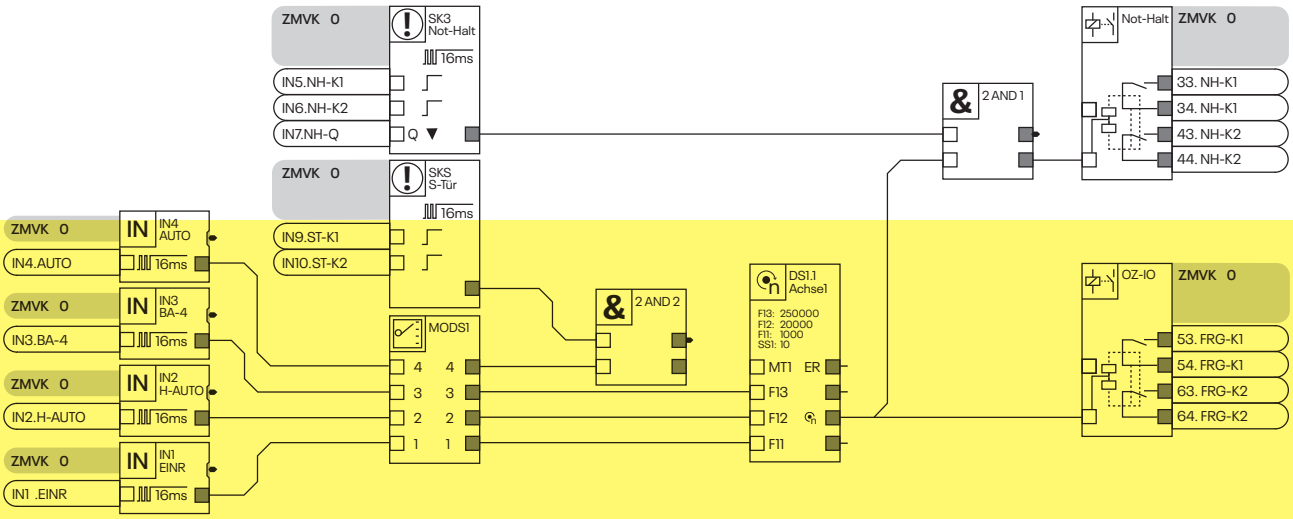
DINA

SAFELINE VARIO Designer

Instruction Manual



Graphical programming software

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Legal information

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Table of contents

SL VARIO Designer

The tool for fast implementation of user applications

Product description

With the SL VARIO Designer graphical programming software, you can create a safety-oriented project for the DINA SL VARIO product series.

The program makes an extensive library of standard modules and safety modules available to the user. These can be used to link the inputs and outputs of the SL VARIO modules to one another in an application-specific manner as well as realize safety-related functions, such as emergency stops or speed monitors.

Parameter tables provide a high level of flexibility.

The graphical simulation is able to replicate the created application on the PC. This simplifies analysis and trouble-shooting.

The project is transmitted via the USB port of the central module. Extensive online diagnostic options are then available.

Version overview / Change history

Version	Date	New features / Changes
0333	11/20/2013	Standard
0340	02/11/2014	Inverted terminals on HW and SW inputs, additional operating mode selector symbol, PWR-On reset, 3-way AND gate, door element, data comparison, additional markers
0342	04/29/2014	Cascading, AOPD, 16 door elements
0343	07/25/2014	Copy/paste. Import/export texts, HTL encoder, advanced analog terminals, fan monitoring, advanced cascading, 1 of N element receives another output, area scanners, DNCO and multiplexers, 8x muting
0344	12/2014	X-gate, clocked inputs, change on analog ok, D flip-flop
0347	01/2015	SIV and NIV modules, cams, RTAN (analog acknowledgment), zone monitoring
0347	05/2015	Power control
0348	06/2015	Safe brake test
0349	08.2015	Synchronous monitoring of two drives on DSV, pulse shaper
0350	06/2017	Simulation, ramp monitoring, prewarning limit for speed monitoring on the central module, 2-man operation, SLW data comparison, synchronous monitoring of two drives with HTL, inverted input terminals on AND and OR, single-input timers, DSCHK (DSV2 only), reset terminal, diagnostic output on safety circuits, autostart, binary coders/decoders, current monitoring on O1/O2, analog step switch, inverter, switch 1 of 2, proof test, adjustable AOPD clock
0351	2018	Extension for ZMVD, "1 out of N" block extended to 4, pulse time configurable for pulse shaper, 500 netlists, zoom function, notepad, serial diagnosis
0352	2021	Extension for DNSL-BIV

1 Installation

1.1 System requirements

- **Operating system:**
  Windows XP, Windows Vista, Windows 7, Windows 8, Windows 10
- **JAVA**
- **Connection cable between PC and SL VARIO central module:**
  USB connection cable Part number: 99SO11

1.2 Starting the setup program

You can find the setup program on the SD card of the central module or you can contact us through **www.dina.de**.

▶ Execute the setup program.

To achieve the maximum transfer speed and the optimal speed of SL VARIO diagnostics, change the waiting timein the BM settings (advanced connection settings) to 1ms.

To do so, proceed as follows:

▶ Open Device Manager -> Ports (COM&LPT)

▶ Select USB Serial Port

▶ Under "Port Settings -> Advanced" reduce the waiting time to 1 ms.

1.3 Starting the Designer

Start the Designer and select the language. (Fig. 1-1)

Fig 1-1

CAUTION

After the Designer and Java runtime are installed for the first time, you must start the Designer once as administrator. To do this, right-click on the Designer icon and select "Run as administrator".

The next time the Designer is started, it does not need to be run as administrator.

2 Creating a project

▶ In the Start mask (Fig. 2-1), select the File menu item to open a project or start a new project with .

▶ Select the version for 350 or 500 netlists.

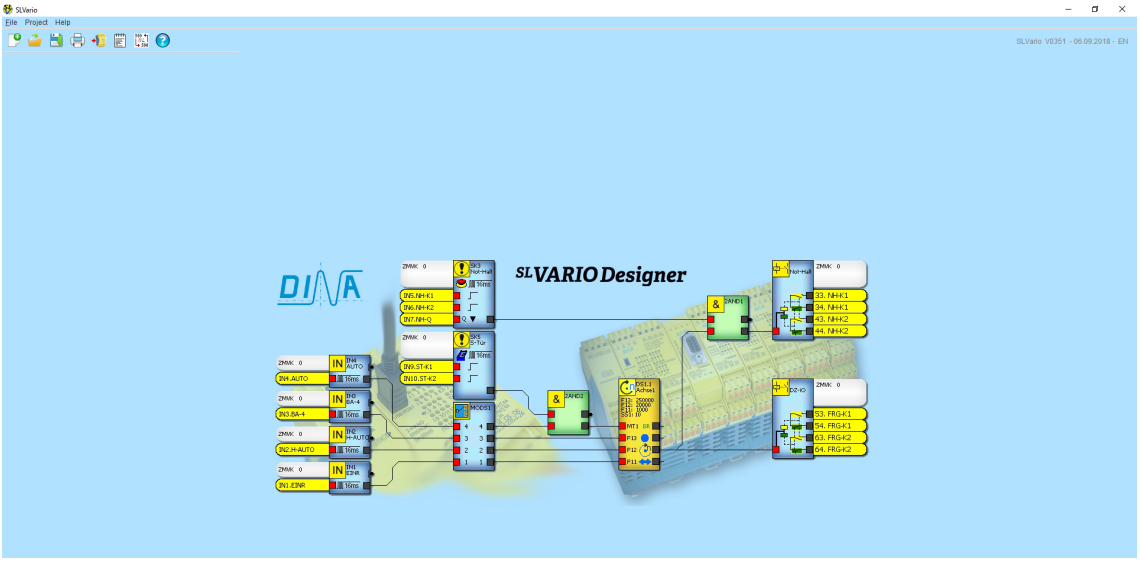


Fig. 2-1

2.1 Hardware configuration

In the hardware configuration (Fig. 2-2), you define which SL VARIO modules you will use. A rack always consists of a central module and a different number of function modules.

The available SL VARIO modules can be found in the left area.

Displayed in the middle area is the rack structure. Here, the numbers 0 – 14 correspond to the slots in the rack.

The rack is graphically depicted in the right area. If no modules have yet been placed, the empty bus connector is displayed.

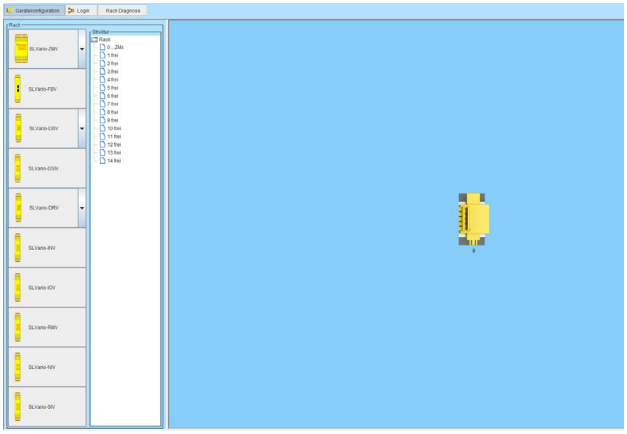


Fig. 2-2

2.2 Assembling the rack

The central module must be placed on slot 0.
The function modules can be freely distributed.

A number of central modules are available. (Fig. 2-3) Make your selection using the drop-down menu.

▶ Select the appropriate central module

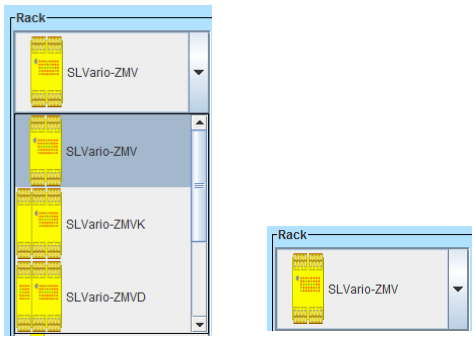


Fig. 2-3

▶ With the left mouse button pressed down, drag the selected module to the desired slot 0 in the "Structure" area. (Fig. 2-4)

The module is graphically depicted in the right area.

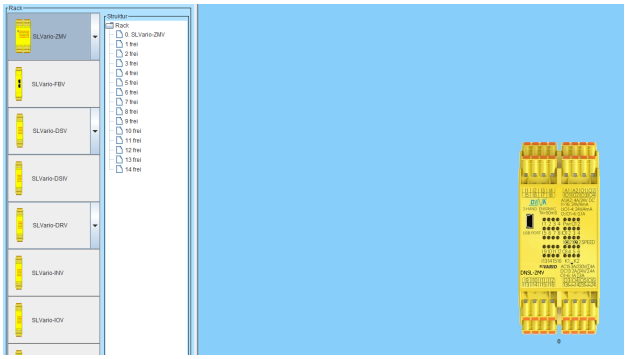


Fig. 2-4

▶ Drag the function modules to their slots in the same way. (Fig. 2-5)

The function modules do not need to be placed on the slots continuously, i.e., without gaps.

As a result, the slot numbering does not correspond to the slot. In the example, the DSV module is assigned slot number 2, even though it is plugged into slot 1 in the control cabinet. INV is assigned slot number 4, even though it is plugged into slot 2.

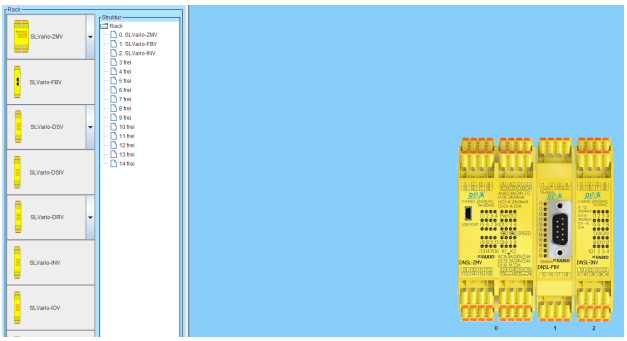


Fig. 2-5

2.3 Removing a module from the hardware configuration

- Select the module in the tree structure.
- To delete the module, press the "DELETE" key on the PC or right-click and select the "Delete" function. (Fig.2-6)

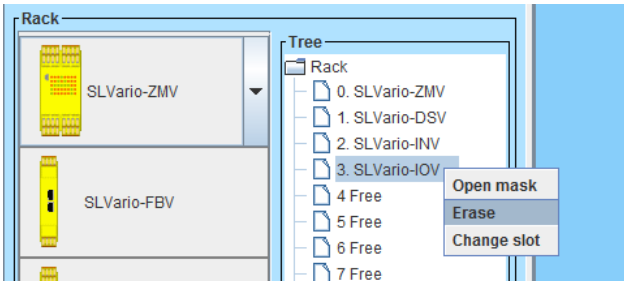


Fig. 2-6

CAUTION

Please note that the software elements of the module will also be deleted!

2.4 Changing the module slot

- Select the module in the tree structure. (Fig. 2-7)
- Right-click and select the "Change slot" function to move the module to a different slot. (Fig. 2-8)

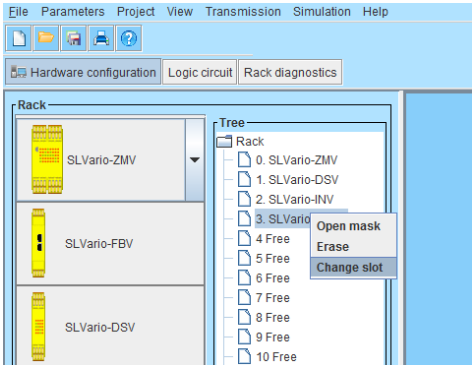


Fig. 2-7

Fig. 2-8

2.5 Opening the mask

- Select the module in the tree structure.
- Right-click and select the "Open mask" function to open the parameter mask for the modules. (Fig. 2-9)

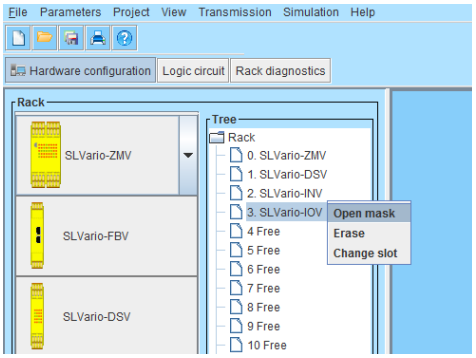


Fig. 2-9

3 Menu bar

The menu bar is located on the top line of the Designer screen. (Fig. 3-1) Located beneath this are the navigation buttons (see chapter Navigation buttons) and, on the right edge of the screen, the Designer version, number of netlists, date and language.

The various editing screens can be selected on the third row.

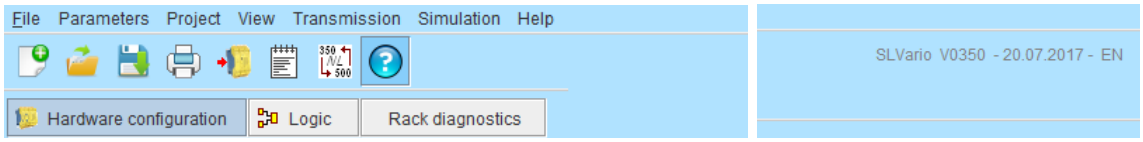
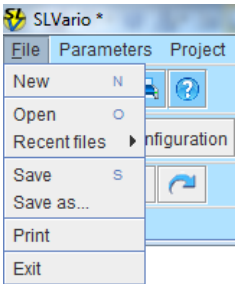


Fig. 3-1

3.1 File

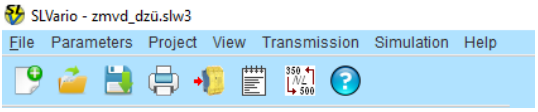


3.1.1 New

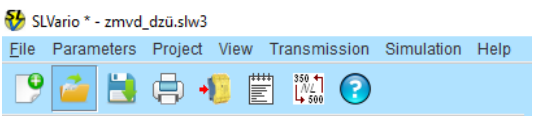
Starts a new project.

3.1.2 Open

Opens an existing project. This has file extension ".slw3". Once loaded, the file name appears in the title bar of the Designer screen. (Fig. 3-2)



If a change is now made to this project, a * appears before the file name. (Fig. 3-3)



3.1.3 Recent files

Displays the last ten opened projects. The project opens after it is selected.

3.1.4 Save

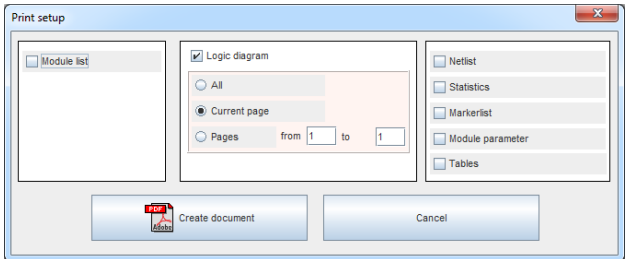
Saves the project in the directory that was set. The directory can be changed with the Project – Settings menu item. (Chapter Settings)

3.1.5 Save as

Saves the project in the specified directory with the specified name.

3.1.6 Print

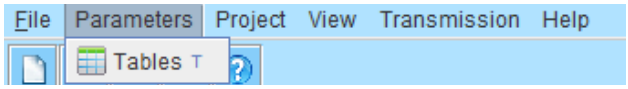
Creates a PDF file of the current project. You can define the scope of this file in the print options. (Fig. 3-4). The PDF file is stored in the same directory as the project file.



3.1.7 Exit

Exits the SL VARIO Designer. If changes were made to the current project, a dialog box appears asking if you would like to save the project.

3.2 Parameters

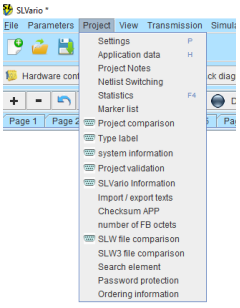


3.2.1 Tables

Tables contain the module parameters of the configured central module and of the function modules. Details on these topics can be found in chapter “Parameter tables”.

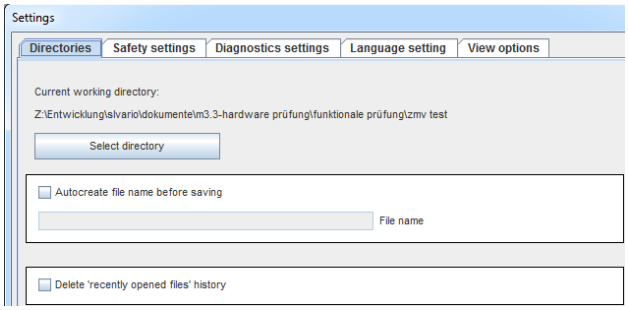
3.3 Project

A connection to the central module must exist for functions marked with the  symbol. (Fig. 3-5)



3.3.1 Settings

Directories



Current working directory

▶ Define the project path that is set when the Designer is started.

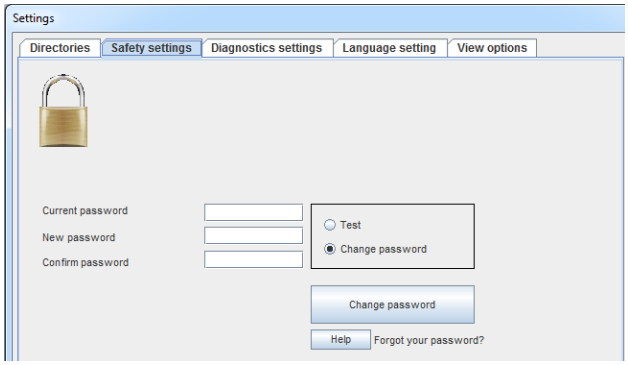
Autocreate file name before saving:

The file name that appears here is generated when the project is stored and also includes the date and time of file creation. E.g.: when stored, the file name machine1 becomes machine1_D260213_T1249.slw3. Saving the file again results in the creation of a new file.

Delete the "Recently opened files" history

The history of the most recently opened files is deleted.

Safety settings



The transmission of an application to the central module can be protected with a device password.

- **Maximum 8 characters**
- **No special characters or blank spaces**

Test

▶ Establish connection to the central module
▶ Enter current password
▶ Select Test

Change password

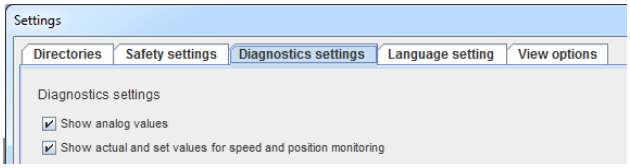
- ▶ Enter current password
- ▶ Enter new password
- ▶ Confirm password
- ▶ Select "Change password"

Delete password

- ▶ Enter current password
- ▶ Do not enter any characters in the fields lo-cated underneath
- ▶ Select "Change password"

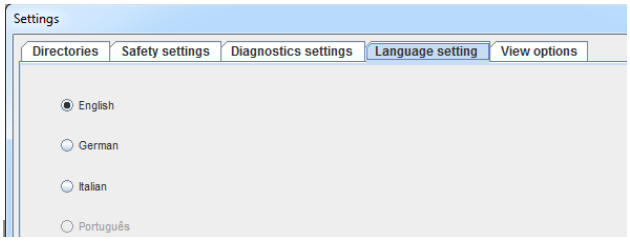
You can find other safety settings for the application in chapter Password protection for the application.

Diagnostic settings



To speed up online diagnostics, individual diagnostic functions can be deselected if they are not relevant for troubleshooting.

Language setting



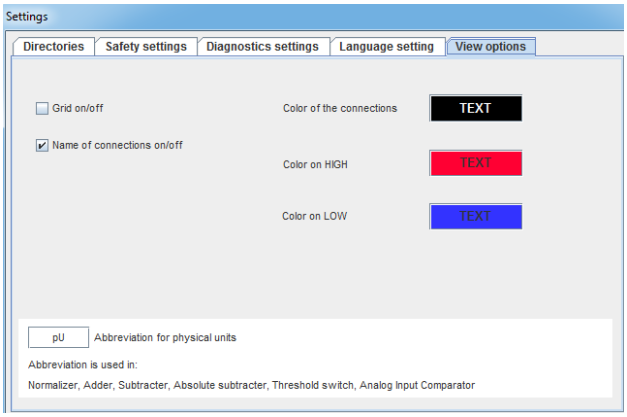
CAUTION

If you change the language, you must restart the Designer.

View options

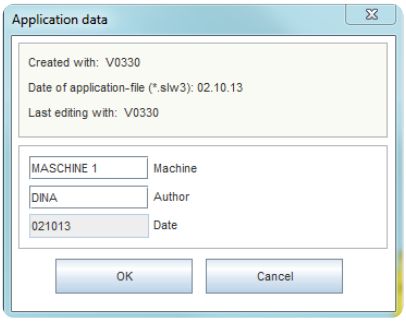
The display of the logic diagram can be changed in various ways.

- Display/hide the background grid in the logic diagram
- Display/hide the name of the connection lines
- Color of the connection lines
- Color of a connection line in the online diagnostics if it has a HIGH logic state.
- Color of a connection line in the online diagnostics if it has a LOW logic state.
- Abbreviation for physical units of the elements listed below the unit.



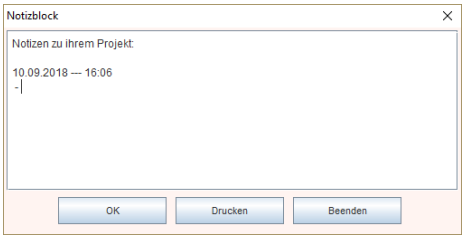
3.3.2 Application data

Application-specific data can be queried here. (Fig. 3-11). You can also enter the name of the machine and the author.



3.3.3 Project notes

Notes for the project can be entered and printed here (Fig. 3-12). These are automatically provided with date and time. The notes are not visible in the project documentation.



3.3.4 Netlist Switching

Depending on the SL Vario hardware, 350 or 500 netlists are available. Switching takes place via this menu item.

3.3.5 Statistics

Statistics provides you with a list of elements and netlists that are still available.
E.g.: Netlists 337/350 means: 337 of 350 netlists are still available.

3.3.6 Marker list

The marker list contains all placed input markers and the page reference to the corresponding output marker.

3.3.7 Project comparison

The central module must be connected to the PC to perform this operation. The various tables of the current project are then compared with the project stored in the central module.

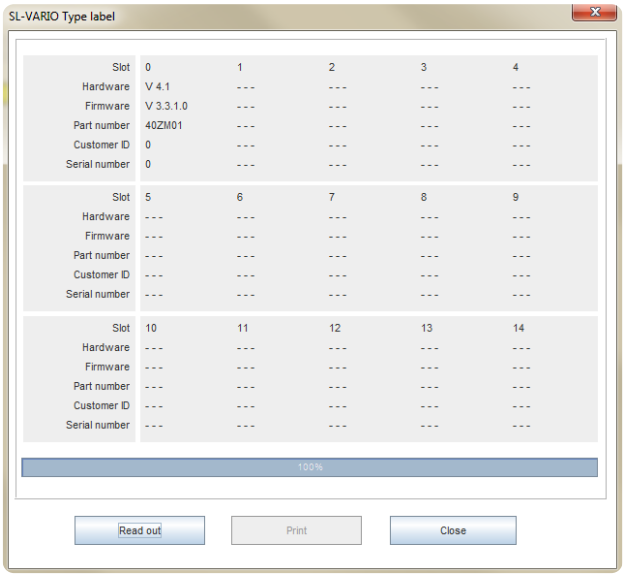
3.3.8 Type label

Electronic type labels are stored in the SL VARIO modules. These can be read out. (Fig. 3-13)

▶ Connect the central module to your computer.

▶ Read out the type label (READ OUT)

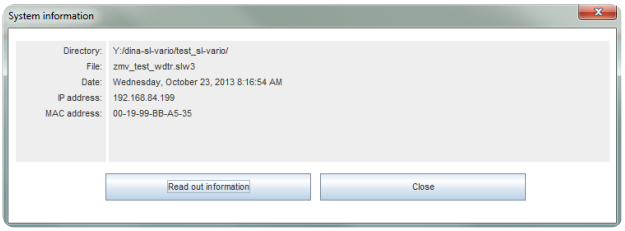
Press "Print" to create a PDF document.



3.3.9 System information

The central module must be connected to the PC to perform this operation.
You receive the following information (Fig. 3-14)

- Path of the last transmitted application file
- File name of the last transmitted application
- Date and time of transmission (time stamp)
- IP and MAC address of the PC from which the file was transmitted.



3.3.10 Project validation

▶ Connect the central module to your computer.

▶ Start validation with the "Start validation" button.

Following successful validation, a PDF document is automatically created and opened. All validation data is listed in this file. If a validation was already performed, the information can be called up again.

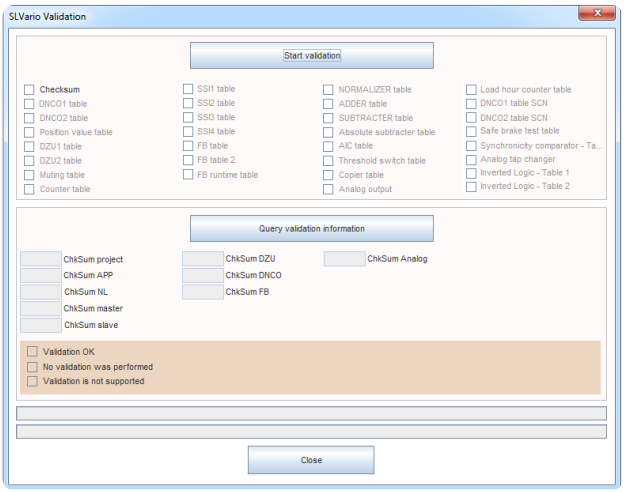


Fig. 3-15

3.3.11 SL VARIO Information

The program displays information on the firmware of the connected central module and the available functions. If you selected or placed functions that are not supported by the firmware, they are listed.

▶ Connect the central module to your computer.

▶ Start the function with the "Read out firmware" button.

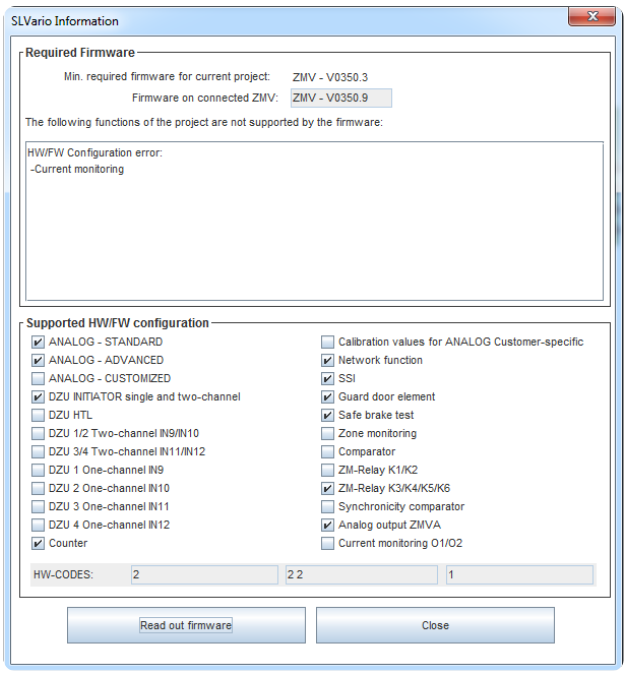


Fig. 3-16

3.3.12 Importing/exporting texts

The texts used in an application can be exported to a text file, edited and then imported again.

▶ "Export file": All texts are stored in a text file with extension .lang. (Fig. 3-17)

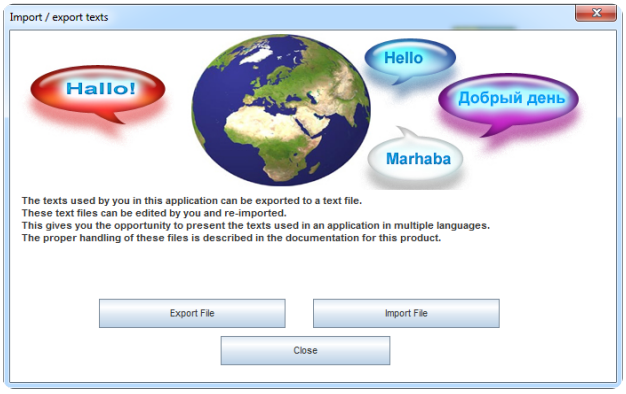


Fig. 3-17

▶ Open and edit the text file with a text editor. (Fig. 3-18)

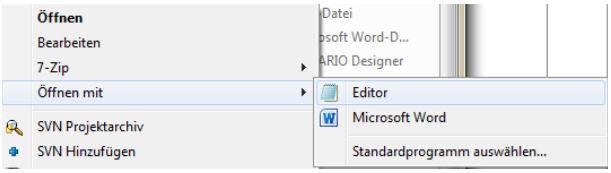


Fig. 3-18

Please note that only the text – not the previous addressing – may be changed. The number before the "=" indicates the maximum character length. (Fig. 3-19)

```
GATE.00.0009.00002.2.255=Schutztüre Arbeitsraum
GATE.00.0009.00002.2.255=Schutztüre Wartungsraum
GATE.00.0008.00002.2.255=Schutzbereich Spindel i.O.
GATE.01.0024.00046.1.008=SB_SP1
GATE.01.0024.00046.2.255=Schutzbereich Spindel i.O.
```

Example:

GATE.00.0009.00002.2.	255	Schutztüre Arbeitsraum
Adresse	Max. Zeichen	Text

▶ Save the text file with extension .lang

▶ "Import File": the edited file is read in

CAUTION

Terminal designations are retained after a logic symbol is deleted and are, thus, included in the text file. These can be deleted in the Parameters - Tables - Connection terminals menu.

3.3.13 Checksum APP

Two checksums are displayed (Fig. 3-20)

- Application data
- Logic data only

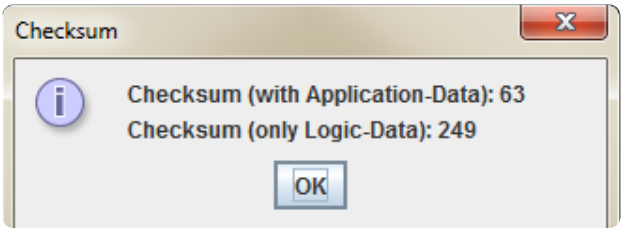


Fig. 3-20

3.3.14 Number of FB octets

When using a fieldbus module, the number of used octets can be queried here. (Fig. 3 21)

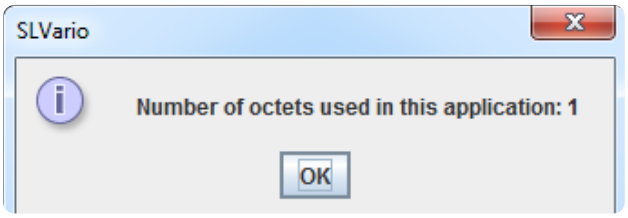


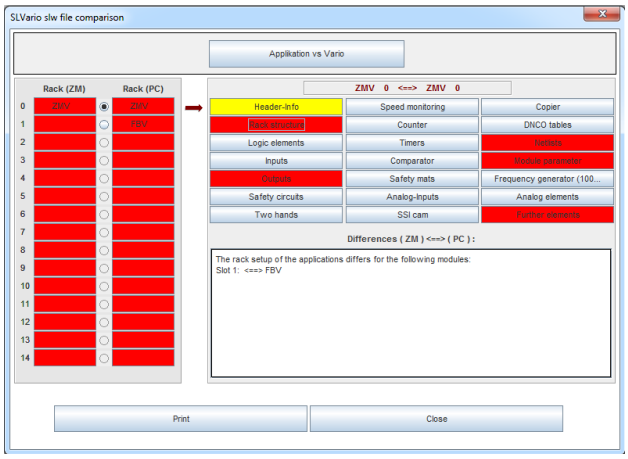
Fig. 3-21

3.3.15 SLW file comparison

Use this function to compare the application on your computer with the application on the central module.

▶ **Start the comparison with "Application vs. Vario".**

The hardware configuration is displayed in the left field.



The areas in red indicate that there are differences here. You can obtain further information by selecting the slot and the area in the right field. The differ-ences are listed in the info window located underneath.

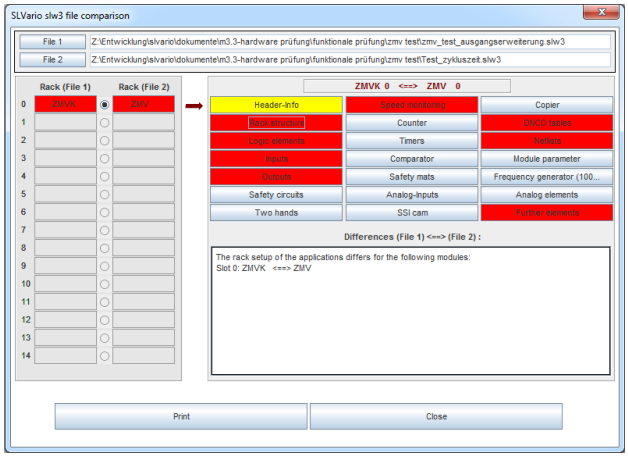
This information can be printed out.

3.3.16 SLW3 file comparison

This function compares two applications with one another.

▶ **Use the File 1 and File 2 buttons to select the two applications.**

The hardware configuration is displayed in the left field.



The areas in red indicate that there are differences here. You can obtain further information by selecting the slot and the area in the right field. The differ-ences are listed in the info window located underneath. This information can be printed out.

3.3.17 Search element

It is possible to search for certain elements or modules in this menu. Various search criteria are available.

- Slot
- Element group
- Name/description

The corresponding elements are listed after selecting the search criteria.

- Use the "Element", "Name" or "Page" button to list alphabetically.
- Click the desired element to open this page

Please note that when searching by name/description, the "Search" button must also be pressed.

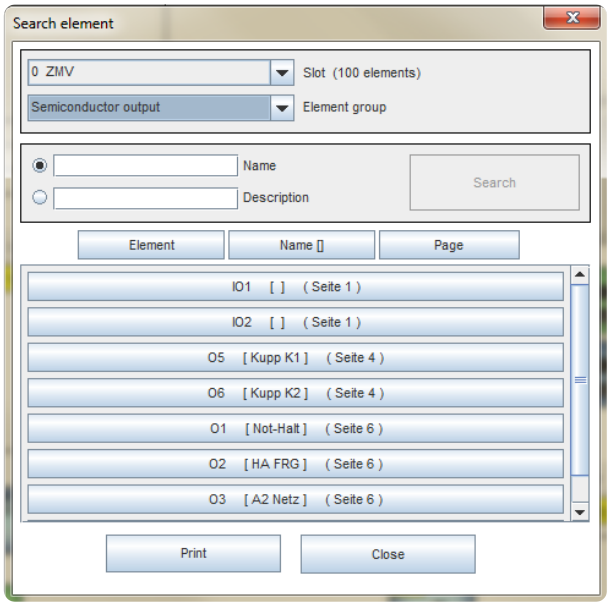


Fig. 3-24

You can also enter just part of a name or of designation. In this case, you must enter a * as wildcard character, e.g., *door*.

3.3.18 Password protection

See chapter "Password protection for the application".

3.3.19 Ordering information

An overview of all central modules that support the functions of your application is displayed. (Fig. 3-25)

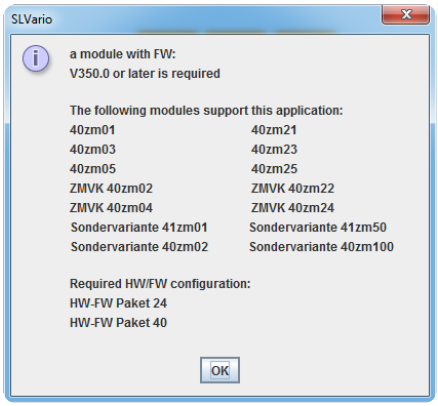


Fig. 3-25

3.4 View

You can switch between the various levels here (hardware configuration, logic, rack diagnostics). (Fig. 3-26)

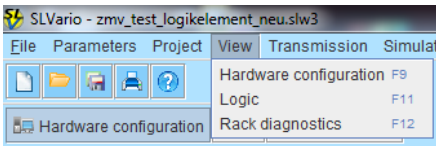


Fig. 3-26

3.5 Transmission

The following selection appears under the "Transmission" menu item. (Fig. 3-27)

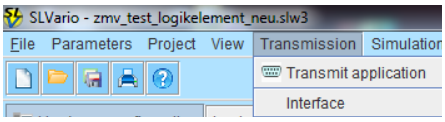


Fig. 3-27

3.5.1 Transmit application

The following steps are necessary for transmitting the application to the central module.

- **Connect the central module to your computer.**
- **Select the COM port.**
- **Start transmission with "OK".**

Additional functions are available in this transmission menu. (Fig. 3-28)

- **COM-Port TEST:** A test is performed to determine whether the central module is actually connected to the selected COM port.
- **Refresh COM-Port List:** The first time a central module is connected, the list of COM ports on the PC is updated.
- **Autostart:** The central module is automatically restarted following transmission (beginning with central module firmware 350).
- **Verification:** The program checks whether all data was transmitted in full. Verification precludes the use of autostart. The central module must be restarted.
- **Machine, author, date:** A ten-character machine name and a six-character author name can be entered. The date is generated automatically.
- **Firmware comparison test:** During transmission, plausibility checks between the application and the firmware of the connected hardware are performed.

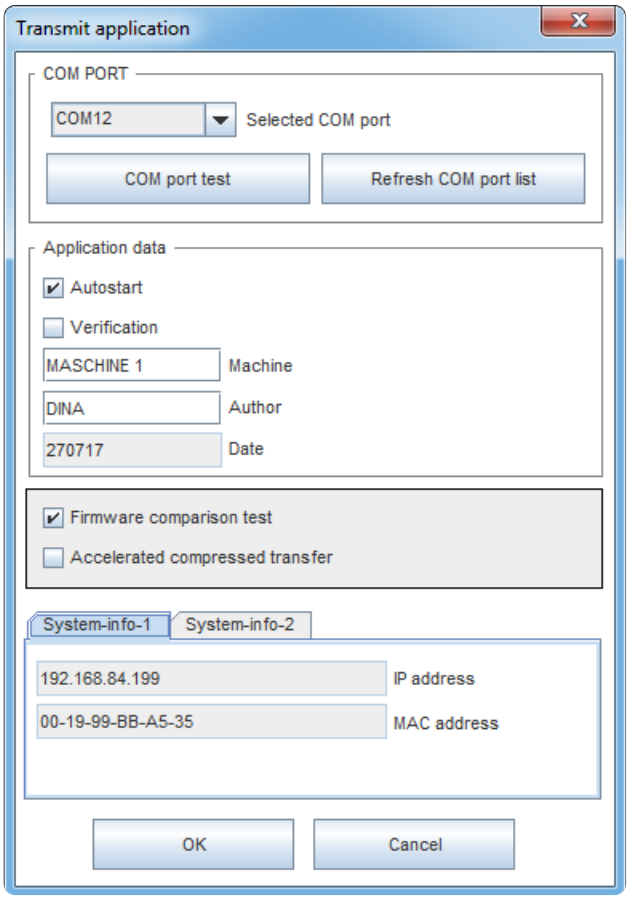


Fig. 3-28

The data of system info 1 and 2 is also transmitted to the central module. (Fig. 3-29)

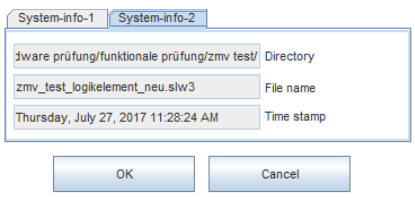


Fig. 3-29

3.5.2 Interface

You can use the following parameters to set the transmission interface.

- **COM Port**
- **Speed:** During initial commissioning, this value is to be adapted to the computer. If a checksum error appears after transmission, select a smaller value.
- **Timeout:** If problems occur during diagnostics due to delays on the data line (e.g., diagnostics via remote maintenance), increase the timeout.
- **COM-port TEST:** A test is performed to determine whether the central module is actually connected to the selected COM port.
- **Refresh COM-port list:** The first time a central module is connected, the list of COM ports on the PC is updated.

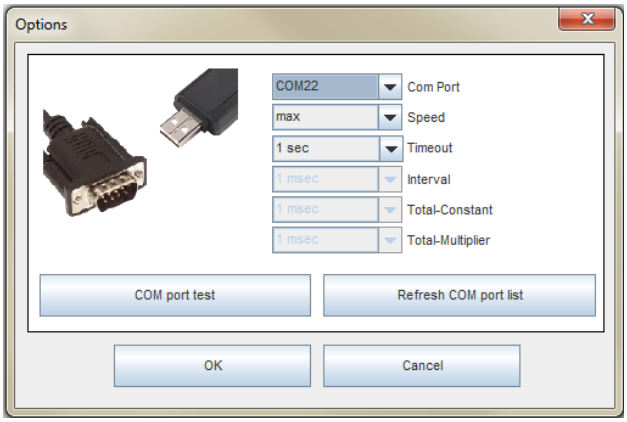


Fig. 3-30

3.6 Simulation

In Simulation, you can simulate an existing application without connected hardware. A presetting can be made in the Simulation function menu (Fig. 3 31). You can find further information on simulations in chapter "Simulation".

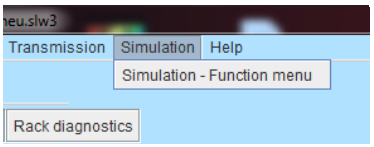


Fig. 3-31

3.7 Help

In Help (Fig. 3-32) you can find:

- the Designer operating instructions
- the hardware operating instructions
- the diagnostics operating instructions
- information on the Designer version

You can also call up the Help files with function keys F1 to F3 on your computer.

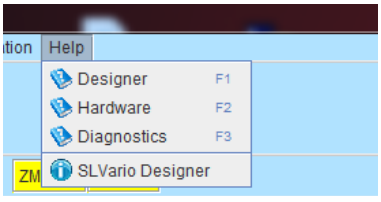
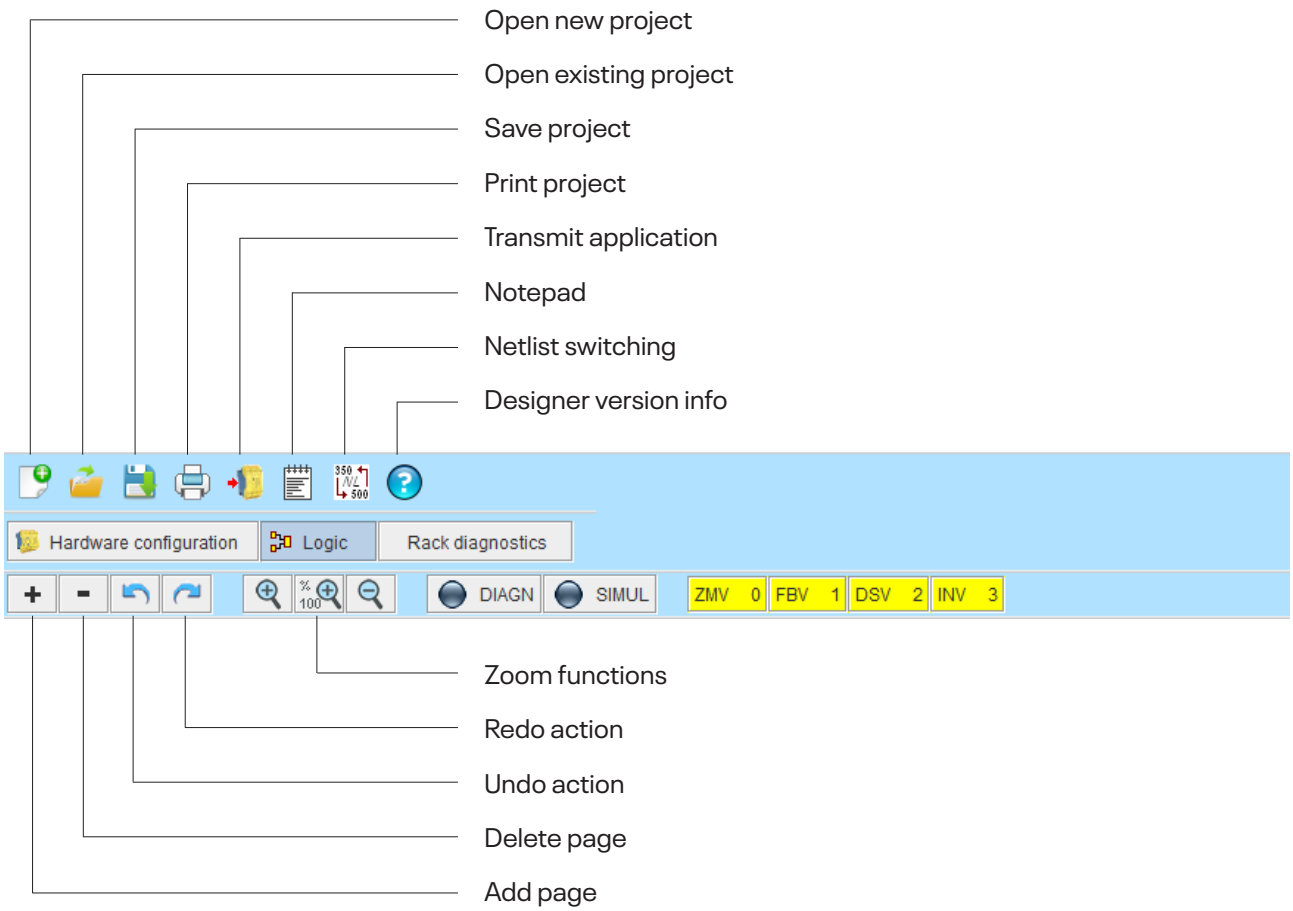


Fig. 3-32

4 Navigation buttons

With the navigation buttons (Fig. 4-1), you can quickly switch between the "hardware configuration", "logic" and "rack diagnostics" function levels as well as select the file functions. You can also select online "diagnostics" and "simulation" here. Open the respective toolbar using the buttons of the modules.

The icon buttons have the following meaning:



4.1 Notepad

This button opens a notepad in which you can enter and print project notes sorted by date and time. These are not visible in the project documentation.

4.2 Netlist switching

Depending on the SLVario hardware, 350 or 500 netlists are available. Switchover is done via this button or in the menu item "Project".

4.3 Zoom function

You change the size of the logic diagram either with the mouse wheel or with the following three buttons.

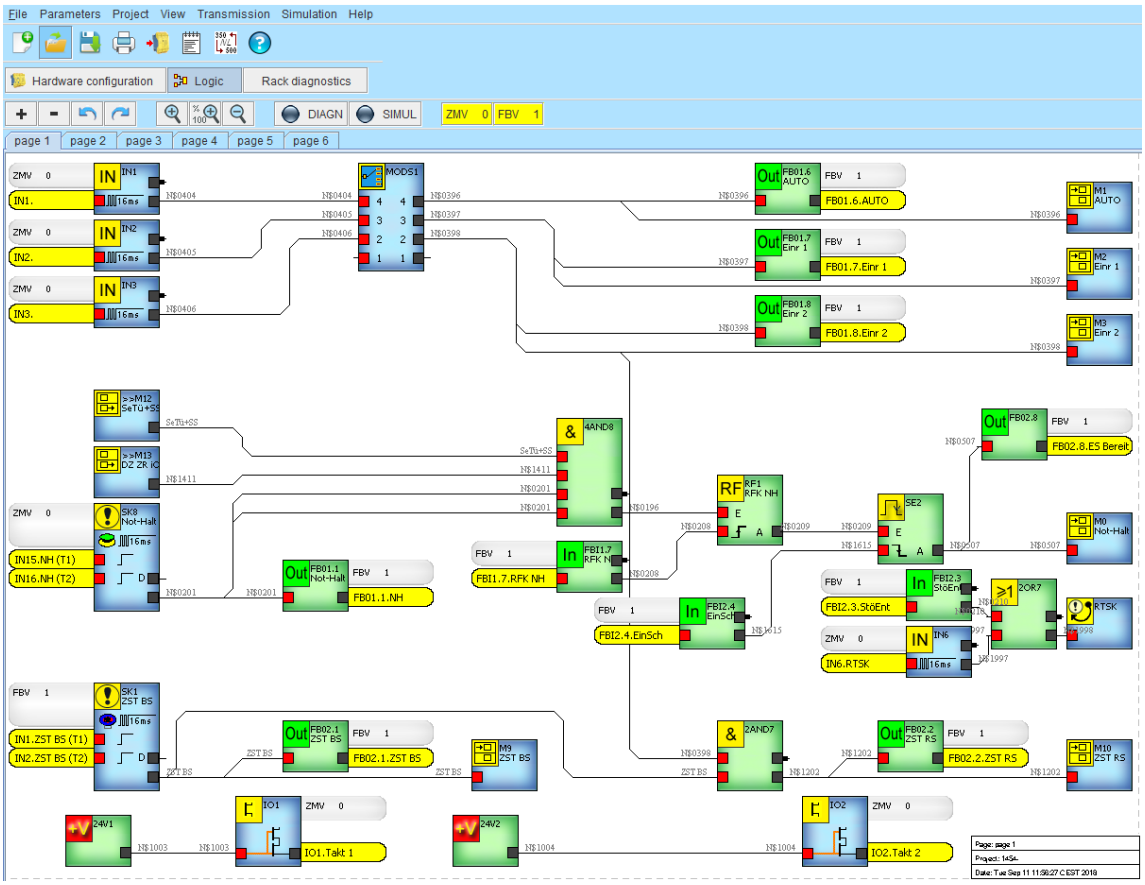
enlarge in steps

decrease in steps

reset to original size

5 Logic

You create the logic diagram for your application in this area. An extensive library of standard and safety elements is available for each SL VARIO module. You can find an overview of all elements in chapter "Toolbar of the SL VARIO modules". In the logic diagram, you place the elements, connect them according to your circuit diagram specifications and configure them according to your machine-specific requirements.



5.1 Placing an element

▶ Open the toolbar of the SL VARIO module by clicking on the corresponding module. (Fig. 5-2)

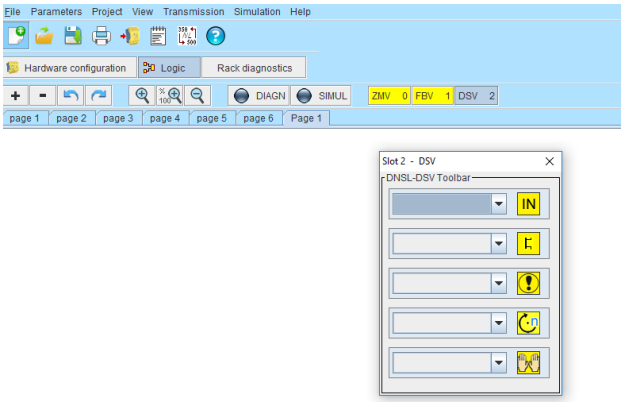


Fig. 5-2

▶ Select the element. (Fig. 5-3)

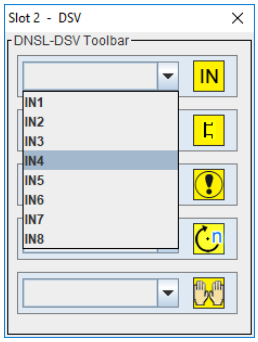


Fig. 5-3

After making a selection, the corresponding parameter mask opens. (Fig. 5-4)

You can enter element-specific data here.

This differs depending on the function of the element and is explained in greater detail in the corresponding chapters.

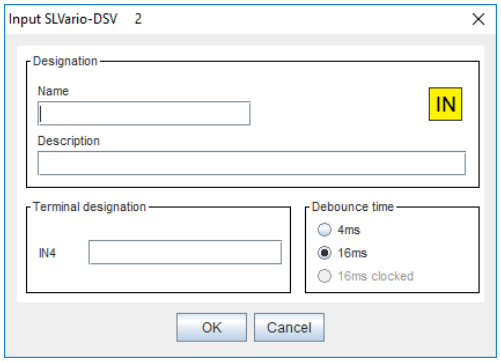


Fig. 5-4

▶ Enter the application-specific data.

▶ Confirm with "OK".

The symbol appears on the logic. (Fig. 5-5)

▶ Move the symbol to the desired location and conclude placement with the left mouse button.

A symbol that has already been placed can be moved later by selecting it and moving it with mouse button pressed down.

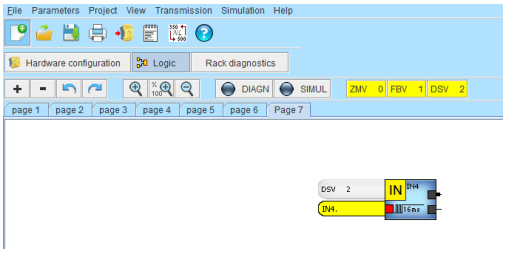


Fig. 5-5

5.2 Opening element properties

▶ Select the element with the right mouse button.

▶ Select "Properties".

or

▶ Double-click the left mouse button on the element.

You can access Help for an element that has been placed by right-clicking the element on the logic diagram and then selecting the "Help..." item from the context menu that opens.

5.3 Selecting multiple elements

▶ Hold the left mouse button pressed down while you drag a frame around the desired elements.

or

▶ Group individual elements into an element group by selecting individual elements with the left mouse button while holding down the shift key.

5.4 Deleting elements

▶ Delete selected elements/element groups with the "DELETE" key.

or

▶ Select the element with the right mouse button. Select "Remove".

5.5 Moving elements

▶ Select the element/selected element groups with the right mouse button.

▶ Select "Move to ...".

▶ Select the page to which the elements are to be moved.

5.6 Copying elements

▶ Select the elements/selected element group with the right mouse button.

▶ **Select "Copy":**

The elements are copied to a buffer and can be inserted into the same application.

▶ **Select "Copy to file ...":**

The elements are copied to a buffer and can be inserted into another application.

How to insert the copied elements is described in chapter "General functions in the logic diagram".

5.7 Input → Duplicates

▶ Select the input with the right mouse button.

▶ Select "Input → Duplicates".

A list of all pages on which this input was used is displayed. (Fig. 5-6)

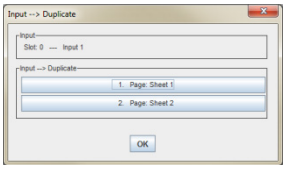


Fig. 5-6

5.8 Connecting elements

350 netlists are available for connecting the elements. Each connection reduces the netlist number by 1. Under "Project" - "Statistics" you can find the netlists that are still available.

Wiring is always from an element output to an element input. (Fig. 5-7)

▶ Click on the output of the element.

▶ Move the mouse pointer to the input of the element that you would like to connect.

▶ Click on the input.

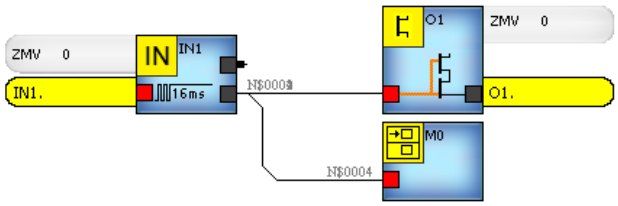


Fig. 5-7

The line between the two points is created automatically. It is also possible to define intermediate points with the mouse pointer. (Fig. 5-8)

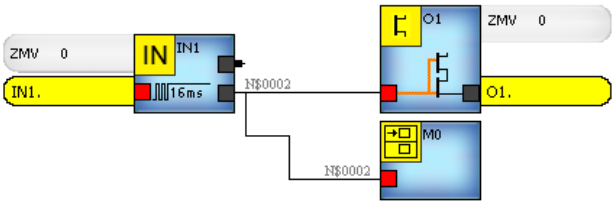


Fig. 5-8

5.9 Deleting logic diagram wiring

While wiring, you can undo individual connections with the "ESC" key step-by-step, all the way back to the initial situation.

Existing connections are deleted with the right mouse button and the "Delete connection" function or with the "Delete" key.

5.10 Connection properties

Each connection can be assigned an 8-character name and an 80-character description.

▶ Select the connection with the right mouse button.

▶ Select "Properties".

If you assign a name, it then appears on the connection in the logic diagram. (Fig. 5-9)

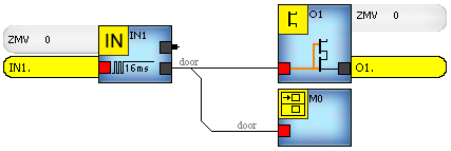


Fig. 5-9

5.11 General functions in the logic diagram

Click the right mouse button in an empty area of the logic diagram. The following selection menu appears (Fig. 5-10).

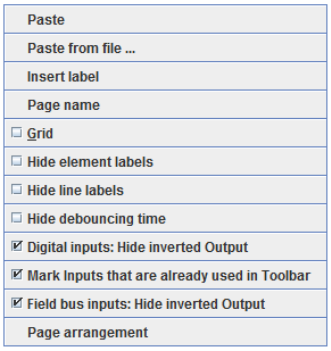


Fig. 5-10

5.11.1 Paste

Use the "Paste" function to insert previously copied elements (see chapter "Copying elements") into an application.

- Select "Paste": the copied elements appear and can now be moved to the desired location.
- Complete the action with the left mouse button.

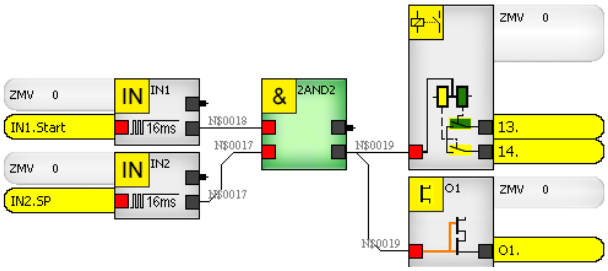


Fig. 5-11

Elements shown in gray must be redefined via the properties. The copy of non-configurable elements is automatically always the next free element of the same type. These are not shown in gray. (Fig. 5-11)

- Select the element with the right mouse button.
- Select "Properties".

or

- Double click on the element.

A list of the elements that are still available is displayed.

- Select the element and complete the process with "OK".
- Configure the element and complete the process with "OK".

5.11.2 Paste from file

Use the "Paste from file" function to insert elements previously copied into a file (see chapter "Copying elements") into an application.

- Select "Paste from file".
- Select the file that you would like to insert. (Fig. 5-12)
- Open the file and insert it at the desired location.

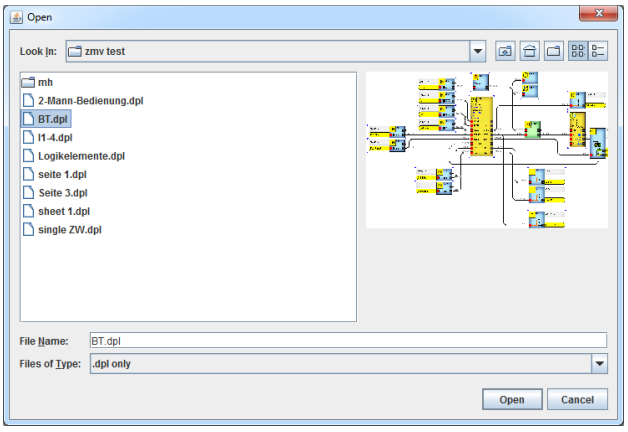


Fig. 5-12

Elements shown in gray must be redefined via the properties. The copy of non-configurable elements is automatically always the next free element of the same type. These are not shown in gray. (Fig. 5-13)

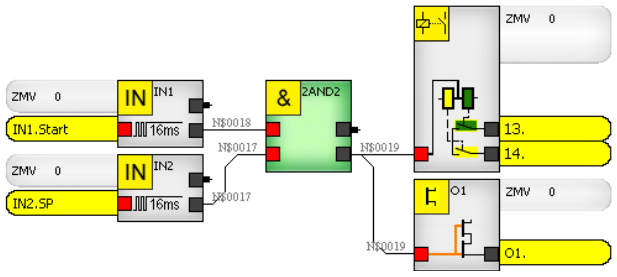


Fig. 5-13

5.11.3 Insert label

Use the "Insert label" function to insert a descriptive text on the logic diagram.

You can format the text and define these attributes as the default. (Fig. 5-14)

If the text is to appear over multiple lines, a "\" must be located at the end of the line.

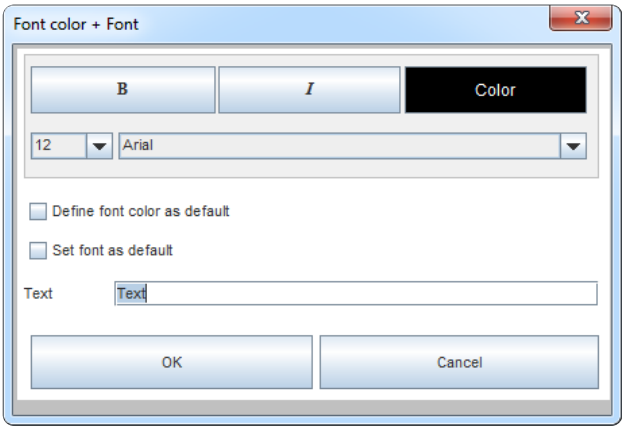


Fig. 5-14

5.11.4 Page name

The designation of a logic diagram page may be up to 40 characters long. (Fig. 5-15)

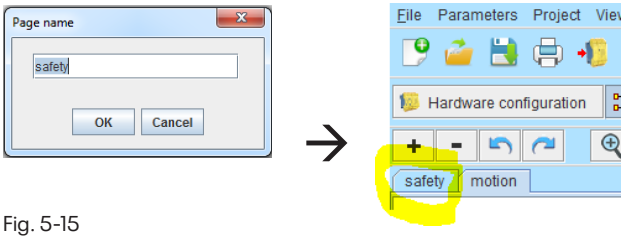


Fig. 5-15

5.11.5 Grid

Select whether you would like to use a grid in the logic diagram.

5.11.6 Hide element labels

If you select "Hide element labels", the element name, terminal designation and element designation do not appear in the logic diagram symbol. (Fig. 5-16)

Fig. 5-16

5.11.7 Hide line labels

If you select "Hide line labels", these no longer appear on the connection lines in the logic diagram. (Fig. 5-17)

Fig. 5-17

5.11.8 Hide debounce time

If you select "Hide debounce time", the debounce time no longer appears in the symbol. (Fig. 5-18)

Fig. 5-18

5.11.9 Hide inverted outputs

If you select "Hide inverted outputs", they no longer appear in the logic diagram symbol. (Fig. 5-19).

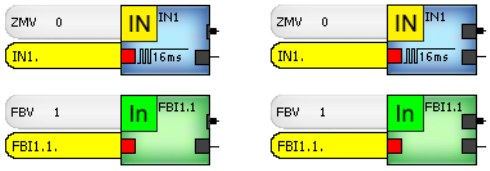


Fig. 5-19

5.11.10 Mark inputs that are already used in the toolbar

Inputs that are already used in the application are marked in the toolbar with an "*". (Fig. 5-20)

Fig. 5-20

5.11.11 Page arrangement

The current logic diagram page can be moved to the position selected in the drop-down menu.

(Fig. 5-21)

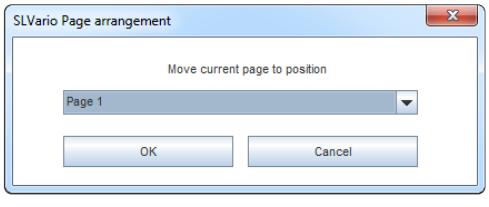


Fig. 5-21

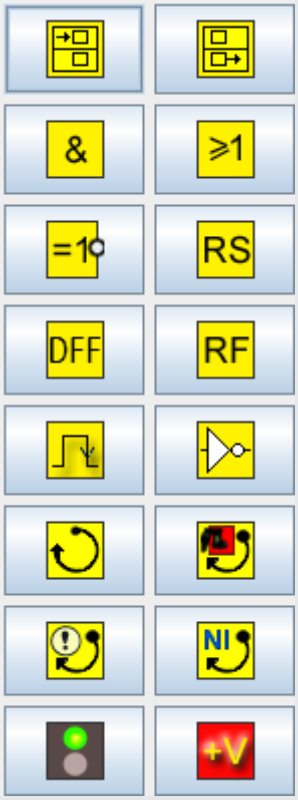
6 Rack diagnostics

Information on this topic can be found in the separate document **SL VARIO Diagnostics** or in the **SL VARIO Designer** via the "F3" key or the Help menu.

7 Toolbar of the SL VARIO modules

Listed below is an overview of the available elements.

7.1 Overview of the elements of the central module

Toolbar 1	Symbol	Function	Number available
		Input marker	100
		Output marker	100
		2-way AND 3-way AND 4-way AND	52 10 26
		2-way OR 3-way OR	52 26
		XNOR	16
		RS flip-flop	8
		D flip-flop	8
		Feedback element	16
		Start element	4
		Inverter	16
		RTDS	1
		RTSM	1
		RTSK	1
		RTNI	1
		SLOK	1
		24V	1

Toolbar 2	Symbol	Function	Number available
		SW operating mode selector	2
		Operating mode selector T	1
		Frequency generator	1
		Watchdog trigger	2
		Analog OK	1
		DSCHK (in preparation)	1
		Proof test	2
		Power-on reset	1

Toolbar 3	Symbol	Function	Number available
		Conversion factor	1
		Adjuster (in preparation)	1
		Adder	8
		Subtracter	4
		Absolute subtracter	4
		Analog input comparator	4
		Threshold switch	2
		Copier	2
		RTAN	1
		Debounce time filter for analog inputs	1
		Power control	1
		Analog step switch	4

7.2 Overview of the elements of the central module and the function modules

Elements	ZMV/ ZMVK	ZMVD	ZMVD2	DSV/ DRV	BIV	INV	IOV	RMV	NIV	FBV	SIV
 Input	✔ 16	✔ 32	✔ 48	✔ 8	✔ 8	✔ 12	✔ 8	✔ 8	✔ 8	✔ 8	✔ 8
 Semicon-ductor output	✔ 6	✔ 6	✔ 6	✔ 7	✔ 7	✔ 4	✔ 7	–	✔ 4	–	✔ 4
 as input or output or clock output, configura-ble in pairs	✔ 4	✔ 4	✔ 4	–	–	✔ 4	–	–	–	–	–
 Relay output	✔ 0, 2/ 6	✔ 0, 2/ 6	✔ 0, 2/ 6	–	–	–	–	✔ 2	–	–	–
 Timer	✔ 15	✔ 15	✔ 15	–	–	–	–	–	–	–	–
or					–						
 Single-input timer	✔ 30	✔ 30	✔ 30	–	–	–	–	–	–	–	–
 Counter	✔ 4	✔ 4	✔ 4	–	–	–	–	–	–	–	–
 Com-parator [1]	✔ 16	✔ 16	✔ 16	–	–	–	–	–	–	–	–
 Safety circuit	✔ 8	✔ 8	✔ 8	✔ 4	✔ 4	✔ 8	✔ 4	✔ 4	✔ 4	✔ 4	✔ 4

Elements	ZMV/ ZMVK	ZMVD	ZMVD2	DSV/ DRV	BIV	INV	IOV	RMV	NIV	FBV	SIV
 Two hands	✔ 2	✔ 2	✔ 2	✔ 1	✔ 1	✔ 1	✔ 1	✔ 1	–	✔ 1	–
 Speed moni-toring	✔ 2	✔ 6	✔ 6	✔ 2	✔ 2	–	–	–	–	–	✔ 2
 Scanner	✔ 2	✔ 2	✔ 2	–	–	–	–	–	–	–	–
 Safety mat	✔ 8	✔ 8	✔ 8	–	–	–	–	–	–	–	–
 Analog input	✔ 8 IN1-8	✔ 8 IN1-8	✔ 8 IN1-8	–	–	–	–	–	–	–	–
 AOPD	✔ 2	✔ 2	✔ 2	–	–	–	–	–	–	–	–
 Multiplexer	✔ 2	✔ 2	✔ 2	–	–	–	–	–	–	–	–
 1 of N	✔ 4	✔ 4	✔ 4	–	–	–	–	–	–	–	–
 Cam	✔ 64	✔ 64	✔ 64	–	–	–	–	–	–	–	–
 Analog output [2)]	✔ 2	✔ 2	✔ 2	–	–	–	–	–	–	–	–
 Door element	✔ 16	✔ 16	✔ 16	–	–	–	–	–	–	–	–

Elements	ZMV/ ZMVK	ZMVD	ZMVD2	DSV/ DRV	BIV	INV	IOV	RMV	NIV	FBV	SIV
 Safe brake test	✔ 8	✔ 8	✔ 8	–	–	–	–	–	–	–	–
 Synchronous comparator	✔ 1	✔ 1	✔ 1	–	–	–	–	–	–	–	–
 Pulse shaper	✔ 8	✔ 8	✔ 8	–	–	–	–	–	–	–	–
 Normalizer	✔ 8	✔ 8	✔ 8	–	–	–	–	–	–	–	–
 Current monito-ring	✔ 2	✔ 2	✔ 2	–	–	–	–	–	–	–	–
 Binary coder	✔ 2	✔ 2	✔ 2	–	–	–	–	–	–	–	–
Binary decoder	✔ 2	✔ 2	✔ 2	–	–	–	–	–	–	–	–
 Switch 1 of 2	✔ 8	✔ 8	✔ 8	–	–	–	–	–	–	–	–
 Serial diagnosis	✔ 4	✔ 4	✔ 4	–	–	–	–	–	–	–	–
 FB input	–	–	–	–	–	–	–	–	–	✔ 32	–
 FB output	–	–	–	–	–	–	–	–	–	✔ 128	–

Elements	ZMV/ ZMVK	ZMVD	ZMVD2	DSV/ DRV	BIV	INV	IOV	RMV	NIV	FBV	SIV
 RTFB	–	–	–	–	–	–	–	–	–	✔ 1	–
 FB version informa-tion	–	–	–	–	–	–	–	–	–	✔ 1	–
 NIV input	–	–	–	–	–	–	–	–	✔ 7x32	–	–
 NIV output	–	–	–	–	–	–	–	–	✔ 7x32	–	–
 SSI terminals	–	–	–	–	–	–	–	–	–	–	✔ 7

1) in preparation 2) hardware-dependent

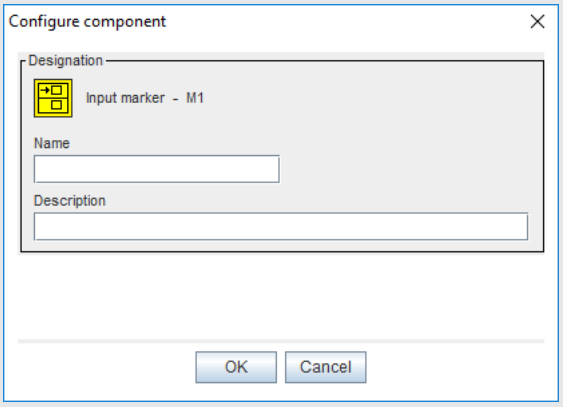
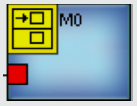
8 Elements of the central module

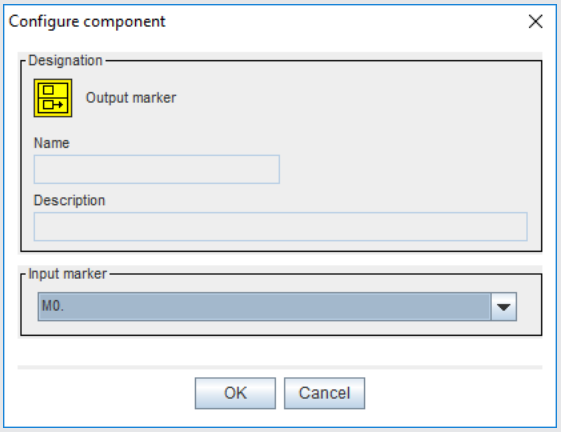
The central module is provided with the most extensive element library. Each element of this library can be precisely defined using a specific parameter mask. These differ in the number and type of parameters. Only the "Name" and "Description" parameters are present on each mask.

- **The name may be up to eight characters long and is displayed in the symbol.**
- **The description may be up to 80 characters long and is only displayed if the mouse pointer moves over the symbol.**

All other parameters are element-dependent and are described in further detail in the following chapters.

8.1 Input and output markers

Toolbar	Parameter mask	Symbol	Description
			Input marker

Toolbar	Parameter mask	Symbol	Description
			Output marker The assignment to the source marker is made via the drop-down menu.

CAUTION

- The output of a +24 V element must not be connected to an input marker.
- Markers must not remain open; they must be wired in the logic diagram.
- It is not possible to connect an output marker directly to an input marker. Alternatively, you can place an OR element between them.

8.1.1 Source – target markers

The function is used for finding the source and target markers in an application.

▶ Select the input or output marker with the right mouse button.

▶ Select "Source<>target markers".

A list of all output markers and their input markers is displayed. (Fig. 8-1)

▶ Select the marker. The corresponding page opens.

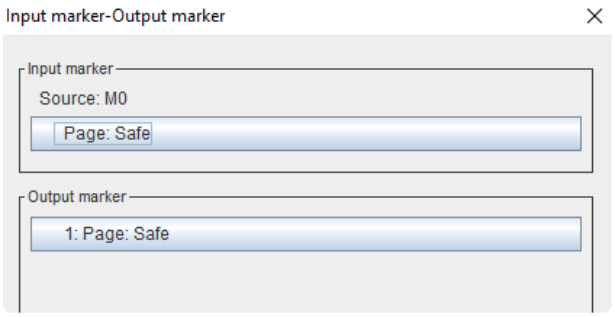
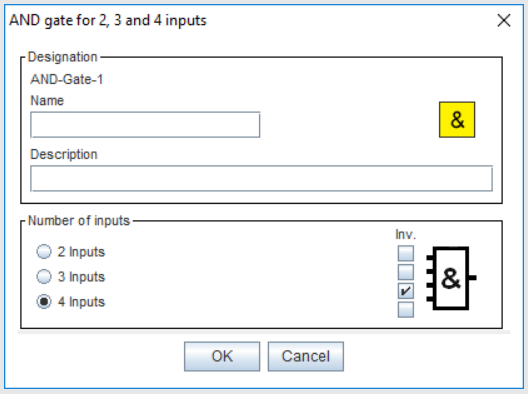
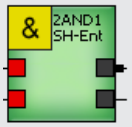
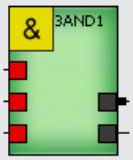
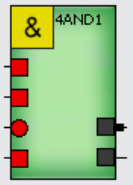


Fig. 8-1

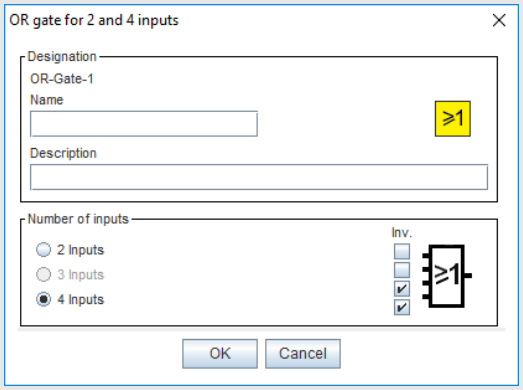
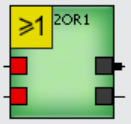
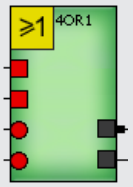
8.2 AND / NAND gates (2-way, 3-way and 4-way)

Toolbar	Parameter mask	Symbol	Description
		 2 inputs  3 inputs  4 inputs, one of which is inverted	Example for 2AND1:

A	B	Y	/Y
0	0	0	1
0	1	0	1
1	0	0	1
1	1	1	0

A Input 1
B Input 2
Y Output
/Y Negated output (corresponds to a NAND)
inverted input

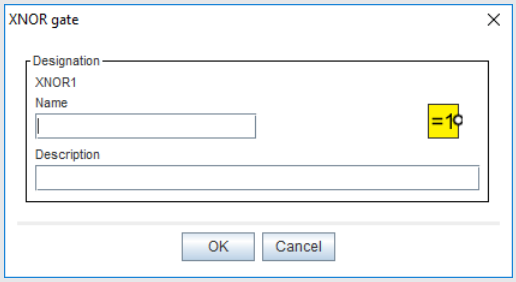
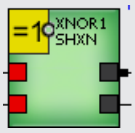
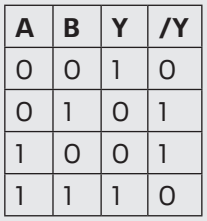
8.3 OR / NOR gates (2-way and 4-way)

Toolbar	Parameter mask	Symbol	Description
		 2 inputs  4 inputs, two of which are inverted	Example for 2OR1

A	B	Y	/Y
0	0	0	1
0	1	1	0
1	0	1	0
1	1	1	0

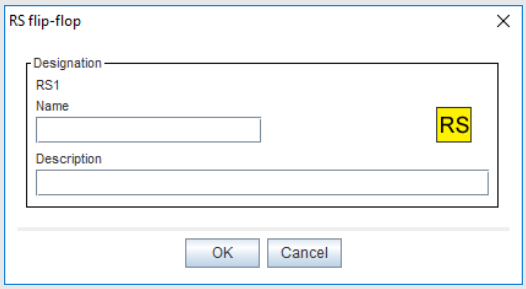
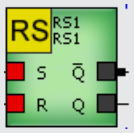
A Input 1
B Input 2
Y Output
/Y Negated output (corresponds to a NOR)
inverted input

8.4 XNOR / XOR gates

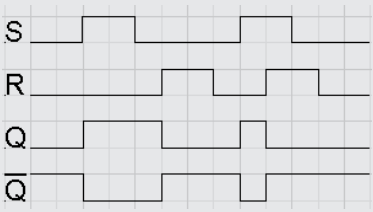
Toolbar	Parameter mask	Symbol	Description
			 A Input 1 B Input 2 Y Output /Y Negated output (corresponds to an XOR)

A	B	Y	/Y
0	0	1	0
0	1	0	1
1	0	0	1
1	1	1	0

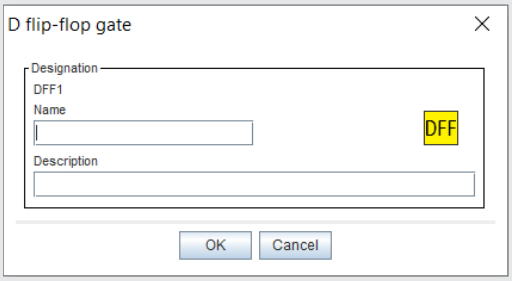
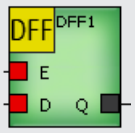
8.5 RS flip-flop

Toolbar	Parameter mask	Symbol	Description
			**Normal state after PWR ON:** Q=0, /Q =1 **Set:** If input S is HIGH, output Q is set to HIGH. **Save:** If input S is LOW, output Q remains unchanged. **Reset:** If HIGH is applied to input R, output Q is set to LOW and /Q is set to HIGH. **Save:** If input R is LOW, output /Q remains unchanged.

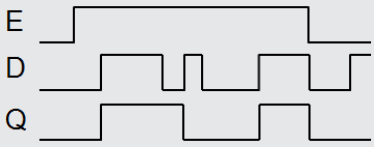
Pulse diagram



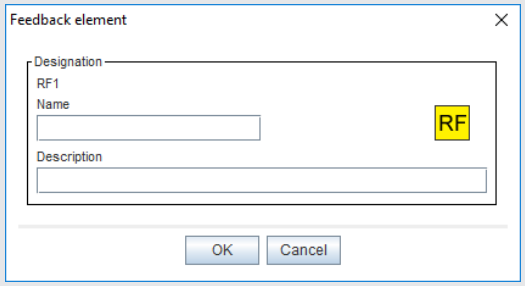
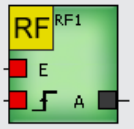
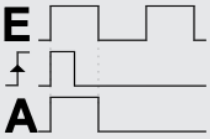
8.6 D flip-flop

Toolbar	Parameter mask	Symbol	Description
DFF			**Set:** If input E is HIGH and there is a rising edge on input D, output Q is set to HIGH. **Reset:** If input E is HIGH and there is a rising edge on input D, output Q is set to LOW.

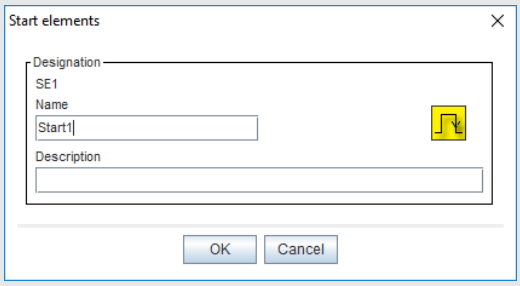
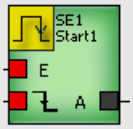
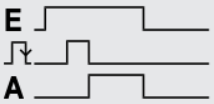
Pulse diagram



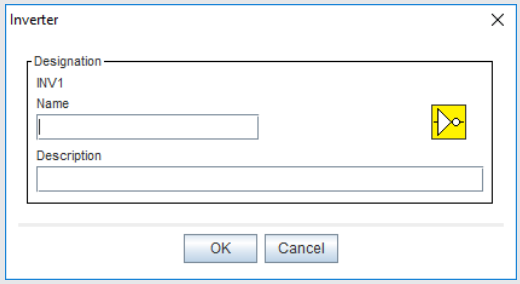
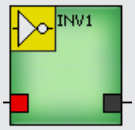
8.7 Feedback element

Toolbar	Parameter mask	Symbol	Description
RF			**Pulse diagram** 

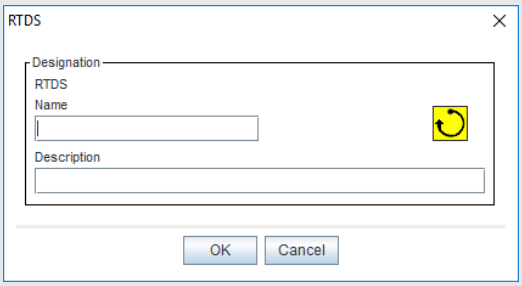
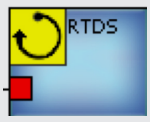
8.8 Start element

Toolbar	Parameter mask	Symbol	Description
			Pulse diagram 

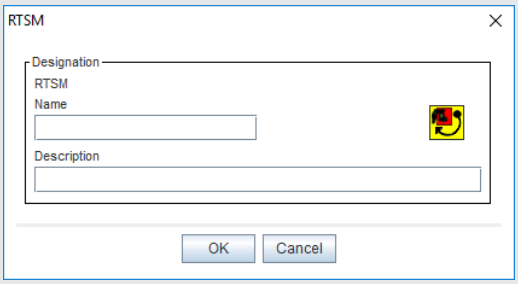
8.9 Inverter

Toolbar	Parameter mask	Symbol	Description
			The inverter inverts the incoming signal.

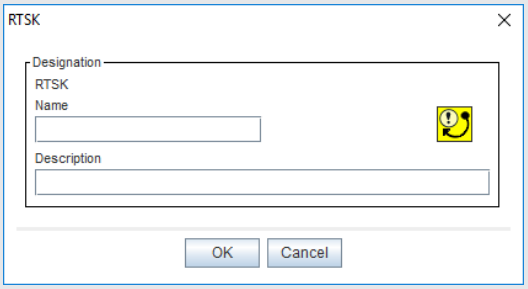
8.10 RTDS (reset speed monitoring)

Toolbar	Parameter mask	Symbol	Description
			Acknowledgment of triggered speed monitors Acknowledgment occurs on the rising edge and must be applied >100 ms. See also chapter "Speed monitoring". The element can only be placed once.

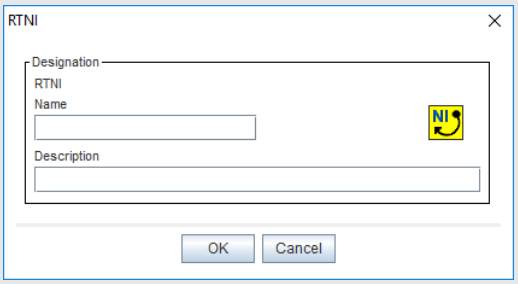
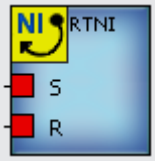
8.11 RTSM (reset safety mat)

Toolbar	Parameter mask	Symbol	Description
			Acknowledgment of triggered safety mat monitors. Acknowledgment occurs on an edge change on a mat that has not been actuated. The safety mat is automatically switched on again if RTSM is not used in the application. See also chapter "Analog inputs for safety mats". The element can only be placed once.

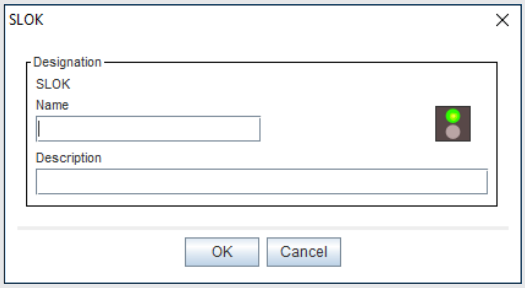
8.12 RTSK (reset error messages)

Toolbar	Parameter mask	Symbol	Description
			Acknowledgment of error message, e.g., in safety circuits or triggered speed monitors (latch). Acknowledgment occurs on a falling edge. See also chapter "Safety circuits". The element can only be placed once.

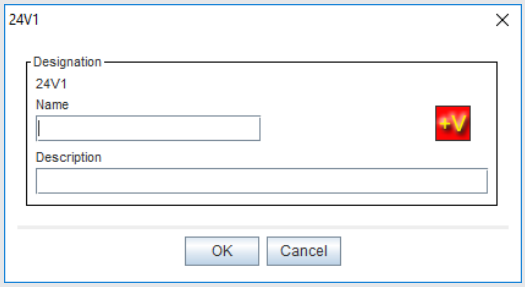
8.13 RTNI (release network input information)

Toolbar	Parameter mask	Symbol	Description
			Release the network input information for DNSL-NIV. **S-Eingang:** Release the network input information. **R-Input:** Reset the network inputs. This is dominant. **Normal state after PWR ON:** RTNI is reset! The element can only be placed once.

8.14 SLOK (SafeLine ok)

Toolbar	Parameter mask	Symbol	Description
			Output is HIGH if SL VARIO is ready for operation. The element can only be placed once.

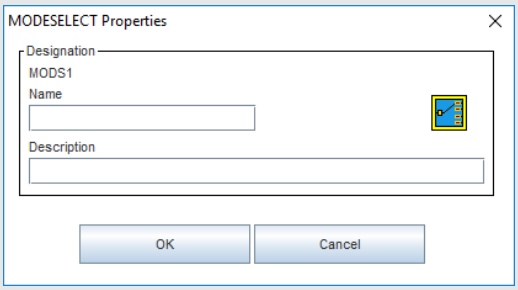
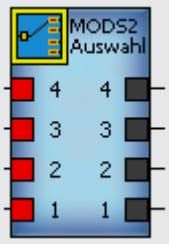
8.15 Virtual 24 V

Toolbar	Parameter mask	Symbol	Description
			The output is also HIGH on SLOK OFF. The element can be used multiple times.

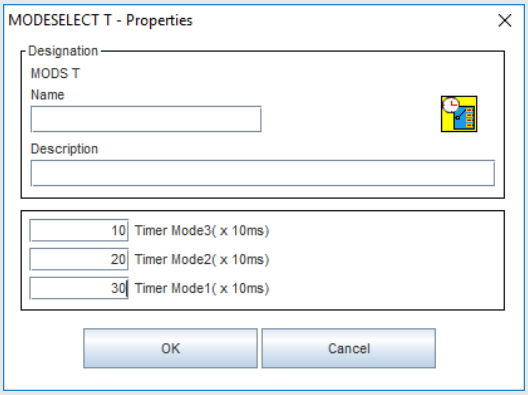
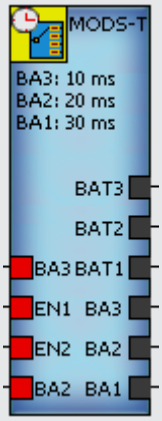
CAUTION

▶ The output must not be connected to an input marker.

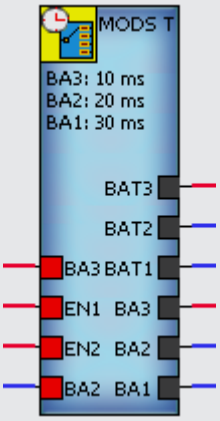
8.16 Mode select (SW operating mode selector)

Toolbar	Parameter mask	Symbol	Description
			HIGH level on the input switches on the corresponding output. If more than one input is actuated, all outputs are LOW.

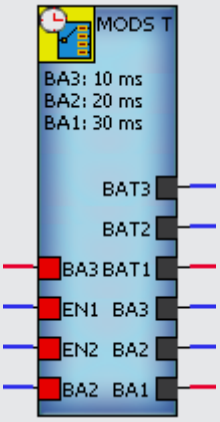
8.17 Operating mode selector T

Toolbar	Parameter mask	Symbol	Description
			Operating modes switch with a time delay. Timer BA1 – 3: Delay times Operating modes 2 and 3 expect enable signals EN1 and EN2. If no inputs are active, outputs BA1 and BAT1 are HIGH. If all inputs are active, no outputs switch. If an enable signal is interrupted or if a different operating mode is selected, the deselected BA output switches immediately and the BAT output switches off with a time delay.

Beispiel:



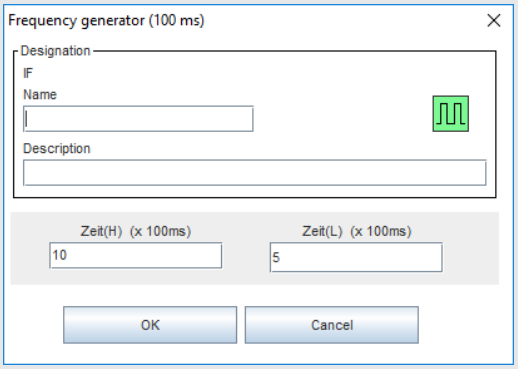
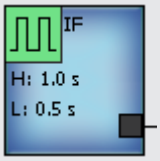
BA3- und EN inputs high
=> BA3/BAT3 active



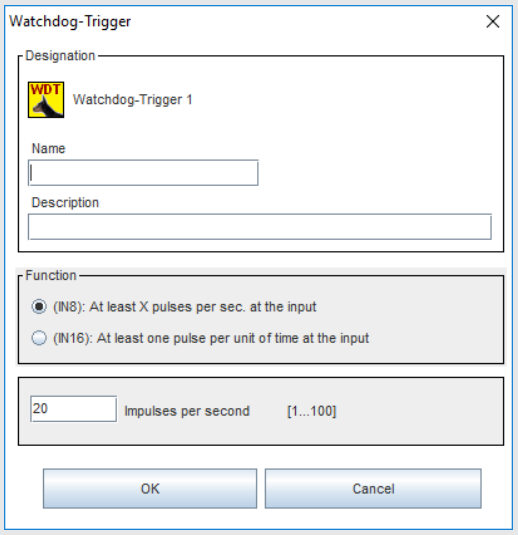
EN inputs low =>

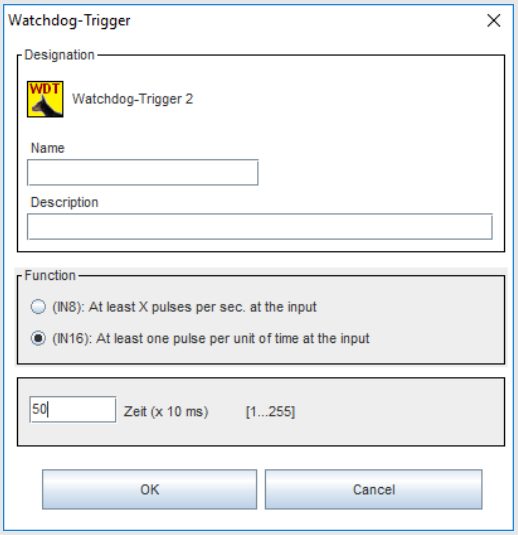
- Output BA3 switches off immediately
- Output BAT3 switches off after 10 ms
- Outputs BA1 and BAT1 switch on immediately

8.18 Frequency generator

Toolbar	Parameter mask	Symbol	Description
			Pulse time (H) and pause time (L) can be set separately in increments of 100 ms 1 = 100 ms, 255 = 25.5 s = maximum value If the value 0 is entered, the output does not switch on. The element can only be placed once.

8.19 Watchdog triggers WDTR1 and WDTR2

Toolbar	Parameter mask	Symbol	Description
			**Watchdog-Trigger WDTR1** checks whether the number of pulses entered in field "Number of pulses /sec" was counted at input IN8 within one second. The normal state of the output is HIGH. It switches off if the required number of pulses is not reached within 1 sec. It switches back on if the pulses again reach the required number.

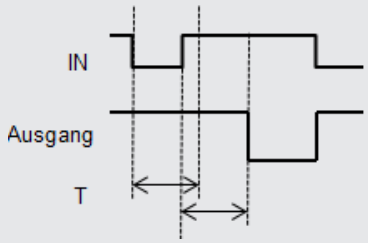


Watchdog-Trigger WDTR2 checks whether a signal change occurs at input IN16 in the specified time.

The time is calculated from the factor that is to be entered (from 1 to 255) multiplied by 10 ms.

The normal state of the output is HIGH. It switches off if no signal change is detected at the input in the specified time inter-val.

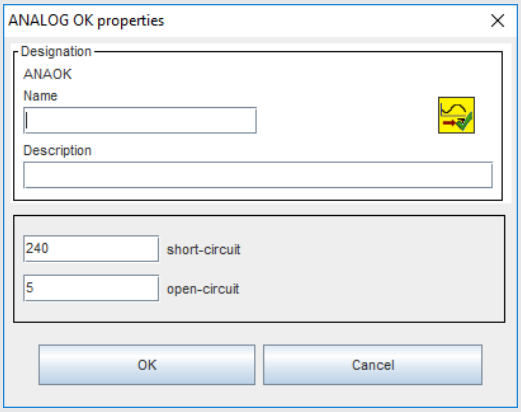
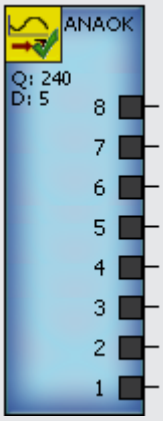
It switches on again if another signal change occurs.



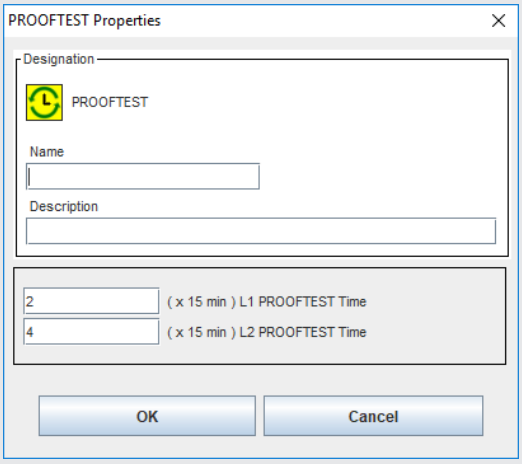
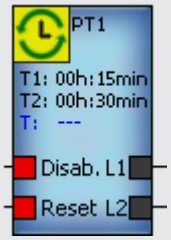
Note:

The LED of IN8 or IN16 on the ZMV corresponds to the state of the WDTR output.

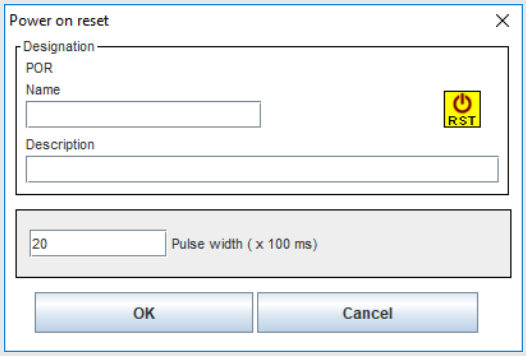
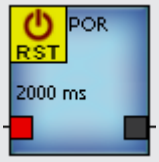
8.20 Analog-OK

Toolbar	Parameter mask	Symbol	Description
			If a cross connection or wire breakage occurs at analog input 1 to 8, the corresponding output 1 to 8 switches off. The values to be monitored must be entered in the "Cross connection" and "Open circuit" fields. The following applies: The entered value must be in the range 0 – 255, corresponding to a voltage range of 0 – 24 V. The element can only be placed once.

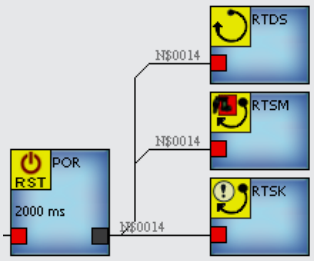
8.21 Proof test

Toolbar	Parameter mask	Symbol	Description
			**Normal state after PWR ON:** Outputs L1 and L2 are HIGH. After time T1 elapses, output L1 switches off; after time T2 elapses, output L2 switches off. **Reset input:** Resets the time on a falling edge. **Disab. input:** Stops the operation and restarts it again when the signal is removed.

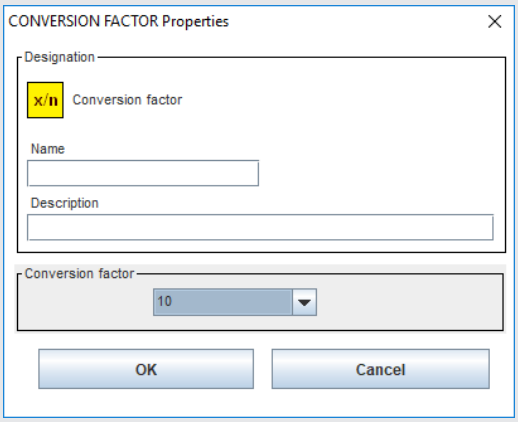
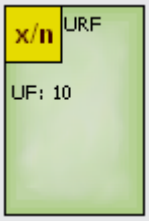
8.22 Power on Reset

Toolbar	Parameter mask	Symbol	Description
			When the system is switched on (Power On) or the input is actuated, the output switches to HIGH for the duration of the configured time. It is not mandatory that the input be wired. The function can be used, e.g., to set the enable signals after switching on. The element can only be placed once.

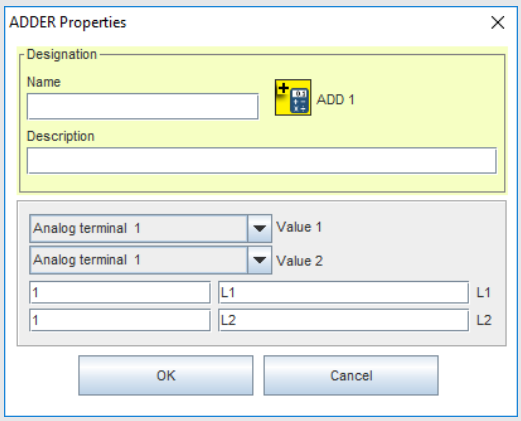
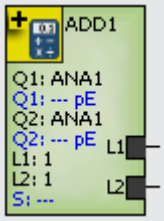
Example



8.23 Conversion factor

Toolbar	Parameter mask	Symbol	Description
			A conversion factor can be selected from the drop-down menu. This appears in the symbol. The element can only be placed once.

8.24 Adder

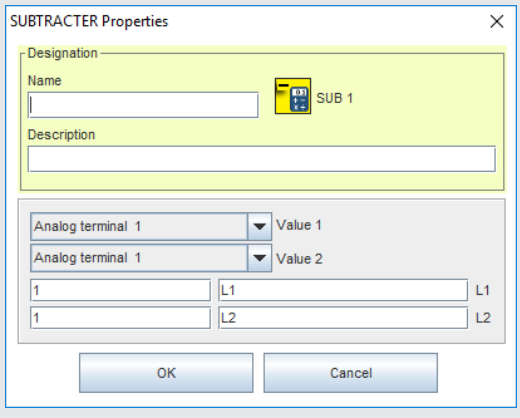
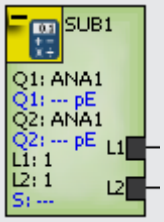
Toolbar	Parameter mask	Symbol
		

Description:

Output L1 is LOW if the sum of "**Value 1**" and "**Value 2**" is less than the entered L1 switch-off value. **Output L2** is LOW if the sum of "**Value 1**" and "**Value 2**" is less than the entered **L2** switch-off value.

Text fields **L1** and **L2** can be overwritten and serve documentation purposes only. "**pE**" in the symbol stands for "physical unit". This can be defined in the "**Project - Settings - View options**" menu.

8.25 Subtracter

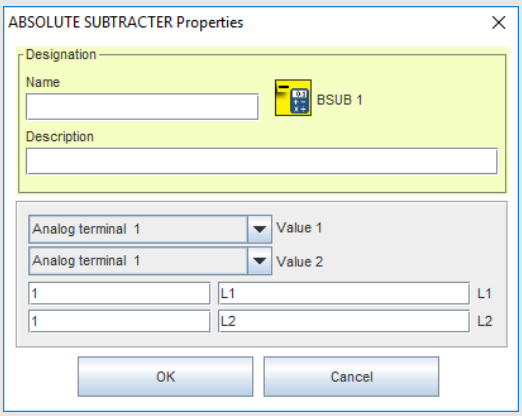
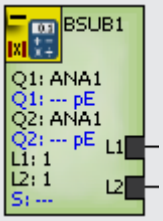
Toolbar	Parameter mask	Symbol
		

Description:

Output L1 is LOW if the difference of "**Value 1**" and "**Value 2**" is less than the entered L1 switch-off value. **Output L2** is LOW if the difference of "**Value 1**" and "**Value 2**" is less than the entered **L2** switch-off value.

Text fields **L1** and **L2** can be overwritten and serve documentation purposes only. "**pE**" in the symbol stands for "**physical unit**". This can be defined in the "**Project - Settings - View options**" menu.

8.26 Absolute subtracter

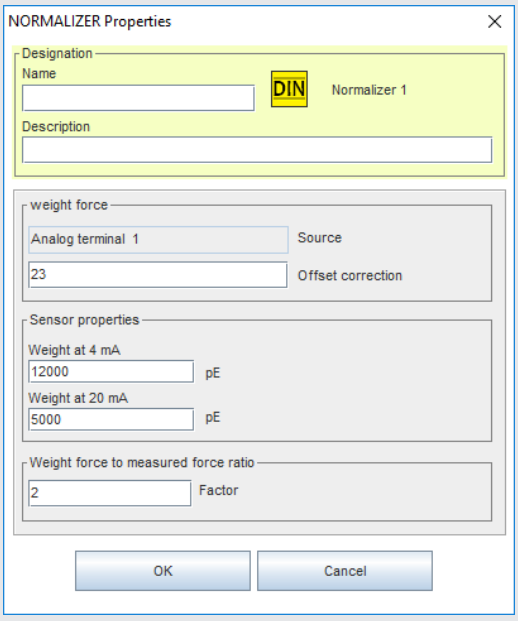
Toolbar	Parameter mask	Symbol
		

Description:

Output L1 is LOW if the absolute value of the difference of "**Value 1**" and "**Value 2**" is less than the entered **L1** switch-off value. **Output L2** is LOW if the absolute value of the difference of "**Value 1**" and "**Value 2**" is less than the entered **L2** switch-off value.

Text fields **L1** and **L2** can be overwritten and serve documentation purposes only. "**pE**" in the symbol stands for "**physical unit**". This can be defined in the "**Project - Settings - View options**" menu.

8.27 Normalizer

Toolbar	Parameter mask	Symbol
		

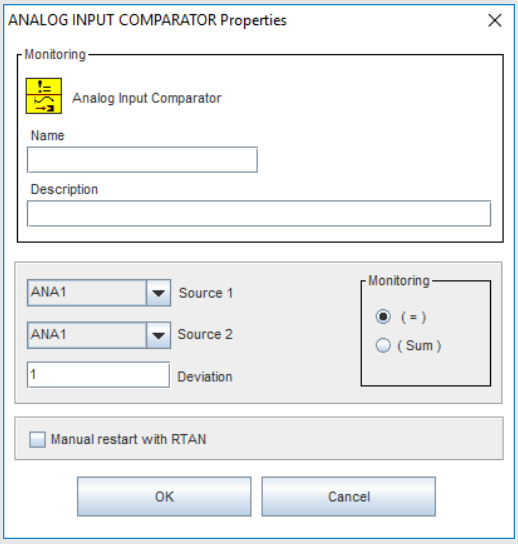
Description:

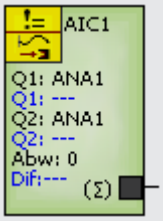
The selected analog terminal supplies values between 4 mA and 20 mA. Each current value is assigned a weight by the offset and the sensor data. A normalizer can only be placed if the correspond-ing analog input was placed.

An analog input can only be deleted if the corresponding normalizer is not present or was previously deleted.

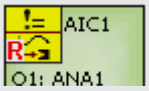
8.28 Analog Input Comparator

Toolbar	Parameter mask	Symbol





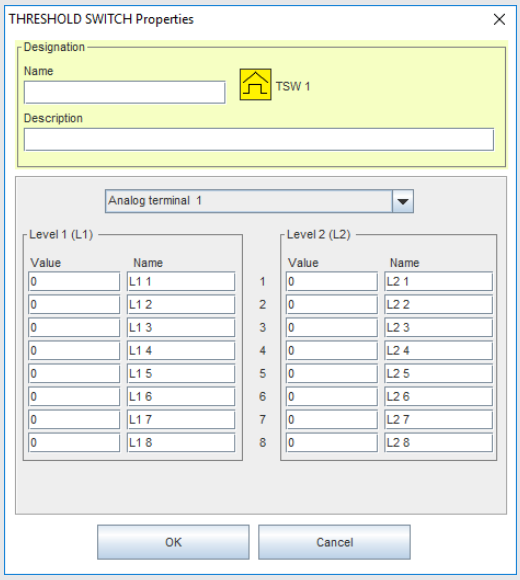
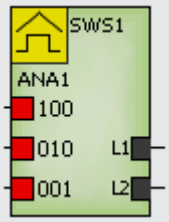
Manual start-up



Description:

The AIC checks the input data of the analog termi-nals selected in source 1 and 2. In addition, a tolerated deviation of the AD con-verter values can be entered in the sources. The monitoring for equali-ty (=) switches the output (=) if both sources are the same within the tolerated deviation. Monitoring of the sum switches the output (∑) if the sum of both sources yields the value 1000 +/- the deviation. The output can be manually switched on again with the RTAN symbol.

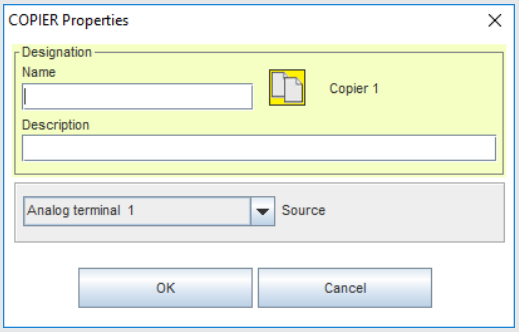
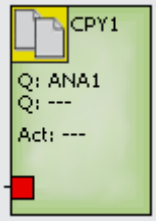
8.29 Threshold switch

Toolbar	Parameter mask	Symbol
		

Description:

Each threshold switch can be configured with up to eight different switching threshold pairs (L1, L2). Entering a name for these limit values simplifies subsequent changes and is only used to document the table values. At runtime, one of these switching threshold pairs can be selected by means of a binary input signal pattern on each threshold value switch. The outputs of the threshold value switches respond to the currently set limit values depending on the selected source: as long as the input value is less than the activated limit value, the output (L1, L2) that corresponds to the level is switched on; if greater than the limit value, the output is switched off.

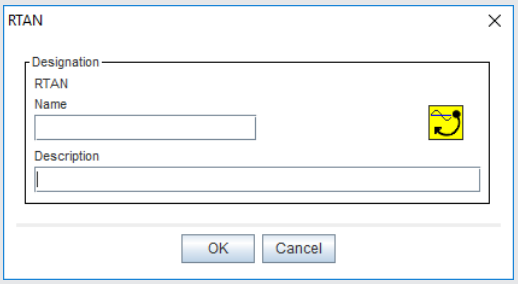
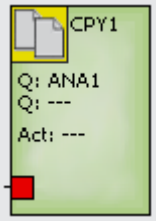
8.30 Copier

Toolbar	Parameter mask	Symbol
		

Description:

If an input signal is applied, the copier stores the source information. An analog input can be selected as source. If input signal = OFF, the most recently stored value is retained. Other analog elements, such as adder, subtracter or similar, can process the value stored in Act as input source.

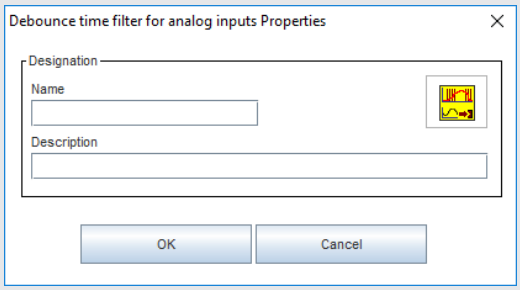
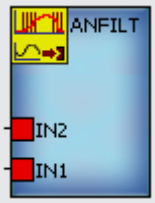
8.31 RTAN

Toolbar	Parameter mask	Symbol
		

Description:

Acknowledgment for switching the analog inputs and the AIC back on again. With these elements, an automatic restart can also optionally be selected. Acknowledgment occurs on a falling edge. The element can only be placed once.

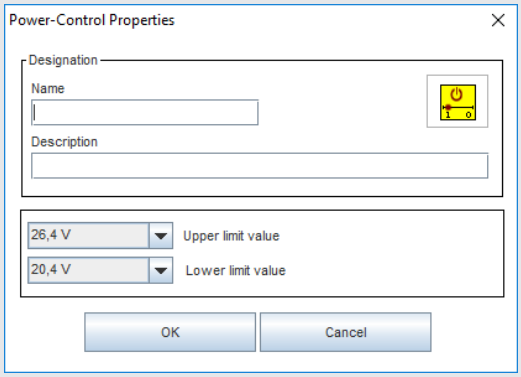
8.32 Debounce time filter for analog inputs

Toolbar	Parameter mask	Symbol
		

Description:

During runtime, the debounce time for the signal filter of the analog inputs can be determined by the bit-coded input value at the gate. The element can only be placed once.

8.33 Power control

Toolbar	Parameter mask	Symbol
		

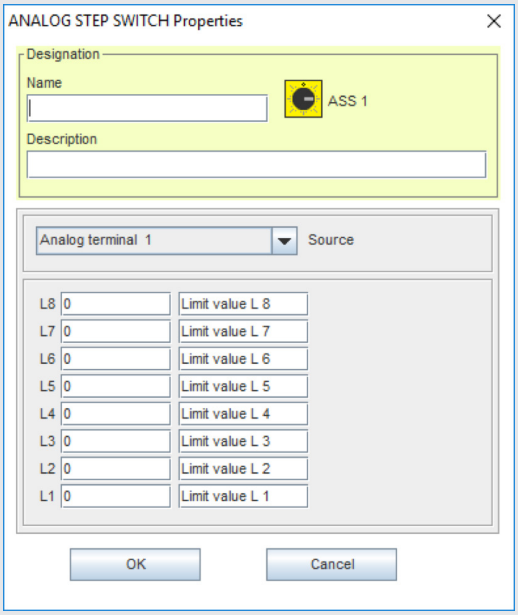
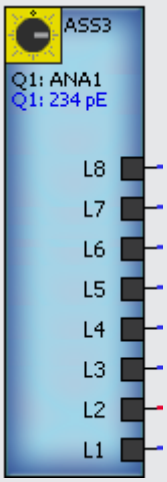
Description:

Outputs Q1 and Q1+T are HIGH as long as the supply voltage at the central module is between the lower and up-per limit value. Otherwise, output Q1 switches immediately and output Q1+T switches after 500 ms. The element can only be placed once.

CAUTION

▶ Please note that element RTSK is needed for switching on again.

8.34 Analog step switch

Toolbar	Parameter mask	Symbol
		

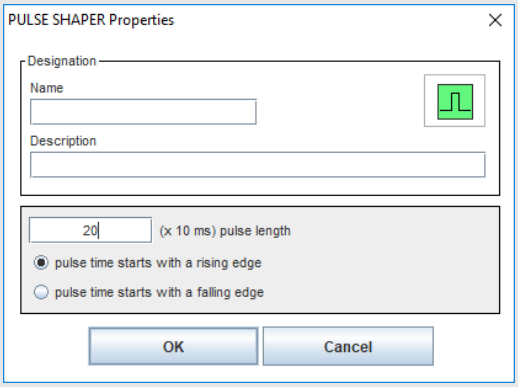
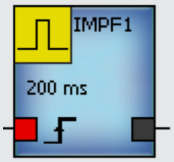
Description:

Each level step switch can be configured with up to eight different switching threshold pairs (L1, L8).

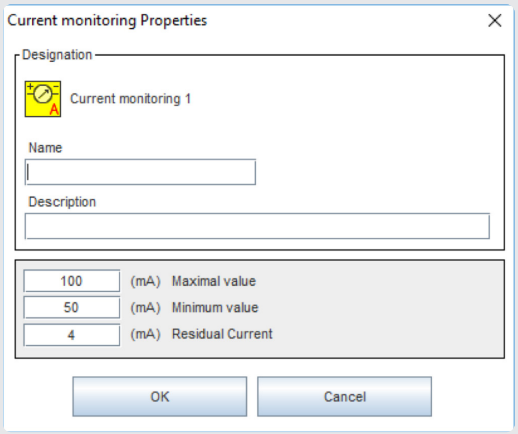
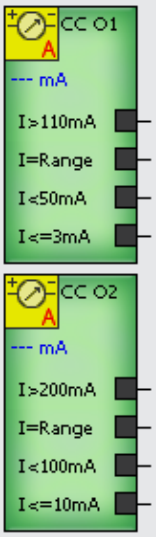
Entering a name for these limit values simplifies subsequent changes and is only used to document the table values.

The outputs of the step switch react to the entered limit values depending on the selected source: the output that corresponds to the level is HIGH if the input value has exceeded the level. It is LOW if the next level is reached.

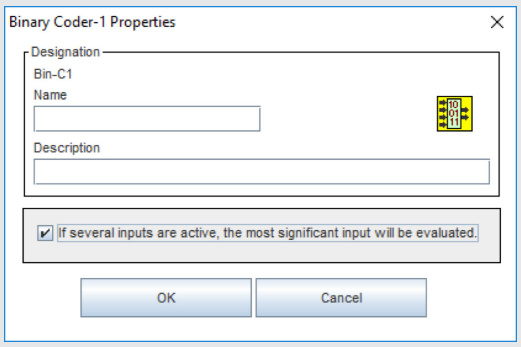
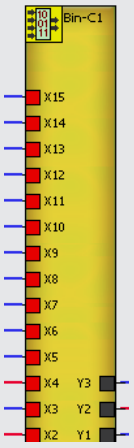
8.35 Pulse shaper

Toolbar	Parameter mask	Symbol	Description
			The output is HIGH for the parameterized time if a positive or negative edge change occurs at the input. The pulse length can be set from 3ms to 1000ms.

8.36 Current monitoring

Toolbar	Parameter mask	Symbol	Description
			This element compares the current I measured at outputs O1 and/or O2 of the central module with the entered limit values and switches the corresponding outputs.

8.37 Binary coder

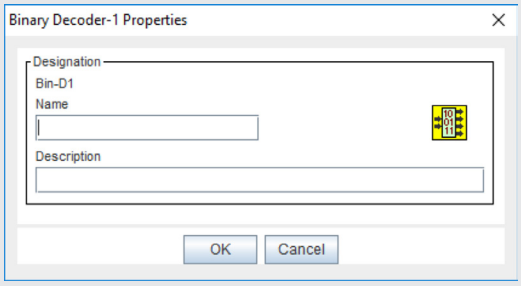
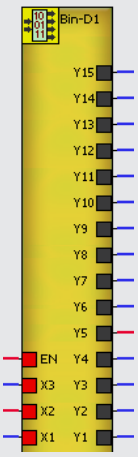
Toolbar	Parameter mask	Symbol
		

Description:

The binary coder converts decimal numbers from 0 – 15 to binary code. Inputs X1 – X15 correspond to decimal numbers 1 – 15; no input corresponds to decimal number 0. Outputs Y0 – Y3 corresponds to values 0 – 3 of the binary number.

If multiple inputs are active, **no** outputs switch. This behavior can be deactivated with the checkmark. If this is set, only the highest-value input is evaluated.

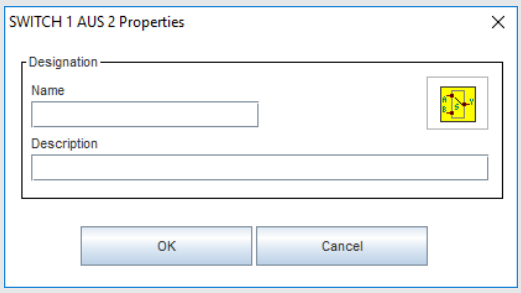
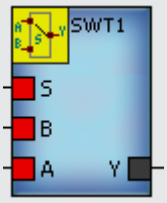
8.38 Binary decoder

Toolbar	Parameter mask	Symbol
		

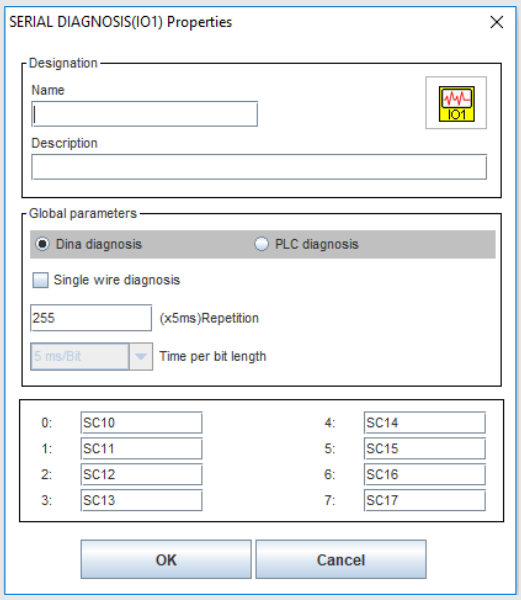
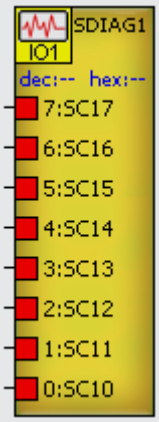
Description:

The binary decoder converts binary numbers to decimal numbers from 0 – 15. Inputs X0 – X3 corresponds to values 0 – 3 of the binary number. Outputs Y0 – Y15 correspond to decimal numbers 0 – 15. Decoding does not occur until input EN (enable) is available.

8.39 Switch 1 of 2

Toolbar	Parameter mask	Symbol	Description
			If input S is HIGH, the state of input B is replicated on output Y. If input S is LOW, the state of input A is replicated on output Y.

8.40 Serial diagnosis

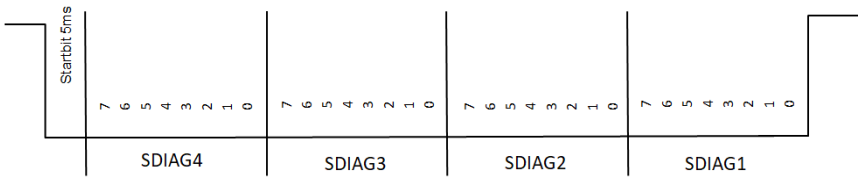
Toolbar	Parameter mask	Symbol
		

Description:

The SDIAG provides the input signals in serial form at the output IO1 of the central module. The telegram length per element is 40ms (5ms per input) plus a start bit of 5ms length. To extend this time unit, select PLC diagnosis. The repetition rate can be set to a maximum of 1.2s.

The telegram length depends on the placed number of SDIAG blocks.

Telegram length = start bit + number of SDIAG x 8 x time per bit length



Example

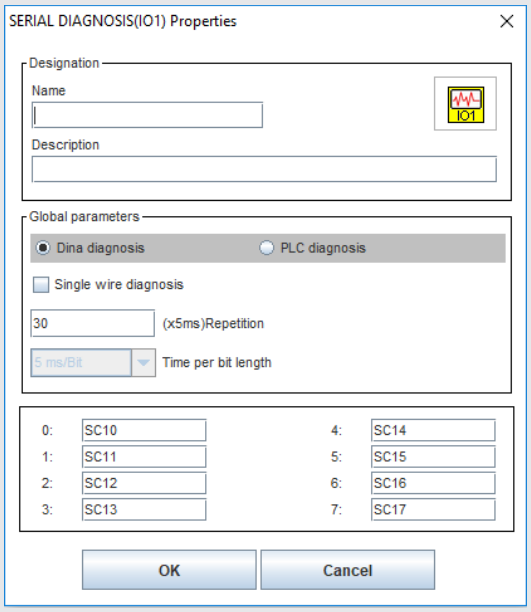


Fig. 8-2

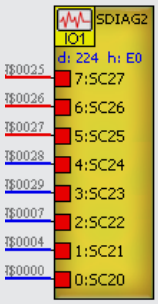


Fig. 8-3

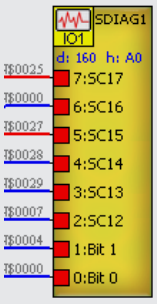
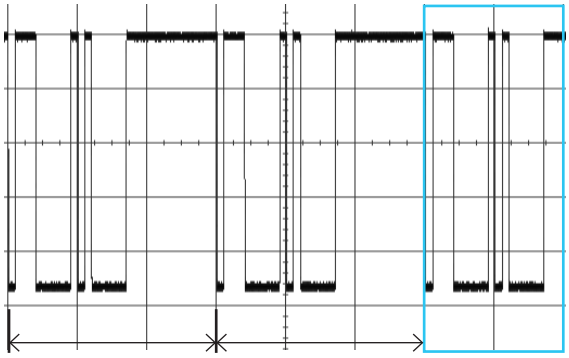


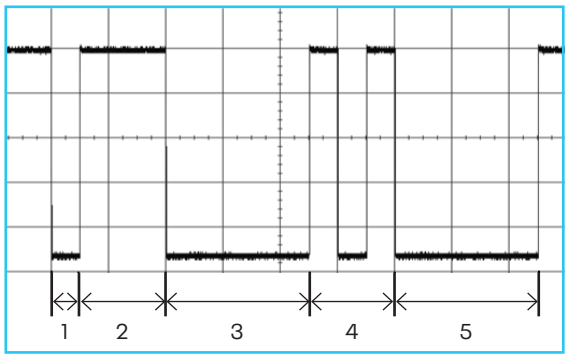
Fig. 8-4

The global parameters apply to all SDIAG blocks. The names of the blocks and the terminals can be assigned separately for each block (Fig. 8-2). In the application, terminals 5-7 of the SDIAG2 (Fig. 8-3) and terminals 5 and 7 of the SDIAG1 (Fig. 8-4) are connected.



Repeat rate 150ms

After the start bit, the state of the terminals 7 to 0 of the SDIAG2 and the SDIAG1 is queried and passed on in series to the output IO1. This sequence repeats every 150ms.



A sequence looks like this:

Startbit	5ms
SDIAG2: I7, I6, I5	3x 5ms = 15ms
SDIAG2: I4, I3, I2, I1, I0	5 x 5ms = 25ms
SDIAG1: I7, I6, I5	3x 5ms = 15ms
SDIAG1: I4, I3, I2, I1, I0	5 x 5ms = 25ms

9 Inputs of the SL VARIO modules

Each SL VARIO module has a different number of inputs. These can be used

- as digital, safe inputs I, IO
- for evaluating 2-channel sensors
- as ANA analog inputs

9.1 Overview of the inputs of the SL VARIO modules

Module DNSL-	Inputs / inputs-outputs															
ZMV ZMVK	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	I14	I15	I16
	IO1	IO2	IO3	IO4												
ZMVD	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	I14	I15	I16
	I17	I18	I19	I20	I21	I22	I23	I24	I25	I26	I27	I28	I29	I30	I31	I32
	IO1	IO2	IO3	IO4												
ZMVD2	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	I14	I15	I16
	I17	I18	I19	I20	I21	I22	I23	I24	I25	I26	I27	I28	I29	I30	I31	I32
	I33	I34	I35	I36	I37	I38	I39	I40	I41	I42	I43	I44	I45	I46	I47	I48
	IO1	IO2	IO3	IO4												
DSV	I1	I2	I3	I4	I5	I6	I7	I8								
DRV	I1	I2	I3	I4	I5	I6	I7	I8								
BIV	I1	I2	I3	I4	I5	I6	I7	I8								
INV	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12				
	IO1	IO2	IO3	IO4												
IOV	I1	I2	I3	I4	I5	I6	I7	I8								
RMV	I1	I2	I3	I4	I5	I6	I7	I8								

NIV	I1	I2	I3	I4	I5	I6	I7	I8	
FBV*	I1	I2	I3	I4	I5	I6	I7	I8	
SIV	I1	I2	I3	I4	I5	I6	I7	I8	

*) FBV stands for all fieldbus modules

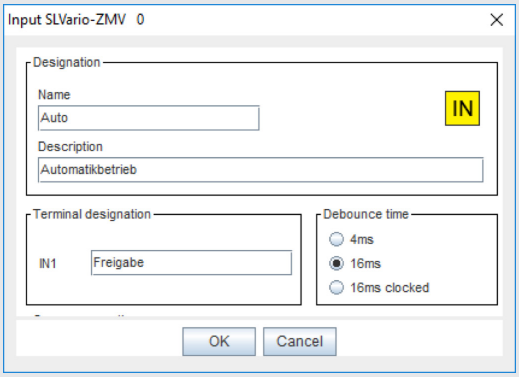
The parameter mask of the inputs contain the following information /parameter fields

- **Element name, module name and slot number of the module**
- **Name (max. 8 characters)**
- **Description (max. 80 characters)**
- **Terminal designation (max. 12 characters)**

9.2 Digital inputs

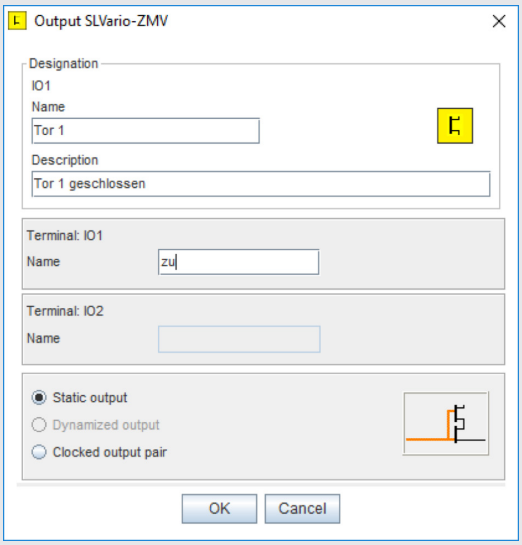
Mechanically influenced switch-on times can be taken into account with the "Debounce time" parameter. The following selection is available:

- **4 ms**
- **16 ms**
- **16 ms clocked (I1 to I8 of the central module only, forced dynamic sampling by connecting the input to a clock output of a VARIO module)**

Toolbar	Parameter mask	Symbol	Description
IN			Digital input IN1 with · **Name** · **Terminal designation** · **Debounce time** The description appears when the mouse is moved over the symbol.

9.2.1 Configurable inputs/outputs

Some modules of the SL VARIO series have configurable inputs/outputs, so called IOs. They can be used as inputs or outputs. They are configured in pairs.

Toolbar	Parameter mask	Symbol	Description
IN			**Digital input IO1** The IOs do not have a negated output on the central module.

CAUTION

▶ The IOs can only be configured pairwise as inputs or outputs. (Fig. 9-1)
Mixed operation (e.g., IO1 as input and IO2 as output) is barred by the Designer.

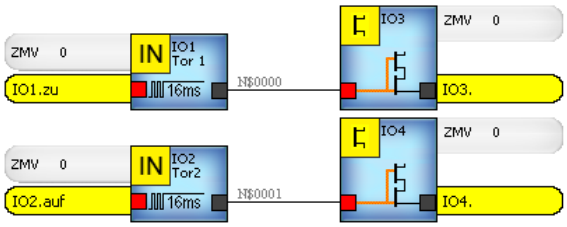


Fig. 91

9.3 Analog inputs

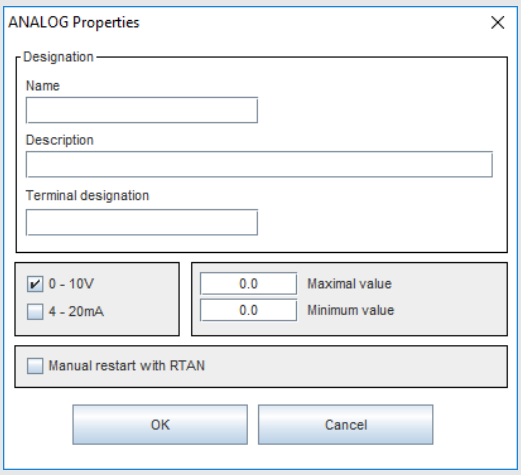
Inputs I1 to I8 can be used as safe analog inputs on all central modules. These can be used for voltage evaluation from 0 to 10 V, for current evaluation from 4 to 20 mA or for safety mat evaluation.

Used analog inputs are no longer available as digital inputs.

Module	Analog inputs															
DNSL-ZMV ZMVK	I1	I2	I3	I4	I5	I6	I7	I8								

Toolbar

Parameter mask



Automatic start-up

The output is HIGH if the voltage value connected via input I1 lies between the entered "Minimum value" and "Maximum value". Switching on again occurs automatically.

Manual start-up

The output can be manually switched on again with the RTAN enable symbol.

9.4 Analog inputs for safety mats

The analog inputs can be used by up to eight short-circuit-forming safety mats. Shutdown does not occur until the voltage measured at the input is outside of the permissible range. Switching on again occurs automatically. If automatic switching on is to be prevented, the RTSM enable symbol is needed. The reset command must occur by means of an edge change and can only be performed on a pressure-free safety mat.

Toolbar	Parameter mask	Symbol	Description
			The output is HIGH if the safety mat is pressure-free and changes to LOW if the voltage value connected via input I1 exceeds or falls below the permissible voltage range of 9.4 V to 14.1 V.

9.5 Inputs for speed monitoring via initiators

Inputs I9 to I16 can be used for speed monitoring on the central module. The drive speed is captured by means of proximity switches with 180° phase shift or an HTL measurement system. A detailed description can be found in chapter "Speed monitoring".

10 Outputs of the SL VARIO modules

Each SL VARIO module has a different number of safe outputs. A distinction is made here between:

- **Semiconductor outputs O**
- **Configurable inputs/outputs IO**
- **Contact outputs K**
- **Analog outputs ANAO**

10.1 Overview of the outputs

The following table lists the available outputs and inputs/outputs on SL VARIO modules.
The outputs in **bold** text can be configured as **clock outputs.**

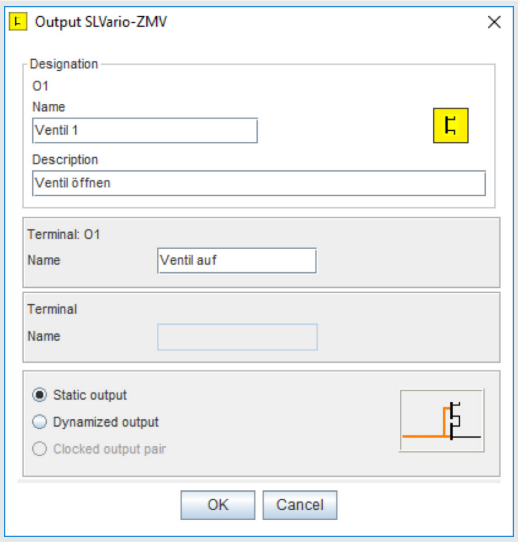
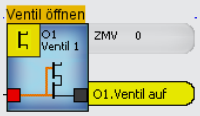
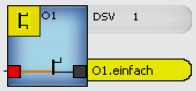
Module DNSL-	Outputs/In-Outputs						
ZMV	O1	O2	O3	O4	O5	O6	
ZMVD	**IO1**	**IO2**	**IO3**	**IO4**			
ZMVD2	K1	K2					
ZMVK	O1	O2	O3	O4	O5	O6	
	IO1	**IO2**	**IO3**	**IO4**			
	K3	K4	K5	K6			
DSV	**O1**	**O2**	**O3**	**O4**	O5	O6	O7
DRV	**O1**	**O2**	**O3**	**O4**	O5	O6	O7
BIV	**O1**	**O2**	**O3**	**O4**	O5	O6	O7
INV	**IO1**	**IO2**	**IO3**	**IO4**			
IOV	**O1**	**O2**	**O3**	**O4**	O5	O6	O7
RMV	K1	K2					
NIV	**O1**	**O2**	**O3**	**O4**			
SIV	**O1**	**O2**	**O3**	**O4**			

The parameter masks of all outputs contain the following information/parameter fields
- **Element name, module name and slot number of the module**
- **Name (max. 8 characters)**
- **Description (max. 80 characters)**
- **Terminal designation (max. 12 characters)**

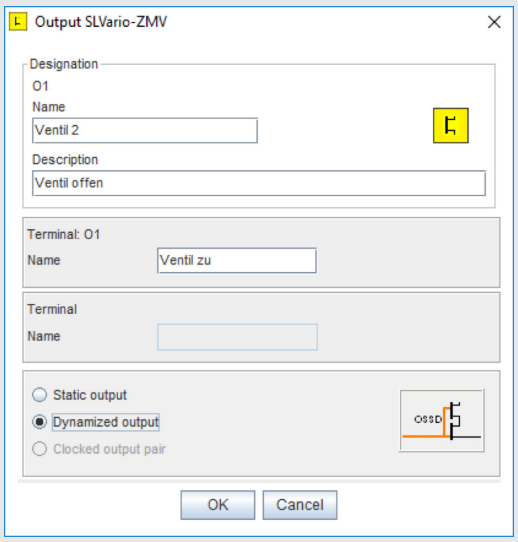
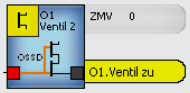
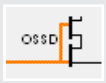
10.2 Semiconductor outputs

Semiconductor outputs can be defined as
- **Static output:** positive-switching safe output
- **Dynamized output:** positive-switching safe output with test pulse
- **Clocked output pair (see overview of the outputs):** positive-switching safe output with test pulse.

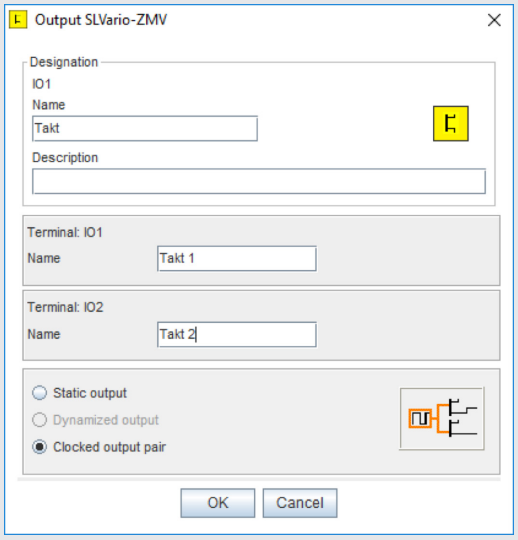
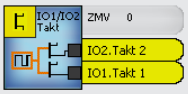
10.2.1 Static semiconductor output

Toolbar	Parameter mask	Symbol	Description
		 	**Safe semiconductor output O1 with** · Name · Terminal designation The description appears when the mouse is moved over the symbol. **Simple semiconductor output, static**

10.2.2 Dynamized semiconductor output

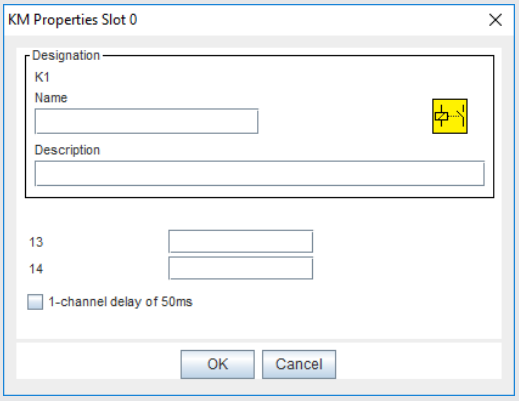
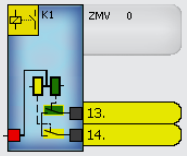
Toolbar	Parameter mask	Symbol	Description
			**Safe semiconductor output, dynamized** The "Dynamized" parameter appears in the symbol as OSSD. 

10.2.3 Clocked output pair

Toolbar	Parameter mask	Symbol	Description
			**Clock outputs IO1/IO2** The "Clocked" parameter is visible in the symbol. 

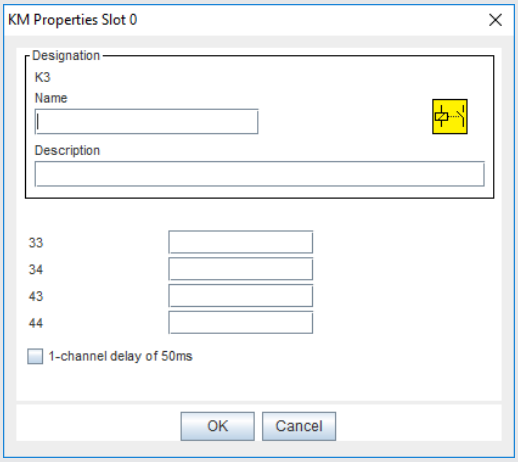
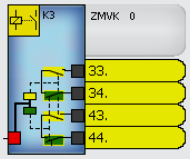
10.3 Safe contact outputs on DNSL-ZMV

The SL VARIO ZMV has two contact outputs, each with one safe NO contact.

Toolbar	Parameter mask	Symbol	Description
			Contact output K1 with a safe NO contact **One-channel delay of 50 ms** This can be useful for high pickup currents to prevent sticking of the relay contacts. A relay contact then switches with a delay.

10.4 Safe contact outputs on DNSL-ZMVK and DNSL-RMV

When using the DNSL-ZMVK or -RMV module, four additional outputs, each with two safe NO contacts, are available.

Toolbar	Parameter mask	Symbol	Description
			Contact output K3 with two safe NO contacts. **One-channel delay of 50 ms** This can be useful for high pickup currents to prevent sticking of the relay contacts. A relay contact then switches with a delay.

11 Timers

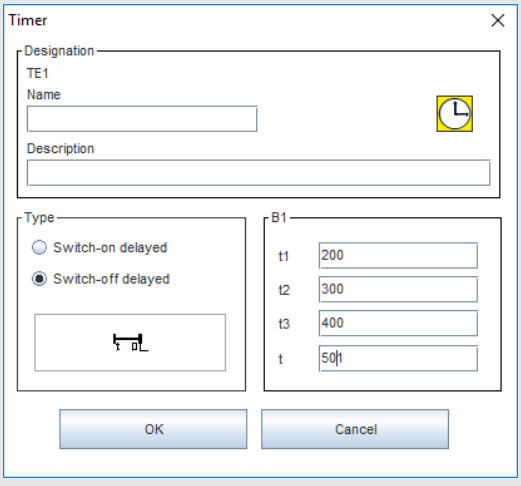
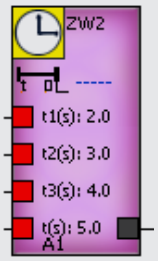
Timers are selected from the toolbar of the central module.
The following types are available:

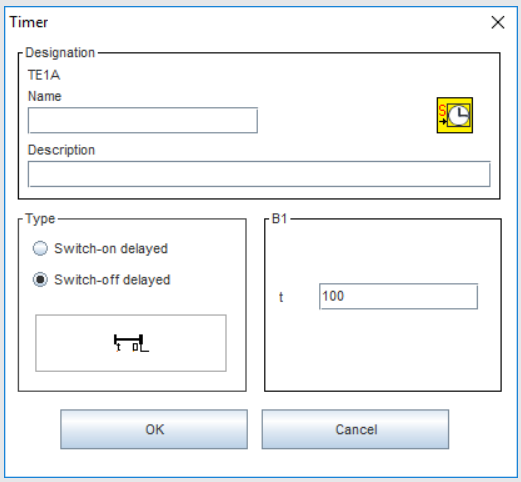
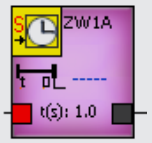
- **with one input**
- **with four inputs**
- **switch-off delayed**
- **switch-on delayed**

The following conditions apply for the timers:

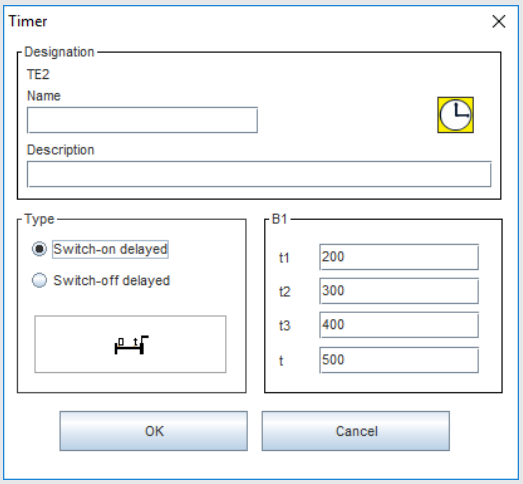
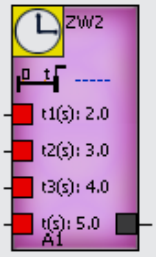
- **Times are possible in the range from 1 to 300 s.**
- **For timers with four inputs, prioritization is as follows: t3 > t2 > t1 > t**
- **The set time starts following an edge change at the t-terminal.**
  The off-delayed timer expects a negative edge change;
  the on-delayed timer expects a positive edge change.

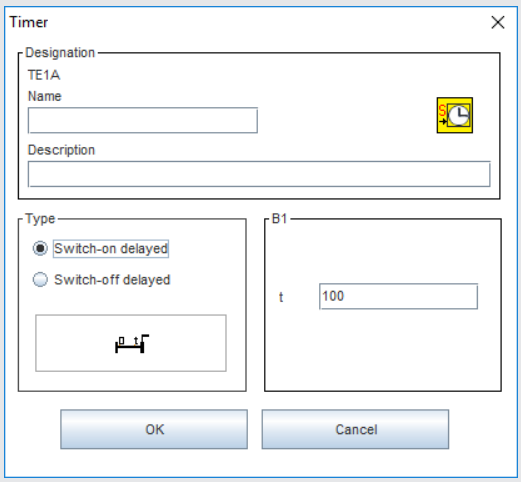
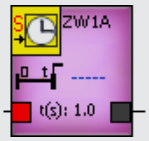
11.1 Off-delayed timers

Toolbar	Parameter mask	Symbol	Description
			In the normal state, the output is HIGH. A negative edge change at input t starts the time. After the time elapses, the output is LOW. If multiple inputs are wired, prioritization applies. If t1, t2 and t3 are not wired, the timer counts down from t.

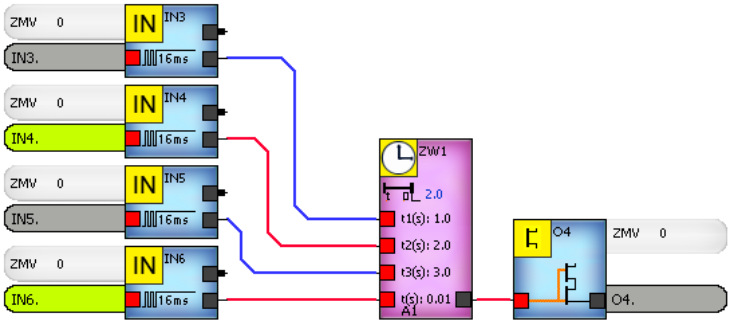
Toolbar	Parameter mask	Symbol	Description
			Single timers have only one input.

11.2 On-delayed timers

Toolbar	Parameter mask	Symbol	Description
			In the normal state, the output is LOW. A positive edge change at input t starts the time. After the time elapses, the output is HIGH. If multiple inputs are wired, prioritization applies. If t1, t2 and t3 are not wired, the timer counts down from t.

Toolbar	Parameter mask	Symbol	Description
			Single timers have only one input.

11.2.1 Example on-delayed timer



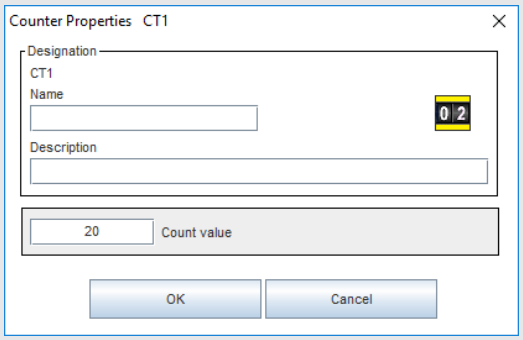
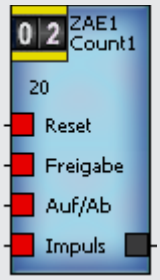
Example Timer

Input IN4 is wired. The time stored there is entered in the timer (blue). If a positive edge change now occurs via input IN6, output O4 switches on after 2.0 s.

12 Counter

Counters are selected from the toolbar of the central module. The following conditions apply:

- **Counter values between 1 and 30000 are possible.**
- **The normal state of the output is HIGH.**
- **Before each count process, the count value must be reset via the Reset input.**
- **The count direction can be selected via the wiring.**
- **The count process must be enabled via the Enable input.**
- **Upward counting: The output switches off if the entered count value is reached.**
- **Downward counting: The output switches off if zero is reached.**
- **When counting upward, the counter continues to count upward after the output is switched off.**
- **The count direction can be changed while counting.**

Toolbar	Parameter mask	Symbol
		

Reset input:
Upward counting: Counter is set to "0"

Downward counting: Counter is set to counter value

Enable:
HIGH: Count process enabled

LOW: Stop the count process.

Up/Down:
Count direction

HIGH: Upward counter

LOW: Down-ward counter

Pulse:
Input for count pulse

12.1 Example of a counter

IN3 specifies the "upward counting" count direction. The count value is reset to 0 by means of a one-time signal on the Reset input. (Fig. 12-1)

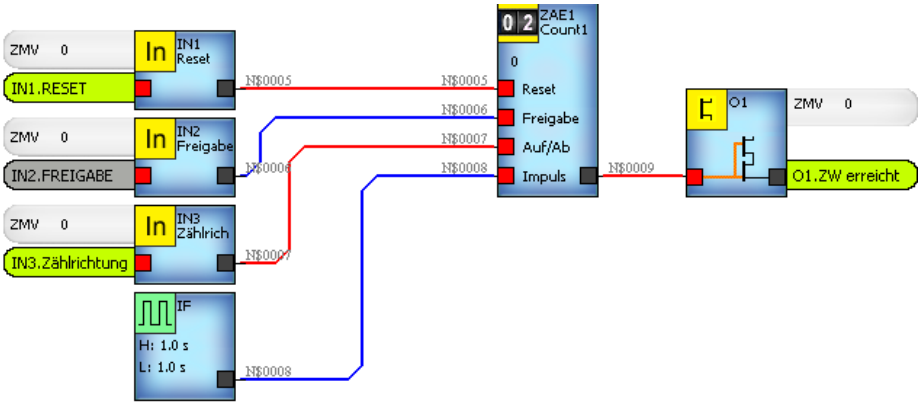


Fig. 12-1

IN2 starts the count process. The frequency generator generates the count pulses. The count value is increased by one on each pulse. (Fig. 12-2)

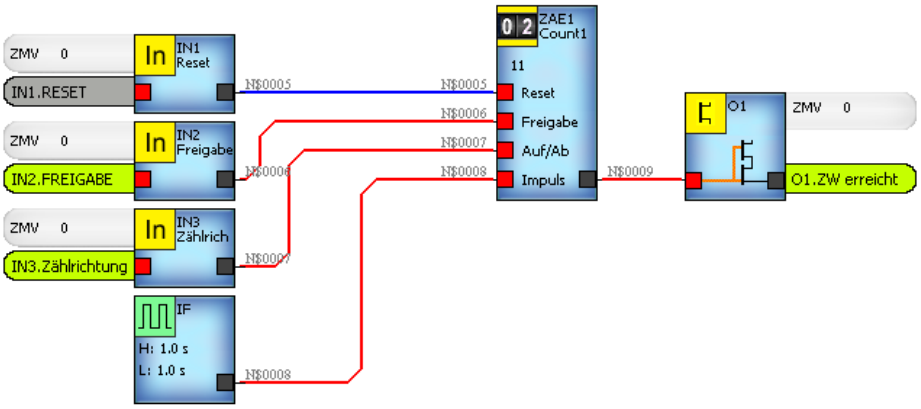


Fig. 12-2

After the count value is reached, output O1 switches off. The counter continues to count as long as the Enable signal is applied. (Fig. 12-3)

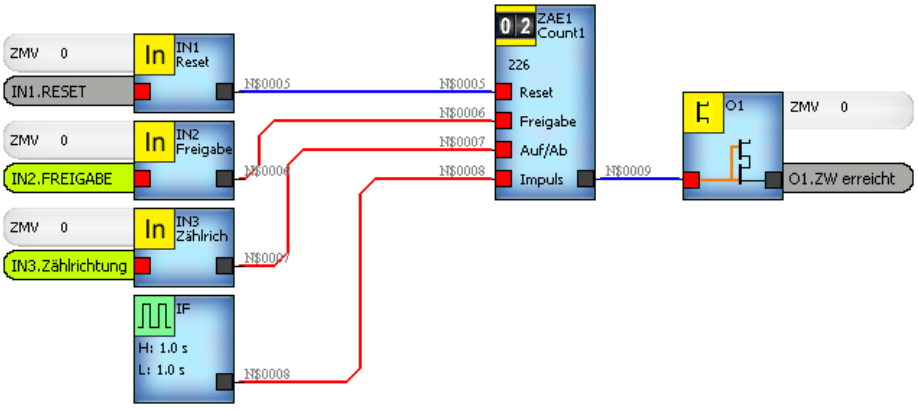
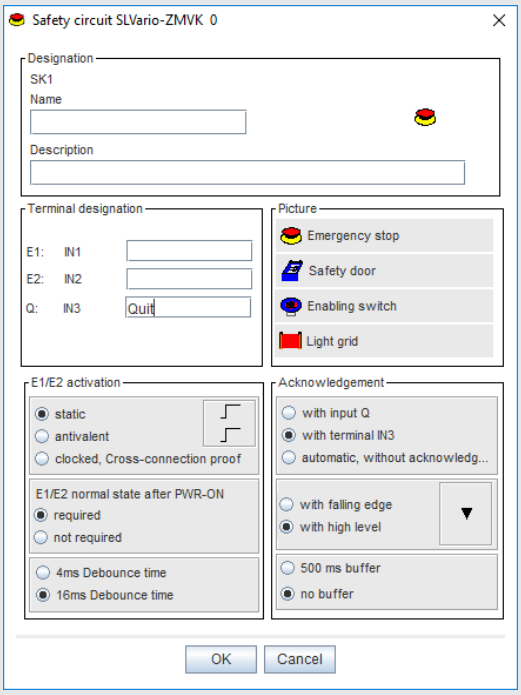
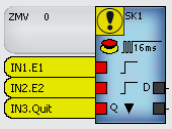


Fig. 12-3

13 Safety circuits

Digital outputs are available on the SL VARIO modules for the realization of safety circuits, such as an EMERGENCY stop, safety doors or light curtains.

A number of parameters are available for configuring safety circuits. With these, you define the type of control and type of acknowledgement. A detailed description of the parameters can be found in chapter "Configuring the safety circuits".

Toolbar	Parameter mask	Symbol	Description
			Safety circuit SC1 with static control and acknowledgement. The output switches on if the conditions for the safety circuit are satisfied. See Hardware in the Help system Upon shutdown of the safety circuit, diagnostic output D is activated.

13.1 Configuring the safety circuits

Designation

- **Name (max. 8 characters)**
- **Description (max. 80 characters)**
- **Terminal designation (max. 12 characters)**

Picture

Depending on the type of safety circuit, a symbol can be selected for emergency stop, safety door, enabling switch or light curtain.

E1/E2 activation

• **static**	Control signals E1 and E2 are applied statically.
• **antivalent**	Control signals E1 and E2 are switched antivalent.
• **clocked, cross-connection proof**	The control signals are clocked. The clock signal must be generated by a clocked output pair on an SL VARIO module.

E1/E2 normal state after PWR-ON

- **required:** After the system switches on, the safety circuit must be switched off and back on again to test the safety circuit.
- **not required:** After the system switches on, the safety circuit does not need to be switched off and back on again.
- **Debounce time** Debounce time of inputs E1/E2 and Q. For clocked safety circuits, only a debounce time of 16 ms is possible.

Acknowledgment

- **with input Q** The acknowledgement input can be freely selected.
- **with terminal INx** Depending on the safety circuit, the next free input after the control inputs is used as acknowledgement input. This reduces the number of safety circuits by one.
- **automatic, without acknowledg.** The safety circuit has no acknowledgement input.
- **with falling edge** Acknowledgment takes place on a falling edge at the acknowledgement input.
- **with HIGH level** Acknowledgment takes place on a HIGH level, which may be applied constantly.
- **500 ms buffer** The acknowledgement signal is stored for 500 ms. If activation occurs < 500 ms after acknowledgement, the switching output switches on. If activation occurs after this time, the output does not switch.
- **no buffer** The acknowledgement signal is not stored.

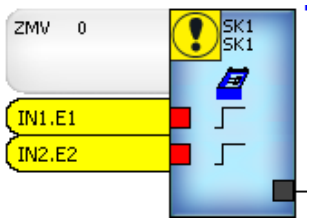
CAUTION

▶ The "emergency stop" function requires an acknowledgement input and selection of the "no buffer" acknowledgement.

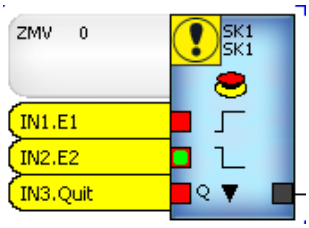
13.2 Logic diagram symbols of the safety circuits

The configuration of the safety circuits is graphically depicted in the symbol.

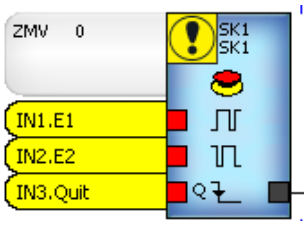
Static activation without acknowledgment



Antivalent activation Acknowledgment with HIGH level

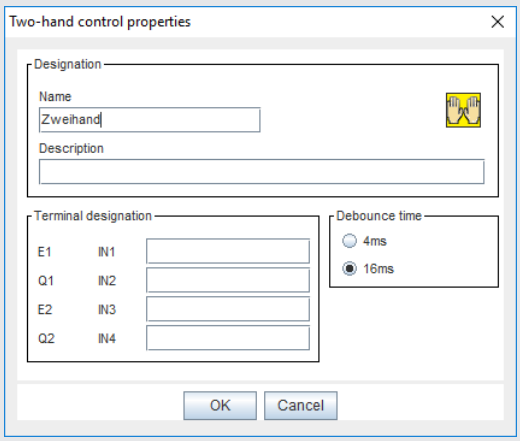
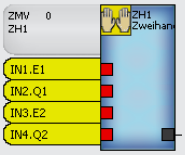


Clocked activation Acknowledgment with falling edge



14 Two-hand control

A two-hand control can be realized on the modules of the SL VARIO series through permanently defined inputs.

Toolbar	Parameter mask	Symbol	Description
			**Two-hand control** The output switches if the activation conditions are satisfied. See Hardware in the Help system

14.1 Configuring the two-hand control

Designation

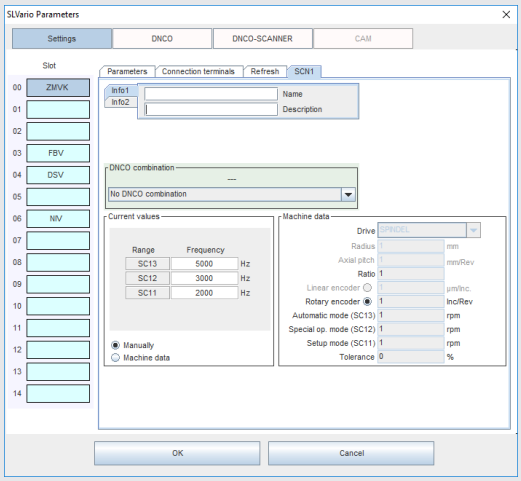
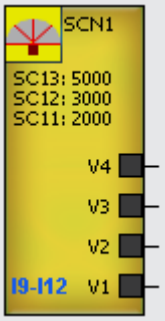
- Name (max. 8 characters)
- Description (max. 80 characters)
- Terminal designation (max. 12 characters)

Debounce time

- Debounce time of inputs E1/E2 and Q1/Q2.

15 Scanner

This function can be used for, e.g., area scanners. Depending on its speed and the configured frequencies, outputs V1 to V4 switch. Two scanners are available. The speed is captured via inputs I9 to I12 for scanner 1 and inputs I13 to I16 for scanner 2. These inputs are then no longer available as digital inputs or for speed monitoring via initiators.

Toolbar	Parameter mask	Symbol	Description
			Outputs V1 to V4 switch depending on the defined frequency ranges. **See chapter "Configuration"**

15.1 Configuring the scanner

INFO1

- **Name (max. 8 characters)**
- **Description (max. 80 characters)**

Current values

Enter frequencies SC11, SC12, SC13 or SC21, SC22, SC23 with which the measured speed is to be compared. Alternatively, the frequencies can be calculated using the "machine data" function. See also chapter "Speed monitoring".

DNCO combination

It is possible to store the frequencies in a separate DNCO SCANNER table. These frequencies are then selected either via defined inputs on the module or via the DNCO multiplexer. See chapter "DNCO function".

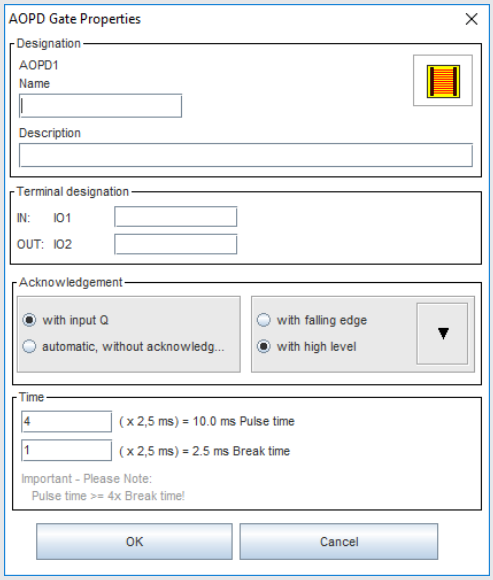
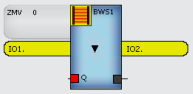
The outputs of the scanner switch according to the following logic:

	Vist<SC11	SC11<Vist<SC12	SC12<Vist<SC13	Vist>SC13
V4	0	0	0	1
V3	0	0	1	0
V2	0	1	0	0
V1	1	0	0	0

16 AOPD (Active Optoelectronic Protective Device)

With the AOPD element, active optoelectronic protective devices (AOPD) of type 2 (periodic testing necessary to detect a dangerous failure) can be reliably evaluated and operated.

The AOPD is supplied with power via the hardware output (IO2, right); feedback takes place via the input (IO1, left). Testing is adjustable. A restart interlock with either static or falling edge can be configured.

Toolbar	Parameter mask	Symbol	Description
			The output switches off in the event of a malfunction or interruption of the protective device. It switches on again either automatically or after acknowledgement via input Q.

16.1 Configuration

Designation

- Name (max. 8 characters)
- Description (max. 80 characters)
- Terminal designation (max. 12 characters)

Acknowledgment

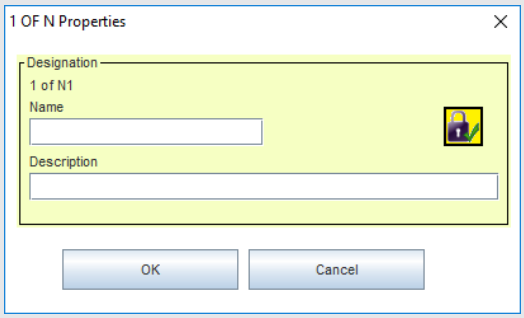
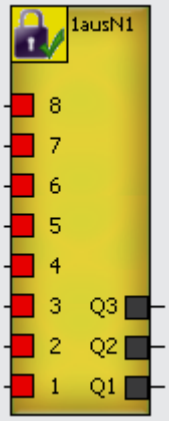
• **with input Q**	The acknowledgement input can be freely selected.
• **automatic, without acknowledgement**	No acknowledgement input necessary.
• **with falling edge**	Acknowledgment takes place on a falling edge at the Q input.
• **with HIGH level**	Acknowledgment takes place on a HIGH level at the Q input.

Time

Setting for testing with pulse and pause time.

17 1 of N

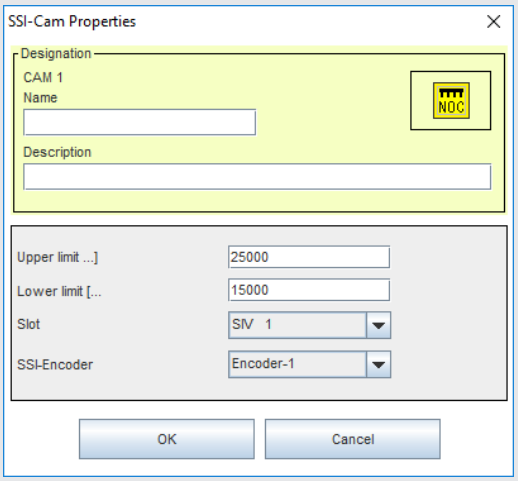
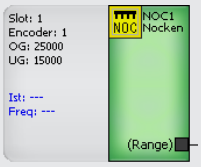
The element ascertains a three-digit output signal pattern from an eight-digit input signal pattern.

Toolbar	Parameter mask	Symbol
		

Output Q1 is HIGH if	Output Q2 is HIGH if	Output Q3 is HIGH if
one input is HIGH and seven inputs are LOW	**one input is LOW and seven inputs are HIGH**	**all inputs are HIGH.**
oder	oder	
all inputs are LOW.	**all inputs are HIGH.**	

18 Cams

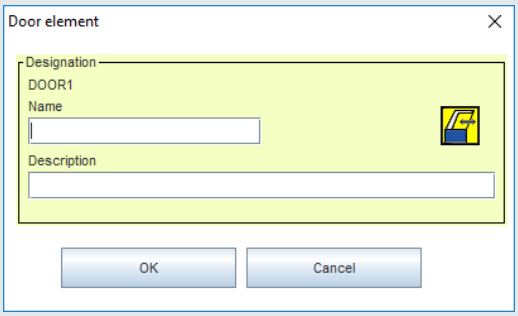
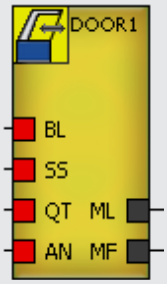
Cams define work areas. These work areas can be monitored in combination with an SL VARIO SIV module and an SSI encoder. The toolbar of the central module includes 64 cams. In the parameter masks, the areas are defined by specifying the increments that may be traveled. The corresponding SIV module returns the traveled actual values.

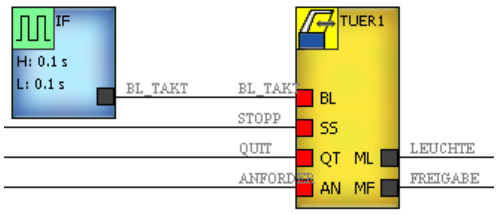
Toolbar	Parameter mask	Symbol	Description
			**Limit values** Enter the limit values that are to be monitored. **Slot** Select the SIV module. **SSI encoder** Select the encoder interface. The output (Range) is HIGH if the axis moves within the lower and upper limit value.

19 Door element

With the door element, it is possible to realize the logical control of a door release (magnet) via a request and enable input (e.g., safe standstill) as well as an acknowledgement input (after closing the door).

If a signal lamp is present for the door, the states of the door element (request = flashing; released = continuous light) can be visualized for the operator by integrating a logical clock generator.

Toolbar	Parameter mask	Symbol	Description
			**Inputs:** **BL** for clock generator **SS** safe standstill **QT** acknowledge **AN** request **Outputs**: **ML** signal lamp **MF** magnet release



Example:

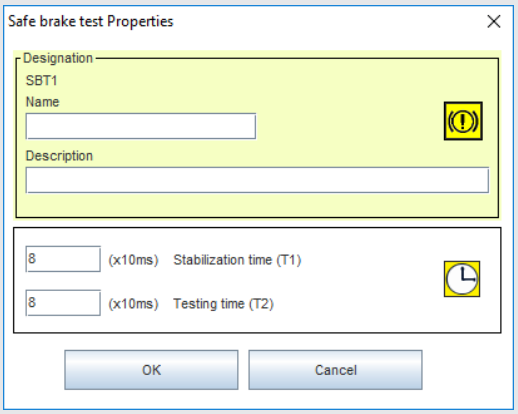
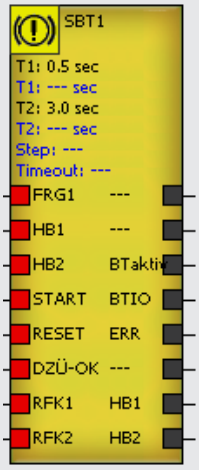
1. Request with falling edge on ON
   → **ML flashes**
2. Safe stop pending
   → **ML on, MF on**
3. Acknowledge with falling edge on QT
   → **ML off, MF off**

20 Safe brake test SBT

The "Safe brake test" (SBT) function module can be used to test the brakes of gravity-loaded (vertical) axes (in the version for constructional applications, with two holding brakes) for safe function. This test is intended to represent the start condition for automatic operation and can be repeated cyclically during operation.

Following activation of the test, a sequence of steps is executed in the function element that actuates the individual brakes and monitors their feedback as well as the safe standstill of the measurement system during the process. Testing and stabilization times can be set in a parameter mask.

Following successful execution, automatic mode is enabled. In the event of an error, the test aborts after the largest entered time has elapsed twice. In rack diagnostics, the faulty test step and, thus, the possible cause of the problem can be localized.

Toolbar	Parameter mask	Symbol	Description
			Enter the stabilization and test time. **Appearing in the symbol are** **T1:** Stabilization time **T2:** Test time **Step:** Test step **Timeout:** 2xT1 or 2xT2

20.1 Start conditions

1. Input **FRG1** must be HIGH.
2. Input **RESET** must be LOW.
3. Input **DZU-OK** (safe standstill) must be HIGH.
4. the inputs **RFK1 und RFK2** (feedback circuits for brake 1 and 2) must be LOW.

- Once all conditions are satisfied, the test cycle can be started with a falling edge on the START input. ⇨ Output BTakt (brake test active) is HIGH.
- If conditions 1 to 3 are not satisfied, the test cycle cannot be started.
- If condition 4 is not satisfied, the test cycle starts and BTaktiv is HIGH. At the end of the timeout, output ERR is HIGH.

20.2 Possible error states during the test process

1. Axis moves from safe standstill (input DZU-OK is LOW)

- during the testing time
- during the stabilization time

→ **Interruption of the test process, output ERR is LOW, BTaktiv is HIGH.**

2. Enable FRG1 is discontinued

→ **Interruption of the test process, output ERR is LOW, BTaktiv is HIGH.**

3. Feedback from holding brakes faulty

→ **Interruption of the test process after timeout has elapsed, output ERR is HIGH, BTaktiv is HIGH.**

A restart following an interruption is not possible until after negative edge triggering of the RESET input!

20.3 Brake-test test steps

Step	Meaning	Expectation	Fault
0	**Enables** and **START** aktive	Input **FRG1** and start are **HIGH**	
1	Wait for falling edge on the start input	Start input switches from **HIGH** to **LOW**	
2	Check **DZU** ok	Input **DZU** OK is **HIGH**	ERR
3	Check **RFK** feedback circuits	**RFK1 and RFK2 are LOW**	(Timeout) + ERR
4	**Open holding brake 2**	Output **HB2** is **HIGH**	
5	Check feedback circuit **RFK2**	Input **RFK2** is **HIGH**	(Timeout) + ERR
6	Testing time running out		
7	**Close holding brake 2**	Output **HB2** is **LOW**	
8	Stabilization time running out		
9	Check **DZU** ok	Input **DZU** OK is **HIGH**	ERR
10	Check **RFK** feedback circuits	**RFK1 and RFK2 are LOW**	(Timeout) + ERR
11	**Open holding brake 1**	Output **HB1** is **HIGH**	
12	Check feedback circuit **RFK1**	Input **RFK1** is **HIGH**	(Timeout) + ERR
13	Testing time running out		
14	**Close holding brake 1**	Output **HB1** is **LOW**	
15	Stabilization time running out		
16	Check **RFK** feedback circuits	**RFK1 and RFK2 are LOW**	(Timeout) + ERR
17	Brake test OK	Output **BTIO** is **HIGH**	

21 Synchronous comparator

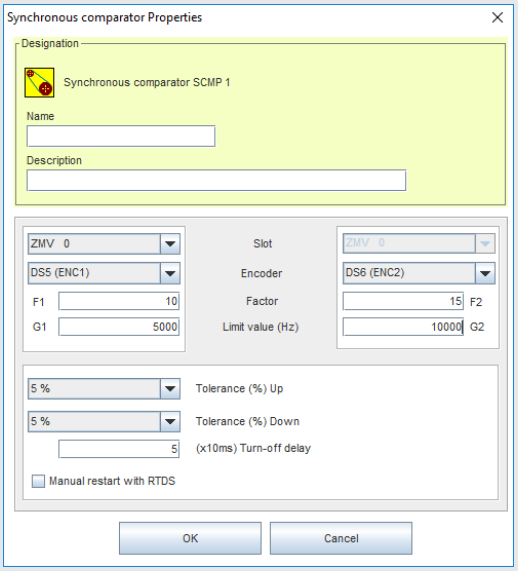
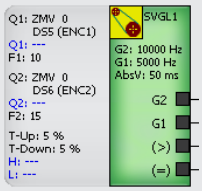
The synchronous comparator monitors the synchronization between two drives. The drive movements are captured via the central module or the DSV speed module. Both measurement systems must be connected to the same module. Measurement ranges from 500 Hz to 250 kHz are possible.

Unequal input frequencies, such as may occur when using gears, can be compensated for with the two correction factors F1 and F2.

Permissible deviations when comparing the synchronization of the two speeds are defined using the tolerance values. Here, the tolerance is calculated with the speed on encoder input 1, i.e., synchronization is ensured even if the speed on the second encoder is smaller by T-down or larger by T-up than the speed on the first encoder input.

A speed limit value G1 or G2 can be preset for each drive. If this is exceeded, the respective output, G1 or G2, switches off. The correction factor is not taken into account with these parameters.

By entering a turn-off delay, you can avoid undesired shutdowns on drives that are not jerk-free. When comparing two speeds on the central module, the turn-off delay should be at least twice as large as the refresh/cycle time on the speed monitor.

Toolbar	Parameter mask	Symbol	Description
			**Q1:** Speed source 1 **F1:** Correction factor 1 **Q2:** Speed source 2 **F2:** Correction factor 2 **T-up/down:** Tolerance **Outputs:** (=) Drives run synchronously within the tolerance (>) Drive 2 runs slower than drive 1. Up tolerance is taken into account. G1 and G2 switch off if the configured limit values G1 and G2 are exceeded.

21.1 Configuration

Designation

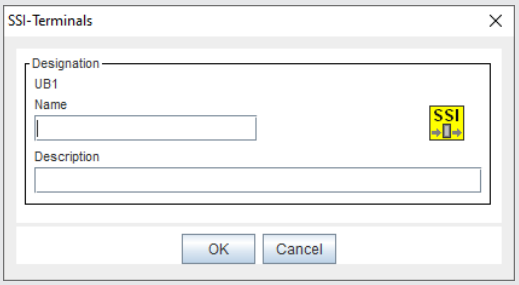
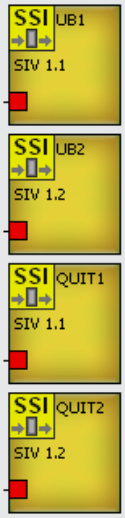
▶ **Name**	(max. 8 characters)
▶ **Description**	(max. 80 characters)
▶ **Slot**	Select the speed monitoring module.
▶ **Encoder**	Select the encoder inputs.
▶ **Factor**	Enter the correction factors for speed ratios not equal to 1.
▶ **Tolerance up**	Select the permissible upward tolerance.
▶ **Tolerance down**	Select the permissible downward tolerance.
▶ **Turn-off delay**	Enter a factor for the turn-off delay.
▶ **Manual start-up with RTDS**	If the checkbox is selected, the outputs cannot be restarted until the RTDS acknowledgement element is set.

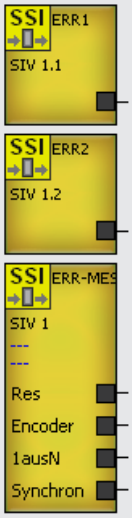
22 SSI terminals

The SSI terminals are needed if an SIV module with SSI encoder is used.

These perform the following functions:

- **24 V supply of the encoders**
- **Set the reference point**
- **Report error states to the measurement system**
- **Detect conditions**

Toolbar	Parameter mask	Symbol	Description
			**UB1:** Switch on 24 V supply of encoder 1. **UB2:** Switch on 24 V supply of encoder 2. **Quit1:** Set reference points - encoder 1. **Quit2:** Set reference points - encoder 2.

Toolbar	Parameter mask			Symbol	Description
					⚠ The reference points must be set with a pulse that may be applied for up to 3 s! **ERR1:** Error at measurement system - encoder 1 **ERR2:** Error at measurement system - encoder 2
	ERR-MESS: **Res:** Not yet in use **Encoder:** HIGH level if measurement system ok.	**1 of N:** HIGH level if at least one cam of this module is in the specified range.	**Synchron** HIGH level if the condition for synchronization or total length is ok.		⚠ Switching the outputs back on requires the RTDS acknowledgement signal.

23 Module parameters

In the module parameters, you can view and edit module-specific settings, create frequency tables and define cam parameters.

Call up the parameters with the "T" key or via the "Parameters" - "Tables" menu.

The parameters are divided into 4 groups: (Fig. 24-1)

Settings: these are module-specific
DNCO: Frequency tables
DNCO-SCANNER: Frequency tables for scanners
Cams

Detailed information on the module-specific settings is provided in the following chapters.

23.1 Central module settings

In Fig. 24-1 under "Settings", select the central module. Additional parameter tables are displayed.

23.1.1 ZMV parameters

Name
Max. 12 characters

Autostart
If this function is activated, the SL VARIO system is immediately ready for operation following transmission of the application. Otherwise, the operating voltage must be briefly switched off (approx. 2 s).

Verification
If this function is activated, a check is performed after transmission of the application to determine whether the entire data set was transmitted. This increases the transmission time.

SLOK delay (s)
Turn-off delay time (1 s – 25 s) of all of the system's outputs after an internal or external error.

ZMV to IZK extension
Advanced CAN addressing

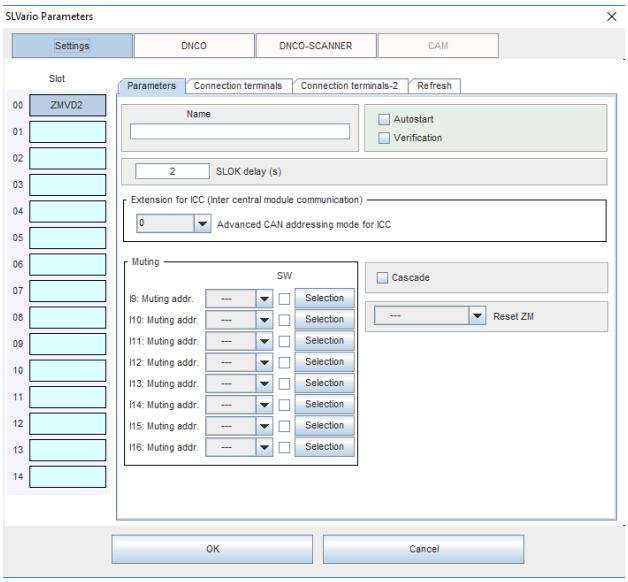


Fig. 24-1

Muting

This option is used to mute function modules over inputs I9 to I16. You can find further information in chapter "Muting".

SW

Muting via software bits. No inputs are required. You can find further information in chapter "Muting".

Reset ZM

(Fig. 24-2)
Select an input I1 to I16 with which you restart the central module in the event of a SLOK OFF. In normal operation, this input remains available as a digital input.

Deselect with selection "--".

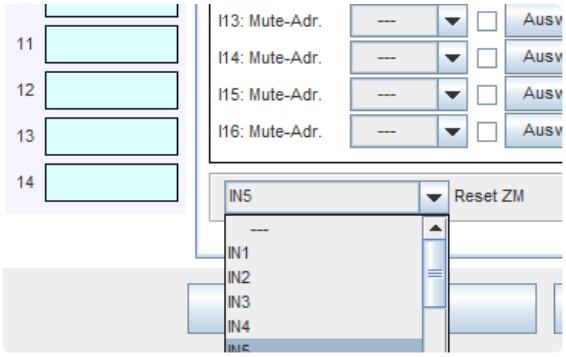
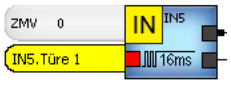


Fig. 24-2

23.1.2 Connection terminals

In the "Connection terminals" area (Fig. 24-3), you can assign the 12-character designations for the input and output terminals of the module. These are displayed in the symbol.



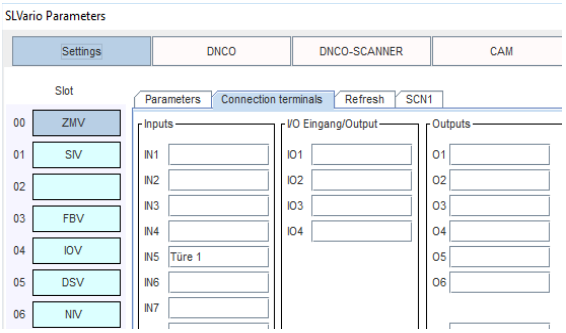


Fig. 24-3

23.1.3 Refresh

In the "Refresh" area (Fig. 24-4), you can adjust the refresh time for measurement values, such as speeds and position values.

The adjustment range is between 10 and 500 ms.

A list of possible settings can be opened via the drop-down menu.

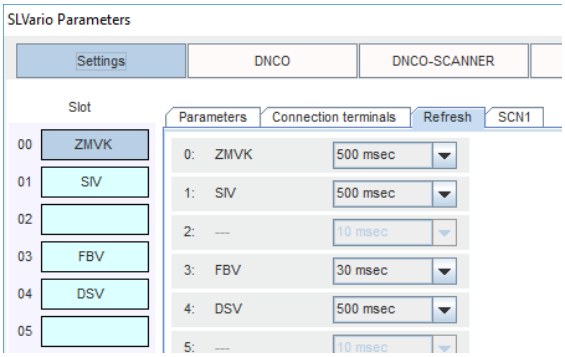


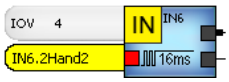
Fig. 24-4

23.2 Settings of the function modules

With the function modules, only the FBV, NIV, SIV and DSV/DRV modules have a special Parameters area. This is covered in a separate chapter. For the other function modules, the menu is limited to the connection terminal designations.

23.2.1 Connection terminals of the function modules

In the "Connection terminals" area (Fig. 24-5, you can assign the 12-character designations for the input and output terminals of the module. These are displayed in the symbol.



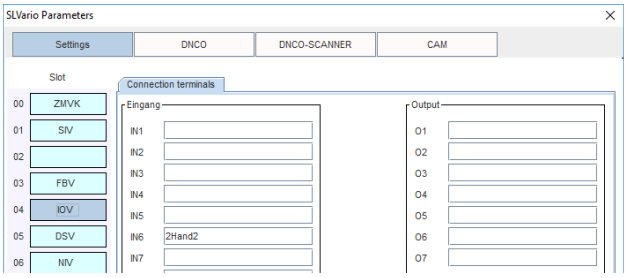


Fig. 24-5

23.3 Settings of the FBV fieldbus modules

In Fig. 24-6, select the fieldbus module under "Settings". Additional parameter tables are displayed.

23.3.1 FBV parameters

Name
Max. 12 characters

Stationsadresse

▶ Enter the station address in the range from 2 to 125.

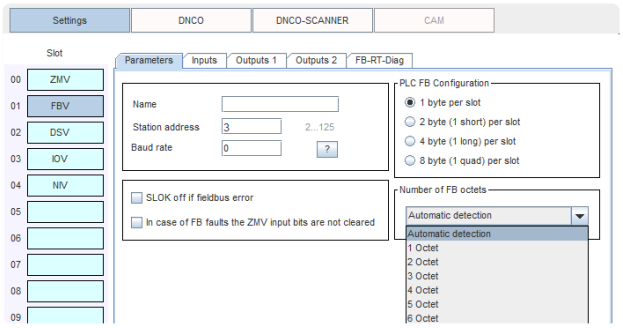


Fig. 24-6

For modules with external addressing, the station address is set bit-coded via inputs I5 to I8 of the fieldbus module. In this case, the value 0 must be entered in this field. Fieldbus addressing then begins with 32.

Example:

I8	I7	I6	I5	Address
0	0	0	1	33

⚠ After a change to the station address, it is absolutely necessary that the SL VARIO be briefly (approx. 2 s) disconnected from the supply voltage.

Baud rate

▶ **Select the baud rate.**

Use the ? button to display a list of the valid input values for CAN open bus systems. Other bus systems do not evaluate this entry.

SLOK-Off on fieldbus malfunction
If this checkbox is selected, the central module switches off if the data line is faulty.

Do not delete ZM FB input bits on FB malfunction

Select this function if the input bits on the central module should not be deleted in the event of a fieldbus malfunction.

PLC-FB configuration
Configuration of the communicating PLC.

Number of FB octets

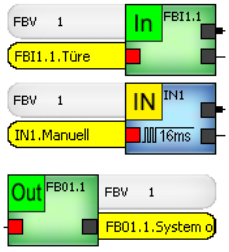
The number of octets needed can be determined automatically or be predefined. The selection is made via the drop-down menu.

Examples of a PLC-FB configuration:

Byte/ Slot	Octet	Input	Output
1	1	8x1 Byte	8x1 Byte
1	2	16x1 Byte	16x1 Byte

23.3.2 Designations of the FBV inputs/outputs

In the "Inputs" and "Outputs" areas (Fig. 24 7), you can assign the 12-character names for the virtual inputs and outputs and the digital input terminals. These are displayed in the symbol.



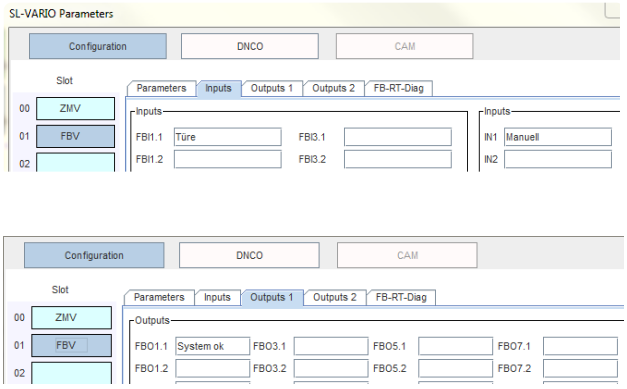


Fig. 24-7

23.3.3 FB-RT-Diag

The FB runtime diagnostics (Fig. 24-8) provides you with easy-to-use, real-time diagnostics. This can be used to send the states in the central module to your higher-level PLC.

Diagnostics must be configured as follows:

Slot
Currently only central module is possible.

Element group
▶ Select the element group.

Element
▶ Select the element.

Length
Display of the actual data length of the selected element.

▶ Now select the octet and byte to which you would like to map the data.

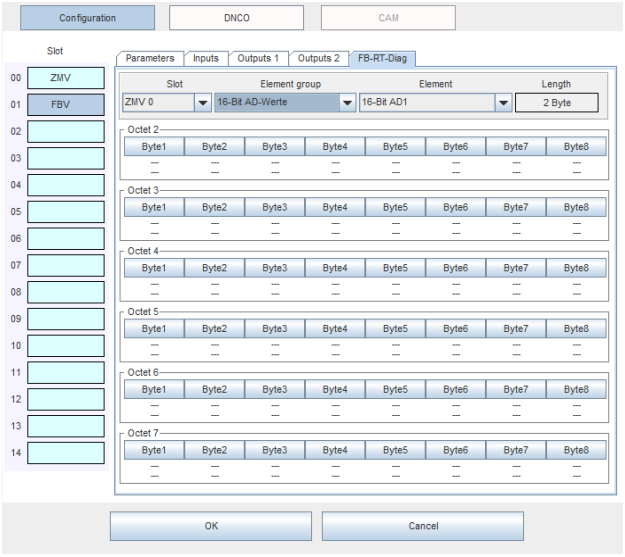


Fig. 24-8

The "SL VARIO FB Runtime Diagnostics" mask opens. (Fig. 24-9)

The output bytes to which the selected diagnostic data is written are defined with the "Accept setting" selection and the "Accept" button.

These are marked in yellow. (Fig. 24-10)

This setting is reset with the "Reset settings" selection and the "Accept" button.

The setting is accepted with "OK".

Existing settings can be reset by clicking again.

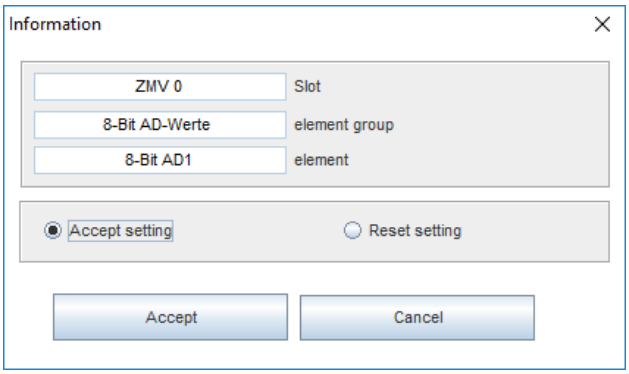


Fig. 24-9

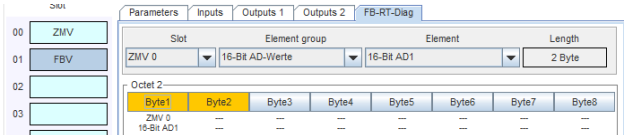


Fig. 24-10

23.4 NIV module settings

In Fig. 24-11, select the network module under "Settings". Additional parameter tables are displayed.

23.4.1 NIV parameters

Name
Max. 12 characters

Network address

▶ Enter the network address of this module in the range from 1 to 8.

Baud rate

▶ Select the transmission rate.

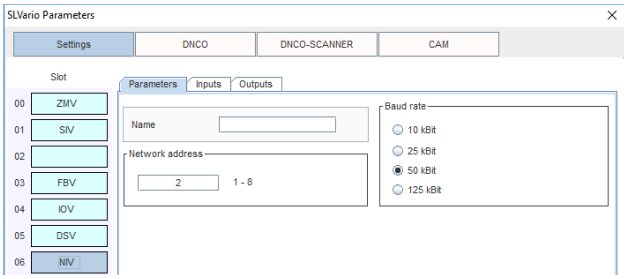


Fig. 24-11

23.4.2 Designations of the NIV inputs/outputs

In the "Inputs" and "Outputs" areas (Fig. 24-12), you can assign the 12-character names for the individual hardware input and output terminals as well as the network inputs and outputs. These are displayed in the symbol.

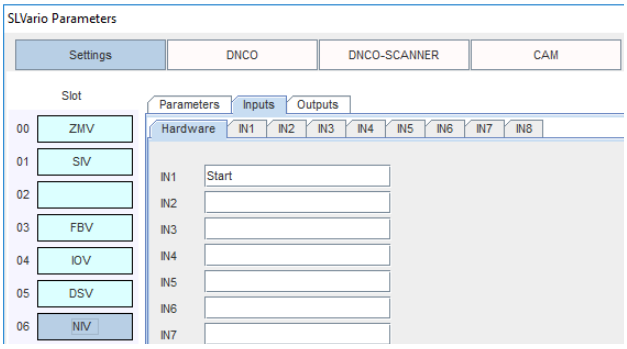
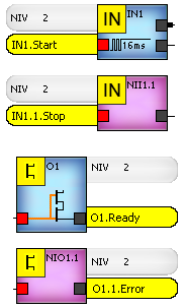


Fig. 24-12



23.5 SIV module settings

In Fig. 24-13, select the SIV module under "Settings". Additional parameter tables are displayed.

23.5.1 SIV parameters

SSI1/SSI2 data length

▶ Enter the number of data bits specified by the encoder.

Code

▶ Select binary or Gray code.

When monitoring with two encoders (Fig. 24-14), the following selection must be made as well:

Total length

I Encoder 1 actual value **I** +
I Encoder 2 actual value **I**

The length of the area to be monitored must be entered in the input field. This is monitored with a tolerance of 6.25%.

Synchronization

I Encoder 1 actual value -
Encoder 2 actual value **I**

The tolerance for synchronization monitoring must be entered in the input field.

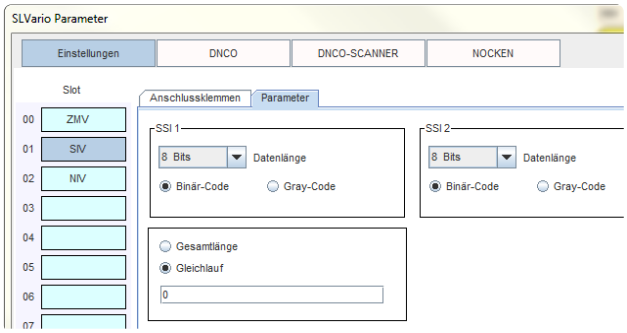


Fig. 24-13

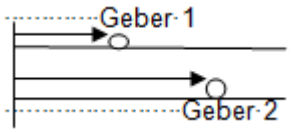


Fig. 24-14

23.5.2 Designations of the SIV inputs/outputs

In the "Inputs" and "Outputs" areas (Fig. 24-15), you can assign the 12-character names for the individual hardware input and output terminals as well as the network inputs and outputs. These are displayed in the symbol.

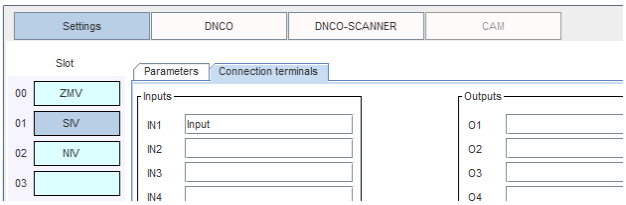


Fig. 24-15

23.6 DSV/DRV/BIV module settings

See chapter "Speed monitoring".

23.7 DNCO

See chapter "DNCO".

23.8 DNCO scanner

See chapter "Scanner".

23.9 Cam parameters

This menu item (Fig. 24-16) cannot be selected until cams have been placed in the application. These can then be edited via the drop-down menu.

A description of the parameters can be found in chapter "Cams".

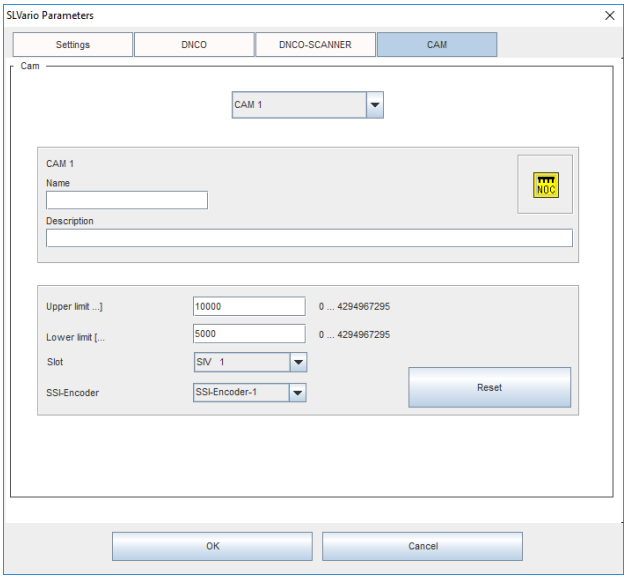


Fig. 24-16

24 Speed monitoring

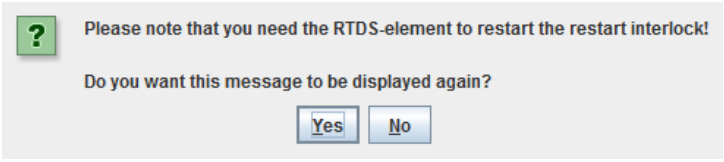
Modules DNSL-ZMV/ZMVK, -ZMVD, -DSV, -DRV, -BIV and -SIV can be used to record and evaluate multiple independent drive movements. Incremental measurement systems, resolver measurement systems and absolute measurement systems can be detected by the different modules. The connection happens via RJ45.

With DNSL-ZMV/ZMVK, hardware inputs I9 to I16 are used for recording the drive speed. To detect the drive speed, it is possible to use, e.g., sensors, proximity switches with 180° phase shift or a TTL/HTL measurement system.

The configuration is performed in the Designer.

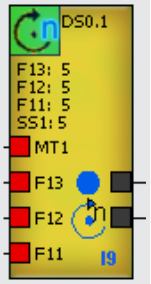
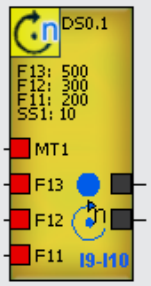
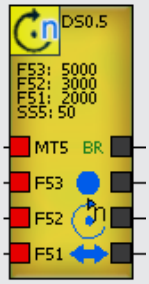
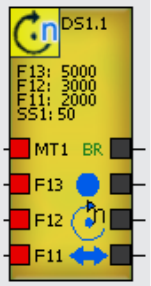
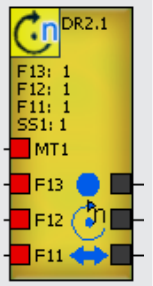
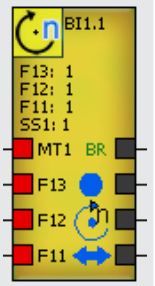
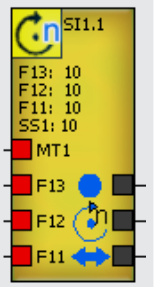
▶ **Open the toolbar of the corresponding module.**
▶ **Select the**  **symbol and place it in the logic diagram.**

The following message appears:



The RTDS restart interlock  is used to activate speed monitoring as well as to acknowledge triggered speed monitors to enable restarting. If RTDS is constantly activated, automatic restart is possible and must be prevented through other measures!

24.1 Overview of the speed monitoring symbols

ZMV/ZMVK one-channel	ZMV/ZMVK two-channel	ZMV/ZMVK TTL/HTL	DSV, ZMVD	DRV	BIV	SIV
						

24.2 Speed monitoring inputs

The inputs can be activated via hardware inputs or virtual outputs.
Select from four operating modes:

MTx: Mutes the operating modes. This input is used if drive monitoring is to be suppressed in special situations.
Fx3: Selects automatic operation
Fx2: Selects automatic operation
Fx1: Selects setup operation

If multiple inputs are actuated at the same time, priorities are as follows:

MTx → **Fx3** → **Fx2** → **Fx1** → Standstill

24.3 Speed monitoring outputs

	**Brake monitoring** See chapter "Brake ramp monitoring".
	**Advance warning limit** (for central module only)
	**Standstill:** HIGH level on **V**act < **V**standstill LOW level on **V**act > **V**standstill independent of the selected operating mode. HIGH level even without measurement system.
	**Speed ok:** HIGH level on **V**act < **V**max LOW level on **V**act > **V**max **V**max is dependent on the selected operating mode. If no operating mode is selected, the standstill frequency is monitored: HIGH level on **V**act = Vstandstill LOW level on **V**act > Vstandstill
	**Fan monitoring** HIGH level if **V**act > **V**max LOW level if **V**act < **V**max
	**Direction monitoring** See chapter "Direction monitoring"

24.4 Speed monitoring parameters

The parameter mask for configuring speed monitoring can be called up via the "Parameter–Tables" menu or via the Properties menu (Fig. 25-1). It is nearly identical in structure for the various SL VARIO modules. After selecting the module and the encoder interface, the corresponding mask appears.

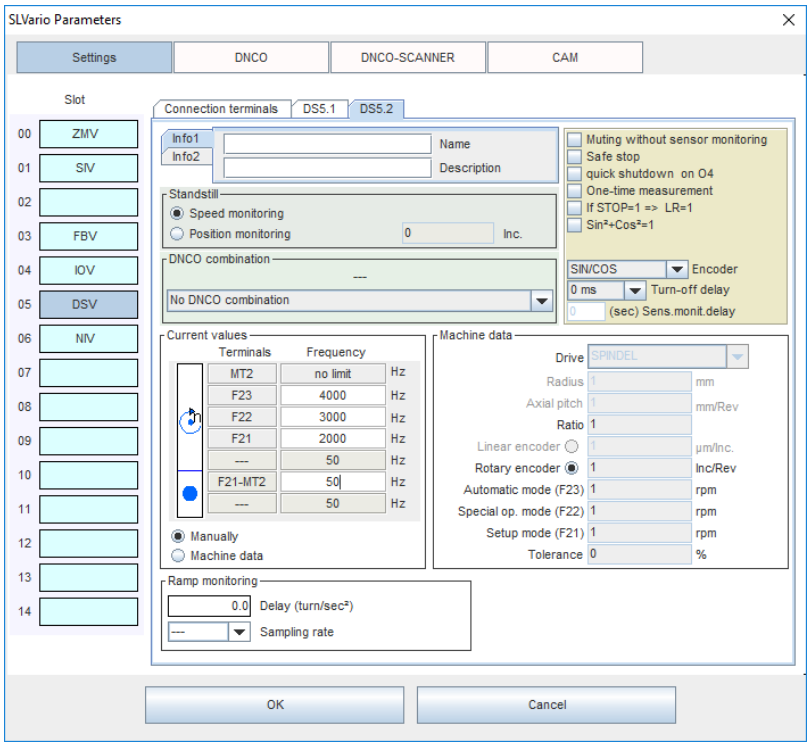


Fig. 25-1

Info 1

- Name (max. 8 characters)
- Description (max. 80 characters)

Info 2

- DINA cable adapter type (max. 20 characters)
- Interface (max. 20 characters)

Standstill

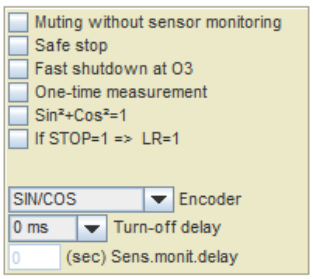
- Drive is monitored for speed while at a standstill.
- Drive is monitored for position while at a standstill.

▶ Enter the increments to be monitored in the assigned field.

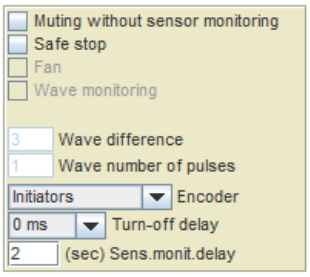
DNCO combination

The speeds to be monitored are entered in a frequency table. See chapter "DNCO function". In the right part of the parameter mask, various functions can be selected or deselected and parameters entered depending on the given module. (Fig. 25-2)

DSV



ZMV



DRV

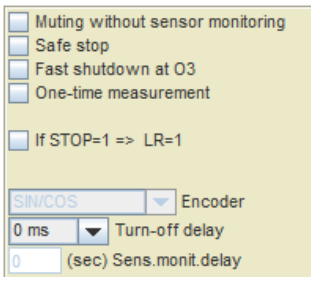


Fig. 25-2

Muting without sensor monitoring

This function suppresses sensor monitoring in the MUTE operating mode:

- The Speed ok and Standstill outputs are HIGH.
- MT input terminal is displayed in gray in the symbol. 

- The symbol is displayed in gray in online diagnostics if the MT terminal is activated..

Safe stop

With this function, the Standstill and Speed ok outputs are LOW if no sensors are present.

Without this function, only the Speed ok output is set to LOW.
The Standstill output remains at HIGH.

Fast shutdown at O3 on DS1 or O4 on DS2

With this function, output O3 (DS1) or O4 (DS2) of the speed module can be used for fast shutdown on overspeed. Turn-off times < 8 ms are thereby achieved.

The Speed ok output must be connected to the corresponding output in the application.

One-time measurement

With one-time measurement, turn-off times < 4 ms can be achieved at the speed output.

Sin2+cos2=1

Monitoring of the signal amplitude. Additional plausibility check for SIL3-certified sin/cos encoders With other sin/cos encoders, the signal may be of lower quality, resulting in frequent shutdowns.

If STOP=1 ⇨ LR=1

If this function is selected, the direction monitoring output is HIGH as long as the standstill output is HIGH.

Fan

With fan monitoring, the Speed ok output is inverted and is displayed with the symbol :

- HIGH level if Vact > Vmax
- LOW level if Vact < Vmax

Shaft monitoring

With this function, initiators are monitored for synchronism. As soon as the number of pulses at two measurement inputs deviates by the parameterized difference amount, the speed output of the speed monitoring, which counted more pulses, switches off.

The assignment of the inputs is fixed, [I9, I10] and [I11, I12]. The difference must be set the same on both speed symbols.

Advance warning limit

With speed monitoring on the central module via an HTL/TTL encoder, the brake output BR can be used to indicate that a percentage of the setpoint speed (advance warning limit) has been exceeded.

- **It is HIGH if the actual value is less than this advance warning limit.**
- **It is LOW if the actual value is greater than this advance warning limit.**

The function is not active until a value < 100% has been entered. The designation of the brake output then also changes on the speed symbol.

Encoder

Specification of the measurement system signals

Turn-off delay

A time from 0 ms to 750 ms can be entered here within which monitoring switches off after detection of overspeed. The delay has no effect if the position is monitored while at a standstill.

Sens.monit.delay

Only for speed monitoring via initiators on the ZMV. In the input field, a delay time > 0 sec. can be entered within which a LOW level may be present on the sensor before monitoring switches off.

Refresh/cycle

Only for speed monitoring via TTL/HTL encoders on the ZMV. The smallest frequency that can be monitored with these monitors is normally 50 Hz with a gate time of 25 ms. With Refresh/cycle, it is possible to reduce this minimum frequency by selecting a higher gate time (up to 250 ms). It should be noted here that the trigger time increases as a result.

Example:

Standstill frequency: 50 Hz
Refresh/cycle: 100 ms
Monitored minimum frequency: 12,5 Hz

f= (25ms/100ms)×50Hz = 12,5Hz

Current values

In this area, enter the speeds that are to be monitored. There are two possibilities here:

▶ Select "Manually": Enter the frequencies directly for the respective operating mode. (Fig. 25-3)
▶ Select "Machine data": Enter the machine-specific data. The frequencies are calculated automatically on the basis of this data. (Fig. 25-4)

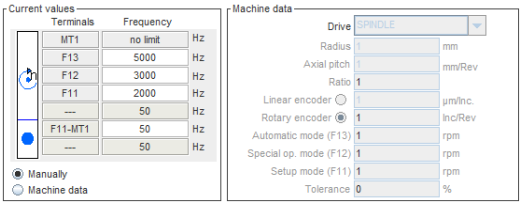


Fig. 25-3

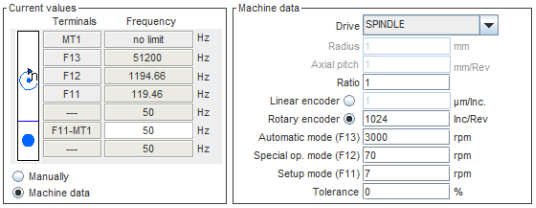


Fig. 25-4

Because it is not possible to monitor absolute standstill due to reasons of operational safety, a frequency must be stored for monitoring the standstill. Based on experience, the value should be 5 – 10% of the setup mode speed. Standstill monitoring is active if no operating mode is selected.

Enter this frequency in field "Fxx-MT2".

Machine data

The frequency values are automatically calculated on the basis of machine-specific data. After selecting the axis type, the mechanical quantities must be entered in the table. After entering the speeds that are to be monitored and a possible tolerance value, the corresponding frequency value is calculated and added to the list of current values.

A plausibility check is performed during this process. If the frequency value is outside of the permissible values, the respective field turns red. (Fig. 25-5)

Only after all values are in the permissible range can they be accepted with OK.

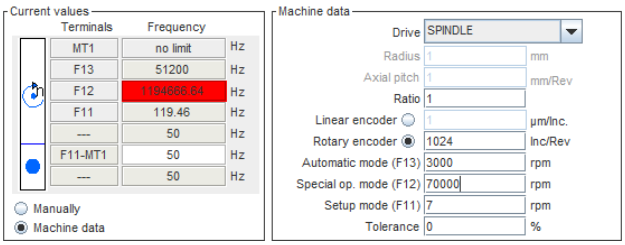


Fig. 25-5

If "Manually" is now selected again, the calculated frequency data is overwritten with the most recently entered manual data. If machine data is selected again, the calculated data is entered again.

Ramp monitoring

The DSV speed module enables monitoring of a linear brake ramp.

The deceleration and the sampling rate as well as the encoder resolution must be entered in the application for this purpose. (Fig. 25-6)

You can find a detailed description in chapter "Brake ramp monitoring".

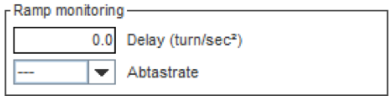


Fig. 25-6

24.5 Additional parameter settings for DNSL-BIV

With the DNSL-BIV module, the speeds are only entered via the machine data. In addition, the encoder type must be specified more precisely. (Fig. 25-7)

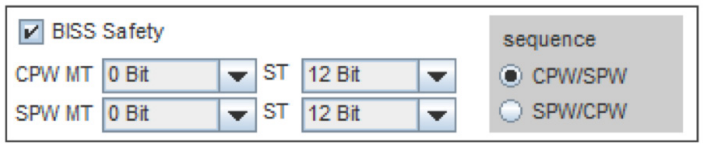


Fig. 25-7

24.6 Special parameter settings for speed monitoring on the central module

24.6.1 One-/two-channel monitoring via initiators

Special features for one-channel and two-channel monitoring:

- If an operating mode is selected, the standstill output switches off at approx. 4 Hz.
- If no operating mode is selected, the standstill output switches off at 4 Hz and the speed output switches off at the standstill frequency entered in the parameter mask.
- The speed output and standstill output do not switch back on again until the frequency is < 4 Hz.

Additional selection options appear in the parameter mask for speed monitoring via initiators. (Fig. 25-7)

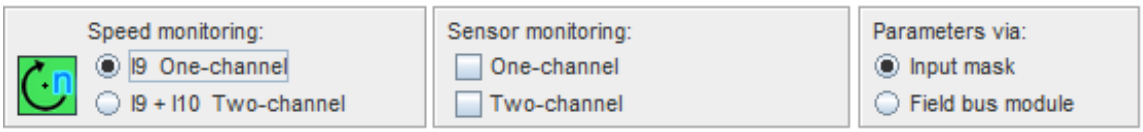
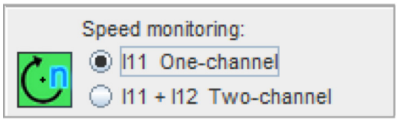


Fig. 25-7

Speed monitoring

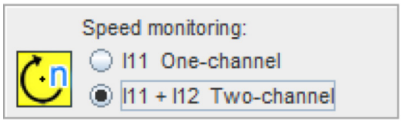
One-channel

One-channel monitoring is selected by activating "One-channel" in the parameter field.



Two-channel

Safe, two-channel monitoring is selected by activating "Two-channel" in the parameter field.



Parameters via

The Parameters via fieldbus card can only be selected with one-channel speed monitoring. If you have a fieldbus card, the monitoring parameters of the non-safe, one-channel speed monitoring can also be assigned via this module. To do this, "Fieldbus card" must be selected in the parameter mask.

Only two operating modes are available in this case. Fx1 to Fx3 are grouped together internally as one operating mode. These inputs of the logic symbol do not, therefore, need to be wired. The MUTE operating mode can be used and wired as usual.

Contained in octets 2 to 5 for each one-channel monitor are:

- Setpoint: 2 bytes
- Max. tool speed in rpm: 2 bytes
- Increments/revolution: 1 byte
- Tolerance during SS monitoring: 1 byte
- Start ramp: 1 byte
- Brake ramp: 1 byte

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Setpoint		Max. tool speed in rpm		Inc./rev.	Tolerance	Start ramp	Br. ramp

Sensor monitoring

With one-channel speed monitoring, it is possible to implement two-channel sensor monitoring. To do this, a second sensor that delivers the negated signal must be connected to the input located underneath. The first input is then the actual measurement input; the second serves only as a control input. If a signal is detected on the second input and the first input receives no signal, the speed output switches off.

24.7 Requirements on the measurement systems

24.7.1 Inputs for speed monitoring on the central module

On the central module, hardware inputs I9 to I16 are used for recording the drive speed. To detect the drive speed, it is possible to use, e.g., sensors, proximity switches with 180° phase shift or a TTL/HTL measurement system.

Requirements on the proximity switches

- Two signals with 180° phase shift. One switch before the tooth on the cog and the other before the gap.
- Positive switching to 24 VDC (PNP)
- While at a standstill, the setup must enable at least one HIGH signal.

Option 1: five monitors, one of which is safe

	DS1	DS2	DS3	DS4	DS6			
Measurement system	Sensor 1	Sensor 2	Sensor 3	Sensor 4	TTL/HTL			
					+A	+B	-A	-B
DNSL-ZMV	I9	I10	I11	I12	I13	I14	I15	I16

Option 2: four monitors, two of which are safe

	DS1		DS3	DS4	DS6			
Measurement system	Proximity switch 1		Sensor 3	Sensor 4	TTL/HTL			
	Sensor 1	Sensor 2			+A	+B	-A	-B
DNSL-ZMV	I9	I10	I11	I12	I13	I14	I15	I16

Option 3: three safe monitors

	DS1		DS3		DS6			
Measurement system	Proximity switch 1		Proximity switch 2		TTL/HTL			
	Sensor 1	Sensor 2	Sensor 3	Sensor 4	+A	+B	-A	-B
DNSL-ZMV	I9	I10	I11	I12	I13	I14	I15	I16

Option 4: two safe monitors, each via one HTL measurement system

	DS5				DS5			
Measurement system	TTL/HTL				TTL/HTL			
	+A	+B	-A	-B	+A	+B	-A	-B
DNSL-ZMV	I9	I10	I11	I12	I13	I14	I15	I16

24.7.2 Inputs for speed monitoring on DNSL-DSV, -DRV, -SIV, -BIV and ZMVD

Function modules DNSL-DSV, DNSL-DRV, DNSL-BIV and DNSL-SIV can each be used to record and evaluate two independent drive movements. An incremental measurement system (TTL, HTL or Sin/Cos) or proximity switches can be monitored via the DSV module, a resolver measurement system via the DRV module and an absolute measurement system via the SIV module or the BIV module. The ZMVD monitors two or four TTL, HTL or Sin/Cos measurement systems. The configuration is performed in the Designer.

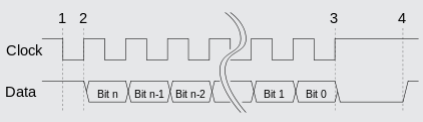
Incremental measurement system (Sin/Cos, TTL/HTL)

DNSL-DSV	Encoder 1	Encoder 2	 4 bis 5V  oder  0,8-1Vss SIN/COS

Resolver measurement system

DNSL-DSV	Resolver 1	Resolver 2	  1-10Vss SIN/COS

Absolute measurement system

DNSL-SIV or DNSL-BIV	Encoder 1	Encoder 2	 

An absolute measurement system is used with this module. The synchronous serial interface (SSI) is used to receive absolute position information through serial data transmission.

25 Position monitoring

Position monitoring is used to monitor an axis or spindle over a defined range.

This range is defined by the permissible number of increments. (Fig. 26-1)

Activate position monitoring as follows:

- Select the encoder input. In this example, DNSL DSV encoder DS1.1
- Select "Position monitoring" and enter the permissible number of increments.

Within this range, the axis can move to the left and right without a shutdown occurring.

This value is taken over in the "Current values" table and describes the trigger condition for the standstill output and speed output on the DSV element if no operating mode is selected (F11-F13, MT1 open).

For DNSL-DRV (resolver measurement system), the number "1" is entered. For one-pole resolvers (1 period /revolution), the movement window is ±10° without a shutdown occurring.

For multi-pole resolvers, the movement window is correspondingly smaller.

With DNSL-BIV, the permitted deviation is entered in percent. (Fig. 26-2)

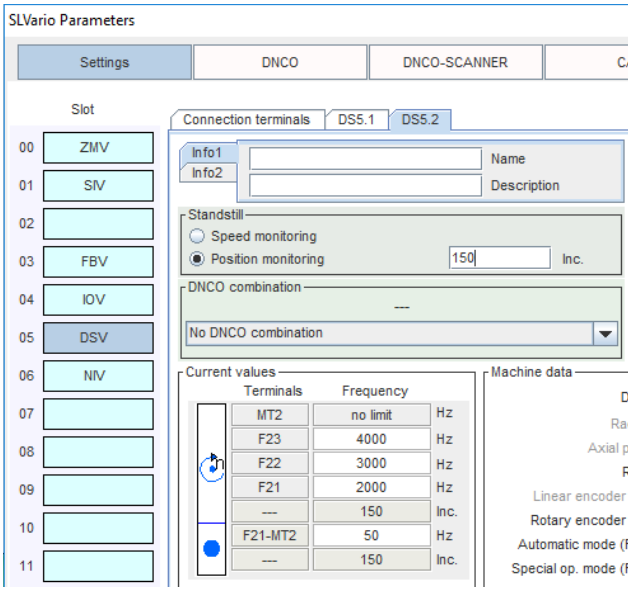


Fig. 26-1

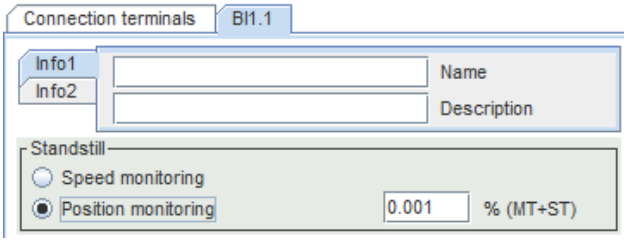


Fig. 26-1

26 Direction monitoring

The  output can be used for direction monitoring. It is HIGH while at a standstill and with advancing sine wave; it is LOW with advancing cosine wave. The direction can be detected by means of logical operations with the standstill output. (Fig. 27-1)

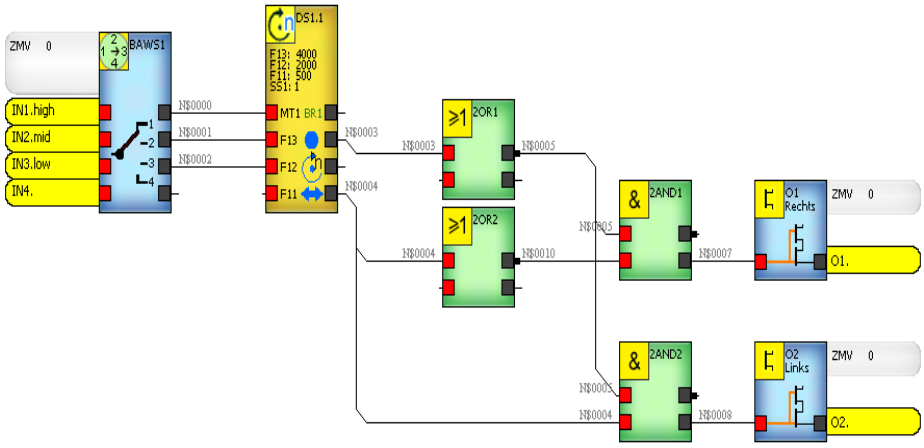


Fig. 27-1

27 Brake ramp monitoring with DNSL-DSV

The DNSL-DSV speed module enables the monitoring of a linear brake ramp. (Fig. 28-1)

- ▶ Open the parameter mask of the DV module.
- ▶ Define the machine data
- ▶ In the "Ramp monitoring" area, enter the deceleration (max. 4 digits before the decimal and 2 after).

With spindles, the deceleration is specified in revolutions/sec² and in mm/sec² for axes.

- ▶ Define the measurement range under "Sampling rate". The higher this value is, the longer it takes to detect the brake ramp.

If no ramp monitoring is desired, deselect it with with ---.

The module calculates the parameters necessary for ramp monitoring from this data.

If the deceleration value has a red background, an internal limit value was exceeded. In this case, the sampling rate must be adjusted. (Fig. 28-2)

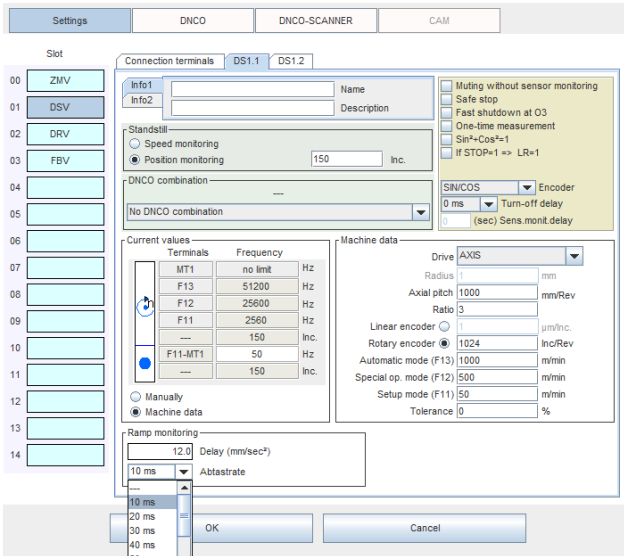


Fig. 28-1

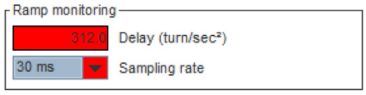


Fig. 28-2

Alternatively, the brake ramp can be calculated without entering the machine data. Select "Manually" in this case.

You now only need to enter the deceleration in revolutions/sec², the sampling rate and the encoder resolution in inc./rev. (Fig. 28-3)

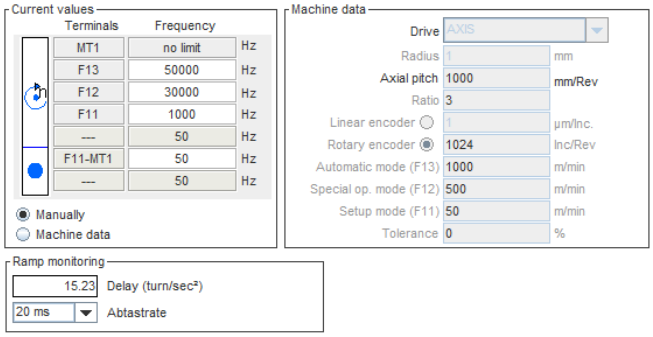


Fig. 28-3

If ramp monitoring is active, the brake output BR of the speed monitoring element is LOW if the slope of the brake ramp is less than the configured decel-eration. It is HIGH if it is greater than or equal to the configured deceleration.

If ramp monitoring is switched off, the output is LOW. (Fig. 28-4)

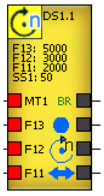


Fig. 28-4

28 DNCO function

With DNSL-DSV, DNSL-DRV and DNSL-ZMV, the DNCO function enables the speed monitoring of

- **up to 16 different speeds per encoder input and per operating mode.**

  or

- **up to 64 different speeds per encoder input in automatic mode.**

The speeds are stored in two frequency tables (DNCO1 and DNCO2). The assignment of which encoder input accesses which table is defined in the parameter mask of the respective speed monitoring module.

The frequency selection is then made via the bit-coded wiring of defined inputs on the central module or the function modules. Four or six inputs are provided for this purpose. The frequencies for all operating modes can be selected with four inputs. If more than 16 frequencies are needed, six inputs are to be provided. In this case, the DNCO function can only be used in the automatic operating mode, however.

Alternatively, the frequencies in all operating modes can also be selected via any of the inputs. To do this, the "DNCO multiplexer" logic module must be placed in the application. See chapter "DNCO function via multiplexer".

28.1 Inputs for selecting the frequencies in the DNCO tables

	Encoder 1				Encoder 2			
DNSL-ZMV	I1	I2	I3	I4	I5	I6	I7	I8
DNSL-DSV	I1	I2	I3	I4	I5	I6	I7	I8
DNSL-DRV	I1	I2	I3	I4	I5	I6	I7	I8
DNSL-INV	I1	I2	I3	I4	I5	I6	I7	I8
DNSL-IOV	I1	I2	I3	I4	I5	I6	I7	I8
DNSL-NIV	I1	I2	I3	I4	I5	I6	I7	I8
DNSL-SIV	I1	I2	I3	I4	I5	I6	I7	I8
DNSL-RMV	I1	I2	I3	I4	I5	I6	I7	I8
DNSL-FBV	I1	I2	I3	I4	I5	I6	I7	I8

28.2 Selecting the DNCO function

The DNCO function is selected in the parameter mask for speed monitoring. The speed element must have been previously placed on the logic diagram.

In the DNCO combination area, six different DNCO options area available in the drop-down menu. The selected DNCO combination is displayed in the window above the drop-down menu. The inputs used here are also displayed. (Fig. 29-1)

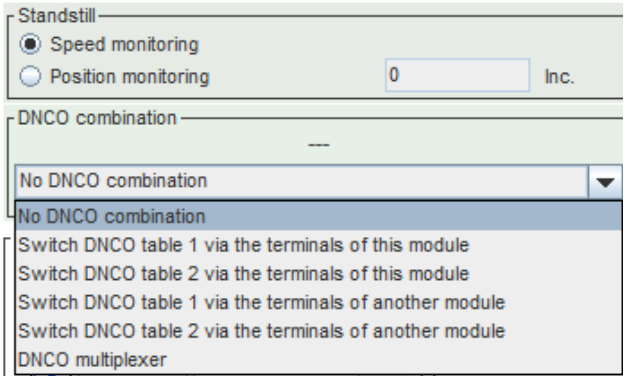


Fig. 29-1

No DNCO combination:

Frequencies are entered under current values.

Switch DNCO table 1 via the terminals of this module:

The frequency to be monitored is selected from the DNCO 1 table using the bit-coded wiring of the inputs of the selected module.

Switch DNCO table 2 via the terminals of this module:

The frequency to be monitored is selected from the DNCO 2 table using the bit-coded wiring of the inputs of the selected module.

Switch DNCO table 1 via the terminals of another module:

The frequency to be monitored is selected from the DNCO 1 table using the bit-coded wiring of the inputs of the globally defined module. To be selected under "DNCO-alternative DNCO terminals".

Switch DNCO table 2 via the terminals of another module:

The frequency to be monitored is selected from the DNCO 2 table using the bit-coded wiring of the inputs of the globally defined module. To be selected under "DNCO-alternative DNCO terminals".

DNCO Multiplexer :

The frequency to be monitored is selected from the DNCO 1/2 table via the DNCO multiplexer symbol from the toolbar of the central module. See chapter "DNCO function via multiplexer".

After selecting a DNCO combination, it appears in the "Current values" fields. (Fig. 29-2)

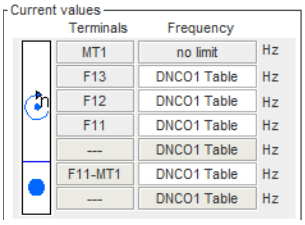


Fig. 29-2

The DNCO combination is displayed in the logic diagram symbol. (Fig. 29-3)

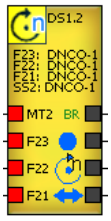


Fig. 29-3

28.3 Frequency tables DNCO 1 and DNCO 2

The DNCO tables are called up in the "Parameters - Tables - DNCO" menu or via the parameter mask of the speed monitoring module. Define the number of inputs for the frequency selection. The selection applies for both tables. Mixed operation is not possible!

28.3.1 DNCO frequency selection via 4 inputs

The frequencies are selected via inputs I1 to I4 for encoder 1 and I5 to I8 for encoder 2. A column with 16 fields is then available for each operating mode. (Fig. 29-4)

▶ In the table fields of the DNCO 1 or DNCO 2 table, enter the frequency values that are to be monitored.

Tolerance

The tolerance prevents speed monitoring from triggering in the event of a low, process-related overshoot. The recommended tolerance is 10%.

▶ Enter a tolerance in the 0 – 20% range

▶ Press the "Tolerance" button.

The table values are recalculated.

Alternative DNCO1/DNCO2 terminals

If the frequencies are to be selected via the terminals of another module, this module must be selected here.

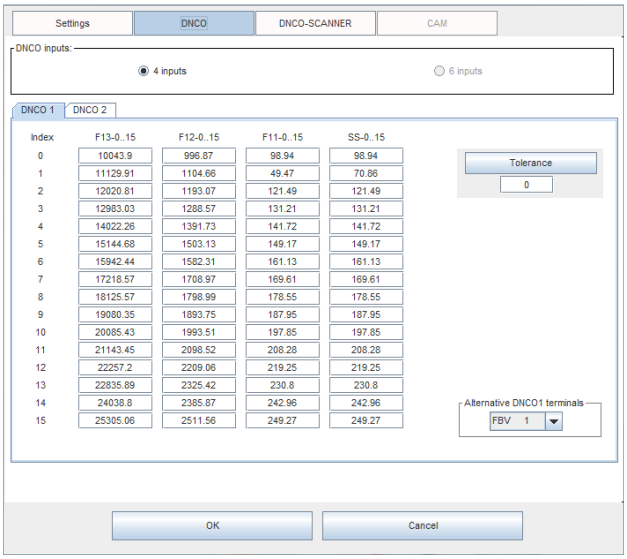


Fig. 29-4

28.3.2 DNCO frequency selection via 6 inputs

The frequencies are selected via inputs I1 to I6. There are then four columns of 16 fields each available for the automatic operating mode. Thus, 64 different speeds can be selected.

28.4 Application example for the DNCO function on the DSV module

Encoder input 2 of the DSV module is to be monitored at the frequency that is selected through the wiring of inputs I5 to I8 of the DSV speed module. The speeds are listed in the DNCO 1 table. While at a standstill, monitoring is always to be at 100 Hz.

- Place speed module DS2 in the logic diagram. (Fig. 29-5)

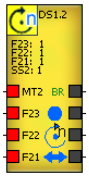


Fig. 29-5

- Call up the parameter mask of the DSV.
- Select DS1.2.
- For DNCO combination, select "Switch DNCO table 1 via the terminals of this module".

The selection is taken over in "Current values". (Fig. 29-6).

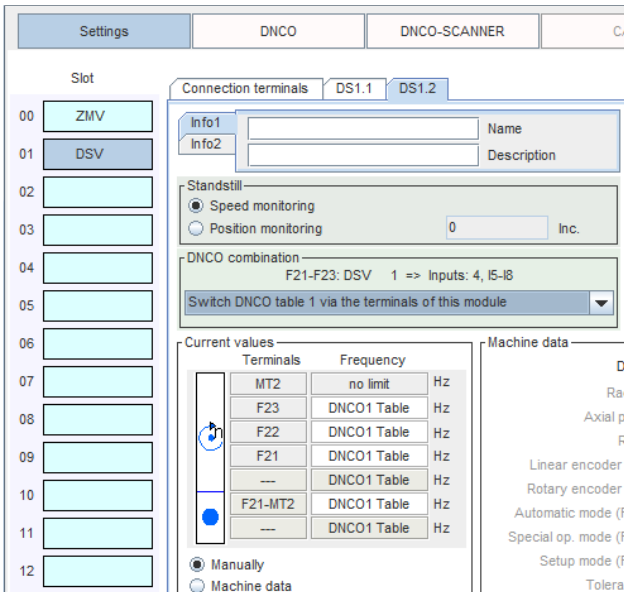


Fig. 29-6

- Select DNCO 1
- Enter the frequencies that are to be monitored and save with OK.
- Transmit application

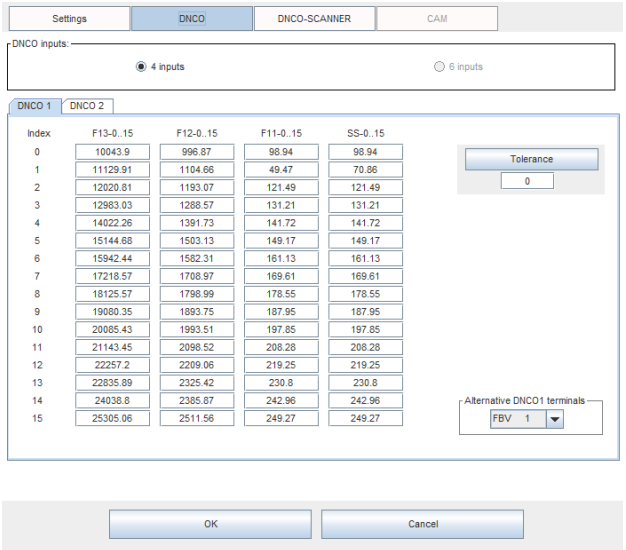


Fig. 29-7

▶ Wire the inputs on the speed module.

In the example in fig. 29-8, monitoring is performed at the table values in index 3.

	Inputs of the DSV-Module			
Index	I8	I7	I6	I5
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
...				

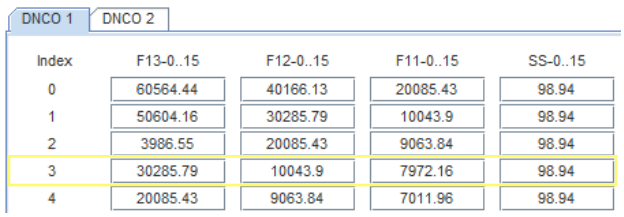


Fig. 29-8

28.5 DNCO function via multiplexer

With the "DNCO multiplexer" element, the frequencies can be selected from the DNCO table via any inputs. To do this, the "Multiplexer" must be selected as DNCO combination in the parameter mask of the speed element. (Fig. 29-9)

Two multiplexers are available.

The assignment of multiplexer 1 and 2 to the encoder inputs is fixed!

Multiplexer DNCO 1 is assigned the monitoring on encoder 1, 7, 9, 11, 13 and references DNCO table 1.

Multiplexer DNCO 2 is assigned the monitoring on encoder 2, 8, 10, 12, 14 and references DNCO table 2.

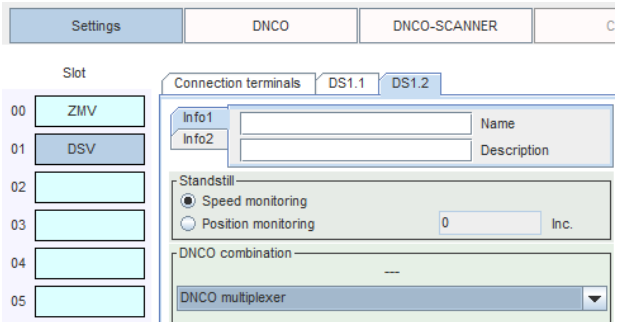
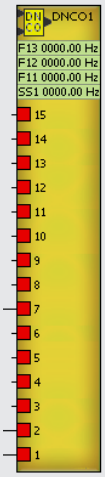
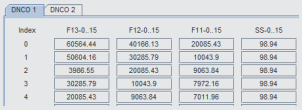


Fig. 29-9

Toolbar	Selection list	Logic diagram	DNCO 1 table	Description
	 DNCO1 for DS1, DS7, DS9, DS11, DS13 DNCO2 for DS2, DS8, DS10, DS12, DS14			Inputs 1 – 15 of the multiplexer correspond to the indices of the DNCO table. • If an input is HIGH, monitoring is is performed at this index value. • If no input is wired to the multiplexer, monitoring is performed at the speed stored in index 0. • If multiple inputs are wired, the higher-valued input is used.

29 DNSL FBV fieldbus modules

29.1 Fieldbus inputs and outputs

The fieldbus modules of the SL VARIO series are equipped with 4 x 8 (FBI1.1-FBI1.8 to FBI4.1-FBI4.8) inputs and 16 x 8 outputs (FBO1.1-FBO1.8 to FBO16.1-FBO16.8).

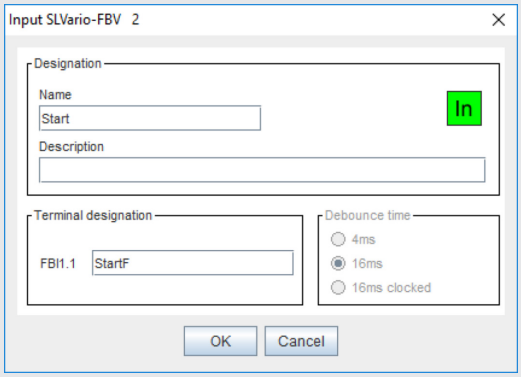
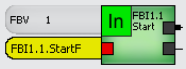
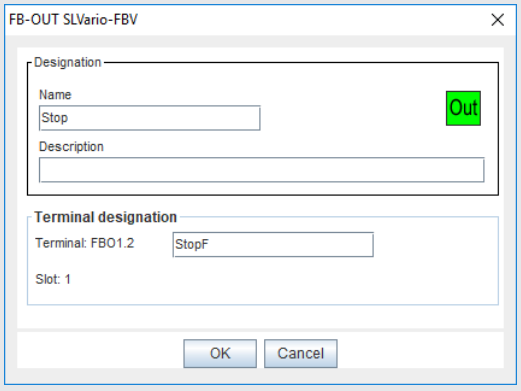
The signals are transmitted from the fieldbus master to SL VARIO via the inputs. The signals are transmitted from SL VARIO to the fieldbus via the outputs. In addition, eight safe digital inputs are also available.

CAUTION

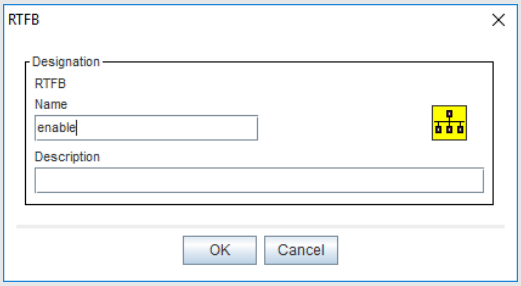
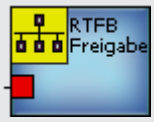
▶ Fieldbus inputs must not be used for applications in the field of "functional safety".

The parameter mask of the inputs contain the following information/parameter fields

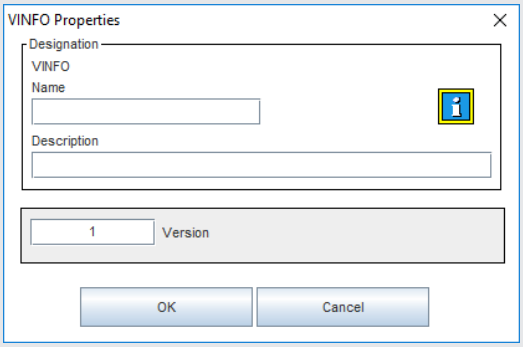
- **Element name, module name and slot number of the module**
- **Name (max. 8 characters)**
- **Description (max. 80 characters)**
- **Terminal designation (max. 12 characters)**

Toolbar	Parameter mask	Symbol	Description
In			**Fieldbus input** Receives data from the fieldbus master.
Out			**Fieldbus output** Transmits data to the fieldbus master.

29.2 RTFB

Toolbar	Parameter mask	Symbol	Description
			The fieldbus outputs can be activated or de-activated via the RTFB input signal. The symbol is not mandatory, but must be wired if used. It can only be placed once.

29.3 FB version information

Toolbar	Parameter mask	Symbol	Description
			The entered version number (1 – 255) is compared with the version information of the fieldbus (FBI8.1. to FBI8.8). The output switches if the versions are equal.

30 Cascading

A cascade structure allows the modules of an application to be split up over various control cabinets. DNSL-CMV modules are needed to set up a cascade. Located in the base unit are the central module and any other function modules, as well as a CMV module in the last slot.

Each of the peripheral units is equipped with a CMV module in the first slot and one or more function modules. Up to five peripheral units can be configured.

Addressing is performed through the wiring of CMV inputs AD1 – 4.

30.1 Configuring a cascade

- To activate cascading, select the "Cascade" checkbox in the settings for the central module ("Parameters - Tables" menu). (Fig. 31-1)
- Use the "Cascading" button to open the configuration menu. (Fig. 31-2)

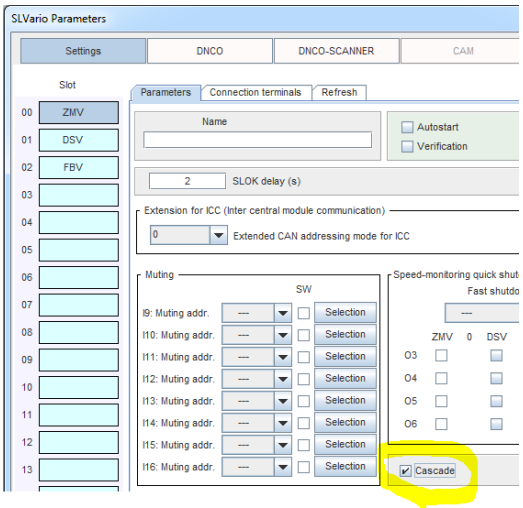


Fig. 31-1

The peripheral units are defined in the configuration menu: (Fig. 31-3)

- Enter the number of peripheral units.
- Address the racks.

Shown in the graphic are the total number of configured modules and the distribution of the individual racks.

A CMV cascade module is in front of each rack. For this reason, the necessary wiring of CMV inputs AD1 – 4 is displayed for you graphically.

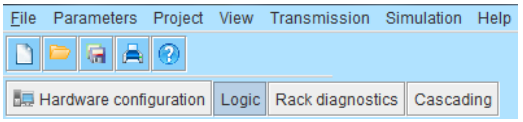


Fig. 31-2

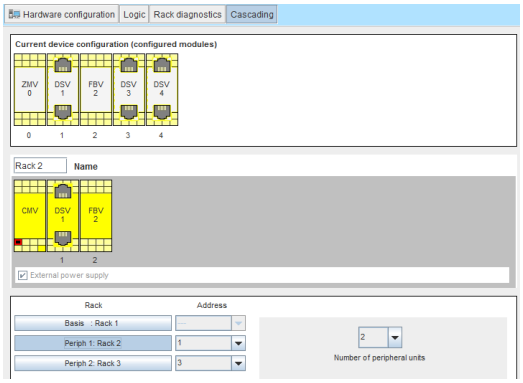


Fig. 31-3

31 Network module

With the DNSL-NIV network module, up to eight racks can be networked together. Here, a rack consists of a central module, a NIV module and up to 13 other function modules.

31.1 Configuring the network module

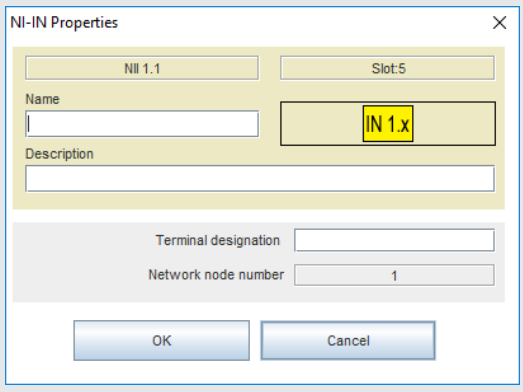
- ▶ Place the NIV module in the hardware configuration. It can be placed on any slot.
- ▶ Enter the network address in the parameter table of the NIV module.
- ▶ Place the inputs and outputs of the NIV module as well as the RTNI element.

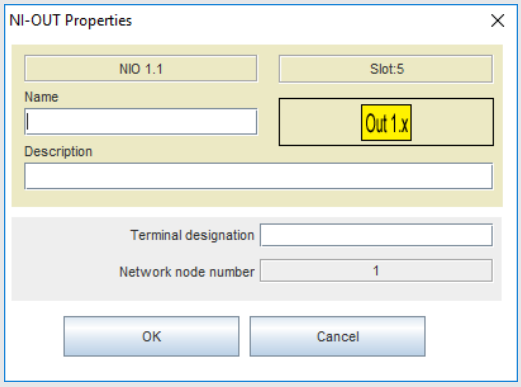
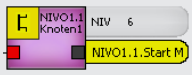
31.2 Network inputs and outputs

The network modules are equipped with 7 x 32 inputs and outputs for communication between one another. In addition, eight safe inputs and four safe semiconductor outputs are available.

The parameter mask of the inputs contain the following information / parameter fields

- **Element name, module name and slot number of the module**
- **Name (max. 8 characters)**
- **Description (max. 80 characters)**
- **Terminal designation (max. 12 characters)**
- **Network node number**

Toolbar	Parameter mask	Symbol	Description
IN 1.x			**Input NIV1.1** Receives data from network 1.

Toolbar	Parameter mask	Symbol	Description
Out 1.x			**Output NIVO1.1** Transmits data to network 1.

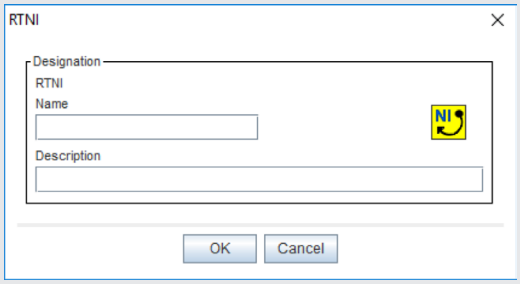
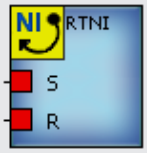
31.3 RTNI (network release)

When turned on and after a malfunction (e.g., interruption of the network connection), the network inputs are LOW. The inputs must be enabled via the RTNI element for updating. Controlled start-up is thereby ensured.

The network inputs can be reset via the R input.

The network outputs are not influenced. These can be queried directly after switching on or after/during a malfunction.

The RTNI symbol can be selected via the toolbar of the central module.

Toolbar	Parameter mask	Symbol	Description
NI			**S-input:** Enables the network inputs. **R-input:** Resets the network inputs. This is dominant. After transmission and after power off, the RTNI is reset!

Example: (Fig. 32-1)

A fault has occurred at the network connection of node 1 to node 2:

- Network inputs NIVI1.1 on network node 2 and NIVI2.1 on network node 1 are set to LOW.
- Node 3 continues to send and receive information from node 2.
- The network inputs must again be released via the S input of the RTNI.

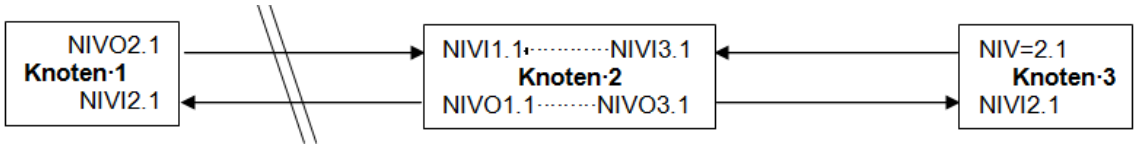
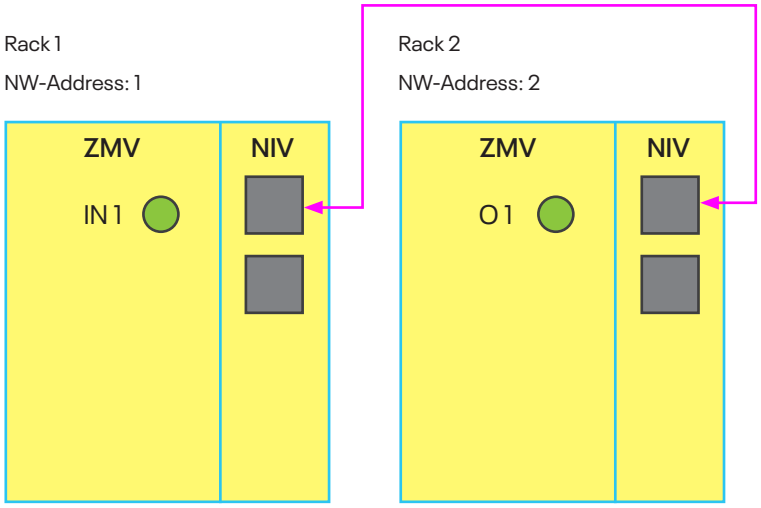


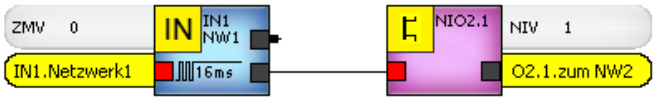
Fig. 32-1

31.4 Application example

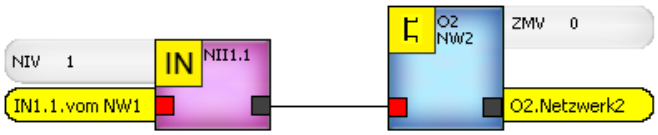


Input IN1 of central module 1 (NW address 1) is to switch output O2 of central module 2 (NW address 2).

In the application of rack 1 digital input IN1 sets network output NIO2.1.



In application 2 of rack 2 network input NII1.1 is queried.



If the input is HIGH and RTNI is set, transistor output O2 of network 2 switches.

CAUTION

▶ The RTNI element must be placed and the S input activated once (Fig. 32-2)

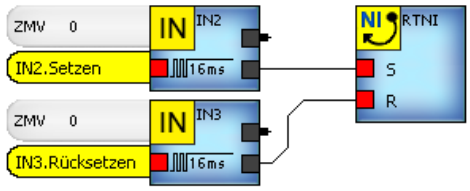


Fig. 32-2

32 Muting

This option serves to mask out function modules so that an application can be used for various expansion stages. Muting is performed via inputs I9 to I16 of the central module or via the software.

CAUTION

- The muted modules must be removed from the rack.
- Only make changes to the hardware and accept the settings with POWER OFF.
- The states of the logic elements of the muted modules are set to logical "0" if no other selection was made.

The "Muting" function is configured in the "Parameters - Tables" menu.

- Select the module that is to be muted.

In Fig. 33-1, input IN13 on the central module would mute speed module DSV 3.

Muting can also be performed via the software of the central module:

- Select the module that is to be muted.
- Select the "SW" checkbox next to the module.

In Fig. 33-2, the RMV would be muted. Input I9 is not needed.

In some cases, it is necessary that the states of the muted modules remain set for further processing. This can be defied in the "Muting selection".

- Select "Selection". (Fig. 33-2)
- Define which elements of this module are to remain set.

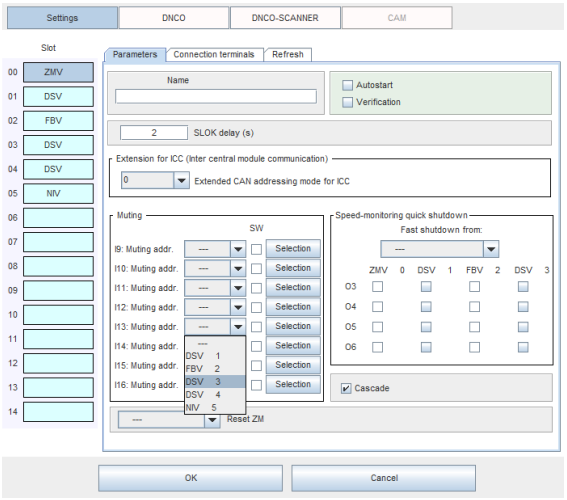


Fig. 33-1

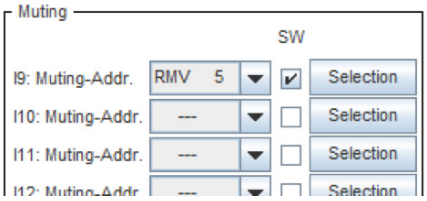


Fig. 33-2

In Fig. 33-3, input IN1 and the output of the SC2 of this module remain set.

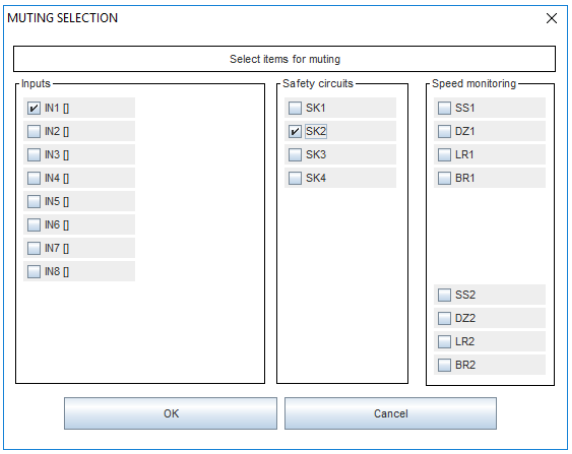


Fig. 33-3

33 Password protection for the application

Each application can be protected with up to three different passwords. Each password is assigned different permissions (responsibilities). These permissions are defined in levels 0 to 3.

It is also possible to define whether an application can always be loaded in a defined level or if a password request always appears.

The settings and responsibilities are accepted when the application is saved. Upon transmission of the application, the password level 0 is stored on the central module. SL VARIO is then password protected! Another application can only be transmitted with a valid password.

CAUTION

- Only one password can be stored in the central module!
- This password can be created in two different menus in the Designer.

Password entry in the Designer menu ...		DNSL-ZMV device password
1. **Project - Settings - Security settings** Enter eight-character password X X X X X X X X 2. **Project - Password protection** Enter eight-character password X X X X X X X X	----------> Transmit application	X X X X X X X X

CAUTION

- The device password can only be deleted in the "Settings" menu.

The parameter mask for password protection is called up via the "Project - Password protection" menu.

If password protection was activated, a lock icon appears with the current level in the navigation area of the Designer mask (Fig. 34-1). The parameter mask can also be called up from here.

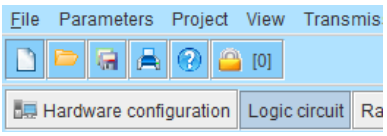


Fig. 34-1

33.1 Settings

The assignment of passwords and definition of responsibilities can only be performed in level 0. (Fig. 34-2)

Current project level
Display of the selected level.

Activate password protection for project
Activation of password protection

Password can be loaded without password

- **Yes:** The application can be opened without a password request.
- **No:** The application cannot be opened until the correct password has been entered.

▶ Enter the passwords (max. eight characters, no special characters).

▶ Accept the settings.

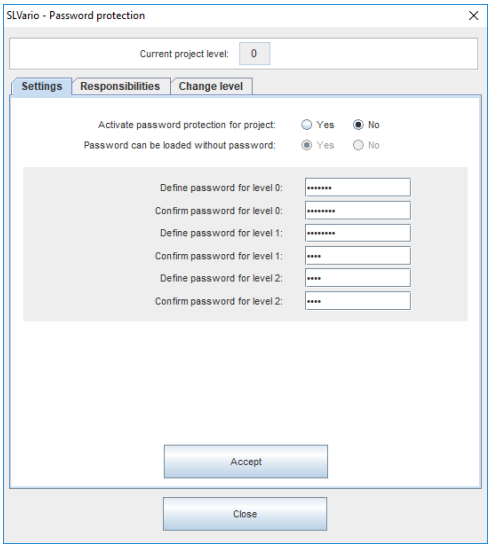


Fig. 34-2

33.2 Responsibilities

Define the permissions for the individual levels in the "Responsibilities" parameter mask (Fig. 34-3).

Current project level
Display of the selected level.

The responsibilities for level 0 (Engineer) are all activated and cannot be deactivated.

▶ Activate the responsibilities for level 1 and level 2.

▶ Accept the settings.

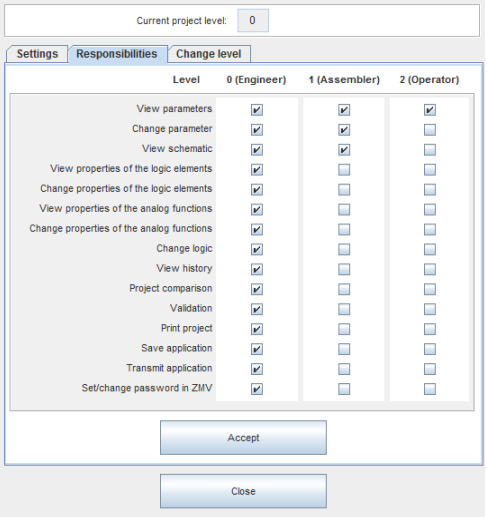


Fig. 34-3

The responsibilities allow the user to perform the following functions:

View parameters:
- Display the parameters

Change parameter:
- Display and change the parameters

View schematic:
- Display the schematic (logic)

View properties of the logic elements:
- Display the properties of the used logic elements in the schematic (logic)

Change properties of the logic elements:
- Display and change the properties of the used logic elements in the schematic (logic)

View properties of the analog functions:
- Display the properties of the used analog elements in the schematic (logic)

Change properties of the analog functions:
- Display and change the properties of the used analog elements in the schematic (logic)

Change logic:
- Display the properties of the used logic elements in the schematic (logic)
- Add and remove modules in the hardware configuration
- Add and remove logic elements in the schematic (logic)
- Delete/add connections

Project comparison:
- Execute the Project comparison menu item

Validation:
- Execute the Project validation menu item

The following actions are only possible in level 0 and cannot be enabled for levels 1 or 2:

- Add page
- Insert label
- Page arrangement

33.3 Change level

In the "Change level" mask (Fig. 34-4), you can switch between the levels.

Current project level
Display of the selected level.

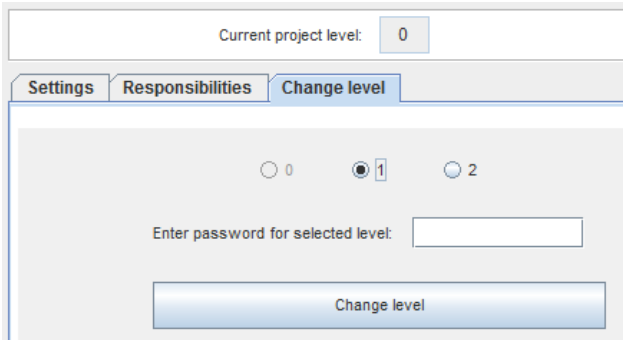


Fig. 34-4

▶ Select the level to which you would like to switch.

▶ Enter the password for this level.

▶ Press the "Change level" button.

34 Simulation

The SL VARIO Designer offers the possibility to simulate the created application on a PC. The elements are switched on and off or controlled by means of simple mouse clicks or sliders. The signal characteristics can thereby be simulated immediately after creating the application. Transmission to the hardware is not necessary.

34.1 Starting the simulation

▶ Start the simulation with the "SIMUL" button. (Fig. 35-1)

Fig. 35-1

The green button indicates that the simulation is active. Menu items that can no longer be selected are grayed out.

IThe states of the gates and the signal characteristics are displayed with corresponding colors in the logic diagram. (Fig. 35-2)

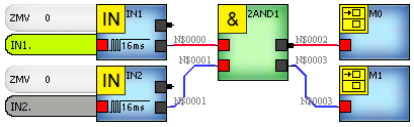


Fig. 35-2

The colors of the connections can be changed in the menu bar under Project - Settings - View options.

The Simulation function menu opens at the same time. (Fig. 35-3)

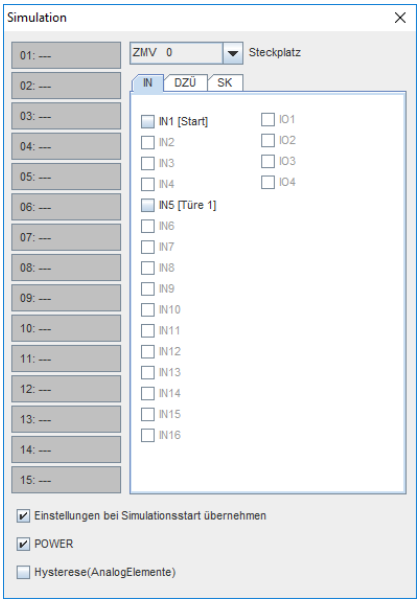


Fig. 35-3

The inputs, speed monitors and safety circuits of each module are listed here.

The fields with gray background are so called shortcut buttons. These can be assigned to specific inputs in advance.

The elements can be simulated via this function menu or directly in the schematic by clicking the respective symbol.

The settings in this module are accepted upon exiting the simulation if the "Accept settings on simulation start" checkbox is selected.

POWER: Deselecting the checkbox simulates a power-off.

34.2 Simulating the inputs

The digital inputs, fieldbus inputs, network inputs and safety mats are simulated by left-clicking the corresponding symbol. The input changes its state. As with online diagnostics, this is made apparent by a green input terminal and colored connection line.

CAUTION

▶ With the network inputs, note that the RTNI enable must be set in order for them to switch through.

Alternatively, the inputs can also be switched on and off via the function menu. (Fig. 35-4)

▶ Select the desired module (slot).

▶ Select the checkbox for the input.

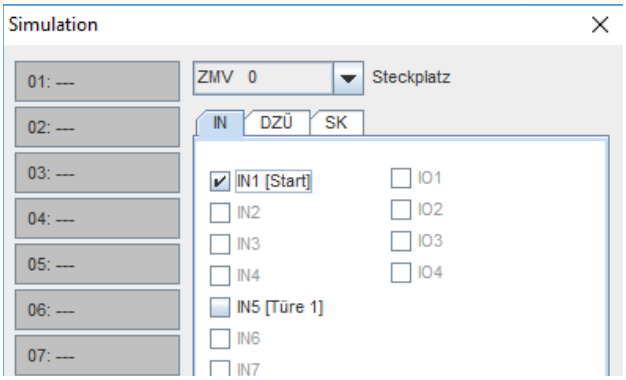


Fig. 35-4

34.2.1 Shortcut button assignment

The digital inputs can be assigned so-called shortcut buttons.
To do this, the simulation must be switched off.

▶ In the menu bar under "Simulation", select the Simulation function menu.

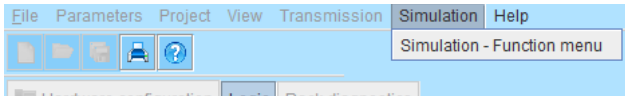


Fig. 35-5

▶ Select the desired input in the logic diagram with the right mouse button.

▶ Select the "Simulation: Shortcut button assignment..." function. (Fig. 35-6)

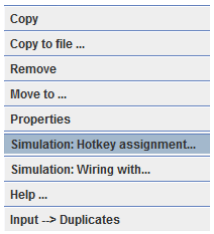


Fig. 35-6

The "Selection: Button assignment" window then opens.

▶ Accept the preset button with "ok" or select a different button. (Fig. 35-7)

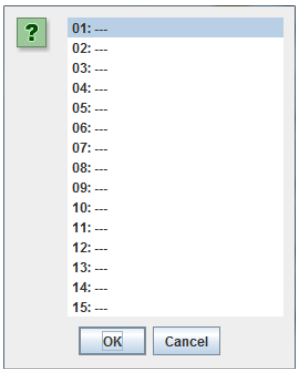


Fig. 35-7

The shortcut button is assigned this input. (Fig. 35-8)

It can be overwritten at any time with a different input.

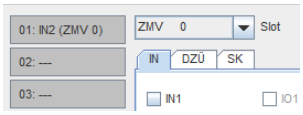


Fig. 35-8

You can now switch this input on and off with the shortcut button. While switched on, the field is green. (Fig. 35-9)

Fig. 35-9

34.2.2 Wiring inputs virtually

For simulation purposes, digital inputs can be virtually wired to any output.

- Select the desired input in the logic diagram with the right mouse button.
- Select the "Simulation: Wire with..." function (Fig. 35-10)

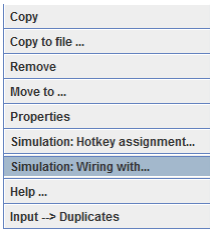


Fig. 35-10

You can virtually wire any configured output with this input. (Fig. 35-11)

- Select the slot and the output.
- Activate the wiring by selecting the "Activate external wiring" checkbox.

To disable the wiring, simply deselect the checkbox.

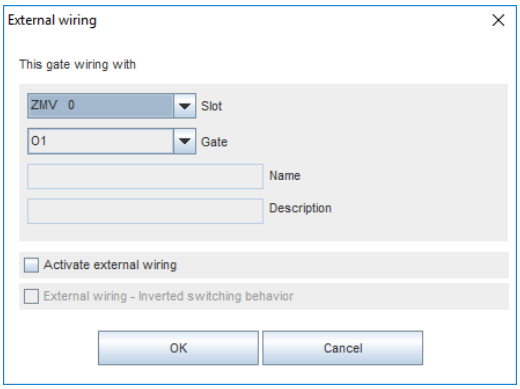


Fig. 35-11

You can identify a wired input by the changed symbol. (Fig. 35-12)

The input now behaves like the virtually wired output.

Fig. 35-12

34.3 Simulating the analog inputs

- Select the analog input.

A slider with a scale from 0 to 10 V or from 4 to 20 mA opens. (Fig. 35-13)

- Set the desired value with the slider.

The analog input switches according to its configuration.

Analog inputs that are configured with restart via RTAN require a falling edge at the RTAN in the simulation as well.

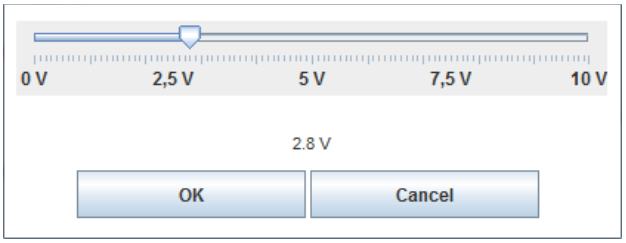


Fig. 35-13

34.4 Simulating the safety circuits

The safety circuits can be simulated either by clicking on the symbol of the safety circuit or via the Simulation function menu. In the first case, only the interconnection is simulated. Possible acknowledgement inputs are not taken into account here.

The behavior is different if the safety circuit is simulated via the function menu.

In this case, both the acknowledgement inputs as well as the correct switching of the individual safety circuit inputs are taken into account.

The clock signals for clocked safety circuits are simulated in the function menu with selection "SC". (Fig. 35-14)

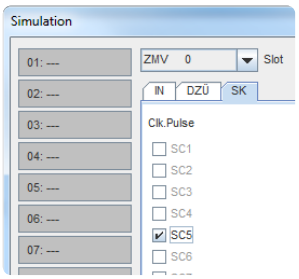


Fig. 35-14

After selecting the clock for the safety circuit and the acknowledgement input, the safety circuit switches through. (Fig. 35-15)

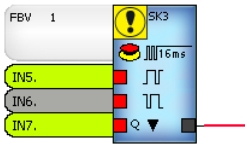


Fig. 35-15

Errors in the wiring of the safety circuits are indicated by orange terminals on the symbol and can be deleted again with the RTKS acknowledgement symbol. (Fig. 35-16)

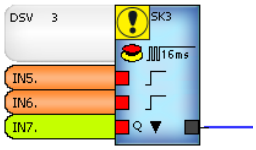


Fig. 35-16

34.5 Simulating the two-hand function

The two-hand symbol switches to its normal state when the simulation is switched on. (Fig. 35-17)

Click on the element to change the inputs according to the two-hand specification and switch on the output. The output can likewise be switched off again.

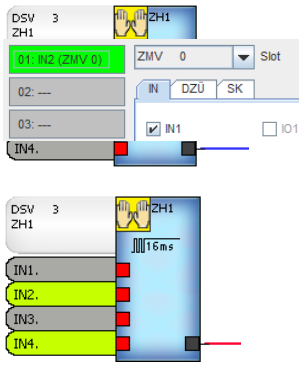


Fig. 35-17

34.6 Simulating speed monitoring

The following parameters are taken into account when simulating speed monitors:

- **elected operating mode**
- **Setpoints, even if configured via DNCO or multiplexer**
- **Type of standstill monitoring (position or speed)**

▶ Select the speed symbol.

A slider opens. (Fig. 35-19)

▶ Set the desired speed value with the slider.

▶ Select clockwise or counterclockwise.

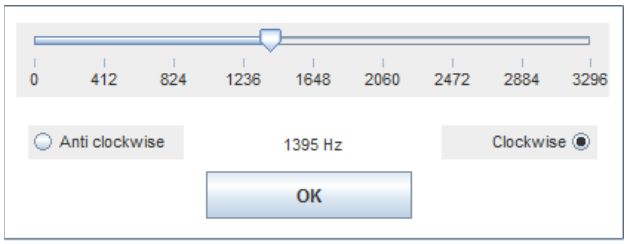


Fig. 35-19

The outputs switch according to the configuration.

Please note that the RTDS acknowledgement signal is needed for switching on again.