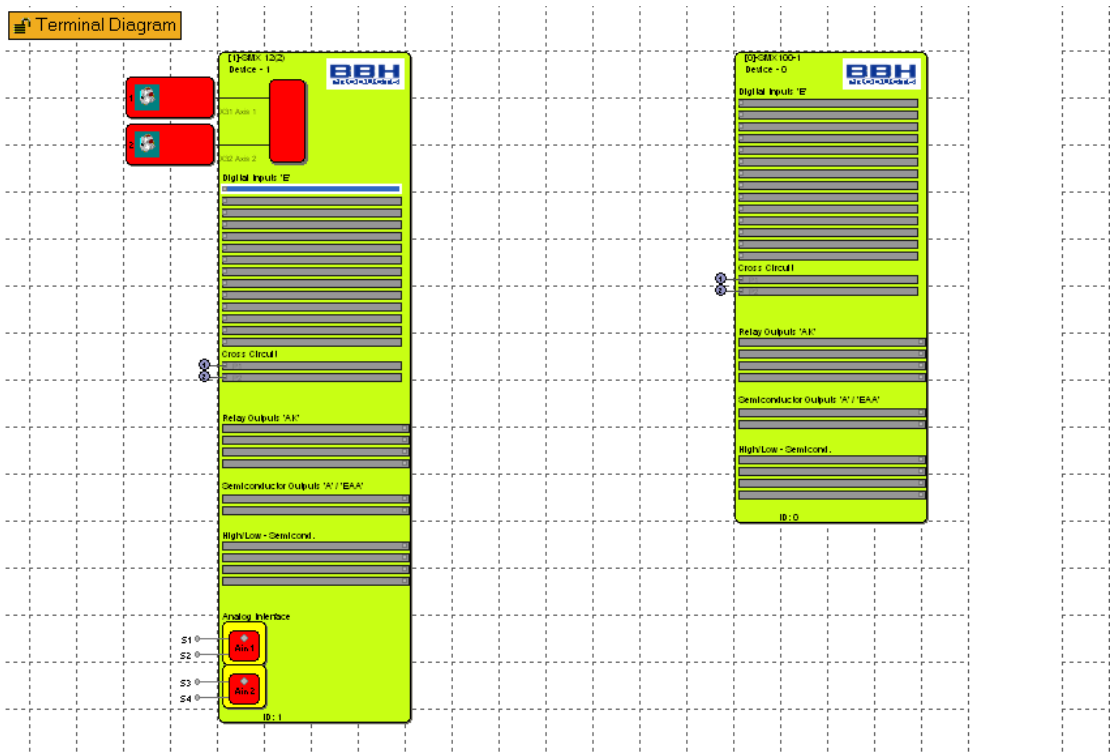
Note: If the command is triggered via the context menu, it is important to place the mouse pointer on a selected blow, as otherwise other blocks will be deselected.

QuickJump

By double-clicking on the colour-coded BlockID's in the message window one can have the associated block centred in the
logic diagram window. This enables quick localization of function blocks belonging to an output and to make necessary changes, if this is required.

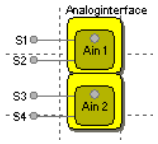
Predefined Function Blocks

In the terminal diagram these elements represent the available inPorts and outPorts of the PSCBR-C-100-PSCBR-C-100-module.



Sensorinterface

This block consists of the encoder inPorts, the signal list for the digital inPorts and the analog inPorts. The individual areas can be selected and modified either by double-clicking, or by using the context menu command “Properties...”.



e.g. Analog inPorts

Double-clicking on one of these encoder elements opens the configuration dialog.

Digital inPorts

In this area the logic operation of inputs signals from the peripheral elements tales place. This logic operation takes place automatically when inserting function blocks described below. Double-clicking on a signal list opens a comment window. Here one can enter a describing text for the inPort.

PSCBR-C-100 outPorts

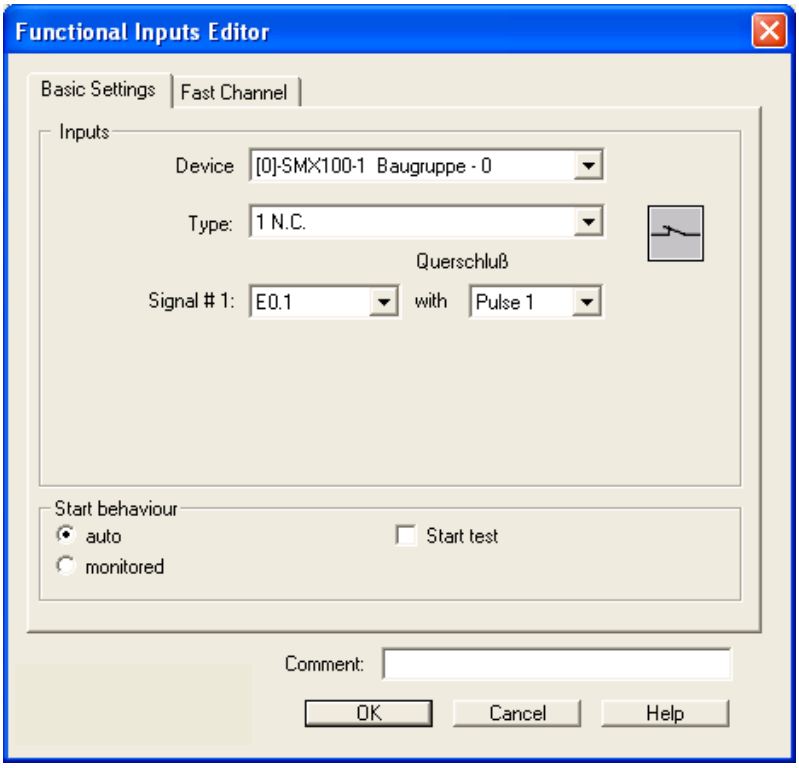
This block consists of the signal lists for the relay outPorts and the semi-conductor outPorts. As with the inPort signals wiring also takes place automatically when adding the associated function blocks.

Inserting InPort blocks

The input elements deliver the data about operating status of the plant monitored by the PSCBR-C-100- module. These components, which, from the point of view of the PSCBR-C-100- module, are outside the device, can only be inserted and configured in the terminal plan.

The automatic monitoring of resources of the function block elements for the PSCBR-C-100- module has the effect, that only the available elements are enabled in the program. This, above all, concerns the time-monitored peripheral devices. If there are no resources (memory) available for the monitoring program in the PSCBR-C-100- module, the commands for inserting the corresponding components or function b locks will be disabled (menu options or tool bars appear in grey). This is e.g. the case when all digital inPorts of the PSCBR-C-100 module are occupied or all timer modules have been used. These resources can be released again by deleting the corresponding function blocks.

The peripheral components have been structured according to use and input signal type, enabling targeted resource monitoring of the PSCBR-C-100 module. The following paragraphs list details to this type (e.g. enable switch).



Note
The configuration oft the inport block has a significant effect to the performance level. See installation manual.

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

Type
Switch type used for the component that is connected to the PSCBR-C-100 module. The number of associated input signals and the monitoring behaviour of the PSCBR-C-100 module changes in dependence on the selection.
With *time monitored switch elements* another signal change must take place with t=3s after the first signal. If this is not true, a malfunction is recognized.

Signal-No.
Assignment number of the signal at the digital inPort of the PSCBR-C-100 module. This selection list shows the still unused inPort signal designators (e.g. “E.1”) of the PSCBR-C-100 module. These are assigned by the user. Double assignments of input signals is not permitted. If the resources of the PSCBR-C-100 module are almost exhausted and the selection of the switch type would use up too many input signals, the selection list will remain empty. The inPort block can, in this case, not be inserted. Here a switch type with less connections must be used.

Cross-shorting test
Number of pulse that is to be applied to the input signal. In order to ensure reliable monitoring for short-circuit or line breakage, inPorts next to each other on the PSCBR-C-100 module should have different pulse numbers assigned. If this is not true, a warning will be issued.

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

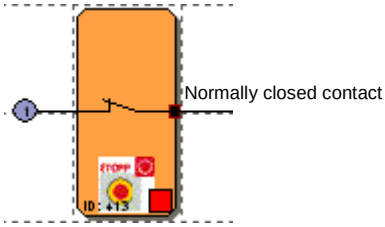
automatic
This pre-set type of starting enables the booting of the PSCBR-C-100 module without the necessity of any feedback from the user.

monitored
Release of the monitored inPort element in case of descending edge on the specified monitoring inPort. This is required at any time when the monitored inPort element is to be switched. Example: Start of a drive only after this has been confirmed by the operating personnel.
With monitored starting mode an additional connector for linking to a Start element is made available. In this element one can configure the further behaviour for monitoring the component when starting the plant by means of the PSCBR-C-100 module.

Start test

Manual starting after a equipment reset, including testing of the connected monitoring equipment. The monitoring equipment must trigger once in monitoring direction and switch back on again. Followed by normal operation. This non-recurrent triggering of the inPort element when starting (or resetting) the monitored equipment ensures the function of the inPort element at the time of starting. A start test can be performed for two inPort elements, after this the dialog element is disabled.

An activated start test is indicated by a *red rectangle on an added function block*.



Comment:
Edit a text for display on the block.

Enable switch

Switch type	Designation	Comment
1 (eSwitch_1o)	1 normally closed	Enable switch standard SIL2
2 (eSwitch_1s)	1 normally open	
3 (eSwitch_2o)	2 normally closed	Enable switch increased request SIL 3
4 (eSwitch_2oT)	2 normally closed time monitored	Enable switch monitored SIL3

Emergency Stop

Switch type	Designation	Comment
1 (eSwitch_1o)	1 normally closed	Emergency stop standard SIL 2
3 (eSwitch_2o)	2 normally closed	Emergency stop increased request SIL 3
4 (eSwitch_2oT)	2 normally closed time monitored	Emergency stop monitored SIL3

Door - Monitoring

Switch type	Designation	Comment
3 eSwitch_2o	2 normally closed	Door monitoring increased request SIL 3
4 eSwitch_2oT	2 normally closed time monitored	Door monitoring monitored SIL3
5 eSwitch_1s1o	1 normally open + 1 normally closed	Door monitoring increased request SIL 3
6 eSwitch_1s1oT	1 normally open + 1 normally closed time monitored	Door monitoring monitored SIL3
7 eSwitch_2s2o	2 normally open + 2 normally closed	Door monitoring increased request SIL 3
8 eSwitch_2s2oT	2 normally open + 2 normally closed time monitored	Door monitoring monitored SIL3
9 eSwitch_3o	3 normally closed	Door monitoring increased request SIL 3
10 eSwitch_3oT	3 normally closed time monitored	Door monitoring monitored SIL3

Two-hand button

Switch type	Comment	Classification category	Classification SIL
2 two-way switch	Two-hand button higher requirements	Type III C category 4	SIL3
2 normally open	Two-hand button monitored	Type III A category 2	SIL1

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

Limit Switch

Switch type	Designation	Comment
1 (eSwitch_1o)	1 normally closed	Enable switch standard SIL2
2 (eSwitch_1s)	1 normally open	
3 (eSwitch_2o)	2 normally closed	Enable switch increased request SIL 3
4 (eSwitch_2oT)	2 normally closed time monitored	Enable switch monitored SIL3

Light curtain

Switch type	Designation	Comment
3 eSwitch_2o	2 normally closed	Light curtain increased request SIL 3
4 eSwitch_2oT	2 normally closed time monitored	Light curtain monitored SIL3
5 eSwitch_1s1o	1 normally open + 1 normally closed	Light curtain increased request SIL 3
6 eSwitch_1s1oT	1 normally open + 1 normally closed time monitored	Light curtain monitored SIL3

Mode selector switch

Switch type	Designation	Comment
13	Selector switch normally closed/normally open	Operation mode switch monitored SIL 3
14	Selector switch 3 steps	Operation mode switch monitored SIL 3

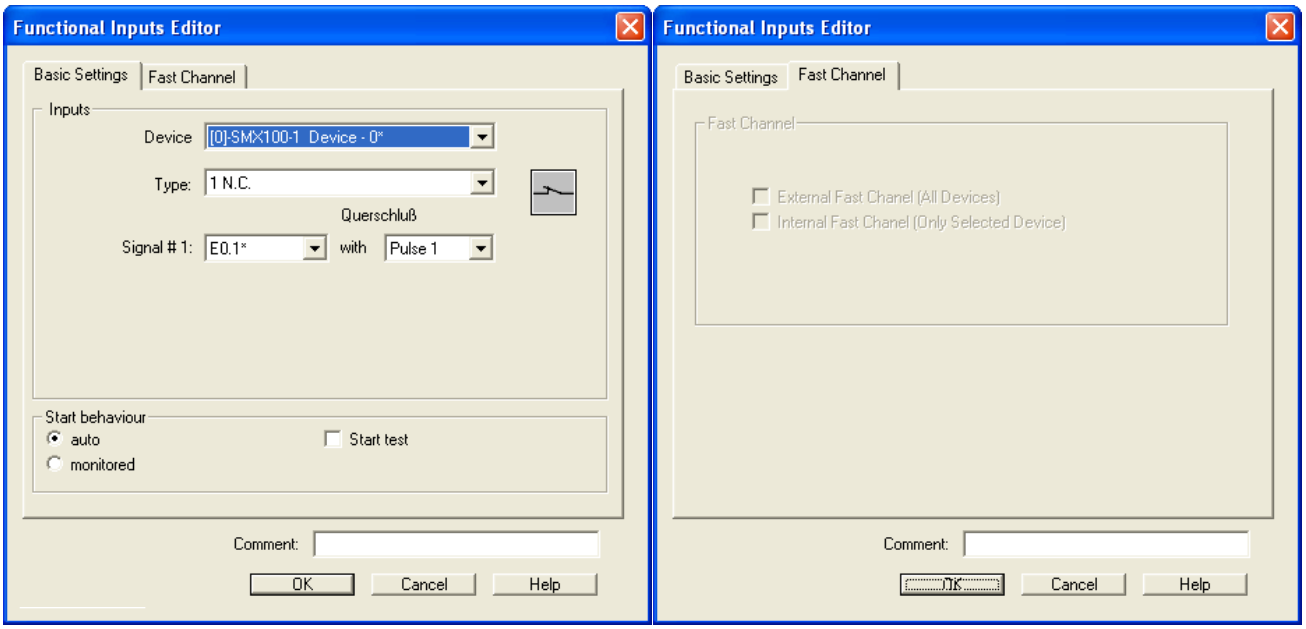
Note: When changing the status of the switch the SafePLC program to be created must ensure that the outputs of the PSCBR-C-100 module are deactivated. (Note: Norm 60204-Tei1-Abschnitt 9.2.3).

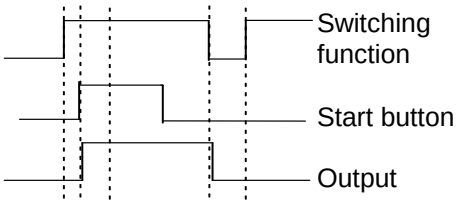
Sensor

1 eSwitch_1o	1 normally closed	Sensor inPort standard SIL2
2 sSwitch_1s	1 normally open	Sensor inPort standard SIL2
3 eSwitch_2o	2 normally closed	Sensor inPort increased request SIL 3
4 eSwitch_2oT	2 normally closed time monitored	Sensor inPort monitored SIL3
5 eSwitch_1s1oT	1 normally open + 1 normally closed time monitored	Sensor inPort monitored SIL3

Start test

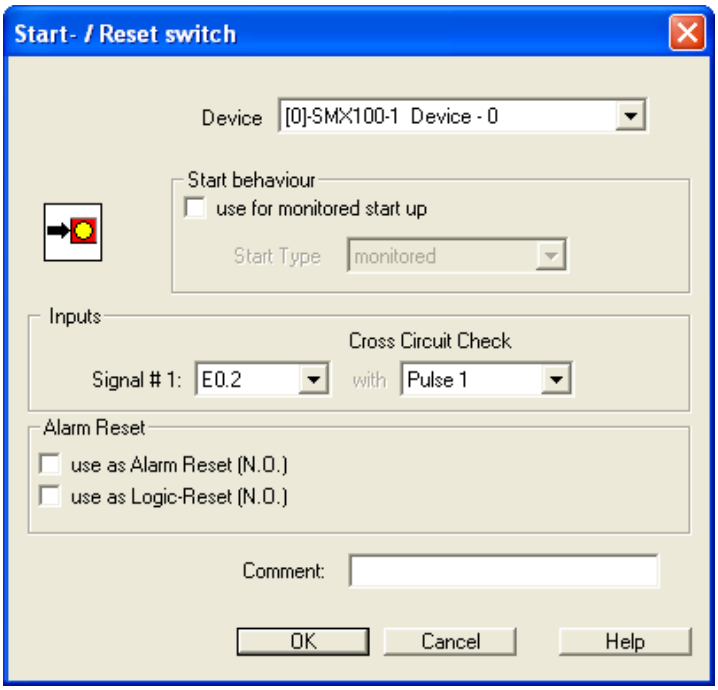
Every inPort block gets the possibility to configure a start test.



Start type	Function	IL	Scheme
Manual start (by hand)	Manual start after equipment reset. OutPort of the inPort element becomes 1 when the safety circuit is closed/active acc. to the definition of the switch type and the start button has been pressed 1 x. OutPort becomes 0 after safety circuit is open. E1: Switching function E2: Start button M.(X1): Auxiliary marker 1	LD E.1 AND E.2 S M.(X1) LD NOT E.1 R M.(X1) LD M.(X1) AND E.1 ST IE.X	

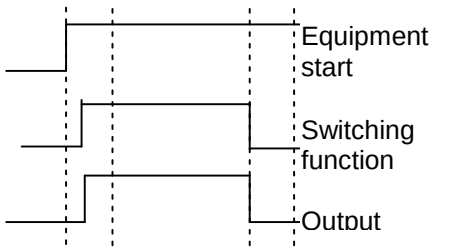
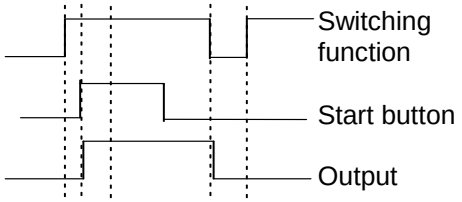
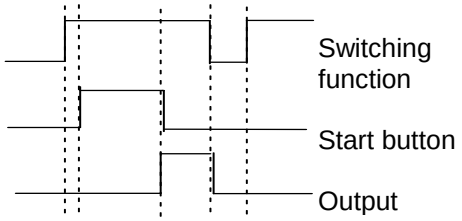
Start and reset element

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

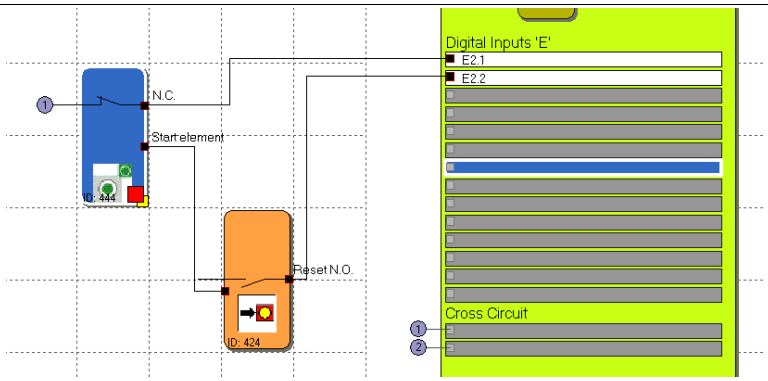


use for start monitoring
With start monitoring set, special IL code segments for monitoring an inPort segment during a restart or reset of a plant are generated. This function related testing of a periphery element (e.g. confirmation of the emergency stop switch) inside a certain time window of 3 seconds is intended to ensure its functionality when the equipment is started.

Start type

Start type	Function	IL	Scheme
auto	Automatic start after equipment reset or activation of the inPort. OutPort of the inPort element becomes “1” when the safety circuit is closed/active acc. to the definition of the switch type		
Manual start (by hand)	Manual start after equipment reset. OutPort of the inPort element becomes 1 when the safety circuit is closed/active acc. to the definition of the switch type and the start button has been pressed 1 x. OutPort becomes 0 after safety circuit is open. E1: Switching function E2: Start button M.(X1): Auxiliary marker 1	LD E.1 AND E.2 S M.(X1) LD NOT E.1 R M.(X1) LD M.(X1) AND E.1 ST IE.X	
Start monitored	Manual start after equipment reset with monitoring of start circuit for static 1-signal. OutPort of the inPort element becomes 1 when the safety circuit is closed/active acc. to the definition of the switch type and the start button has been pressed 1 x and released again. OutPort becomes 0 after safety circuit is open. E1: Switching function E2: Start button M.(X1): Auxiliary marker 1 M.(X2): Auxiliary marker 2	LD E.1 AND E.2 S M.(X1) LD NOT E.1 R M.(X1) LD M.(X1) AND E.1 AND NOT E.2 S M.(X2) LD NOT E.1 R M.(X2) LD M.(X2) AND E.1 ST IE.X	

The monitoring inPort of the start element must be connected to the outPort labelled “Start element” of the inPort elements. Several elements can be monitored.
e.g.



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

InPort - Signal No. 1

As with the inPort elements, this selection list is used to determine the inPort on the PSCBR-C-100 module to which the button for for the start element is to be connected. If only the start of other inPort elements is to be monitored, the inPort number can be assigned as desired.

use as AlarmReset (normally open)

If this option is set, the associated button can be used to reset (acknowledge) a fault that may occur during operation. The user is thus not forced to reset an occurring fault with the “Func” button on the PSCBR-C-100 module. No special program code is generated, but this input is directly processed by the PSCBR-C-100 module in case of an alarm.

Note: If a reset element is used, no cross-shorting monitoring can be processed for this inPort. When closing this dialog, the cross-shorting test is in this case set to “OFF”. Only one Alarmreset can be used.

The table shows resettable safety module:

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

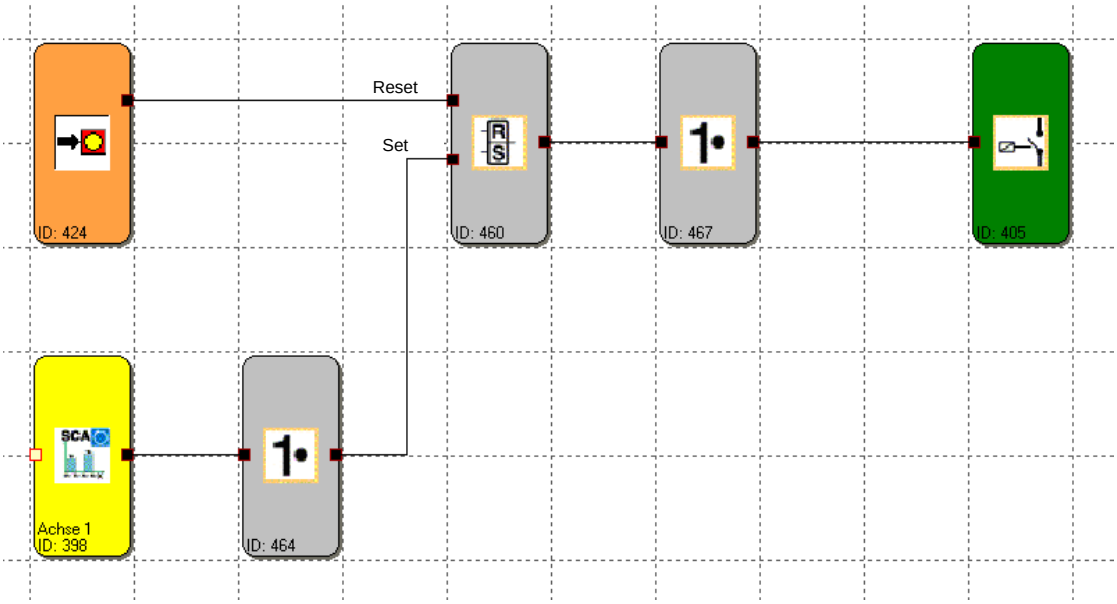
Note

- The same functionallity can be done with the „Func.“ switch.
- Fatal errors can only be resetted with an equipment start.
- The alarm reset inPort can be operated with 24V continuous voltage and is edge triggered.

use as Logic Reset (normally open)

If this additional option is set, the outPort of the function block is made available in the logic diagram. In this case it can be used for linkage with logic functionality. This is intended for the case that an occurring SCA fault is permanently set in an RS-module and can only be reset by pressing the reset button on the RS-module.

e.g.
save and reset errors of SCA module with RS-Flip-Flop.

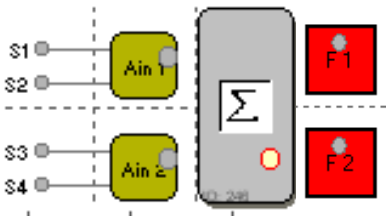


Switch type	Comment	Classification category	Classification SIL
1 normally open	Alarm reset standard (evaluation of edge)	--	--
1 normally open	Logic reset standard	Category 3	SIL 2
1 normally open	Start monitoring standard (optional function)	--	--

Analog signal input

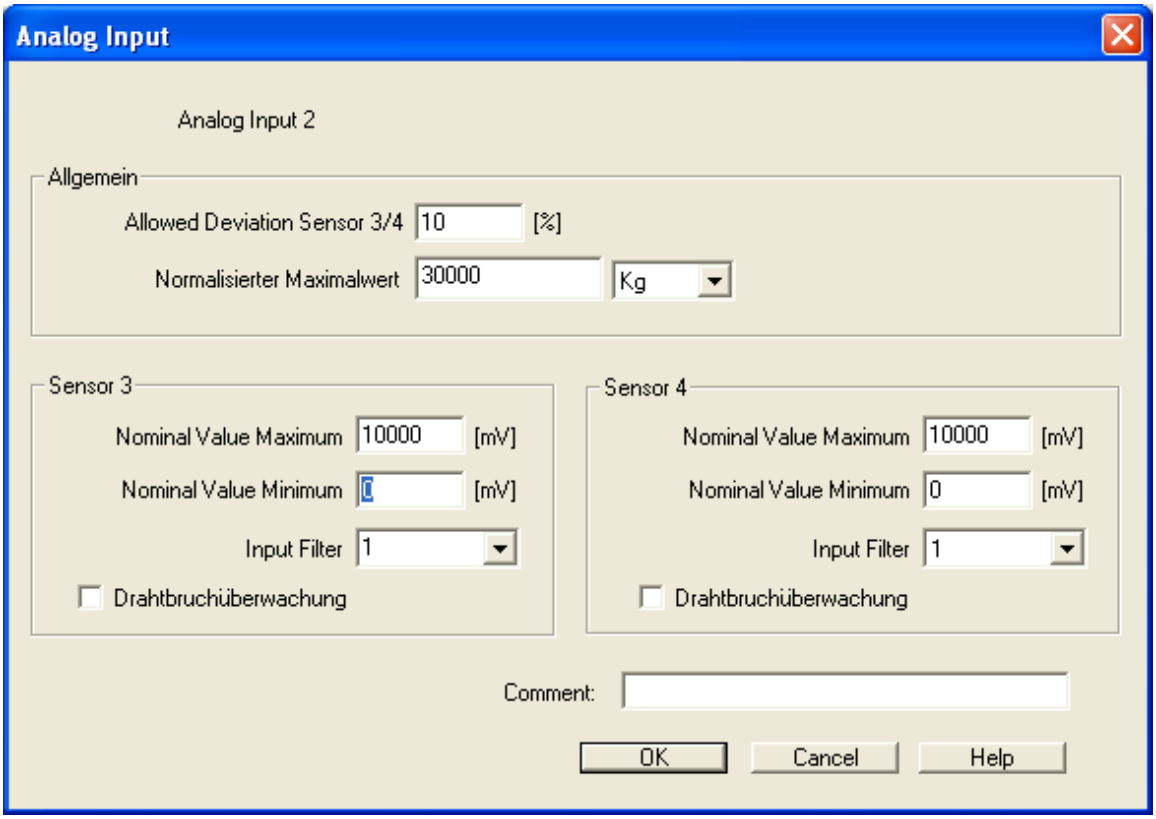
This dialog is used to define the magnitude of incoming analog signals for the monitoring in the PSCBR-C-100 module. If an inPort for monitoring has been activated, the colour of the function block will change from red to green. For analog signal monitoring both inPorts (Ain1 and Ain2) must be wired. This way one achieves the demanded safety category up to category 4, provided that 2 independent “voltage sources” are connected.

Analog inPorts
In the logic diagram the analog inPorts and the associated filter modules are shown accordingly. Double-clicking opens the configuration dialog.



Analog inPort Ain1 / Ain2

The dialog enables the adaptation to the applied analog signals. The physical analog inPorts S1/S2 and S3/S4 are assumed to belong together as pairs.



Allowed Deviation sensor 1/2
Permissible tolerance between the sensors belonging together Sensor1/Sensor2 and Sensor3/Sensor4. Basis is the minimum nominal value.

Nominal value minimum
Lowest still permissible limiting value in Millivolt. After normalization this will be the minimal value “0”.

Nominal value maximum
Highest still permissible limiting value in Millivolt. After normalization this will be the “Normalisierter Maximalwert”

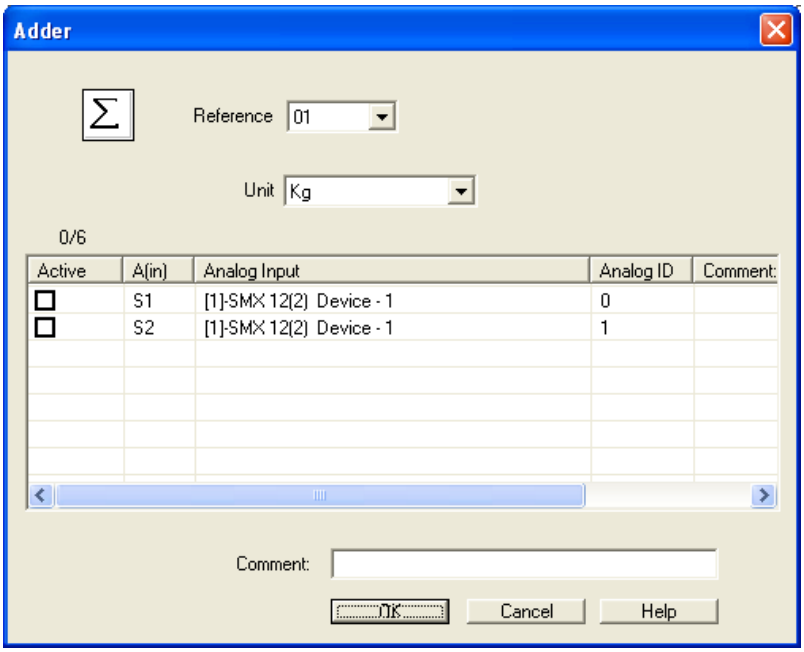
Input filter
Filter that has a direct effect on the input signal. This filtered value is then processed further by the adder.

Note:
Reaction time see installation manual

Drahtbruchüberwachung
If activated the analog input value has to be > 1000mV. If the value is <= 1000mV an alarm will be generated.

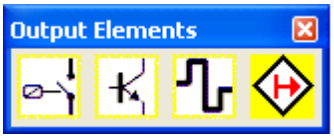
Proportion adder

The proportion adder enables the weighting of the analog signals, e.g. in case of unevenly balanced hoisting of loads.



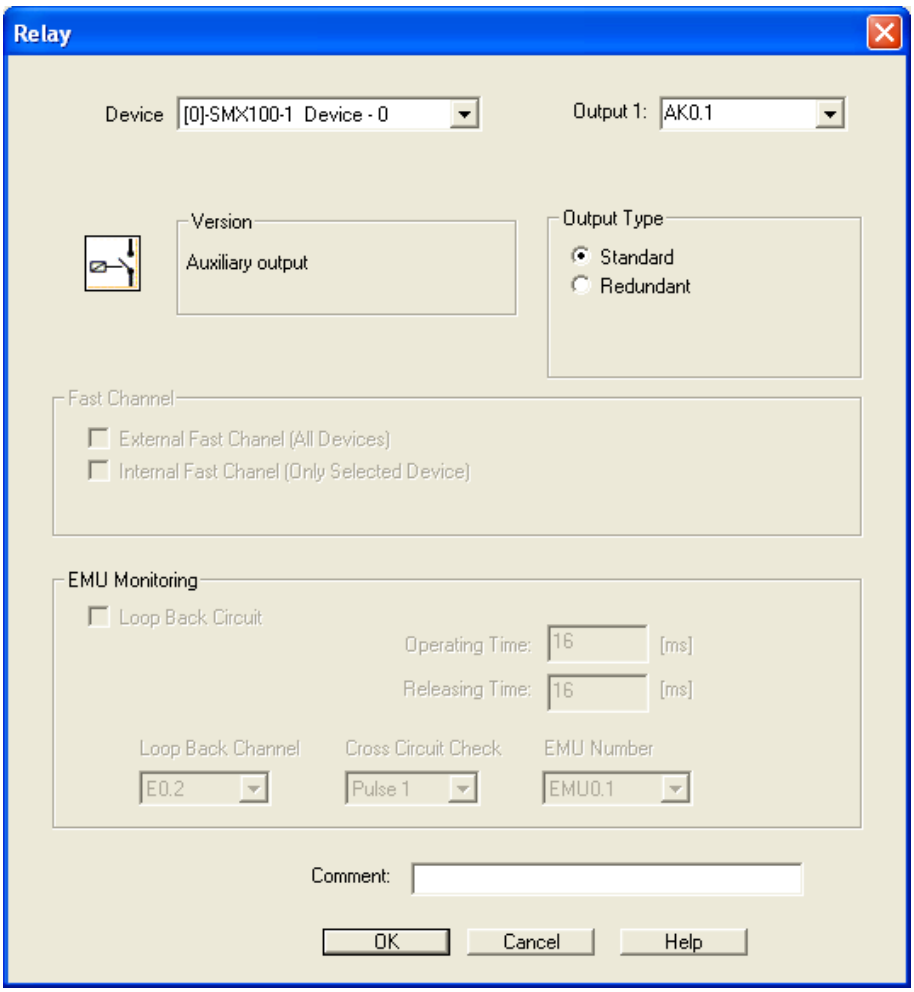
Unit
Configurable unit of analog inPorts.

Inserting outPort blocks



This logic diagram element exerts a direct influence on the drive to be monitored. Moreover, one can also specify how external switchgear is to be monitored.
The automatic monitoring of resources of the function block elements for the PSCBR-C-100-module has the effect, that only the available elements are enabled in the program. If there are no resources (memory) available for the monitoring program in the PSCBR-C-100-module, the commands for inserting the corresponding components or function blocks will be disabled (menu options or tool bars appear in grey). This is e.g. the case when all digital outPorts of the PSCBR-C-100 module are occupied. These resources can be released again by deleting the corresponding function blocks.

Relais outPort



OutPort type

Standard
2 single relays (K1 and K2) can be selected.

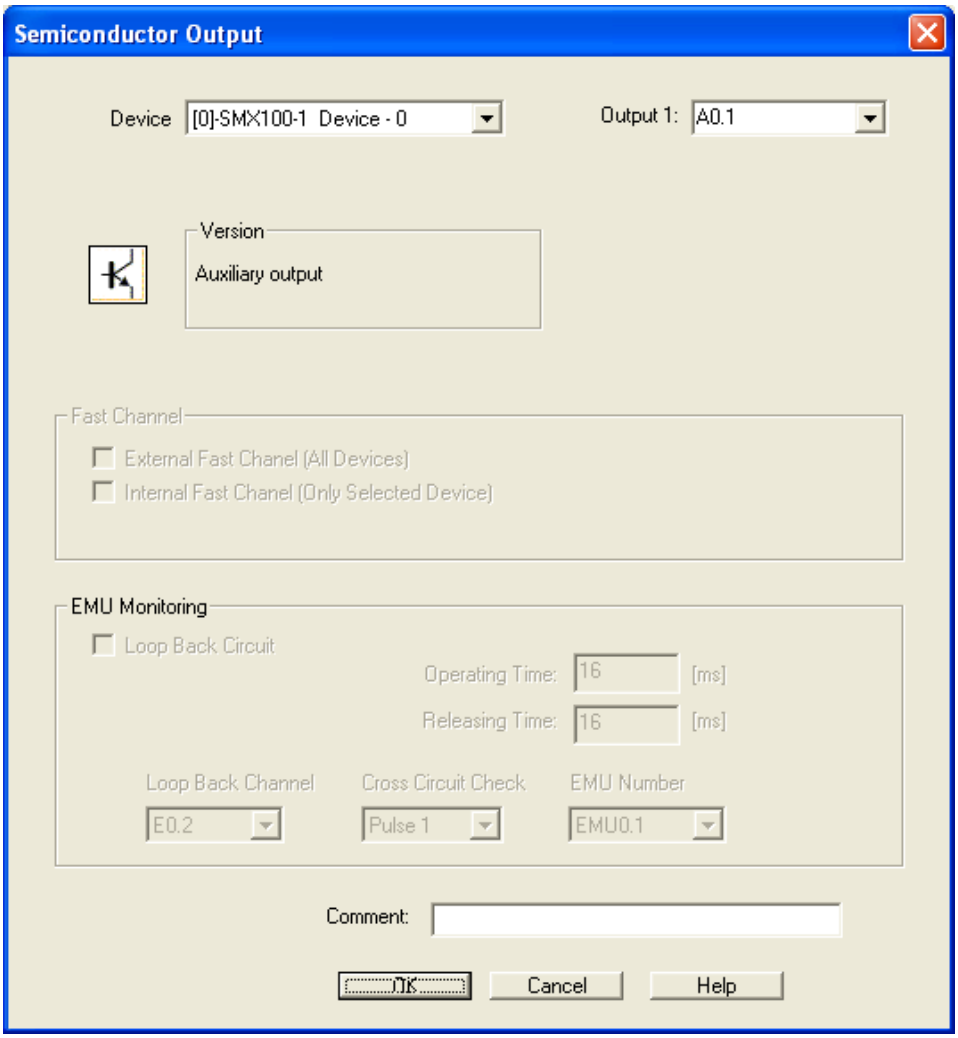
Redundant
Two relay outputs can be switched synchronously.

Note: For the case of redundant assignment see installation manual.

For EMU monitoring see chapter EMU monitoring

Semi-conductor outPort/ Hi Lo semi-conductor outPort

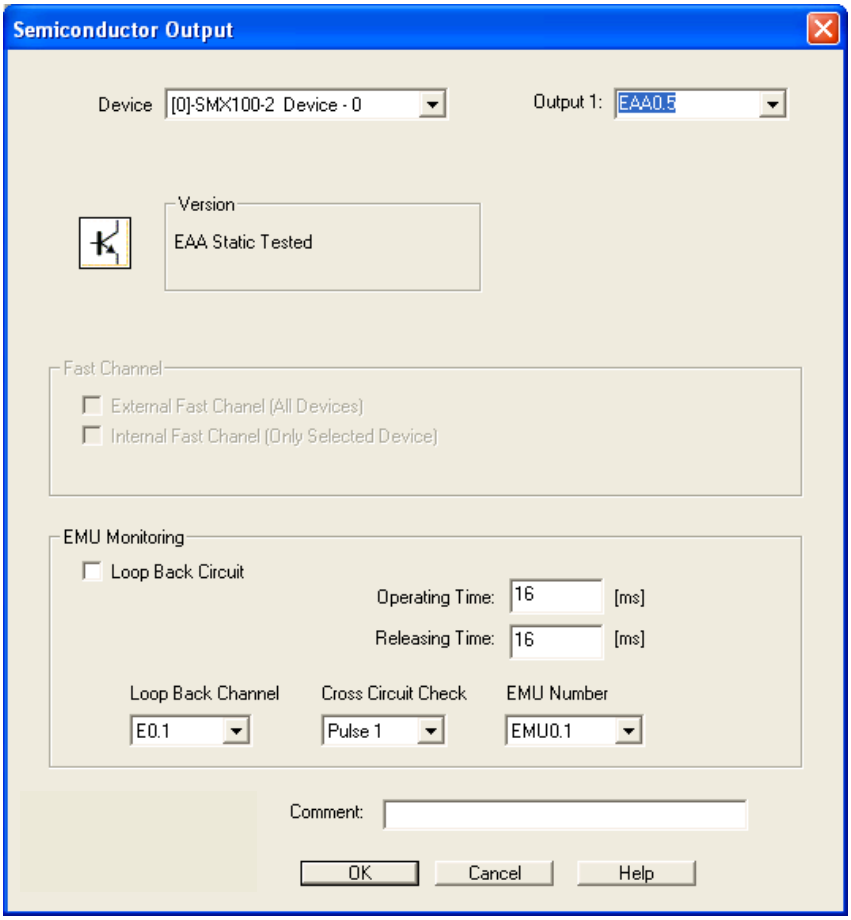
Semi-conductor outPort as auxillary outPort
Certain semi-conductor outPorts can solely be used as auxiliary outPorts and are thus not suitable for safety applications (refer to the installation manual for details). The editor can only be used to set the initial assignment.



Semi-conductor outPort with safety function

Semi-conductor outPorts with safety function are internally structured with two channels and can be combined with external contact monitoring (EMU).

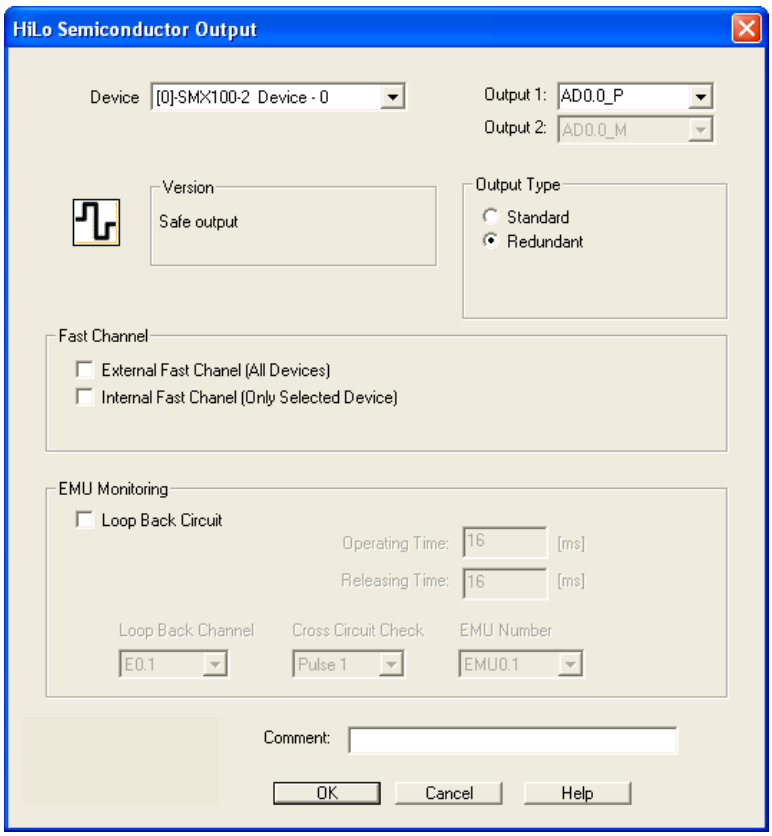
For exact contact monitoring see chapter EMU function



Fastchannel: Fast Channel is not suitable for safety applications.

HiLo outPort

Semi-conductor outPort as standard or safety outPort
HiLo semi-conductor outPorts can be used individually as standard outPorts and grouped as safety outPorts (refer to the installation manual for details).
The editor can be used to set the initial assignment.



OutPort type
Single
"HISIDE" (= P-switching) or "LOSIDE" (= M-switching) can be selected as standard outPort. The use of single standard outPorts is not suitable for safety outPorts.
Redundant
With the option "Redundant" the editor compellingly specifies a combination of "HISIDE" and "LOSIDE" outPorts.

For exact contact monitoring see chapter EMU-function

Fastchannel: OutPort type „Redundant“ can only configured to a Fast Channel. A master device outPort can use “External” the axis slave device “External” or/and “Internal” Fast Channel. The safety functions SLS and SOS can trigger a Fast Channel event.

Note:
Only one Fast Channel event can be created, i. e. all outPorts configured with Fast Channel will be switched off. For Reaction time see installation manual.

EMU function

The multiplication of contacts and power normally requires additional switching devices, which are triggered through the shut-down circuits of the PSCBR-C-100 module. When used in compliance with category 4 of EN 954-1, functional monitoring is required for these types of switchgear. For this purpose the switchgear must be equipped with positively driven auxiliary contacts. Details can be found in the "PSCBR Installation Guidelines".
Contacts to be monitored are switched in series and are closed when in idle state. It is verified whether all contacts are closed in idle state and open in active state. The contacts to monitored must be supplied through the fixed assigned cycle lines.

Hinweis: For more details (examples) see installation manual.

Rückführkreis
Switch to activate EMU monitoring

Rückführkanal
Digital inPort of the feedback circuit. The outPorts for activation of the external switching function and the feedback circuit are located on the same *PSCBR-C-100-system* module (basic module or expansion module).

Pickup time
Variable time slot (closing delay) for testing the safety contacts
Min{T_{EMU}} = 8 msec
Max{T_{EMU}} = 3000 msec

Dropout time
Variable time slot (release delay) for testing the safety contacts
Min{T_{EMU}} = 8 msec
Max{T_{EMU}} = 3000 msec

Note:

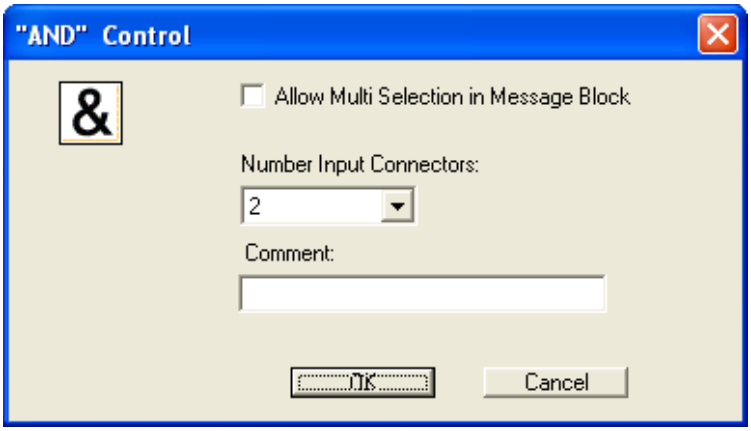
- The result of EMU function of the master device is routed in the PLC code tot he configured outPort.
- EMU function in the slave device generates in case of an error a alarm event on the master device.

The Logic Modules

These modules form the basis for creating a program for monitoring a drive axis. They enable the logic operation of function blocks and outPorts among each other. Inserting logic modules is only possible in the logic diagram, otherwise the associated menu commands are disabled. This is also the case when the resources for a module are already exhausted, e.g. after all timer modules have been inserted.

Logic AND

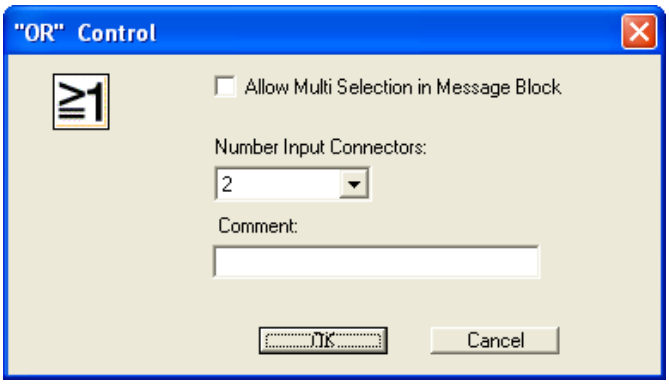
Serves the “AND”-operation of maximum 5 output signals from other function blocks. The AND-operation delivers the signal status “1” as logic result just in that moment, when all queried operands deliver “1” a query result.



Note: The number of inPort connectors can only be reduced in case of free connectors. Once all connectors have been linked, these links must be deleted beforehand.

Logic OR

Serves the “OR”-operation of maximum 5 output signals from other function blocks. The OR-operation delivers the signal status “1” as a logic result, if at least one of the queried operands has the signal status “1”.

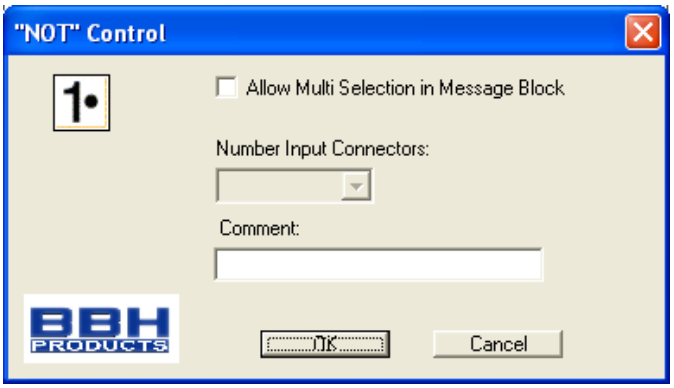


Logic EXCLUSIV OR

Serves the “EXCLUSIVE OR”-operation of maximum 2 output signals from other function blocks. The XOR-block delvers a 1 exactly when one of the two inPorts is 1.

Logic NOT

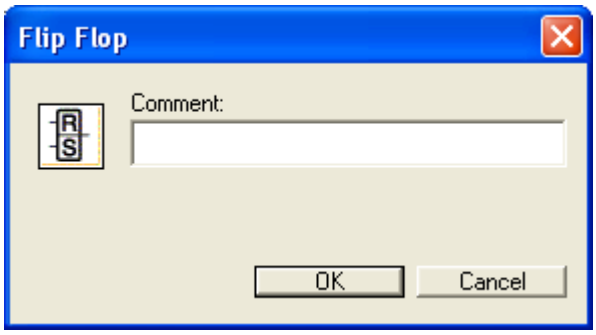
The logic result of this function block is the negation of the input signal. The term negation means that the logic result is reversed (negated).

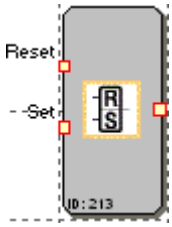


RS Flip Flop

Set / reset contact element. This switching element shows the following characteristics:

- The logic result during initialization of the element is “0”.
- The logic result becomes “1”, if an edge change from “0” to “1” takes place at the “Set” inPort. The outPort remains at “1”, even if the state of the “Set” inPort changes back to “0”.
- The logic result becomes “0”, if an edge change from “0” to “1” takes place at the “Set” inPort.
- With both inPorts set to “1”, the result is “0”!

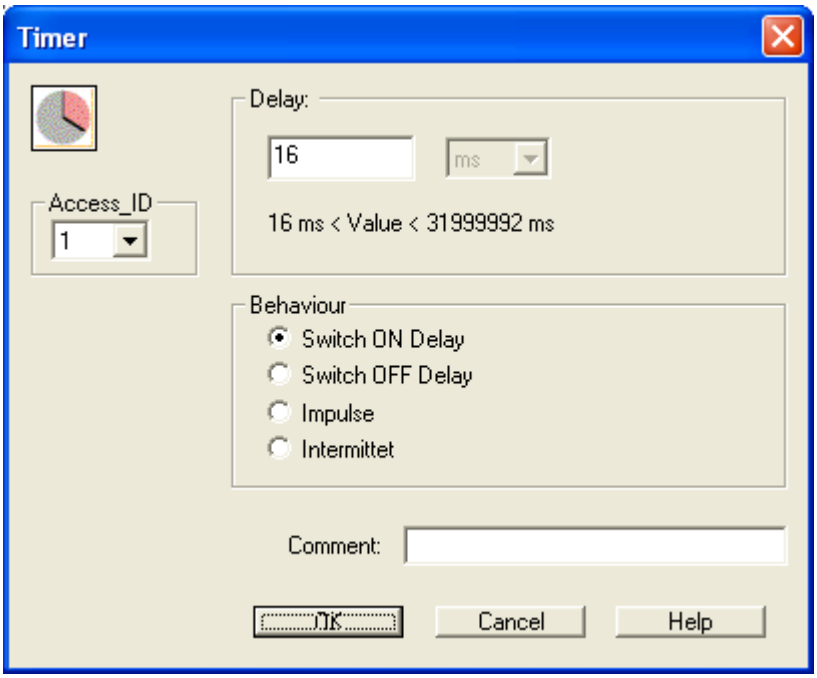




Note: The desired switching state of this element is only achieved by linking as specified in the labelling.

Timer

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

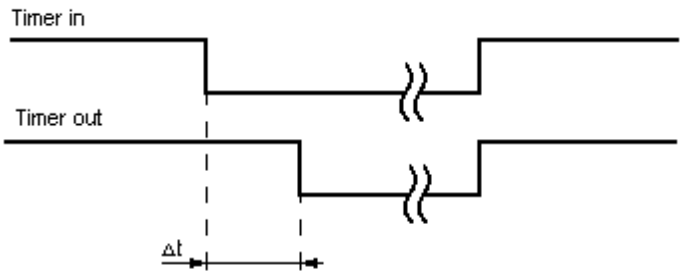
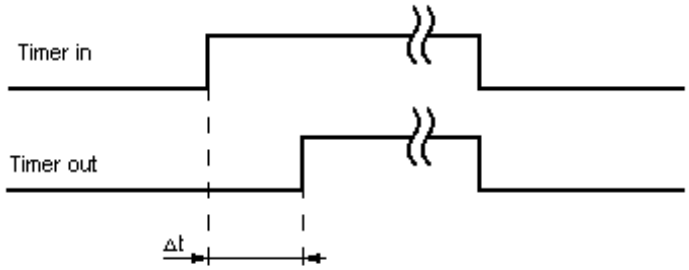
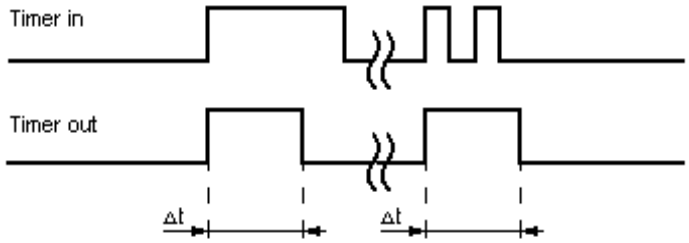
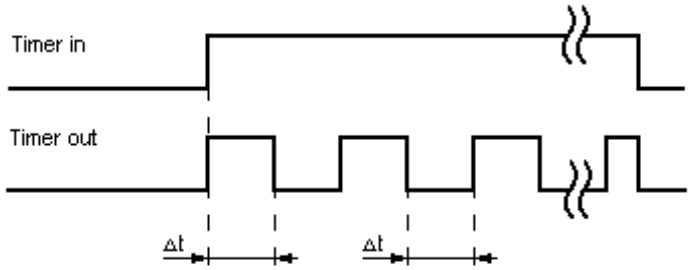


Block ID: Number of timer. This can be set when inserting. Once all timers are used up, the timer command will be disabled in the menu.
Delay: Desired period of time the timer should run.

T min	= 8 ms
T max	= 533 min (31999992 ms)

Note: Due to the fixed cycle times of the PSCBR-C-100 module the timer specification must be a multiple of 8ms.

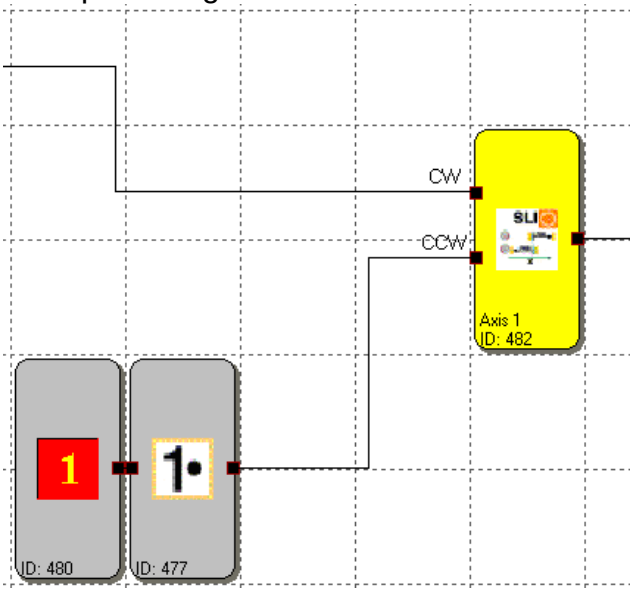
Characteristic

Function	Activation timer	Timing diagram
Switch ON Delay	Faling edge	
Switch OFF Delay	Rising edge	
Impulse	Rising edge	
Intermittiet	Rising edge	

Note: Δt = PLC Timerwert

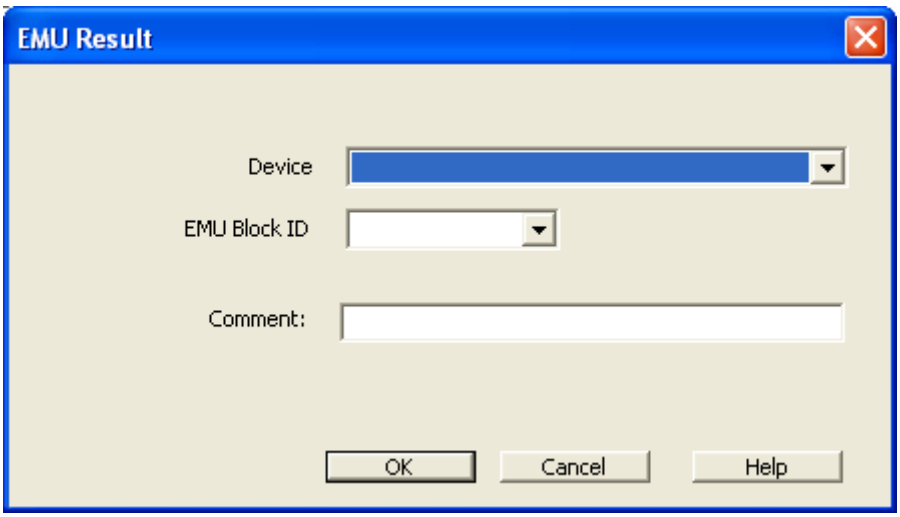
Permanently logic “1” module

This module delivers the constant value “1”, so that targeted pre-assignments can be made.
Example: Assignment of an unused inPort on a direction dependent SLI



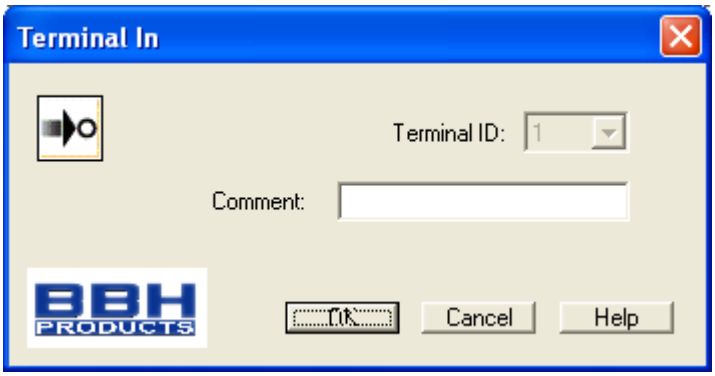
Result of the EMU module

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



Set InPort connecting point

These elements serve the clear representation of logic diagrams. These elements provide “outPort connecting point” elements. The connection in-between is then drawn. The reference numbers of the connecting points are automatically generated. If an “inPort connecting point” block is selected, the associated “outPort connecting point” blocks will also be selected, when the CTRL key is held depressed. This serves the purpose of quick representation of dependent blocks.



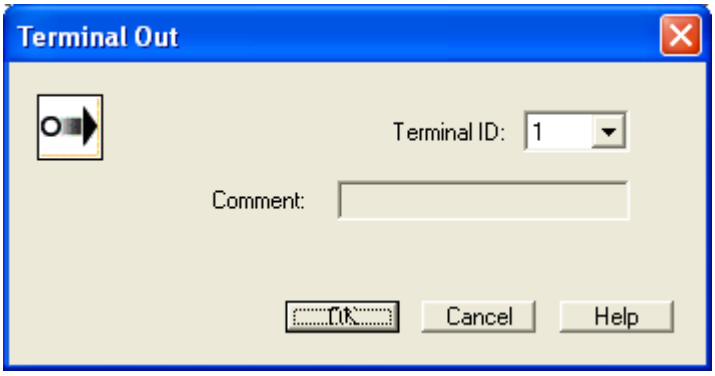
Terminal number: Identification number of the connecting point.

Note: When deleting “Connecting point” elements, which are referenced by “outPort” blocks, the user will receive a warning. When confirmed, the dependent function blocks will be deleted. If no associated “Marker outPort”block has been defined, this will result in a compiler error: “Unreferenced “Set connecting point” block”.

Tip: Use the comment line. The entered comment will simplifies the assignment of elements.

Connecting Point OutPort

This element enables the continuation of a signal, which leads to a “Set connecting point” function block. According to this, these elements can only be inserted after a “Set connecting point” element has been defined.



Terminal number: Identification number of the “Set connecting point” connecting point.

Note: Since this element refers to the set “Set connecting point” element, the comment for this element is displayed. Since this is the only place where it can be edited, the input field is disabled.

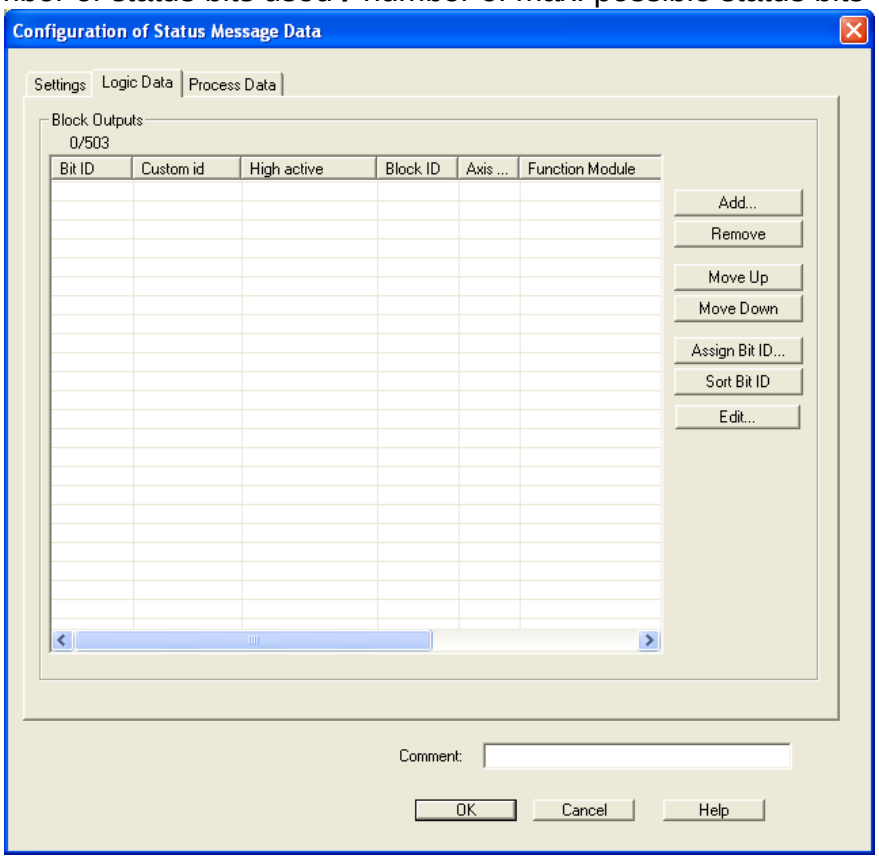
Status Message Data

This module enables the configuration of the transferred diagnostics values, the process representation and the signal channel.
It consists of two channels: Logic data and Process Data.

Logic data

This dialog area contains the list of states of the function blocks inserted in the logic diagram to be transferred.

- The signal channel list contains the references of the added function block outPorts.
- The result bit of the module is entered at the point of the set bit ID.
- The bit positions are here displayed based on 1
- Custom ID: enables reference to various modules
- Block ID: Block Number of function block in logic diagram
- Function module: Designation of the connector
- The bit value of a function block (status) is assigned to the corresponding signal channel via the bit ID.
- In OK-state the monitoring modules always have the value 1 (High).
- The numbers under the designation “Module outPorts” indicate: Number of status bits used **/** number of max. possible status bits



Add...

Opens the “Add status bit” dialog. The module selected here is added at the end of the reference list.

Delete
Deletes the currently selected line from the reference list. The bit ID of the following entries remains unchanged.

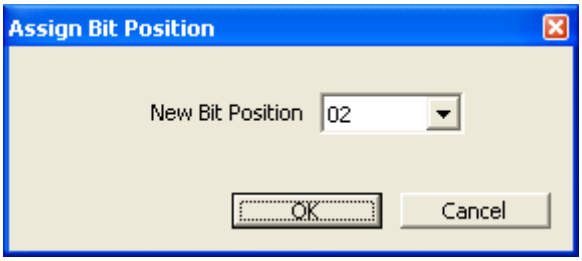
Move Up
Changes the currently selected line in the reference list by one line upwards and takes over this line's bit ID.

Move Down
Changes the currently selected line in the reference list by one line downwards and takes over this line's bit ID.

Assign Bit ID
Enables the user to use an arbitrary bit ID.
The assignment dialog can only be opened under the following conditions.

- There must still be at least one free bit ID available.
- A line must be selected in the signal channel list.

Double-clicking on the line also opens the dialog.



- At this point please set the desired bit position for the selected line. The numbering system is 1-based. The result of the referenced module is transferred to the set position.

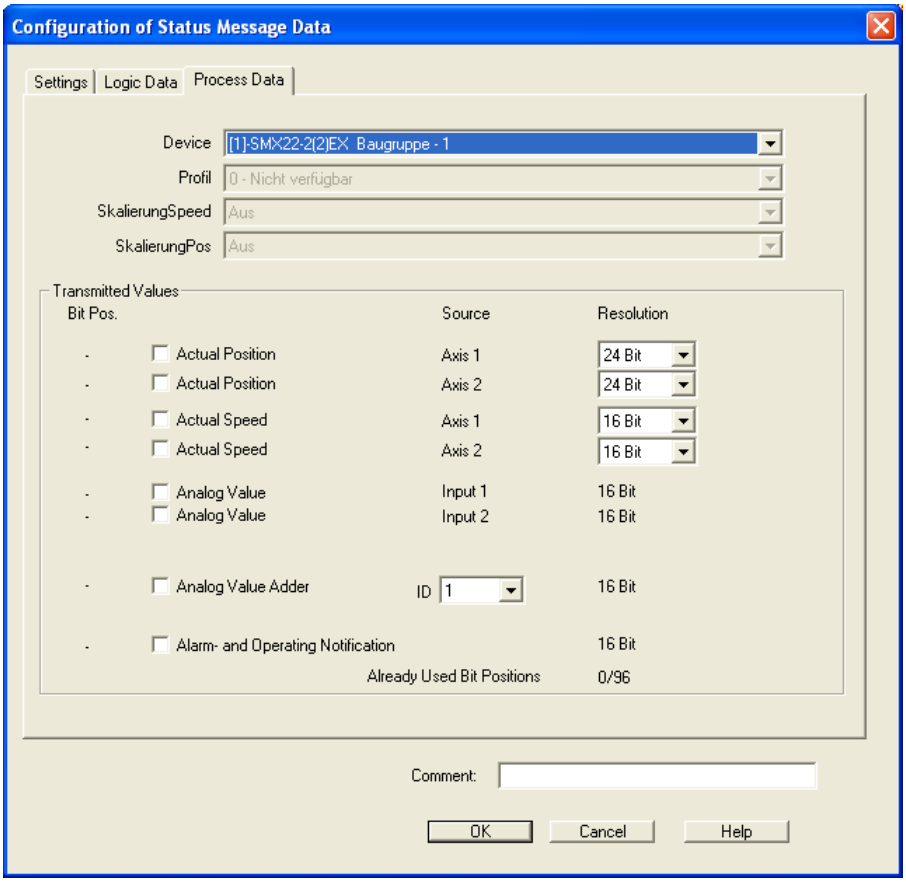
Sort bit ID
Sorts the signal channel list in the sequence of the assigned bit IDs.

Note: The assignment of status bits should only take place after a successful compiler run, because the addresses calculated by the compiler must be accepted. These are displayed in the “Symbol addresses” column. The entries in this column remain empty or are not updated, as long as the logic diagram cannot be compiled completely.

Process data

In this dialog area one can set the dynamic process data to be transferred from the PSCBR-C-100 module to the CAN-interface. 96 bit are available in total per axis module. The values set in the dialog are evaluated from “top” to “bottom” and copied into the transferred data section in accordance with the selected resolution. This area must be interpreted as integer value! It complies with the standardized encoder position, which results from the current sensor configuration.

Note: To get the correct encoder values they have to be divided with “FaktorPos” or “FaktorSpeed”. See window “Infofeld Sensorik”



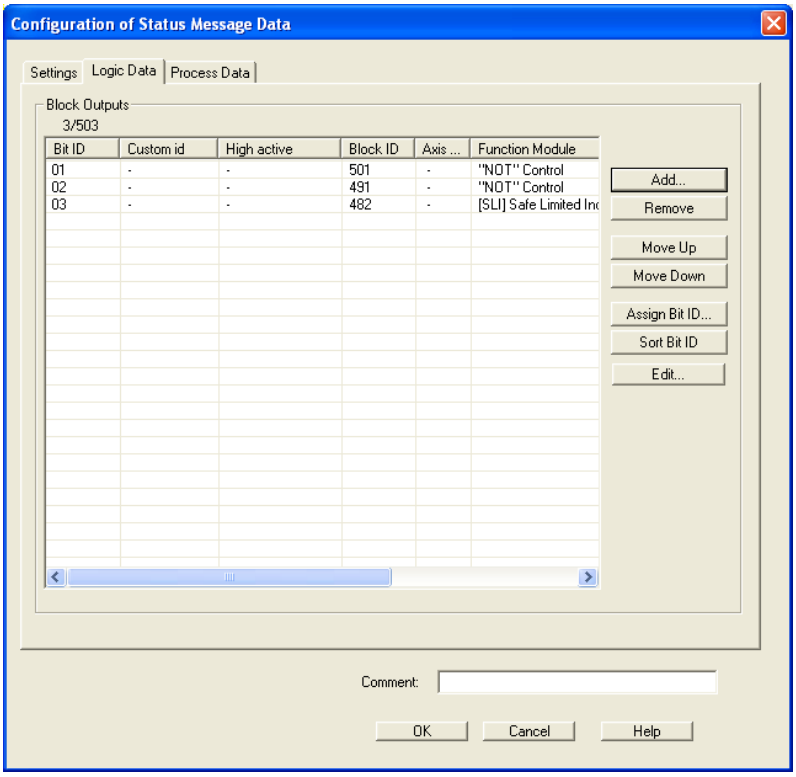
Extended signal channel

Signalizing of diagnostic bits via a 7-segment display of the PSCBR-C-100 master module.
Configuration of the extended signal channel takes place in the diagnostics address and signal channel editor.

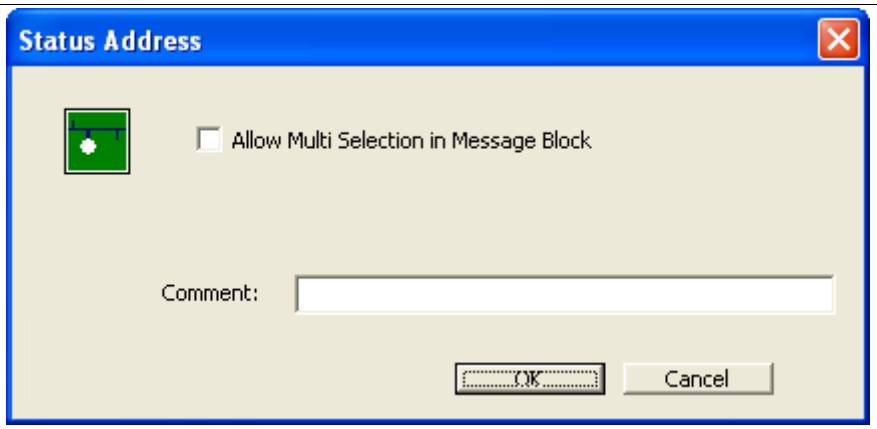
Procedure:

Step 1: Inserting diagnostic addresses

Step 2: Inserting in signal channel editor



Step 3: Activation of the extended functions



BitID:	Display of bit IDs in the signal channel block (only display)
Condition:	in case of signal status ‘1‘ -> activation of display if bit = “1”
	in case of signal status ‘0‘ -> activation of display if bit = “0”

Output on 7-segment display:

If the continuous condition of the diagnostic address is fulfilled, the display shows the following sequence:

- Display operating mode “4” for 5 seconds
- Display " c _ _ _"

Note) _ _ _ : 3-digit bit ID (see diagnostic address editor)

Note:

- Subsequent displacement of already used diagnostic addresses in the signal channel editor (bit ID) requires a new confirmation by the user in the diagnostic address editor.
- Output via 7-segment display only takes place in operating mode “4” and if no “ECS-error” is present.
- If several diagnostic addresses are configured, the bit IDs will be displayed in succession without pause.

Function Groups

Function groups connect several functional modules to a superordinate logic structure. This matching group of modules is created inside the function group frame and connected via this frame.
This grouping gives the logic diagram a much clearer structure and, with the export / import functionality, enables the creation of an own function library.

Creating a function group frame

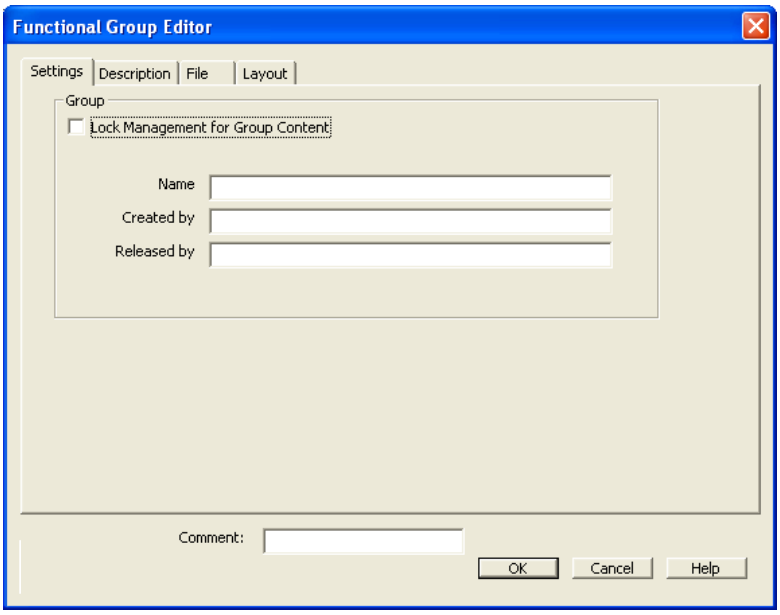
Inserting a group module

First the command “Insert group frame” is started by clicking on the toolbar button “Insert”. The menu: Group->Insert group frame… can alternatively be invoked.
Two coordinates are specified with the mouse pointer to determine the size of the group frame.

1.) First position the mouse pointer with the left mouse button in the left upper corner of the group frame and hold the mouse button depressed.
2.) Then drag the mouse pointer with the left mouse button held depressed. You can thereby determine the right bottom corner of the group area.
3.) Releasing the mouse button will insert the group frame and open the group editor.

Opening the group editor

The group editor can optionally be opened by double-clicking in the status line of the group frame, or via the context menu (right mouse button) of a selected module.



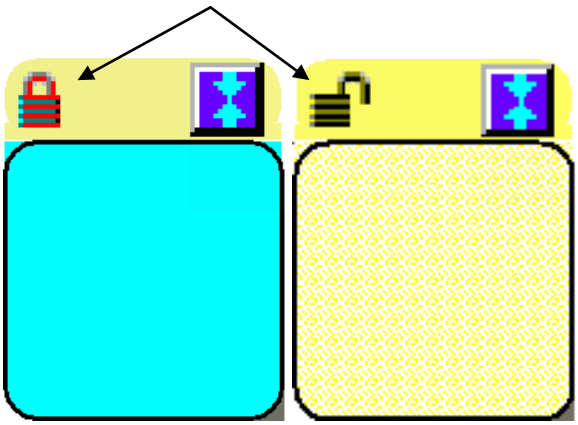
The tab-dialogs “Settings” and “Description” contain group related settings, as well as the function related description of the group. The dialog tab “File” can be used to export the group into a file, or to import the group from a file.

Setting the group management

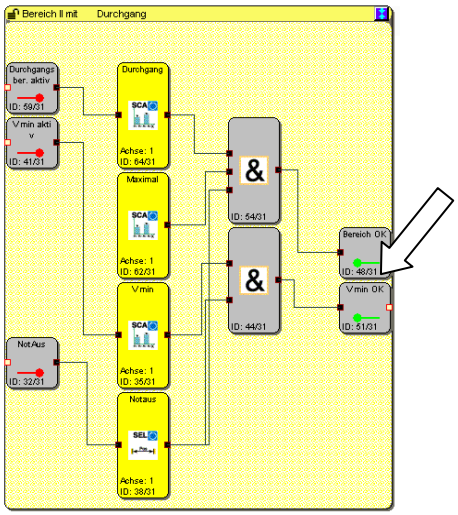
With the switch “Disable group management” the group modules can be disabled or enabled.
With the switch set, the function block management of the frame is disabled and the modules are frozen.

- Modules can no longer be removed from the group. Please note: Configuring parameters is still allowed. But care should be taken when changing a basic functionality (functional parameters) within the module parameters. Here no management has yet been implemented.
- Deleting a group frame also deletes all group modules.
- No new modules can be added to the group.
- Group members appear “grey shaded”.
- When disabled, the group has a time stamp assigned, which is also displayed when the group editor is opened (quasi the latest modification).
- The control buttons for the info fields “Name”, “Created by” and “Released by” are disabled.

The group status “disabled” is indicated by the padlock symbol in the status bar of the group module at the top left.



When inserting a new group frame the switch “Disable group management” is initially not set. After closing the group editor the drawn frame appears in the logic diagram and represents the active area of the group.
The associated function modules can now be newly added or moved to this area. The modules will automatically be accepted in the group, unless the group is in disabled state. The function modules in this case additionally show the group number.



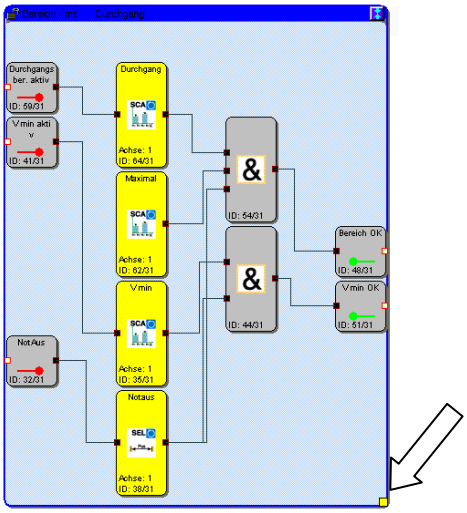
Note: The following block types cannot be contained in a group. They are filtered out when the modules are moved into the frame area.

- InPort modules
- OutPort modules
- All function blocks pre-defined in the logic diagram (e.g. encoders, analog modules, IOs)
- Signal channel module
- Terminal blocks

The group is able to accept maximum 200 function blocks.

Changing the size of a group frame

A selected module can be adapted in size via its “Hotspot”. This must be selected with the mouse pointer and dragged with the left mouse button held depressed. The change in size is displayed.



Showing and hiding function modules

The modules contained in the group can be shown or hidden be clicking on the control button in the status bar with the mouse pointer (single click). The group module automatically adapts its size to the modules contained in the group when showing the function modules again.

Note: Do not use the show/hide function while editing modules, as otherwise the planned free space for more modules may be reset. In this case the group needs to be manually enlarged again via the “Hotpoint”.

Tip: The size of the group frame can be fixed by using a text element, which is placed in the bottom right hand corner.

The visibility of the associated function blocks in the logic diagram can also be set in the group dialog using the switch “Show associated modules”.

Show modules

The size of the group module is determined by the position of the functional modules contained therein.

Hide modules

The group module is set to a size of approx. 2 x 3 fields of the logic diagram. The bitmap for the symbol is display.
If several function groups are available, all group modules can be shown or hidden by using the symbol in the group tool bar, or the group menu.

Creating the group interface

The group interface modules represent the interface of the function group to the function modules outside the group. Connections to function blocks outside the group can only be made via this interface module.

Inserting a group interface module is started by clicking on the button in the group tool bar (alternatively menu: Group->Insert interface module...) After placing a module inside a group frame the group interface editor is opened. Initially it is sufficient to stop using the module.

Setting the usage

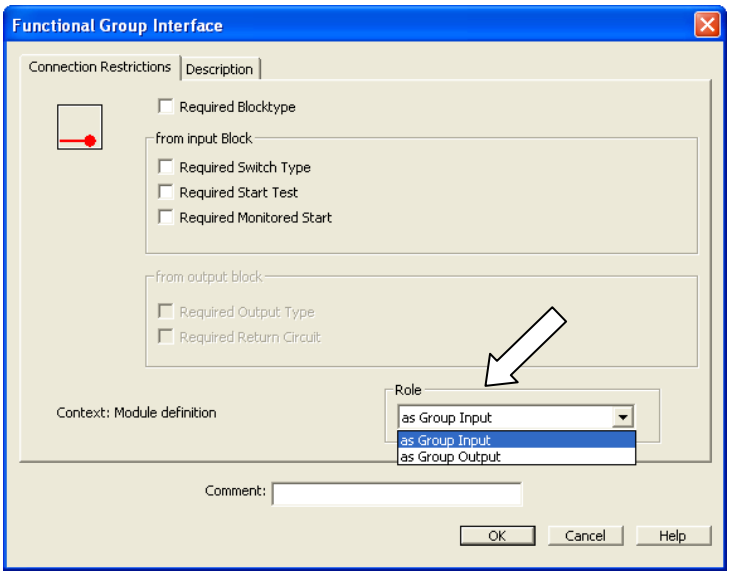
This setting specifies how the module is to be used in its environment.

“as group inPort”

Connection for function blocks outside the group at the inPort connector. Serves the purpose of activating the group functionality. The module should be positioned on the left side of the group area. The outPort connector must be connected inside the group.

“as group outPort”

This module delivers the result of the group functionality. The module is the last link in the sequence of modules. The outPort connector is connected to a function block outside the group.

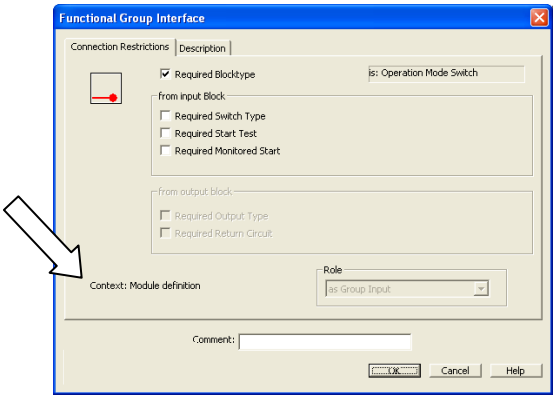


Restrictions

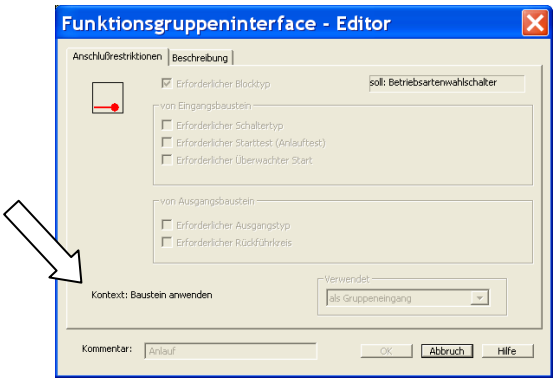
The main duty of the interface modules is the control of whether an imported function group will be connected with the required function elements. This can be set via the connection restrictions.
The state the associated group is in is initially decisive. The group can be enabled (= definition mode) or disabled (= use mode). These states reflect the context of the interface module.

Note: Restrictions can only be set correctly, if the interface module is connected with the required logic diagram elements. This means, that interface modules in definition mode must be connected with the function blocks in question.

Context: Defining a module:
The interface module reads the type and the restriction criteria of the connected module and offers these as restriction. The restriction is shown when the associated switching element is set.
Example: A mode selector switch is connected to the group interface module. In user mode the group module always expects to be connected with the function block type “Mode selector switch”



Context: Using a module
When connecting to an external functional module, the interface module expects the set restriction criteria. If these are not fulfilled a compiler error will occur and the program cannot be compiled.
Example: nominal operation mode switch



Procedure for Creating a Function Group

A function group is created via a group frame. Function blocks within the colour contrastive area of a group frame are assigned to this group. As long as the group module is enabled, function modules can be added to or deleted from the area of the group frame. If a block has been added to the function group, the info display will show then message “Contained in function group: No”.

Tips:

- The group(s) should remain in enabled condition for as short a time as possible.
- Enable as little groups as possible in the logic diagram.
- Don’t move as possible unlocked groups in the logic diagram
- Lock groups before saving
- Refrain from moving groups in the logic diagram.
- Create connections only as late as possible.

1. Step: Adding interface modules

The function modules contained in a group can only be linked with the function elements outside the group frame via the interface modules. In these interface modules restrictions can be set as required, which will demand the same connection constellation when importing the group into another logic diagram. The interface modules enable a description of the inPort and outPort parameters of the function group. If restrictions are set, these should in any case be described in the module.

2. Step: Adding function modules to the group

Function modules can only be added to the group frame in enabled condition. This is indicated by the symbol in the status bar.
If function blocks are to be added to a group, a module must either be inserted within the group area, or it must be moved into this area.

Please note:

- No function blocks can be taken in by simply moving the group frame! The modules must be moved into the group frame instead.
- Only logic modules and monitoring modules can be accepted in the group, inPort and outPort modules, pre-defined elements such as signal lists, analog modules or encoder modules are not permitted.
- In case of modules with existing connections it may happen, that a connection projects from the group frame during the step-by-step movement of the selection. This is under no circumstances permitted and the connection will be automatically deleted.
- If modules, that have already been connected, are to be added to groups with their connections by moving, you should proceed as follows:
    - Enlarge the group frame to a sufficient size. At least two grid elements bigger than required.
    - The move the group frame over the function blocks. The affected connections must all be inside the group frame.
    - Select the modules and displace them by one grid position inside the group module.

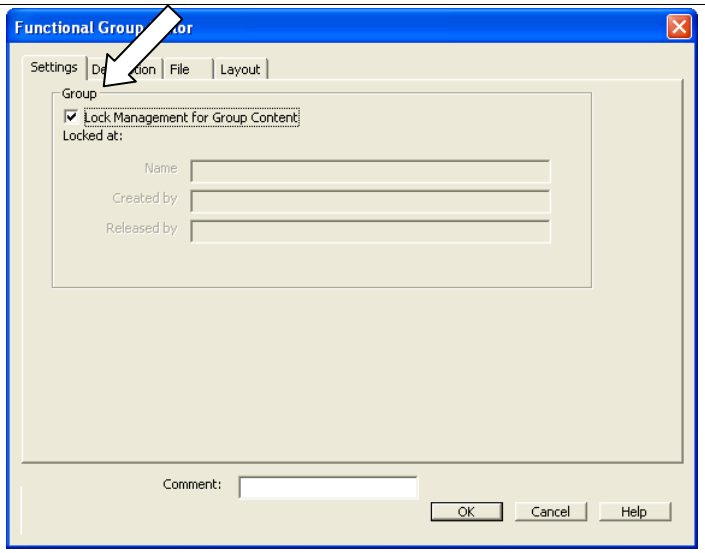
3. **Step: Create connections**
4. **Step: Connect group interface**
5. **Step: Set connection restrictions**

Test function group

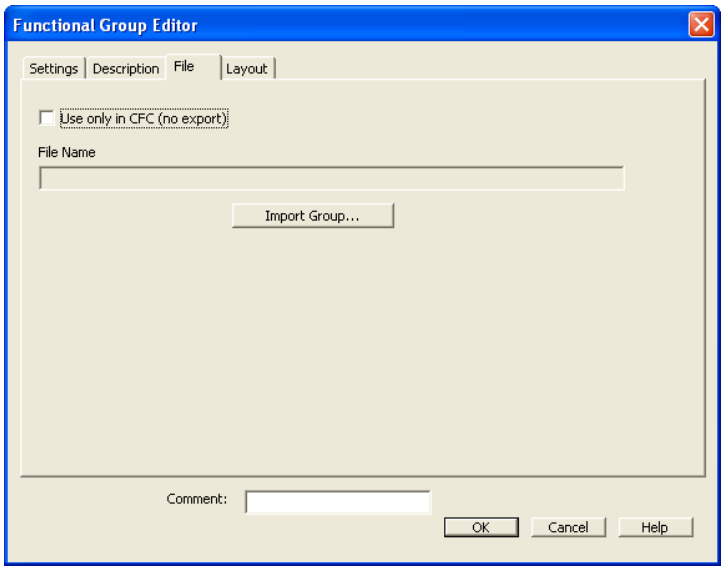
The user himself is responsible for the correctness of the functionality. During the import of the group into another logic diagram the parameters must be checked and adapted by the user! A description about the use of the function group is required. The logic diagram should be in a compilable condition. The inPorts and outPorts of the function group must be described.

Disabling a function group

When disabling a function group, the function blocks contained in this group are tied to the group module. The modules can in this case no longer be deleted individually and only moved via the group module.



Exporting a function group



The modules of a group can be exported into a *.fgr file. An exported group can be imported into another group frame. This enables the creation of a library with pre-defined function groups, which can then be imported into new projects.

Note: The function library can only be used for edit and the customer has always to validate the group elements in the application.

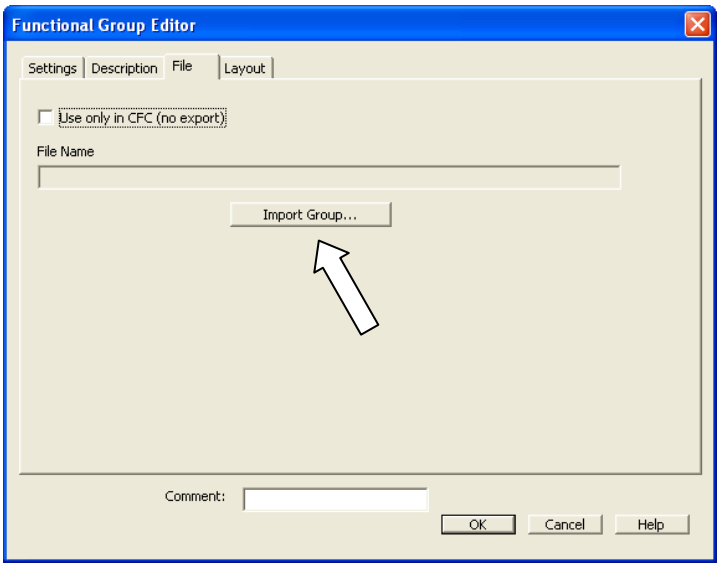
The switch “Disable permanently” is a special export feature. If this option is set, the group can no longer be enabled after it has been imported.

Please note: If this option remains set and the dialog is quit with OK, the group is disabled within the logic diagram and the dialog element “Disable group management” is permanently hidden. It is highly recommended to make a backup copy of the still enabled function group.

After the option “Disable permanently” has been set, the structure of the function group can no longer be changed!

Importing a function group

A function group file can only by imported using an already inserted group frame. For this purpose the group editor is started.



Note: Modules already available in the group, will be deleted.

The import process includes the verification of the sensor configuration and the still existing resources in the logic diagram. The group can only be imported if the resources for all modules are available. The necessary sensor settings must be checked, particularly in case of position dependent monitoring modules.

If a resource is no longer available, this is indicated by an error message.
In case of resource errors make sure that the sensor settings comply with the requirements of the group. This is particularly valid if position dependent modules were used in the function groups (SEL SLP SCA).

The Safety Functions

The safety functions are the essential functionality of the device. Pre-defined functions for:

- Speed monitoring
- position detection
- monitoring of limits and target positions
- functional emergency monitoring
- standstill
- travel direction
- function monitoring of external shut-down devices
- reset
- muting

are available.

The functionality for monitoring position, speed and shut-down is only activated after successful encoder configuration in the terminal diagram. Once this has been done, the corresponding functions can be inserted as long as there are resources available in the PSCBR-C-100 module for this purpose. Once these have all been used, the menu option for the corresponding function block is disabled.

Function named in EN 61800–5–2	Number of blocks
SLS - Safe Limited Speed	48
SOS - Safe Operational Stop	12 (1 per axis)
SDI = Safe Direction Indication	12 (1 per axis)
SSX = Safe Stop 1/2	24 (4 per device)
SLI = Safe Limited Increment	12 (1 per axis)
SCA = Safe Cam	64
SEL = Safe Emergency Limit	12 (1 per axis)
SLP = Safe Limited Position	12 (2 per device)
SAC = Safely Analog Control	48
EMU – Emergeny Monitoring Unit	16
DEM – Dynamic Encoder Muting	12 (1 per axis)
ECS – Encoder Supervisor	1 per slave device
ICS – Input Elements Muting	1 per slave device
ACS – Analolg Input Muting	1 per slave device

EOS – External Offset Setup	1 per axis

Note: If no position monitoring is activated in the encoder configuration, the dependent control elements are disabled in the dialogs.

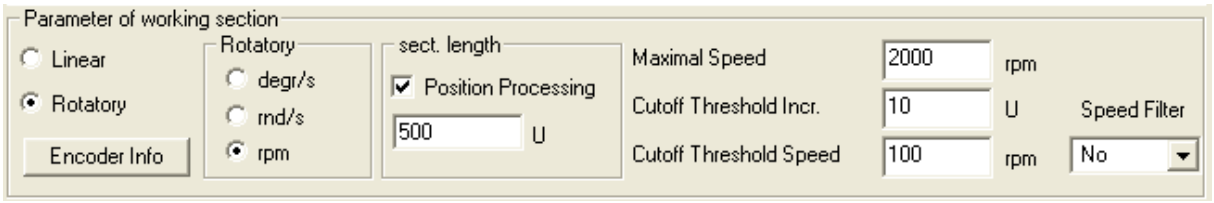
Encoder

Selection of encoder type and measuring section as well as the parameterization of both sensors for position and speed detection takes place in the “Encoder” input screen.

Note:

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

Parameterization of the measuring section:



The following options and inputs are possible in the field “Parameters of measuring section”

Linear:	The measuring section has a linear characteristic, the movement is a longitudinal movement. This means, a linear movement with respect to position and speed with the units mm or mm/s resp. m or m/s is detected.
rotatory:	The measuring section has a rotational characteristic, the movement is a rotation. The position is detected in mdeg or rev and the speed in mdeg/s resp. rev/s or rev/min.
Position processing:	This functionality is only active after an absolute code has been selected in the sensor range! With an activation all position related monitoring functions are enabled. When deactivating this option, only a speed and direction detection is possible. Note: For a position detection the measuring length must always be known.
Sect. length:	Specification of the max. measuring length for position in mm, m or mdeg, rev. Here a maximum value of 1000000 can be entered for each unit. If the

	actual position is out of the Sect. length an alarm is generated.
Maximum speed:	Specification of the max. speed of the reference axis given in the currently selected unit. The permissible maximum speed describes the highest speed that can possibly be reached with the current technological system configuration. Here one should enter the max. value that may possibly be reached by the axis to be monitored. This may just refer to a theoretical maximum speed, because it is not reached in the control or the parameterization. This value does not refer to the safety-related shut-down as for e.g. the function 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. Should this occur, the PSCBR-module will change into alarm state and switch off all outPorts. 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 “Info field sensors” value table shows these calculated limiting values for the variables V_max, V_min.
Shut-down thresholds	The shut-down threshold defines the tolerable speed/position deviation between the two detection channels / encoder channels. It depends, among others, on the arrangement of sensors and the max. mechanical clearance (e.g. caused by gear batches and spring stiffness values) between the detection points. The lowest possible value, at which

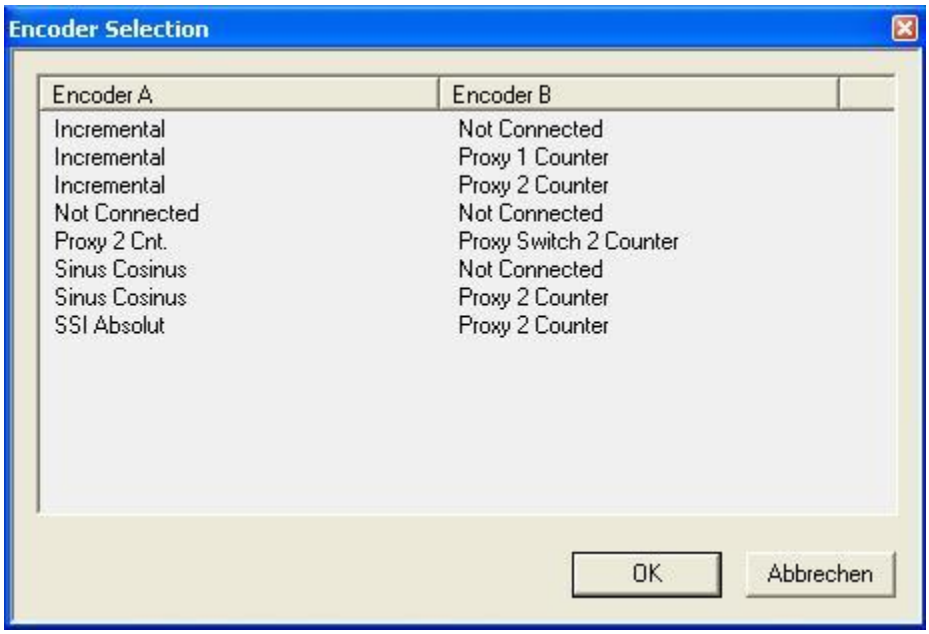
	monitoring is not yet triggered in normal operation, should be chosen, under due consideration of the dynamic processes (e.g. load/play in gearbox).
Speed filter:	Average filter covering the detected speed values of the encoder to dampen peak speeds in systems susceptible to jolting. With the filter switched on the specified response time of the overall system will increase by the set time. The filter has an effect on the speed related parameters of the monitoring modules.

Note:

- Determining the characteristic of the measuring length as linear or rotational generally influences all position and speed inputs in the other inPort masks of the monitoring functions. It generally changes the inPort from mm, m or mm/s, m/s to mgrd, rev or mgrd/s, rev/s or rev/min and vice versa.
- The specification of max. measuring length and max. speed is mandatory. A missing or incorrect entry can cause undesired responding of the monitoring functions.
- In general sensor 1 has the function of a process sensor and sensor 2 acts as a reference sensor. If sensors with different resolution are used, the sensor with the higher resolution should be configured as sensor 1 and the one with lower resolution as sensor 2.

Encoder Selection

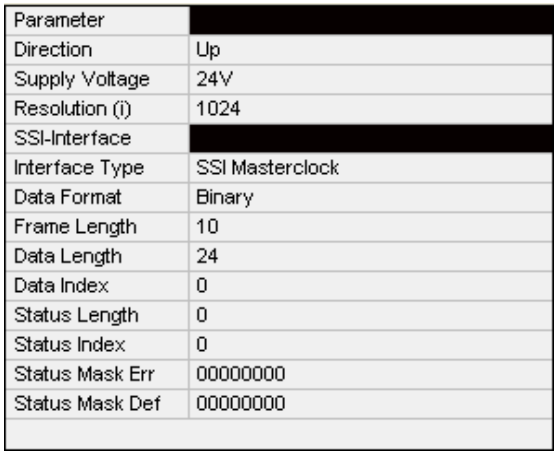
Select encoder combination with button „Encoder Selection“.



See „ANHANG Geberkombinationen“ for all encoder combinations.

Sensor 1 or Sensor 2

These two option and input fields are used to parameterize the sensors.



Parameter	
Direction	Up
Supply Voltage	24V
Resolution (i)	1024
SSI-Interface	
Interface Type	SSI Masterclock
Data Format	Binary
Frame Length	10
Data Length	24
Data Index	0
Status Length	0
Status Index	0
Status Mask Err	00000000
Status Mask Def	00000000

Parameter depends on encoder type:

Parameter	**description**	**value**
Direction	Selection of sensor counting direction	Up / Down
Supply Voltage	Encoder power supply	8V, 10V, 12V, 20V, 24V
Resolution (i) (i)=double click open calculation dialog	Encoder resolution referring to the measuring axis in the pre-defined context (linear or rotational)	1 – 2 000 000 inkr/1000 oder inkr/U
Offset (i) (i)=double click open calculation dialog	Offset value for position encoder. Usable if “Position Processing” is activated	0 – 268435455 Inkr
Encoder type (SinCos EX)	Activation high resolution mode for slow counting SinCos Encoder.	Simple -> no high resolution HighRes -> high resolution
SSI-Interface (Absolutencoder)		
Interface Type	SSI Ausführung	SSI-Masterclock, SSI-Listener
Data Format	Format of position data	Binär, Graycode
Frame Length	Length of whole SSI frame	10 – 31 Bits
Data Length	Length SSI-Daten starting with MSB. In this data field no e.g. status bits are allowed (only SSI data).	10 – 28 Bits
Data Index	Start-index for bit information encoder data.	Integer value: Bit position starting at LSB
Status Length	Length status infprmation (e.g.: error bit, status bits)	Integer value: Length starting at LSB

Status Index	Index, where a status information (bit index) is listed	Integer value: Bit position starting at LSB
Status Mask Err	Not used	
Status Mask Def	Not used	
Resolver type (Resolver)		
Formfaktor	Formfactor des Resolvers	Off, Sinus, Triangle
Resolver Ratio	Resolver ratio	2:1, 3:2, 4:1, Pattern1 (Amplitude Check: Off), Pattern2 (Frequency Check: Off), Pattern3 (Frequency&Amplitude Check: Off)
Polpaare	Number of pole pairs	1 – 8 Pole pairs
Interface Type	Resolver type	Master, Listener
Listener Frequency	Frequency listener mode	6 kHz – 12 kHz, 14 kHz, 16 kHz

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

With the "Incremental" type an impulse multiplication takes place inside the device. The resolution of the sensor must always be entered into the "Resolution" field as pulses per revolution (PPR) The multiplication depends on the set sensor configuration and runs internally automatically. Further information can be found in the installation manual.

Sensor info field

After successful parameterization an info field with various selection and result data related to the currently used sensors can be displayed by simply clicking on the button “Sensor Info Field”.

Axis area

Column name	*Meaning*
Class-ID	Unambiguous ID of axis configuration
General flags	BIT-coded assignment D0: 1= shows that this axis input is activated
Modes	Internally used
Axis CFG ID	Unambiguous ID for both sensor configurations
Measuring length	The measuring length for the position from the main dialog
PosFactor	Factor for position calculation (Standardization)
FactorSpeed	Factor for speed calculation (Standardization).
MaxSpeed	Maximum standardized speed.
Shut.down threshold Pos	Value of shut-down threshold incr. but non-standardized
Shut.down threshold Speed	Value of shut-down threshold speed, but non-standardized
Unit	Internally used

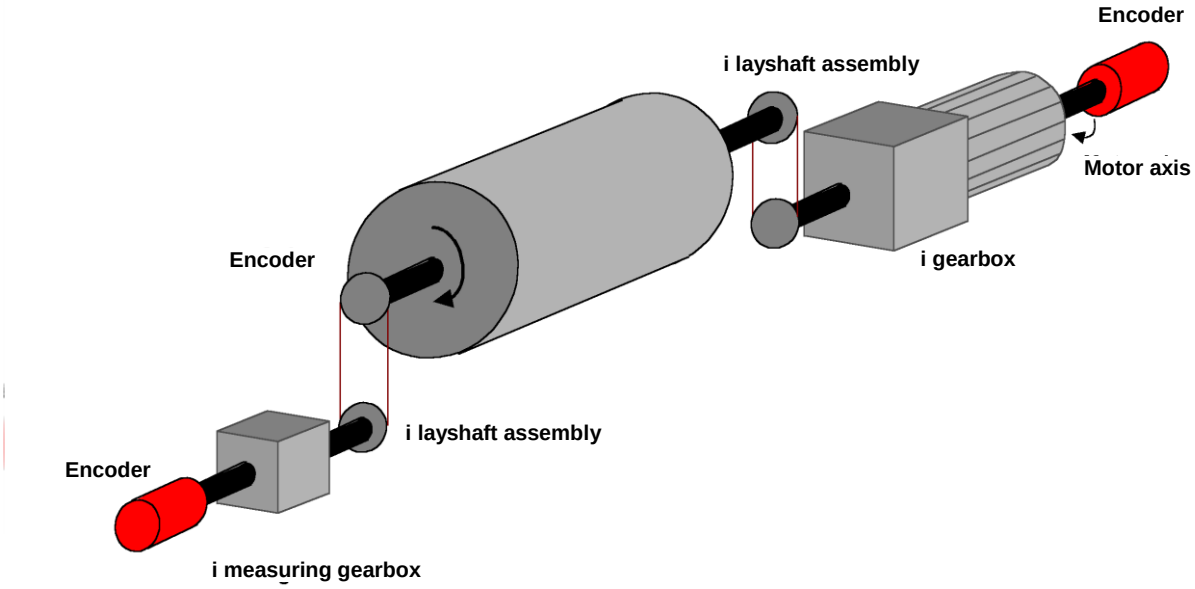
Area sensor

Column name	*Meaning*
Class-ID	Unambiguous ID of sensor configuration
General flags	Internally used
Modes	Internally used
EXT-Modes	Internally used
V_Standardization	Standardization value for speed (internal calculation value)
PosStandardization	Standardization value for position (internal calculation value)
ShiftvalPos	Interger exponent for basis 2. Internal calculation value for position standardization.
ShiftvalSpeed	Interger exponent for basis 2. Internal calculation value for speed standardization.
Offset	Corresponds with the input field Offset in the sensor interface
Resolution	Corresponds with the input field Resolution in the sensor interface
FilterTime	Internally used
Data width	Corresponds with the value in the input field Data Width in the sensor interface
Cycle time	Specifies the cycle time of the axis module
V_max	The maximum speed that can be entered for the parameterization of the monitoring dialogs. Is defined via “Encoder dialog maximum speed” * Factor 1.5
V_minused	Internal minimum speed for standardization calculation
V_min	The minimum speed that can be entered for then parameterization of the monitoring dialogs.
Measuring length	Entered measuring length.
Pos_Minused	Internal minimum position for standardization calculation
Pos_min	The maximum position that can be entered for the parameterization of the monitoring dialogs.

Note: The displayed values are assist the Technical Support in the encoder configuration and are used for the standardization calculation in the PSCBR-C-100 module.

Determination of the Resolution with Regard to Different Characterized Measuring Lengths:

Rotational measuring length



Reference axis	*Input values*		*Resolution related to measuring length*
Feed axis (process axis)	Encoder 1: Resolution Gb 1 i measuring gearbox i layshaft assembly	A_Gb1 in [steps/rev] I_MG I_VG	**Gb1 = I_MG · I_VG · A_Gb1**
	Encoder 2: Resolution Gb 2 i gearbox i layshaft assembly for drive	A_Gb2 in [steps/rev] I_G I_VA	**Gb2 = I_G · I_VA · A_Gb2**
Motor axis	Encoder 1: Resolution Gb 1 i measuring gearbox i layshaft assembly ∅ measuring gear i gearbox i layshaft assembly	A_Gb1 in [steps/rev] I_MG I_VG D_MR in [mm] I_G I_VA	$Gb1 = \frac{I_MG \cdot I_VG \cdot A_Gb1}{I_G \cdot I_VA}$

Input example 1

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

Selecting the module

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

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

- Rotational
- Measuring length unknown
- Reference axis is rotational axis => designation = rotatory

Determination of parameters for SensorA
Sensor 1 is directly connected with the outPort axis of the gearbox = load axis.
A sensor with the data: Pulse generator A/B-track, 5000 pulses/revolution is used.
The following parameters are selected:

- Encoder type incremental
- Resolution:

Sensor A:	
Resolution Gb 1	5000 [steps/rev]
i measuring gearbox	1
i layshaft assembly	1

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

Determination of parameters for SensorB
The existing motor feedback system is used as sensor 2. The motor is connected to the rotational axis of the manufacturing device by means of an intermediate gear. The sensor interface is connected to the pulse outPorts of the power converter. The sensor data are as follows: Hiperface, 1024 I/rev. According to the data sheet of the power converter manufacturer the sine/cosine tracks of the Hiperface encoder are outPort in the form of pulses -> emulated encoder on the pulse outPort of the power converter = pulse generator, A/B-track, 1024 I/rev. The following parameters are selected:

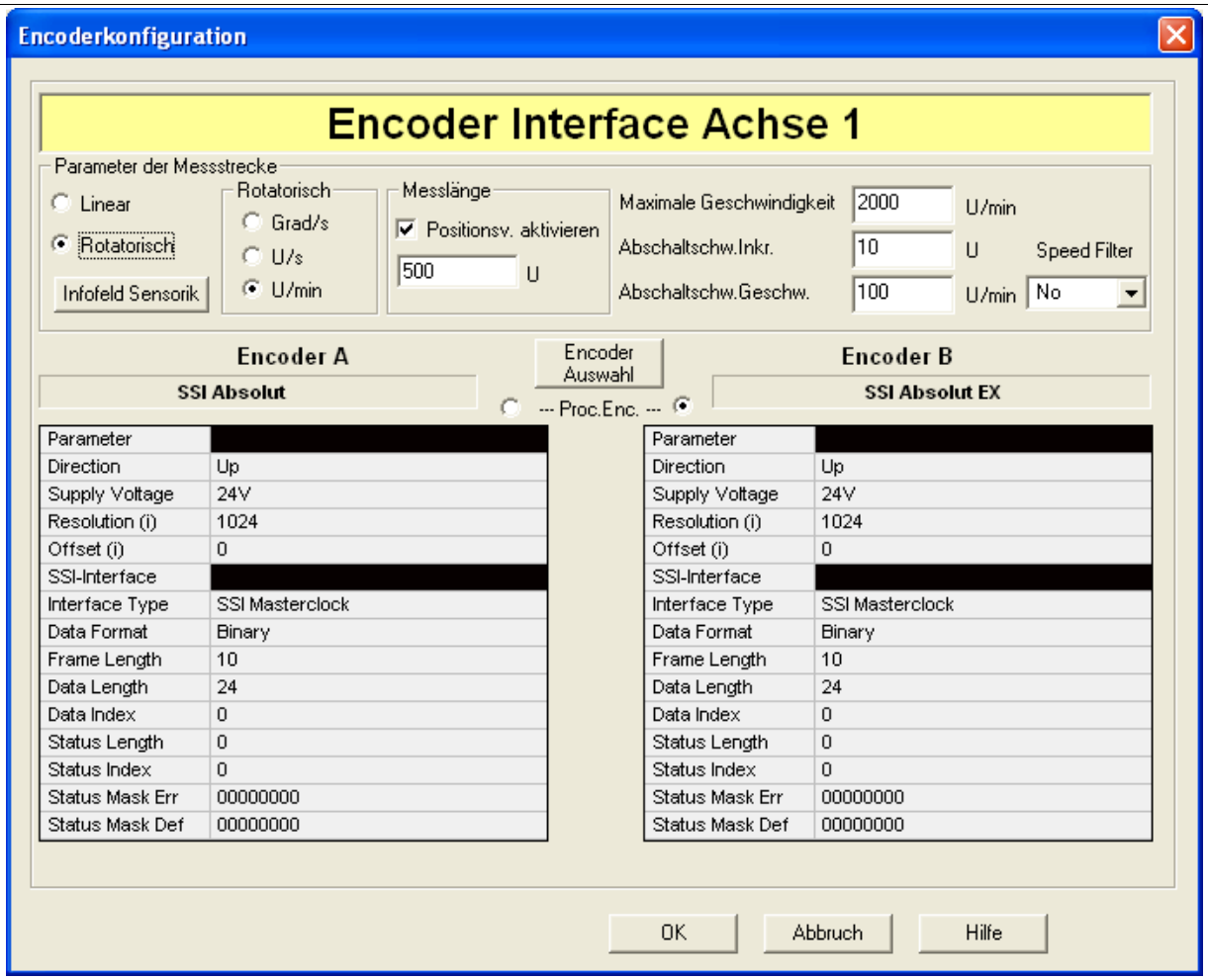
- Encoder type incremental
- Resolution:

Sensor B:	
Resolution Gb 1	1024 [steps/rev]
i measuring gearbox	350
i layshaft assembly	1

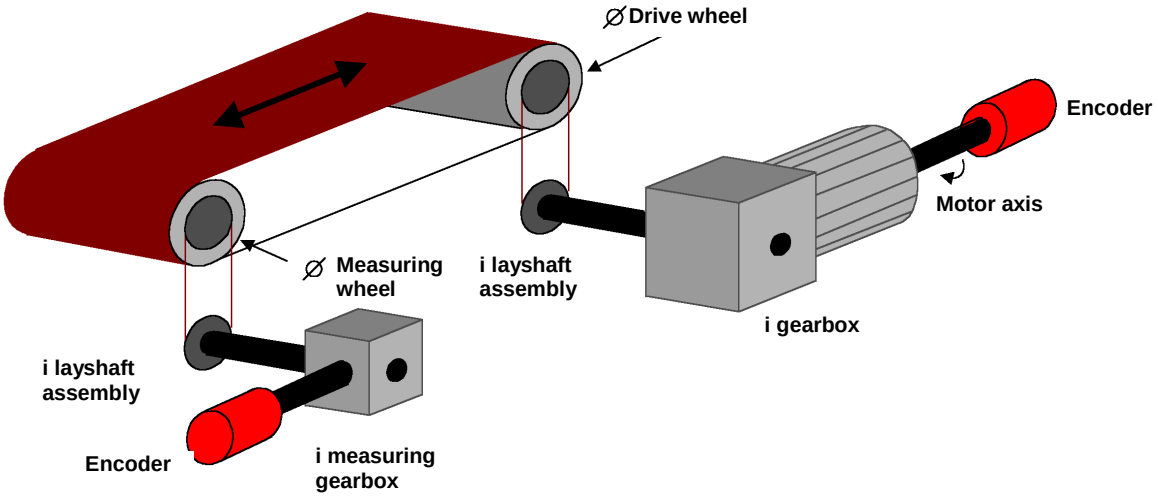
Gb2 = I_G · I_VA · A_Gb2 = 1024 · 350 · 1 = 35840;

Specification of max. speed
The max. speed of the outPort axis is derived from the max. motor speed. In rev./s related to the load axis and with Nmax = 1500 rev./min it is
(1500 [rev./min] / 60 [s]) / 350 = 0,
Converted to degr /s this results in 0.07142 [1/s] * 360 *10^3 [degr] = 25 714 [degr/s]

Input of max. deviation
The empirical measurement reveals a maximum difference between both detection points of 80 degr. A value of 100 degr is chosen.


Encoderkonfiguration
Encoder Interface Achse 1
Parameter der Messstrecke
Linear
Rotatorisch
Infofeld Sensorik
Rotatorisch
Grad/s
U/s
U/min
Messlänge
Positionsv. aktivieren
500
U
Maximale Geschwindigkeit
2000
U/min
Abschaltschw.Inkr.
10
U
Speed Filter
Abschaltschw.Geschw.
100
U/min
No
Encoder A
SSI Absolut
Encoder Auswahl
--- Proc.Enc. ---
Encoder B
SSI Absolut EX
Parameter
Direction Up
Supply Voltage 24V
Resolution (i) 1024
Offset (i) 0
SSI-Interface
Interface Type SSI Masterclock
Data Format Binary
Frame Length 10
Data Length 24
Data Index 0
Status Length 0
Status Index 0
Status Mask Err 00000000
Status Mask Def 00000000
OK
Abbruch
Hilfe

Linear measuring length



Reference axis	***Input values***		***Resolution related to measuring length***
Feed axis (process axis)	Sensor1: Resolution Gb 1 i measuring gearbox i layshaft assembly ∅ measuring gear	A_Gb1 in [steps/rev] I_MG I_VG D_MR in [mm]	$Gb1 = \frac{1000}{D_MR \cdot \pi} \cdot I_MG \cdot I_VG \cdot A_Gb1$
	Sensor 2: Resolution Gb 2 i gearbox i layshaft assembly for drive ∅ drive gear	A_Gb2 in [steps/rev] I_G, I_VA, D_AR in [mm]	$Gb2 = \frac{1000}{D_AR \cdot \pi} \cdot I_G \cdot I_VA \cdot A_Gb2$
Motor axis	Sensor 1: Resolution Gb 1 i measuring gearbox i layshaft assembly ∅ measuring gear i gearbox i layshaft assembly for drive ∅ drive gear	A_Gb1 in [steps/rev] I_MG I_VG D_MR in [mm] I_G I_VA D_AR in [mm]	$Gb1 = \frac{\frac{1000}{D_MR \cdot \pi} \cdot I_MG \cdot I_VG \cdot A_Gb1}{\frac{1000}{D_AR \cdot \pi} \cdot I_G \cdot I_VA \cdot A}$

Input example 2

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

Selecting the module

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

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

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

Determination of parameters for sensor A
Sensor 1 is directly connected to the drive axis. A sensor with the data: Absolute encoder SSI, 4096 steps/rev. is used.
The following parameters are selected:

- Encoder type absolute
- Data format SSI
- Resolution:

Sensor A:	
Resolution Gb 1	4096 [steps/rev]
i measuring gearbox	1
i layshaft assembly	1
∅ drive gear	31.83

$$Gb1 = \frac{1000}{D_MR \cdot \pi} \cdot I_MG \cdot I_VG \cdot A_Gb1 = \frac{1000}{31{,}83 \cdot \pi} \cdot 1 \cdot 1 \cdot 4096 = 40960$$

Determination of parameters for sensor B

The existing motor feedback system is used as sensor 2. The motor is connected with the drive gear via an intermediate gearbox. The ratio of the gearbox is 4.51 times the Ø of the drive gear 31.831 mm.
The sensor interface is connected to the pulse outPorts of the power converter. The sensor data are as follows: Hiperface, 1024 I/rev. According to the data sheet of the power converter manufacturer the sine/cosine tracks of the Hiperface encoder are output in the form of pulses -> emulated encoder on the pulse outPort of the power converter = pulse generator, A/B-track, 1024 I/rev.
The following parameters are selected:

- Encoder type incremental
- Resolution:

Sensor B:	
Resolution Gb 2	1024 [steps/rev]
i gearbox	4.51
i layshaft assembly	1
∅ drive gear	31.83

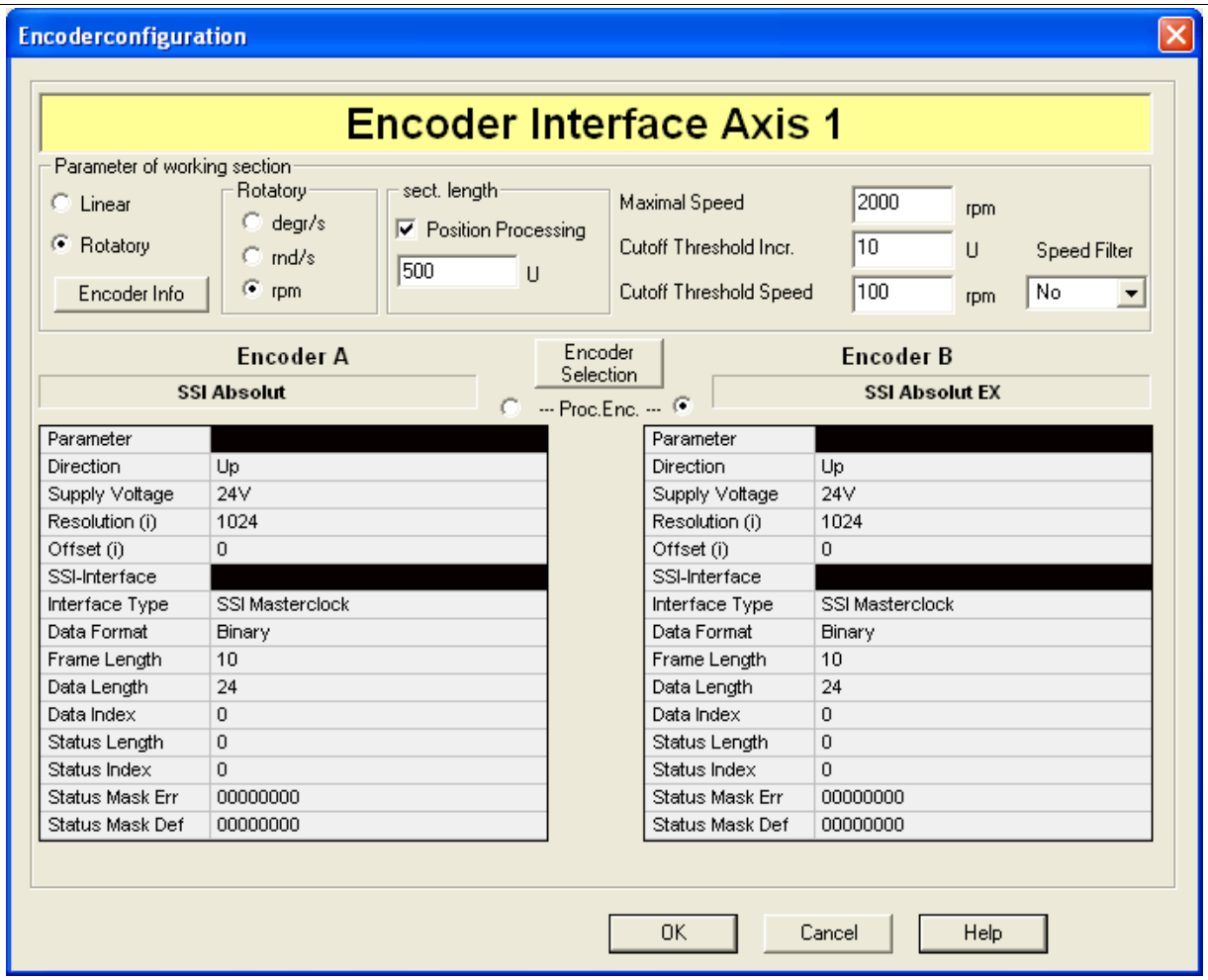
$$Gb2 = \frac{1000}{D_AR \cdot \pi} \cdot I_G \cdot I_AV \cdot A_Gb2 = \frac{1000}{31{,}83 \cdot \pi} \cdot 4{,}51 \cdot 1 \cdot 1024 = 46182$$

Specification of max. speed

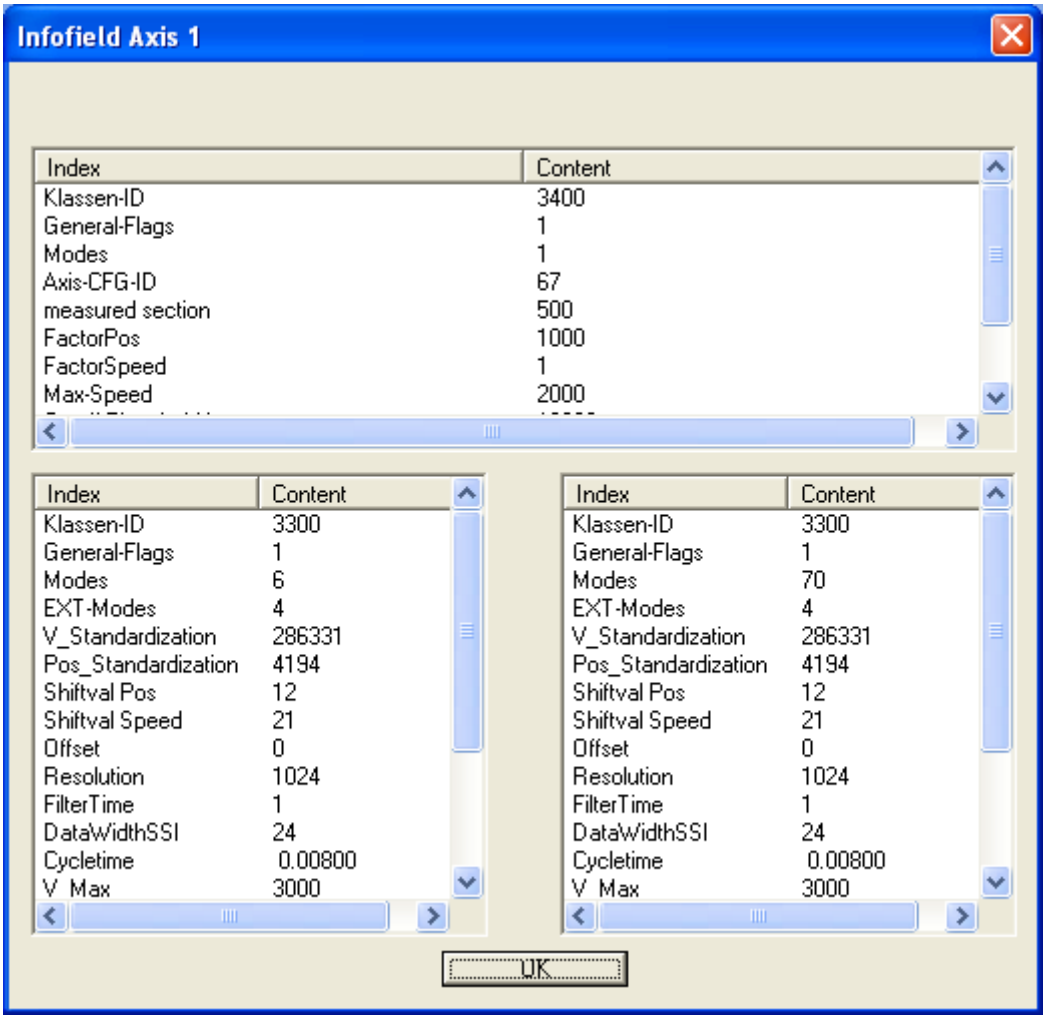
The max. speed of the outPort axis is derived from the max. motor speed. In rev./s related to the load axis and with Nmax = 1500 rev./min it is
(1500 [rev/min] / 60 [s]) * 0.012 [m] = 0.3 [m/s] = 300 [mm/s].

Input of max. deviation

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


Encoderconfiguration
Encoder Interface Axis 1
Parameter of working section
Linear
Rotatory
Encoder Info
Rotatory
degr/s
rnd/s
rpm
sect. length
Position Processing
500
U
Maximal Speed
2000
rpm
Cutoff Threshold Incr.
10
U
Speed Filter
Cutoff Threshold Speed
100
rpm
No
Encoder A
SSI Absolut
Encoder Selection
--- Proc.Enc. ---
Encoder B
SSI Absolut EX
Parameter
Direction Up
Supply Voltage 24V
Resolution (i) 1024
Offset (i) 0
SSI-Interface
Interface Type SSI Masterclock
Data Format Binary
Frame Length 10
Data Length 24
Data Index 0
Status Length 0
Status Index 0
Status Mask Err 00000000
Status Mask Def 00000000
Parameter
Direction Up
Supply Voltage 24V
Resolution (i) 1024
Offset (i) 0
SSI-Interface
Interface Type SSI Masterclock
Data Format Binary
Frame Length 10
Data Length 24
Data Index 0
Status Length 0
Status Index 0
Status Mask Err 00000000
Status Mask Def 00000000
OK
Cancel
Help

The Sensor Info Field shows the following result entries:



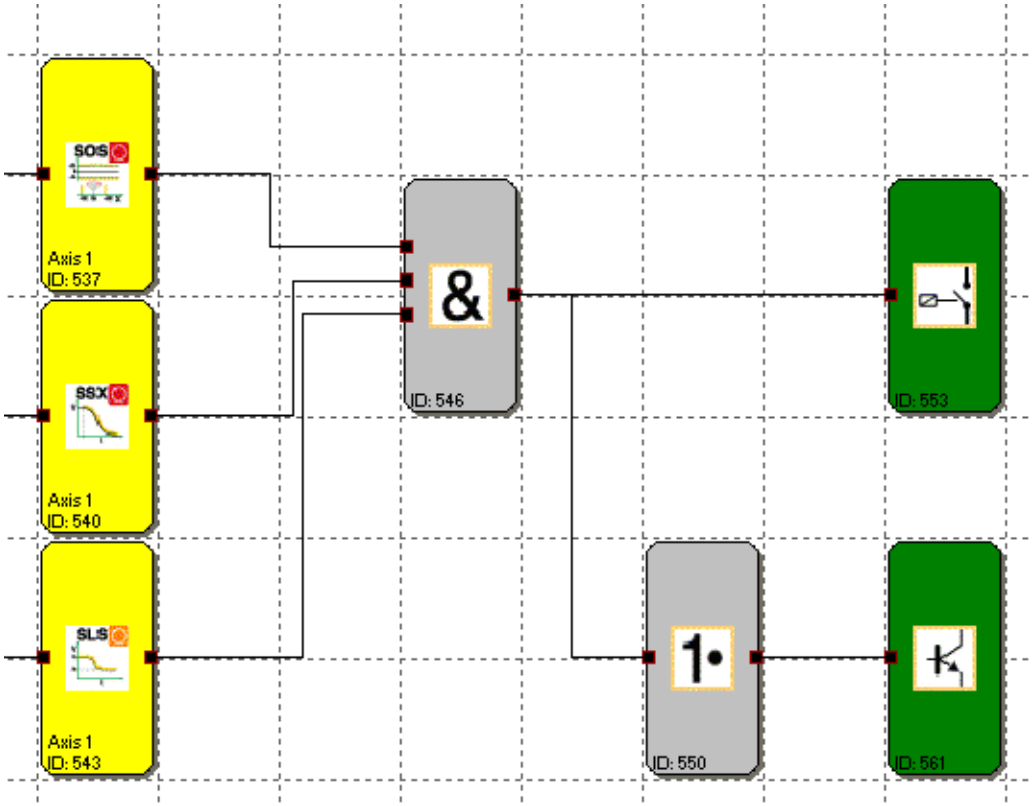
These can be switched to the second axis by clicking on the “Axis Change” button.

Safety Modules

If a monitoring function responds, the linked outPorts on the PSCBR-C-100 module are switched off.
If this switching off by a monitoring function is to be signalized to the outside, e.g. to a control unit, an auxiliary outPort may be used for this purpose. Once a 1 is applied to the outPorts of the monitoring functions in OK condition, the result is to be negated as per following example for the feedback.

Note: If the logic will be programmed recursive the reaction time could be longer

Example for a safety module connection:



SEL (Safe Emergency Limit)

Monitoring of the maximum movement range

Number: see chapter “The Safety Functions”

Access-ID: Identification of function element

Function: Monitoring of the permissible speed related to the relative distance to the maximum limit of the movement / adjustment range. This function replaces the conventional safety limit switches!

InPort: Standardized position sigbnal X from the encoder interface

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

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

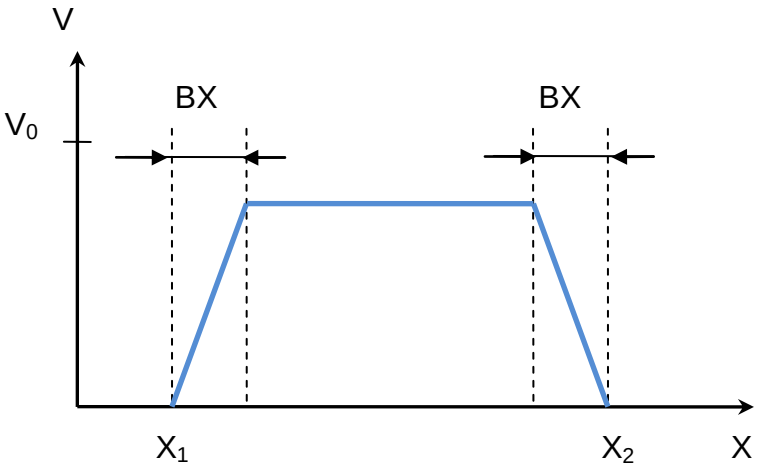
Note: Reset of this function is only possible if position is in the valid position area of SEL.

Operation:

- Calculation of actual speed V using position signal X
- Determination of the stopping distance related to the current status (acceleration) and speed
  => Cyclic determination of the $Stop_Distanz_{Akt.} = f(V, a)$ a= acceleration
- Comparison: $Pos_{Akt.} + Stop_Distanz_{Akt.} < Ziel_Pos_{max}$
- Comparison: $Pos_{Akt.} - Stop_Distanz_{Akt.} > Ziel_Pos_{min}$

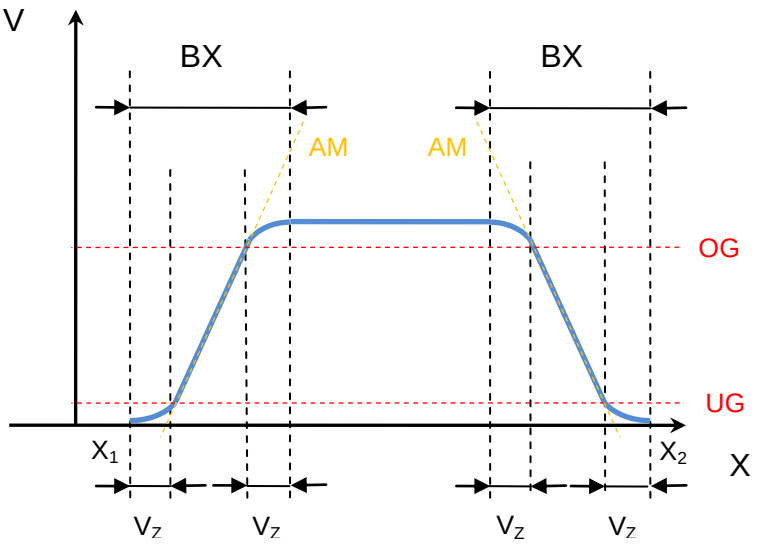
A trapezoidal or S-shaped speed profile serves as basis for the calculation. For a trapezoidal speed profile the limit curve is the result of the parameterized acceleration, whereas an S-shaped speed profile additionally uses the change in acceleration for the calculation.

Trapezoidal speed profile:



BX = Braking/approaching range
X1 = Min. position
X2 = Max. position
V0 = Maximum speed for $X\ (X_1 + BX) < X < (X_2 - BX)$

S-shaped speed profile

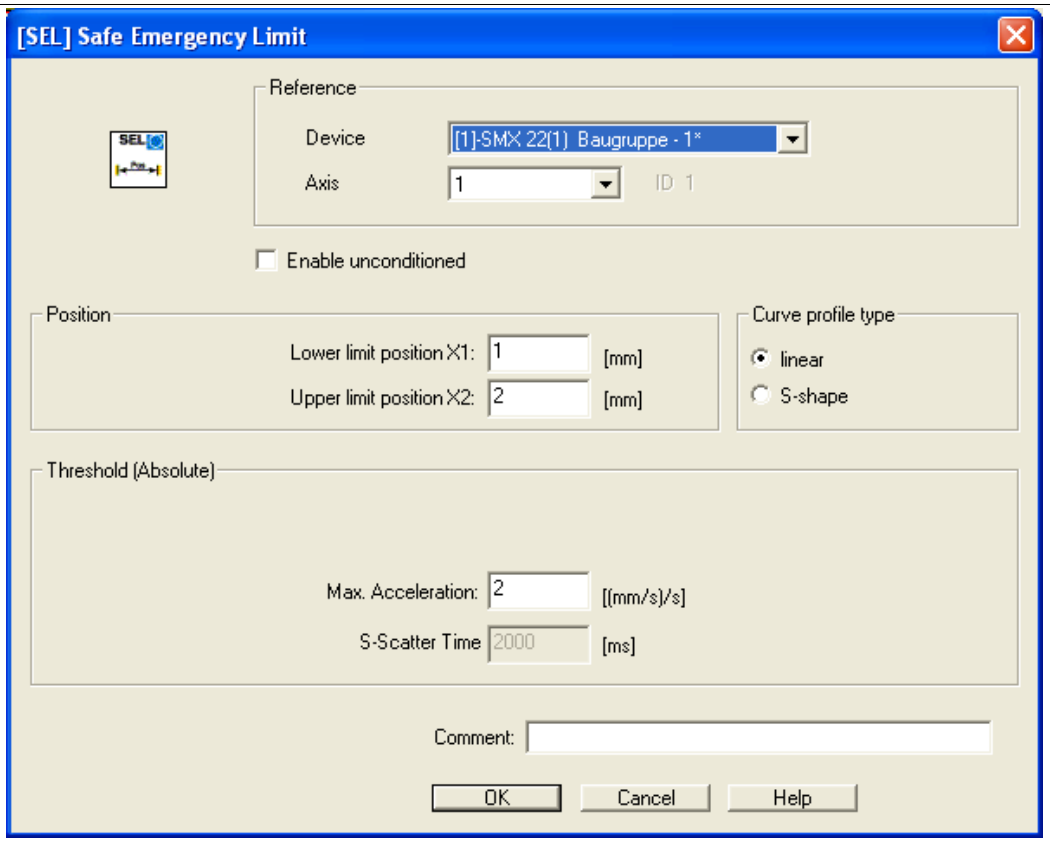


BX = Braking/approaching range
X1 = Min. position
X2 = Max. position
V_Z = S-Scatter time
AM = Max. Acceleration
UG/OG = area of max. acceleration

OutPort function

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

Limit curve = Speed profile derived from the actual parameterization



Parameters:

Device
Choice of axis device the function should work.

Axis
Axis number of the device.

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

Lower limit position X1
Lower limit position

Upper limit position X2
Upper limit position

Curve type linear
Linear calculation method for the stopping distance with respect to the limit position.

Curve type S-shaped
Square calculation method for the stopping distance relative to the limiting position under inclusion of the max. change in acceleration.

Max. acceleration
Maximum acceleration

S-Scatter time
Define the time period the curve type is S-shaped. It is the time before and after the acceleration reach a_{max}.

Input example 1

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

1. Limit position

The reference zero point of the main drive axis is located in the top dead centre. The mechanical trailing distance subordinate is = X1 = -5mm.
The lower end position is at 600mm + 5 mm safety limit.
=> X2 = 605mm

2. Form of speed selection

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

3. Limit value selection

All other limit values are taken from the machine parameterization.
Maximum acceleration = 1000 mm/s²
Maximum change of acceleration = 3000 mm/s³

SLP = (Safe Limited Position)

GOTO monitoring

Number: see chapter “The Safety Functions”

Access-ID: Identification of function element

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

InPort: Standardized position sigbnal X from the encoder interface

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

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

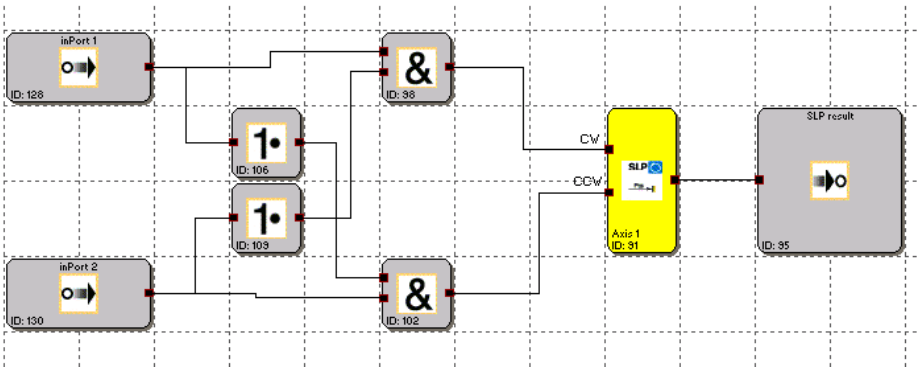
Operation:

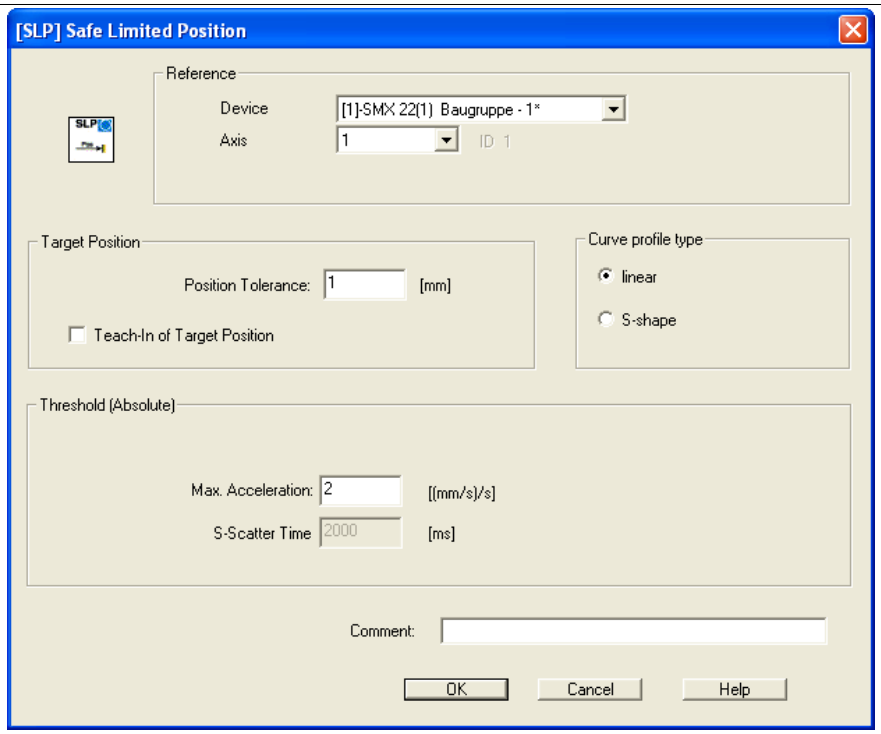
- Calculation of actual speed V using position signal X
- Determination of the stopping distance related to the current status of acceleration and speed
  => Cyclic determination of the $Stop_Distanz_{Akt.}$ = f (V, a) with a = acceleration
- Comparison: $Pos_{Akt.}$ + $Stop_Distanz_{Akt.}$ < Ziel_Pos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

Note: If the function will be enabled it’s not allowed the inPort Signal cw and ccw are enabled at the same time. If both are enabled an alarm will be generated.

.

Example:





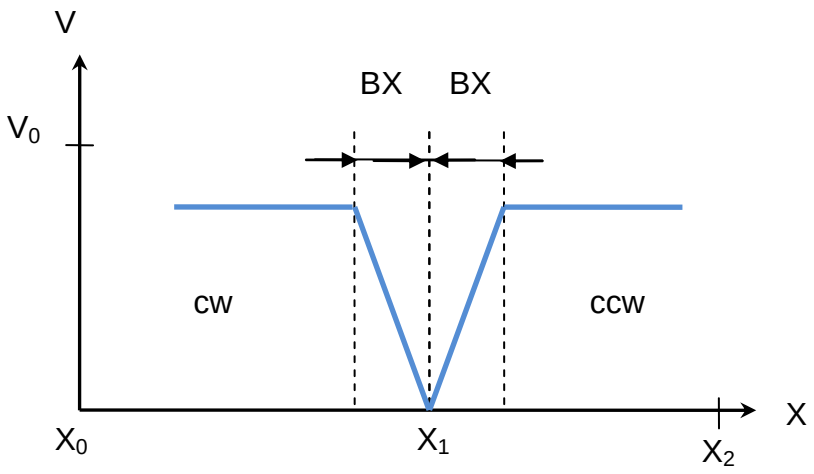
Parameters:

Device
Choice of axis device the function should work.

Axis
Axis number of the device.

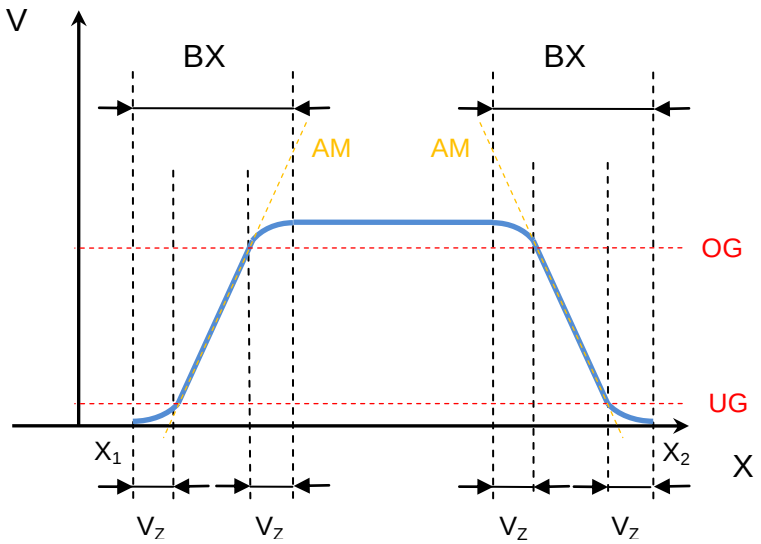
Target Position
Absolute position value that must not be over travelled after the OLC-functionality has been activated

Curve type linear
Linear calculation method for the stopping distance with respect to the target position



BX = Braking/approaching range
X2-X0 = configured position range in encoder settings
X1 = Target Positon
cw = inPort cw enabled ($Pos_{Akt.}$ + $Stop_Distanz_{Akt.}$ < Target_Pos)
ccw = inPort ccw enabled ($Pos_{Akt.}$ - $Stop_Distanz_{Akt.}$ > Target_Pos)

Curve type S-shaped
Square calculation method for the stopping distance relative to the Target position.



Max. acceleration
Maximum speed

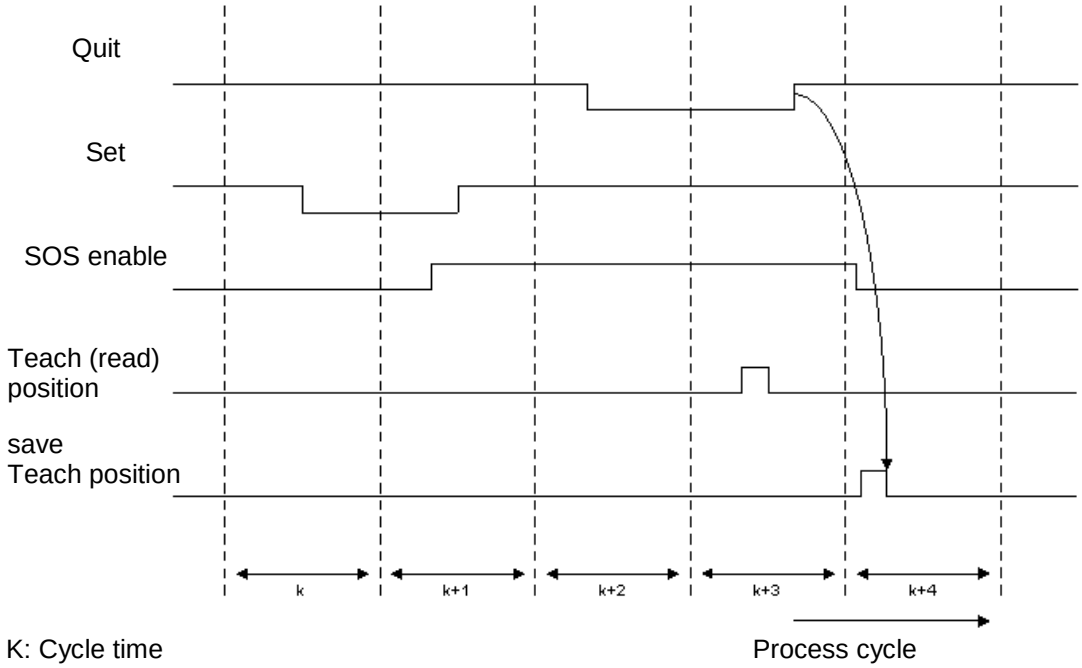
S-Scatter time
Define the time period the curve type is S-shaped. It is the time before and after the acceleration reach a_{max}.

Teach-In of Target Position

Option Teach-In can set the Target Position without changing the SLP parameters. Following steps are necessary:

- If Teach-In activated input field „Target Position“will change to „Position Tolerance“. This functionality needs the safety function SOS.
- Teach_In Position can only be set in standstill operation of the drive.
- Two inPorts are generated to enable Teach-In “SET” and „QUIT“.
- InPort „QUIT“can only be connected to an inPort Block.

Timing diagram SET/QUIT inPort:



The process is time monitored and generates an alarm if there are any faults during this function.

Maximum time period will be 3 seconds!

Position Tolerance
Tolerance value for Teach-In position.
cw (enabled) = $Pos_{Akt.}$ + $Stop_Distanz_{Akt.}$ < Ziel_Pos + Position Tolerance
ccw (enabled) = $Pos_{Akt.}$ - $Stop_Distanz_{Akt.}$ > Ziel_Pos - Position Tolerance

Note: InPort „SET“ should be connected to a key switch or to two position sensors which are connected via logic block AND.
Position Tolerance parameter +- Teach In position should be not greater than the max positons or less then „0“.

Parameter SOS-Block: see SOS module

SCA (Safe Cam)

Monitoring of position range with rotational speed/speed monitoring

Number: see chapter “The Safety Functions”

Access-ID: Identification of function element

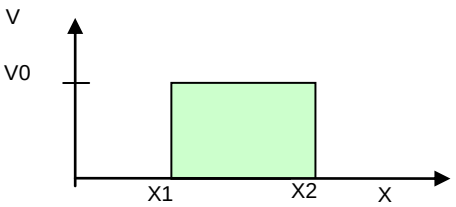
Function: Monitoring of a parameterizeable position range with associated MIN/MAX limit values. In this position range monitoring of the maximum is possible.

InPort: Standardized position signal X or digital speed signal from encoder interface.

Reset function: After a alarm shut-down has been triggered, the SCA-module does not need to be reset. With correct values, the alarm state is automatically reset.

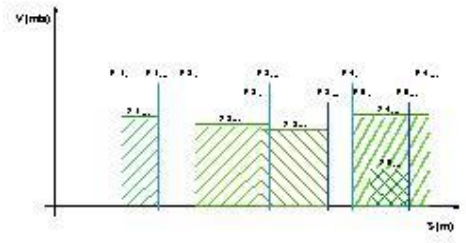
Operation:

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

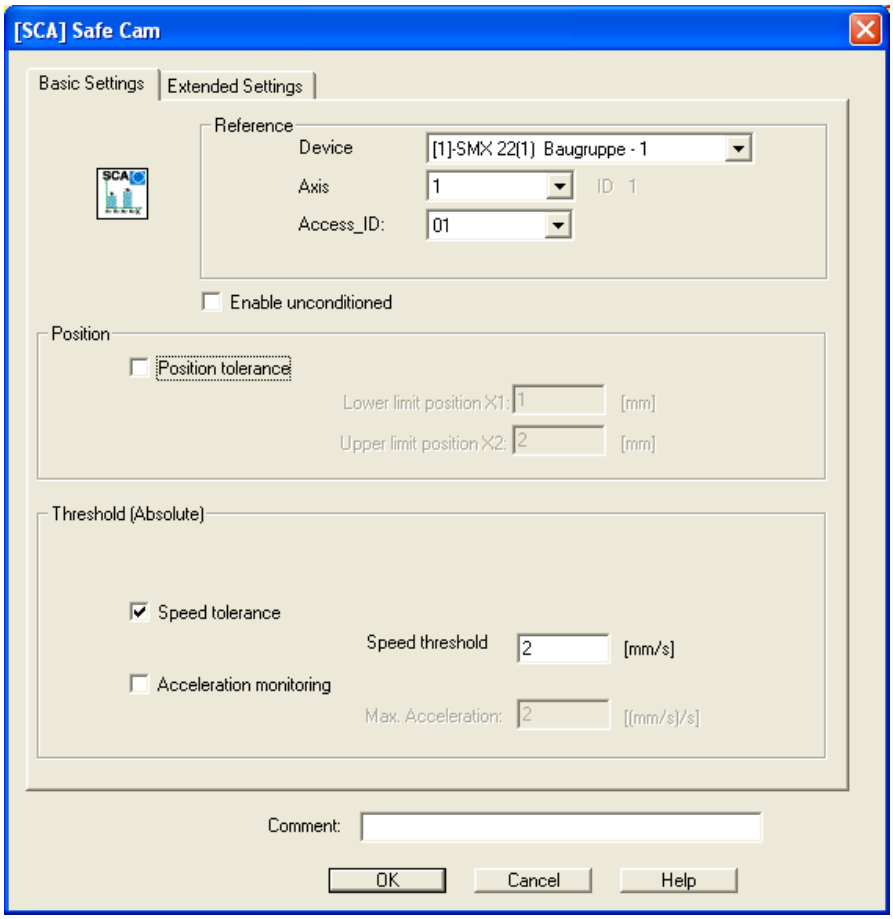


Range		HI	LO
X < X1 X > X2	OR		X
X >= X1 X <= X2 V < V0	AND AND	X	
X >= X1 X <= X2 V >= V0	AND AND		X

Ranges can be defined as overlapping and nested.



Basic Settting:



Device
Choice of axis device the function should work.

Axis
Axis number of the device.

Access_ID
Internal number of the monitoring block. Used for creating symbol addresses when compiling.

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

Lower limit position X1
Min. position for the range to be monitored.

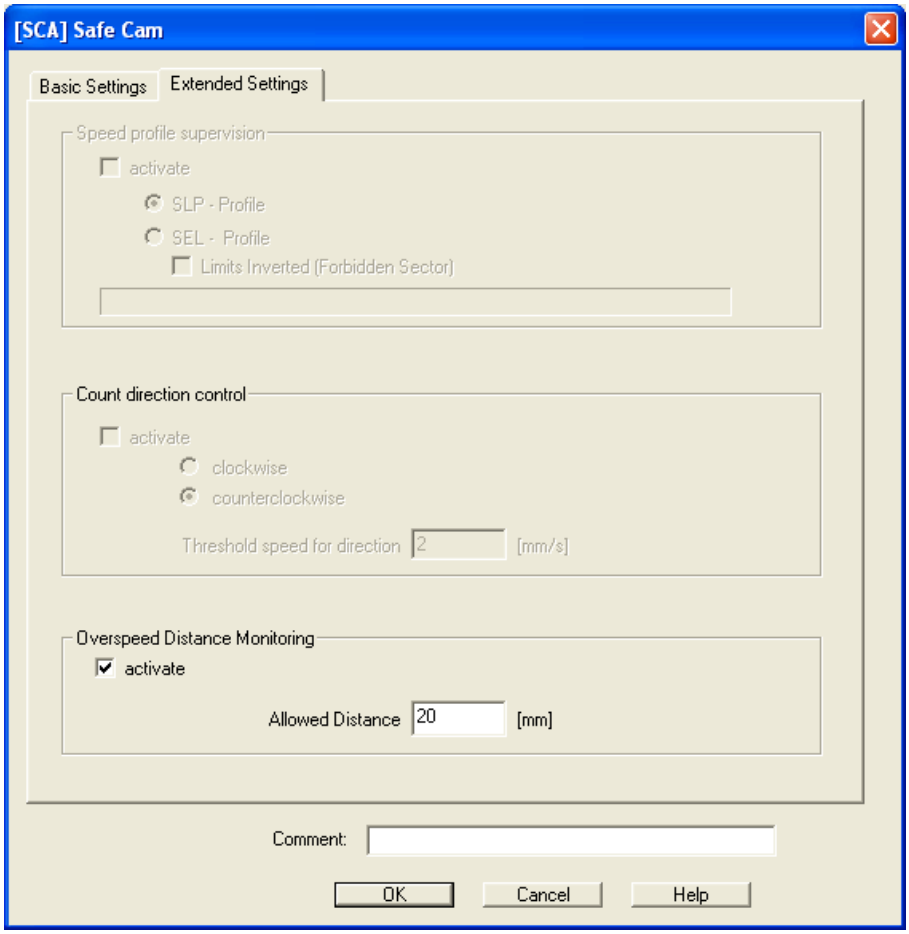
Upper limit position X2
Max. position for the range to be monitored.

Speed threshold

Maximum permissible speed within the validity range.

Max. acceleration
Maximum permissible acceleration within the validity range.

Extended monitoring:



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

- **with positive encoder count mode**:
  Resut of function block is set to “1” for clockwise speed
- **with negative encoder count mode**
  Resut of function block is set to “1” for clockwise speed

- **Threshold speed for direction**
  Threshold value to activate the module if it is exceeded and then direction is appropriate. If speed is less than this value the result is “0”.

Speed profile supervision
Additional condition for ramp monitoring. If this setting is used, the parameters defined under SLP or SEL will be checked within the specified range limits.
This switch can only be activated with the SLP / SEL function block inserted.

- Limits inverted (Forbidden sector)
  Monitoring invers to the position limits X1 and X2

Overspeed distance monitoring
This additional functionality enables filtering of peak speeds in case of irregular travel operation (speed peaks in signal). The path integer is calculated on basis of the difference between the current speed and the parameterized speed monitoring value and compared with the entered value. If the entered value is exceeded the monitoring function is triggered.
The function can only be activated if the acceleration monitoring function is switched off.
Attention: If this functionality is used, the response time of the monitoring function used will be delayed.

Input example:
On a manufacturing machine access to the working area is to be enabled at certain positions of the main feed axis for manual feeding or setup work. The drive remains active in this position and is only monitored for standstill. The limits of the working stroke are variable and are to be monitored electronically in safety-relevant mode, as a replacement of the mechanical safety limit switch. The movement to be actively monitored is a linear movement. An absolute encoder is positively connected with this main drive axis of the linear length measuring system. The main axis serves as reference axis for the PSCBR-C-100 module.

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

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

SSX (Safe Stop 1/ Safe Stop 2)

Function monitoring for emergency stop

Number: see chapter “The Safety Functions”

Access-ID: Identification of function element

Function: Monitoring the sequence of a controlled EMERGENCY STOP.

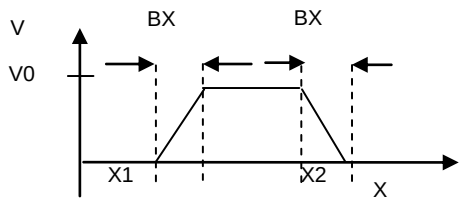
InPort: Standardized position signal X or digital speed signal from encoder interface.

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

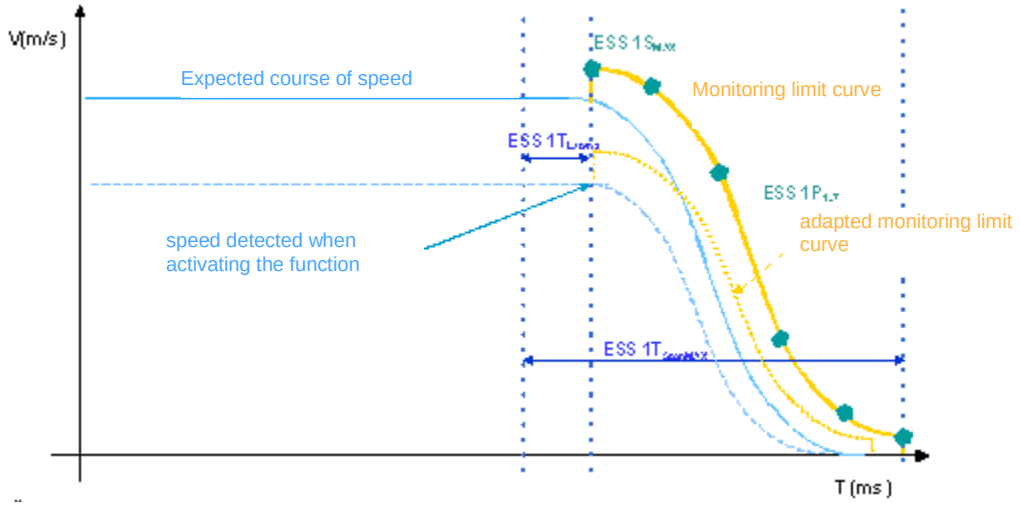
- RESET function in the group of inPort elements
- Function key on the front side of a basic module
- FBus reset element

Note: If this function triggers an alarm, the device unit is reset to its normal state after a RESET on the device or via a configured inPort on the “Alarm Reset” module.
A rest requires an operating state in the periphery to be monitored, in which the “Enable” input of the function is set to “zero”.

Operation:
Monitoring the sequence of a controlled EMERGENCY STOP
by comparing the speed drop with a parameterizable monitoring curve over the course of time. This curve is defined on the basis of latency time, maximum speed, maximum stop time and 6 further, optional control points.
Once monitoring has been activated, the course is controlled on the basis of the actual speed in comparison with the monitoring limit curve.



Trapezoidal course of speed

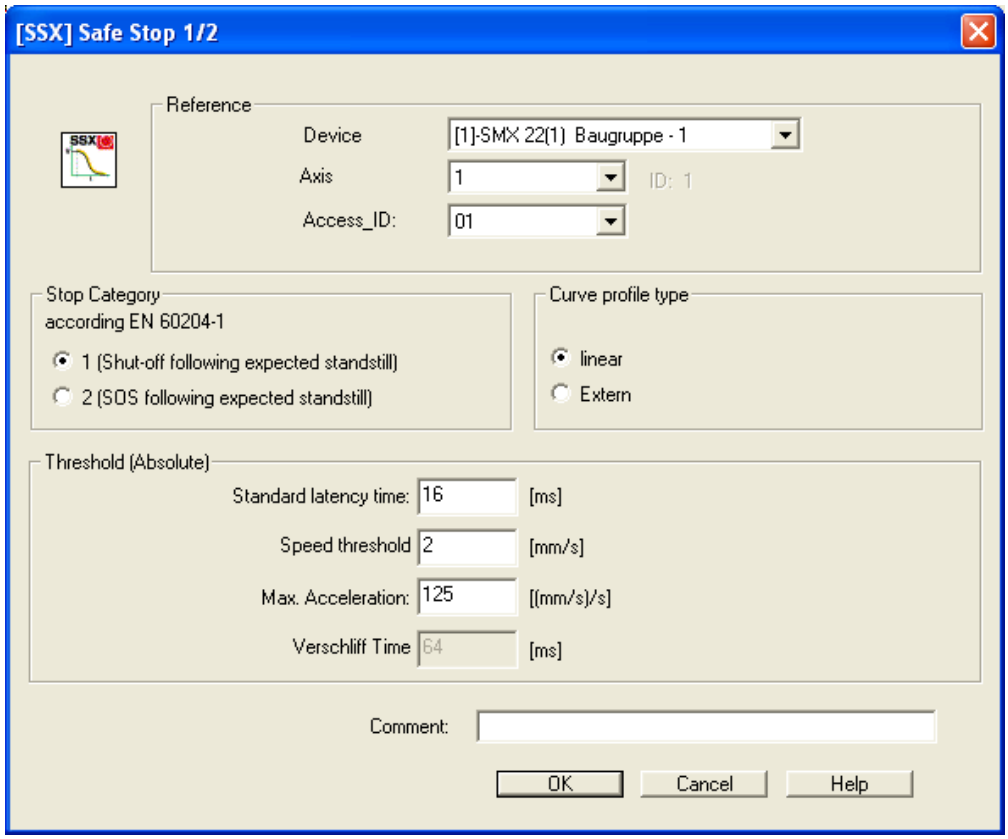


Monitoring limit curves with S-shaped course of speed

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

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

Parameters:



Device
Choice of axis device the function should work.

Axis
Axis number of the device.

Access_ID
Internal number of the monitoring block. Used for creating symbol addresses when compiling.

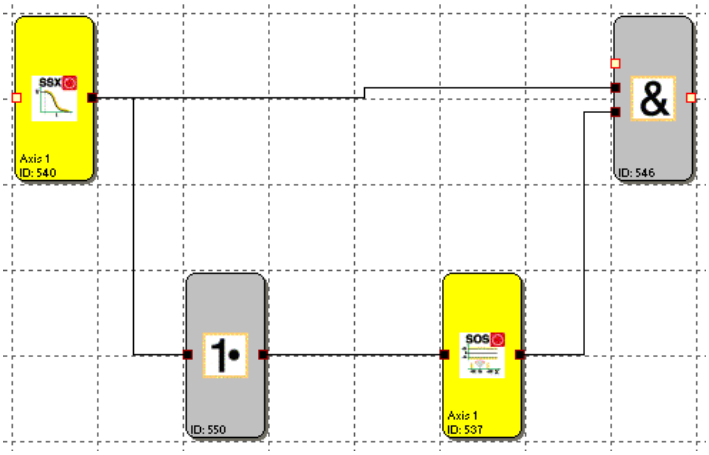
Stop category 1
This option realizes monitoring of the controlled emergency stop acc. to EN 60604. The energy supply is disconnected after the drive has stopped.

Stop category 2 (SOS after expected standstill)
This option realizes monitoring of the controlled emergency stop acc. to EN 60604. After the drive has stopped it is monitored for SOS (Safe Operational Stop = Standstill). If no SOS - function block has yet been defined in the logic diagram, the SSX-dialog will be extended by this functionality, the parameters of which must be manually entered. If a SOS monitoring block is to be used at a later date, this block will be used for standstill monitoring and the SOS extension in the SSX-dialog will disappear.

Note: SSX2-function needs the SOS function to finalize the configuration

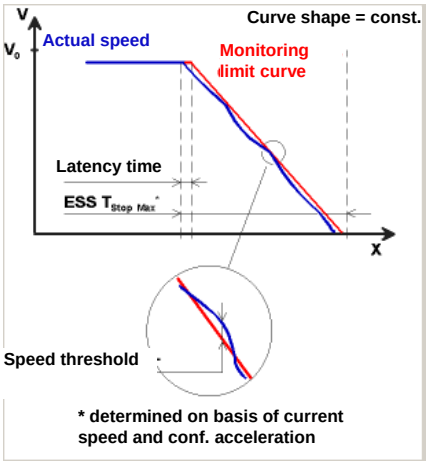
If the SSX2-function is used in connection with SOS, the following circuitry must be used. If the standstill in the PSCBR-C-100 module has been recognized, SOS monitoring is automatically activated.

Since there is only one SOS block per axis the enable inPort of SOS block can be extended with a logic block ≥1 "OR".



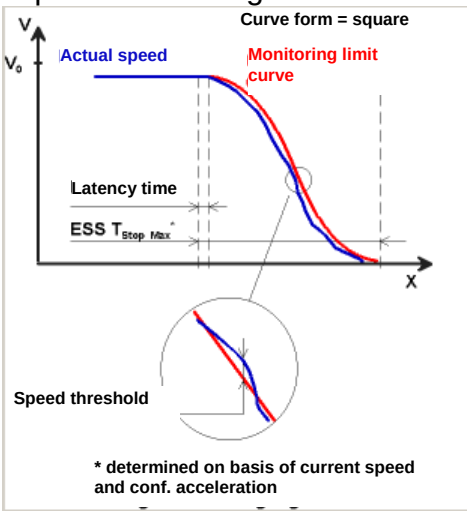
Curve type linear

Linear monitoring limit curve for the stop sequence



Curve type S-shaped

Square monitoring curve for the stop sequence



Standard latency time
Latency time until the occurrence of active deceleration

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

Max. acceleration
Acceleration (deceleration) threshold that must not be exceeded during the stopping process, as otherwise the energy supply will be disconnected.

S-Scatter time
Define the time period the curve type is S-shaped. It is the time before and after the acceleration reach a_{max}.

Input example:

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

1. Selecting the stop category
In order to keep times of standstill and restart as short as possible, the stop category 2 acc. to DIN 60604-1 (controlled stop with drive subsequently actively controlled to V=0) is to be used => Selection stop category 2

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

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

All other limit values are taken from the machine parameterization.
Maximum feed speed = 300 mm/s²
Maximum acceleration = 1000 mm/s²
S-Scatter time = 30

SLI (Safe Limited Increment)

Monitoring of the max. step measurement

Number: see chapter “The Safety Functions”

Access-ID: Identification of function element

Function: Monitoring of the max. permitted step measurement.

InPort: Standardized position / speed signal V and X from encoder interface. Direction indication LEFT/RIGHT.

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

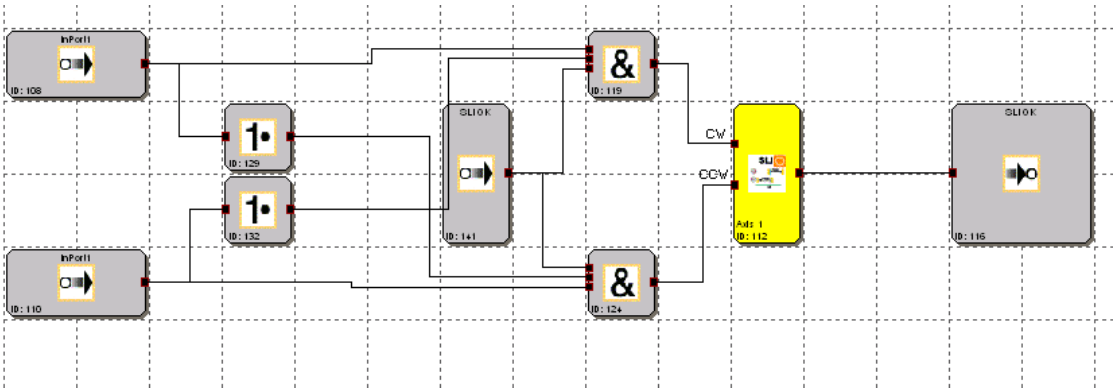
- RESET function in the group of inPort elements
- Function key on the front side of a basic module
- FBus reset element

Note: InPorts of SLI block has to be set to „0“ in case of a reset event. Otherwise the function could not be reset.
If the function will be enabled it’s not allowed the inPort Signal cw and ccw are enabled at the same time. If both are enabled an alarm will be generated.

Operation:

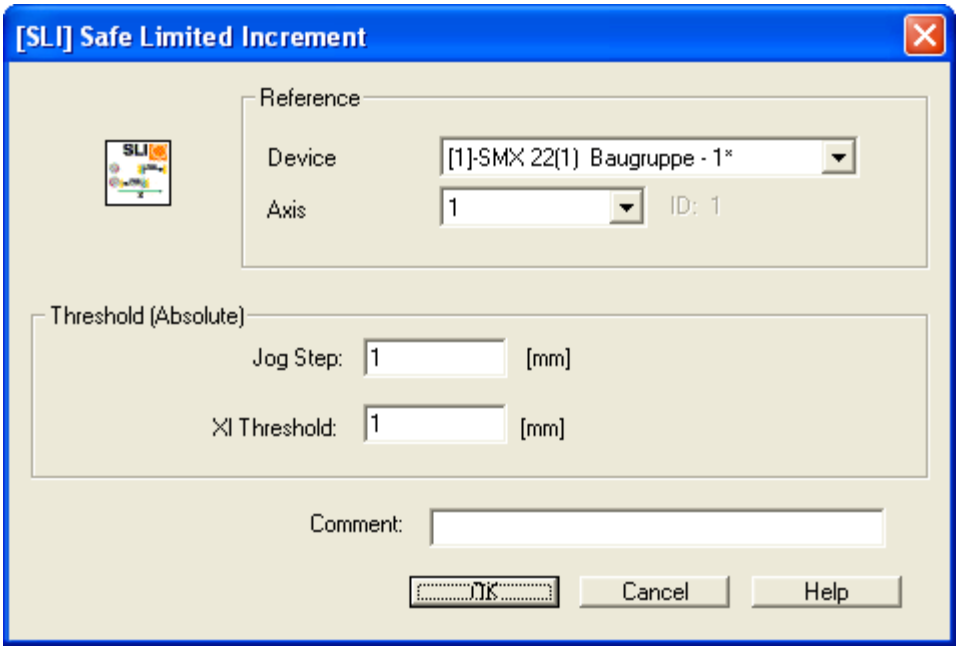
- Monitoring of the max. permitted step measurement = relative travel range for uninterrupted travelling in jog mode.
- Calculation of the current sense of rotation RX on basis of position / speed signal X
- Determination of the relative travel after the start of the movement.
- Monitoring for compliance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

Example:



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

Parameters:



Device
Choice of axis device the function should work.

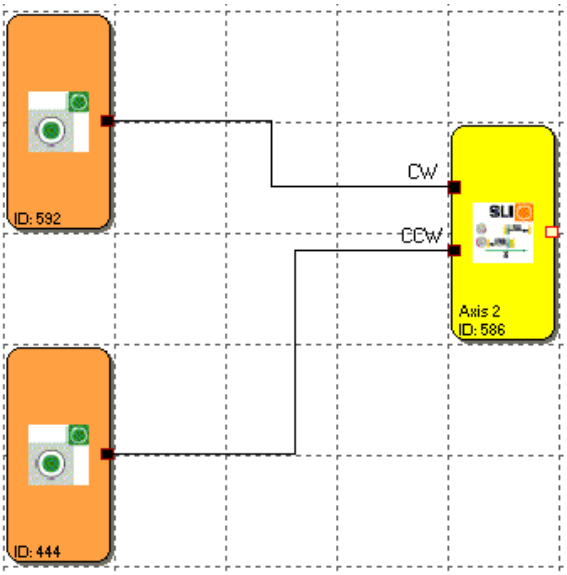
Axis
Axis number of the device.

Step measurement
Maximum relative travel after activating the movement

XI threshold
Tolerance threshold for position in opposite direction as well as standstill

Axis assignment
In case of a multi-axis device, the axis to be monitored can be set here. For a single axis device only “Axis 1” is available.

Example:



Input example:
The max. travel in the material feed system of a manufacturing facility is to be safely monitored in jog mode. According to the risk analysis this travel is max. 50 mm. Standstill and faulty travel in opposite direction are also monitored.

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

2. Monitoring standstill and travel direction
Tolerable travel in standstill and to opposite direction (=creeping motion of drive) = 1 mm/s

3. Monitoring inPort
Once monitoring has been activated, the direction must be specified by a clear signal. => Buttons for direction specification are directly connected with the default inPorts on the PSCBR-C-100 => selection E 01, E 02

SDI (Safe Direction Indication)

Direction detection

Number: see chapter “The Safety Functions”

Access-ID: Identification of function element

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

InPort: Standardized **position / speed signal X** from encoder interface. Direction marker LEFT/RIGHT.

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

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

Note: InPorts of SLI block has to be set to „0“ in case of a reset event. Otherwise the function could not be reset.
If the function will be enabled it’s not allowed the inPort Signal cw and ccw are enabled at the same time. If both are enabled an alarm will be generated.

Example:

See SLI function.

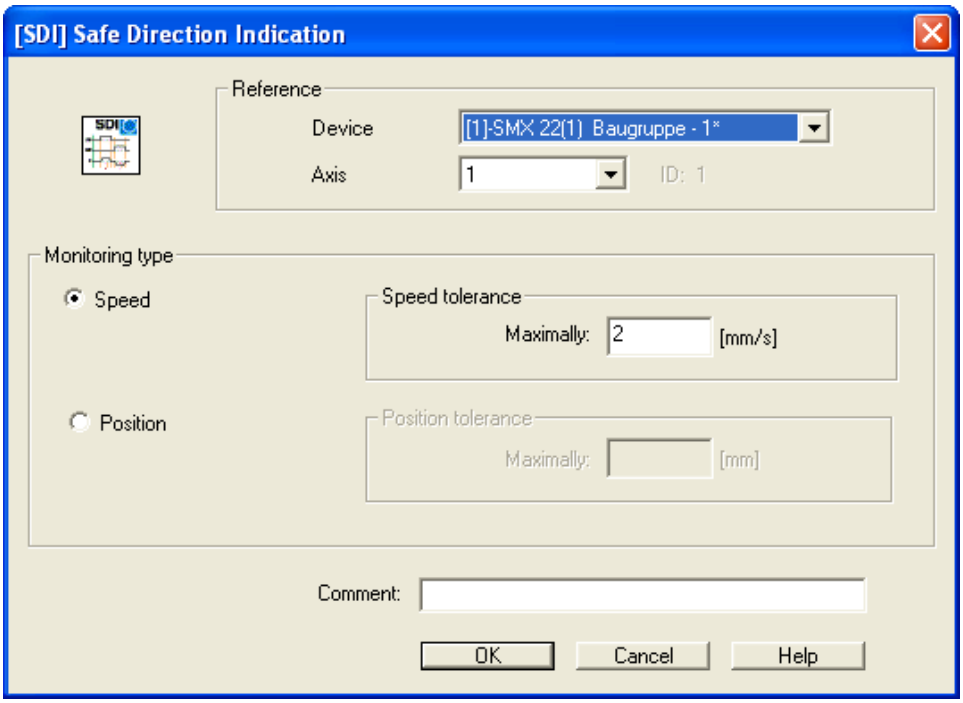
Operation:

- Monitoring the pre-defined sense of rotation/direction of movement
- Calculation of the current sense of rotation RX on basis of the position/speed signal X

OutPort state:

Range		HI	LO
V < 0 DIRECTION MARKER = LEFT	AND	X	
V >= 0 DIRECTION MARKER = RIGHT	AND	X	
V < 0 DIRECTION MARKER = RIGHT	AND		X
V > 0 DIRECTION MARKER = LEFT	AND		X

Parameters:



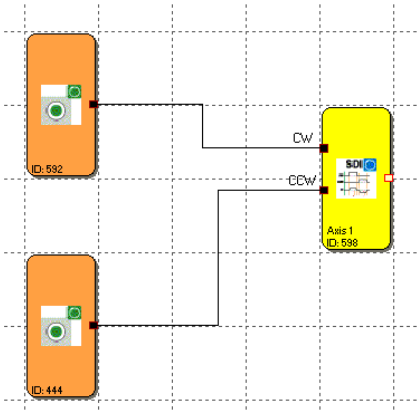
Device
Choice of axis device the function should work.

Axis
Axis number of the device.

Speed tolerance
Tolerance threshold for speed in opposite direction

Position tolerance
Tolerance threshold for position in opposite direction

Example:



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

1. InPort for monitoring function
Monitoring of speed (only incremental encoder present)
=> Speed

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

SLS (Safe Limited Speed)

Monitoring of a minimum speed

Number: see chapter “The Safety Functions”

Access-ID: Identification of function element

Function: Monitoring of the maximum speed.

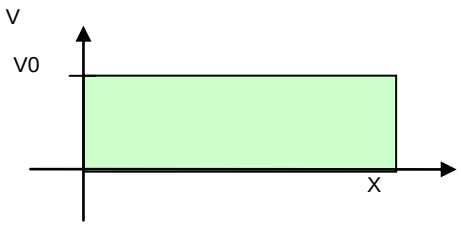
InPort: Standardized position signal X from the encoder interface

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

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

Operation:

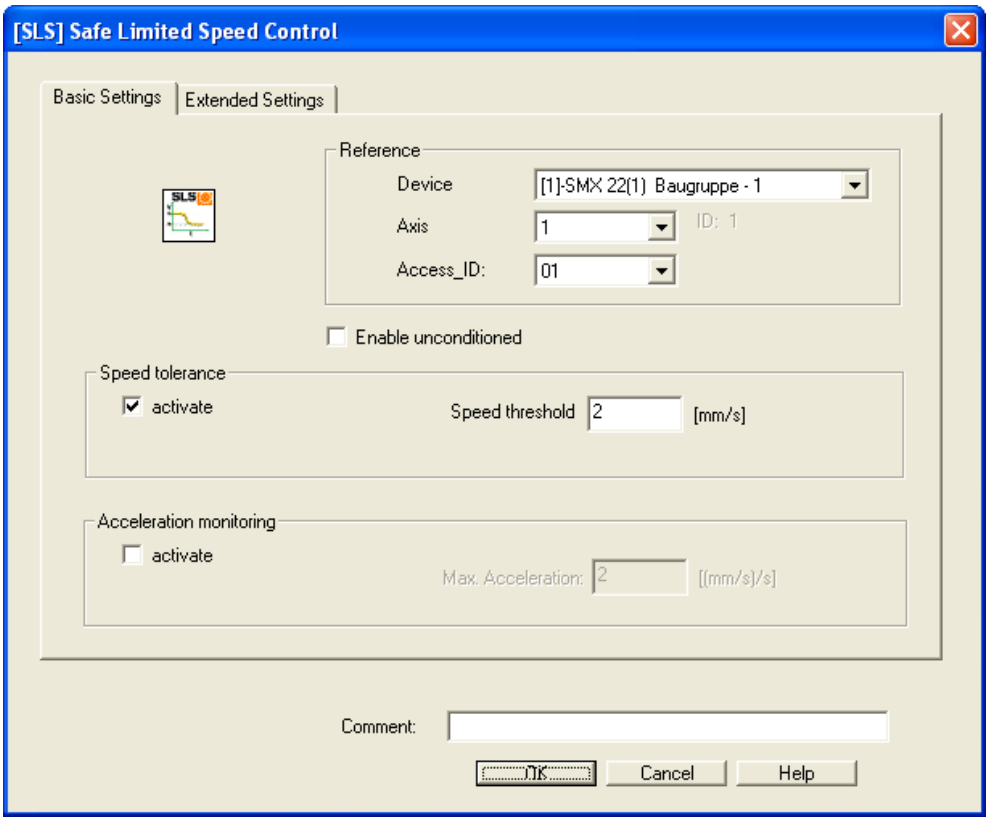
- Monitoring the maximum speed or rotational speed of a drive.
- Calculation of the current speed V on basis of position or digital speed signal X
- Comparison of the actual speed with the parameterized speed threshold
- Monitoring of a variable speed (from fast to slow) with the help of SSX
- Overspeed distance monitoring



OutPort status:

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

Basic Settings:



Device
Choice of axis device the function should work.

Axis
Axis number of the device.

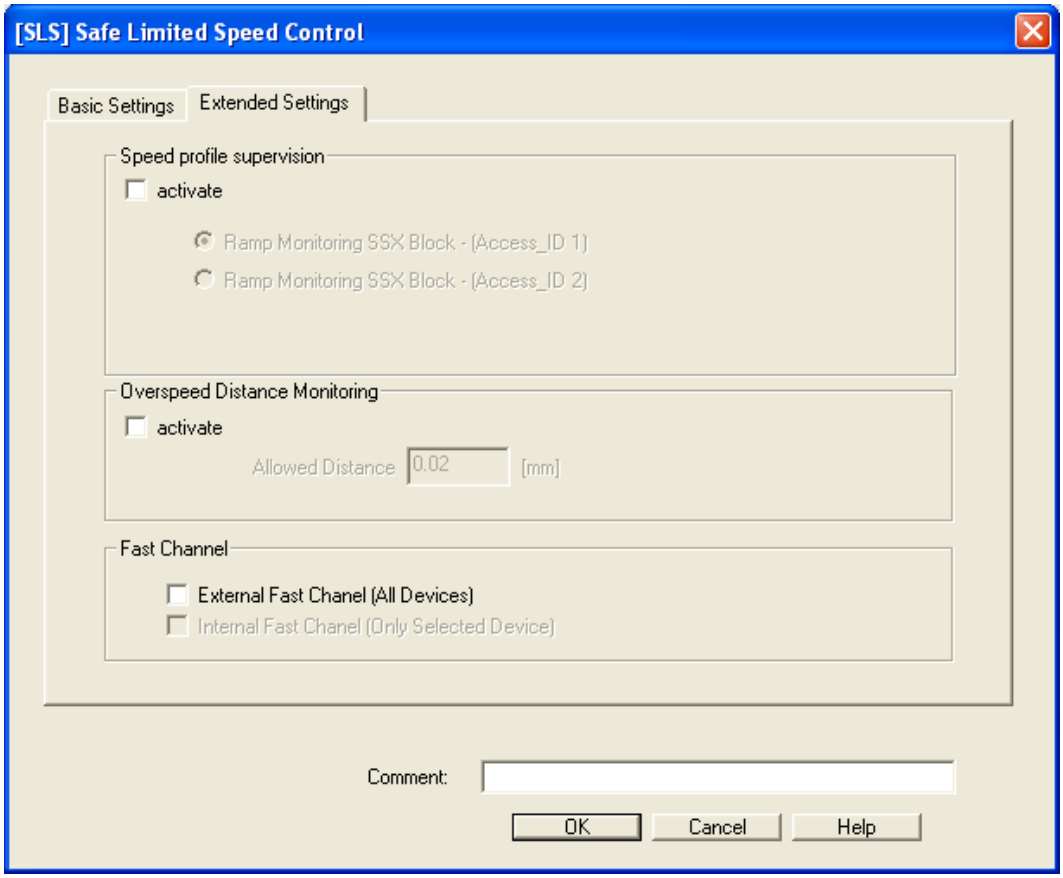
Access_ID
Internal number of the monitoring block. Used for creating symbol addresses when compiling.

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

Speed tolerance
Maximum permissible speed.

Max. acceleration
Specification of the max. acceleration

Extended Settings:



Speed profile supervision
If set, the ramp parameters are also included in the examination in accordance with the values defined in an SSX block. This functionality requires an existing SSX-block with a correspondingly axis ID.

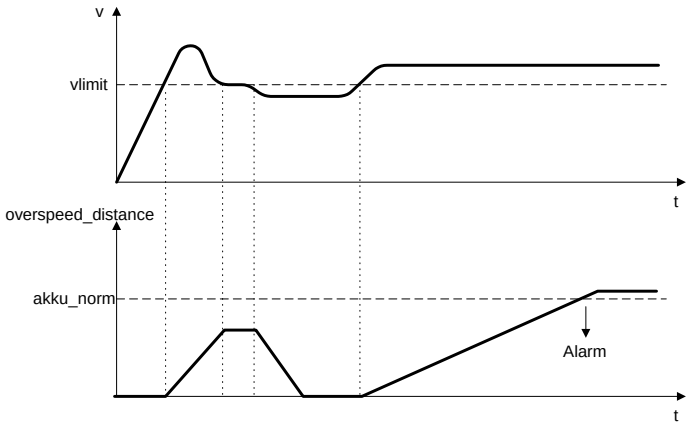
Overspeed distance monitoring
This additional functionality enables filtering of peak speeds in case of irregular travel operation (speed peaks in signal). The path integer is calculated on basis of the difference between the current speed and the parameterized speed monitoring value and compared with the entered value. If the entered value is exceeded the monitoring function is triggered.
The function can only be activated if the acceleration monitoring function is switched off.
Attention: If this functionality is used, the response time of the monitoring function used will be delayed.

Fast Channel
With the option „Fast Channel“ the reaction time of the system can be reduced. The semi-conductor outPort HI/LO can be used for swith off channel.

Attention: Reaction time see installation manual!

Example of fault distance monitoring:

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



Attention:
When using this function, the response behaviour of the application will change. In this case strictly follow the explanations in the installation manual.

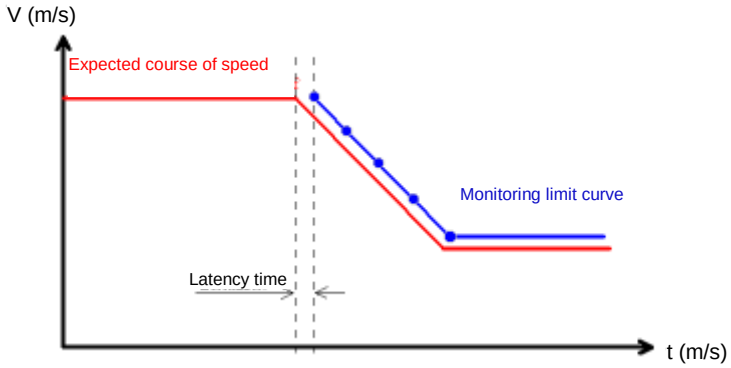
Example Speed profile supervision:

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

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

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

3. Ramp monitoring
Speed monitoring and ramp monitoring acc. to SSX must be activated. In this case the SSX used must already be inserted or configured in the project. The transition from a fast to a slower (= parameter max. speed) speed can now be monitored (see graph).



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

Note:

- If the SSX used is activated during “SLS ramp monitoring” (i.e. normal emergency stop function via SSX-enable), the “normal” SSX-connection is prioritized.
- The SSX-function is always activated by the SLS, when the current speed is higher than the SLS-threshold.
- The SLS threshold value must be higher than 0, as otherwise an emergency stop will be triggered.
- If the “ramp course” acc. to SSX is violated, an SLS or SSX error is triggered.

- If several SLS-functions with ramp monitoring are activated, the lowest SLS-threshold value is used as threshold value for the SSX-ramp.

SOS (Safe Operating Stop)

Standstill monitoring

Number: see chapter “The Safety Functions”

Access-ID: Identification of function element

Function: Monitoring standstill.

InPort: Standardized position / speed signal

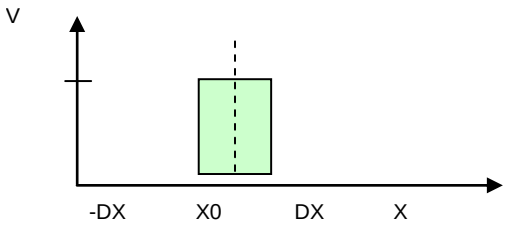
RESET-function: The violation of the permissible monitoring range is saved and requires a RESET acknowledgement. This occurs alternatively via:

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

Note: A rest requires an operating state in the periphery to be monitored, in which the “Enable” input of the function is set to “zero”.

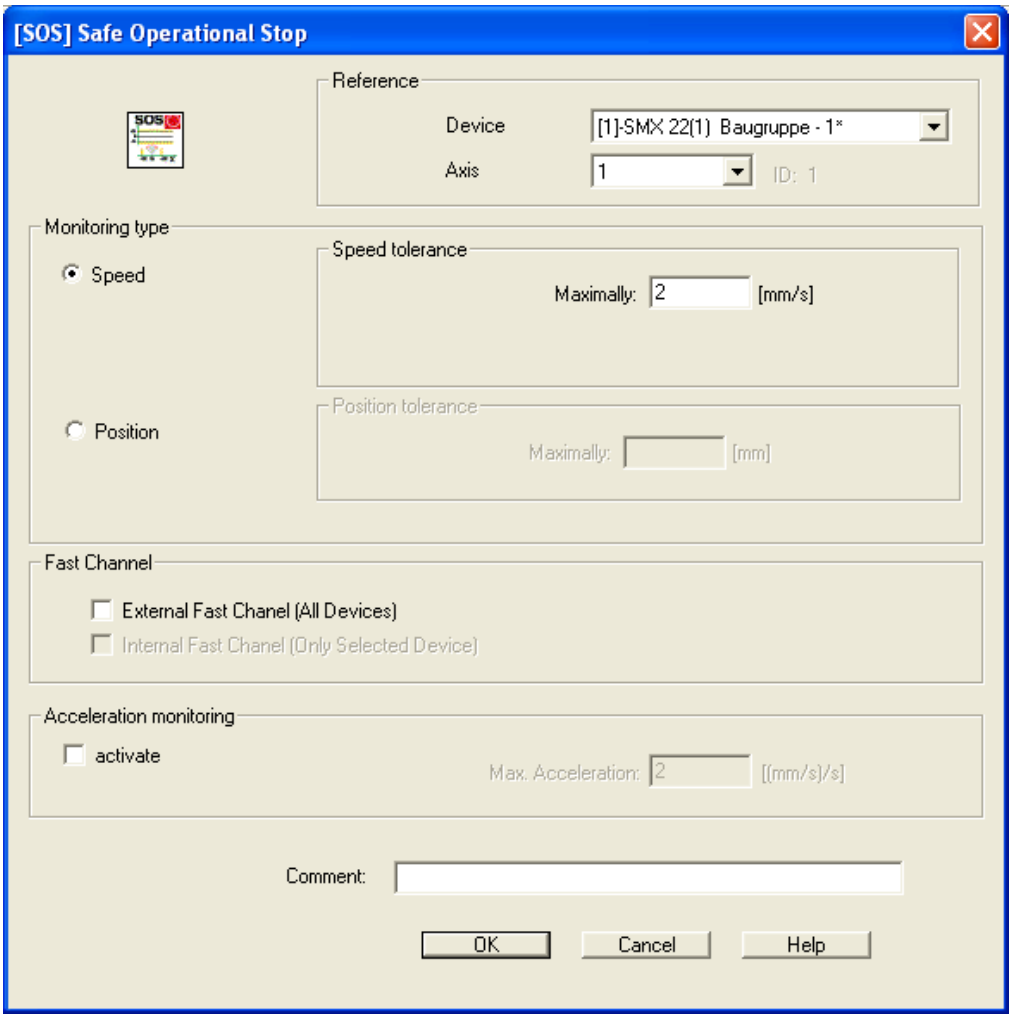
Operation:

- Standstill monitoring of drive at the current position with drive enabled and possibly activated position controller.
- Calculation of the current speed V on basis of position or digital speed signal X
- Comparison of the actual speed with the parameterized monitoring slot



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

Parameter:



Device
Choice of axis device the function should work.

Axis
Axis number of the device.

Speed tolerance
Maximum permissible speed.

Position tolerance
Tolerance threshold for position

Max. acceleration
Specification of the max. acceleration

Fast Channel
See description in SLS fuction.

Input example 1

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

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

2. Speed monitoring
Specification of the tolerable speed monitoring value

Input example 2

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

1. Selecting the type
The position is monitored (absolute encoder available) => position monitoring

2. Position monitoring
Specification of the tolerable position monitoring value

SAC (Safe Analog Control)

Monitoring of an analog input signal

Number: see chapter “The Safety Functions”

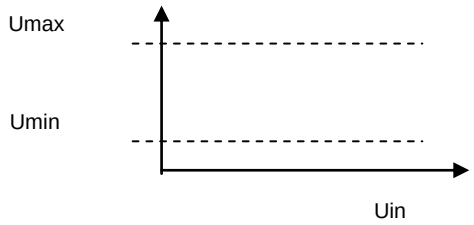
Access-ID: Identification of function element

Function: Monitoring of a parametrizable analog range

InPort: Standardized analog signal Uin1 and Uin2

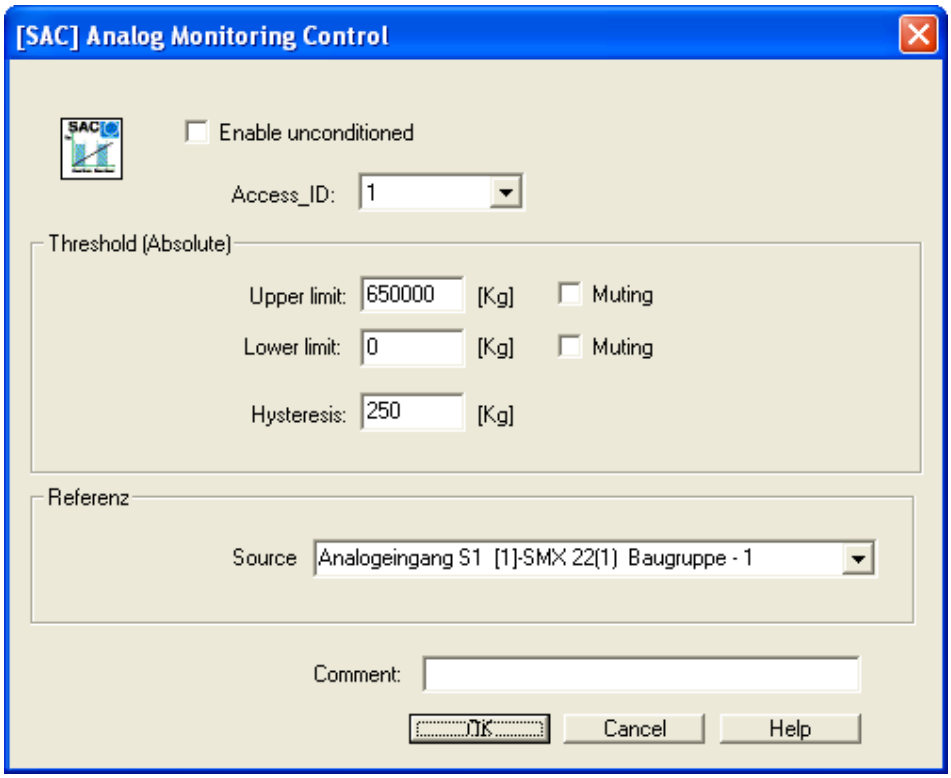
RESET-Function: After a alarm shut-down has been triggered, the SCA-module does not need to be reset. With correct values, the alarm state is automatically reset

Operation:
Monitoring of a parametrizable range, which is defined at the analog inPorts.



Range	HI	LO
Uin > Umin	X	
Uin < Umax	X	
Uin <= Umin OR Uin >= Umax		X

Parameter:



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

Access_ID
Internal number of the monitoring block. Used for creating symbol addresses when compiling.

Lower limit
Minimum value – threshold

- Muting – If enabled this threshold will be deactivated.

Upper limit
Maximum value – threshold

- Muting – If enabled this threshold will be deactivated.

Note: If muting enabled the monitoring of „Lower Limit“ or „Upper Limit“ is not active.

Hysteresis
Hysteresis for threshold values

Source
Adjustable reference for which analog signal is to be processed in the AMC module.

- Analog inPort S1
  S1 is inPort signal of analog sensor 1 and sensor 2
- Analog inPort 2
  S2 is inPort signal of analog sensor 3 and sensor 4
- Adder ID 1 … 8

ECS (Encoder Supervisor)

User defined evaluation of encoder status.

Number: see chapter “The Safety Functions”

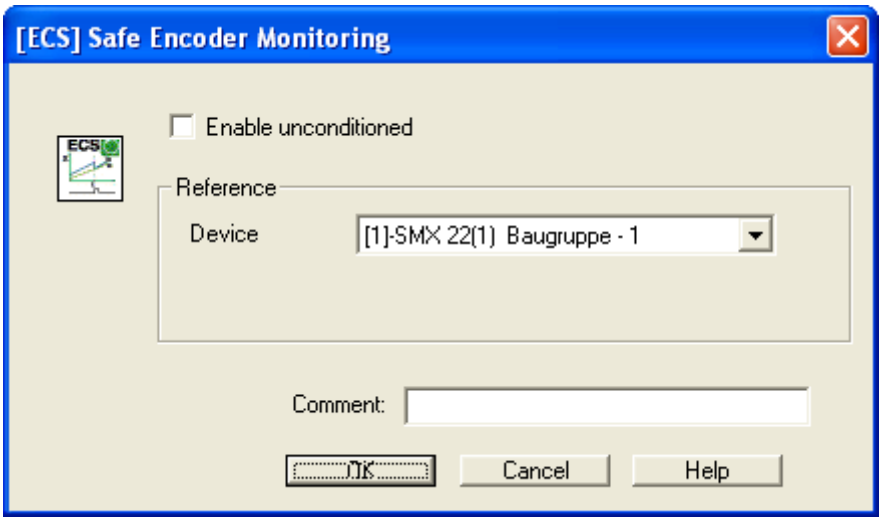
Access-ID: Identification of function element

Function: Muting of encoder alarms

Reset function: The violation of the permissible monitoring is saved and requires a RESET acknowledgement. This occurs alternatively via:

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

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



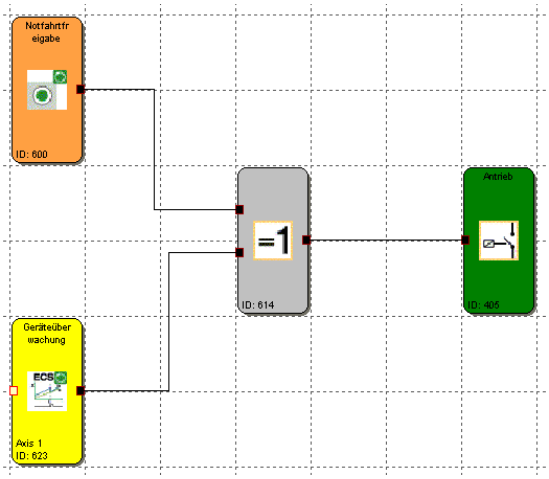
The number of modules depends on the number of devices. Only one ECS can be used per device. This works on both axes.

Application:

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

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

Example for the use of the ECS-function:



DEM (Dynamic Encoder Muting)

Number: see chapter “The Safety Functions”

Access-ID: Identification of function element

Funcion: Alarm muting of encoder diagnostic functions if a parametrizable speed tolerance is exceeded.

RESET-Funktion: no reset necessary

Note: DEM-function can only be used for axis parametrized without position processing.

Operation:

- Alarm muting of encoder diagnostic functions if a parametrizable speed tolerance is exceeded if function is enabled.
- If a safety function with the same axis will be enabled the DEM-function will be disabled.
- The alarm status of encoder diagnostics will be internally saved. Status FALSE (encoder alarm) will be cleared if the speed muting gets inactive.
- The saved alarm status will generate an alarm if a other safety function will be enabled during muting.

OutPort:
The outPort signalized the status (only diagnostic) of this function and will be cleared depending of the muting function if the muting gets inactive.

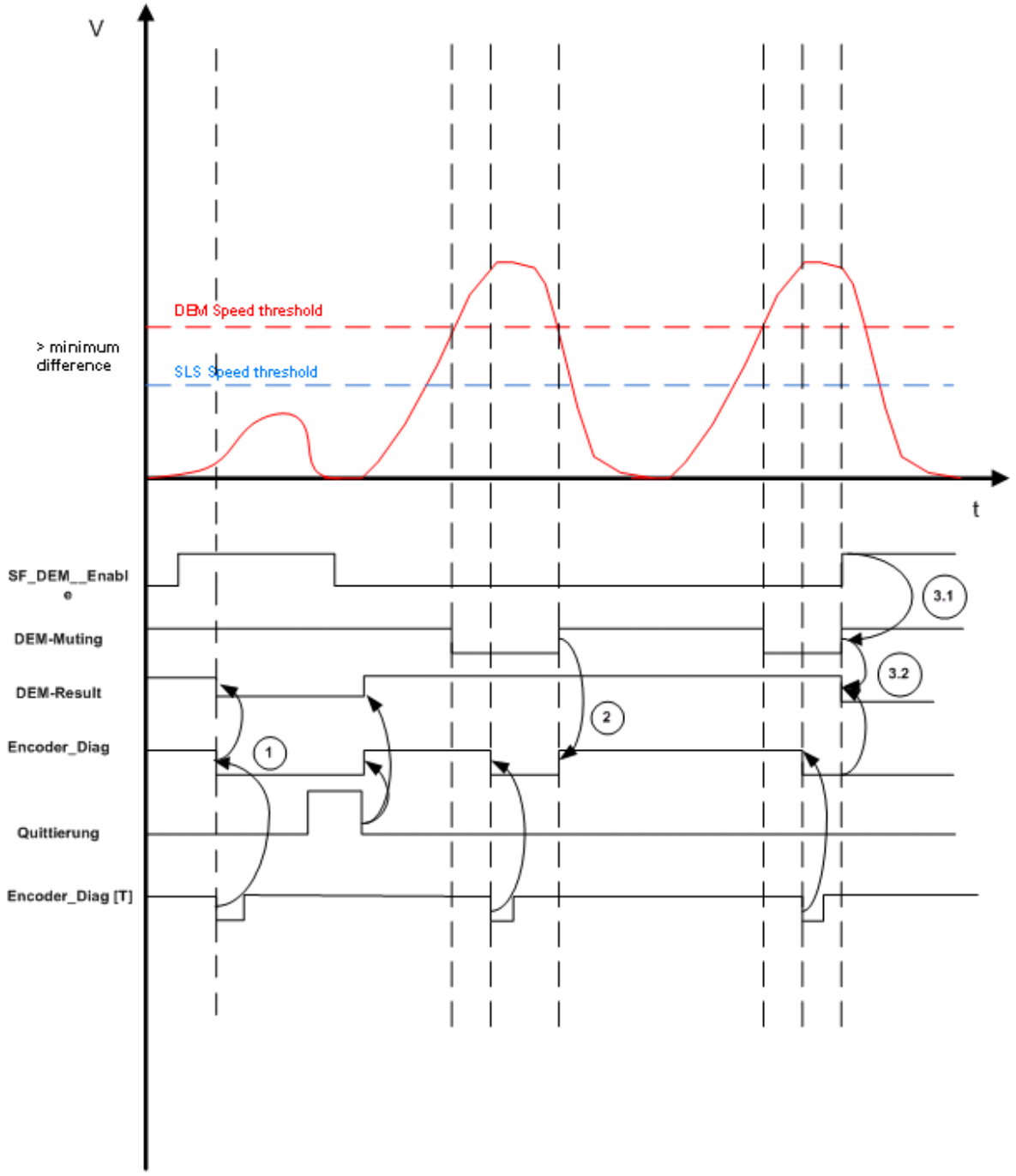
⚠ Safety advice:

- The speed threshold should be always much greater than the speed threshold in other safety functions used the axis number.

- The outPort of DEM should be evaluated.The evaluation is not safety related and can be done in a non safe controller.

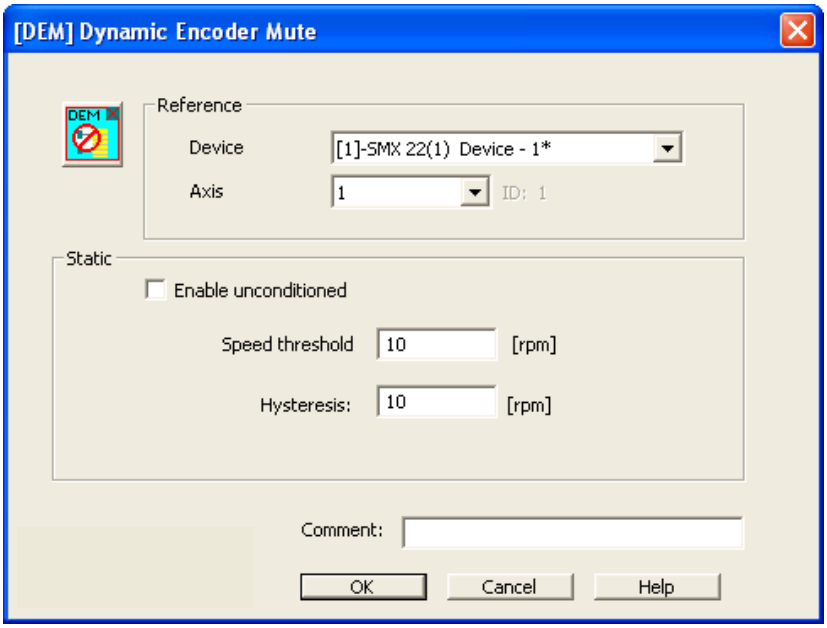
- The signal used for enable the DEM-function has to be the highest SIL or PL level as the used safety function on the same axis.
  Example: DEM function axis1 with SLS according to Pl_d and SOS according to Pl_e. The activation of DEM will be if door is closed. Closed state will be controlled with a door – monitoring block.
  ⇨ Highest level Pl = Pl_e, inPort signal has to be Pl_e
  ⇨ Door- monitoring signal has to be Pl_e
  ⇨ 2-pole
  ⇨ 2-pole positively driven door contact in electrical and mechanical design accordingly Pl_e, on input interface PSCBR-C-100 with activated short circuit monitoring.

Functional timing diagram :



	SF_ Enable (min. one other safety function enabled)	V_System > Speed threshold + hystersis	InPort DEM	Encoder_Diag (merker for encoder faults)	Encoder alarm	DEM_OutPort
Encoder monitoring = True (no alarm occured)	Don't care	Don't care	Don't care	True	True	(1)
	False	Don't care	Don't care	False	True	1
	True	Don't care	Don't care	False	False	0
Encoder monitoring = False (alarm occured)	True	Don't care	Don't care	False	False	0
	False	True	False	False	False	0
	False	True	True	False	True	1
	False	False	Don't care	False	False	0

Parameter:



Device
Choice of axis device the function should work.

Axis
Axis number of the device.

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

Speed threshold:
If this value will be exceeded the muting function will be enabled.
Bei Überschreiten des in diesem Feld vorgegebenen Geschwindigkeitswertes wird die Mutingfunktion aktiviert.

Note: It's not allowed that the speed tolerance value is less than the speed tolerance value in all other safety functions.

Hysteresis:
To avoid a toggle in the enable oft he function a hystersis value can be set:

- Enable function:
  Speed threshold + Hysteresis
- Disable function:
  Speed threshold

EOS (Encoder Offset Supervisor)

Sets encoder position to configured position value

Number: see chapter “The Safety Functions”

Access-ID: Identification of function element

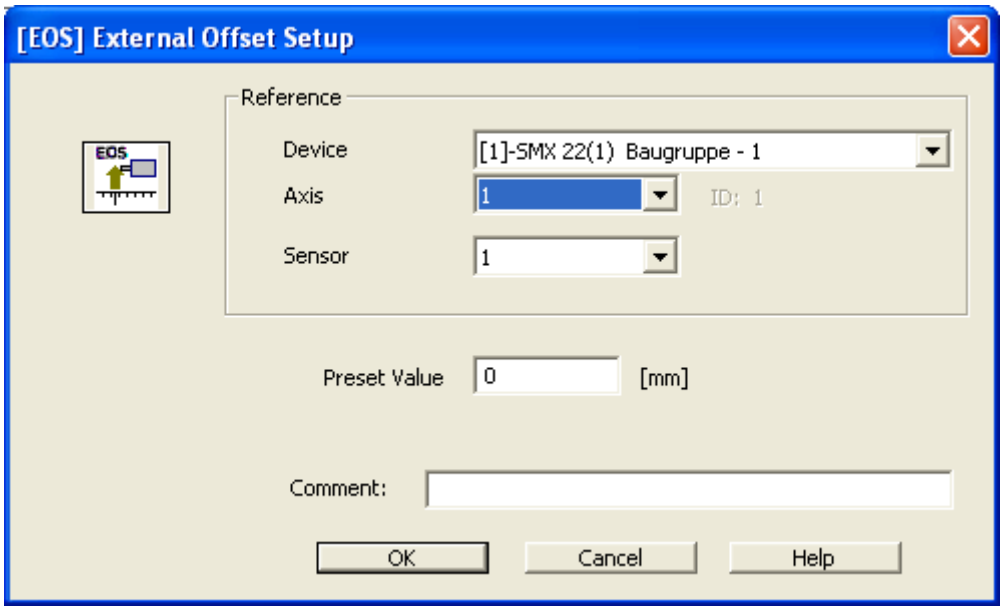
Function: Calculation of an offset value for position sensors based on a parametrizable Set position derived from the current sensor position. By activating the EOS-function the current position value is adapted to a parametrizable preset value by recalculating and setting of the offset value. The offset value is in this case permanently saved.

InPort: **Position signal X** from the encoder interface.
Selection module / axis and sensor

Reset funktion: no reset necessary

Operation:
Activation of this function starts with a rising edge at the inPort of the function.
The EOS-function can only be used after position processing has been activated and absolute encoder (e.g. SSI-encoder) has been parameterized on the selected sensor channel.

Parameter:



Device
Choice of axis device the function should work.

Axis
Axis number of the device.

Sensor
Choice of sensor connected to Encoder A (= 1) or Encoder B (= 2).

Preset Value
Preset value (set position) for selected sensor.

Note:

- Max. one EOS-function can be used for an absolute encoder.
- Any operational activation of the EOS-function must be ruled out. The function serves the purpose of service and maintenance. This must be assured by choosing suitable operating means for triggering this function. Suitable operating means are e.g. key switch, only accessible for qualified service and maintenance personnel.
- Suitable organisational measures must be applied to ensure compliance between the physical position of the axis and the Set position.
- The calculated offset value is stored in the device in a voltage protected way.
- ECS-function has to be enabled during the use of EOS-function for correct working.

I/O Module Extension PSCBR-E-31-12-DI-10DIO

Equipment selection

In the modular series PSCBR-C-100 an I/O device can be selected via the device selection.

Management of additional inPorts/outPorts

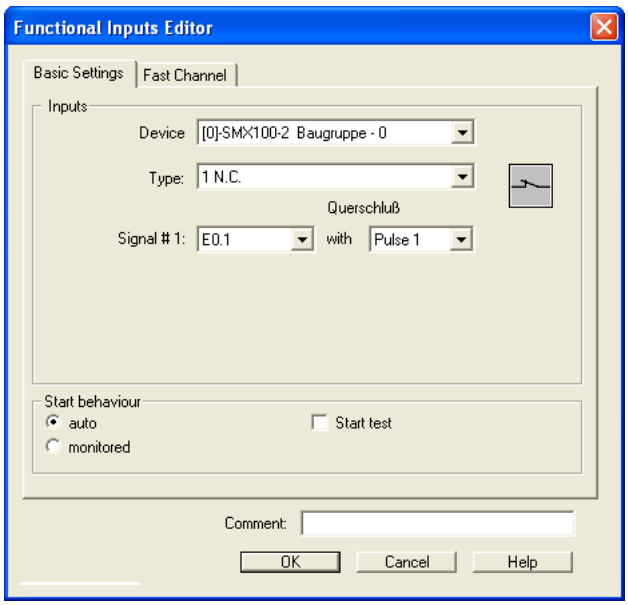
The PSCBR31 extends the number of inPorts and outPorts available in SafePLC as follows:

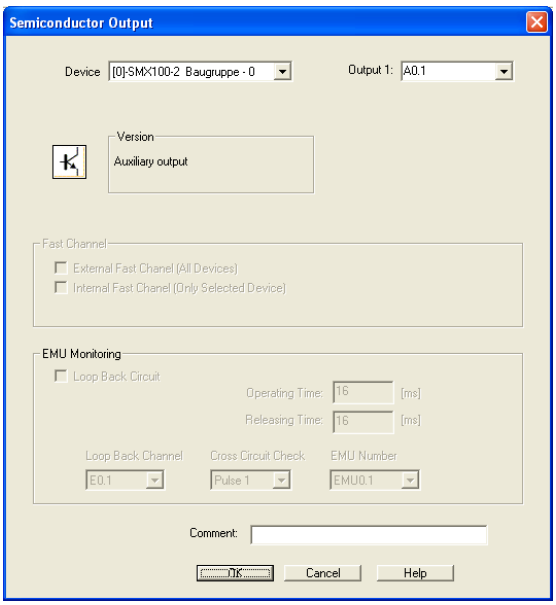
- 12 additional digital inPorts
- 10 IOs, used as digital inPorts / outPorts
- 2 auxiliary outPorts
- 2 Pulse outPorts P1 / P2

Note: If an EAE-inPort is occupied, the associated EAA-outPort is also no longer available and vice-versa.

Selection of inPorts and outPorts

Selecting the PSCBR-E-31-12-DI-10DIO increases the number of available IO modules in the SafePLC programming environment. The additional IOs are available in the selection lists of then corresponding modules.





Identification of inPorts:

Ex.1 .. Ex.12 Digital inPort PSCBR-E-31-12-DI-10DIO
EAEx.1 .. EAEx.10 Digital PSCBR-E-31-12-DI-10DIO I/O used as inPort

X = I/O slave address

Identification of outPorts:

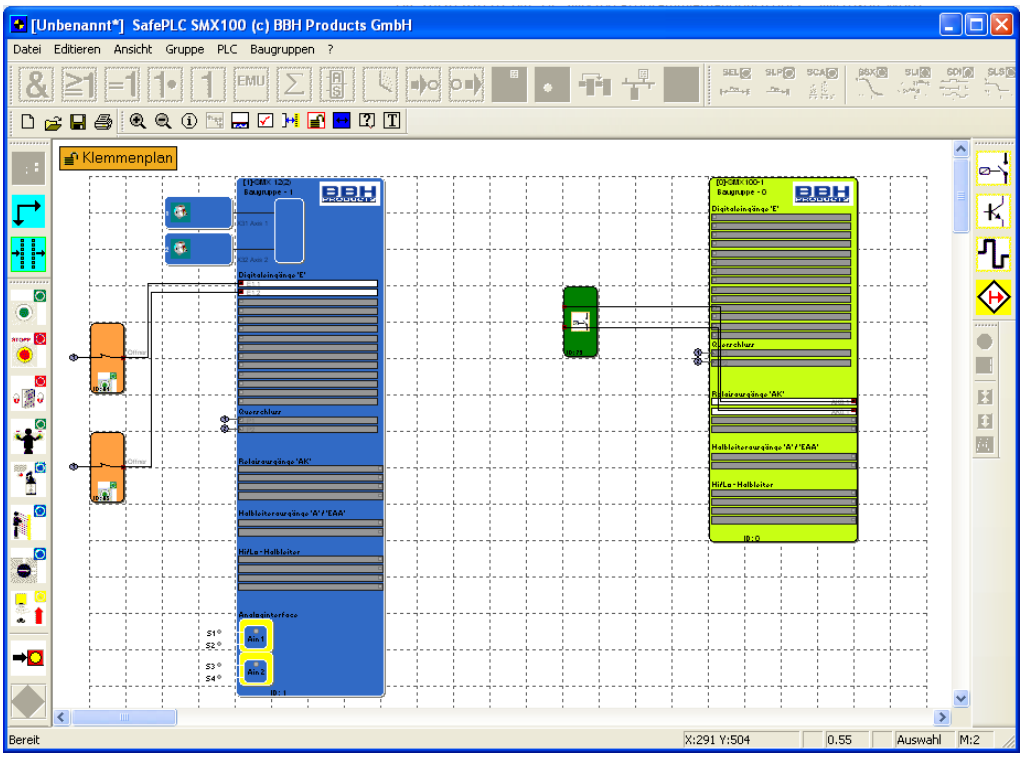
Ax.1 .. Ax.2 Digital standard outPort PSCBR-E-31-12-DI-10DIO
EAAx.1 .. EAAx.10 Digital PSCBR-E-31-12-DI-10DIO I/O used as outPort

X = I/O slave address

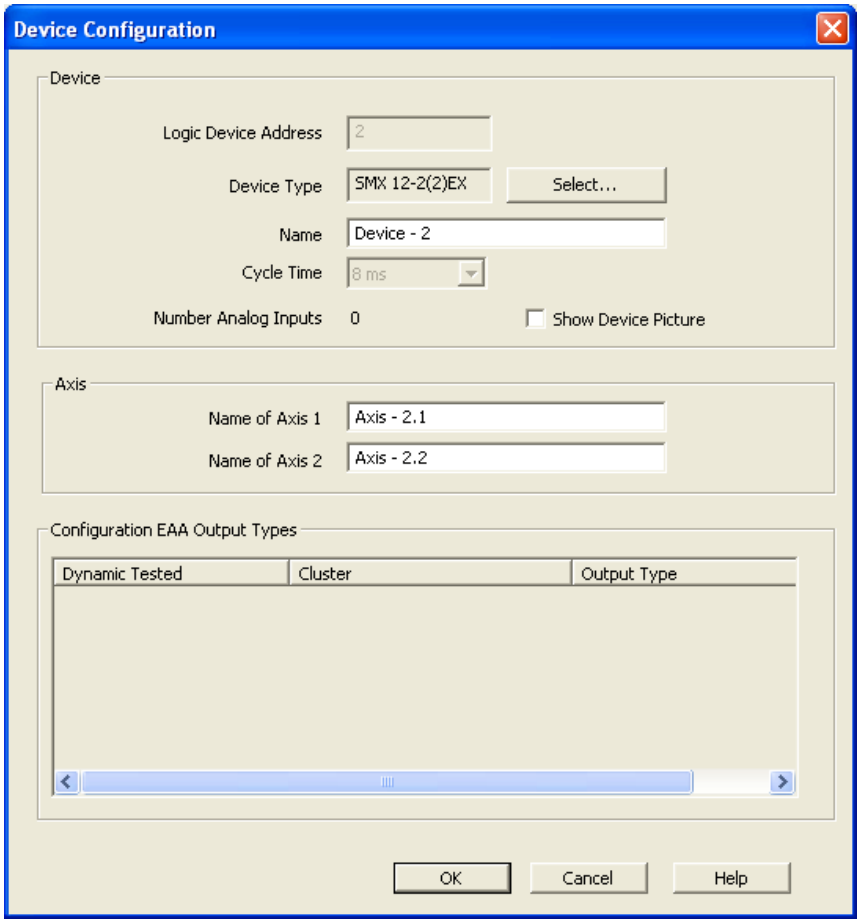
Note: I/O devices can be configured in modular series to maximum number of slave devices.

Input of serial number for physical assignment

The dialog is invoked by double-clicking on the signal list (blue selected in the illustration).



Parameter:



PSCBR-E-31-12-DI-10DIO outPort types
The digital EA outPorts of the PSCBR31 module can either be used as standard or as safety outPorts.

As safety outPorts
The term “safe” used in the following text in any case refers to the classification as a safe function for application up to Pl e acc. to EN ISO 13849-1 or SIL3 acc. to EN 61508.

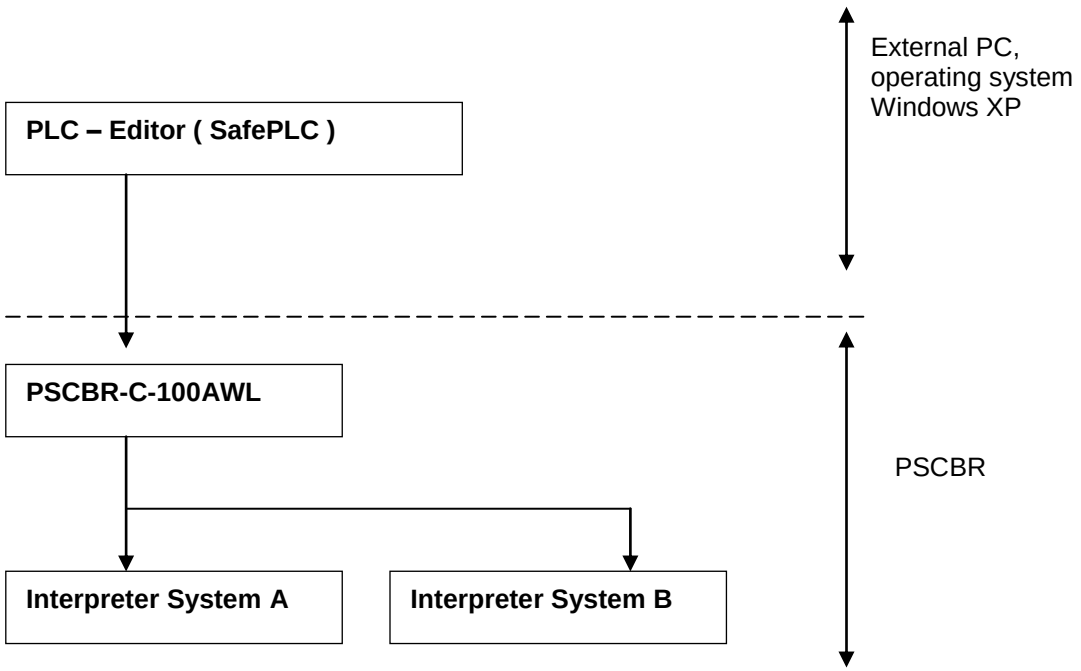
As standard outPorts
When used as standard outPort, EMU monitoring is not possible. If the outPort type is subsequently changed to standard outPort after EMU monitoring has been configured, a compiling error will be triggered.

Appendix Process Image

Introduction

The PSCBR-C-100-system is able to execute interpreter code saved in the module with PLC-functionality in real-time.

With an external, not safety related PLC-editor (**SafePLC**) a program can be created in function block representation as specified in IEC 61131, compiled and saved in the format **PSCBR-C-100A*WL*** . The same program adds the **PSCBR-C-100AWL -** instructions to the configuration data and transmits the data to the module PSCBR-C-100.



Evidence of the correct assignment of inPorts and outPorts must be provided by the user within the scope of a safety documentation.

The PSCBR-C-100AWL-CODE is executed by both systems in each cycle. For this purpose the input variables used in the program are linked in compliance with the interpreter code. The interpreter run delivers the following result:

- Setting/deleting one or several variables in the initial process image
- Enabling/disabling a monitoring function
- Setting/deleting a PLC-outPort
- PLC-markers 1 to 1024
- Timer 1 to 64

For the processing of MACRO-functions there is the possibility of creating program sequences (macros). In this case the entire function block consisting of several instructions is marked at the beginning and at the end by a CRC-signature. This function is used e.g. for macros in two-hand operation.

Designation of safety function

The listed table provides a relation between the syntax of addresses and designators in a process representation / IL Code and the function name acc. to EN 61800-5-2.

SCHMERSAL-designation	Function name acc. to EN 61800–5–2
MSC = Maximum Speed Control	SLS - Safe Limited Speed
ZSC = Zero Speed Control	SOS - Safe Operational Stop
DMC = Direction Monitoring Control	SDI = Safe Direction Indication
ESS = Emergency Stop Supervision	SSX = Safe Stop 1/2
JSS = Jogging Skip Supervision	SLI = Safe Limited Increment
PSC = Position Speed Control	SCA = Safe Cam
ELC – Emergency Limit Control	SEL = Safe Emergency Limit
OLC – Operational Limit Control	SLP = Safe Limited Position
EMU – Emergency Monitoring Unit	SEC = Safe external circuit
PDM – Position Deviation Mode	(SPM = Safe Position Muting)
ECS – Encoder Supervisor	(SEM= Safe Encoder Monitoring)

Specification of the PLC-functionality

Input variables

Input variables for the PLC-system are marked by:Output variables for the PLC-system are identified by:

- Affiliation to the system image of the PSCBR-C-100-system
- the unambiguously determined address (byte index in system image, bit index in entry of system image).
- by the 1-bit value of the inPort variable (TRUE or FALSE)
- Type of input variables: HW-inputs, RESULT of the monitoring function, RESULT of markers, RESULT of timers
- Access to the input variables always takes place **bit by bit!**

Syntax and addressing:

Idx	PAE name	Description
1	Drive SAC 1-8	Result SAC funktion 1…48
2	Drive SAC 9-16	
3	Drive SAC 17-24	
4	Drive SAC 25-32	
5	Drive SAC 33-40	
6	Drive SAC 41-48	
7	Drive SDI 1-8	Result SDI Function 1-12 Bit 13-16 not used
8	Drive SDI 9-16	
9	Drive SLI 1-8	Result SLI Function 1-12 Bit 13-16 not used
10	Drive SLI 9-16	
11	Drive SEL 1-8	Result SEL Function 1-12 Bit 13-16 not used
12	Drive SEL 9-16	
13	Drive SSX 1-8	Result SSX Function 1-24
14	Drive SSX 9-16	
15	Drive SSX 17-24	
16	Drive Base	DRB_STAT.1 = ESTOP external DRB_STAT.2 = RUNNING DRB_STAT.3 = LOCK DRB_STAT.4 = RESET
17	Drive SLP 1-8	Result SLP Function 1-12 Bit 13-16 not used
18	Drive SLP 9-16	
19	Drive SLS 1-8	Result SLS Function 1-48
20	Drive SLS 9-16	
21	Drive SLS 17-24	
22	Drive SLS 25-32	
23	Drive SLS 33-40	
24	Drive SLS 41-48	
25	Drive SCA 1-8	Result SCA Function 1-64
26	Drive SCA 9-16	
27	Drive SCA 17-24	
28	Drive SCA 25-32	
29	Drive SCA 33-40	
30	Drive SCA 41-48	
31	Drive SCA 49-56	
32	Drive SCA 57-64	
33	Drive SF 1-8	Not used

34	Drive SF 9-16	
35	Drive SOS 1-8	Result SOS Function 1-12 Bit 13-16 not used
36	Drive SOS 9-16	
37	Drive PDM 1-8	Not used
38	Drive PDM 9-16	
39	Drive ECS 1-8	Result ECS Function 1-12 Bit 13-16 not used
40	Drive ECS 9-16	
41	Drive ACS 1-8	Result ACS Function 1-12 Bit 13-16 not used
42	Drive ACS 9-16	
43	Drive EMU 1-8	Result EMU Function 1-16
44	Drive EMU 9-16	
45	PLC Timer 1-8	Result PLC Timer 1 -64
46	PLC Timer 9-16	
47	PLC Timer 17-24	
48	PLC Timer 25-32	
49	PLC Timer 33-40	
50	PLC Timer 41-48	
51	PLC Timer 49-56	
52	PLC Timer 57-64	
53	FunctionalInp 1-8	Functional inPorts 1-32
54	FunctionalInp 9-16	
55	FunctionalInp 17-24	
56	FunctionalInp 25-32	
57	StarteElement Timer 1-8	Results for inPort time monitored 1…64
58	StarteElement Timer 9-16	
59	StarteElement Timer 17-24	
60	StarteElement Timer 25-32	
61	StarteElement Timer 33-40	
62	StarteElement Timer 41-48	
63	StarteElement Timer 49-56	
64	StarteElement Timer 57-64	
65	Anlauftest 1-8	Result of start behaviour monitored
66	Anlauftest 8-16	
67	Anlauftest 17-24	
68	Anlauftest 25-32	
69	Anlauftest 33-40	
70	Anlauftest 41-48	
71	Anlauftest 49-56	
72	Anlauftest 57-64	
73	Ausgang Zweihandtimer 1-8	Result of Two-hand button
74	Ausgang Zweihandtimer 9-16	
75	Digital Inp 1-8	InPort Master E0.1 bis E0.12
76	Digital Inp 9-16	
77	Digital Inp 17-24	InPort Master EAE0.1 bis E0.8
78	Digital Inp 25-32	InPort Master EAE0.9 bis E0.16
79	Digital Inp 33-40	InPort Master EAE0.17 bis E0.24
80	Digital Inp 41-48	InPort Master EAE0.25 bis E0.32
81	Digital Inp 49-56	InPort Master EAE0.33 bis E0.40
82	Digital Inp 57-64	Nicht verwendet
83	Digital Inp 65-72	InPort Slave Adresse 1
84	Digital Inp 73-80	InPort Slave Adresse 1
85	Digital Inp 81-88	InPort Slave Adresse 1
86	Digital Inp 89-96	InPort Slave Adresse 2
87	Digital Inp 97-104	InPort Slave Adresse 2
88	Digital Inp 105-112	InPort Slave Adresse 2
89	Digital Inp 113-120	InPort Slave Adresse 3
90	Digital Inp 121-128	InPort Slave Adresse 3
91	Digital Inp 129-136	InPort Slave Adresse 3
92	Digital Inp 137-144	InPort Slave Adresse 4
93	Digital Inp 145-152	InPort Slave Adresse 4
94	Digital Inp 153-160	InPort Slave Adresse 4
95	Digital Inp 161-168	InPort Slave Adresse 5
96	Digital Inp 169-176	InPort Slave Adresse 5

97	Digital Inp 177-184	InPort Slave Adresse 5
98	Digital Inp 185-192	InPort Slave Adresse 6
99	Digital Inp 193-200	InPort Slave Adresse 6
100	Digital Inp 201-208	InPort Slave Adresse 6
101	Digital Inp 209-216	InPort Slave Adresse 7
102	Digital Inp 217-224	InPort Slave Adresse 7
103	Digital Inp 225-232	InPort Slave Adresse 7
104	Digital Inp 233-240	InPort Slave Adresse 8
105	Digital Inp 241-248	InPort Slave Adresse 8
106	Digital Inp 249-256	InPort Slave Adresse 8
107	Digital Inp 257-264	Not used
108	Digital Inp 265-272	Not used
109	Digital Inp 273-280	Not used
110	Digital Inp 281-288	Not used
111	Digital Inp 289-296	Not used
112	Digital Inp 297-304	Not used
113	Digital Inp 305-312	Not used
114	Digital Inp 313-320	Not used
115	Digital Inp 321-328	Not used
116	Digital Inp 329-336	Not used
117	Digital Inp 337-344	Not used
118	Digital Inp 345-352	Not used
119	Digital Inp 353-360	Not used
120	Digital Inp 361-368	Not used
121	Digital Inp 369-376	Not used
122	Digital Inp 377-384	Not used
123	Digital Inp 385-392	Not used
124	Digital Inp 393-400	Not used
125	Digital Inp 401-408	Not used
126	Digital Inp 409-416	Not used
127	Digital Inp 417-424	Not used
128	Digital Inp 425-432	Not used
129	Digital Inp 433-440	Not used
130	Digital Inp 441-448	Not used
131	SOC Status 1-8	Status information from Slave Adresse1
132	SOC Status 9-16	
133	SOC Status 17-24	
134	SOC Status 25-32	
135	SOC Status 33-40	Status information from Slave Adresse2
136	SOC Status 41-48	
137	SOC Status 49-56	
138	SOC Status 57-64	
139	SOC Status 65-72	Status information from Slave Adresse3
140	SOC Status 73-80	
141	SOC Status 81-88	
142	SOC Status 89-96	
143	SOC Status 97-104	Status information from Slave Adresse4
144	SOC Status 105-112	
145	SOC Status 113-120	
146	SOC Status 121-128	
147	SOC Status 129-136	Status information from Slave Adresse5
148	SOC Status 137-144	
149	SOC Status 145-152	
150	SOC Status 153-160	
151	SOC Status 161-168	Status information from Slave Adresse6
152	SOC Status 169-176	
153	SOC Status 177-184	
154	SOC Status 185-192	
155	SOC Status 193-200	Status information from Slave Adresse7
156	SOC Status 201-208	
157	SOC Status 209-216	
158	SOC Status 217-224	
159	SOC Status 225-232	Status information from Slave Adresse8

160	SOC Status 233-240	
161	SOC Status 241-248	
162	SOC Status 249-256	
163	Meisterschalter Eingang 1-8	Result Master switch
164	Meisterschalter Eingang 9-16	
165	Meisterschalter Eingang 17-24	
166	Meisterschalter Eingang 25-32	
167	DriveDEM 1-8	Result DEM Function 1-12 Bit 13-16 not used
168	DriveDEM 9-16	

Note) Digital inPort Slave x:

- Bit0…11: Ex.1 …Ex.12
- Bit12…21 -> EAEx.1… EAEx.10

PLC – Output variables

Output variables for the PLC-system are identified by:

- Affiliation to the system image of the PSCBR-C-100-system
- the unambiguously determined address (byte index in system image, bit index in entry of system image).
- by the 1-bit value of the input variable (TRUE or FALSE)

Syntax and addressing

Idx	PAA name	Description
1	Drive SAC_EN 1-8	Enable SAC Function 1-48
2	Drive SAC_EN 9-16	
3	Drive SAC_EN 17-24	
4	Drive SAC_EN 25-32	
5	Drive SAC_EN 33-40	
6	Drive SAC_EN 41-48	
7	Drive SDI_EN 1-8	Enable SDI Function 1..12 One Function needs 2 enable bits
8	Drive SDI_EN 9-16	
9	Drive SDI_EN 17-24	
10	Drive SLI_EN 1-8	Enable SDI Function 1..12 One Function needs 2 enable bits
11	Drive SLI_EN 9-16	
12	Drive SLI_EN 17-24	
13	Drive SEL_EN 1-8	Enable SEL Function 1..12 bit 13-16 not used
14	Drive SEL_EN 9-16	
15	Drive SSX_EN 1-8	Enable SSX Function 1..24
16	Drive SSX_EN 9-16	
17	Drive SSX_EN 17-24	
18	Drive SLP_EN 1-8	Enable SLP Function 1..12 One Function needs 4 enable bits
19	Drive SLP_EN 9-16	
20	Drive SLP_EN 17-24	
21	Drive SLP_EN 25-32	
22	Drive SLP_EN 33-40	
23	Drive SLP_EN 41-48	
24	Drive SLS_EN 1-8	Enable SLS Function 1..48
25	Drive SLS_EN 9-16	
26	Drive SLS_EN 17-24	
27	Drive SLS_EN 25-32	
28	Drive SLS_EN 33-40	
29	Drive SLS_EN 41-48	
30	Drive SCA_EN 1-8	Enable SCA Function 1..64
31	Drive SCA_EN 9-16	
32	Drive SCA_EN 17-24	
33	Drive SCA_EN 25-32	
34	Drive SCA_EN 33-40	
35	Drive SCA_EN 41-48	
36	Drive SCA_EN 49-56	
37	Drive SCA_EN 57-64	
38	Drive SF 1-8	Not used
39	Drive SF 9-16	
40	Drive SOS_EN 1-8	Enable SOS Function 1..12 bit 13-16 not used
41	Drive SOS_EN 9-16	
42	DriveBASE_EN	
43	Drive PDM_EN 1-8	Not used
44	Drive PDM _EN 9-16	
45	Drive ECS_EN 1-8	Enable ECS Function 1..12 bit 13-16 not used
46	Drive ECS_EN 9-16	
47	Drive ACS_EN 1-8	Enable ACS Function 1..12 bit 13-16 not used
48	Drive ACS_EN 9-16	
49	Drive EMU_EN 1-8	Not used

50	Drive EMU_EN 9-16	
51	PLC Timer_EN 1-8	Enable PLC Timer 1-64
52	PLC Timer_EN 9-16	
53	PLC Timer_EN 17-24	
54	PLC Timer_EN 25-32	
55	PLC Timer_EN 33-40	
56	PLC Timer_EN 41-48	
57	PLC Timer_EN 49-56	
58	PLC Timer_EN 57-64	
59	Enable Input Timer 1-8	Enable inPort element with time monitored One Function needs 2 enable bits
60	Enable Input Timer 9-16	
61	Enable Input Timer 17-24	
62	Enable Input Timer 25-32	
63	Enable Input Timer 33-40	
64	Enable Input Timer 41-48	
65	Enable Input Timer 49-56	
66	Enable Input Timer 57-64	
67	Enable Input Timer 65-72	
68	Enable Input Timer 73-80	
69	Enable Input Timer 81-88	
70	Enable Input Timer 89-96	
71	Enable Input Timer 97-104	
72	Enable Input Timer 105-112	
73	Enable Input Timer 113-120	
74	Enable Input Timer 121-128	
75	Start behaviour 1-8	Enable start behaviour monitored One Function needs 2 enable bits
76	Start behaviour 8-16	
77	Start behaviour 17-24	
78	Start behaviour 25-32	
79	Start behaviour 33-40	
80	Start behaviour 41-48	
81	Start behaviour 49-56	
82	Start behaviour 57-64	
83	Start behaviour 65-72	
84	Start behaviour 73-80	
85	Start behaviour 81-88	
86	Start behaviour 89-96	
87	Start behaviour 97-104	
88	Start behaviour 105-112	
89	Start behaviour 113-120	
90	Start behaviour 121-128	
91	Enable Input Two-hand timer 1-8	Enable Two-hand button
92	Enable Input Two-hand timer 9-16	
93	Digital Outp. 1-8	Output Master Bit0:HISIDE1 Bit1:LOSIDE1 Bit2: HISIDE2 Bit3: LOSIDE2 Bit4: Relay K1 Bit5: Relay K2 Bit6: A0.1 Bit7: A0.2
94	Digital Outp. 9-16	OutPort Master EAA0.1-EAA0.8
95	Digital Outp. 17-24	OutPort Master EAA0.9-EAA0.16
96	Digital Outp. 25-32	OutPort Master EAA0.17-EAA0.24
97	Digital Outp. 33-40	OutPort Master EAA0.25-EAA0.32
98	Digital Outp. 41-48	OutPort Master EAA0.33-EAA0.40
99	Digital Outp. 49-56	Not used
100	Digital Outp. 57-64	OutPort Slave Adresse1
101	Digital Outp. 65-72	
102	Digital Outp. 73-80	
103	Digital Outp. 81-88	
104	Digital Outp. 89-96	OutPort Slave Adresse2

105	Digital Outp. 97-104	
106	Digital Outp. 105-112	
107	Digital Outp. 113-120	
108	Digital Outp. 121-128	OutPort Slave Adresse3
109	Digital Outp. 129-136	
110	Digital Outp. 137-144	
111	Digital Outp. 145-152	
112	Digital Outp. 153-160	OutPort Slave Adresse4
113	Digital Outp. 161-168	
114	Digital Outp. 169-176	
115	Digital Outp. 177-184	
116	Digital Outp. 185-192	OutPort Slave Adresse5
117	Digital Outp. 193-200	
118	Digital Outp. 201-208	
119	Digital Outp. 209-216	
120	Digital Outp. 217-224	OutPort Slave Adresse6
121	Digital Outp. 225-232	
122	Digital Outp. 233-240	
123	Digital Outp. 241-248	
124	Digital Outp. 249-256	OutPort Slave Adresse7
125	Digital Outp. 257-264	
126	Digital Outp. 265-272	
127	Digital Outp. 273-280	
128	Digital Outp. 281-288	OutPort Slave Adresse8
129	Digital Outp. 289-296	
130	Digital Outp. 297-304	
131	Digital Outp. 305-312	
132	Digital Outp. 313-320	Not used
133	PLC-Merker 1..8	PLC Merker
…	…	
260	PLC-Merker 1017…1024	
261	SCO_cmd_status1-8	Status information to the Slave Adresse1
262	SCO_cmd_status9-16	
263	SCO_cmd_status17-24	
264	SCO_cmd_status25-32	
265	SCO_cmd_status33-40	Status information to the Slave Adresse2
266	SCO_cmd_status41-48	
267	SCO_cmd_status49-56	
268	SCO_cmd_status57-64	
269	SCO_cmd_status65-72	Status information to the Slave Adresse3
270	SCO_cmd_status73-80	
271	SCO_cmd_status81-88	
272	SCO_cmd_status89-96	
273	SCO_cmd_status97-104	Status information to the Slave Adresse4
274	SCO_cmd_status105-112	
275	SCO_cmd_status113-120	
276	SCO_cmd_status121-128	
277	SCO_cmd_status129-136	Status information to the Slave Adresse5
278	SCO_cmd_status137-144	
279	SCO_cmd_status145-152	
280	SCO_cmd_status153-160	
281	SCO_cmd_status161-168	Status information to the Slave Adresse6
282	SCO_cmd_status169-176	
283	SCO_cmd_status177-184	
284	SCO_cmd_status185-192	
285	SCO_cmd_status193-200	Status information to the Slave Adresse7
286	SCO_cmd_status201-208	
287	SCO_cmd_status209-216	
288	SCO_cmd_status217-224	
289	SCO_cmd_status225-232	Status information to the Slave Adresse8
290	SCO_cmd_status233-240	
291	SCO_cmd_status241-248	
292	SCO_cmd_status 249-256	

293	MasterSwitch_Enable 1-8	Enable Master switch
294	MasterSwitch_Enable 9-16	
295	MasterSwitch_Enable 17-24	
296	MasterSwitch_Enable 25-32	
297	DriveDEM_EN 1-8	Enable DEM Function 1..12
298	DriveDEM_EN 9-16	Bit 13-16 not used

Process Data

Idx	PAE name	Description
1	Limit20 Axis:1	Not used
2	Limit20 Axis:2	
3	Limit20 Axis:3	
4	Limit20 Axis:4	
5	Limit20 Axis:5	
6	Limit20 Axis:6	
7	Limit20 Axis:7	
8	Limit20 Axis:8	
9	Limit20 Axis:9	
10	Limit20 Axis:10	
11	Limit20 Axis:11	
12	Limit20 Axis:12	
13	Position20 Axis: 1	Position value axis 1 ... 12
14	Position20 Axis: 2	
15	Position20 Axis: 3	
16	Position20 Axis: 4	
17	Position20 Axis: 5	
18	Position20 Axis: 6	
19	Position20 Axis: 7	
20	Position20 Axis: 8	
21	Position20 Axis: 9	
22	Position20 Axis: 10	
23	Position20 Axis: 11	
24	Position20 Axis: 12	
25	BG20 Axis: 1	TeachIn position value axis 1 ... 12
26	BG20 Axis: 2	
27	BG20 Axis: 3	
28	BG20 Axis: 4	
29	BG20 Axis: 5	
30	BG20 Axis: 6	
31	BG20 Axis: 7	
32	BG20 Axis: 8	
33	BG20 Axis: 9	
34	BG20 Axis: 10	
35	BG20 Axis: 11	
36	BG20 Axis: 12	
37	StopDistanz20 Axis: 1	Not used
38	StopDistanz20 Axis: 2	
39	StopDistanz20 Axis: 3	
40	StopDistanz20 Axis: 4	
41	StopDistanz20 Axis: 5	
42	StopDistanz20 Axis: 6	
43	StopDistanz20 Axis: 7	
44	StopDistanz20 Axis: 8	
45	StopDistanz20 Axis: 9	
46	StopDistanz20 Axis: 10	
47	StopDistanz20 Axis: 11	
48	StopDistanz20 Axis: 12	
49	SysSpeed Axis: 1	Speed value axis 1 ... 12
50	SysSpeed Axis: 2	
51	SysSpeed Axis: 3	
52	SysSpeed Axis: 4	
53	SysSpeed Axis: 5	
54	SysSpeed Axis: 6	
55	SysSpeed Axis: 7	
56	SysSpeed Axis: 8	

57	SysSpeed Axis: 9	
58	SysSpeed Axis: 10	
59	SysSpeed Axis: 11	
60	SysSpeed Axis: 12	
61	SysAcc Axis: 1	Acceleration value axis 1 ... 12
62	SysAcc Axis: 2	
63	SysAcc Axis: 3	
64	SysAcc Axis: 4	
65	SysAcc Axis: 5	
66	SysAcc Axis: 6	
67	SysAcc Axis: 7	
68	SysAcc Axis: 8	
69	SysAcc Axis: 9	
70	SysAcc Axis: 10	
71	SysAcc Axis: 11	
72	SysAcc Axis: 12	
73	AIn Eingang: 1	Analog inPort Ain 1 ... 16
74	AIn Eingang: 2	
75	AIn Eingang: 3	
76	AIn Eingang: 4	
77	AIn Eingang: 5	
78	AIn Eingang: 6	
79	AIn Eingang: 7	
80	AIn Eingang: 8	
81	AIn Eingang: 9	
82	AIn Eingang: 10	
83	AIn Eingang: 11	
84	AIn Eingang: 12	
85	AIn Eingang: 13	
86	AIn Eingang: 14	
87	AIn Eingang: 15	
88	AIn Eingang: 16	
89	AnalogAdder Id: 1	Analog adder 1 … 8
90	AnalogAdder Id: 2	
91	AnalogAdder Id: 3	
92	AnalogAdder Id: 4	
93	AnalogAdder Id: 5	
94	AnalogAdder Id: 6	
95	AnalogAdder Id: 7	
96	AnalogAdder Id: 8	

PLC – Commands

Operator	Operand	OPCODE	Description
LD	all inPort and outPort operands	02	Equates current result with operand
LD NOT	all inPort and outPort operands	04	Equates current result with operand and inverts the operand
ST	only outPort operands	06	Saves current result to operand address
AND	all inPort and outPort operands	08	Boolean AND
AND NOT	all inPort and outPort operands	10	Negated Boolean AND
OR	all inPort and outPort operands	12	Boolean OR
OR NOT	all inPort and outPort operands	14	Negated Boolean OR
XOR	all inPort and outPort operands	16	Boolean Exclusive OR
NOT	all inPort and outPort operands	18	Inverts the accumulator value
SET MARKER	PLC_MARKER in outPort image	20	Sets marker
RESET MARKER	PLC_MARKER in outPort image	22	Resets marker
SET	all inPort and outPort operands	24	Sets operand to 1
RESET	all inPort and outPort operands	26	Sets operand to 0
MACRO_INFO	Description of macro element	28	Operand field: 2 byte for macro identification
MACRO_CRC	CRC the previous macro field	30	Operand field: 1. Operand: CRC_LO (8 Bit) 2. Operand: CRC_HI (8 Bit)
INFO	Info field	32	Operand field: 1. Operand: reserved free! 2. Operand: reserved free!

Assignment of resources

Element	In	Out	Qty. MX	IN/OUT Process image	PLC-Code	Qty. IL
AND2	2	1	1	0	LD x1.y1 AND x2.y2 ST MX.z	3
AND5	5	1	1	0	LD x1.y1 AND x2.y2 AND x3.y3 AND x4.y4 AND x5.y5 ST MX.z	6
OR2 .. OR5					Analog AND	3 … 6
XOR 2					Analog AND	3
NOT	1	1	1	0	LD x1,y1 NOT ST MX.z	3
RS-Flipflop	2	1	0	Output = 1	LD x1.y1 (source S) S M.z LD x2.y2 (source R) R M.z	4
Timer	1	1	0	Output = 1	Timer enable : LD x1.y1 ST PLCT_EN.z	2
Monitoring functions	1	1	0	Output = 1	Monitoring function enable : LD x1.y1 ST uuu_EN.z	2
Semi-conductor outPort Single	1	1	0	Output = 1	LD x1.y1 ST DO.x_y	2
Semi-conductor outPort Redundant	1	2	0	Output = 2	LD x1.y1 ST DO.x_P ST DO.x_M	3

APPENDIX Encoder combinations

See encoder types in installation manual.

Fault types PSCBR

See installation manual.