



Configuration and startup of the PSR-TRISAFE-M safety module with the PSR-TS-SDI8-SDIO4 and PSR-TS-SDOR4 extension modules

User manual

UM EN PSR-TRISAFE-M

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Designation	Order No.
PSR-TRISAFE-M	
PSR-SCP-24DC/TS/M	2986012
PSR-SPP-24DC/TS/M	2986025
PSR-TS-SDI8-SDIO4	
PSR-SCP-24DC/TS/SDI8/SDIO4	2986038
PSR-SPP-24DC/TS/SDI8/SDIO4	2986041
PSR-TS-SDOR4	
PSR-SCP-24DC/TS/SDOR4/4x1	2986096
PSR-SPP-24DC/TS/SDOR4/4x1	2986106

Please observe the following notes

User group of this manual

The use of products described in this manual is oriented exclusively to:

- Qualified electricians or persons instructed by them, who are familiar with applicable standards and other regulations regarding electrical engineering and, in particular, the relevant safety concepts.
- Qualified application programmers and software engineers, who are familiar with the safety concepts of automation technology and applicable standards.

Explanation of symbols used and signal words



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety measures that follow this symbol to avoid possible injury or death.

There are three different categories of personal injury that are indicated with a signal word.

DANGER This indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING This indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION This indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.



This symbol together with the signal word **NOTE** and the accompanying text alert the reader to a situation which may cause damage or malfunction to the device, hardware/software, or surrounding property.



This symbol and the accompanying text provide the reader with additional information or refer to detailed sources of information.

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1 For your safety

1.1 Purpose of this user manual

This user manual should enable the user to set up, configure, and start up the PSR-TRISAFE-M safety module according to the safety requirements and the risk analysis performed.

The user manual is therefore designed as a system description. It provides an introductory system overview, then describes the PSR-TRISAFE-M safety module, the PSR-TS-SDI8-SDIO4 safe extension device, the PSR-TS-SDOR4 safe extension module, and the associated SAFECONF configuration software, and finally explains the necessary steps for configuration and startup.

For additional information and detailed step-by-step instructions for SAFECONF, please refer to the online help for the configuration software.



The PSR-TRISAFE-M configurable safety module is referred to in this documentation as “safety module” for short.

1.2 General safety notes



WARNING: Personal injury and damage to equipment if these safety notes are not followed.

When working with the PSR-TRISAFE-M safety module, please observe all the safety notes included in this section.

Requirements

Knowledge of the following is required:

- The PSR-TRISAFE-M safety module used and the I/O devices (extension devices, sensors, actuators)
- The SAFECONF configuration software
- Safety regulations in the field of application

Qualified personnel



WARNING: In the context of the use of the PSR-TRISAFE-M safety module with SAFECONF configuration software and safe function blocks, the following operations may only be carried out by qualified personnel:

- Planning, parameterization, configuration (development of the safety logic)
- Installation, startup, servicing
- Maintenance, decommissioning

This user manual is therefore aimed at:

- Qualified personnel who plan and design safety equipment for machines and systems and are familiar with regulations governing occupational safety and accident prevention.
- Qualified personnel who install and operate safety equipment in machines and systems.

Qualified personnel are persons who, because of their education, experience and instruction, and their knowledge of relevant standards, regulations, accident prevention, and service conditions, have been authorized to carry out any required operations, and who are able to recognize and avoid any possible dangers.

Safety of personnel and equipment



The safety of personnel and equipment can only be assured if the safe function blocks are used correctly (see "Intended use" on page 15).

NOTE: Please note that responsibility for fault avoidance lies with the user.

Error detection

Depending on the wiring and parameterization of the inputs and outputs, the PSR-TRISAFE-M safety module and the PSR-TS-SDI8-SDIO4 and PSR-TS-SDOR4 extension devices can detect various errors within the safety equipment (e.g., cross circuits).

Observe startup behavior

Some of the safe function blocks in the SAFECONF configuration software have parameters for specifying a startup inhibit and/or a restart inhibit. An active startup inhibit/restart inhibit can be removed by pressing a reset button that is connected and appropriately wired to the safety module or the PSR-TS-SDI8-SDIO4 or PSR-TS-SDOR4 safe extension devices.

Use these parameters in the SAFECONF configuration software to monitor the startup/restart of the safety module.

Do not carry out any repairs, do not open the housing



In the event that an error caused by reconfiguring or modifying the wiring, etc. cannot be removed, please contact Phoenix Contact immediately.

WARNING: Repair work may not be carried out on the PSR-TRISAFE-M safety module or the extension modules. It is strictly prohibited to open the housing.

1.3 Electrical safety



DANGER: Hazardous shock currents or loss of functional safety

In order to ensure electrical safety, please observe the following points and the information in the user manuals for the devices used (e.g., sensors, actuators or extension devices).

Direct/indirect contact

Ensure that all components connected to the PSR-TRISAFE-M safety module or extension devices are protected against direct and indirect contact according to DIN VDE 0100-410. In the event of an error, parasitic voltages must not occur (single-fault tolerance).

Safe isolation

Only use devices with safe isolation if dangerous contact voltages can occur at their connections.

Power supply unit

Only use power supply units with safe isolation and PELV according to EN 50178/VDE 0160 (PELV). This prevents short circuiting between primary and secondary sides.

ESD

**NOTE: Electrostatic discharge**

The device contains components that can be damaged or destroyed by electrostatic discharge. When handling the device, observe the necessary safety precautions against electrostatic discharge (ESD) according to EN 61340-5-1 and EN 61340-5-2.

1.4 Safety of the machine or system

**WARNING: Ensure the safety of the machine or system.**

The operator bears sole responsibility for the safety of the machine or system. The Machinery Directive must be observed.

Draw up and implement a safety concept

In order to use the system described in this document with the associated safe function blocks, you must have drawn up an appropriate safety concept for your machine or system. This includes a hazard and risk analysis, as well as a test report for validating the safety functions.

The target safety integrity level (SIL according to IEC 61508, SIL CL according to EN 62061, and category or performance level according to EN ISO 13849-1) is ascertained on the basis of the risk analysis.

The safety integrity level or category ascertained determines:

- How safe sensors, control devices, and actuators should be wired within the overall safety function
- How safe function blocks should be used in the safety logic
The safety logic is created using the SAFECONF configuration software.

Within the safe control system used, the safe function blocks support the following safety integrity requirements:

- Up to SIL 3 according to standard IEC 61508
- Up to SIL CL 3 according to standard EN 62061
- Up to category 4 or PL e according to standard EN ISO 13849-1



Please note that you are responsible for implementing all additional requirements resulting from applicable directives and legislation in order to meet the above safety integrity requirements (see also “Directives and standards” on page 13).

Check hardware and device parameterization

Please note that you must carry out a validation every time you make a safety-related modification to your overall system. Use the relevant checklists when carrying out the validation and also enter the details requested in the “Project Information” dialog box in the SAFECONF safe configuration software.

Use your test report to ensure that:

- The safe sensors and actuators are connected correctly in the PSR-TRISAFE-M safety application. To do this, use the “Wiring check” function in SAFECONF (see page 29).
- The inputs and outputs of the PSR-TRISAFE-M safety module have been parameterized correctly.
- The signals have been connected to the safe sensors and actuators correctly (single-channel or two-channel).

- Cross-circuit detection is implemented in your application, if required (see page 26).
- All safe function blocks and functions in the SAFECNF configuration software are connected correctly.

1.5 Directives and standards

The manufacturers and operators of machines and systems, in which the PSR-TRISAFE-M safety module is used, are responsible for adhering to all applicable directives and legislation.

Directives and standards considered in the development and implementation of the safety module:

Directives

- Machinery Directive 2006/42/EC
- Machinery Directive 98/38/EC
- EMC Directive 2004/108/EC
- Low Voltage Directive 2006/95/EC
- Guideline for test and certification GS-ET-26: Bus systems for the transmission of safety-related messages

Table 1-1 Standards

Standard	Contents
IEC 61508-1:11.2002 IEC 61508-2:12.2002 IEC 61508-3:12.2002 IEC 61508-4:11.2002 IEC 61508-5:11.2002 IEC 61508-6:06.2003 IEC 61508-7:06.2003	Functional safety of electrical/electronic/programmable electronic safety-related systems
EN ISO 13849-1	Safety of machinery - Safety-related parts of control systems; best suited for less complex systems. Part 1: General principles for design This standard was created on the basis of EN 954-1:1996, quality management and reliability aspects have been added.
EN ISO 13849-2: 12.2003	Safety of machinery - Safety-related parts of control systems - Part 2: Validation
EN ISO 12100-2	Safety of machinery - Basic concepts, general principles for design Part 2: Technical principles
IEC 62061	Safety of machinery - Functional safety of electrical, electronic and programmable control systems for machinery. Sector standard for machinery, created on the basis of IEC 61508. Safety for complex programmable systems. Proof of safety of devices as well as evaluation of risk reduction of the entire safety function through calculation.
EN 60204-1:11.1998	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
EN ISO 13850	Safety of machinery - Emergency stop - Principles for design
EN 61131-2:02.04	Programmable controllers - Part 2: Equipment requirements and tests
EN 61131-3:02.04	Programmable controllers - Part 3: Programming languages
EN 61496-1:06.98	Safety of machinery - Electro-sensitive protective equipment - Part 1: General requirements and tests

Table 1-1 Standards

Standard	Contents
EN 1088	Safety of machinery - Interlocking devices associated with guards - Principles for design and selection
EN 953	Safety of machinery - Guards - General requirements for the design and construction of fixed and movable guards
EN 574	Safety of machinery - Two-hand control devices - Functional aspects - Principles for design
EN 50254:07.1999	High efficiency communication subsystem for small data packages
EN 50178:04.1998	Electronic equipment for use in power installations
EC/ISO 7498	Information technology - Open Systems Interconnection

1.6 Intended use



WARNING: Only use the PSR-TRISAFE-M safety module in accordance with the information in this section.

PSR-TRISAFE-M

The safety module and all extension modules may only be used in industrial applications in accordance with standards IEC 61508, EN ISO 13849, and EN 62061.

The safety module and all extension modules are designed for evaluating safety-related sensors on a machine or system, which are connected to the inputs of the safety module, and for controlling its outputs according to the configured safety logic.

The safety module can only perform its safety-related tasks if it is integrated into the execution process correctly and in such a way as to avoid errors.

You must observe all information in this user manual as well as the user manuals and online help listed in "Documentation" on page 16. In particular, only use the safety module in accordance with the technical data listed in the package slip.

PSR-TS-SDI8-SDIO4

The PSR-TS-SDI8-SDIO4 safe extension module is an extension to the safety module. It provides additional configurable inputs and outputs.

PSR-TS-SDOR4

The PSR-TS-SDOR4 safe extension module is an extension to the safety module. It provides additional outputs.

SAFECONF

The SAFECONF safe configuration software is designed for the configuration of the safety module and its connected extension devices.

Safe function blocks and functions in SAFECONF

The safe function blocks and functions available in the SAFECONF configuration software for creating the safety logic are designed solely for use within the safety module and support specific safety functions.

The safe function blocks/functions can only perform their safety-related tasks within the safe control system if they have been integrated into the execution process correctly and in such a way as to avoid errors.



You must observe all information in the online help for each function block. Theoretical examples of the use of the safe function blocks are described under "Examples of use".

The area of responsibility of the block manufacturer in terms of the function of a safe function block or a safe function ends at the user interface, which is generated by the inputs and outputs of the function blocks/functions.

In order to fully execute a safety function, it is your responsibility to connect the inputs and outputs of the safe function blocks/functions in the SAFECONF configuration software:

- To your safety network
- To the single-channel or two-channel sensors and actuators connected to the inputs and outputs of the safety module

In defining the safety integrity level or category for the overall safety function, you must take into consideration all components involved in the execution of this safety function (sensors, actuators, wiring, etc.).



WARNING: In order to use a safe function block or a safe function according to the required safety integrity as defined by IEC 61508, EN ISO 13849 or EN 62061, you must take into consideration the entire path of the safety function (safety module, device parameterization, wiring, sensors, actuators, single-channel or two-channel operation, etc.) starting from the “block input/output” interface.

Validate the entire path on completion.

1.7 Documentation

Latest documentation

Make sure you always use the latest documentation. Find out from the manufacturer or their homepage on the Internet whether any changes or additions have been made to the documentation used.

When working on and with the PSR-TRISAFE-M safety module, you must always keep this documentation and other items of product documentation to hand and observe the information therein.

You must observe all information:

- In the technical description of the safety module
- In the technical description of the PSR-TS-SDI8-SDIO4 safe extension device
- In the technical description of the PSR-TS-SDOR4 safe extension device
- In the user documentation for I/O devices (e.g., sensors/actuators, etc.) connected to the safety module and connected to safe function blocks in the safety logic (SAFECONF configuration software)
- In the online help for the SAFECONF safe configuration software (see also Figure 1-1) and for each of the safe function blocks
- In the documentation for the supplementary standard technology, if applicable

Calling online help

The diagram below illustrates the various options for opening the online help and searching for information via context-sensitive help or via the contents or index.

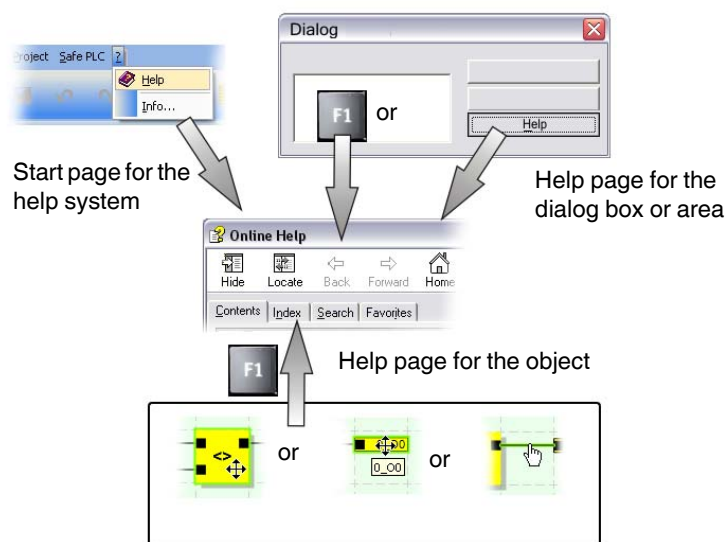


Figure 1-1 Calling the online help in the SAFECONF configuration software

2 System description

2.1 Method of operation and structure of the PSR-TRISAFE-M safety system

**The overall system:
hardware and software**

The PSR-TRISAFE-M safety system consists of the following components:

- The PSR-TRISAFE-M safety module
- Optional PSR-TS-SDI8-SDIO4 safe extension modules
- Optional PSR-TS-SDOR4 safe extension modules
- The SAFECONF configuration software
- Suitable safe control devices, sensors, and actuators (depending on the application)

The PSR-TRISAFE-M safety module is designed for monitoring and evaluating safety-related control devices in machines and systems (see “Intended use” on page 15). The safety module monitors safe control devices and safety sensors connected at its inputs and at the inputs of the safe extension modules (if present), evaluates the incoming signals according to its configuration, and controls the outputs accordingly.

The SAFECONF configuration software is used to configure the PSR-TRISAFE-M safety module and the PSR-TS-SDI8-SDIO4 and PSR-TS-SDOR4 safe extension modules, and therefore provides the relevant editors as well as suitable startup and diagnostic tools.

The diagram below illustrates the overall system in an example of use.

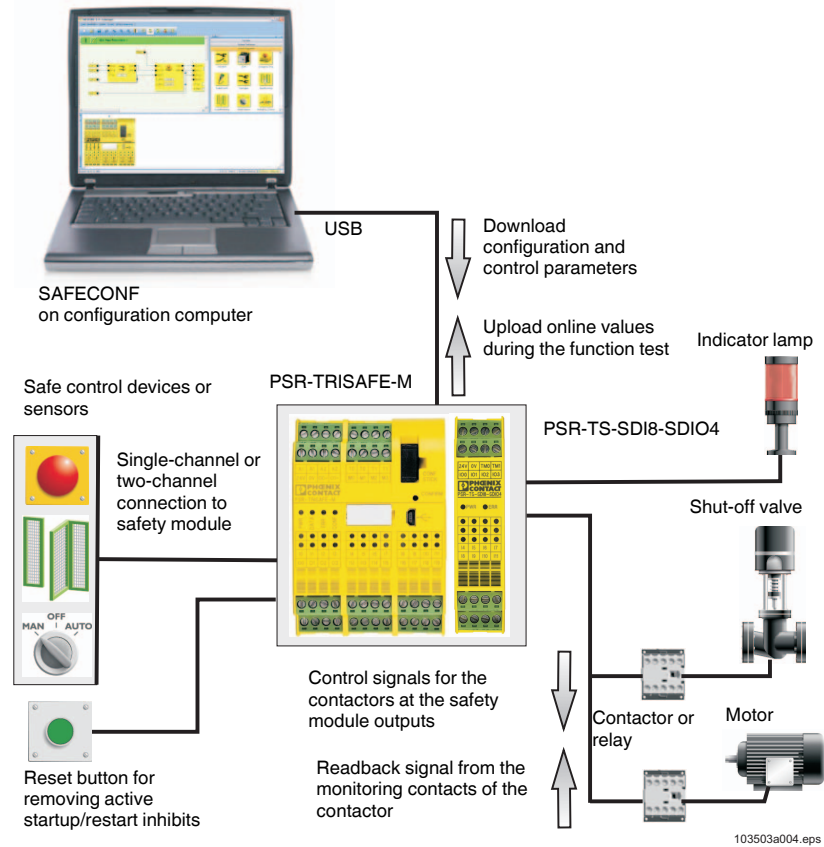


Figure 2-1 Example structure of a safety system

Hardware:
PSR-TRISAFE-M

The PSR-TRISAFE-M safety module offers 20 digital safe inputs for connecting a maximum of 20 single-channel or 10 two-channel safety-related sensors and control devices.

The PSR-TRISAFE-M has 4 digital safe outputs, all of which are semiconductor outputs (24 V DC/2 A (total current)). The outputs are designed to meet up to category 4 according to EN 954-1.

Depending on the configuration, stop category 0 according to EN 60204-1 can be achieved for each output (see “Stop category 0” on page 23).

In addition, four signaling current paths, two test clocks at two outputs each, and two ground switching outputs are available.

For more detailed information on the safety module, please refer to the device description in Section 3.

The PSR-TRISAFE-M safety module can be used both with and without extension modules.

Hardware:
PSR-TS-SDI8-SDIO4

The PSR-TS-SDI8-SDIO4 safe extension module has eight safe digital inputs and four signals, which can all be configured either as safe inputs or as outputs.

The two module outputs, TM0 and TM1, can be configured as alarm outputs or clock outputs. Alarm outputs can be used, for example, to control a standard PLC or a basic signaling module (e.g., a signal lamp). Test clock outputs can be used to implement cross-circuit detection for input signals.

For more detailed information on the PSR-TS-SDI8-SDIO4 safe extension module, please refer to the device description in Section 4.

Hardware:
PSR-TS-SDOR4

The PSR-TS-SDOR4 safe extension module has four safe relay outputs that can be switched individually.

In addition, there are four standard alarm outputs on the module that can be used, for example, to control a standard PLC or a basic signaling module (e.g., a signal lamp).

For more detailed information on the PSR-TS-SDOR4 safe extension module, please refer to the device description in Section 5.

Software:
SAFECONF

The PSR-TRISAFE-M safety module and the PSR-TS-SDI8-SDIO4 and PSR-TS-SDOR4 safe extension modules can only be configured and parameterized using the SAFECONF configuration software, which is executed on a separate Windows® PC.

The software offers a graphical connection editor for this purpose. The safety logic can be created here by graphically connecting prepared safe functions and function blocks to the inputs and outputs of the safety module. The connections are made intuitively using the mouse, and the editor prevents impermissible connections (e.g., between certain outputs).

In addition, the software provides a safe parameterization editor, which can be used to configure each input and output of the PSR-TRISAFE-M safety module and the PSR-TS-SDI8-SDIO4 and PSR-TS-SDOR4 safe extension modules.

A special online mode supports a detailed **function test** of the safety logic executed in the PSR-TRISAFE-M safety module. Current signal values can be read from the PSR-TRISAFE-M safety module, transmitted to the configuration software, and displayed there “live” in the connection editor.

For more detailed information on the configuration software, please refer to the software description in Section 6.

Safe communication

Communication between the PSR-TRISAFE-M safety module and the configuration software is via a USB interface.

The two components communicate in both directions:

- PC → safety module: the configuration data and device parameters are downloaded from the configuration PC to the safety module. Configuration data refers to the application logic which was created using SAFECONF.
The configuration can also be downloaded using the plug-in IFS-CONFSTICK. Please refer to “Downloading the configuration from SAFECONF” on page 98 and “Downloading the configuration using the IFS-CONFSTICK” on page 101.
- Safety module → PC: for diagnostic purposes, online values can be read from the PSR-TRISAFE-M safety module via the USB interface and displayed “live” in the software. For more detailed information, please refer to “Function test” on page 104.

Communication via the PSR-TBUS DIN rail connector

The PSR-TRISAFE-M safety module (master module) is equipped with an interface for the PSR-TBUS DIN rail connector. The Phoenix Contact PSR DIN rail connector can be used to connect up to ten extension modules such as the PSR-TS-SDI8-SDIO4. Communication with these modules is then established automatically via the connector of the PSR DIN rail connector. Safety-related cross-wiring is not required (see also “Mounting the safety module” on page 48).

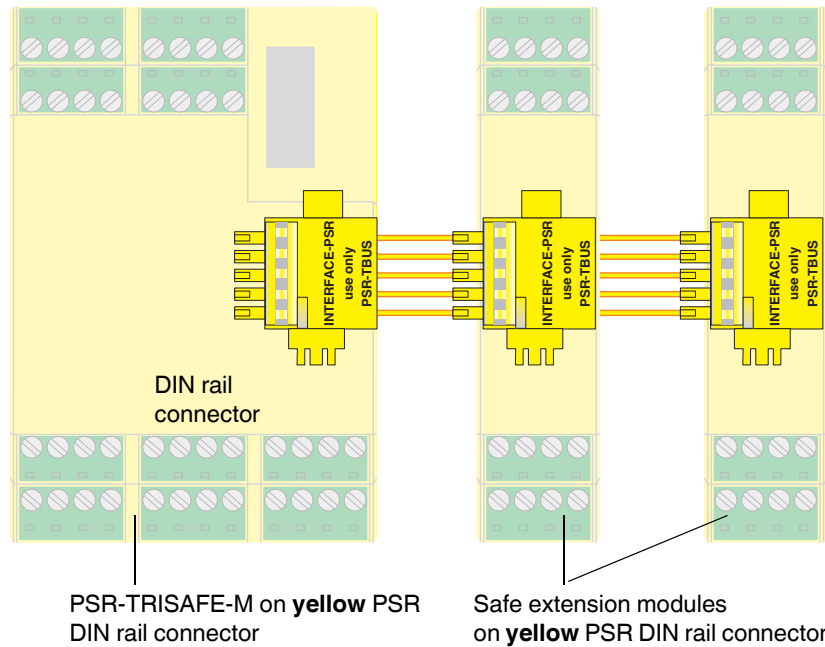


Figure 2-2 PSR-TBUS DIN rail connector from Phoenix Contact



The maximum continuous current for extension modules supplied via the PSR-TBUS is 4 A.

2.2 Using the system

The PSR-TRISAFE-M safety module configured with SAFECONF is designed for monitoring and evaluating safety control devices and safety sensors in machines. Optional safe extension modules (PSR-TS-SDI8-SDIO4 and PSR-TS-SDOR4) provide additional safe inputs for the connection of safe control devices/sensors.

The Machinery Directives and various standards and safety regulations require machine or system manufacturers to meet a high standard of safety.



The term “machine” is used here to represent any technical system according to Machinery Directive 2006/42/EC.

Safety circuits

Safety control devices and safety sensors differ as follows:

Emergency stop control devices can only be detected in the event of dangerous operation and therefore operate in the background. Safety door switches or light grids, for example, are often required for operational reasons and therefore regularly control the connection/disconnection of the safety-related part of the machine.

The safety module can be configured flexibly. For the creation of the safety logic, it has safe function blocks which are part of the system. The PSR-TRISAFE-M can be used to implement various safety functions in different safety circuits. Some of the most important options are:

- Emergency stop monitoring
- Safety door monitoring (with and without guard locking)
- Two-hand control devices (types II and III)
- External device monitoring (feedback monitoring)
- Monitoring and checking electrosensitive protective equipment
- Mode selector switch (evaluation of a mode selector switch and an enable switch)
- Muting applications (light grid monitoring with parallel muting)

Stop category 0

Depending on the safety logic configured for the actual application, outputs of the safety module and the safe extension devices can be used to stop machines/drives with stop category 0 according to EN 60204-1.

EN 60204-1 defines stop category 0 as uncontrolled stopping by immediate removal of power to a machine.

Whether a safe output meets stop category 0 depends on the safety blocks connected in the safety logic: It is only when the module output is connected **directly** to the enable output of a safe function block, which executes stop category 0 at its output, that the module output also meet this category.

Example

The EmergencyStop function block executes stop category 0 at its enable output. If this block output is connected directly to a module output, the safety module also executes stop category 0 at this output.

Figure 2-3 on page 25 shows an example of this type of connection.

Equipment on the machine

The configuration and startup of the relevant safety circuit must be planned and verified precisely. Different machines are subject to different requirements regarding the implementation of a safety function.

Example: you are responsible for planning and implementing the startup behavior and the restart behavior according to your risk analysis. To prevent an unexpected startup, a reset button may be required to generate a manual reset signal at the machine. This will depend on the results of the risk analysis as well as the signal path.

Additional safe control devices, such as three-position enable switches, may be required.

2.3 System startup and restart behavior

Startup

“Startup” refers to the behavior of the PSR-TRISAFE-M safety module (and therefore also that of the safe extension devices used) after switching on (or applying the supply voltage) and following configuration via USB interface or IFS-CONFSTICK.

Unless a startup inhibit is configured, the safety module starts up immediately following successful configuration (i.e., after pressing the “Confirm” button). The signal inputs are then evaluated and the outputs are controlled accordingly.

Restart

“Restart” refers to the behavior of the safety module and the safe extension devices after the safety function is triggered and following a return to normal operation (e.g., after unlocking the emergency stop control device), which makes safe operation possible again.

With an active startup/restart inhibit, the corresponding (inhibited) safe module output remains in the safe state. This prevents unintentional startup/restart of a machine controlled by the relevant output terminal block.



The **safe state** of an output terminal block is power off mode (signal value: FALSE).

Reset button

To enable the function of the machine, which is controlled by the module output affected by the active startup inhibit/restart inhibit, the inhibit must be removed by a reset signal.

As in the case of the stop category (see page 23), the startup and restart behavior of the safety module and the safe extension devices depends on a specific output, and how this output is connected in the configured safety logic.

The reset signal is simultaneously used to exit the error state once the error cause has been removed.

Implementation using safe function blocks

To implement a startup inhibit/restart inhibit, safe function blocks which have the relevant parameters for activating the startup inhibit and/or restart inhibit must be used in the SAFECNF configuration software.

The table below lists the function blocks that offer these parameters.

Table 2-1 Function blocks that support a startup inhibit/restart inhibit

Block name	Function	Available inhibit
EmergencyStop	Emergency stop monitoring	Startup inhibit, restart inhibit
EDM	External device monitoring	Startup inhibit
EnableSwitch	Evaluation of a three-position enable switch	Restart inhibit
ESPE	Monitoring of electrosensitive protective equipment (e.g., light grid)	Startup inhibit, restart inhibit
GuardLocking	Monitoring of a safety door with four-state interlocking	Startup inhibit, restart inhibit
GuardMonitoring	Monitoring of a safety door with two-state interlocking	Startup inhibit, restart inhibit
MutingPar_2Sensor	Monitoring of two muting sensors and light grid	Startup inhibit
MutingPar	Monitoring of four muting sensors (two pairs of sensors in parallel) and light grid	Startup inhibit
MutingSeq	Monitoring of four muting sensors (two pairs of sensors in sequence) and light grid	Startup inhibit
TestableSafetySensor	Monitoring of a connected optoelectronic protective device (e.g., light curtain) with test function	Startup inhibit, restart inhibit

To configure a startup inhibit for a specific safe output, for example, this output must be **directly** linked in the safety logic to the output of a safe function block, for which a startup inhibit is set via the parameters.

Example

In the example below, EmergencyStop as well as a startup inhibit (S_RES parameter = FALSE) and a restart inhibit (A_RES = FALSE) are specified for the safe function block. The OUT enable output of the function block is connected directly to safe output O0, where O0 offers a restart inhibit and a startup inhibit. (EmergencyStop executes stop category 0 at its output, which is also transmitted to O0 by the direct connection.)

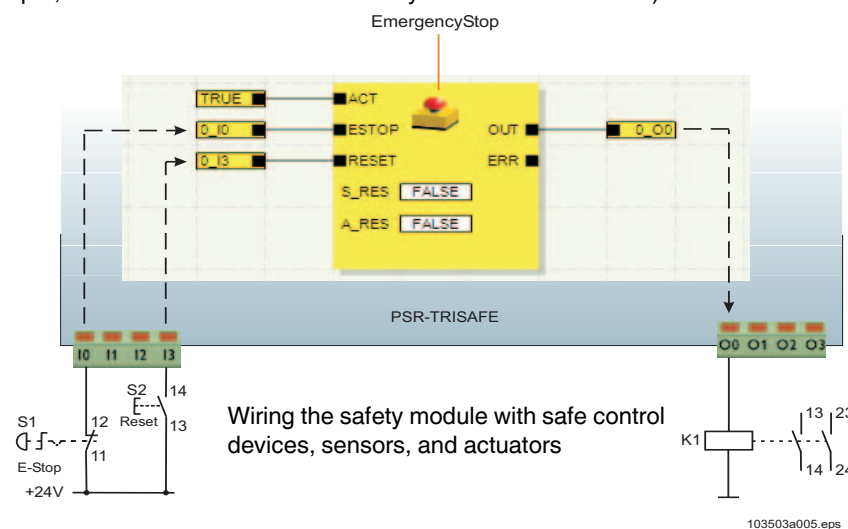


Figure 2-3 Implementing a startup inhibit, restart inhibit, and stop category 0 for safe output O0

2.4 Error detection in I/O devices

Cross-circuit detection

Cross circuits of the connected signal lines can be detected at the safe inputs.

A cross circuit is an unintentional, incorrect connection between redundant circuits.

Clock outputs T0 and T1

The safety module provides clock outputs T0 and T1 as an aid for detecting such a cross circuit. The test clocks output here are asynchronous.

For example, if two differently clocked signals are routed back to two inputs of the safety module along two channels via an emergency stop control device, a cross circuit can be reliably detected in this emergency stop circuit. In the event of a cross circuit, the same clock signal would be present at both inputs, instead of two different ones.



The SAFECONF configuration software specifies the clock signals to be used: for all “even” inputs (I0, I2, I4 ... I18), cross-circuit detection is implemented with test clock T0. For “odd” inputs (I1, I3, I5 ... I19), test clock T1 must be used for cross-circuit detection.

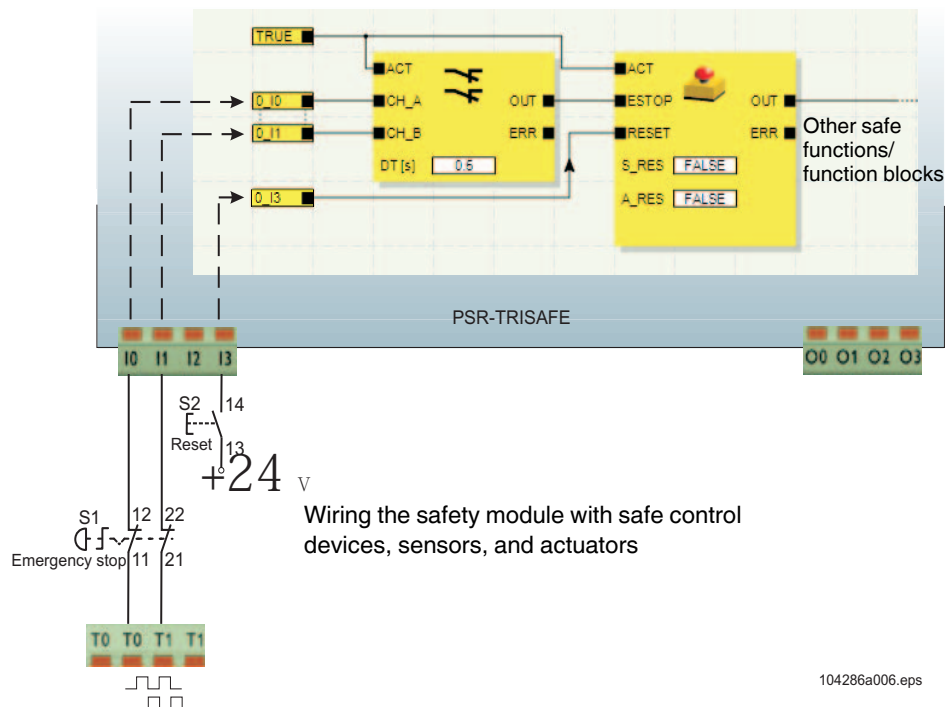


Figure 2-4 Implementing cross-circuit detection for an emergency stop control device at inputs I0 and I1 of the safety module

Parameterization editor in SAFECONF

For this purpose, cross-circuit detection for the safety module inputs to be monitored must be activated in the SAFECONF configuration software in the parameterization editor of the hardware editor.

Activating cross-circuit detection for the safety module inputs:

1. Open the parameterization editor by double-clicking in the SAFECONF hardware editor.
2. Select the corresponding input.
3. In the selection box for this input, set “cross-circuit detection”, as shown in the image below for inputs 0 and 1.

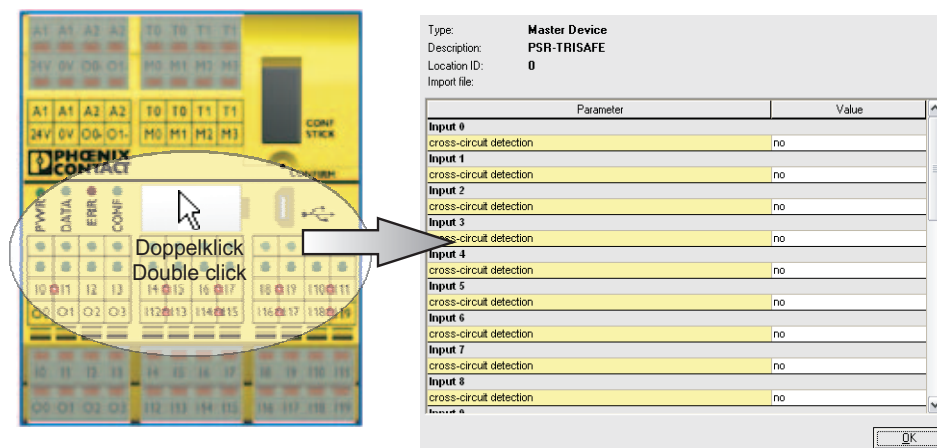


Figure 2-5 Parameterizing cross-circuit detection for a module input



Cross-circuit detection is also supported at the inputs of the PSR-TS-SDI8-SDIO4 safe extension module. For this, module outputs TM0 and TM1 must be configured as clock outputs. For additional information on cross-circuit detection in the PSR-TS-SDI8-SDIO4 safe extension module, please refer to the device description in Section 4.

2.5 Diagnostic tools



For an overview of the diagnostics and status indicators, please refer to Table 3-1 on page 39.

The SAFECONF configuration software, the PSR-TRISAFE-M safety module, and the PSR-TS-SDI8-SDIO4 safe extension module provide various tools that can be used to diagnose the active configuration on the safety module:

- Hardware diagnostics in the event of a safe function block error
- Wiring check
- Diagnostics and status indicators on the safety module
- Online tooltips in the connection editor

Hardware diagnostics in the event of a safe function block error

When a safe function block detects an error, it sets its ERR error output to TRUE and the OUT enable output to the safe status FALSE.

For additional information, please refer to the descriptions of the safe function blocks in the SAFECONF online help, particularly in the corresponding "ERR output" help topic.

If the ERR output of a safe function block is TRUE, all the inputs that are connected **directly** to the inputs of this function block flash on the safety module or the corresponding safe extension device.

This tells you which module input is affected by the problem. You can take measures to remove the fault (check the connecting cables to the sensors or the connected sensors themselves, etc.).



This function enables hardware errors to be localized even without a PC. An error is indicated by flashing LED(s) at the inputs of the safety module. The project documentation enables conclusions to be drawn regarding the relevant safe function block based on which module input is flashing.

The following **example** shows a simplified schematic view:

An emergency stop control device with two N/C contacts is connected to inputs I0 and I1 of the safety module. The status of the N/C contacts is monitored by the Equivalent safe function block. In our example, the function block reports an error (ERR output = TRUE, the icon for the function block is surrounded by a red border when the configuration software is in online mode).

Therefore, the LEDs for inputs I0 and I1, which are both directly connected to this function block, flash on the safety module.

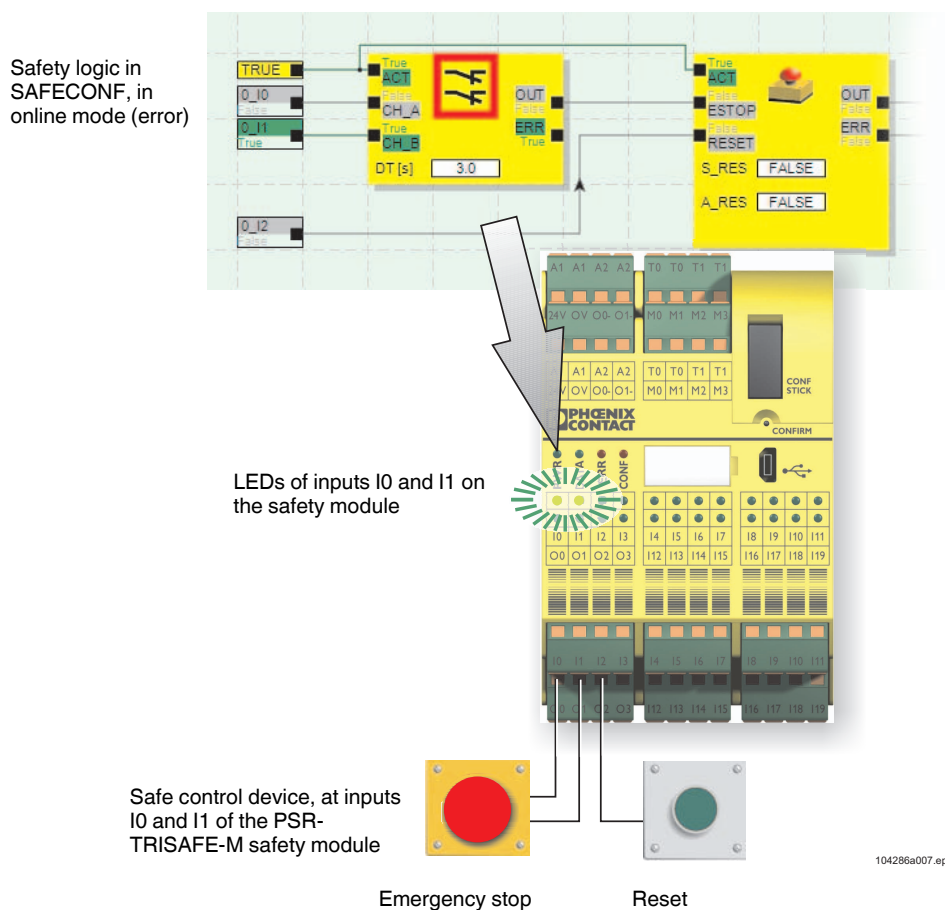


Figure 2-6 Hardware diagnostics in the event of a safe function block error



Hardware diagnostics are also possible for inputs and outputs of safe extension devices (e.g., PSR-TS-SDI8-SDIO4).

Wiring check

If the connection editor is in startup mode, the wiring check can be used to check the terminal block position of the input used in the logic. This takes you to the correct position on the graphical display and enables you to gain a better overview of the control cabinet interior.

1. **Requirement:** the PSR-TRISAFE-M safety module must be running.
Switch the connection editor to online mode, then to startup mode.
2. In the connection editor, position the cursor over the icon for the input or output you want to check, **without** clicking. The icon starts to flash after around one second.

At the same time, the LED for the corresponding input/output flashes on the safety module or on the corresponding safe extension device.

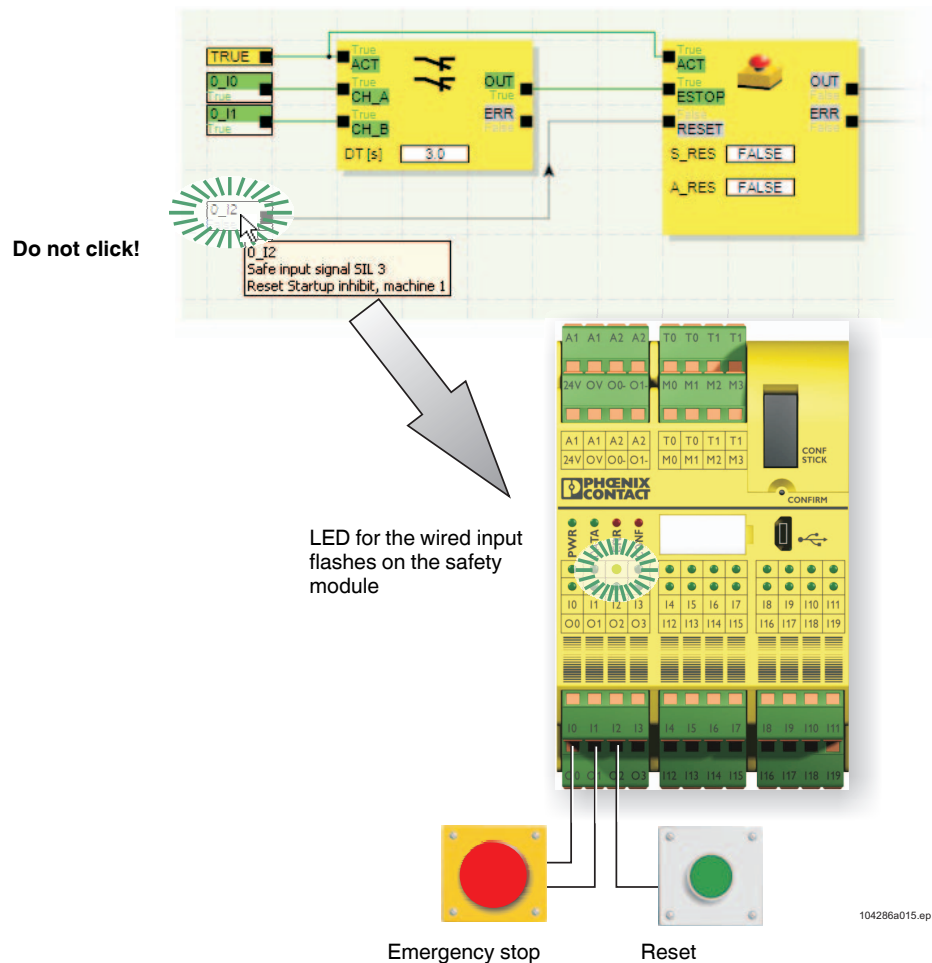


Figure 2-7 Simplified schematic view: wiring check



A wiring check is also possible for inputs and outputs of safe extension devices (e.g., PSR-TS-SDI8-SDIO4).

Diagnostics indicators on the safety module

There are four diagnostics indicators on the PSR-TRISAFE-M safety module.

- PWR (green): indicator for the power supply of the safety module
- DATA (green): indicator for communication with extension modules (with/without TBUS)
- ERR (red): error indicator
- CONF (green): indicator for the configuration status and communication via USB interface

The LEDs indicate the status of the safety module.



For a detailed list of possible indicator combinations and their meanings, please refer to “Diagnostics and status indicators” on page 38.

Diagnostics indicators on the PSR-TS-SDI8-SDIO4 safe extension device

There are two LEDs on the PSR-TS-SDI8-SDIO4 safe extension device.

- PWR (green): indicator for the power supply of the extension module
- ERR (red): error indicator

Online tooltips in the connection editor

In online mode, when the SAFECONF configuration software reads signal values from the PSR-TRISAFE-M safety module and displays them “live” in the connection editor, the safe function blocks indicate their status and, in the event of an error, display a description of the error as a tooltip as soon as you position the cursor over the icon for a function block.

In the event of an error, the tooltip contains not only a description of the error, but also information on how to remove it. In the event of an error, the function block icon is also outlined in red. This ensures that, in online mode, errors can be identified at a glance.

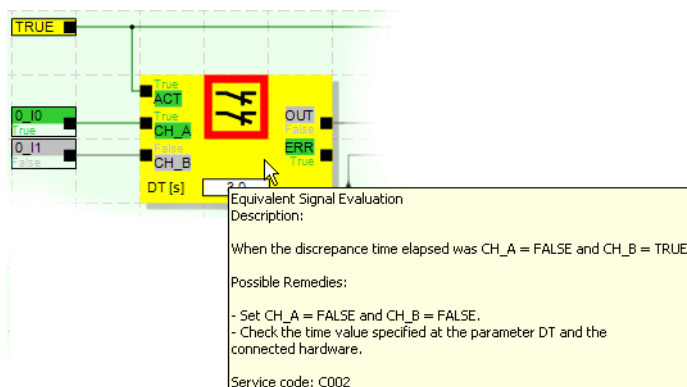


Figure 2-8 Example of an online tooltip in the event of an error

Offline tooltips

Tooltips are also available while editing the safety logic in the connection editor. For all function blocks, functions, and their I/Os, as well as for the buttons in the toolbar, descriptions are displayed as soon as the cursor is positioned over the item.



Figure 2-9 Examples of tooltips in the connection editor in offline mode (while editing the safety logic)

2.6 Password protection

With two passwords, PSR-TRISAFE-M and SAFECONF provide double protection against unauthorized changes to the configuration and the project in the configuration software.



Figure 2-10 Password protection for PSR-TRISAFE-M and SAFECONF

Controller password

The controller password protects the configuration on the PSR-TRISAFE-M safety module against unauthorized access and the safety module itself against unauthorized changes of operating mode. Although online values can be read from the safety module and displayed in SAFECONF without entering the controller password. However, a new configuration or new device parameters can only be downloaded to the safety module (and the safety module can only be launched accordingly) once the controller password has been entered.



When an unconfigured PSR-TRISAFE-M safety module is connected to the configuration computer for the first time, SAFECONF automatically prompts the user to define a controller password. This password can be modified later if required.

Project password

The project password protects the configuration project in SAFECONF against unauthorized changes to the safety logic and the project information. You can still open and display projects without a password, but you can only change and save them once you have entered a project password. This ensures that only authorized persons in possession of the correct project password can change the safety logic.



When creating a new project, you are automatically requested to define a password.

Automatic logoff after a long period of inactivity in SAFECONF

If no user activity is detected in SAFECONF for a certain period of time, you will be logged off from the project automatically. This prevents unauthorized persons from making changes to the project if you have not logged off from the project.

For the PSR-TRISAFE-M safety module: after a long period of inactivity, you must enter the controller password again in order to communicate with the safety module in SAFECONF.

During automatic logoff, for safety reasons the safety module remains in the mode that was running prior to automatic logoff.

Example: automatic logoff does not cause startup mode to be exited, but you must log on again before you will be able to influence signals once more.



For additional information on password protection, please refer to the online help for SAFECONF.

2.7 Ordering data

Products

Description	Type	Order No.	Pcs. / Pkt.
Configurable safety module			
Module with screw connections	PSR-SCP-24DC/TS/M	2986012	1
Module with spring-cage connections	PSR-SPP-24DC/TS/M	2986025	1
Configurable safe extension module			
Module with screw connections	PSR-SCP-24D C/TS/SDI8/SDIO4	2986038	1
Module with spring-cage connections	PSR-SPP-24D C/TS/SDI8/SDIO4	2986041	1
Configurable safe extension module			
Module with screw connections	PSR-SCP-24D C/TS/SDOR4	2986096	1
Module with spring-cage connections	PSR-SPP-24D C/TS/SDOR4	2986106	1
PSR configuration package including SAFECONF configuration software, configuration cable (USB), and quick start guide			
German	PSR-SAFECONF-BOX-DE	2986151	
English	PSR-SAFECONF-BOX-EN	2986164	
Memory module for PSR-TRISAFE-M (supplied as standard with the safety module)	IFS-CONFSTICK	2986122	1
Connecting cable , USB to mini-USB for PSR-TRISAFE-M	CABLE-USB/MINI-USB-3.0M	2986135	3 m

2.8 System requirements for the SAFECONF configuration software

Software requirements

Supported operating systems	Windows 8 (32-bit or 64-bit) Windows 7 (32-bit or 64-bit) SP1 Windows XP SP3
Supported browsers	Internet Explorer Version 6 or later

Hardware requirements

CPU	Pentium	2 GHz (recommended)/1 GHz (minimum)
RAM	Windows 7/Windows 8 Windows XP	2 GB (recommended)/1 GB (minimum) 1 GB (recommended)/512 MB (minimum)
Hard disk	At least 250 MB available hard disk space	
Drive	CD-ROM	
Operating devices	Keyboard, mouse	
Monitor resolution	At least 800 x 600	

Other

Basic functions	Configuration of the PSR-TRISAFE safety module
Supported languages	German, English, Spanish, French, Italian

3 PSR-TRISAFE-M safety module

3.1 Device description

The PSR-TRISAFE-M safety module is a configurable safety module with 20 digital safe inputs, which enable the connection of a maximum of 20 single-channel or 10 two-channel safe sensors or control devices.

The four digital safe outputs, O0 to O3, are controlled after evaluating the incoming signals according to the configuration which was created with the SAFECONF configuration software and downloaded to the safety module via USB interface.

The safety module also has two ground switching outputs, O0- and O1-, which can be used, for example, to switch off a contactor connected to the safety module either via the output or via ground. Use of the ground switching outputs increases the shutdown protection and cross-circuit protection of the safety circuit.

In addition, the safety module has four non-safety-related digital alarm outputs (M0 to M3), which can be used, for example, to control a standard PLC or signaling units.

The two asynchronous test clocks at T0 and T1 provide safe cross-circuit detection at the inputs of the safety module (see "Error detection in I/O devices" on page 26).

All connection terminal blocks can be plugged in. The individual terminal block bases are mechanically coded to prevent incorrect connection. The safety module is available either with screw connections (shown on the left in Figure 3-1) or with spring-cage connections (shown on the right in Figure 3-1).

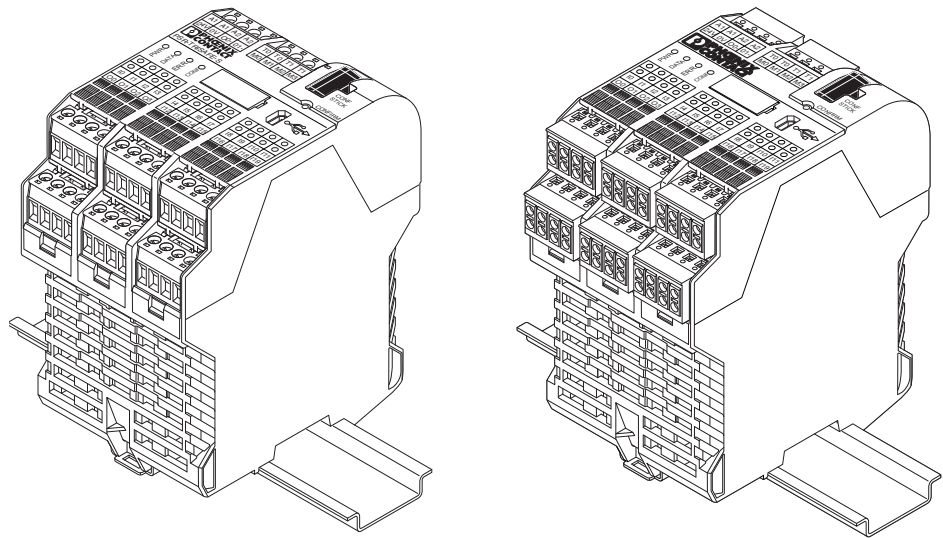


Figure 3-1 Screw connection (left) and spring-cage terminal blocks (right)

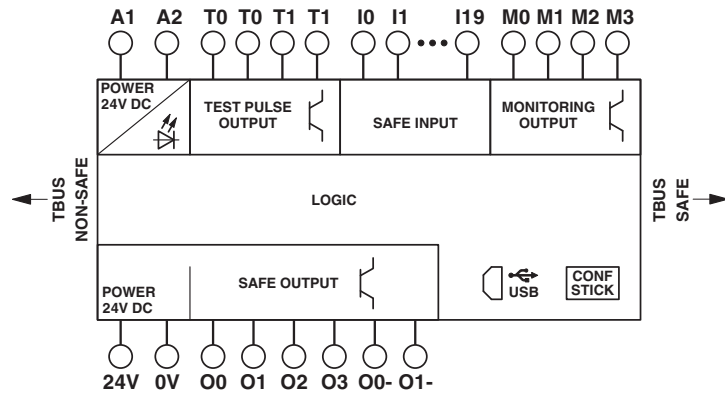


Figure 3-2 Block diagram of the PSR-TRISAFE-M safety module

The safety module can be used both with and without extension modules.

3.2 Operating modes (status) of PSR-TRISAFE-M

The diagram below illustrates the possible operating modes (status) of the PSR-TRISAFE-M safety module and the possible status transitions. When there is a USB connection to the PC, the module status is indicated on the far right of the status bar in the SAFECONF configuration software.

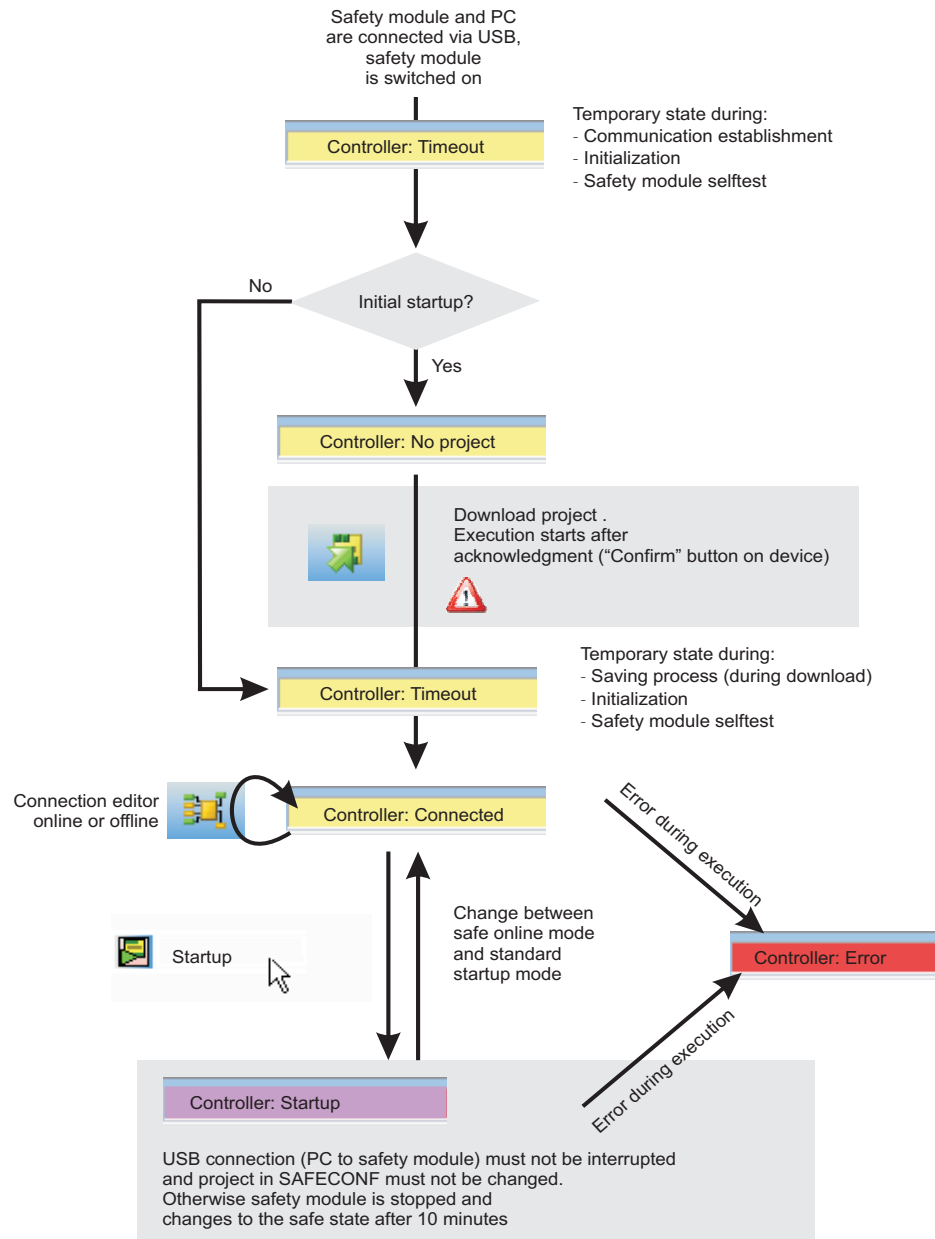


Figure 3-3 Possible operating modes (status) of the safety module

3.3 Operating and indication elements

All operating and indication elements for the PSR-TRISAFE-M safety module are located on the front of the device. The elements are described in the following sections.

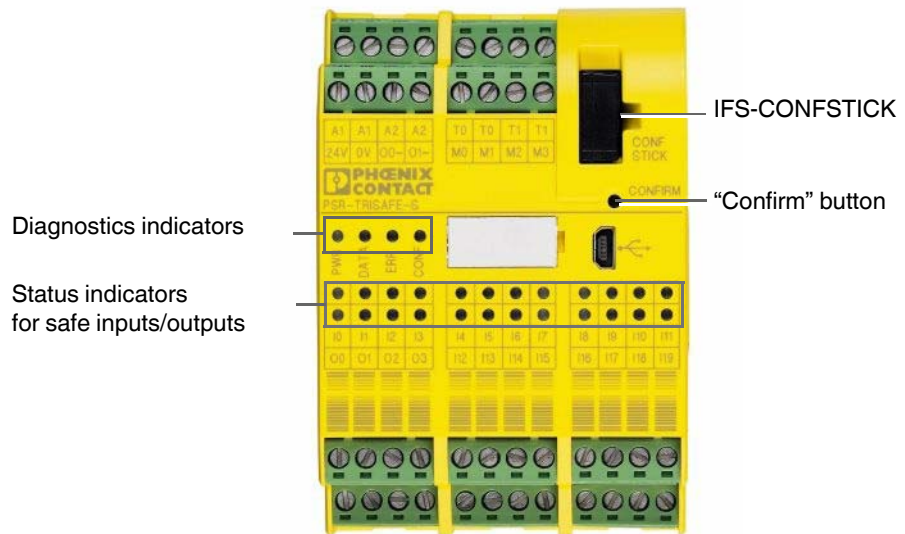


Figure 3-4 Operating and indication elements of the safety module

3.3.1 Diagnostics and status indicators

Diagnostics indicators

The four diagnostics indicators on the front of the device can be used to read the operating status of the safety module. The following LEDs are available (from left to right):

- “PWR”: indicator for the power supply of the safety module
- “DATA”: indicator for communication with extension modules (with/without PSR-TBUS DIN rail connector). This LED only lights up when a TBUS device is connected.
- “ERR”: error indicator
- “CONF”: indicator for the configuration status and communication via USB interface

The following table lists the possible indicator combinations for the diagnostics indicators and their meanings. A distinction is made between slow flashing and fast flashing LEDs.

The LED symbols in the table mean:

LED is off



LED is on



LED is flashing



Slow = 1.7 Hz

Fast = 6.3 Hz

Table 3-1 Meaning of diagnostics indicators

PWR (green)	DATA (green)	ERR (red)	CONF (green)	I0 ... I19	O0 ... O3	Meaning
●	●	●	●			Device is switched off, no power supply at A1/A2
☀	☀	☀	☀			Initialization phase after power up (maximum duration: 4 s)
☀	●	●	☀/● 1.7 Hz			Acknowledgment of new configuration required after download. → Press “Confirm” button on the device.
☀	●	●	☀/● 6.3 Hz			Acknowledgment of new configuration required after transfer via IFS-CONFSTICK. → For sequence, see 7.3 on page 101.
☀	☀	●	☀/● 1.7 Hz			Extension device replaced: acknowledgment required. → Press “Confirm” button on the device.
☀	●	●	●			Normal operation without connected extension devices (TBUS communication)
☀	☀	●	●			Normal operation with connected extension devices (TBUS communication)
☀	● ☀	☀	●			Limited operation with error affecting at least one input/output. → Remove error, deactivate input/output. Press the “Confirm” button on the device for 10 s. This will induce a warm start of the device and reset the error message.
☀	●	●	☀			Delivery state. No configuration data on the IFS-CONFSTICK. → Download project with SAFECONF.
☀	●	☀	☀			No IFS-CONFSTICK. → Insert IFS-CONFSTICK and apply power supply.

Table 3-1 Meaning of diagnostics indicators

PWR (green)	DATA (green)	ERR (red)	CONF (green)	I0 ... I19	O0 ... O3	Meaning
	●	/● 6.3 Hz	●			An error has occurred. → Read out the error code with SAFECONF.
●	●	●	●	/● 6.3 Hz	●	A cross circuit has occurred. → Check wiring of I/O devices. → Then press the "Confirm" button for 3 s.
●	●		●	●	/● 6.3 Hz	Short circuit at the safe output (GND applied to a safe output). → Press the "Confirm" button for 15 s.
●	●	●	●	●	●	Short circuit at the safe input (GND applied to a safe input). → Remove the short circuit at the safe input. The PSR-TRISAFE is then ready to operate again.
●	●		●	/● 6.3 Hz	●	Short circuit at clock output (GND applied to a clock output). → Remove the short circuit at the clock output. → Press the "Confirm" button for 15 s.

LEDs for signal inputs/outputs

The state of each of the 20 safe inputs and 4 safe outputs is indicated by an LED on the front of the device.

Table 3-2 Status indicators for safe inputs and outputs

LED	State	Meaning
For each input ("I0" to "I19")	●	No switching signal at the relevant input
		Switching signal active at the input
	/●	Diagnostic error (see page 27)
	/● Long on Short off	Wiring check at an active input or non-equivalence input.
	/● Long off Short on	Wiring check at an inactive input or non-equivalence input.

Table 3-2 Status indicators for safe inputs and outputs

LED	State	Meaning
For each output ("O0" to "O3")	●	Output is not active
	☀	Output is active
	☀/●	Diagnostic error (see page 27)
	☀/● Long on Short off	Wiring check at an active output or non-equivalence input.
	☀/● Long off Short on	Wiring check at an inactive output or non-equivalence input.

3.3.2 Confirm button

Confirming the new configuration

The "Confirm" button is located on the right-hand side of the front of the PSR-TRISAFE-M safety module, above the USB interface. Press this button using a pen to confirm a new configuration downloaded via the USB interface before it is accepted by the safety module. See also "Downloading the configuration from SAFECONF" on page 98.

Warm start of the device

To initiate a warm start of the device, press and hold down the "Confirm" button on the device for 10 seconds. During the warm start, all outputs are initially set to the safe state FALSE and error messages are reset provided the error cause has been removed. The device then enters the initialization phase.

Replacing the IFS-CONFSTICK

The "Confirm" button also has an important role to play when the IFS-CONFSTICK is replaced. To load a new configuration by replacing the IFS-CONFSTICK rather than via the USB interface, press and hold down the "Confirm" button while removing and inserting the IFS-CONFSTICK using the specified procedure.

For the precise procedure, please refer to "Downloading the configuration using the IFS-CONFSTICK" on page 101.

3.4 Signal connections

All input and output connections, with the exception of the USB interface, are made via plug-in coded connection terminal blocks.

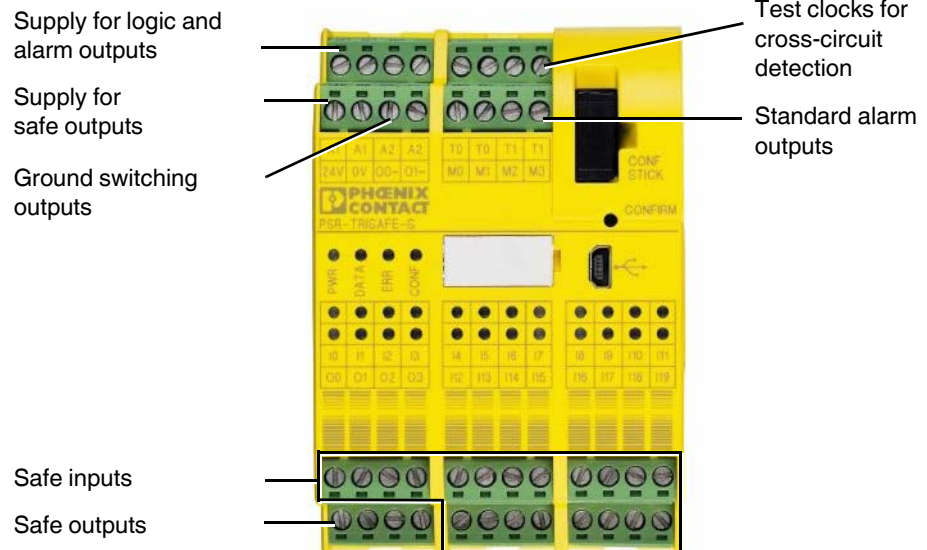


Figure 3-5 PSR-TRISAFE-M signal connections

The various signal connections are described in the following sections.

3.4.1 Signal inputs

The safety module has 20 digital signal inputs (24 V HTL/3 mA) for the direct connection of safe control devices and/or safety sensors for monitoring and evaluating processes.

The safe inputs are linked to the safety logic in the connection editor of the SAFECNF configuration software. See also "Inserting and connecting functions, function blocks, and signals" on page 81.

Signal redundancy due to dual signals

Every two adjacent signal inputs (i.e., I0 and I1, I2 and I3, etc.) are grouped together and interlocked by default to form a dual signal in the SAFECNF safe configuration software. This is indicated in the representation of the safety module in the hardware editor of the configuration software by a red padlock at the relevant inputs. The two signals are then always used as a pair, i.e., both signals are dragged, dropped, cut or deleted together in the connection editor.

However, if required, this interlock can be removed and the dual signal split into two individual signals.



Dual signals are not interconnected internally; they are simply grouped together.

As input signals with even and odd IDs are processed in different ways in the safety module, using dual signals ensures that the safety module will perform redundant processing.

Two-channel sensors

To ensure signal redundancy, the prepared dual signal must be used to process two-channel signals (2-wire sensors and control devices). For example, in order to monitor or evaluate both signals of an emergency stop control device redundantly and to performance level PL e according to EN ISO 13849-1 or EN 954-1, category 4, these two adjacent signal inputs (e.g., I0 and I1) must be connected.

Cross-circuit detection

A cross circuit is an unintentional, incorrect connection between redundant circuits. The safety module provides clock outputs T0 and T1 as an aid for detecting such a cross circuit.

For example, if two differently clocked signals are routed back to two inputs of the safety module along two channels via an emergency stop control device, a cross circuit can reliably be detected in this emergency stop circuit: in the event of a cross circuit, the same clock signal would be present at both inputs, instead of two different ones.

The SAFECNF configuration software specifies the clock signals to be used: for “even” inputs (I0, I2, I4 ... I18), cross-circuit detection is implemented with test clock T0. For “odd” inputs (I1, I3, I5 ... I19), test clock T1 must be used for cross-circuit detection.



For an example of two-channel connection of an emergency stop control device with **dual signal and cross-circuit detection**, please refer to Figure 2-4 in “Error detection in I/O devices” on page 26.

3.4.2 Safe outputs

Safety-related outputs O0 to O3 are designed as digital semiconductor outputs for 24 V DC/2 A (total current), up to category 4 according to EN 954-1.

The outputs are controlled according to the configured safety logic. The safe outputs are linked to the safety logic that controls the outputs in the connection editor of the SAFECNF configuration software. See also “Inserting and connecting functions, function blocks, and signals” on page 81.



To increase cross-circuit protection, outputs O0 and O1 can also be used in conjunction with ground switching outputs O0- and O1-, see “Ground switching outputs O0- and O1-” on page 45.



An appropriate protective circuit (diode or varistor) for safe outputs O0 to O3 is strongly recommended.



The safe output signals are clocked with a test pulse of 1 ms.

3.4.3 Alarm outputs M0 to M3

Non-safety-related alarm outputs M0, M1, M2, and M3 are designed as digital semiconductor outputs for 24 V DC/100 mA.

These alarm outputs can be used, for example, to control a standard PLC or a signaling module (e.g., a signal lamp).

As is the case for safe inputs and outputs, the alarm outputs are linked in the connection editor of SAFECONF (see "Inserting and connecting functions, function blocks, and signals" on page 81).



NOTE: Alarm outputs must not be connected in parallel.
Feedback to alarm outputs is not permitted.

3.4.4 Test clock outputs T0 and T1

The test clocks output at outputs T0 and T1 are used for cross-circuit detection at the inputs. Each output is available twice. The output test clocks T0 and T1 are asynchronous, i.e., T0 does not equal T1.

To implement cross-circuit detection, the relevant safe inputs must be configured accordingly using the parameterization editor (part of the hardware editor in SAFECONF).

The SAFECONF configuration software specifies the clock signals to be used: for "even" inputs (I0, I2, I4 ... I18), cross-circuit detection is implemented with test clock T0. For "odd" inputs (I1, I3, I5 ... I19), test clock T1 must be used for cross-circuit detection.

Please also refer to "Signal inputs" on page 42 and "Error detection in I/O devices" on page 26.

3.4.5 24 V/0 V supply connection

The 24 V/0 V supply connection is used to supply the outputs of the safety module and the clock and ground switching outputs with power.

3.4.6 Supply connections A1 and A2

Supply connection A1/A2 is used to supply the logic of the safety module and the alarm outputs with power.

At the double terminal block contacts, 2 and 3-wire sensors and control devices can be supplied directly by the safety module ($U_{nom} = 24 \text{ V DC}$).



For 3-wire sensors, please note that the GND potential of the sensor/control device is the same as the GND potential of the safety module.



The maximum continuous current for devices connected to terminal blocks A1 and A2 is 6 A (limiting continuous current for looped through current paths A1/A1 and A2/A2).

3.4.7 Ground switching outputs O0- and O1-

Ground switching outputs O0- and O1- increase the shutdown protection and cross-circuit protection of the safety system. For example, these outputs can be used to switch off a contactor connected to the safety module via both the output and ground.



Ground switching output O0- can only be used in conjunction with output O0, ground switching output O1- can only be used in conjunction with output O1.

The diagram below shows an example application: the two contactors, K1 and K2, are switched between safe module output O0 and ground switching output O-.

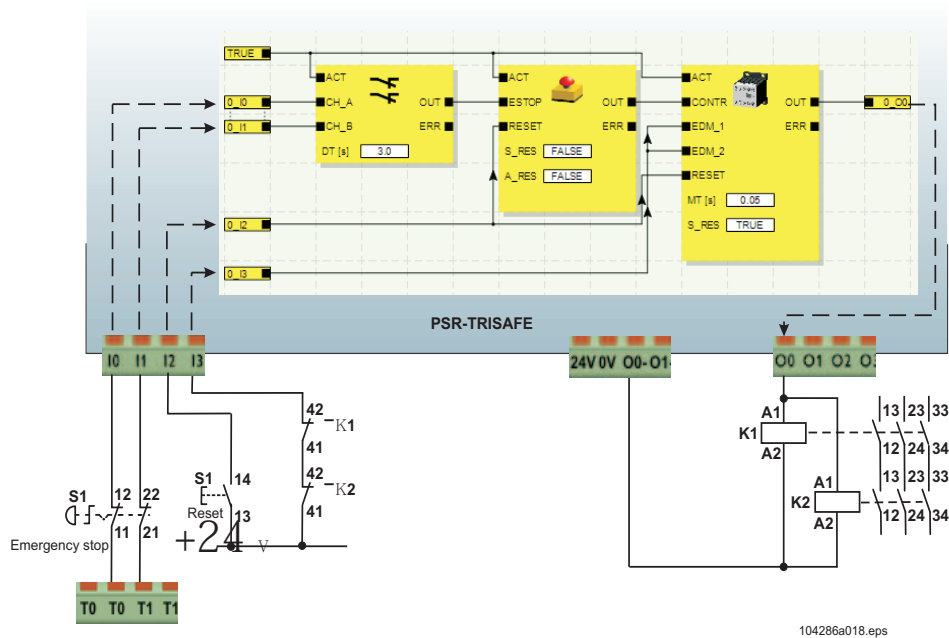


Figure 3-6 Example application for ground switching outputs O0- and O1-



In order to use the ground switching outputs, the corresponding parameters must be set for outputs O0 and O1 in the SAFECONF configuration software. For more detailed information, please refer to the online help topic "Parameterizing the inputs/outputs of the safety module".

3.5 USB interface

The USB interface (standard USB 2.0) is used for communication between the safety module and the SAFECONF configuration software.

This includes:

- Downloading configuration data (i.e., for the SAFECONF project)
- Optional upload of the configuration in order to open it as a project and edit it as required in SAFECONF
- Reading values from the safety module during operation and displaying the read values “live” in the connection editor of SAFECONF (online mode)
- Forcing signals on the running safety module for startup purposes (standard startup mode)



Before the safety module is connected to the configuration PC, the SAFECONF configuration software must be installed with the appropriate USB drivers for the module.



NOTE: Electrostatic discharge

The safety module contains components that can be damaged or destroyed by electrostatic discharge. When handling the USB interface, observe the necessary safety precautions against electrostatic discharge (ESD) according to EN 61340-5-1 and EN 61340-5-2.

Once the USB connecting cable (mini-USB plug, 5-pos., maximum cable length of 3 m) has been connected, if appropriately configured, the PC detects the safety module automatically.

If the SAFECONF configuration software has already been started, the software will detect the status of the safety module and display this in the status bar at the bottom right of the screen.

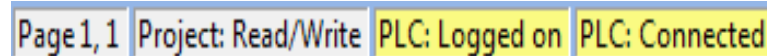


Figure 3-7 Status bar in the SAFECONF safe configuration software (safety module already contains a configuration project)

3.6 IFS-CONFSTICK

The safety module is equipped with a plug-in memory module (IFS-CONFSTICK).

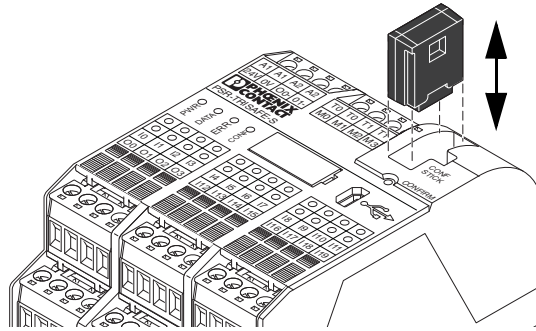


Figure 3-8 IFS-CONFSTICK on PSR-TRISAFE-M

IFS-CONFSTICK as a hardkey

The IFS-CONFSTICK **must** be inserted in the safety module both during normal operation and for downloading configuration data from SAFECONF via the USB interface.

If no IFS-CONFSTICK is inserted in the safety module or if it is removed, the safety module behaves as follows:

- If no IFS-CONFSTICK is inserted when downloading configuration data, the configuration cannot be downloaded and SAFECONF outputs an error message.
- If no IFS-CONFSTICK is inserted when the safety module is started, all outputs remain deactivated and the safety module indicates an error. The safety module does not execute any functions.
- If the IFS-CONFSTICK is removed during operation, the safety module deactivates all outputs and indicates an error. The safety module does not execute any more functions.
- If the IFS-CONFSTICK is removed from the safety module and reinserted as described in “Downloading the configuration using the IFS-CONFSTICK” on page 101, the safety module deactivates all outputs and does not execute any functions until the IFS-CONFSTICK is inserted again correctly. The safety module **does not indicate an error**.



As an alternative to downloading the configuration via the USB interface, it can be downloaded to the safety module using the IFS-CONFSTICK. For instructions on how to proceed, please refer to “Downloading the configuration using the IFS-CONFSTICK” on page 101.

3.7 Installing the safety module


WARNING: Serious personal injury or damage to equipment.

Disregarding this warning may result in damage to equipment and/or serious personal injury.

The electrical connection, startup, and operation of this device may only be performed by qualified personnel.

With respect to the safety notes in this document, qualified personnel are persons who are authorized to start up, to ground, and to mark devices, systems, and equipment according to the standards of safety technology. In addition, these persons must be familiar with all warning instructions and maintenance measures in this document.

3.7.1 Mounting the safety module


CAUTION: Risk of injury and damage to equipment.

Only mount and remove the safety module when the power supply is disconnected.

For standard extension modules, the safety module is equipped with an interface for the PSR-TBUS DIN rail connector on the mounting side (see page 22).

The PSR-TBUS DIN rail connector can be used to connect the system power supply or to connect gateways (e.g., for PROFIBUS) for transmitting standard diagnostic data. The PSR-TBUS DIN rail connector eliminates the need for cross-wiring between the safety module and the gateway modules or system power supply.

The voltage supply can be provided at any PSR device or using the system power supply via the PSR DIN rail connector (see "Connecting the supply voltage" on page 50).

3.7.1.1 Mounting


CAUTION: Risk of damage to equipment due to incorrect installation.

Please observe the following notes for mounting:

- Use only the yellow PSR-TBUS DIN rail connector (Order No. 2890425) to connect the PSR-TRISAFE-M safety module. Connection with another DIN rail connector is not permitted.
- Use only the yellow PSR-TBUS DIN rail connector (Order No. 2890425) to connect safe extension devices. Connection with another DIN rail connector is not permitted.
- Safe extension devices must be mounted to the right of the master module.
- Use only the green PSR-TBUS DIN rail connector (Order No. 2707437) to connect standard devices. Connection with another DIN rail connector is not permitted.
- Standard devices must be mounted to the left of the master module.

To mount the PSR-TRISAFE-M safety module, proceed as follows:

Mounting a 35 mm DIN rail

1. The safety module should only be mounted on 35 mm DIN rails according to EN 60715. To avoid contact resistance, only use clean, corrosion-free DIN rails.

Mounting PSR-TBUS DIN rail connectors (optional)

2. To use PSR-TBUS DIN rail connectors to create a connection station with a system power supply or with extension units, proceed as follows:
 - Connect together the required number of PSR DIN rail connectors for the connection station (see Figure 3-9, A).
 - Push the connected PSR DIN rail connectors onto the DIN rail (B and C).

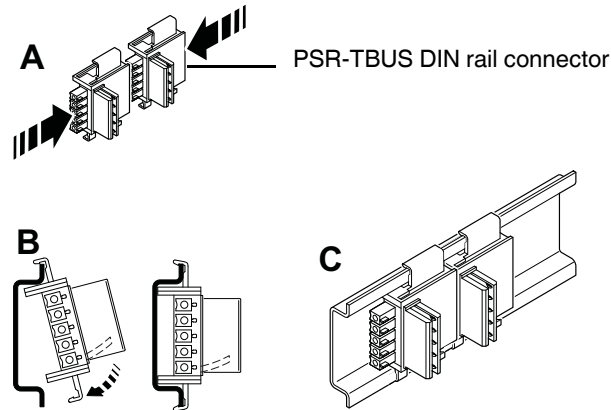


Figure 3-9 Mounting PSR-TBUS DIN rail connectors

Mounting the PSR-TRISAFE-M safety module

3. Place the module onto the DIN rail from above as shown in Figure 3-10 so that the upper holding keyway of the module hooks onto the top edge of the DIN rail. When using PSR DIN rail connectors, make sure that the contact opening in the base of the module is aligned correctly over the contact block of the PSR DIN rail connector.

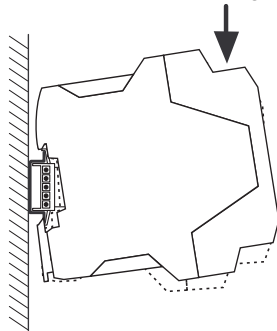


Figure 3-10 Attaching the PSR-TRISAFE-M safety module to the DIN rail

4. Push the lower part of the module that is furthest from the DIN rail towards the DIN rail until it audibly snaps in.
5. Check that the module is securely mounted on the DIN rail.

6. When mounting additional modules on the DIN rail (e.g., gateway extension modules or power supply), place them on the DIN rail with no spacing, i.e., in direct contact with the sides of the housing. All standard extension devices must be mounted to the left of the safety module.
7. End brackets can be mounted on both sides of the module (or module group) to stop the module(s) from slipping on the DIN rail.

3.7.1.2 Removal

To remove the PSR-TRISAFE-M safety module, proceed as follows:

1. Pull the locking latch on the bottom of the module down using a screwdriver, for example, to release the module from the DIN rail.
2. Lift the bottom of the module away from the DIN rail slightly.
3. Pull the module diagonally upwards away from the DIN rail.

3.7.2 Connecting the supply voltage

The safety module has no main switch and is switched on simply by applying the supply voltage.

The safety logic and the alarm outputs are supplied with power via connections A1/A2; the safe outputs, clock outputs, and ground switching outputs are supplied via connections 24V/0V.

Once the "PWR" status indicator is permanently on, the safety module is ready to operate.



Outputs "A1" and "A2" provide the supply voltage for supplying other modules, such as sensors (see "Supply connections A1 and A2" on page 44).

3.7.2.1 Direct connection of the supply voltage on the PSR-TRISAFE-M

Connect the supply voltage (as shown in the figure below):

1. Supply voltage for the safe module outputs and the ground switching outputs at terminal block contacts "0V" and "24V".
2. Supply voltage for the safety module logic, the clock outputs, and the alarm outputs at terminal block contacts "A1" (24 V) and "A2" (0 V).

Once the supply voltage has been applied, the safety module executes an initialization routine (all LEDs on).

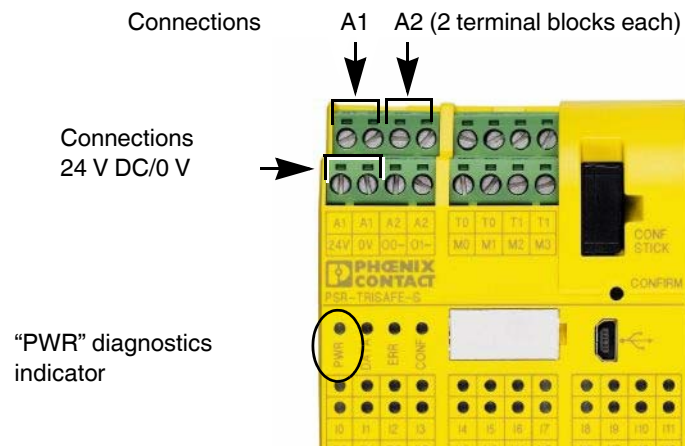


Figure 3-11 Connecting the supply voltage at A1/A2 and 24V/0V

3.7.2.2 Supply via the system power supply

As an alternative, the devices can also be supplied with power using the MINI-SYS-PS-100-240AC/24DC/1.5 system power supply (Order No. 2866983). The devices are then connected via the PSR-TBUS DIN rail connector.

Usually the system power supply is mounted as the first device in a topology. A second system power supply can be used to create a redundant supply concept.

3.7.3 Connecting the signal lines



CAUTION: Ensure signal redundancy.

Ensure signal redundancy when connecting the signal lines of two-channel control devices and sensors to the inputs of the safety module. Please refer to “Signal inputs” on page 42.



CAUTION: Avoid cross circuits and short circuits.

Prevent cross circuits and short circuits by using a suitable cable installation. Implement cross-circuit detection (see “Cross-circuit detection” on page 43).

Cable lengths

Many applications use large numbers of sensors or control devices. Depending on the size of the machine or system, a considerable amount of cabling may be required to wire the sensors. Make sure that the specified cable lengths are not exceeded, so as to ensure error-free operation of the safety circuits and, therefore, a reliable safety demand.

For reliable and touch-proof contacts, strip the cable ends as follows:

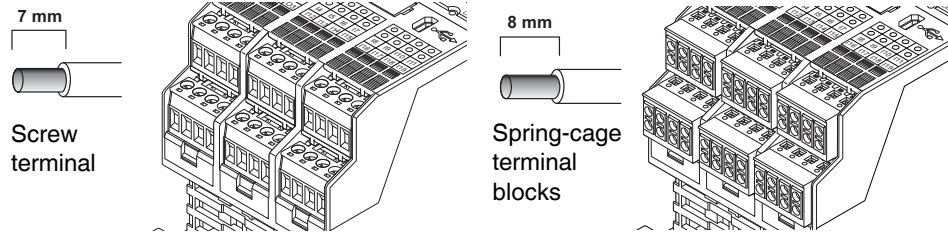


Figure 3-12 Connection to screw terminal blocks (left) and spring-cage terminal blocks (right)

3.8 Firmware update for PSR-TRISAFE-M

The firmware for the PSR-TRISAFE-M safety module can be updated using the SAFECONF safe configuration software.

You can download the latest firmware version from the Phoenix Contact download page.



Only the firmware for the safety module can be updated. The firmware for extension modules, e.g., PSR-TS-SDI8-SDIO4, cannot be updated using this method.



Updating the firmware does **not** delete or change the current configuration project. This means that once the new firmware has been confirmed manually, the safety module immediately resumes execution of the currently loaded project.

3.8.1 Safety notes for the firmware update

The following safety notes must be observed during and after the firmware update:



CAUTION: Once a firmware update is in progress, it must not be interrupted

During the update process, you must not disconnect the USB cable or switch off the safety module. Interrupting the connection between the PC and safety module during firmware installation can damage the device.

Under certain circumstances, faulty or incomplete firmware installation can render communication between the PC and safety module impossible. In this case, the faulty installation cannot be corrected with the assistance of SAFECONF.



CAUTION: Standard operation during firmware update

While the firmware update is in progress, the PSR-TRISAFE-M operates in **standard mode**. There is no absolute guarantee that the safety demand will be detected in this phase.

Therefore, make sure that running the firmware update will not lead to any hazardous situations. Take action to prevent the machine from being started up unintentionally (by disconnecting the terminal blocks on the output side from the PSR-TRISAFE-M, for example, and disconnecting the drives from the power supply).



CAUTION: On completion of the update, validate/verify the safety application

Once the firmware update is complete, you must validate and verify the safety application again.

3.8.2 Requirements for firmware update

A number of requirements must be met in order for a new firmware version to be installed on the safety module. Before running the update, make sure that:

- The PSR-TRISAFE-M is connected to the PC via the USB cable and is switched on
- An IFS-CONFSTICK is inserted in the PSR-TRISAFE-M
- A project for the PSR-TRISAFE-M safety module is loaded in SAFECONF
- Simulation mode is deactivated in SAFECONF
- “Controller: Connected” and “Controller: Logged off” are displayed in the status bar of SAFECONF
- “Project: Write-protected” is displayed in the status bar of SAFECONF

3.8.3 Updating the firmware

To start the firmware update in SAFECONF, select the “Safe controller > Firmware update” menu item. The wizard, which will guide you through the update, is displayed.

Proceed **as described in detail in the online help**. You will find “Firmware update (safety module)” listed in the help contents (please also refer to “Online help” on page 70).

4 PSR-TS-SDI8-SDIO4 extension module

4.1 Device description

The PSR-TS-SDI8-SDIO4 safe extension module is an extension device for the PSR-TS-SDI8-SDIO4 safety module. It provides the safety module with additional configurable inputs and outputs to which safe control devices and sensors/actuators can be connected.

Just like the inputs and outputs of the safety module, the inputs and outputs of the safe extension module are connected in the SAFECONF configuration software. During operation, the safe outputs of the extension module are controlled according to the safety logic executed in the safety module.

The extension module has eight digital safe inputs (I4 - I11) and four signals (IO0 - IO3), which can be configured either as safe digital inputs or outputs. The signal direction (input or output) can only be switched over block by block, i.e., for all four signals (IO0 - IO3) at once.

Two more signals (TM0 and TM1) are also available; these can be configured either as non-safety-related digital alarm outputs or as clock outputs. If TM0 and TM1 are configured as clock outputs, they will support cross-circuit detection at the inputs of the safe extension module (see "Error detection in I/O devices" on page 26).

If the signals are configured as alarm outputs, a standard PLC or signaling units can be controlled, for example.

All connection terminal blocks can be plugged in. The individual terminal block bases are mechanically coded to prevent incorrect connection. The extension module is available either with screw connections or spring-cage connections.



Figure 4-1 Extension module with screw connections

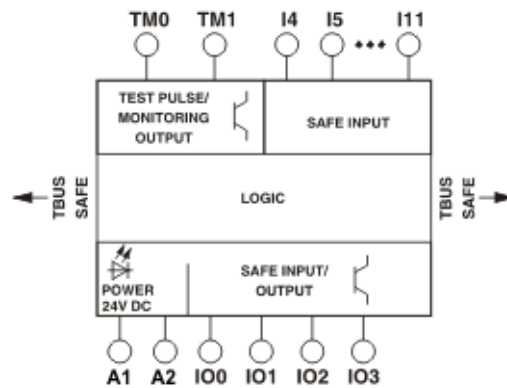


Figure 4-2 Block diagram for PSR-TS-SDI8-SDIO4

4.2 Diagnostics and status indicators

The LEDs on the safe extension module are located on the front of the device.

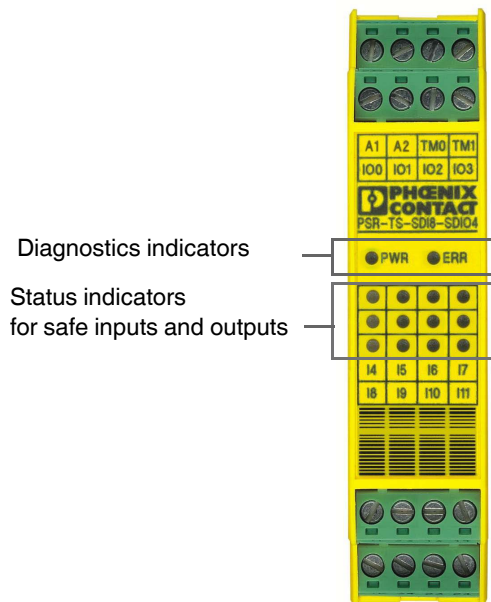


Figure 4-3 Diagnostics and status indicators on the extension device

Diagnostics indicators

The two diagnostics indicators on the front of the device can be used to read the operating status of the extension module. The following LEDs are available:

- “PWR”: indicator for the power supply of the safety module
- “ERR”: error indicator

The following table lists the possible indicator combinations for the diagnostics indicators and their meanings. A distinction is made between slow flashing and fast flashing LEDs.

The LED symbols in the table mean:

LED is off



LED is on



LED is flashing



Slow = 1.7 Hz

Fast = 6.6 Hz

Table 4-1 Meaning of the diagnostics indicators

PWR (green)	ERR (red)	Meaning
		Device is switched off, no power supply at 24 V/0 V or TBUS
		Initialization phase after power up (maximum duration: 4 s)
		Normal operation. A flashing LED at an input or output signals an error affecting the corresponding signal (see Table 4-2 below).
	6.3 Hz	An error has occurred. → Read out the error code with SAFECNF.

LEDs for signal inputs/outputs

The state of each of the eight safe inputs and four configurable safe inputs/outputs is indicated by a separate LED on the front of the device.

Table 4-2 Status indicators for safe inputs and outputs

LED	State	Meaning
For each input ("I4" to "I11") and for "IO0" to "IO3", if these are configured as safe inputs		No switching signal at the relevant input
		Switching signal active at the input
		Diagnostic error (see page 27)
	Long on Short off	Wiring check at an input or non-equivalence input.
For "IO0" to "IO3", if these are configured as safe outputs		Output is not active
		Output is active
		Diagnostic error (see page 27)
	Long on Short off	Wiring check at an output

4.3 Signal connections

All of the inputs and outputs are connected via plug-in coded connection terminal blocks.

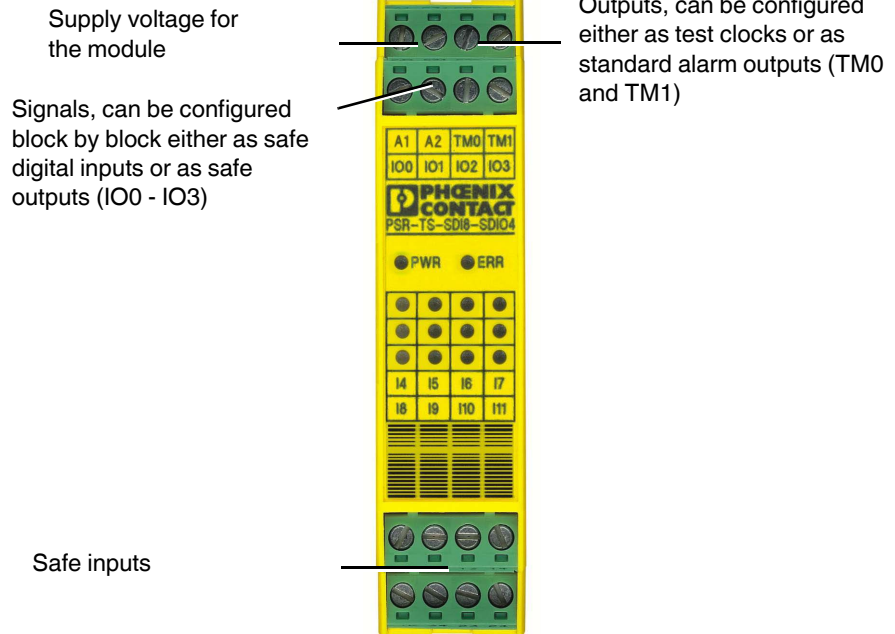


Figure 4-4 PSR-TS-SDI8-SDIO4 signal connections

The various signal connections are described in the following sections.

4.3.1 Signal inputs

The PSR-TS-SDI8-SDIO4 safe extension module has 12 digital signal inputs (24 V HTL/3 mA) for the direct connection of safe control devices or safety sensors for monitoring and evaluating processes. Four of the inputs (IO0 - IO3) can also be configured as safe digital outputs (see "Safe outputs" on page 59).



The parameterization editor (see "Device parameterization in the safe parameterization editor" on page 85) is used to set the input and output parameters and therefore select the configuration.

The safe inputs are linked to the safety logic in the connection editor of the SAFECNF configuration software. See also "Inserting and connecting functions, function blocks, and signals" on page 81.

Signal redundancy due to dual signals

Every two adjacent signal inputs (i.e., I0 and I1, I2 and I3, etc.) are grouped together and interlocked by default to form a dual signal in the SAFECNF configuration software. This is indicated in the representation of the safe extension module in the hardware editor of the configuration software by a red padlock at the relevant inputs. The two signals are then always used as a pair, i.e., both signals are dragged, dropped, cut or deleted together in the connection editor.

If required, this interlock can be removed and the dual signal split into two individual signals.



Dual signals are not interconnected internally; they are simply grouped together.

As input signals with even and odd IDs are processed in different ways in the safety module, using dual signals ensures that the safety module will perform redundant processing.

Two-channel sensors

To ensure signal redundancy, the prepared dual signal must be used to process two-channel signals (2-wire sensors and control devices). For example, in order to monitor or evaluate both signals of an emergency stop control device redundantly and to performance level PL e according to EN ISO 13849-1 or EN 954-1, category 4, these two adjacent signal inputs (e.g., IO and I1) must be connected.

Cross-circuit detection

A cross circuit is an unintentional, incorrect connection between redundant circuits. The extension module provides signals TM0 and TM1, which can be configured as clock outputs, as an aid for detecting such a cross circuit.

For example, if two differently clocked signals are routed back to two inputs of the safe extension module along two channels via an emergency stop control device, a cross circuit can be reliably detected in this emergency stop circuit. In the event of a cross circuit, the same clock signal would be present at both inputs, instead of two different ones.

The SAFECONF configuration software specifies the clock signals to be used. For “even” inputs (IO0 and IO2 and I4 ... I10), cross-circuit detection is implemented with the test clock at TM0. For “odd” inputs (IO1 and IO3 and I5 ... I11), the test clock at TM1 must be used for cross-circuit detection.



Configuring the IOs as inputs: if the IOs (IO0 to IO3) are configured as inputs, the cross-circuit detection function supported by the extension module **MUST** be used, i.e., power must be supplied to the inputs concerned via clock outputs TM0 and TM1 of the extension module. See also “Clock/alarm outputs TM0 and TM1” on page 60.



For an example of two-channel connection of an emergency stop control device with **dual signal and cross-circuit detection**, please refer to Figure 2-4 in “Error detection in I/O devices” on page 26.

4.3.2 Safe outputs

Signals IO0 to IO3 can be configured as safety-related outputs. They are designed as digital semiconductor outputs for 24 V DC/0.5 A (2 A total current), up to category 4 according to EN 954-1.

The outputs are controlled according to the configured safety logic. The safe outputs are linked to the safety logic that controls the outputs in the connection editor of the SAFECNF configuration software. See also “Inserting and connecting functions, function blocks, and signals” on page 81.



An appropriate protective circuit (diode or varistor) for IO0 to IO3 signals configured as safe outputs is strongly recommended.



The safe output signals are clocked with a test pulse of 1 ms.

4.3.3 Clock/alarm outputs TM0 and TM1

Outputs TM0 and TM1 of the PSR-TS-SDI8-SDIO4 extension module can be configured as alarm outputs or clock outputs as required. The two options are described in the next two sections.



The parameterization editor (see “Device parameterization in the safe parameterization editor” on page 85) is used to set the input and output parameters and therefore to select the configuration.

4.3.3.1 TM0 and TM1 as alarm outputs

Make the following settings in the safe parameterization editor (part of the hardware editor) to configure output TM0 or TM1 as an alarm output:

- For TM0, set the “Configuration” parameter to the value “Alarm output (M0)”
- For TM1, set the “Configuration” parameter to the value “Alarm output (M1)”

Non-safety-related alarm outputs are designed as digital semiconductor outputs for 24 V DC/100 mA. These alarm outputs can be used, for example, to control a standard PLC or a signaling module (e.g., a signal lamp).

The alarm outputs are linked in the same way as the safe inputs and outputs in the connection editor of SAFECNF (see “Inserting and connecting functions, function blocks, and signals” on page 81).



NOTE: Alarm outputs must not be connected in parallel.
Feedback to alarm outputs is not permitted.

4.3.3.2 TM0 and TM1 as clock outputs

Make the following settings in the safe parameterization editor to configure output TM0 or TM1 as a clock output:

- For TM0, set the “Configuration” parameter to the value “Clock (T0)”
- For TM1, set the “Configuration” parameter to the value “Clock (T1)”

The test clocks output at outputs TM0 and TM1 (if configured accordingly) are used for cross-circuit detection at the inputs of the same extension module. The output test clocks T0 and T1 are asynchronous, i.e., T0 does not equal T1.

To implement cross-circuit detection, the relevant safe inputs must be configured accordingly using the parameterization editor (part of the hardware editor in SAFECNF).

The SAFECONF configuration software specifies the clock signals to be used: for “even” inputs (IO0 and IO2 and IO4 ... IO10), cross-circuit detection is implemented with the test clock at TM0. For “odd” inputs (IO1 and IO3 and IO5 ... IO11), the test clock at TM1 must be used for cross-circuit detection.



If the IOs (IO0 to IO3) are configured as inputs, the cross-circuit detection function supported by the extension module **MUST** be used, i.e. power must be supplied to the inputs concerned via clock outputs TM0 and TM1 of the extension module (see “Clock/alarm outputs TM0 and TM1” on page 60).

Please also refer to “Signal inputs” on page 58 and “Error detection in I/O devices” on page 26.

4.3.4 Supply connection A1/A2

Voltage is supplied to the PSR-TS-SDI8-SDIO4 safe extension module via supply connection A1 (24 V)/A2 (0 V) (see also “Connecting the supply voltage” on page 61).

4.4 Installing the safe extension device



WARNING: Serious personal injury or damage to equipment

Disregarding this warning may result in damage to equipment and/or serious personal injury.

The electrical connection, startup, and operation of this device may only be performed by qualified personnel.

With respect to the safety notes in this document, qualified personnel are persons who are authorized to start up, to ground, and to mark devices, systems, and equipment according to the standards of safety technology. In addition, these persons must be familiar with all warning instructions and maintenance measures in this document.

4.4.1 Mounting the safe extension device

The extension device is mounted in the same way as the safety module (see “Mounting the safety module” on page 48).

4.4.2 Connecting the supply voltage

The extension module has no main switch and is switched on simply by applying the supply voltage at connections A1 (24 V) and A2 (0 V).

Once the “PWR” diagnostics indicator is permanently on, the extension module is ready to operate.

Once the supply voltage has been applied, the safe extension module executes an initialization routine (all LEDs on).

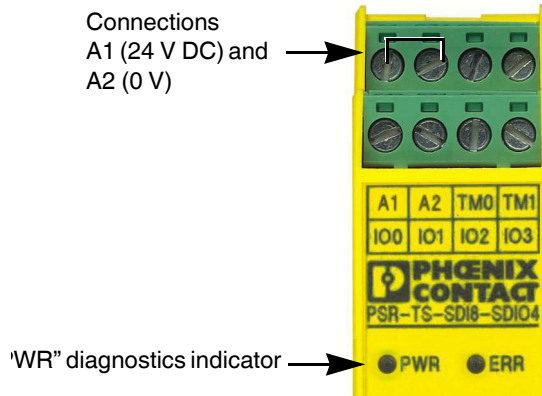


Figure 4-5 Connecting the supply voltage

4.4.3 Connecting the signal lines



CAUTION: Ensure signal redundancy.

Ensure signal redundancy when connecting the signal lines of two-channel control devices and sensors to the inputs of the safety module. Please refer to “Signal inputs” on page 58.



CAUTION: Avoid cross circuits and short circuits.

Prevent cross circuits and short circuits by using a suitable cable installation. Implement cross-circuit detection (see “Cross-circuit detection” on page 59).

The signal lines are connected to the extension device in exactly the same way as on the safety module (see “Connecting the signal lines” on page 51).

5 PSR-TS-SDOR4 extension module

5.1 Device description

The PSR-TS-SDOR4 safe extension module is an extension device for the PSR-TS-SDOR4 safety module. It provides the safety module with additional configurable outputs to which safe control devices and sensors/actuators can be connected.

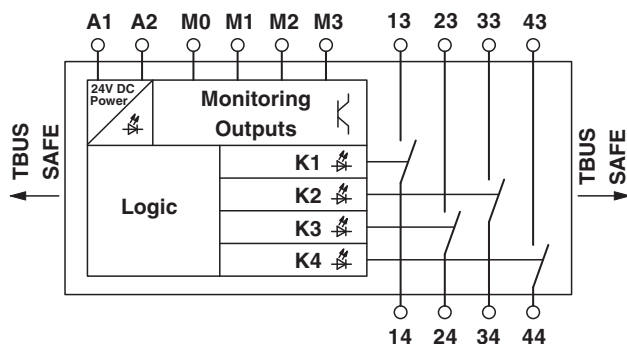
Just like the inputs and outputs of the safety module, the outputs of the safe extension module are connected in the SAFECONF configuration software. During operation, the safe outputs of the extension module are controlled according to the safety logic executed in the safety module.

The extension module has four safe relay outputs (O0 - O3) and four alarm outputs (M0 - M3).

All connection terminal blocks can be plugged in. The individual terminal block bases are mechanically coded to prevent incorrect connection. The extension module is available either with screw connections or spring-cage connections.



Figure 5-1 Extension module with screw connections



Block diagram for PSR-TS-SDOR4

5.2 Diagnostics and status indicators

The LEDs on the safe extension module are located on the front of the device.

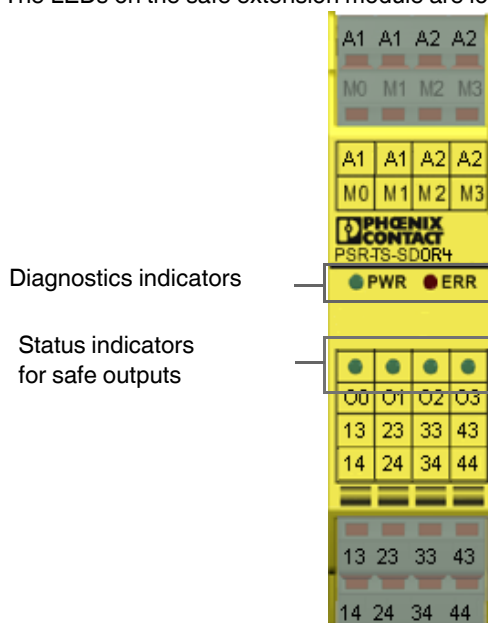


Figure 5-2 Diagnostics and status indicators on the extension device

Diagnostics indicators

The two diagnostics indicators on the front of the device can be used to read the operating status of the extension module. The following LEDs are available:

- “PWR”: indicator for the power supply of the extension module
- “ERR”: error indicator

The following table lists the possible indicator combinations for the diagnostics indicators and their meanings. A distinction is made between slow flashing and fast flashing LEDs.

The LED symbols in the table mean:

LED is off



LED is on



LED is flashing



Slow = 1.7 Hz

Fast = 6.6 Hz

Table 5-1 Meaning of the diagnostics indicators

PWR (green)	ERR (red)	Meaning
		Device is switched off, no power supply at 24 V/0 V or TBUS
		Initialization phase after power up (maximum duration: 4 s)
		Normal operation. A flashing LED at an input or output signals an error affecting the corresponding signal (see Table 5-2 below).
		An error has occurred. → Read out the error code with SAFECONF.

LEDs for signal outputs

The state of each of the four safe outputs is indicated by an LED on the front of the device.

Table 5-2 Status indicators for safe outputs

LED	State	Meaning
For "O0" to "O3"		Output is not active
		Output is active
		Diagnostic error (see page 27)
		Long on Short off

5.3 Signal connections

All of the outputs are connected via plug-in coded connection terminal blocks.

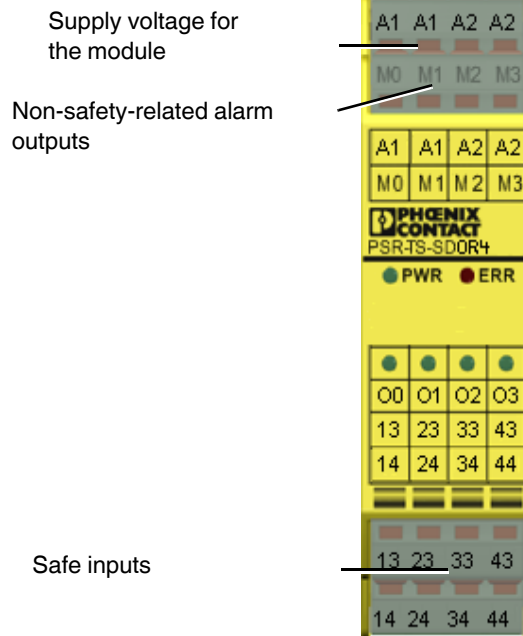


Figure 5-3 PSR-TS-SDOR4 signal connections

The various signal connections are described in the following sections.

5.3.1 Signal inputs

The PSR-TS-SDOR4 extension module does not have any signal inputs.

5.3.2 Safe outputs

Signals O0 to O3 can be configured as safety-related outputs.

These can be used as follows:

- For two-channel assignment:
 - Two two-channel outputs (delivery state)
- For single-channel assignment:
 - Four single-channel outputs

The outputs are controlled according to the configured safety logic. The safe outputs are linked to the safety logic that controls the outputs in the connection editor of the SAFECNF configuration software. See also “Inserting and connecting functions, function blocks, and signals” on page 81.



NOTE: Mixing different voltages (e.g. SELV/PELV with mains voltage) or connecting multiple phases is not permitted on the relay contacts.

5.3.3 Alarm outputs M0 and M1

Non-safety-related alarm outputs are designed as digital semiconductor outputs for 24 V DC/100 mA. These alarm outputs can be used, for example, to control a standard PLC or a signaling module (e.g., a signal lamp).

The alarm outputs are linked in the same way as the safe inputs and outputs in the connection editor of SAFECONF (see “Inserting and connecting functions, function blocks, and signals” on page 81).



NOTE: Alarm outputs must not be connected in parallel.
Feedback to alarm outputs is not permitted.

5.3.4 Supply connection A1/A2

Voltage is supplied to the PSR-TS-SDOR4 safe extension module via supply connection A1 (24 V)/A2 (0 V) (see also “Connecting the supply voltage” on page 67).

5.4 Installing the safe extension device



WARNING: Serious personal injury or damage to equipment

Disregarding this warning may result in damage to equipment and/or serious personal injury.

The electrical connection, startup, and operation of this device may only be performed by qualified personnel.

With respect to the safety notes in this document, qualified personnel are persons who are authorized to start up, to ground, and to mark devices, systems, and equipment according to the standards of safety technology. In addition, these persons must be familiar with all warning instructions and maintenance measures in this document.

5.4.1 Mounting the safe extension device

The extension device is mounted in the same way as the safety module (see “Mounting the safety module” on page 48).

5.4.2 Connecting the supply voltage

The extension module has no main switch and is switched on simply by applying the supply voltage at connections A1 (24 V) and A2 (0 V).

Once the “PWR” diagnostics indicator is permanently on, the extension module is ready to operate.

Once the supply voltage has been applied, the safe extension module executes an initialization routine (all LEDs on).

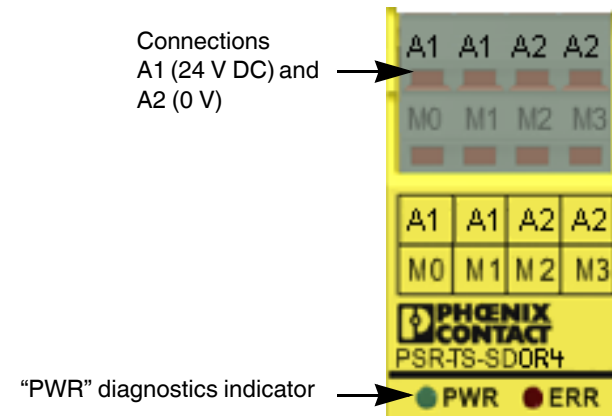


Figure 5-4 Connecting the supply voltage

5.4.3 Connecting the signal lines



CAUTION: Avoid cross circuits and short circuits.

Prevent cross circuits and short circuits by using a suitable cable installation.

The signal lines are connected to the extension device in exactly the same way as on the safety module (see "Connecting the signal lines" on page 51).

6 SAFECONF configuration software

6.1 Installing SAFECONF

The installation routine for the configuration software includes the installation of the driver for the USB interface. This driver is required for communication between the PC and the safety module.



To ensure that the configuration software detects the safety module automatically and correctly, the software must be fully installed on the computer before the device is connected for the first time.

Proceed as follows:

1. If you have **downloaded** the configuration software, extract the downloaded file and start the installation program (setup file).
If you have purchased the **PSR-SAFECONF-BOX**, insert the supplied CD-ROM in the drive. A menu opens. Select "Install software" to start the installation program.
(If you have deactivated the auto start option on your computer, open the "SAFECONF" folder on the CD-ROM and execute the setup file.)
2. Select the desired language for the installation routine. (This also sets the language for the SAFECONF user interface, which is set when the software is started for the first time.)
3. The installation program now guides you through the installation step by step. Follow the on-screen instructions.
4. Once SAFECONF is installed, you will be prompted to install the drivers for the safety module. Follow the on-screen instructions.
5. In the Windows dialog box for driver installation, select "Install the software automatically (recommended)".

Finally, a message appears indicating that the configuration software and drivers for the safety module have been fully installed.

6.2 Overview of functions and features

The SAFECONF safe configuration software is used to configure the PSR-TRISAFE-M safety module and the extension modules used. The software supports the user in all operating phases, from planning the application and carrying out the configuration to starting up the PSR-TRISAFE-M safety module and compiling system documentation.

The SAFECONF functions support:

- Up to ten extension modules can be added from the "Hardware" compartment of the toolbox to the hardware editor using drag & drop. Previously added devices can be removed via the context menu in the hardware editor.

**Adding/removing
extension devices**

Creating the safety logic	– Creation of the safety logic with the help of a graphical connection editor. The circuit which the safety module runs on is created by graphically linking safe function blocks certified according to the PLCopen specification via connecting lines and safe functions. Safe functions range from logic operations such as AND, OR, etc., to timer and trigger functions.
Linking inputs/outputs to safety logic	– The inputs and outputs of the safety module are linked to the safety logic using drag & drop.
Parameterizing inputs/outputs	– The inputs and outputs of the safety module and of the extension devices (e.g., PSR-TS-SDI8-SDIO4) are parameterized using a safe parameterization editor.
Downloading/uploading the configuration	– You can download the configuration project, including all device parameters, to the safety module in a few steps. It is also possible to upload the project saved on the safety module to the connected PC in order to display or edit it in the configuration software.
Online mode for function test	– During safe operation, you can read signal values from the safety module and display them in a special online mode. The connection editor indicates the current “live” status of each signal and the inputs and outputs of each function block in the safety logic. The hardware editor in online mode maps the LEDs on the safety module.
Startup mode (additional)	– There is a mandatory function test of the active system, e.g., the activation of the safe control devices. You can also use “standard” startup mode. For example, instead of pressing an actual switch, you can force the corresponding signal in the connection editor and test the safety logic in this way.
Documentation, checklist	– The configuration software provides you with a project information dialog box, where you can save information relating to the project and complete a safety-related checklist. This dialog box is supplemented by an assignment list, where comments can be added to the signals of the safe devices used in order to document the wiring. All documentation, including the graphical safety logic, the assignment list, and the device parameters, can be printed out.
EASYSIM simulation	– Simulation of the safety module, for example, for preliminary testing of the developed safety logic even if no safety module is available.
Online help	You will find a description of the comprehensive functions of SAFECONF in the online help for the software. There are various ways of calling the online help: • In the “?” menu, select “Help topics”. The table of contents for the online help appears. Search for a help topic as described below. • In an active dialog box or window, press <F1>. The context-sensitive online help for the active dialog box or window appears. • In the connection editor, select an object and press <F1> in order to view information relating to that object. For safe functions and function blocks, general information about the objects can be accessed in this way. • There is also specific function block information which can be called via the “Help” context menu item for the relevant function block or function.

6.3 Description of the user interface

This section provides an overview of the user interface for the SAFECONF configuration software. For more detailed information, please refer to the online help.

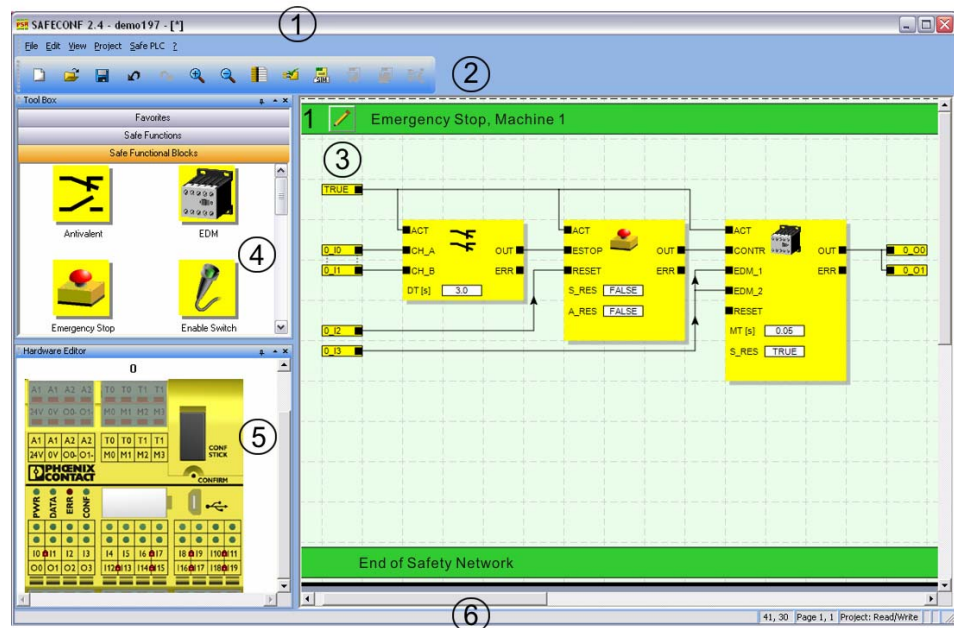


Figure 6-1 SAFECONF user interface



The windows may be arranged differently to the format shown here, either when the software is delivered or once you have adapted the program to your preferences.

The user interface consists of the following components:

1. **Menu**
The menus contain all commands for controlling the configuration software.
2. **Toolbar**
You can access frequently used functions quickly via the icons in the toolbar.
3. **Connection editor**
The connection editor is used to develop the safety logic by dragging graphical function blocks from the toolbox and signals from the hardware window to the circuit (using drag & drop) and connecting them to one another.
4. **Toolbox**
The toolbox contains standard functions, safe function blocks, safe functions, and connectors in the corresponding compartments. These elements can easily be dragged from the toolbox to the connection editor. The "Hardware" compartment contains extension devices (if present) as soon as the PSR-TRISAFE-M master module has been added to the hardware editor.
If a fieldbus gateway is available, the "External Signals" compartment will contain special exchange signals which have been designated specifically for data exchange between the safety module and a higher-level controller. This type of communication must take place via the intermediary of a suitable fieldbus module. If a higher-level

standard PLC is involved, from the perspective of the safe application, these are always standard signals which can be linked and processed accordingly in SAFECONF. The toolbox also contains a “Favorites” compartment. You can insert frequently used functions and function blocks here as required.

5. **Hardware editor**

The hardware editor contains a graphical representation of the PSR-TRISAFE-M safety module. It also shows all the extension modules that you have inserted from the “Hardware” compartment of the toolbox. When configuring the safety logic, input and output signals can be moved from here to the connection editor using drag & drop. Double-click on a module in the hardware editor to start the safe parameterization editor for the relevant module (not shown in Figure 6-1).

6. **Status bar**

When working with the configuration software, the status bar displays messages and information, as well as the current logon status, the status of the safety module, and transmission progress when downloading or uploading the configuration from or to the safety module.

The following windows and dialog boxes are not visible in the screenshot:

– **Message window**

The message window can be used to track the progress of the project checking function. Once you have started the check, the message window opens automatically. If the system detects an error when checking the project, you can jump directly to the relevant location of the error by double-clicking on the message in the message window.

– **Assignment list for signals**

The assignment list contains the signal assignments for the individual inputs and outputs of the PSR-TRISAFE-M safety module and the safe extension devices you have added. It provides “wiring documentation” which makes the project easier to understand and helps to prevent incorrect connections being established in the connection editor.

– **Project information dialog box**

This dialog box can be used to enter and display the most important information for the current configuration project (e.g., project-related data, manufacturer data, operator, installation location, data relating to safety inspections, revision history for the project).

6.4 Safe function blocks and functions

The PSR-TRISAFE-M safety module is configured in the SAFECONF configuration software by graphically connecting prepared safe functions and safe function blocks.

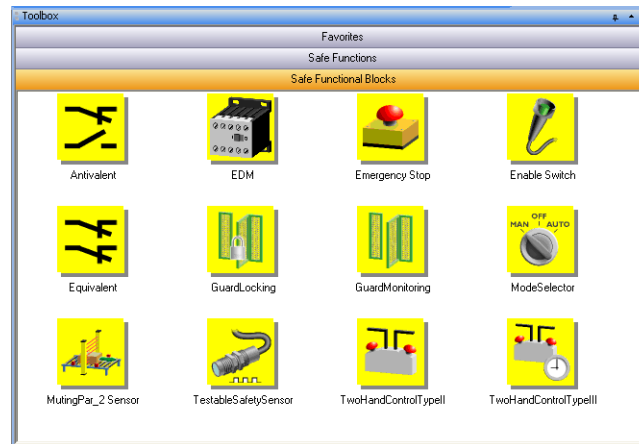


Figure 6-2 Safe function blocks in the toolbox (excerpt)

The connections are made intuitively using the mouse, and the editor prevents impermissible connections (e.g., between certain outputs).

The safe functions include simple Boolean operations and basic functions used in standard digital technology.

Safe functions

The following safe functions are available in the SAFECONF toolbox and can be easily added to the safety logic using drag & drop (in alphabetical order):

- AND (Boolean ANDing)
- CTUD (up/down counter)
- EQ (Boolean comparison)
- F_TRIG (detection of a falling edge)
- NOT (complement or negator)
- NOT_EQ (comparison for Boolean inequality)
- OR (Boolean ORing)
- PULSE_GEN (safe pulse generator)
- R_TRIG (detection of a rising edge)
- RS (bistable function: priority for resetting)
- SR (bistable function: priority for setting)
- TOF (timer for switch-off delay)
- TON (timer for switch-on delay)
- TP (pulse encoder)
- XOR (Boolean EXORing)

Safe function blocks

The safe function blocks provide basic safety-related functions for implementing the required safety circuits. Table 6-1 lists the available function blocks in alphabetical order.

Table 6-1 Safe function blocks

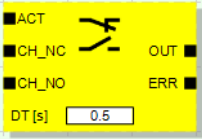
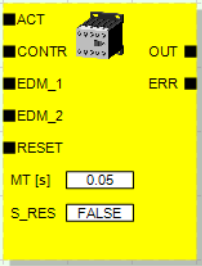
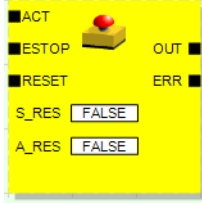
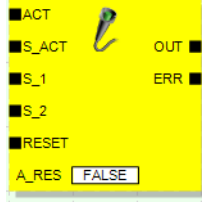
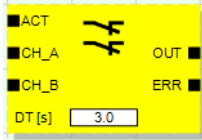
Name Icon in editor	Short description
Antivalent  The icon shows a yellow block with inputs ACT, CH_NC, and CH_NO, and outputs OUT and ERR. A delay time DT [s] is set to 0.5. The icon also features a switch symbol.	The Antivalent safe function block monitors the signals of two safe input terminal blocks for different signal states. Typically, these signals come from two-channel sensors or switches, such as an emergency stop control device.
EDM  The icon shows a yellow block with inputs ACT, CONTR, EDM_1, EDM_2, and RESET, and outputs OUT and ERR. It also includes a monitoring time MT [s] set to 0.05 and a reset signal S_RES set to FALSE. The icon features a contactor symbol.	The EDM (external device monitoring) safe function block monitors the defined initial state and the switching behavior of contactors connected to the safety module.
EmergencyStop  The icon shows a yellow block with inputs ACT, ESTOP, and RESET, and outputs OUT and ERR. It includes reset signals S_RES and A_RES, both set to FALSE. The icon features an emergency stop button symbol.	The EmergencyStop safe function block monitors the switching states of an emergency stop control device. When the control device is actuated, the enable signal at output OUT is set to FALSE.
EnableSwitch  The icon shows a yellow block with inputs ACT, S_ACT, S_1, S_2, and RESET, and outputs OUT and ERR. It includes a reset signal A_RES set to FALSE. The icon features a three-position enable switch symbol.	The EnableSwitch safe function block evaluates the signals of a manually activated three-position enable switch (in accordance with EN 60204) in order to identify its switching stage and switching direction. This means that an enable switch can be used to remove safeguarding, provided that the appropriate safe operating mode (e.g., limitation of the speed or range of motion) is selected and active.
Equivalent  The icon shows a yellow block with inputs ACT, CH_A, and CH_B, and outputs OUT and ERR. A delay time DT [s] is set to 3.0. The icon features a switch symbol.	The Equivalent safe function block monitors the signals of two safe input terminal blocks for the same signal states. Typically, these signals come from two-channel sensors or switches, such as an emergency stop control device.

Table 6-1 Safe function blocks [...]

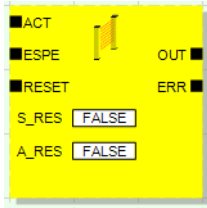
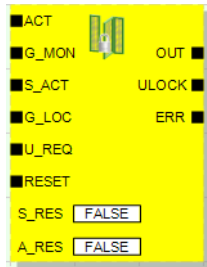
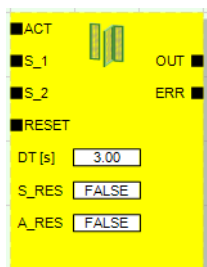
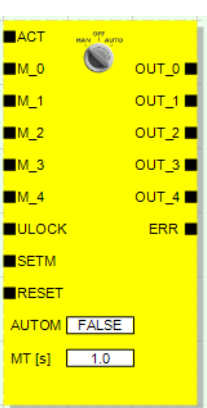
Name Icon in editor	Short description
ESPE  The icon shows a yellow rectangular block with the following labels: ACT, ESPE, OUT, RESET, ERR, S_RES (with a FALSE button), and A_RES (with a FALSE button). A small graphic of a light grid is positioned between ESPE and OUT.	The ESPE (electrosensitive protective equipment) safe function block monitors the switching states of electrosensitive protective equipment (e.g., light grids). When the protective equipment is triggered, i.e., the light grid beam is interrupted, the enable signal at output OUT is set to FALSE.
GuardLocking  The icon shows a yellow rectangular block with the following labels: ACT, G_MON, OUT, S_ACT, ULOCK, G_LOC, ERR, U_REQ, RESET, S_RES (with a FALSE button), and A_RES (with a FALSE button). A small graphic of a safety door with a lock is positioned between G_MON and OUT.	The GuardLocking safe function block supports the monitoring of a guard with guard locking (safety door monitoring with four-state interlocking according to EN 1088).
GuardMonitoring  The icon shows a yellow rectangular block with the following labels: ACT, S_1, OUT, S_2, ERR, RESET, DT [s] (with a 3.00 button), S_RES (with a FALSE button), and A_RES (with a FALSE button). A small graphic of two vertical light beams is positioned between S_1 and OUT.	The GuardMonitoring safe function block monitors a guard (e.g., safety door) with two-state interlocking according to EN 1088.
ModeSelector  The icon shows a yellow rectangular block with the following labels: ACT, M_0, OUT_0, M_1, OUT_1, M_2, OUT_2, M_3, OUT_3, M_4, OUT_4, ULOCK, ERR, SETM, RESET, AUTOM (with a FALSE button), and MT [s] (with a 1.0 button). A small graphic of a rotary mode selector switch is positioned between M_0 and OUT_0.	The ModeSelector function block evaluates the states of a mode selector switch with up to five positions. A mechanical mode selector switch can be used, for example, to set a specific safety level (e.g., service mode, setup mode, cleaning mode, etc.) for operation of the safe application.

Table 6-1 Safe function blocks [...]

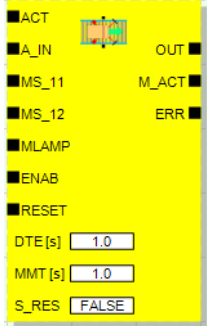
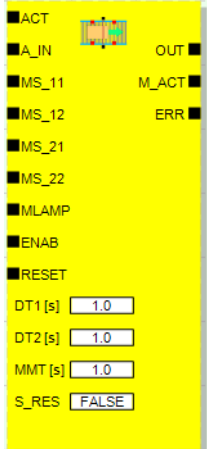
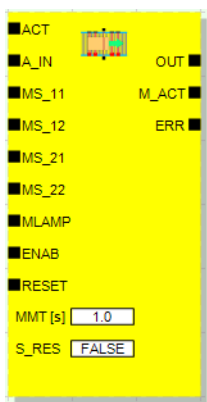
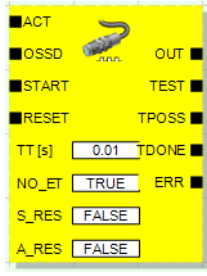
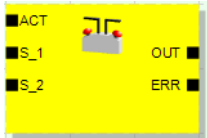
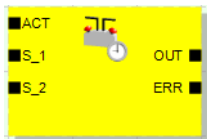
Name Icon in editor	Short description
MutingPar_2Sensor 	The MutingPar_2Sensor safe function block evaluates the signals of two muting sensors and one optoelectronic protective device (e.g., light grid) in an application for parallel muting using two sensors and sets the enable signal at output OUT. This function can be used to temporarily deactivate (or “mute”) safety equipment in the form of a light grid, for example, in order to allow an object which has been identified by the muting sensors as permissible (for the muting operation) to pass through on an assembly line. However, if the light grid is interrupted by a worker's hand, for example, output OUT is set to FALSE to disable the hazard, as the protective equipment had not been previously “muted”.
MutingPar 	The MutingPar safe function block evaluates the signals of four muting sensors and one optoelectronic protective device (e.g., light grid) in an application for parallel muting using four sensors and sets the enable signal at output OUT. This function can be used to temporarily deactivate (or “mute”) safety equipment in the form of a light grid, for example, in order to allow an object which has been identified by the muting sensors as permissible (for the muting operation) to pass through on an assembly line. However, if the light grid is interrupted by a worker's hand, for example, output OUT is set to FALSE to disable the hazard, as the protective equipment had not been previously “muted”. The use of four muting sensors enables the maximum permissible muting duration to be monitored.
MutingSeq 	The MutingSeq safe function block evaluates the signals of four muting sensors and one optoelectronic protective device (e.g., light grid) in an application for sequential muting using four sensors and sets the enable signal at output OUT. This function can be used to temporarily deactivate (or “mute”) safety equipment in the form of a light grid, for example, in order to allow an object which has been identified by the muting sensors as permissible (for the muting operation) to pass through on an assembly line. However, if the light grid is interrupted by a worker's hand, for example, output OUT is set to FALSE to disable the hazard, as the protective equipment had not been previously “muted”. The use of four muting sensors enables the maximum permissible muting duration to be monitored.

Table 6-1 Safe function blocks [...]

Name Icon in editor	Short description
TestableSafetySensor 	The TestableSafetySensor function block evaluates the status of a connected optoelectronic protective device (e.g., light curtain). The function block also has a test function for checking the connected safety equipment.
TwoHandControlTypeII 	The TwoHandControlTypeII safe function block evaluates the switching behavior of a Type II two-hand control device connected to the safety module.
TwoHandControlTypeIII 	The TwoHandControlTypeIII safe function block evaluates the switching behavior of a Type III two-hand control device connected to the safety module.



Online help is available for every function block and every function.

To open the help for a particular safe function block or safe function, right-click on the corresponding block in the SAFECONF connection editor and select "Help" from the context menu.

6.5 Operating the SAFECONF configuration software

Intuitive operation

The SAFECONF configuration software follows the Windows standard for user activities. SAFECONF also offers additional functions. Examples include online diagnostic tools and simulation of the safety module.

Details in the online help

The following sections provide a brief introduction to the most important software functions. The online help contains a detailed description of each software function.

For an overview of the steps required when configuring a project, please refer to "Configuration overview from A to Z" on page 95.

6.5.1 Creating the configuration project

When creating a new project, either use a project template or create an empty project using the Project Wizard.

“Empty” means that although the safety module is already available in the hardware editor for “wiring” the signals, the connection editor does not yet contain any safety logic.

If a project template is used, a predefined circuit, which can be modified or extended as required, will be inserted in the connection editor.

To create a new project, select “New Project...” in the “File” menu, use the keyboard shortcut <Ctrl>+<N> or click on the following icon:



In the “New Project” dialog box, select either the Project Wizard or a specific project template.

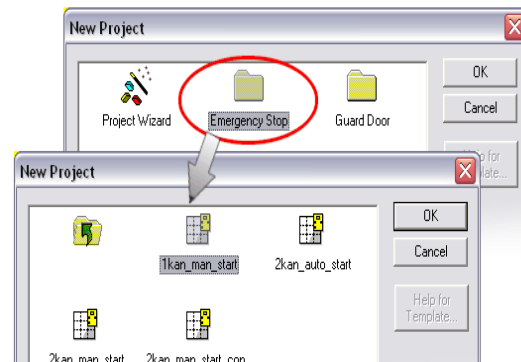


Figure 6-3 Project Wizard for creating a new configuration project

6.5.2 Inserting and removing extension devices

To change the bus configuration, drag & drop extension devices from the “Hardware” compartment of the toolbox into the hardware editor. You can remove these again via the context menu in the hardware editor.

The hardware editor shows a graphical representation of the bus configuration (i.e., the safety module used and available extension modules, as long as these are available for your safety module and are already in use in the project).

Inserting new devices in the hardware editor

To insert new devices in the hardware editor, proceed as follows:

1. Show the hardware editor (“View” menu, “Hardware Editor” command) and the toolbox (“View” menu, “Toolbox” command). If the auto-hide function is enabled, position the cursor over the minimized window as shown in Figure 6-7 for the hardware editor.
2. Click on the corresponding navigation bar to open the “Hardware” compartment in the toolbox.



There will only be a hardware compartment if your safety module features extension devices.

3. Drag the required extension module from the toolbox compartment to the connection editor as follows:
 - a) Left-click on the required object and hold down the mouse button.
 - b) Hold the left mouse button down and drag the object from the toolbox to any position in the hardware editor and then release the mouse button.

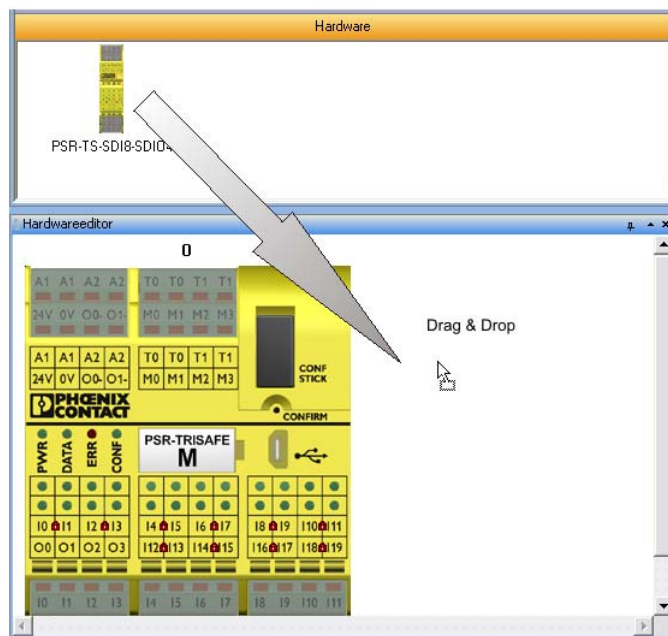


Figure 6-4 Inserting an extension device in the hardware editor

4. Next, a dialog box appears stating that the list of safe devices must be synchronized and, where applicable, that the user needs to provide confirmation. Confirm this dialog box with “OK”.

- The “Confirmation of modified SDIO devices” dialog box appears.

Use the module description (in the lower part of the dialog box) to check whether you are inserting the correct device.

If the device is correct, confirm the dialog box by selecting the checkbox in the list of modified devices and then clicking “OK”. The extension device is then automatically inserted in the correct position and is automatically given the next unassigned ID.

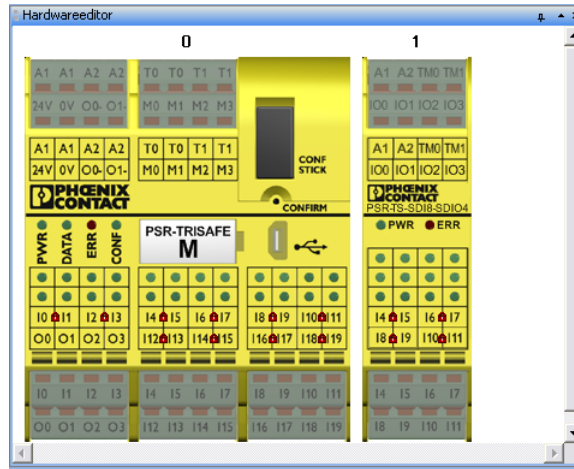


Figure 6-5 Hardware editor with master module and extension module inserted

- Drag & drop the required input or output signals of the newly inserted module into the connection editor and connect them (see Figure 6-8 on page 83).



If there are signals available for data exchange between the safety module and a higher-level controller, these are not dragged from the hardware editor to the connection editor. You can, however, drag & drop them from the “External Signals” compartment of the toolbox into the safety logic.

Removing devices from the hardware editor

To remove devices from the hardware editor, proceed as follows:

- In the hardware editor, right-click on the device you want to remove and select the “Remove device” command in the context menu.
Please note that you can only ever remove the device at the end of the row (on the far right of the bus configuration).
- Confirm the next dialog box that appears with “Yes”.
- Next, a dialog box appears stating that the list of safe devices must be synchronized and, where applicable, that the user needs to provide confirmation. Confirm this dialog box with “OK”.
- The “Confirmation of modified SDIO devices” dialog box appears.
If you want to delete the device in question, confirm the dialog box by selecting the checkbox in the list of deleted devices and then clicking “OK”.
The device is removed from the hardware editor and the ID is made available again for any devices that are going to be inserted subsequently.



For additional information, please refer to the online help (see “Extension devices in the hardware editor (bus configuration)”).

6.5.3 Inserting and connecting functions, function blocks, and signals

The safety logic is created in the connection editor as a network of safe functions and function blocks. These functions and function blocks are available in the various compartments of the toolbox and must be inserted in the connection editor from there.

In order to process the various signals (inputs/outputs and alarm outputs of the safety module and inserted extension devices) in the connection editor, the signals must be inserted in the connection editor from the hardware editor and connected to other objects.



Input and output signals can only be inserted in the connection editor from the hardware editor and linked to function blocks in the connection editor if you have logged on with the correct project password ("Project, Log On" menu).

Function blocks and functions in the toolbox

Safe function blocks/functions and constants are always inserted in the connection editor from the toolbox using drag & drop. To do this, proceed as follows:

1. Show the toolbox ("View, Toolbox" menu). If the auto-hide function is enabled, position the cursor over the minimized window as shown in Figure 6-7 for the hardware editor.
2. In the toolbox, open the required compartment by clicking on the corresponding navigation bar ("Safe Functions", "Safe Functional Blocks" or "Favorites").
3. Drag the required object from the toolbox compartment to the connection editor:
 - Left-click on the required object and hold down the mouse button.
 - Hold the left mouse button down and drag the object from the toolbox to a free position in the safety logic and then release the mouse button.
 - Signal constants can be dragged directly to function block connections, thereby establishing the connection immediately on insertion.

The object is dropped at the selected position (aligned with the grid of the connection editor).

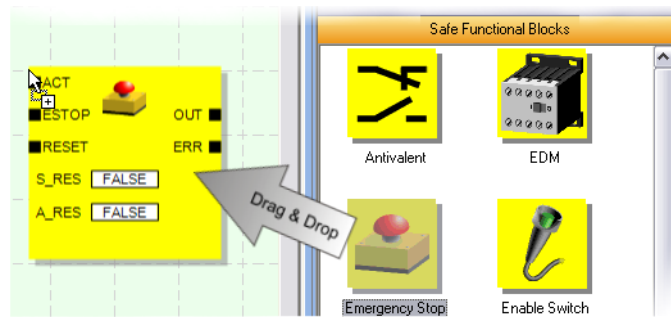


Figure 6-6 Inserting safe function blocks and functions

Signal inputs and signal outputs in the hardware editor



Input and output signals of the safety module and any extension devices that are being used are always inserted in the connection editor from the hardware editor using drag & drop.

If there are signals available for data exchange between the safety module and the higher-level controller, these signals cannot be taken from the hardware editor, but must be taken from the “External Signals” compartment of the toolbox and inserted in the safety logic using drag & drop.

To insert signals from the hardware editor, proceed as follows:

1. Show the hardware editor (“View, Hardware Editor” menu). If the auto-hide function is enabled, position the cursor over the minimized window as shown in the figure below.

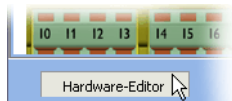


Figure 6-7 Opening the hardware editor with the auto-hide function enabled



Ensure signal redundancy (dual signals)

When evaluating two-channel sensors or control devices, dual signals must be used to connect the two channels.

Dual signals always consist of one “even” and one “odd” input signal, e.g., I0 and I1.

In the case of dual signals, input signals with even and odd IDs are processed in different ways in the safety module. This ensures that the safety module will perform redundant processing.

If required, dual signals can be split into two individual signals.

Please note: dual signals are not interconnected internally; they are simply grouped together.

2. Drag the required (dual) input or output signal from the hardware editor to the connection editor (see Figure 6-8 on page 83).
 - Left-click on the required (dual) signal and hold down the mouse button.
 - Hold the left mouse button down and drag the (dual) signal from the hardware editor directly to a free connection (or two free connections, in the case of a dual signal) in the safety logic and then release the mouse button.
 - Alternatively, you can store signals at any free position in the connection editor. The free signals must then be linked to free function block connections manually (see “Connecting objects” on page 84).

The (dual) signal is dropped at the selected position (aligned with the grid) and, if applicable, directly connected to the corresponding connection.

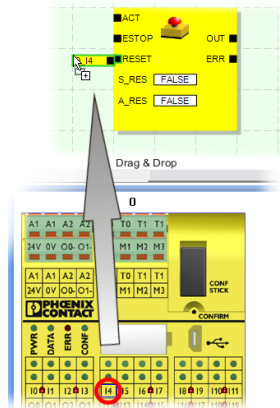


Figure 6-8 Inserting a signal in the connection editor



Standard alarm signals M0 to M3: as well as 20 safe inputs and four safe outputs, the safety module also provides four non-safety-related alarm outputs. These alarm outputs can be used, for example, to control a standard PLC or a basic signaling module (e.g., a signal lamp). Since the alarm signals are not safe, they are shown in gray rather than yellow in the connection editor.

Alarm outputs are edited in the same way as safe input/output signals.



Clock outputs T0 and T1 of the safety module cannot be moved to the connection editor using drag & drop. To implement cross-circuit detection using these two test clocks, the relevant safety module inputs must instead be parameterized accordingly.



Clock/alarm outputs TM0 and TM1 of the PSR-TS-SDI8-SDIO4 safe extension device can be configured as either clock outputs or alarm signals.

If the IOs (IO0 - IO3) are configured as inputs, test clocks TM0 and TM1 must be used to supply power to these inputs (see “Signal inputs” on page 58 and “Clock/alarm outputs TM0 and TM1” on page 60).



External signals

Depending on the higher-level controller and the safety module used, signals are specifically available for data exchange and communication between the higher-level controller and safety module.

These exchange signals cannot be dragged from the hardware editor to the circuit logic, but are available in the “External Signals” compartment of the toolbox. Drag & drop these external signals from the toolbox into the connection editor in the same way as signal constants or connectors, for example.

If a higher-level standard PLC is involved, from the perspective of the safe application, these are standard signals which can be linked and processed accordingly in SAFECONF.

Connecting objects

Signal inputs and outputs as well as constants can be connected as soon as they are inserted in the connection editor (using drag & drop). Free terminal points are connected as described below.

Connecting objects by drawing a connecting line

1. Position the cursor over the connection area where the connecting line is to start. The cursor now appears as a cross (see (1) in the figure below).
2. Left-click, hold down the mouse button, and drag the mouse directly to the destination connection area.
If the connection is permitted, the line is green.
3. Now release the mouse button to create the connection. The connection editor automatically determines the path for the connecting line (automatic routing).

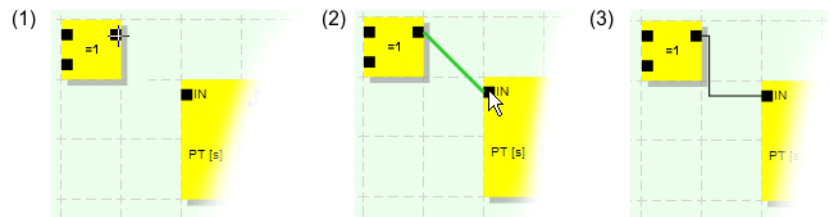


Figure 6-9 Connecting objects using a line

Connecting objects using drag & drop

This method is only suitable for connecting inputs, outputs, and signal constants.

1. Left-click on the (dual) signal or the constant to be connected and hold down the mouse button (see Figure 6-10).
2. Drag the object to the desired destination terminal point. If the relevant signals and connection areas are displayed within a green border (see Figure 6-10, (1)), release the mouse button.

The dragged object is positioned automatically and the connecting line is drawn in (automatic routing).

If required, the objects can then be moved, whereby the connection editor manages the connecting lines automatically.



Figure 6-10 Connecting unconnected signals to function blocks or functions

6.5.4 Device parameterization in the safe parameterization editor

The inputs and outputs of the safety module and the extension module can be parameterized. Specific properties can be defined for each input and output in a special safe parameterization editor.

When checking a project in the SAFECONF configuration software, this data is used to create a parameterization file which is subsequently automatically transmitted to the safety module as part of the configuration project.



The parameters can only be edited if you have logged on with the correct project password ("Project, Log On" menu).

Opening the parameterization editor

The parameterization editor is part of the hardware editor. To open this editor for all inputs/outputs (general view) of a specific device, double-click on the representation of the corresponding module in the hardware editor.

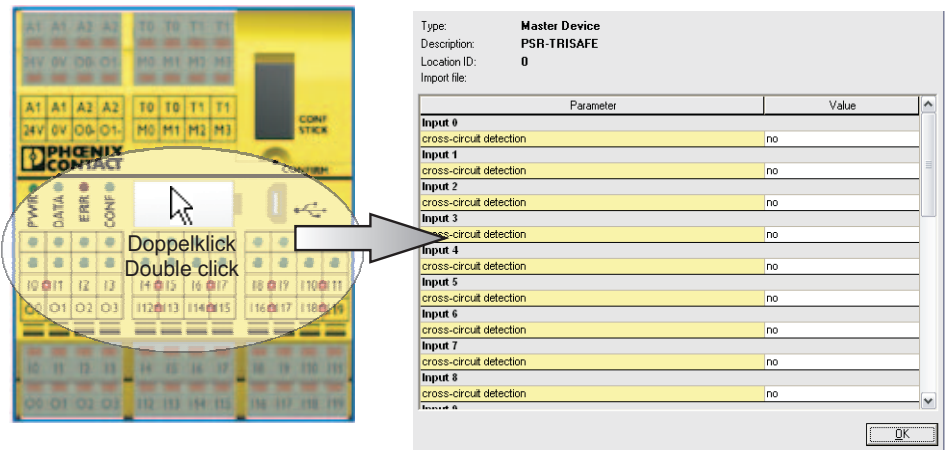
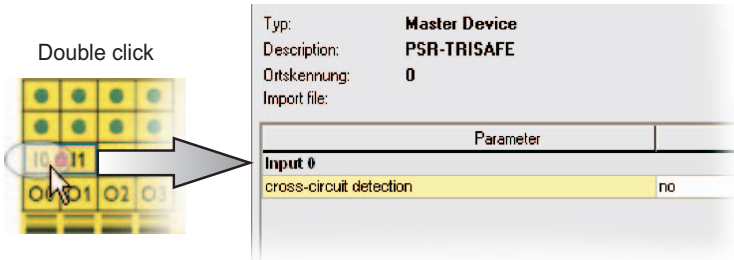


Figure 6-11 Opening the parameterization editor for all inputs/outputs of the PSR-TRISAFE-M safety module

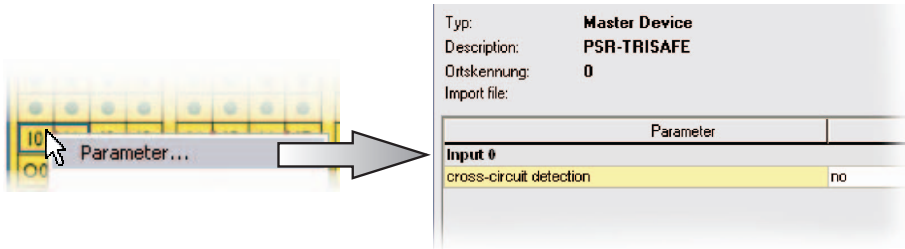
To open the parameterization editor for just one specific input/output, double-click on the relevant signal in the graphical representation of the device:



104286a021.eps

Figure 6-12 Opening the parameterization editor for one specific input/output

Instead of double-clicking, you can also open the parameterization editor via the context menu. Right-click either directly on a specific input/output to open the parameters for it, or on any empty position in the graphical representation of the device to open the general view. In both cases, select “Parameter” from the context menu.



104286a022.eps

Figure 6-13 Opening the parameterization editor via the context menu

Structure of the parameterization editor

The adjustable parameters are provided in table format. At the top left of the table is the device type or the device ID and the “location ID”, which is the unique security ID for the safe device. Every safe device can be clearly identified using just this ID. Underneath you can see the name of the import file, provided that you have imported parameters (see “Exporting and importing parameters” on page 88). The available parameters are then listed row by row. Each parameter (i.e., each row in the table) consists of a fixed parameter name and a value that can be modified.

Modifying parameters

In the interests of security, only predefined parameter values can be selected. Proceed as follows:

1. Click in the white field of the parameter you wish to change. The field displays an arrow for opening a selection list.
2. Click on the arrow to open up the list.
3. Click on the desired value. This list is closed and the selected value is visible in the parameter field.

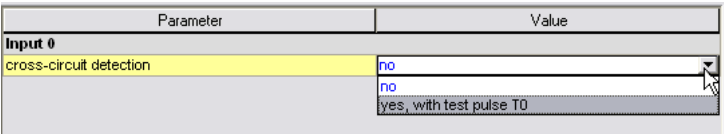


Figure 6-14 Modifying parameters in the parameterization editor

Unless the parameterization editor is closed or another device is selected, several editing steps can be undone (<Ctrl>+<Z>) or redone (<Ctrl>+<Y>).

If you have modified parameters and then close the editor with “OK”, you are prompted to save the changes that have been made.



Certain parameters in the parameterization editor are dependent upon the configuration of the inputs and outputs. For example, clock/alarm outputs TM0 and TM1 must first be configured as clock outputs (test clock) if you wish to select cross-circuit detection for inputs of the safe extension module (see “TM0 and TM1 as clock outputs” on page 60).

**Input parameters for the safety module:
cross-circuit detection**

A cross circuit is an unintentional, incorrect connection between redundant circuits. The safety module provides clock outputs T0 and T1 as an aid for detecting such a cross circuit. To activate cross-circuit detection for an input, set the corresponding “cross-circuit detection” parameter (“no”/“yes, with test pulse T...” to “yes, with test pulse T...” (see Figure 6-14 above).



The SAFECONF configuration software specifies the clock signals to be used: for “even” inputs (I0, I2, I4 ... I18), cross-circuit detection is implemented with test clock T0. For “odd” inputs (I1, I3, I5 ... I19), test clock T1 must be used for cross-circuit detection. For more detailed information on cross-circuit detection, please refer to “Signal inputs” on page 58 and “Error detection in I/O devices” on page 26. An example application is also provided there.

**PSR-TS-SDI8-SDIO4:
cross-circuit detection**

For the PSR-TS-SDI8-SDIO4 safe extension module, clock/alarm outputs TM0 and TM1 must be configured as clock outputs (test clock) in order to enable parameterization for cross-circuit detection.



If the IOs (IO0 - IO3) are configured as inputs, test clocks TM0 and TM1 must be used to supply power to these inputs (see also “Signal inputs” on page 58 and “Clock/alarm outputs TM0 and TM1” on page 60).

**Output parameters for the safety module:
ground switching output**

The “additionally ground switching contact” parameter (“no”/“yes, with O...” is only available for outputs O0 and O1 of the PSR-TRISAFE-M safety module. Output O0 is connected to ground switching output O0- and output O1 to ground switching output O1-. This parameter is used to specify whether the specified ground switching output, which can assist in shutting down a single-channel application safely, should be switched in addition to the relevant safe module output.



Use of ground switching outputs O0- and O1- increases cross-circuit protection, for example. For more detailed information on the use of ground switching outputs O0- and O1- and a corresponding example application, please refer to “Ground switching outputs O0- and O1-” on page 45.

Parameter	Value
Output 0	
additionally ground switching contact	yes, with O0-

Figure 6-15 Setting the parameter for the use of ground switching output O0-

Exporting and importing parameters

Once the inputs and outputs of the safety module have been parameterized, the parameter list can be exported to a file so that it can be used again later.

For instructions on how to export and import parameters, please refer to the online help (see “Parameterizing the inputs/outputs of the safety module”).

Printing parameters

The print dialog box (“File, Print Project” menu) contains a “Safe parameters” checkbox. If you select this checkbox before printing out a project, all the parameters of the safe device will also be printed out.

6.5.5 Checking, downloading, and starting up the project



The project can only be checked if you have logged on with the correct project password (“Project, Log On” menu).



If the current project status has not yet been saved, this will be done automatically prior to checking.



Check values (CRC): to ensure that any distortions to the configuration data during transmission to the safety module can be reliably detected, a check value (CRC) is calculated in the configuration software when the project is checked. The safety module also determines the check value for the downloaded data. If the check values on the safety module and in the configuration software are identical, all data has been saved on the safety module undistorted. If the check values differ, a corresponding error message is output.

The check value (CRC) will also differ if **subsequent changes** have been made to the project in the configuration software, but have not yet been downloaded to the safety module. A change to the project documentation can also modify the check value, for example.

Once the configuration project has been developed, i.e., the safety logic and the device parameterization have been completed, you must check the project. This involves checking the safety logic for errors, such as open function inputs.

To check the project, proceed as follows:

1. Click on the “Check Project” icon in the toolbar:



You can follow the progress of the checking function in the message window, which opens automatically:

If the configuration software detects an error, you can jump directly to the relevant location of the error by double-clicking on the message in the message window.

In the example below, an input is not connected. Double-clicking on the error message highlights the affected object (green border) in the connection editor.

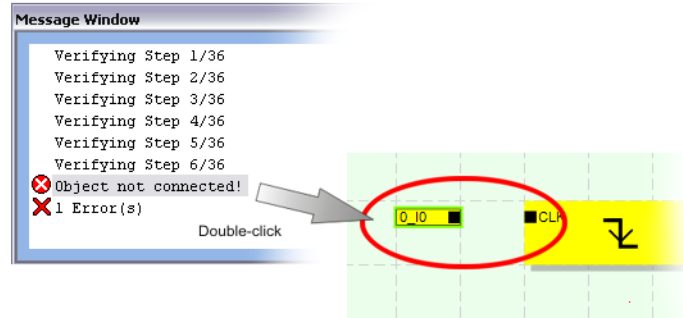


Figure 6-16 Jumping to an error location in the safety logic from the message window when checking the configuration project

2. Correct the error and check the project again.
3. Once a check has been completed without errors, the project can be transmitted to the safety module. For information on downloading a configuration project and the associated startup of the safety module, please refer to “Downloading the configuration from SAFECONF” on page 98.

6.5.6 Documenting the signal assignment and the project

Documenting signal assignment



The system offers the option of maintaining a signal assignment list.

We strongly recommend that this “wiring documentation” is maintained on an ongoing basis, as it makes both the safety logic that has been created and the project as a whole easier to understand, and helps prevent incorrect connections being established in the connection editor. We recommend entering signal names before editing the safety logic because any text entered in the connection editor is visible as tooltips.

1. Click on the following icon in the toolbar:



The “Assignment List” dialog box opens.

2. For each input used, enter a meaningful short description in the right-hand field of the list by double-clicking in the field and typing in the text.

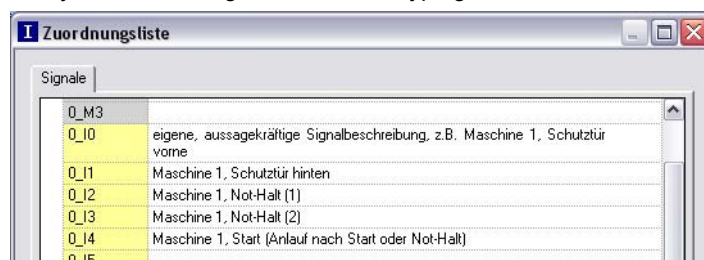


Figure 6-17 “Assignment List” dialog box

- Once all the required texts have been entered, confirm the dialog box with "OK" to save the signal list.



For additional information on signal information, please refer to the online help, which is opened by pressing <F1> when the "Assignment List" dialog box is active.

Entering project documentation

Open the "Project Info" dialog box by selecting the "Project, Project Information..." menu.

This dialog box can be used to enter the most important information for the current project, from project-related data (description of the application, designation, name of the creator/editor, etc.) and manufacturer data, the operator, and installation location to data relating to safety inspections and a revision history for the project.



To ensure compliance with standards, the fields with yellow row headers must be completed each time a new project version is developed.

Entries are not mandatory in fields with a gray background, although we do recommend completing all fields.



Check values (CRC): if the project documentation is modified, the check value is recalculated, i.e., the system detects that the project on the safety module differs from the configuration project.

If the check values on the safety module and in the configuration software are not identical, a corresponding message is output.



For additional information on project documentation, please refer to the online help, which is opened by pressing <F1> when the "Project Information" dialog box is active.

Printing project documentation

The entire project can then be printed.

- Select the "File, Print Project" menu.
A dialog box of the same name appears.
- Select all checkboxes in the dialog box and click "OK".



For additional information on printing, page layouts, and print settings, please refer to the online help, which is opened by pressing <F1> when the "Print Project" dialog box is active.

6.6 Simulation mode in SAFECONF

The SAFECONF configuration software includes the EASYSIM controller simulation, which can be used to simulate the execution of the safety logic:

- If no safety module is available
- If a simulated function test is recommended prior to actual startup of the “real” safety module

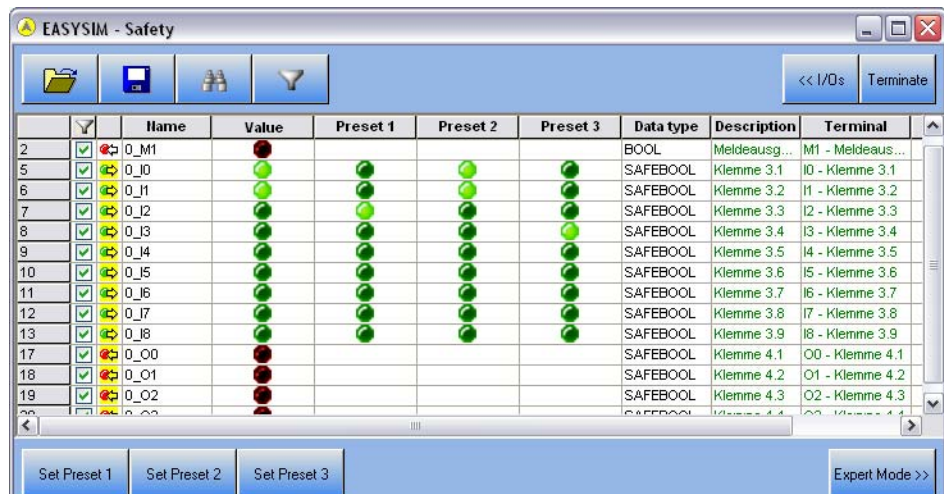


Figure 6-18 Simulation in SAFECONF



WARNING: Simulation is no substitute for a function test.

Under no circumstances may the simulation of the safety application be used as a substitute for the proper function test involving the safety module and safe control devices/sensors/actuators. The test using simulation may only be performed in addition to the standard function test, as a preliminary test, for example.

When working with the EASYSIM simulation instead of the safety module:

- If a safety module or an extension device is connected, it will not be addressed, i.e., its inputs will not be read and its outputs will not be written.
- Execute the same steps in the SAFECONF configuration software as you would if you were working with the real safety module, but ensure that the “Simulate Safety Controller” icon in the toolbar is activated (see Figure 6-19 on page 92). This means that you can force signals or display online values in the connection editor as usual. The simulation continues to run in the background, with the icon visible in the taskbar notification field (system tray, known as systray for short).
- The simulation can be configured for the current application, inputs can be “activated” in the simulation directly, and the effects on outputs can be monitored, thereby simulating the inputs and outputs of the actual hardware.
- The time sequences of the machine/system can be simulated in expert mode.

Starting simulation mode

To start the simulation and download a project, proceed as follows:

1. To start the simulation, click on the “Simulate Safety Controller” icon in the toolbar.
If the icon is activated, the simulation is active and all commands executed, such as “Download” or “Online Values”, will relate to the simulation.

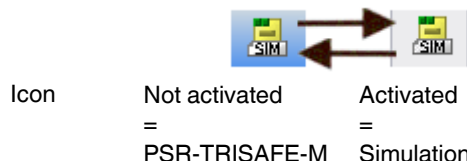


Figure 6-19 “Simulate Safety Controller” icon

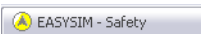
2. Once the icon has been selected, a message window appears stating “Simulation being activated”.
The project is then saved and checked automatically. Any errors detected are output in the message window.
3. Once a check has been completed without errors, the project can be downloaded as usual by clicking on the icon of the same name in the toolbar:



Unlike with the actual safety module, you do not have to log on with a controller password when using the simulation.

4. Once the simulation has been started, the following entry is displayed on the far right in the status bar: **Simulation: Connected**

The EASYSIM application appears minimized in the Windows taskbar.

**Exiting SAFECONF simulation mode**

To switch from the EASYSIM simulation to the real safety module, in the SAFECONF configuration software, click on the simulation icon in the toolbar, which already appears “activated”:



The simulation is now deactivated (see information in the message window) and the project is saved automatically again and checked for use with the real safety module.

**WARNING: Risk of unintentional operations**

As soon as simulation mode is exited, all “online” operations, such as downloading or forcing signals, affect the real safety hardware again.

**Exiting simulation mode does not exit the EASYSIM simulation**

Once you have clicked on the “Simulate Safety Controller” icon again, the destination system is reset in the configuration software, from the EASYSIM simulation to the real safety module. Essentially, this means that only the connection between the configuration software and the simulation software is interrupted. The EASYSIM simulation application is not exited automatically.

Exiting the EASYSIM simulation

To exit the EASYSIM simulation:

If EASYSIM is exited while the “Simulate Safety Controller” button is activated in SAFECONF, EASYSIM restarts automatically after being exited.

1. First exit simulation mode in the configuration software (deselect the “Simulate Safety Controller” button).
2. Then select “Exit” in the EASYSIM context menu (in the Windows taskbar) or click “Exit” in the EASYSIM window.

Additional information on operating EASYSIM

For additional information on the EASYSIM controller simulation, please refer to the “EASYSIM controller simulation” topic in the online help for the SAFECONF configuration software:

- Operating EASYSIM
- Simulating time sequences in EASYSIM expert mode
- Status of the EASYSIM simulation

7 Configuration and startup

7.1 Configuration overview from A to Z

The diagram below describes the simplified sequence, i.e., the general procedure, for developing a configuration project and for starting up the PSR-TRISAFE-M safety module. For detailed information, please refer to the sections specified and the SAFECONF online help.

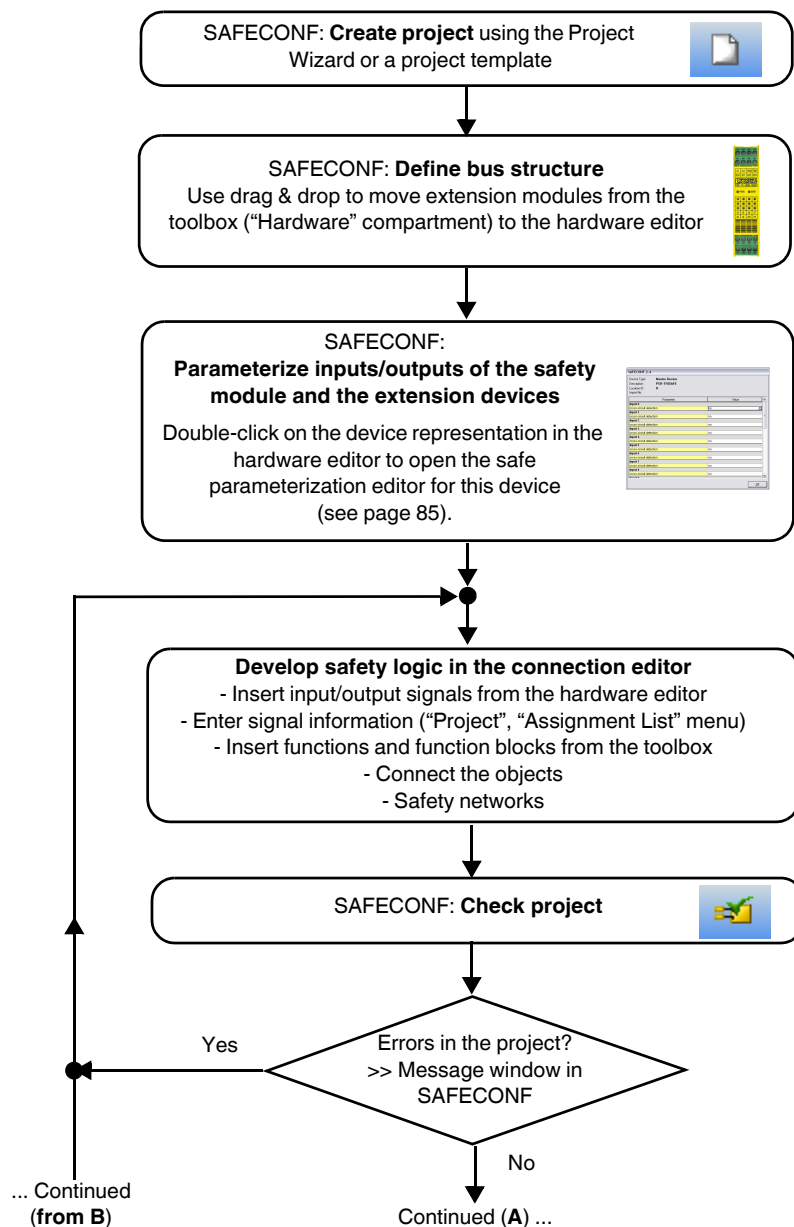


Figure 7-1 Flowchart: configuration from A to Z (1 of 3)

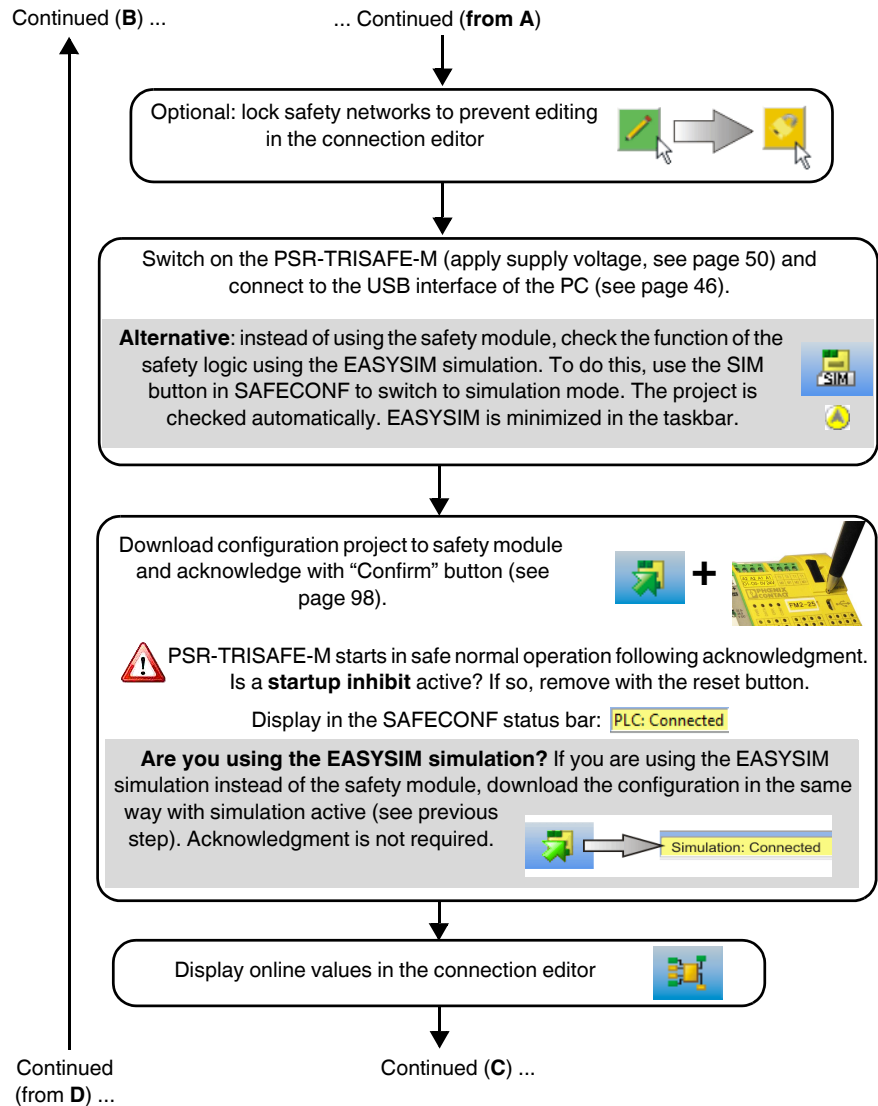


Figure 7-2 Flowchart: configuration from A to Z (2 of 3)

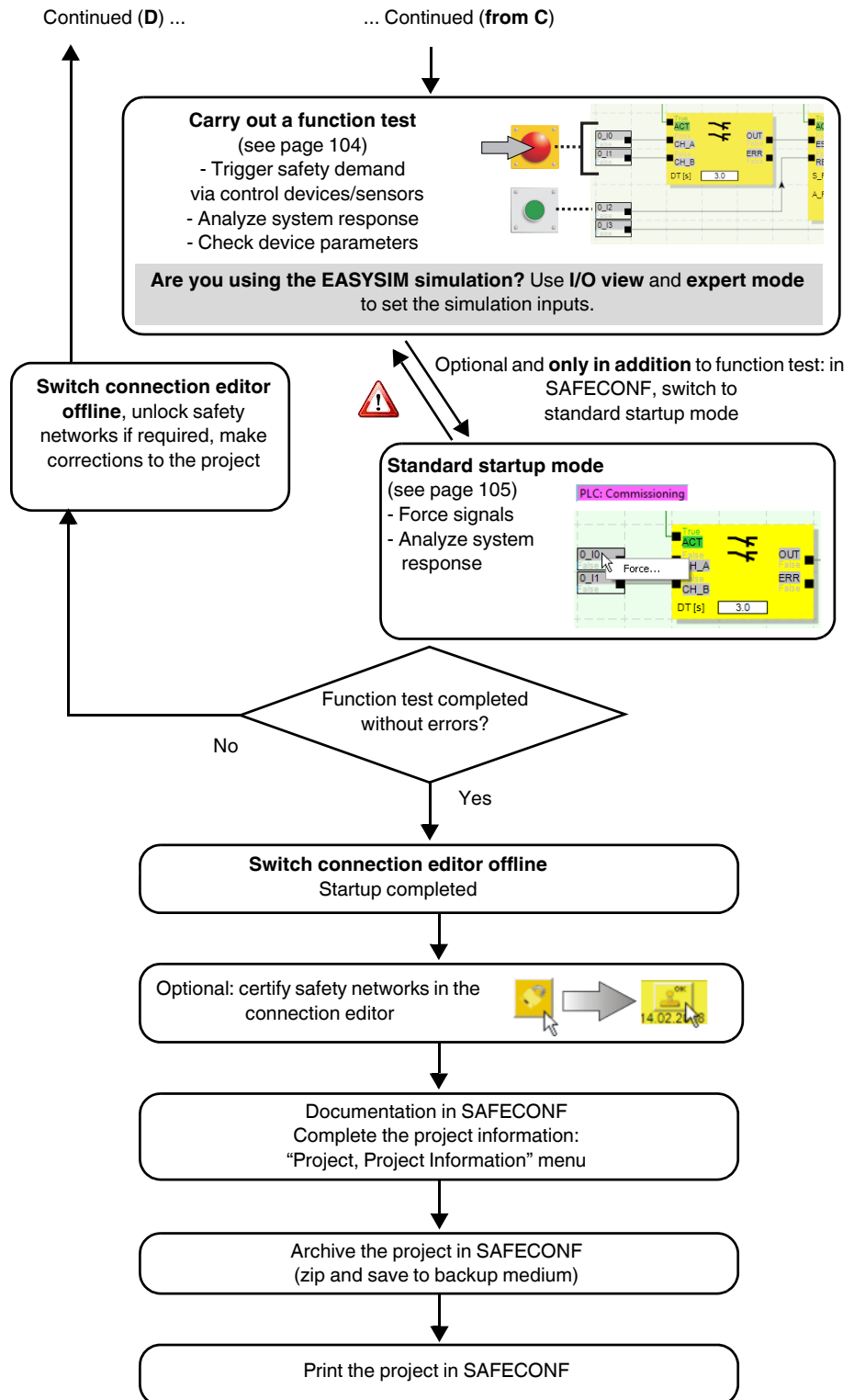


Figure 7-3 Flowchart: configuration from A to Z (3 of 3)

7.2 Downloading the configuration from SAFECONF


WARNING: Risk of damage due to unintentional/incorrect operations

Prior to startup, make sure that if the safety module functions in an unintended or incorrect way this will not cause damage.

The configuration, including the device parameterization, is created in the SAFECONF configuration software as a project and must be downloaded to the safety module once complete. This data is usually transmitted via the USB interface of the safety module.



Alternatively, the configuration can also be downloaded by inserting an IFS-CONFSTICK that contains the relevant data. For further information, please refer to “Downloading the configuration using the IFS-CONFSTICK” on page 101.

1. Make sure that:
 - The safety module is switched on
 - The SAFECONF configuration software is installed on the configuration computer (this installation also includes the required drivers)
 - The SAFECONF configuration software is started
 - An IFS-CONFSTICK is inserted in the safety module (otherwise the configuration cannot be downloaded)
2. Connect the USB cable to the safety module (mini-USB plug, 5-pos., maximum cable length of 3 m) and to a USB port on the PC.


NOTE: Electrostatic discharge

The module contains components that can be damaged or destroyed by electrostatic discharge. When handling the module, observe the necessary safety precautions against electrostatic discharge (ESD) according to EN 61340-5-1 and IEC 61340-5-1.

Once the connecting cable has been connected, the appropriately configured PC detects the safety module automatically and indicates the safety module status at the bottom right in the status bar (see Figure 6-1 on page 71).

“CONF” LED flashes during data transmission

Status indicator for PSR-TRISAFE-M



Figure 7-4 USB connection between PC and safety module

3. The project can only be downloaded to the safety module if you have logged on in SAFECONF with the correct **controller password**. In the "Safe Controller" menu, select "Log On", enter the controller password in the dialog box, and click "OK".
4. Provided that the current project has been checked and has **no errors** (see page 88 or the SAFECONF online help), the project loaded in SAFECONF can be downloaded to the safety module by clicking on the following icon in the toolbar:



Is there already a project on the safety module?

If the status bar has a yellow entry ("Controller: No project") on the right, the project is sent to the safety module without any further prompts.

If another project or another version of the same project already exists on the safety module and is being executed, a corresponding dialog box appears, indicating this fact. Click "Yes" in this dialog box to overwrite the current controller configuration on the safety module.

During data transmission

- A progress indicator is displayed in the SAFECONF status bar.
- The "CONF" status indicator flashes quickly on the safety module (approximately 6 Hz).



If data transmission is interrupted during the download, "Problems and solutions" starting on page 111 describes how to solve this problem.



WARNING: Risk due to activated outputs

Following acknowledgment, the safety module starts running immediately. Provided that no startup inhibit, which must be canceled manually, is active, outputs may be activated immediately after startup. Make sure that the safety module startup will not lead to any hazardous situations.

5. Once data transmission has been completed successfully, the "CONF" status indicator flashes slowly (approximately 1.5 Hz) and a corresponding dialog box appears in the configuration software.

Do not confirm this message yet, first complete the following step.



Please note:

First acknowledge the configuration on the safety module (see step 6.) ...

... before clicking "OK".

Figure 7-5 Dialog box following successful data transmission

6. Confirm the new configuration by pressing the “Confirm” button using a pen (see Figure 7-6).



WARNING: Risk due to activated outputs

Following acknowledgment, the safety module starts running immediately. Provided that no startup inhibit, which must be canceled manually, is active, outputs may be activated immediately after startup. Make sure that the safety module startup will not lead to any hazardous situations.

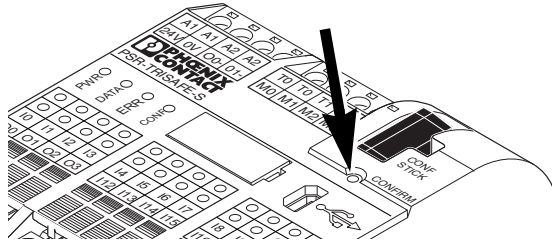


Figure 7-6 Confirming the configuration with the “Confirm” button

The safety module is then reinitialized (all diagnostics indicators are on briefly) and then switches to safe normal operation (only “PWR” LED on).



Startup inhibit active?

If a startup inhibit has been preset in the configuration, it will now be active following startup. An active startup inhibit must be canceled by pressing a reset button which is connected to the safety module according to the configuration.

For additional information, please refer to “System startup and restart behavior” on page 24.



If the safety module is not initialized correctly, proceed as described in “Problems and solutions” on page 111.

Next steps

Next, continue with the function test (see “Function test” on page 104).



Check values (CRC): to ensure that any distortions to the configuration data during transmission to the safety module can be reliably detected, a check value (CRC) is calculated in the configuration software when the project is checked. The safety module also determines the check value for the downloaded data. If the check values on the safety module and in the configuration software are identical, all data has been saved on the safety module undistorted. If the check values differ, a corresponding error message is output.

The check value (CRC) will also differ if **subsequent changes** have been made to the project in the configuration software, but have not yet been downloaded to the safety module. A change to the project documentation can also modify the check value, for example.

7.3 Downloading the configuration using the IFS-CONFSTICK



WARNING: Risk of damage due to unintentional/incorrect operations

Prior to startup, make sure that if the safety module functions in an unintended or incorrect way this will not cause damage.

As well as being downloaded via the USB interface, configurations can also be downloaded using the IFS-CONFSTICK. This means that the configuration of one device can be transferred to other safety modules. This is useful if no configuration computer is available at an installation location or if you wish to transfer the configuration to a new device on device replacement.

To replace the IFS-CONFSTICK, proceed as follows. This sequence ensures that the active configuration is not overwritten by accidental insertion of an IFS-CONFSTICK.

Removing the IFS-CONFSTICK

1. The IFS-CONFSTICK should not be replaced during operation. If the safety module is already running, proceed as follows:
 - c) First, shut down the machine.
 - d) Switch off the safety module.
 - e) Remove the current IFS-CONFSTICK.

Inserting the new IFS-CONFSTICK



WARNING: Risk due to activated outputs.

When the IFS-CONFSTICK is replaced, outputs may be activated. Once the configuration has been downloaded in this way, the safety module starts program execution. Provided that no startup inhibit, which must be canceled manually, is active, outputs may be activated immediately.

Make sure that the safety module startup will not lead to any hazardous situations.

2. Insert the new IFS-CONFSTICK in the safety module (which must still be switched off). The IFS-CONFSTICK is mechanically coded and cannot be inserted in the device incorrectly.
3. Switch the safety module on and wait until it has initialized (all four diagnostics indicators light up once during initialization). The safety module now detects the previously unknown IFS-CONFSTICK and indicates this by making the "CONF" diagnostics indicator flash.
4. Remove the IFS-CONFSTICK again.
5. Press the "Confirm" button on the device and **hold** it down.

6. Reinsert the IFS-CONFSTICK **while** holding down the “Confirm” button.

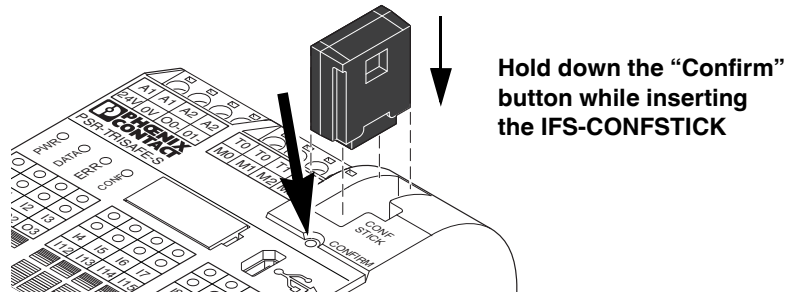


Figure 7-7 Inserting the IFS-CONFSTICK

7. Release the “Confirm” button once the IFS-CONFSTICK is inserted correctly. The safety module now initializes with the new configuration.



Startup inhibit active?

If a startup inhibit has been preset in the configuration, it will now be active following startup.

You must remove an active startup inhibit by pressing a reset button connected to the safety module.

For additional information, please refer to “System startup and restart behavior” on page 24.



If the safety module is not initialized correctly, proceed as described in “Problems and solutions” on page 111.



When the IFS-CONFSTICK has been removed correctly, all of the safety module outputs are FALSE. During the time when the IFS-CONFSTICK is not inserted, the safety module has no function.

If the IFS-CONFSTICK is not removed correctly, the safety module also displays an error message.

7.4 Uploading the configuration from the safety module

Projects downloaded to the safety module are saved there and can be uploaded to the PC and the configuration software again if required.

This may be required, for example, if a project has to be read from the safety module for diagnostic purposes.



It is possible to upload a project from the safety module to the configuration software without the controller password. However, to edit the uploaded project you will need the correct project password.

To upload the project, proceed as follows:

1. If a project is currently open in the configuration software, save it before uploading the required project from the safety module.
2. Exit startup mode and the online mode of the configuration software.
The “Online Values” icon must not be selected prior to starting the upload and the status bar must show the controller status “Controller: Connected”.
3. Click on the “Upload” icon in the toolbar:



4. Click “Yes” in the dialog box to confirm the upload.
5. Transmission from the safety module to the PC starts and a progress indicator is displayed in the SAFECONF status bar.
6. If a project with the same name already exists on the PC, a prompt will appear where you must decide whether you want to overwrite the project which is already loaded or not.

In this dialog box, click:

- “Yes” to overwrite the data of the existing project with that of the project which has just been uploaded.
Overwriting means that the current data will be lost and it will not be possible to recover it.
- “No” to save the uploaded project under a different name or in a different directory.
The “Save Project As” dialog box appears. Here, select a directory, enter a file name, and click “Save”.

7. You are now asked to enter the project password.
Once you have entered the password you can edit and check the project, load it to the safety module, and start it up there as usual.

7.5 Function test



WARNING: Risk of injury or damage to equipment due to unintentional system states or incorrect responses.

Make sure that triggering the safety demand does not endanger people or equipment.

The safety module is in the startup phase, i.e., unintentional system states or incorrect responses cannot be ruled out.

Do not enter any hazardous areas and make sure that no other persons can access the danger zone either.

Validation

Once the project has been uploaded to the safety module, it is executed there following manual acknowledgment. You must perform a function test to ensure that the safety module and therefore the safety logic and all of the cabling are working correctly.

Online mode in SAFECONF

You can switch the SAFECONF configuration software to online mode so that online values can be read cyclically from the safety module and displayed in the connection editor and the hardware editor.

Safety demand/monitoring signals

Once a safety demand has been triggered by activating the safe control devices, e.g., by pressing the emergency stop control device or opening the safety door, the behavior of the safety logic can be analyzed precisely in the configuration software, as in online mode the connection editor displays the value of every signal "live".

To perform a function test, proceed as follows:

Connected/logged on

1. Connect the safety module, which is switched on, to the configuration computer via the USB interface, start the SAFECONF configuration software, and log onto the safety module.

The status bar in SAFECONF displays the following entry on the right-hand side.

PLC: Logged on **PLC: Connected**



The system can only display online values if the project in the safety module and the project in the configuration system are identical. If you have made a change to a project after startup (even something as small as moving an object is classed as a change), you must check the project and download it to the safety module again before you can display online values.

2. Switch SAFECONF to online mode by clicking on the "Display online values" icon in the toolbar: 
"Signal lines" and function block connections are now displayed in the connection editor in different colors according to their state (TRUE/FALSE) and together with the current values. The hardware editor also supports the function test by means of "lit" LEDs.
3. Now trigger a safety demand via the safe control devices. Monitor the response of the machine and the configuration in the connection editor, which has been switched to online mode.

**WARNING: Startup mode is a standard operating mode**

As in online mode, the connection editor displays online values which are read from the safety module. However, as signals can also be influenced in startup mode (which is not possible in online mode), startup mode is a standard operating mode.



Once the supplementary function test has been performed in startup mode, exit startup mode again. This resets forced signals.

Starting startup mode

1. In SAFECONF, select "Startup Mode" from the "Safe Controller" menu.
2. A message appears, alerting you to possible hazards. Click "Yes" in this dialog box to exit safe mode and switch to standard startup mode.



Time limit: you have 30 seconds to switch the operating mode (i.e., to click "Yes"). After this time, a corresponding error message is displayed and "Startup Mode" must be selected again in the "Safe Controller" menu.

The pink background of the status field in the configuration software status bar indicates that the safety module is running in standard mode:

PLC: Commissioning

The connection editor still displays online values, i.e., signals and connections, which are TRUE if green and FALSE if gray. The hardware editor is also visible in online mode.

Forcing signals

3. To force a signal in the connection editor, right-click on the corresponding signal and select the "Force" command from the signal context menu.

**WARNING: Eliminate hazards due to forcing**

You must be extremely careful when forcing signals while the safety module is running. Forcing means that the safe configuration is executed with the values of the signals you have forced.

Alternatively, you can double-click on the signal.

The "Force" dialog box opens.

4. The signal designation can be seen at the top of the dialog box. The value to be forced is determined automatically from the current signal value and preset in the dialog box.
5. Click on the "Force" button to force the corresponding signal to the set value.

**WARNING: Eliminate hazards due to forcing**

Before forcing any signals, make sure that doing so will not endanger people or equipment.

6. A dialog box appears, where you must expressly confirm the forcing procedure once more. Click "Yes" to continue.

The signal remains at the forced value until the forcing function is reset.

Resetting forcing

Right-click on the signal you want to reset and select the “Force” command from the context menu. The “Force” dialog box opens.

In this dialog box you can either reset just the forced signal that is currently selected or all forced signals.



If startup mode is exited while signals are forced, they will be reset.

Exiting startup mode

To exit startup mode, switch back to “normal” online mode; this will cause the safety module to run in a safe operating mode again.

1. In the “Safe Controller” menu, select the highlighted “Startup Mode” menu item (when startup mode is active, the icon next to the menu command appears activated).
2. A confirmation dialog box appears, where you should click “Yes” to exit startup mode. The yellow background of the status field on the right-hand side of the status bar indicates that the safety module is running in safe normal operation again.

8 Examples of use

Block help: Application for each function block

Examples of use are available in the online help for the safe function blocks.

The online help describes at least one typical application for each function block and shows the safety logic configured in SAFECONF as well as the wiring of the PSR-TRISAFE-M safety module and the extension devices in the form of schematic views.

The online help also includes typical signal sequence diagrams which illustrate the behavior of each function block.

The following examples of use are included in the online help for the function blocks:

- Single-channel and two-channel emergency stop circuits
- Single-channel and two-channel safety door monitoring, with and without interlocking
- Mode selector switch selection with interlocking of the set operating mode and manual operating mode acknowledgment
- Evaluation of a three-position enable switch with confirmation of the selected safe operating mode
- Parallel muting with two sensors
- Evaluation of a light curtain connected via a single channel
- Type II and Type III two-hand control devices

9 Problems and solutions

This section contains a list of possible problems which may occur when working with the configuration software and the safety module. The following descriptions are divided into categories corresponding to the different sections of the configuration software.

9.1 General

Table 9-1 Solutions for general problems

Problem	Solution
When the SAFECONF safe configuration software was launched, the installation check identified a faulty system file. A corresponding message window appears.	Uninstall the safe configuration software, then reinstall it by running the setup program from the installation CD.
The operating system test routine has identified that you are trying to launch the SAFECONF configuration software on an operating system that is not supported.	Install an operating system supported by SAFECONF (see “System requirements for the SAFECONF configuration software” on page 33) or consult the technical support team to find out whether a newer version of SAFECONF is available, which supports your current operating system.
An error has occurred (accompanied by a corresponding message) which cannot be removed using any of the measures described here.	Please contact our technical support team.
The SAFECONF safe configuration software or one of its functions is not behaving as described in the user documentation or the online help.	Please contact our technical support team.

9.2 Graphical connection editor

Table 9-2 Solutions for problems with the graphical connection editor

Problem	Solution
You have attempted to open a project, but the safety logic could not be loaded due to a checksum error. A corresponding message window appears.	The project concerned is corrupted and can no longer be used. Use the latest backup copy of the project (as described in the online help under "Zipping and extracting projects"). If the problem persists, please contact our technical support team.
During editing, a message window appears where the connection editor reports corrupted data, a sporadic error or a systematic error.	The project is closed automatically. You do not have the opportunity to save the most recently made changes. If the problem persists when the project is reopened, please contact our technical support team.

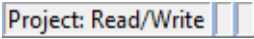
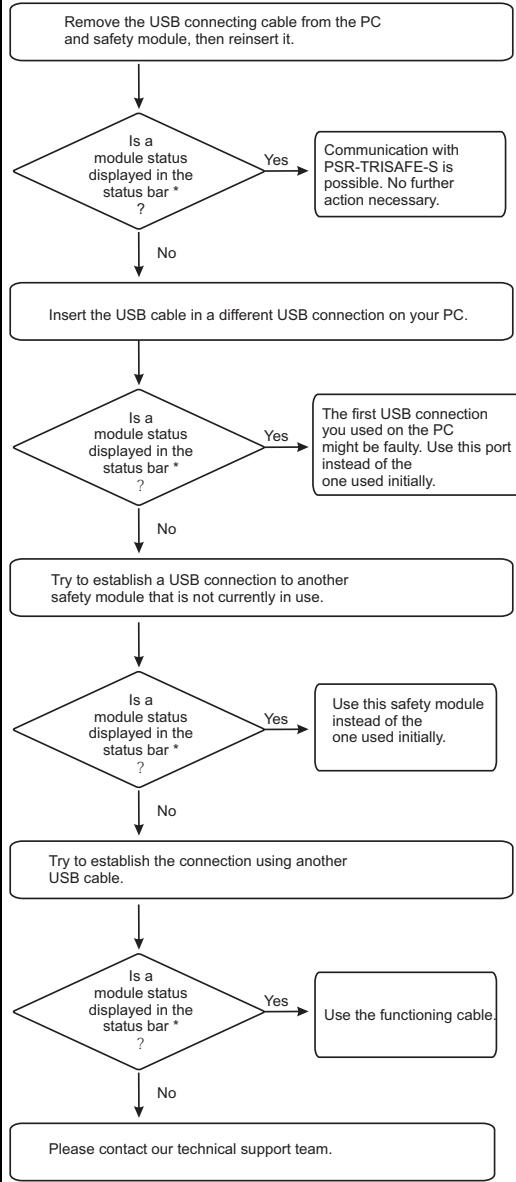
9.3 Parameterization editor

Table 9-3 Solutions for problems with the parameterization editor

Problem	Solution
You have attempted to open the parameterization editor, but the data could not be loaded due to a checksum error. A corresponding message window appears.	The project can no longer be used, as the parameterization data cannot be deleted. Use the latest backup copy of the project (as described in the online help under "Zipping and extracting projects").
The parameterization editor responds unexpectedly to an entry in the parameter table by displaying something other than what has been entered or selected, for example. This may be traced back to a sporadic error or a systematic error.	Undo the last entry (by pressing <Ctrl>+<Z>), then repeat the entry. If the result is still incorrect, please contact our technical support team.
During editing, a message window appears where the parameterization editor reports corrupted data, a sporadic error or a systematic error.	The project is closed automatically. You do not have the opportunity to save the most recently made changes. If the problem persists when the project is reopened, please contact our technical support team.

9.4 Online communication between SAFECONF and the safety module

Table 9-4 Solutions for communication problems between SAFECONF and PSR-TRISAFE-M

Problem	Solution						
A connection cannot be established to the safety module. The status bar does not display a status for the safety module ("Timeout", "No project" or "Connected"; see information under the diagram below). The status bar looks like this, for example: 	Proceed as follows:  <pre> graph TD A[Remove the USB connecting cable from the PC and safety module, then reinsert it.] --> B{Is a module status displayed in the status bar * ?} B -- Yes --> C[Communication with PSR-TRISAFE-S is possible. No further action necessary.] B -- No --> D[Insert the USB cable in a different USB connection on your PC.] D --> E{Is a module status displayed in the status bar * ?} E -- Yes --> F[The first USB connection you used on the PC might be faulty. Use this port instead of the one used initially.] E -- No --> G[Try to establish a USB connection to another safety module that is not currently in use.] G --> H{Is a module status displayed in the status bar * ?} H -- Yes --> I[Use this safety module instead of the one used initially.] H -- No --> J[Try to establish the connection using another USB cable.] J --> K{Is a module status displayed in the status bar * ?} K -- Yes --> L[Use the functioning cable.] K -- No --> M[Please contact our technical support team.] </pre> * Possible module status on existing connection: <table border="1"> <tr> <td>Controller: Timeout</td> <td>→ Temporary during initialization</td> </tr> <tr> <td>Controller: No project</td> <td>→ Download project</td> </tr> <tr> <td>Controller: Connected</td> <td>→ Start function test</td> </tr> </table>	Controller: Timeout	→ Temporary during initialization	Controller: No project	→ Download project	Controller: Connected	→ Start function test
Controller: Timeout	→ Temporary during initialization						
Controller: No project	→ Download project						
Controller: Connected	→ Start function test						

104286a019.eps

Table 9-4 Solutions for communication problems between SAFECONF and PSR-TRISAFE-M

Problem	Solution
Transmission has been interrupted during the download procedure.	1. Start transmission again. 2. If the download fails once more, remove the USB connecting cable from the interface on the configuration computer and reinsert it. 3. Once the safety module has been detected correctly (see display in the status bar), restart the download procedure.
Following successful project download, the SAFECONF safe configuration software identifies that the checksum of the project on the safety module does not match that of the project on the PC. A corresponding message window appears.	Proceed as follows: <pre> graph TD A[Download the project to the safety module again and acknowledge by pressing the "Confirm" button.] --> B{Checksum error still being signaled?} B -- No --> C[No further action necessary. You can start the function test.] B -- Yes --> D[Download the project to another safety module that is not currently in use.] D --> E{Checksum error still being signaled?} E -- No --> F[Use this safety module instead of the one used initially.] E -- Yes --> G[Please contact our technical support team.] </pre> 104286a020.eps

9.5 Communication between the safety module and the extension device

Table 9-5 Solutions for communication problems between PSR-TRISAFE-M and PSR-TS-SDI8-SDIO4

Problem	Solution
Communication between the safety module and the extension device via the DIN rail bus (TBUS) has been interrupted. The "Data" LED on the safety module is off.	Check that all PSR-TS-SDI8-SDIO4 extension modules are correctly connected to the PSR-TRISAFE-M. A connection is correct if there is a PSR-TBUS plug under each extension module and the plug-in connection has been established properly (the module must snap into place). Check whether the power supply at each extension module has been connected and switched on correctly.

9.6 Safety module messages

Table 9-6 Solutions for messages from the PSR-TRISAFE-M safety module

Problem	Solution
Following acknowledgment of the newly loaded configuration, the safety module is not initialized correctly ("Controller: Error" in the status bar and flashing "ERR" status indicator on the safety module).	1. Switch the safety module off and on again. 2. Download the project to the safety module again and acknowledge the new configuration by pressing the "Confirm" button on the device. 3. If the problem persists, please contact our technical support team.
The safety module reports an internal error.	Please contact our technical support team.

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